

## Revolution ACTs

### User Manual

This manual supports the following configurations:

- Revolution ACTs

Some configurations are not suitable for use in some regions.

This product is certified as a Revolution ACTs Scanner.



Revolution ACTs  
Operator Manual, English  
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Revision 3  
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## Revision History

Revision	Date	Reason for change
1	June 2015	Revolution ACTs Initial Release 5641787-1EN
2	Dec 2015	Update for CE Mark
3	Aug 2016	Information Update

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# Chapter 1 : Read me first

Before using your system, familiarize yourself with the purpose and design of this manual and the overview of the system user interface.

## About this manual

### Navigation Bar

- Desktop select
- Disk space and system time display area
- Administrative Program area

### Message Bar

- Operator Console Information Area
- Feature Status Area
- System Status Message Area

### Exam Rx

- New Patient
- Emergency Patient
- Scan Setup screen
- Patient Schedule
- Retro Recon
- Recon Management

### Image Works

### Multitask Bar

### User Interface conventions

### System troubleshooting tips

## About this manual

This section explains the purpose and design of this user manual. It is an introduction to the manual, providing information on the purpose, prerequisite skills, organization, format, and graphic conventions that identify the visual symbols used throughout the manual.

The manual does not identify components or features that are standard or purchasable options. Therefore, if a feature or component included in the manual is not on your system, it is either not available on your system configuration or your site has not purchased the option.

The Technical Reference Manual provides details of System Specification, Regulatory & Safety Information for the product. For Service related information, refer Service Manual.

### Safe and proper use notices

The following safety notices are used to emphasize certain safety instructions. This manual uses the international symbol along with the danger, warning, or caution message.



#### DANGER

Danger is used to identify conditions or actions for which a specific hazard is known to exist that will cause severe personal injury, death, or substantial property damage if the instructions are ignored.



#### WARNING

Warning is used to identify conditions or actions for which a specific hazard is known to exist that may cause severe personal injury, death, or substantial property damage if the instructions are ignored.



#### CAUTION

Caution is used to identify conditions or actions for which a potential hazard may exist that will or can cause minor personal injury or property damage if the instructions are ignored.

### Precautions

The following notice symbols are used to emphasize information that is considered important, requires special notice, or includes helpful troubleshooting tips.



Important indicates information where adherence to procedures is crucial or where your comprehension is necessary to apply a concept or effectively use the product.



Note provides additional information that is helpful to you. It may emphasize certain information regarding special tools or techniques, items to check before proceeding, or factors to consider about a concept or task.



Troubleshooting tips provide information that allow you to investigate the resolution of some type of problem, locate the difficulty, and make adjustments to solve the problem.

## Purpose of this manual

This user manual is written for health care professionals (namely, the technologist) to provide the necessary information relating to the proper operation of this system. The manual is intended to teach you the system components and features necessary to use it to its maximum potential. It is not intended to teach imaging or to make any type of clinical diagnosis.

This user manual should be kept with the equipment at all times. It is important for you to periodically review the procedures and safety precautions. It is important for you to read and understand the contents of this manual before attempting to use this product.

This user manual is originally written in English.

## Prerequisite skills

The operator profile may be limited to registered CT technologists certified by national registries, state licenses, or organizational certification, physicians with or without specific training in radiology, physicists, or other persons adequately trained to operate the equipment.

This manual is not intended to teach imaging. It is necessary for you to have sufficient knowledge to competently perform the various diagnostic imaging procedures within your modality. This knowledge is gained through a variety of educational methods including clinical working experience, hospital based programs, and as a part of many college and university programs.

## Pop-up windows

Pop-up message window require an acknowledgement typically by clicking **OK** or **Accept**. Always respond to the message.

## Mouse controls

For mouse control details, see the [Operate the mouse controls](#) procedure.

## Graphic Conventions and Legend

This manual uses special conventions for images and legends to make it easier for you to work with the information. The table below describes the conventions used when working with menus, buttons, text fields, and keyboard keys.

Table 1-1 Graphic conventions

Example	Description
<b>User Interface conventions</b>	Blue text indicates a link to another topic.
Select	Select an option in a check box or radial button and selecting a tab.
Press <b>Enter</b>	Press a hard key on the keyboard or equipment.
Press and hold <b>Shift</b>	Press and hold down a hard key on the keyboard.
Click <b>Viewer</b>	A button label or Interface button name that you actively click. If there is a reference to a button label that is not actively clicked, it is not displayed in bold or italics.
In the Spacing field ...	The name of the field in which you can select or type text.
Type <b>supine</b> in the Patient Position field	Text you enter into a field.
Select <b>Sort &gt; Sort by date</b>	The pathway of selecting options in a pull-down menu.

CtrlX simultaneously	Press and hold the Control button on the keyboard and simultaneously press the X button on the keyboard. Ctrl is the abbreviation used for the Control keyboard button, and ALT is the abbreviation used for the Alternative keyboard keys.
"Messages"	A system message prompt is in quotations.
Cancel/Close	Cancel/Close typically closes a screen without executing the changes on the screen. The instructions to Cancel/Close are not included in procedures in this manual.

## Operator Console applications

These applications are not included in this user manual.

Common user interface with Advantage Windows for improved productivity. The OC<sup>1</sup> now supports an expanded list of Advanced Application packages such as Volume Viewer, CT Perfusion 4- Multi-Organ or Neuro only, Advantage CTC Pro, AutoBone, AVA Xpress, and Dentascan.

Volume Viewer is a prerequisite to support Advantage CTC Pro, AutoBone, and AVA Xpress.

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1. Operator Console

## Navigation Bar

The Navigation Bar can be considered as the switch for the work environment. When a desktop is open, all the functions related to that desktop are placed on the monitor.

The Navigation Bar is divided into three sections

Figure 1-1 1 = Desktop select, 2 = Disk space and system time display area, 3 = Administration program area



Table 1-2 Desktop select

Icon	Description
	<b>Exam Rx</b> During scanning, display <b>Viewport</b> to view images, and the New Patient and Scan Equipmentscreen.
	<b>ImageWorks</b> Displays a <b>browser</b> from which you can view other exams, archive, network, manual film, apply measurements and apply other features to an image, perform 2D reformations, and access optional software features.

The disk space and system time display area displays the date, time and available system disk space.

It is recommended that you remove images when the image space falls below 20% to ensure sufficient disk space for collecting and reconstructing images. Do not remove images while scanning, restoring, or receiving images.

Figure 1-2 Disk space and system time display area



1. Displays available disk space.
2. Current date and time display as per the selected format.

Table 1-3 Administrative Program area

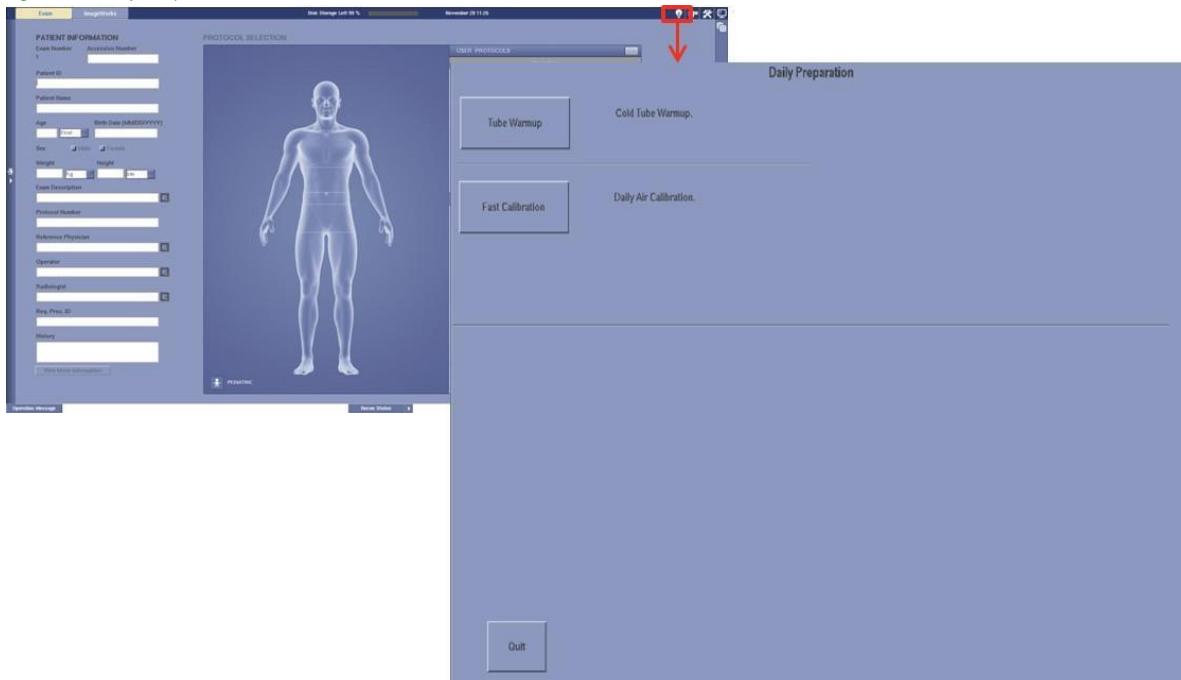
Icon	Description
	<b>Daily Preparation</b> Click the Daily Prep  icon to start tube warm up or quick calibration.
	<b>Scanner Utilities</b> Click the scanner utilities  icon to view the Scanner Utilities screen. Utilities are used primarily by service representatives for system calibration activities.
	<b>Protocol Management</b> Click the Protocol Management icon  to create, edit and delete scanning protocols and automated voice scan protocols, as well as protocol-related dosage check settings.
	<b>Service</b> Click the Service icon  to view study solutions, iLinq, service and system

## Daily Preparation



Click the **Daily Prep** icon to start tube warm up or quick calibration.

Figure 1-3 Daily Preparation

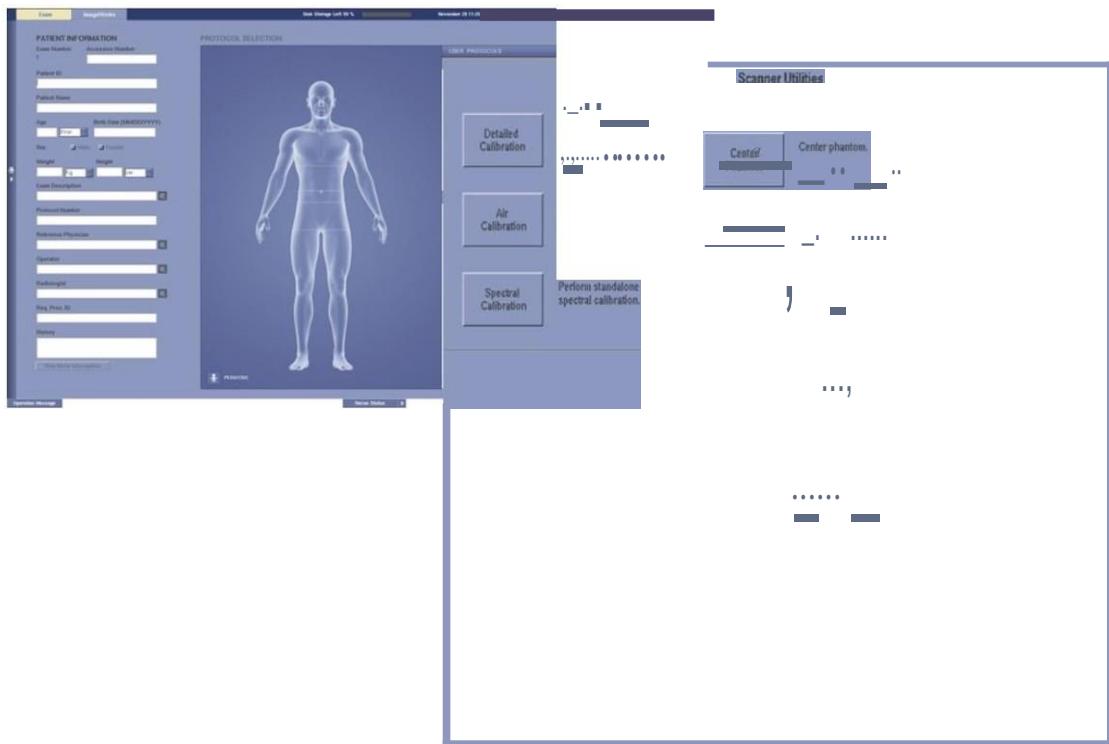


## Scanner Utilities



Click the **Scanner Utilities** icon to view the Scanner Utilities screen. Utilities are used primarily by service representatives for system calibration activities.

Figure 1-4 Scanner Utilities



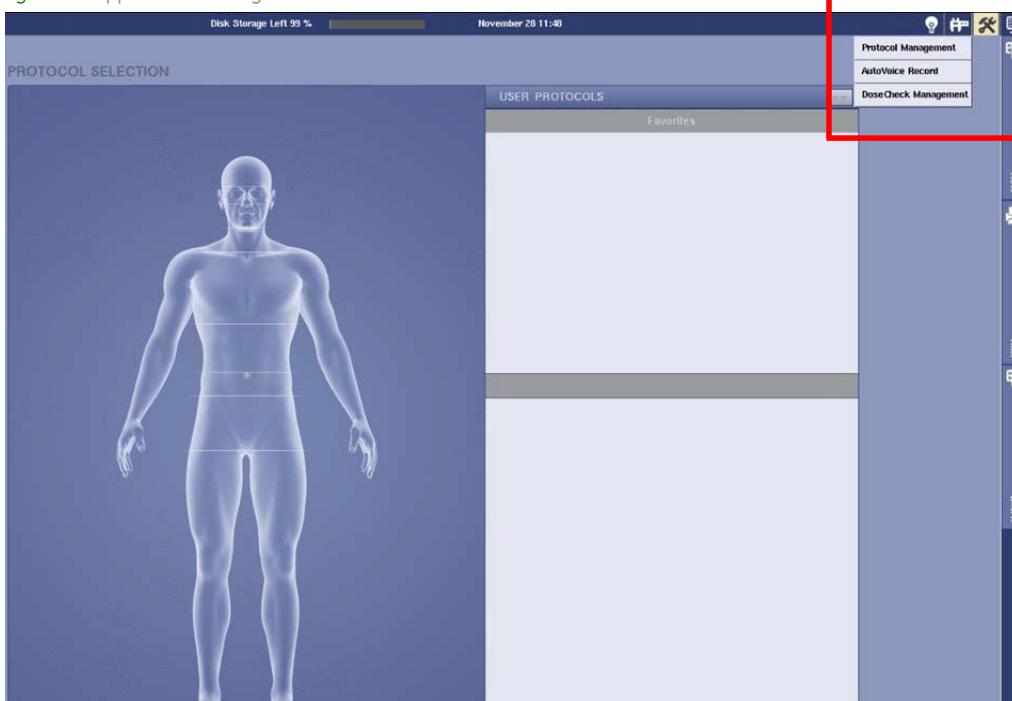
Quit

## Applications Configuration



Click the icon, and then click Protocol Management to view the Protocol Management screen, or click Auto Voice Record to record new automated voice messages and click Dose check management to set dose check settings.

Figure 1-5 Applications Configuration



**Service**

Click Service icon to view study solutions, iLinq, service, and to shut down or restart the system.



Figure 1-6 Service

Manual: Opens electronic based operator information. Place an operator document in the DVD-RW drive, click manual to open the document.

iLing: Opens on-line access to GE Online Center engineers and Answerline Applications Specialists for the purpose of sending and receiving information related to the scanner.

Service: Used most often by field engineers to save User and/or Auto Voice protocols and to perform system diagnostics.

Shutdown: Displays the Shutdown Attention screen from which you can restart the system, shutdown then restart, or perform user log-out for Data Privacy.

## Message Bar

The status area displays system messages and reconstruction, archive, network, film and reconstruction status.

It is divided into three areas

Figure 1-7 1 = Operator Console Information Area, 2 = Function and Status Area, 3 = System Status Message Area.



1. Operator Console Information Area

2. Feature Status Area

- The Recon Status displays the status as the percent of images completed for the exam, series, and image range for both prospective and retrospective reconstruction. Click Recon Status to display the Recon managementscreen.
- The Archive/Restore Status displays the status of the exam, series, and images currently being saved or restored as well as the status of the storage media. The Remove Status is displayed as "Removing" or "Removed". The individual exams, series or images are not listed.
- The Network Status displays the status of the exam, series, and images currently being sent or received.
- The Film Status displays the status of the exam, series, and images currently being filmed. This icon can be used to open the manual film composer

3. System Status Message Area

- Click on the area to see a list of system messages. These messages are not necessarily error messages but can be any informational message generated by the system.
- View Log opens the system log for more detailed information about messages and errors.
- Clear removes messages displayed in the message area.
- Close closes the message window.
- Memo allows you to leave a memo for the service engineer

## New Patient

**Exam Rx**

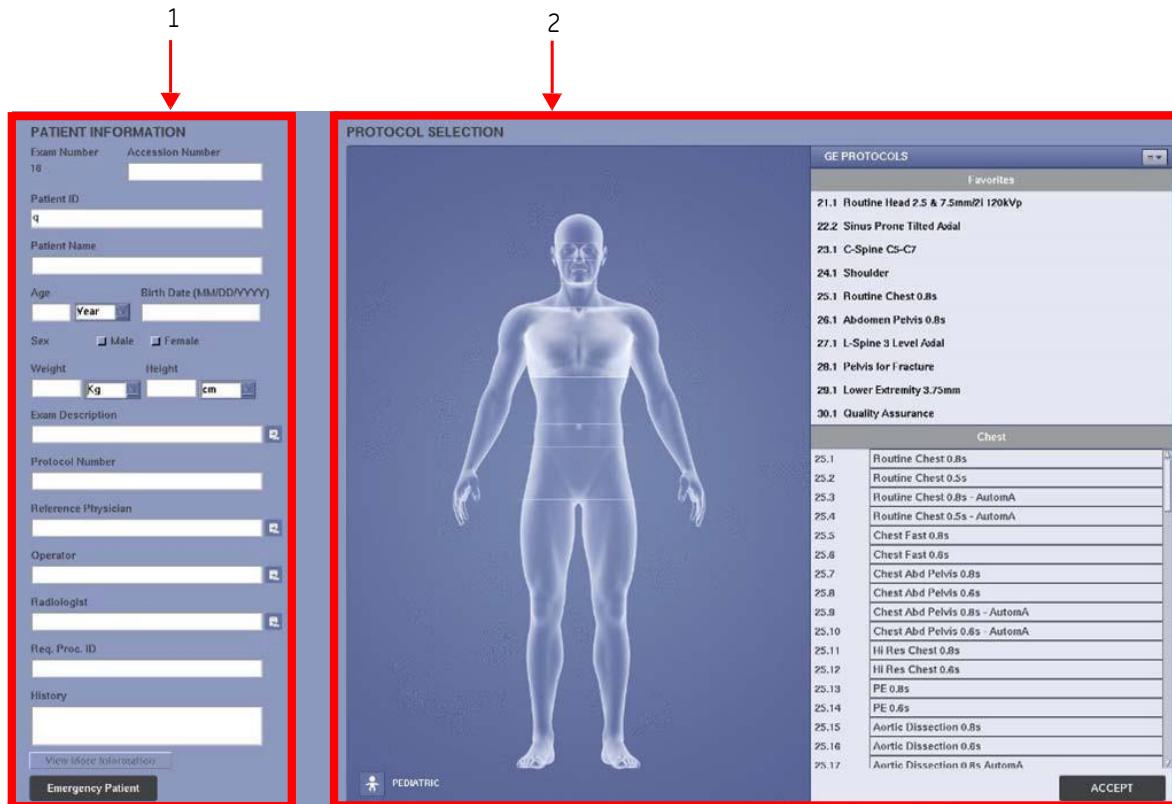
Click the **Exam Rx** icon to open the Exam desktop.

Figure 1-8 Exam Rx Desktop

Default will display new patient interface. It is divided into multiple areas

Area 1 = patient information area

Area 2 = protocol selection area



## Emergency Patient

### Emergency Patient

Click the **Emergency Patient** icon to enable emergency protocol options. It is divided into multiple areas:

Area 1 = patient information area. The Patient ID is always Trauma. The Patient Name is Year/Month/Day/Time and the CT name. Both fields can be modified.

Area 2 = protocol selection area. Protocols are set and edited in Protocol Management.

Figure 1-9 Emergency Patient

## Scan Setup screen

The Scan Setup screen displays when an exam is in process. It is divided into multiple areas:

Area 1 = Patient Position and Series Level Functions area. The buttons that display in the Series Level Functions area may vary depending on your system configurations and purchased options.

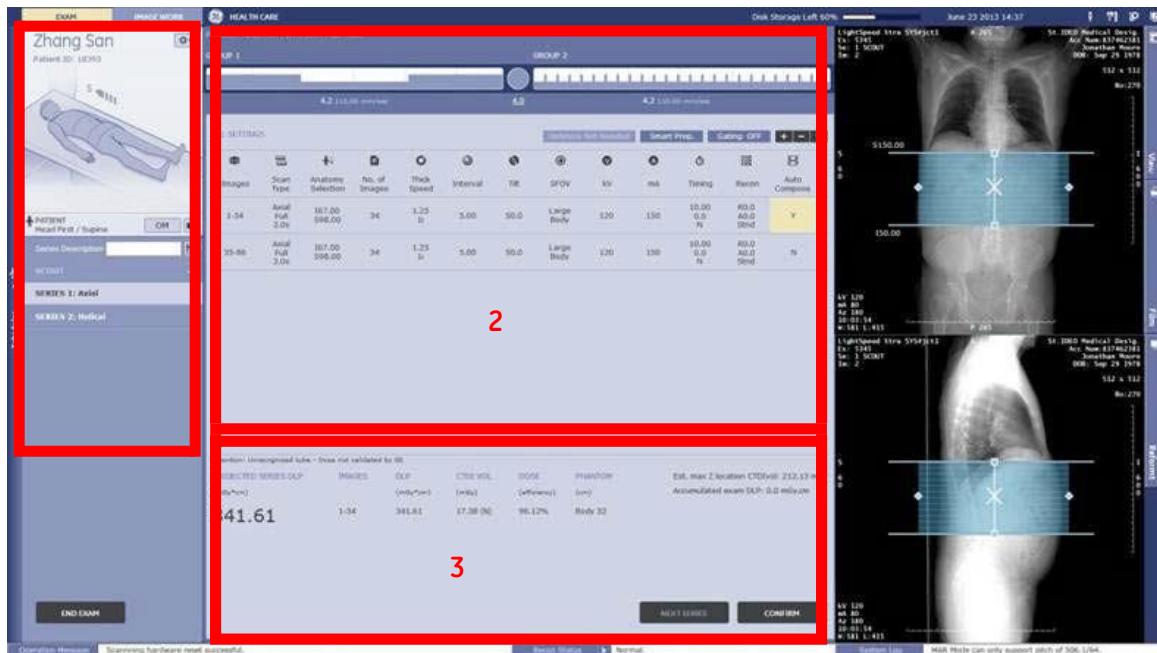
Area 2 = ViewEdit area. This is the area in which you adjust scan parameters. It also displays the real time scan progress information.

ViewEdit conventions:

- You can edit the fields by row or column. If you edit by column, then the changes will apply to all rows. If you edit by row, any changes only apply to the selected row.

Area 3 = displays multiple types of content. Typically, dose information is displayed in this area. It may also display Real Time information when the active application requires it.

Figure 1-10 Scan setup screen

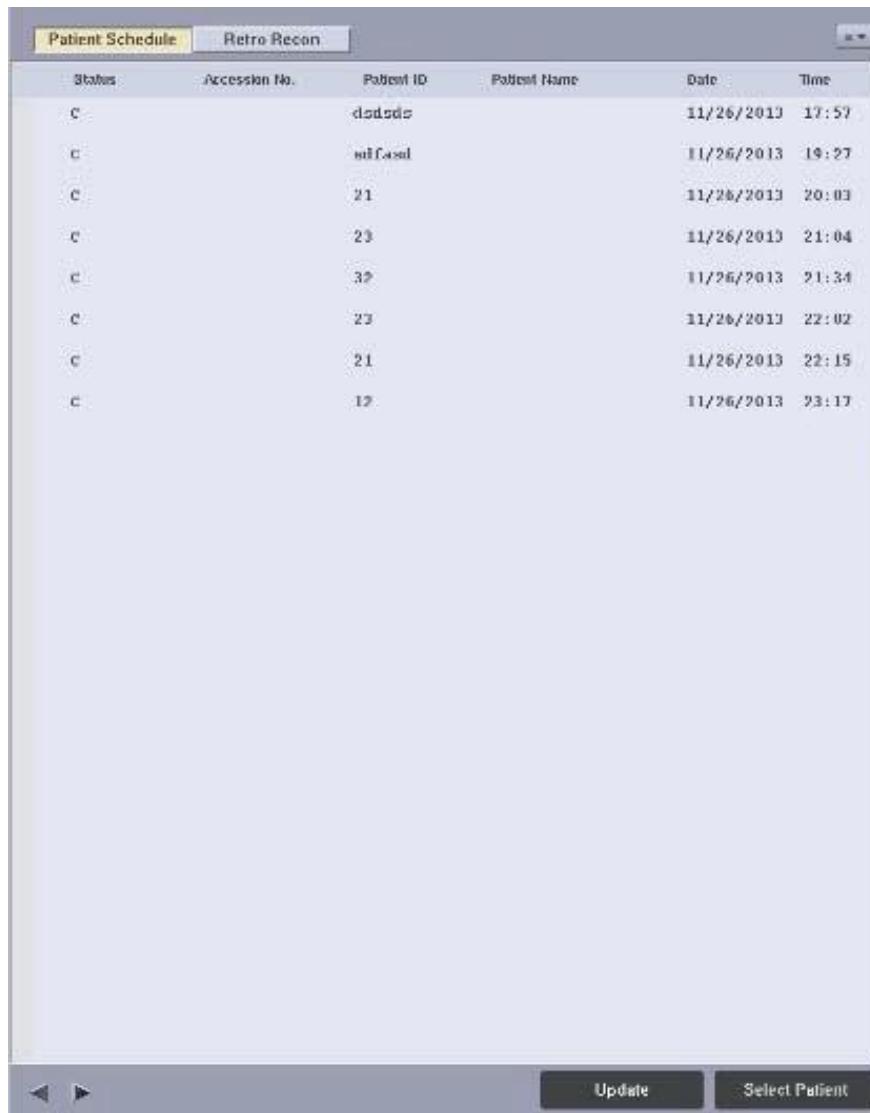


## EXAM RX

### Patient Schedule

Click the **Patient Schedule**  icon to enable the Schedule screen.

Figure 1-11 Patient Schedule



The screenshot shows a software interface titled "Patient Schedule". The window has two tabs at the top: "Patient Schedule" (which is selected) and "Retro Recon". Below the tabs is a table with the following columns: Status, Accession No., Patient ID, Patient Name, Date, and Time. There are eight rows of data in the table, each representing a scheduled exam. The data is as follows:

Status	Accession No.	Patient ID	Patient Name	Date	Time
C		dsdads		11/26/2013	17:57
C		mfassd		11/26/2013	19:27
C		21		11/26/2013	20:03
C		23		11/26/2013	21:04
C		32		11/26/2013	21:34
C		22		11/26/2013	22:02
C		21		11/26/2013	22:15
C		12		11/26/2013	23:17

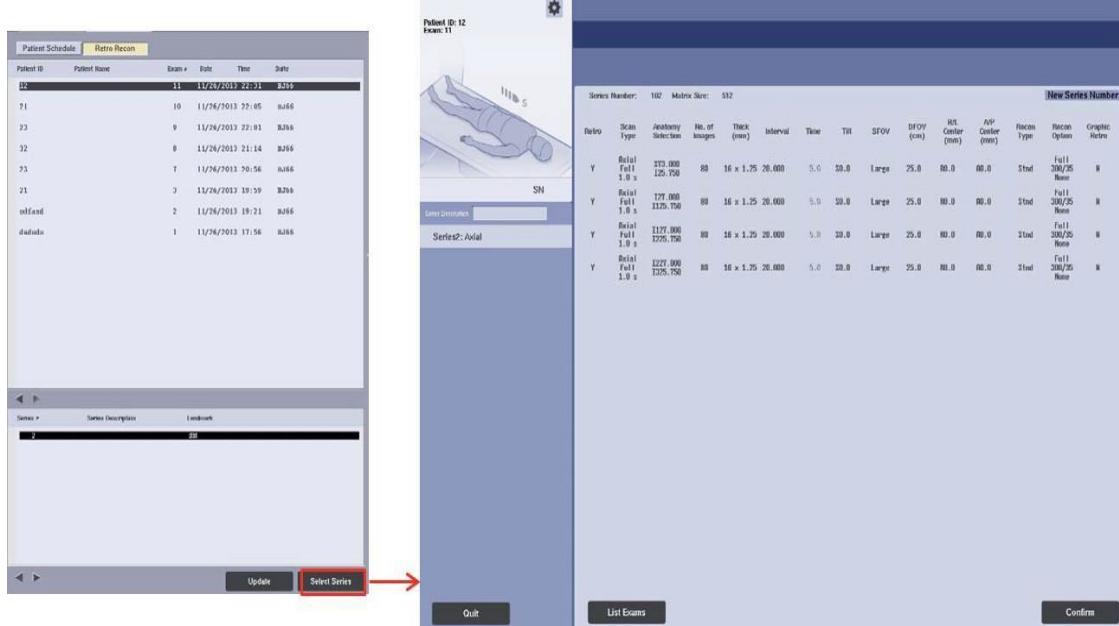
At the bottom of the window, there are navigation arrows, an "Update" button, and a "Select Patient" button.

## Retro Recon

Click **Retro Recon** to open the Retro Recon List Select screen. Select the desired exam and series, then click Select Series to open Retro Recon. Retro ViewEdit conventions.

- You can edit the fields by row or column. If you edit by column, then the changes will apply to all rows. If you edit by row, the change only applies to the selected row.

Figure 1-12 Retro recon

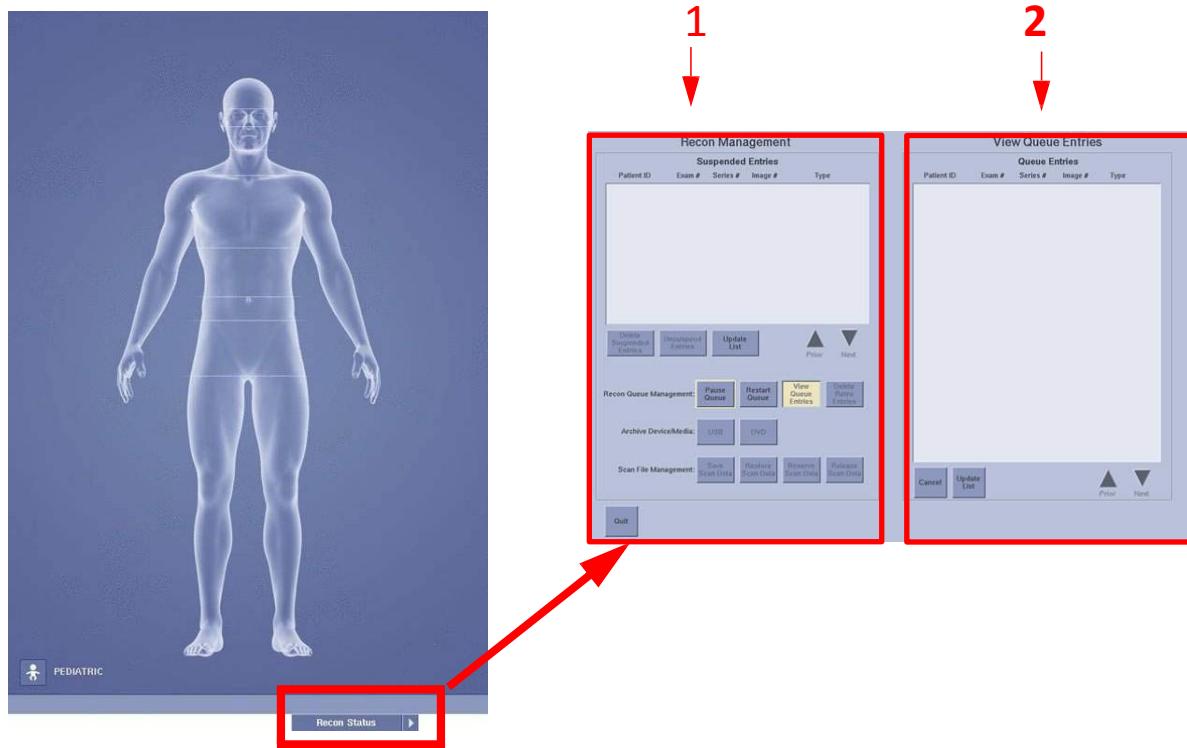


## EXAM RX

### Recon Management

Click **Recon Status** to display the Recon Management screen (1), some options will open the second area (2).

Figure 1-13 Image Reconstruction Management

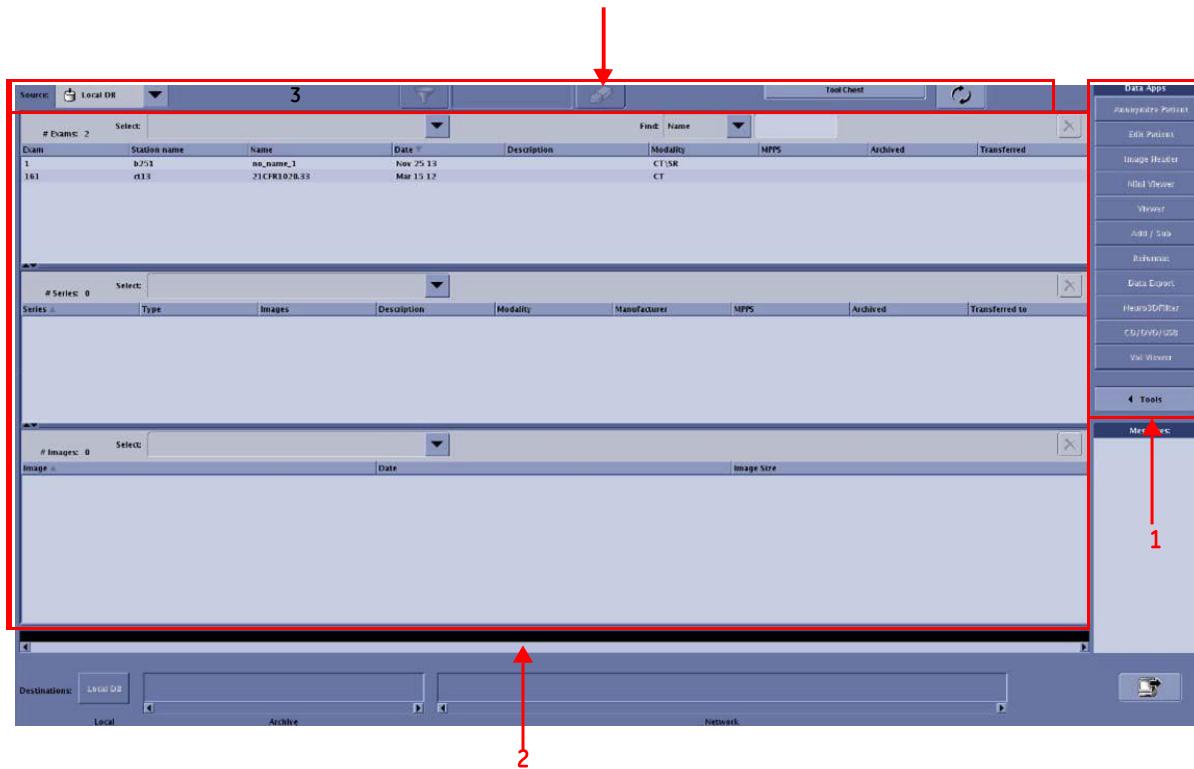


## ImageWorks

Click **Image Works**  to open the browser. Select exam/series/images from the patient list (2) and select an application from the browser menu bar (1).

Figure 1-14 ImageWorks desktop, 1 = browser list of applications, 2 = browser list of patients, 3 = Browser menu bar

3



## Multitask Bar

Click the Film icon to enter film.

Figure 1-15



# User Interface conventions

## Select items from a list

### *Single item*

Click the item.

### *Multiple contiguous items*

- Click and drag over to cover a desired list of items.
- Click a start point in the list, press **Shift**, click an end point in the list, and all items between start and end are selected.

### *Multiple non-contiguous items*

Press **Ctrl** and simultaneously click each item.

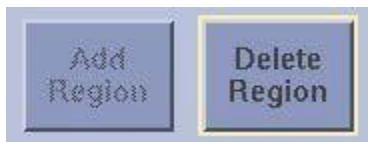
## Cancel

The Cancel button closes a screen without executing the actions or implementing the parameters given on the screen.

## Button appearance

Buttons that are gray are currently not available.

Figure 1-16 the button on right has active or available status, the button on left has inactive or not available status



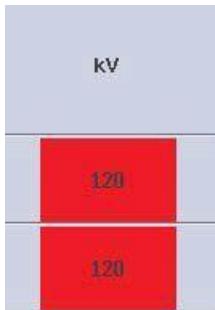
Buttons that are selected are yellow.

Figure 1-17 The bottom button is the button for selected Images



Buttons that are sensitive and invalid are red.

Figure 1-18 Red buttons indicated invalid values



Buttons that are sensitive and the value appearing in the button is updated by the system are orange.

Figure 1-19 Orange button indicates the system has updated the value



Table 1-4 User interface translations

User Interface	English	Translation
Head	Head	Head
Orbit	Orbit	Orbit
Neck	Neck	Neck
Upper Extrem.	UpperExtremity	UpperExtremity
Chest	Chest	Chest
Abdomen	Abdomen	Abdomen
Spine	Spine	Spine
Pelvis	Pelvis	Pelvis
Lower Extrem.	Lower Extremity	LowerExtremity
<b>PEDIATRIC</b>	Pediatric	Pediatric
<b>User Protocols</b>		
<b>GE Protocols</b>	User	User
<b>Service</b>	GE	GE
<b>Most Recent</b>	Service	Service
	Most Recent	Most Recent

## System troubleshooting tips

- If you can no longer type in a field, move the cursor to the field and click the middle mouse to restore functionality. If this does not work, then a system shutdown is required.
- Complete all Fast Cal sections. This will ensure the validity of system air calibrations and generator calibrations.
- Scan aborts may occur during Axial or Helical scanning. Always be aware of the scan progress during an Exam, in the event it stops, select Resume immediately to continue.
- In general, wait for a screen transition to complete before making another selection. Switching desktops before the user interface is displayed can result in the wrong screen displayed on the desktop.
- If the console has no response after 2 minutes or longer, please click **Shutdown** to restart the system. If you cannot select Shutdown, turn off the console power switch, wait 10 seconds, then turn the console power switch back on. The system should come up normally.
- A pink warning dialog may appear indicating the system has low disk space due to a full system disk partition. Removing images does not resolve the problem. Contact your service representative to help resolve the problem. If a message to run storelog appears, select the option to remove the logs.
- If you see the following message, please contact your service provider: "Attention – Scan disk array has encountered a hard drive failure. The system is functional, but if another hard drive fails you will lose scan data. Please contact GE service to have the disk array repaired as soon as possible.

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# Chapter 2 : Safety

The User Manual and Technical Reference Manual include information required for the safe use of the equipment. This chapter summarizes the most important safety issues. Some of the concepts you need to understand:

## Introduction

[Warning labels and symbols](#)

[General safety guidelines](#)

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[Electrical safety](#)

[Mechanical safety](#)

[Emergency Patient](#)

[ASiR](#)

[Laser safety \(Reference 21CFR 1040.10\(h\)\)](#)

[Reconstructed image orientation](#)

[Data safety](#)

[Applications software safety](#)

[Application-specific safety topics](#)

[Accuracy of measurements](#)

[Operator console ergonomics](#)

[Accessories](#)

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[Cleaning equipment \(Bio Hazard\)](#)

[Environmental concerns](#)

[Name and concentration of hazardous substances](#)

# Introduction

This chapter provides information about safety precautions and procedures. It is important for you to read and understand the contents of this chapter so the correct precautions and procedures are followed.

This manual should be kept near the console for easy access.



## CAUTION

This system was designed for use by individuals trained in CT system operation. Study the Safety Tab of this Manual before you scan the first patient. Use the Index to find the section and page number of an item of interest. Periodically review the User Manual, Applications Tips and Workarounds, and the Technical Reference Manual.

If necessary, additional training can be made available from a GE Applications Specialist. Contact your institution's GE sales representative for additional information about further safety and operational training.

The system complies with IEC 60601-1 standards.



## WARNING

Modification of any existing patient data on the system must follow the guidelines specified in the User Manual (21CFR 801.109).

The system is classified as a Type I, IPX0 equipment, not suitable for use in the presence of a flammable anesthetic mixture with oxygen or nitrous oxide. It is rated for continuous operation with intermittent loading. No disinfection is applied. The patient table cradle and cradle accessories are considered Type B accessory parts.

The system is intended to be used for head and whole body computed tomography. Refer to each Technical Reference Manual for the detail information.

United States Federal Regulation 21CFR 801.109



## CAUTION

Federal law restricts this device to sale by or on the order of a physician.



## CAUTION

Improper system usage could void your warranty. More importantly, you could endanger your patients and yourself if you do not follow the correct procedures.

## Warning labels and symbols

This chapter addresses three safety classifications:



### DANGER

The most severe label describes conditions or actions which result in a specific hazard. You will cause severe or fatal personal injury, or substantial property damage if you ignore these instructions.



### WARNING

This label identifies conditions or actions which result in a specific hazard. You will cause severe personal injury, or substantial property damage if you ignore these instructions.



### CAUTION

This label applies to conditions or actions that have potential hazard. You may cause minor injury or property damage if you ignore these instructions.

This chapter uses the international symbol or icon along with the danger, warning, or caution message.

Table 2-1 IEC Standards

Symbol	IEC Standard
~	Alternating current
○ ⊥	Protective earthing point
	ON / Power
○	OFF / Power
→ ○	Input Power
○ →	Output Power
●	Type B Equipment
⊥	Functional Earth Ground
! △	Warning - consult accompanying documents



Caution -- consult accompanying documents



Electrical Shock Hazard

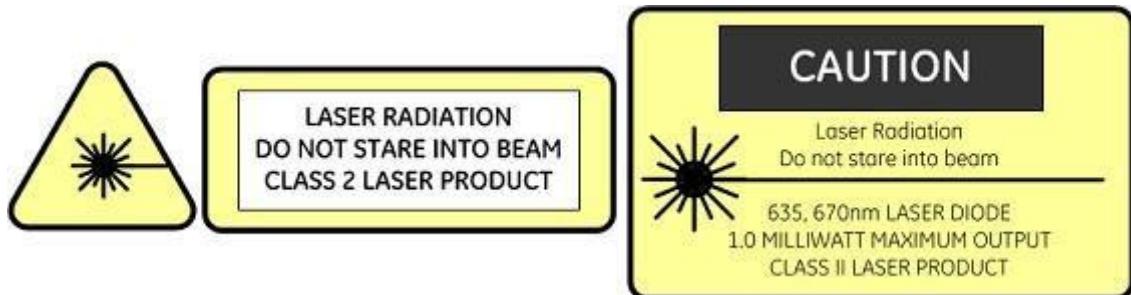
Table 2-2 Symbols used in Labeling

Symbol	Definition
Made For	Refers to the Legal manufacturer (responsible for design)
Made By	Refers to the place of origin
	General Warning Sign (may be accompanied with text)
	Refer to instruction manual/booklet
	Pushing prohibited
	Manufacturer (responsible design owner)
	Model Number
	Serial Number
	Manufacture date
	X-ray Filtration (Al Equivalent Filtration)
	Minimum Filtration
	Radiation of Laser Apparatus
	Large Focal Spot
	Small Focal Spot

## Equipment Warning Labels

The following Warning Labels are used on the equipment:

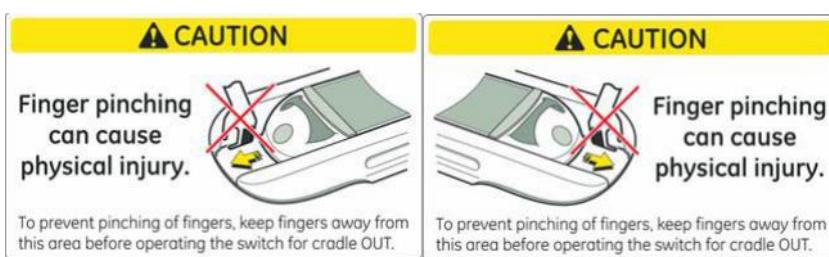
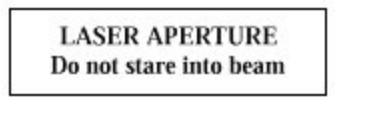
Figure 2-1 The following warning labels are located at the bottom of the gantry cover(Reference 21CFR 1040.10 (h))



### CAUTION

LASER RADIATION  
DO NOT STARE INTO BEAM  
CLASS 2 LASER PRODUCT

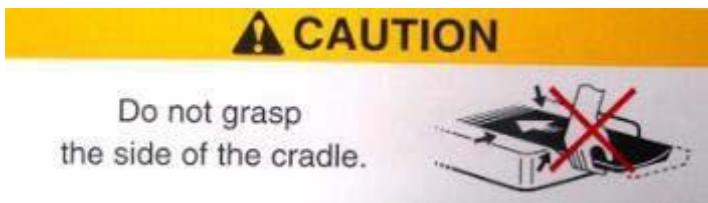
Figure 2-2 Labels on the front of the gantry(Reference 21CFR 1040.10 (h))



Finger pinching can cause physical injury.

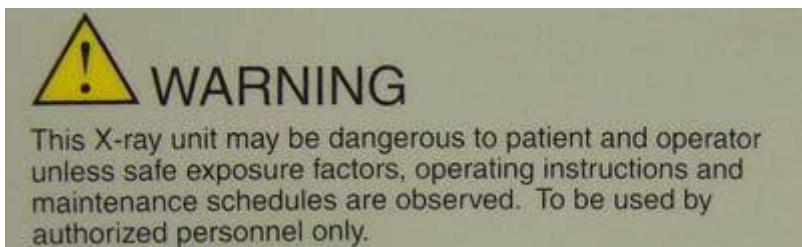
To Prevent pinching of fingers, keep fingers away from this area before operating the switch for cradle OUT.

Figure 2-5 Label on the side of the table

**CAUTION**

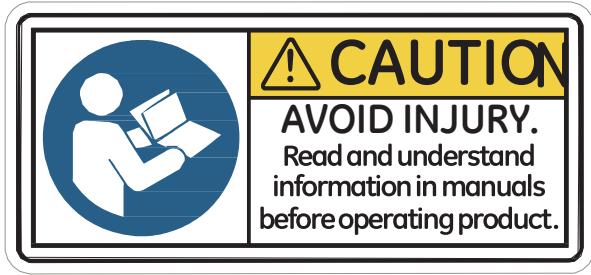
Do not grasp the sides of the cradle in your hands.

Figure 2-6 The following labels are located on the operator console (Reference 21CFR 1020.30 (j))

**WARNING**

This X-ray unit may be dangerous to patient and operator unless safe exposure factors, operating instructions and maintenance schedules are observed. To be used by authorized personnel only.

The following Warning Labels are used on the equipment if the equipment is in compliance with IEC60601-1:2005:

***CAUTION***

AVOID INJURY. Read and understand information in manuals before operating product.

Figure 2-8 Caution Label Located on PDU

***CAUTION***

PDU CAN MOVE AND DAMAGE CABLES. Do not lean on or move when connected to power.

Figure 2-9 The Weight Maximum caution label is used on table

***CAUTION***

AVOID INJURY. Do not exceed Table maximum Capacity of 180kg (397lb).

Figure 2-11 Accessory Caution

**CAUTION**

Do not hit the accessory against the gantry. Patient injury or equipment damage could result.

Figure 2-14 Accessory Load Limit

**CAUTION**

Accessory may fall and cause injury if not latched to cradle. Make sure that accessory is latched to underside of cradle.

## General safety guidelines

- This product was designed and manufactured to ensure maximum safety of operation. It should be operated and maintained in strict compliance with the safety precautions, warnings and operating instructions contained herein, and in any other documentation specific to the product.
- The system has been designed to meet all the safety requirements applicable to medical equipment. However, anyone attempting to operate the system must be fully aware of potential safety hazards.
- The manufacturer or vendor of the equipment makes no representation, however, that the act of reading this manual renders the reader qualified to operate, test or calibrate the system.
- The owner should make certain that only properly trained, fully qualified personnel are authorized to operate the equipment. A list of authorized operators should be maintained.
- This manual should be kept at hand, studied carefully and reviewed periodically by the authorized operators.
- Unauthorized personnel should not be allowed access to the system.
- Do not leave the patient unobserved at any time.
- Become familiar with the functional hardware so that you can recognize serious problems. Do not use the system if it appears damaged or if it fails. Wait for qualified personnel to correct the problem.
- Abbreviations used in the operator manuals can be found in the User Manual.
- If the product does not operate properly or if it fails to respond to the controls as described in this manual, the operator should:
  - First ensure the safety of the patient.
  - Next ensure the protection of the equipment.
  - Evacuate the area as quickly as possible in any potentially unsafe situation.
  - Follow the safety precautions and procedures as specified in this manual.
  - Immediately contact the local service office, report the incident, and await further instructions.
- The images and calculations provided by this system are intended as tools for the competent user. They are explicitly not to be regarded as a sole incontrovertible basis for clinical diagnosis. Users are encouraged to study the literature and reach their own professional conclusions regarding the clinical utility of the system.
- Understand the product specifications, system accuracy, and stability limitations. These limitations must be considered before making any decision based on quantitative values. In case of doubt, please consult your sales representative.
- Do not block the ventilation ports of the electronic equipment. Always maintain at least 6 inches (15 cm) clearance around the ventilation ports to prevent overheating and damage to the electronic hardware.



### CAUTION

Prior to powering on the system, the room environmental operating conditions found in the System Specification chapter must be maintained for at least 24 hours. These conditions must be constantly maintained when the system is energized and/or in use.

**CAUTION**

Do not load any non-GE approved software onto the computer.

Watch for the electromagnetic compatibility from other hardware. For more information, refer to the Electromagnetic Compatibility chapter in Technical Reference Manual.

**DANGER**

Make sure all covers are in place before you use the equipment. The covers protect you and your patient from moving parts or electrical shock. The covers also protect the equipment.



Only qualified Service personnel should service the system with the covers off.

**DANGER**

Information on internal gantry components is provided for user education. The gantry contains dangerous voltages and moving parts. TO PREVENT ELECTRICAL SHOCK OR CRUSHING INJURIES, DO NOT REMOVE COVERS OR ENTER THE GANTRY. ONLY TRAINED, QUALIFIED SERVICE PERSONNEL MAY REMOVE GANTRY OR OTHER EQUIPMENT COVERS.

**WARNING**

This system is intended for use by healthcare professionals only. This system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as reorienting or relocating the system or shielding the location.

**CAUTION**

Only the reference protocols provided by GE contained under the GE tab selector constitute recommendations to be applied directly so as to allow optimized operation. Any other protocols provided by GE are not intended for clinical use.

**WARNING**

If not comply with DICOM conformance statement by GE, connection of the system to a network/data coupling that includes other equipment could result in previously unidentified risks to patients, or operators. Consult GE-published DICOM conformance statement which is available on the GE Healthcare website at [http://www.gehealthcare.com/usen/interoperability/dicom/products/ct\\_dicom.html](http://www.gehealthcare.com/usen/interoperability/dicom/products/ct_dicom.html)



Imaging functions may be lost without warning. Emergency procedures should be developed to prepare for such an occurrence.

## Implanted Device Safety



### WARNING

CT Scans may cause interference with implanted or externally worn electronic medical devices such as pacemakers, defibrillators, neurostimulators and drug infusion pumps. The interference could cause operational changes or malfunction of the electronic medical device.

#### *Recommendations prior to scanning*

- If practical, try to move external devices out of the scan range.
- Ask patients with neurostimulators to shut off the device temporarily while the scan is performed.
- Minimize the X-ray exposure to the electronic medical device.
- Use the lowest possible X-ray tube current consistent with obtaining the required image quality.
- Do not scan directly over the electronic device for more than a few seconds.



For procedures such as CT Perfusion or CT Interventional scans that require scanning over the electronic medical device for more than a few seconds, attending staff should be ready to take emergency measures to treat adverse reactions if they occur.

#### *Recommendations after scanning*

- Have the patient turn the device back on if it had been turned off prior to scanning.
- Have the patient check the device for proper functioning, regardless of whether it was turned off.
- Advise patients to contact their healthcare provider as soon as possible if they suspect their device is not functioning properly after a CT scan.



The above suggestions are taken from the FDA Preliminary Public Health Notification: Possible Malfunction of Electronic Medical Devices Caused by Computed Tomography (CT) Scanning, July 14, 2008.

## Radiation safety

(Reference 21CFR 1020.30 (h) (1) (i))



### **WARNING**

Improperly used X-ray equipment may cause injury. Read and understand the instructions in this book before you attempt to operate this equipment. If you fail to follow safe X-ray practices or ignore the advice presented in the manual, you and your patient risk exposure to hazardous radiation.

### Authorized Users

This equipment incorporates a high degree of protection against X-ray radiation outside the useful beam. But this equipment cannot substitute the essential requirement that every user must take adequate precautions to prevent the possibility of any person carelessly, unwisely, or unknowingly exposing themselves or others to radiation.

Everyone having anything to do with X-ray equipment must receive proper training and become fully acquainted with the recommendations of the NCRP<sup>1</sup> and Measurements and the ICRP<sup>2</sup>. NCRP reports are available from:

NCRP Publications  
7910 Woodmont Avenue  
Room 1016  
Bethesda, Maryland 20814



### **WARNING**

Everyone having anything to do with X-ray equipment must take adequate steps to insure protection against injury.

All persons authorized to use the equipment must understand the dangers posed by X-ray exposure so that they can prevent any injury or damage that may result from such exposure. GE Medical Systems urges you to use protective materials and devices to prevent any injury or damage from X-ray exposure.

### General radiation safety



### **WARNING**

Never scan a patient with unauthorized personnel in the scan room. Warn visitors and patients about potential for harm if they fail to follow instructions.

- 
- 1.National Council on Radiation Protection
  - 2.International Commission on Radiation Protection


**WARNING**

It is prohibited to frequently scan the same patient, especially the children, in a long period of time. Examinations of pregnant woman should be under the instruction of doctors. Pay attention to prevent the possibility of careless, unwise or unknowing exposure to the patient, patient's family and medical staff.


**CAUTION**

The width of the LIGHT FIELD of Alignment Light is not exceed 3mm, which is not represent the actual width of TOMOGRAPHIC SECTION.


**WARNING**

Never calibrate, test the system, or warm the tube with patients or personnel present in the scan room without adequate radiation safety precautions being utilized.

- Stay behind a lead screen or lead glass shield during each X-ray exposure.
- Use technique factors prescribed by the radiologist or diagnostician. Use a dose that produces the best diagnostic results with the least X-ray exposure.
- Amber indicator lights on the gantry control panel, and rear of the gantry, illuminate during X-ray exposure.


**CAUTION**

Use of controls or adjustments, or performance of procedures other than those specified herein, may result in hazardous radiation exposure.

### Scans acquired at the same tomographic plane

IEC standard 60601-2-44 states that you must be warned when scans are acquired at the same tomographic plane, i.e., the same scan location. The need for the warning is to make users aware of the potential dose that can be given to the patient when acquiring scans at the same table location.

When acquiring scans in this mode:

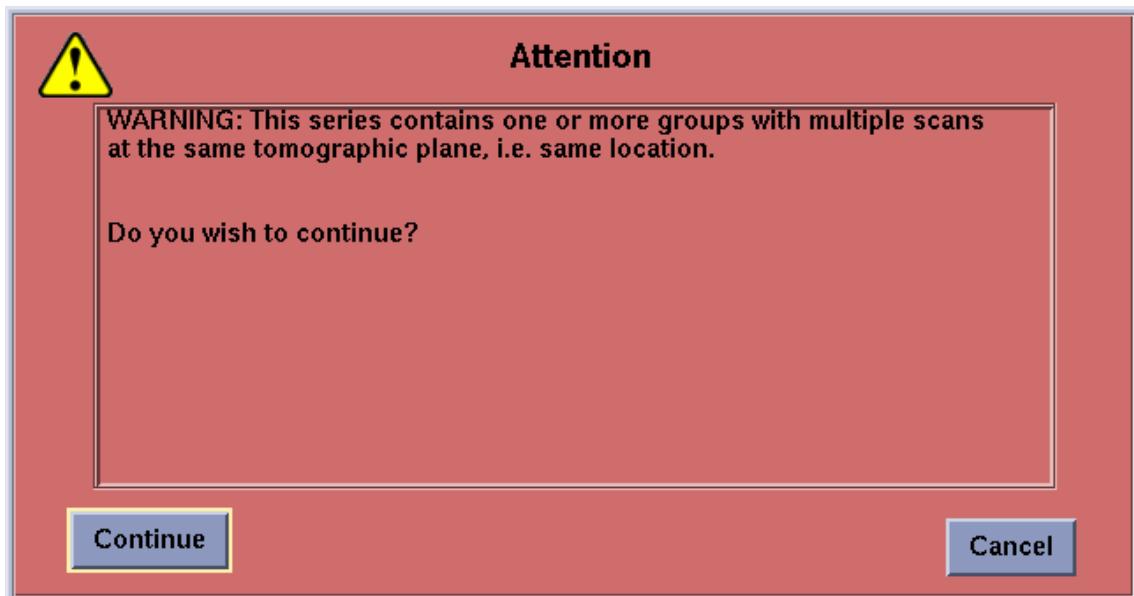
- Utilize the dose information displayed on the ViewEdit screen. The dose information displayed is covered in the next section, CTDIvol.
- An optional DICOM<sup>1</sup> SR<sup>2</sup> Dose Report is saved in Series 997.
- Use proper techniques for the application and anatomy you are scanning.

A warning message (Figure 2-13) is posted when **Confirm** is selected for the following scan types:

- SmartPrep Baseline and Monitor scans
- Cine scans
- Axial scans with zero table increment (interval)

- 
- 1.Digital Imaging and Communications in Medicine
  - 2.Structured Report

Figure 2-15 Warning Message when scanning on the same tomographic plane: Axial, Cine and Helical

**WARNING**

This series contains one or more groups with multiple scans at the same tomographic plane, i.e. same location. Do you want to continue?

**CAUTION**

Prolonged exposure to X-ray in one spot may cause reddening or radiation burns. Users must be aware of the techniques used and exposure time to ensure safe operation.

**CAUTION**

DFOVs larger than 20cm will increase scan range to achieve prescribed digital tilt angle, resulting in an increase for the series total DLP. Please review prescription and make sure DFOV is clinically relevant.

After reading the message, if you wish to continue with the scan, click **Continue**.

**CTDIvol**

As you setup the scan parameters from the ViewEdit screen, the Dose Information area at the upper right of the scan monitor contains updated dose information. This dose information is based on a measurement of the CTDI<sup>1</sup>, which is the current standard for CT dosimetry and performance. By using a measurement called CTDIvol, a single value is provided to estimate the relative dose for an exam.

The CTDIvol is a weighted average measurement in a reference phantom. The dose is expressed in milliGrays. For additional information on specific CTDIvol doses and their calculations, refer to your Technical Reference manual.

---

1.Computed Tomography Dose Index

The DLP<sup>1</sup> is the product of the CTDIvol and the scan length for a group of scans. This number can be summed over the entire exam to give an estimate of the total dose. The value is expressed in milliGray centimeters.

The Projected Series DLP shows the DLP that would result from scanning the current group or groups.

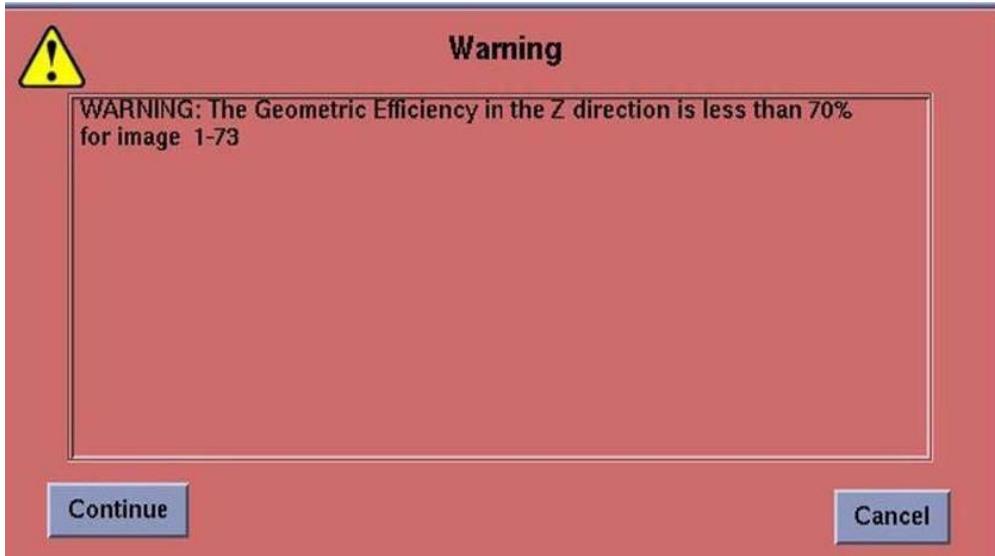
The Accumulated Exam DLP displays the total exam DLP up to the current point in time. Scout dose is not included in the DLP totals since standards for reporting scout dose are not yet defined. Scout dose is generally a very small part of the exam.

The dose information updates when technique values such as kV, mA, scan time, slice thickness, and scan field of view are changed.

Dose information is saved as a screen save image in Series 999 upon selecting End Exam and Series 997 contains the DICOM Dose Structured Report.

A warning is posted when the Geometric Efficiency in the Z direction is less than 70%. Geometric Efficiency is a measure of how much of the X-ray beam in the Z-direction is used by the system.

Figure 2-16 Warning message when dose efficiency less than 70%.



### **WARNING**

The Geometric Efficiency in the Z direction is less than 70% for image 1-73.



The image number of 1-73 is just for example.

### Pediatric and Small Patient Imaging

Adult techniques and protocols should not be used on pediatric patients (under two years of age). The National Cancer Institute and The Society for Pediatric Radiology developed a brochure, (available at: <http://www.cancer.gov/cancertopics/causes/radiation-risks-pediatric-CT>) and the FDA issued a Public Health Notification, (available at: <http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/PublicHealthNotifications/ucm062185.htm>), that discuss the value of CT and the importance of minimizing radiation dose, especially in children. More information can also be obtained at <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm115329.htm>.

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1.Dose Length Product

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### **CAUTION**

Using accessories which are not GE approved accessories might affect dose and image quality.

#### ray tubes

The system uses cooling and reconstruction algorithms specifically designed for GE X-ray tubes.

You risk three dangers when you do not use GE X-ray tubes.

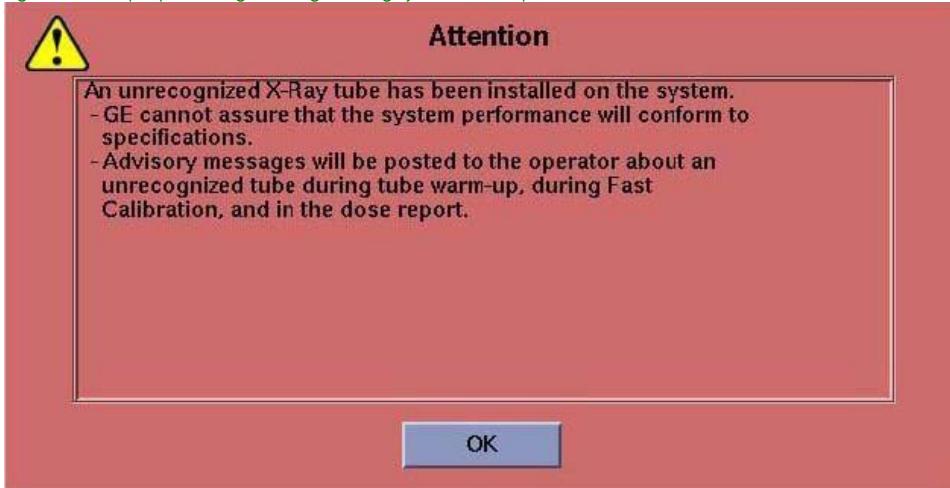
- A non-GE tube could cause destructive component failure if the cooling delays do not meet its design requirements.
- The images could exhibit reduced performance or artifacts if your X-ray tube fails to conform with GE tube performance specifications.
- Radiation leakage may exceed GE specifications when a non-GE X-ray tube is installed in the system.



### **CAUTION**

We cannot guarantee performance or safety if you use a non-GE X-ray tube because the cooling and reconstruction algorithms depend upon the tube design. Radiation leakage may exceed GE specifications when a non-GE X-ray tube is installed in the system.

Figure 2-17 Pop-up warning message during system start up



### **CAUTION**

An unrecognized X-ray tube has been installed on the system.

- GE cannot guarantee that system performance will meet specifications.
- Advisory messages will be posted to the operator about an unrecognized tube during tube warm-up, during Fast Calibration, and in the dose report.

Figure 2-18 Pop-up warning message during tube warm up



### CAUTION

An unrecognized tube has been installed on the system. Tube Cooling algorithms are designed specifically for GE tubes and the performance of the system cannot be guaranteed.



### WARNING

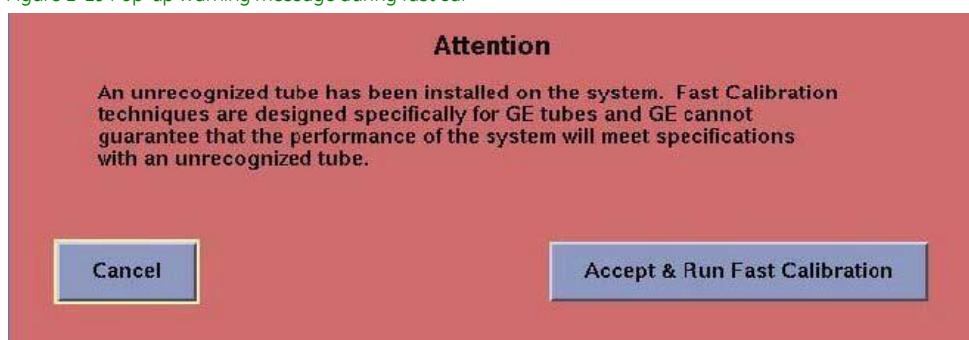
Scans may have been taken within the last two hours.  
Warmup scans may cause subsequent tube cooling delays



### Attention

Tube warmup will run in Autoscan mode.

Figure 2-19 Pop-up warning message during fast cal



### CAUTION

An unrecognized tube has been installed on the system. Fast Calibration techniques are designed specifically for GE tubes and GE cannot guarantee that the performance of the system will meet specifications with an unrecognized tube.

## Electrical safety



### WARNING

To avoid risk of electric shock, this equipment must only be connected to a supply mains with protective earth.



### DANGER

ELECTRICAL SHOCK HAZARD. Avoid all contact with any electrical conductor. Do not remove or open system covers or plugs. Internal circuits use high voltage capable of causing serious injury.

To guarantee safe, reliable equipment performance, prepare the site according to GE Medical Systems requirements. This includes making sure the equipment is connected to a supply mains with a protective earth. If you have any questions about these requirements, contact GE Medical Systems.

An electrical hazard may exist if any light, monitor, or visual indicator stays on after the system is shut down. To prevent possible injury, turn off the main power supply wall switch, and contact your service office immediately.



### DANGER

NO USER SERVICEABLE PARTS. Refer service to qualified service personnel. Only allow people who know the proper procedures, and use of the proper tools, to install, adjust, repair, or modify the equipment.

To guarantee safe, reliable equipment performance, prepare the site according to GE Medical Systems requirements. If you have any questions about these requirements, contact GE Medical Systems.

Fuses blown within 36 hours of being replaced may indicate malfunctioning electrical circuits within the system. Have the system checked by qualified service personnel, and do not attempt to replace any fuse.



### DANGER

ELECTRICAL FIRE. Conductive fluids that seep into the active circuit components of the system may cause short circuits that can result in electrical fires. Therefore, do not place any liquid or food on any part of the system.

To avoid electrical shocks or burns caused by the use of the wrong type of fire extinguisher, make sure that only fire extinguishers approved for use on electrical fires are used.

- Surplus lengths of power cords or other cables from mobile accessory units that may be used during some patient scanning should be stored in safe and isolated areas. For example, excess

cable may be wound in a figure eight and stored at the base of the stationary equipment. This minimizes signal interference and protects cables from damage due to traffic.

A CT System combined with GE approved accessories complies with the IEC60601-1 standards related to safety and performance of medical electrical systems. Refer to the standard for more information.

- Do not connect electric devices to the CT System that are not approved by GE. It may create increased electrical leakage current and there is possibility of electric shock.
- It is expected that the provided cable for the CT system will be used to provide power to the GE console monitor. Do not connect these devices to power sources other than the CT system (for example, wall outlets, or other electrical equipment). It may create increased electrical leakage current and there is possibility of electric shock.
- Note that some powered equipment may only be connected by a signal cable to GE equipment (for example, a network hub). A separation device is required for equipment that is powered by a different power source.

## Mechanical safety

### General mechanical safety

- Check for any obstructions around the equipment before attempting to move the table and gantry. When performing table or gantry motions, always monitor the progress of the motion.
- When the cradle extension or head stabilizer are in place, you must be extremely careful when moving the Table in order to avoid pushing these pieces into the gantry cover.

If the table reaches one of the limits while you are actively pressing the controls, the indicator will turn off when the controls are released.

Clear interference by moving the cradle.

#### CAUTION

Installation of the system shall be performed by qualified persons designated by the Manufacturer. To be certain of the proper installation of the equipment, please contact your local GE Healthcare Service.



#### Warning

- No modification of this equipment is allowed without authorization of the manufacturer.



#### WARNING

Pinching or crushing may happen if the gantry touches the patient.

- Avoid any patient contact with the gantry during cradle movement (manually or software driven).



#### WARNING

Danger of internal rupture - do not allow the system to become exposed to violent mechanical shock or impact (because shock or impact may cause the cathode ray tube (CRT) to break). This may result in flying pieces of glass and Phosphor coating that can cause serious injury.



#### WARNING

The IN-limit position of cradle short coverage area mode should be set in order not to pinch a patient's foot between the cradle edge and the wall of the scan room.



#### WARNING

To prevent pinching or crushing of the patient, always watch the patient and equipment carefully at all times during table movement. If Unwanted Motion Occurs or Motion Does Not Stop, Press the Emergency Stop Switches on the Console or Gantry.

## Patient Positioning



### CAUTION

Keep the patient in view at all times.

- Never leave the patient unattended.



### CAUTION

If the head is poorly positioned in the head holder, images with different CT numbers and intensities may be seen at the edges of two rotational interfaces. Ensure that the patient's head is properly positioned in the head holder, and not located at the area where the holder and cradle connect. If a repeat scan is needed, make sure the locations with different intensities are in the middle of the beam collimation. Please do not repeat the use of completely identical scan preset schemes.



### Danger

Please do not allow patients weighing over 180kg to lie on the table (except High Capacity Table). This could cause the table to fail and the patient could fall.



## Table Capacity

### Revolution ACTs Table

- Ensure weight does not exceed 180kg (397lb), with a position accuracy of  $\pm 0.25$  mm.

The concentrated weight of short, heavy patients may cause the cradle to make contact with the gantry.

- Make sure you do not drive the cradle into the gantry cover.
- Make sure you do not pinch the patient's skin or extremities between the cradle and the gantry.



### CAUTION

When using patient positioning accessories, make sure there are no areas, which might cause a pinch point or interfere with patient tubing or IV tubing.



### CAUTION

Check to make sure the power injector has enough IV tubing to allow free movement of the cradle. Make sure the unit itself does not interfere with table travel.

Ensure excess tubing length is secured to the table top. DO NOT loop additional IV tubing in the patient's fingers.



### CAUTION

The patient positioning straps provided with the system do not support the full weight of the patient.

Patient positioning straps should be used to aid in patient positioning and are not meant to fully restrain the patient.



**CAUTION**

Care should be taken to ensure the patient positioning straps, patient clothing, or other material will not be caught during table motion.

- The scannable range is not indicated by the black marks on the table. The E02 displayed on the gantry display indicates the scannable range.
- 

**CAUTION**

Physically assist all patients on and off the table and into position on the cradle.

**CAUTION**

As pediatric/thin patients are smaller in diameter, usually a folded towel, cushions and/or pads are commonly used to elevate the patient in order to be at the center of the gantry. The center of the gantry can be easily recognized/understood by using the built-in positioning lights.

- Latch the cradle for patient loading and unloading.
- Lock the cradle position before the patient gets on or gets off. When the cradle latched is released, the cradle unlatched indicator will light up.

**WARNING**

To prevent pinching or crushing of the patient's extremities, keep the patient's hands and feet away from the edge of the moving table top/cradle and its surrounding equipment, or keep them away from the areas between the table base and the side panels of the table. (Take special care when positioning physically large patients.)

- Check the length of all patient treatment cords and tubes (IV tubing, oxygen line, etc.) and make sure they are long enough to accommodate for cradle travel. Position these lines so they cannot catch on anything within the patient vicinity or between the table and gantry during cradle travel.

**WARNING**

To prevent pinching or crushing of the patient watch the patient and equipment carefully at all times during table movement. If unintended motion occurs or there is no way to stop motion, press the Emergency Stop switches on the console or the gantry.

**WARNING**

If during the positioning process the patient attempts to wear the head holder themselves, this may break the holder and injure the patient's head and neck. The head holder and cradle extender are only designed to support 34kg(75lb). Guide the patients to move up into the head holder, or manually help them into position.

**CAUTION**

The patient's head holder or cradle extender should be securely fastened to ensure stability. If they not secured properly, image quality degradation may result due to movement of the loose head holder.

**CAUTION**

Any use of an extension accessory to the cradle (like the table extension, head holder and phantom bracket) must not create a table - gantry interference matrix. Therefore, additional care needs to be taken to closely monitor any table in/out movement to avoid contact of the extension accessory with the gantry.



Collision sensors are placed under the table surface which in most cases can stop downward motion and minimize the effects of a collision. Upward motion is still allowed if a collision sensor has been activated.

- Check the accessory attachment plate fixed to the end of the cradle. Repair or replace if loose or damaged.
- The cradle extender can be used to support the patient's head or feet during a scan.

### *RevolutionACTs*

- To move the patient out of the gantry in an emergency, the cradle can be manually withdrawn by applying a minimum 250N (56 lb) of force.

**CAUTION**

Temporal sampling may be degraded due to changes in timing for the table to move from location to location if proper positioning methods are not followed. Make sure that the patient is securely positioned on the table and that their arms are not allowed to drag on the table, or allow clothing, sheets or blankets to get caught causing a table move problem.

**WARNING**

Temporal interval for some of the images exceeds 3.2 seconds. Use of this data for processing of CT Perfusion maps may contain errors in the functional information.

## Emergency Patient

This section contains Emergency Patient warnings.

Figure 2-21 Warning message: Emergency Patient



### CAUTION

No Emergency Patient protocol default has been set. Please use Emergency Patient Protocol in Protocol Management to set Emergency Patient protocol defaults.

- Check that the Protocol content and protocol icon are referenced correctly.
- Check the parameters for each link.
  - PatientOrientation
  - Patientposition
  - Anatomicalreference
  - Anatomicalcoverage

**ASiR\***

The section contains ASiR warnings.

Figure 2-22 Warning message when turning Off ASiR in protocol

**WARNING**

ASiR has been disabled. Please adjust the mA and Noise Index values to the appropriate pre-ASiR values before using Dose Reduction Guidance. Using Dose Reduction Guidance on already dose reduced scan parameters may cause sub-optimal or non-diagnostic images. Please consult your operator documentation for additional information.

Figure 2-23 ASiR Modification Caution

**CAUTION**

The system recommended ASiR level has been modified by the operator. The noise level in the image may be affected. If the desired image quality is not as expected, use Retro Recon to reconstructed the images at the system selected ASiR level.

## Laser safety (Reference 21CFR 1040.10(h))

A laser alignment light system is available in order to accurately define the patient scan region.



### WARNING

THE LASER BEAM CAN CAUSE EYE INJURY.

- Tell all patients to close their eyes before you switch ON the alignment lights.
- Instruct your patients to keep their eyes closed until you turn OFF the alignment lights.



Closely monitor infants and inform patients, and prevent them from accidentally staring into the beam.



### CAUTION

The detector and DAS rotate to position the alignment lights over the laser ports.

- Keep your hands away from the gantry opening.
- Make sure the gantry side covers are in place.



### CAUTION

Use of controls or adjustments, or performance of procedures other than those specified herein, may result in hazardous radiation exposure.

- The indicator on the gantry display panel lights when you turn ON the alignment lights.
- Warning labels regarding laser safety are provided on the gantry, as described in the Warning Labels and Symbols section.

## Reconstructed image orientation



### CAUTION

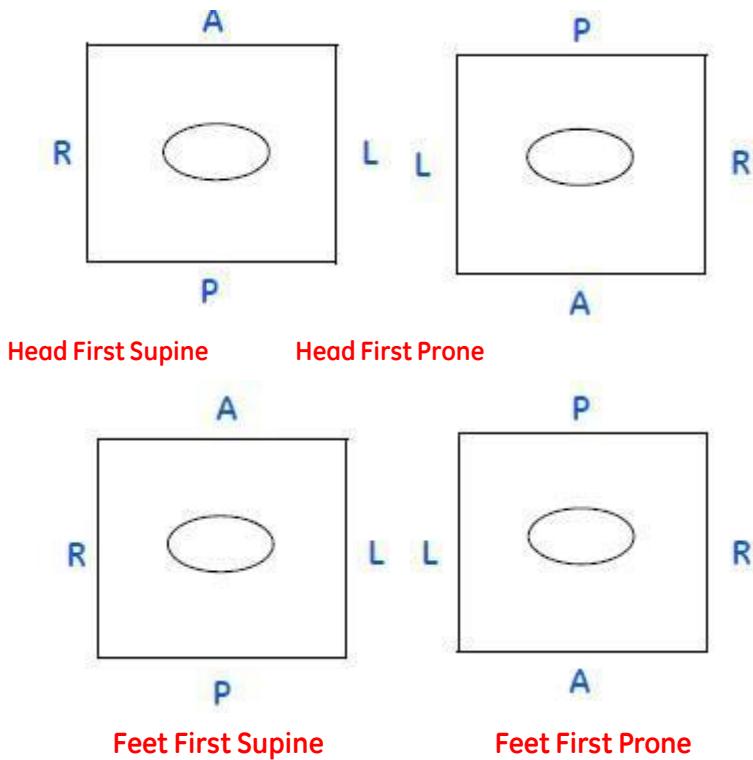
If you plan to reconstruct images, you must first use the files that reside on the disk. Either reserve the scan files you plan to retrospectively reconstruct, or reconstruct unsaved scan files before the system overwrites the file with new scan data. The system refuses to overwrite reserved scan files. Remember to release the reserved scan files when you finish retrospective reconstructions.



### CAUTION

GE CT image reconstruction is in an orientation viewing from the patient's feet. The reconstructed orientation is the orientation in which the image is installed in the image data base, and is the orientation with which images are networked to a remote viewing station.

Figure 2-25 Patient Orientation



The patient position information stored in the image header correctly reflects the orientation (RAS) information for the patient. Viewing applications will correctly reflect Right (R), Left (L), Anterior (A) and Posterior (P) of the patient.

The reconstructed image orientation may differ from preferred anatomical viewing presentation in which the patient's Right is on the viewer's Left and patient's Left is on the viewer's Right. For example, when the patient is scanned Head First and Prone the patient's Left is on the viewer's Left and the patient's Right is on the viewer's Right. The image presentation will need to be modified to display preferred anatomical viewing. Some viewing stations may not have the capability to flip the image presentation, but if the capability exists, you must use display tools such as Flip to change the presentation of the image.

Some remote viewing stations may have the capability to set default viewing protocols. This is another tool that can be used to set an anatomical viewing presentation.

Post processing applications such as Direct MPR, Reformat and Viewer automatically orient images in anatomical viewing orientation. These applications create axial images in anatomical viewing presentation. Please see Auto Applications(Option) of the User Manual for more information. The system also provides the capability to create GSPS<sup>1</sup> to flip the image orientation.

Flip/Rotate in recon can be used to generate images where right/left or anterior/posterior are flipped or where both R/L and A/P have been flipped to meet desired image display preference. An Attention pop-up is displayed at Confirm for series where Flip/Rotate in recon is selected. Attention: This scan prescription utilizes one of the reconstruction-based image flip or rotate options. Please ensure that this prescribed image orientation is displayed appropriately on all remote viewing devices.

Figure 2-26 Flip warning message



**CAUTION**

The scan prescription utilizes one of the reconstruction based image flip and/or rotate options.  
Please ensure the prescribed image orientation is displayed correctly on all remote viewing devices.

1.Gray Scale Presentation State

## Data safety

To ensure data safety:

- Verify and record the patient's identification before starting a scan.
- Observe and record the patient's orientation, position, and anatomical landmarks before starting a scan. Ensure that the patient is positioned within the scan parameters.
- Maintain system image quality by performing Daily QA and other maintenance.

**Connectivity** - Always verify that the data transferred to another system has been correctly received.



### CAUTION

Incorrect data entries or procedures could result in misinterpretation or misdiagnosis.



### CAUTION

When entering Patient ID information, the system may contain multiple instances of the same Patient ID. Multiple schedule records can be due to multiple procedures being ordered under separate accession numbers or New and Completed records in the Patient schedule for the same Patient ID.

When entering the Patient ID, verify that the correct Accession number and Exam Description selected is what is desired. Scanning with an incorrect Accession number may cause problems reconciling exams on a PACS system. See the Schedule Patients chapter for more information.



### CAUTION

The system posts a warning message when expected disk space required to store scan data from the prescribed exam is insufficient.



### CAUTION

The system posts a warning message when expected image space required to store images from prescribed reconstruction is insufficient.



### CAUTION

The system posts a warning message when data was interpolated to generate images.



### CAUTION

The system posts a warning message if there is a failure during the archive of patient data.

**CAUTION**

The system posts a warning message if there is a failure during the network of patient image data.

**CAUTION**

The system posts a warning message when a scan is aborted due to a failure in the acquisition chain.

**CAUTION**

The system posts a warning message when the system has low disk space. This is due to a partition on the system disk getting too full. Removing images will not help. Contact service to help with recovery. If you reboot the system and see the message asking if you want to run storelog, select the option to remove the logs.

**CAUTION**

The system posts a warning message if patient orientation has been changed or does not match after start of exam.

**CAUTION**

The system posts a warning message prior to modifying any existing data set by a software utility.

**CAUTION**

When comparing GE CT images with other images, consult the DICOM Conformance Statement for the details on the DICOM Image Position, Frame of Reference UID and Slice location values stored.

**CAUTION**

Some annotation values are stored in private DICOM elements. When viewing images on a remote station these annotation values may not be visible on the image. Consult the DICOM conformance statement for information on private DICOM data fields.

**CAUTION**

The manual cradle release feature is intended for emergency egress and small movements. In rare instances, if the cradle release is used to move a patient out of the gantry, instead of using the table control buttons as specified in the operator manual, a discrepancy of up to 6 mm between the numerical display on the gantry and the actual position of the table can be introduced.

**CAUTION**

Do not remove images while scanning. Always remove images when the system is idle. Removing images while the system is acquiring and reconstructing data could cause the system to lock up and require a reboot and/or force the system to go into data base recovery.

**CAUTION**

Saving images in Interchange (CD/DVD/USB) while scanning may cause long interscan delays (ISD) to be missed or may cause Auto Voice to fail to play. Do not copy or restore images using CD-R, DVD-R or USB while scanning.

**CAUTION**

If you plan to reconstruct images, you must first use the files that reside on the disk. Either reserve the scan files you plan to retrospectively reconstruct, or reconstruct unsaved scan files before the system overwrites the file with new scan data. The system refuses to overwrite reserved scan files. Remember to release the reserved scan files when you finish retrospective reconstructions.

**CAUTION**

CT Numbers are NOT absolute; misdiagnosis is possible. System and patient variables may effect CT Number accuracy. If you rely solely upon CT numbers without taking the following variables into consideration you could misdiagnosis an image.

## Applications software safety



### CAUTION

Do not initiate a QuickSnap if the system is actively collecting data with X-ray on.



### CAUTION

Do not initiate an IQ Snap while the system is actively scanning or reconstructing data.

## Application-specific safety topics

### Helical scanning



#### **WARNING**

Helical scanning has the inherent ability to produce artifacts when scanning highly sloped anatomy (e.g. pediatric or adult heads). Factors which can deepen this effect include: faster table speeds, thicker image thickness. In some cases these artifacts could be mistaken for a hemorrhage near the cranium, or a thickening of the skull.

To reduce the occurrence of these artifacts, you may prescribe slower table speeds or thinner slices (such as 2.5 mm) during helical scans near the vertex of a pediatric or adult head.



#### **WARNING**

It has been documented in radiology literature that an artifact may occur in the chest that bears the double margin of the great vessels, which emulates a dissection of the vessel during 0.4 - 1.0 second scans. This can occur in axial or helical scans. If you have scanned axially with a 0.4 - 1.0 second rotation time and observe this phenomenon, re-scan the area with a 2 second axial scan to verify if it is artifact or patient pathology. Segment recon mode for helical and cine acquisitions may be used in Retro Recon to also assess if the area is artifact or pathology.

### Lung algorithm

- The Lung algorithm setting provides edge enhancement between structures with large density differences, such as calcium and air, resulting in a sharper lung field when compared to Standard algorithm.
- For best image quality, prescribe a 5 mm scan thickness when you plan to use the Lung algorithm. If you plan to prescribe a High Resolution Lung study with 3.75, 2.5, or 1.25 mm, use the Bone algorithm.
- The Lung setting enhances the contrast of small objects. For best viewing and film quality, select a window width of 1,000 to 1,500 and a window level of -500 to -600.
- The Lung algorithm setting increases the CT number values at the edge of high contrast objects. If you plan to take CT number measurements of vessels or nodules in the lung, please check and compare your results with Standard algorithm images. ROI and Histogram functions use CT numbers.
- **Remember:** The edge enhancement provided by the Lung setting may not be appropriate in some clinical cases. Please take individual viewing preferences into account when you choose the Lung setting.

### Autoscan

- Press and release **Move to Scan** on the console to advance the cradle.
- If Auto Scan is disabled, **Move to Scan** must be pressed for every scan before **Start Scan** will become ready.
- If you select Auto Scan during one group Rx, it remains ON for every group in that series.

Clinician's working in the scan room should wear appropriate protective clothing. Lead aprons, groin and thyroid protection, as well as protective eye wear are available through the GE Accessories Catalog.

## Interventional/biopsy scanning



### CAUTION

The continuous AutoView layout format should not be used for display of images during an interventional study because it does not allow for quick review of images in a free viewport.



### WARNING

When scanning for interventional (biopsy) studies, the scan mode, image thickness, number of images per rotation, and the display layout used affect the display of the images. It is recommended to use the Biopsy Mode provided on the system. If manually prescribing biopsy scans, Axial 1i scan mode or Helical scan mode with a slice thickness greater than 2.5 mm must be used. Do not use Cine scan mode for interventional (Biopsy) imaging. Do not use an AutoView layout with more than one AutoView image viewport.

## Advanced applications safety



### CAUTION

3D or slab reconstructions provide additional supplemental information, complementing diagnosis that should be based on classical techniques.



### WARNING

Non-GE acquired images can be loaded in Volume Viewer but GE does not guarantee the quality or reliability of any reconstruction, segmentation, or measurements performed on these images. Non-GE images can easily be identified by the corresponding image annotation.

Follow the DICOM acquisition parameter guidelines listed in each application user guide. Consult GE-published DICOM conformance statement of Volume Viewer which is available on the GE Healthcare website at [http://www.gehealthcare.com/usen/interoperability/dicom/products/ct\\_dicom.html](http://www.gehealthcare.com/usen/interoperability/dicom/products/ct_dicom.html).



### WARNING

Before using any segmentation tool (threshold, scalpel, remove & keep object, Auto Select, "floater" filters...), always make sure that it will not remove pathologies or other essential anatomical structures.



### WARNING

When using any Segmentation tools (Auto Select, threshold, Paint on slice, Quick Paint...), check contours to check the reliability of the segmentation. Make sure the contours match the correct segmentation and volumes. Check that segmented volumes match contours.

## Measurements



### **WARNING**

Do not use 3D or slab views only to perform any measurements (distance, angle, Region of Interest, Report Cursor, Area, Volume...). Always check measurement points' position and refer to 2D baseline views (acquisition images or reformatted images of minimal thickness) to confirm measurements.



### **CAUTION**

The software calculates and displays measurements with a resolution of one decimal (such as 0.1 mm, 0.1 degree, etc.). You should be aware that the real measurement accuracy is generally less for a number of different reasons (image resolution, acquisition conditions...).

Distance, angle and area measurements are valid only if all trace segments are longer than the inter-slice distance.



### **WARNING**

Depending on WW/WL settings, objects may display differently. Check WW/WL before depositing measurement points.



### **CAUTION**

When filming or saving images for diagnostic purposes, always make sure the patient name and geometry information is displayed on all views, and that they match information on the reference view.



### **CAUTION**

When saving images with a new series description, make sure this description matches the saved images.



### **WARNING**

Check with original datasets the reliability of segmentations and measurements performed in Saved objects after post processing and reloading.

## Segment tools



### **WARNING**

Before using any segmentation tool (threshold, scalpel, remove & keep object, Auto Select, "floater" filters...), always make sure that it will not remove pathologies or other essential anatomical structures.

**WARNING**

When using any Segmentation tools (Auto Select, threshold, Paint on slice, Quick Paint...), check contours to check the reliability of the segmentation. Make sure the contours match the correct segmentation and volumes. Check that the segmented volumes match contours.

## Filming and saving images

**CAUTION**

When filming or saving images for diagnostic purposes, always make sure the patient name and geometry information is displayed on all views, and that they match information on the reference view.

**CAUTION**

When saving images with a new series description, make sure this description matches the saved images.

**CAUTION**

Check with original datasets the reliability of segmentations and measurements performed in Saved objects after post processing and reloading.

## Image reliability

**CAUTION**

3D or slab reconstructions provide additional supplemental information, complementing diagnosis that should be based on classical techniques.

**WARNING**

Always correlate any information (cursor position, image orientation, measurements, image quality...) in any 3D reconstruction (reformatted plane, oblique, MPVR, MIP, Volume Rendering, Navigator endoluminal views, Curved, segmentations, measurements, tracking, saved images...) with the original data (acquisition or baseline images).

**WARNING**

A 3D view is a two-dimensional projection on the screen of the 3D Volume. There is no indication on a 3D view of how "deep" inside the 3D volume a 3D cursor is. Always check the accuracy and consistency of 3D coordinates by checking cursor position on original data (acquisition images).

## Window width and level (W/L)



### **WARNING**

The window width and level (W/L) determine how clearly pathologies and other anatomical structures can be discerned. Incorrect W/L settings may result in pathologies and other essential anatomical structures not being displayed correctly. As a single W/L cannot display all features present in an exam, use several different settings, when necessary to explore all exam data.

## Volume Rendering



### **WARNING**

When using Volume Rendering, incorrect setting of opacity curve, opacity threshold, transparency setting when merging VR objects, can result in pathology or essential anatomies not being visible. Always correlate Volume Rendering images with original images.

## Image quality



### **WARNING**

At all times, it remains the responsibility of the physician to determine whether the inter-slice distance used for a particular exam is acceptable.



### **WARNING**

Loading non-square pixels will result in bad image quality.



### **WARNING**

Default Plaque Color Map preset is provided for information. You must check and adjust Values and segment names.

## Accuracy of measurements

Measure distance for Axial, Helical, and Cine images



### CAUTION

This section includes information on accuracy of measurements used when reviewing images.

Measure error using the straight line distance graphic is less than two times the image pixel size.



### CAUTION

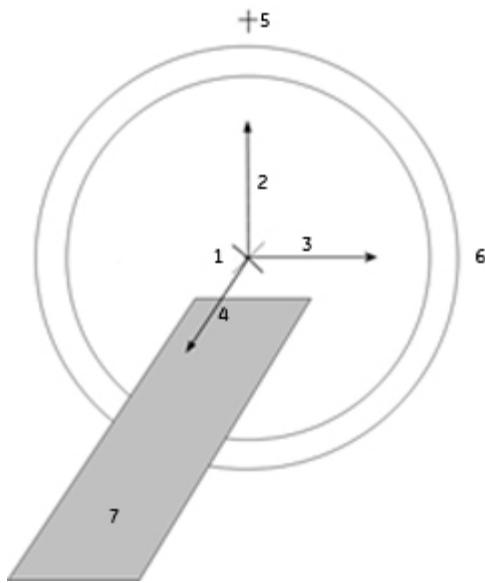
Note that the measurements are accurate only if the trace segments are longer than the slice interval.

## Measure distance for Scout images

Accuracy of measurements for scout images in the "X" direction varies with object thickness and distance from ISO center in the "Y" direction. Note the orientations of the "X" and "Y" axes in the figure shown here assume a scout scan plane of 0°. If the scout plane is rotated, then the "X" and "Y" orientation changes accordingly.

- For measurements of anatomy in the "X" direction that are at ISO center ("Y"):
  - The measure error using the straight line distance graphic is less than 5% of the measured distance plus 2 mm.
- For measurements of anatomy in the "X" direction that are NOT at ISO ("Y"):
  - The measure error using the straight line distance graphic is less than 5% of the measured distance plus 2 mm plus 3% of measured distance per centimeter from ISO.
- For measurements of anatomy in the "Z" direction:
  - Measure error using the straight line distance graphic is less than two times the image pixel size.

Figure 2-27 Scout Scan Plane 1 = ISO center, 2 = Y axis, 3 = X axis, 4 = Z axis, 5 = X-ray tube focal point, 6 = scan plane, 7 = patient table



### Measure angle

Measurement accuracy using the angle graphic is equal to the displayed angle value +/- 10° for an angle measured between segments that are five times larger than the image pixel size. Accuracy improves as the length of the segments increases.

### ROI

Area measurement accuracy using a region of interest graphic (rectangle, smooth curve, ellipse or free draw) is equal to the displayed area +/- the circumference of the region multiplied by (image pixel size)<sup>2</sup>/2. Mean and standard deviation values for the intensity of the pixels in the region are also affected by this accuracy. If the ROI is rotated, the area measurement can vary up to 5%. Region of interest statistics are based on the pixels INSIDE the graphic defining the region.

### Reformat plane thickness

Reformat plane thickness equals 1 pixel.

- If each axial pixel represents 0.5 mm of anatomy, then the reformat plane thickness equals 0.5 mm.
- If pixel size equals 0.9766 mm (500 mm/512), then the reformat plane represents a slice of anatomy about one millimeter thick.



#### CAUTION

The limiting measurement resolution of the cursor is 1 mm, i.e., the distance less than 1 mm but greater than 0.5 mm is rounded to 1 mm, therefore, the accuracy of this testing is limited by the cursor measurement capability. This is especially important for a thin slice measurement where the FWHM is close to 0.625 mm. The results for these thin slice images will not be as accurate as the thick

slice ones. This is the limitation of this testing method.

## Operator console ergonomics

To optimally use the system and reduce the chance of physical strain and fatigue, the following steps are recommended regarding how you use your operator console.

### Posture

Correct posture is very important. To ensure correct posture while sitting at your operator console, follow these basic steps:

1. Face the monitors and keyboard without twisting your body.
2. Sit comfortably erect with the small of your back well supported.
3. Position your forearms parallel to the floor, with your wrists straight.
4. Position the screen so that your eyes are nearly level with the top of the screen.
5. Keep both feet flat on the footrest, with your thighs parallel to the floor.

If you cannot comfortably maintain this position while working at your operator console, you should make the necessary adjustments to your operator console environment.

### Equipment adjustments

#### *Chair*

Adjusting the fit and height of your chair is very important for comfort. Follow these basic guidelines:

1. Fit the backrest snugly against your back. People with shorter legs might need a back cushion.
2. Set your chair height to position your forearms parallel with the floor when your hands are placed on the keyboard. If your feet dangle, you need a footrest.

#### *Keyboard*

Keyboard height is also important. When typing:

- Your wrists should be as straight as possible.
- Your forearms should be parallel to the floor.
- Your hands and fingers should float over the keys or mouse.

#### *Screen*

- The recommended viewing distance from the screen is 18-28 inches (45-70 centimeters).
- With your head straight, your eyes should be looking directly at the top of the screen.
- You should look at the screen straight-on, not at an angle from the side, top, or bottom.
- Glare from the screen can disrupt your viewing and cause eyestrain. Do not face a window, and position the screen at right angles to bright light sources.

### *Comfort*

Comfort at your operator console indicates you have set up your work area correctly. However, even a well-designed area needs frequent adjustment, especially for different users. Take the time when positioning yourself at your operator console to ensure your comfort.

It is also recommended that if you use the operator console for extended periods (several hours at a time), that you take short breaks to get away from your operator console and perform simple stretching exercises to reduce the chance of fatigue.

### *Other considerations*

- Stay alert to your patient's condition.
- Use the speakers and microphones on the table, gantry, and console to stay in constant communication with the patient, even while you sit at the console.
- Follow the exam procedures explained in the User Manual. Carefully enter patient information and position before proceeding.

## Accessories



### WARNING

All non medical equipment connected to the USB port on the CT operator console must comply with IEC/EN/UL60950-1 and should be approved of by GE.



### CAUTION

Do not use the USB or Ethernet port on the front cover of the CT operator console, it is intended for service use only.



### WARNING

Do not connect accessories that are not approved as part of the system. Do not use accessories from other modalities.



### WARNING

None of the accessories support the full weight of a patient. If you sit, stand, or otherwise apply excessive pressure to these devices, they break or come off the cradle and may cause injury. If an accessory breaks, use caution when picking it up and do not continue to use.



### CAUTION

When using patient positioning accessories and straps, make sure there are no areas that might cause a pinch point or interfere with patient tubing or IV.



### WARNING

Accessories like arm boards and catheter bag holders are not secured to the gantry and may interfere with the gantry if not positioned properly.

## GE approved accessories

Use only GE approved equipment together with this system.

With each use, check all accessories for damage and remove them from service if damaged or cracked. Use only GE approved equipment together with this system.



### CAUTION

Using accessories which are not GE approved accessories might affect dose and image quality.

Table 2-3 Types and model

Type	Manufacturer/model
Partial UPS*1	Eaten – 9130



\*1 is CT system component.

The update of compatibility can be confirmed by EC Declaration of Conformity letter of this product.

The following are approved accessories for the system:

- Patient comfort and workflow accessories such as the cradle pad, patient arm board, catheter bag holder, attachable to the cradle.
- Patient positioning accessories including Axial head holders, positioning straps, and pads.
- System quality assurance accessories including imaging phantoms and phantom holder.

Additional accessories and supplies approved for use with the system are available at

[www.GEhealthcare.com](http://www.GEhealthcare.com).

With each use check all accessories for damage and remove them from service if damaged or cracked.

## Systems with metal-free cradles and accessories



### CAUTION

Prevent damage to metal-free accessories! Carefully examine the metal-free clasp assembly on the accessory and the catch on the cradle before attempting to attach the accessory for the first time.

Figure 2-30 Accessory Load Limit

**CAUTION**

Accessory may fall and cause injury if not latched to the cradle. Make sure that accessory is latched to the underside of the cradle.

To latch an accessory:

- Align the accessory tongue with the pocket at the end of the cradle.
- Keep fingers clear of the cradle.
- Push the tongue all the way into the pocket until it latches into place.
- Rubber shims may have been installed on the head holder or cradle extender to give it a tighter fit. Please take care when latching the accessory to make sure that it is completely latched. Push the latch forward until you hear a click. Verify that the latch is fully latched.

To unlatch an accessory:

- Pinch the two L-shaped parts together and pull the accessory out of the cradle.
- An alternate method is to apply a light force to the catch towards the cradle, pinch the L-shaped catch together, and pull the accessory out of the cradle.

Proper operation:

- Keep the accessory "tongue" and cradle pocket clean and free of fluids and debris.
- Keep the latch and cradle pocket area clear of sheets, drapes, pads or any item that could interfere with proper latching and cause damage.

Positioning:

- Positioning patient anatomy over the area where the head holder or cradle extension attaches to the cradle may produce images where the contrast between two adjacent rotations is different. Make sure the area of interest, especially the head, is properly positioned in the head holder or on the cradle extension.

## Limited access room configuration

**CAUTION**

Due to access limitations on the left side of the gantry, some procedures may be affected when ancillary equipment is used. Assess the placement of the equipment needed for the procedure before the patient is placed on the table. Access around the left side of the gantry may also be affected.

## Emergency devices and emergency egress

(Reference 21CFR 1020.33 (f)(2)(ii))

### Emergency devices

The system has two types of Emergency buttons:

1. **Emergency Stop** - When pressed, all table and gantry motions will be halted, X-ray generation will be stopped, laser alignment lights will be turned off. The system aborts any data acquisition in progress, and attempts to save all data acquired prior to the abort. Use the Emergency Stop button for patient related emergencies.
2. **System Emergency Off** Button - when pressed, the power to all system components is cut, stopping all table and gantry motion and generation of X-rays. The system aborts any acquisitions in progress, and data obtained prior to the abort can become corrupt or lost. Use the **System Emergency OFF** button for catastrophic emergencies, such as fire or earthquake.



#### CAUTION

If you press the Emergency Stop or Emergency OFF buttons during a scan, the system will abort the data acquisition.

### Emergency Stop



Every operator should take a few minutes to locate the Emergency Stops on their system before scanning the first patient.

The system has four **Emergency Stop** buttons:

- Two on the front of the gantry





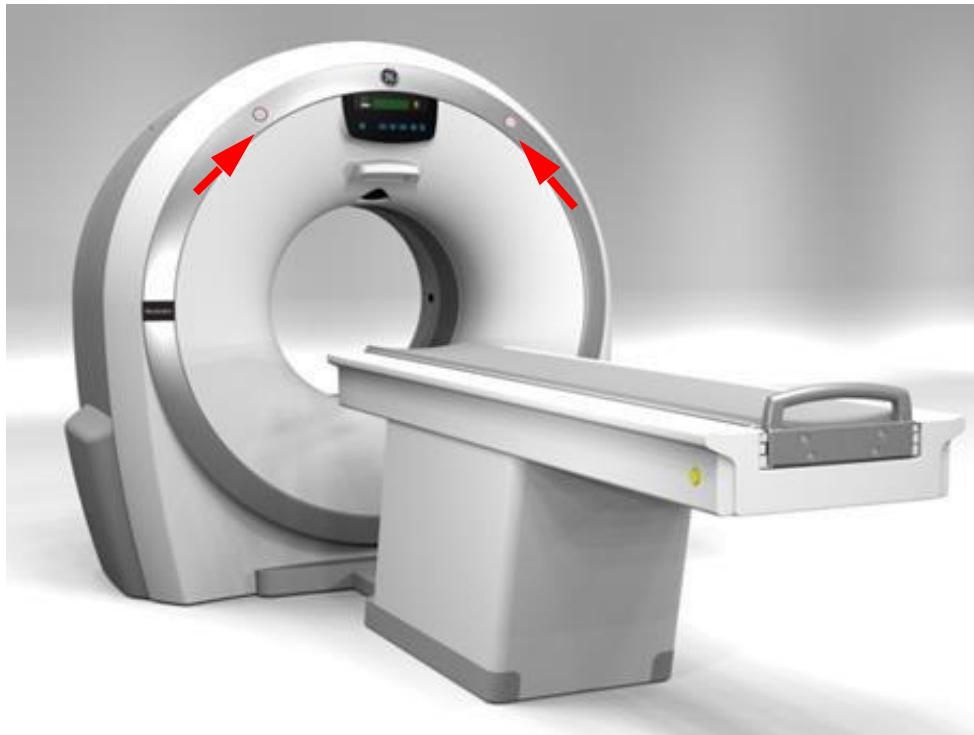


Figure 2-31 Front of gantry Emergency Stop button

- One is located on the front cover of the PDU

Figure 2-32 Emergency Stop button on the PDU



- One is located on the SCBSV

Figure 2-33 Emergency Stop button on the SCBSV



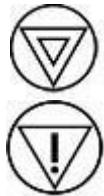
Press an **Emergency Stop** button in the event of a patient-related emergency or if the cradle, table or gantry starts to move unexpectedly.

- Press the E-Reset button on SCBSV with a pin to restore power to the gantry and table once recovered from emergency situation

When **Emergency Stop** is applied, the moving cradle may overrun by less than 10 mm.

### Emergency Stop Button Symbols

Emergency Stop buttons may be accompanied by one of the symbols below.



### System Emergency OFF buttons using Main Disconnect Control

*(If there is MDC function)*

In the event of a fire, flood, earthquake, or any other catastrophic emergency, all power to the system should be turned off. Pressing the **System Emergency OFF** button immediately removes all power to the system by removing power to the **Main Disconnect Control (MDC)**. Because the system has no time to save data, or shutdown in an orderly fashion, pressing the **System Emergency OFF** button can corrupt system files or result in loss of patient data.

The facility designer determines the quantity and locations of the **Emergency OFF** buttons. GE recommends placing an **Emergency OFF** button near the doorway of every room in the system scan suite. Ask your supervisor to show you the location of all the **Emergency OFF** buttons in the system suite. Follow facility guidelines to report an emergency.

Press the **System Emergency OFF** button (red, circular button located on the wall) in the event of a catastrophic emergency, such as fire or earthquake.

### *Reset the Emergency OFF button*

1. Press the Start button on the Main Disconnect Control.
  - Power to the Power Distribution Unit (PDU), operator console, and system electronics will be restored.
2. Stab the E-Reset hole on the Control Panel or SCBSV.
  - Power to the gantry drives, X-ray system, and table drive will be restored.

### *Emergency patient care during X-ray ON*

- Press **STOP SCAN** to abort X-ray and stop gantry/table movement.
- During an exam, the system pauses between scans if you Press any button on the control panel other than the alignment lights. It stops X-ray if you press the same buttons during a scan.
- Select **Resume** on the screen to continue the exam.

### *Emergency egress*

System operation may be stopped due to power failure or a safety event (something coming into contact with the collision sensors), or the system may be halted by the operator in response to emergency conditions.

The Cradle Unlatch button should only be used in Emergency Egress Situations.

### *To safely remove the patient*

1. Press the Cradle Release gantry key or the Emergency Stop button (1) to disengage the clutch.
2. Pull the cradle to its out position, using the Cradle Lip or Cradle Handle (2).
3. Assist the patient off the table.

## Maintenance and cleaning

- To guarantee safe, reliable equipment performance, the site must be prepared according to GE Medical Systems requirements, as specified in the Pre-Installation Manual.
- There are no user serviceable parts in this system. The product should be installed, maintained, and serviced by qualified service personnel according to procedures laid down in the product service manuals.
- The system in whole or in part should not be modified in any way without prior written approval by GE Medical Systems.
- Keep the equipment clean. Remove body fluids and/or IV spills to prevent a health risk and damage to internal parts. Clean the equipment with any of the following approved cleaning agents:
  - Warm water and soap or a mild antiseptic
  - Common household bleach, diluted 10:1
  - Sani-cloth HB
  - Perasafe
  - Incidin Plus
  - TriGene
- Also, use dry cleaning for electronic components.
- Do not clean the connectors on the cables for injector, etc. If you need to clean them, contact GE Service.
- Planned maintenance must be carried out regularly to ensure safe operation of the equipment.
- For user maintenance of the system and performance tests, refer to the maintenance and calibration information in the Technical Reference Manual.

## Cleaning equipment (Bio Hazard)



### CAUTION

Blood Bourne Pathogens Procedure - Before any equipment is serviced or returned to GE Medical Systems, the following criteria must be met:

- Equipment used in a clinical setting must be cleaned and free of any blood and other infectious substances.
- Customers are responsible for the sanitary condition of the equipment. The suggested equipment clean-up procedure for cleaning any fluids or matter discovered in accessible areas or inside under direction of service are as follows:
  - Wear personal protective equipment.
  - Wear proper Nitrile gloves.
  - Before cleanup, take note of sharp corners or objects that could cut the gloves. If gloves tear, remove, wash hands thoroughly, and re-glove.
  - Use cloth or paper towels along with cleaner, taking care not to splash.
  - Sanitize the area using common bleach diluted 10:1 or an approved cleaning agent listed in the Maintenance and Cleaning section. Clean any tools that come in contact with body fluid.
  - Since viruses require moisture to remain active, dry the entire area.
  - When confident the area is clean and dry, place cleaning materials in a red biohazard bag.
  - Remove gloves, turning them inside out, and put gloves in the biohazard plastic bag. Seal and give the bag to appropriate personnel for disposal.

## Environmental concerns



This symbol indicates that the waste of electrical and electronic equipment must not be disposed of as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

## Name and concentration of hazardous substances

The following product pollution control information is provided according to SJ/T11364-2014 *Marking for Restriction of Hazardous Substances caused by electrical and electronic products.*

### Explanation of Pollution Control label



This symbol indicates the product contains hazardous materials in excess of the limits established by the Chinese standard GB/T 26572 Requirements of concentration limits for certain restricted substances in electrical and electronic products. The number in the symbol is the Environment-friendly Use Period (EFUP), which indicates the period during which the hazardous substances contained in electrical and electronic products will not leak or mutate under normal operating conditions so that the use of such electrical and electronic products will not result in any severe environmental pollution, any bodily injury or damage to any assets. The unit of the period is "Year".

In order to maintain the declared EFUP, the product shall be operated normally according to the instructions and environmental conditions as defined in the product manual, and periodic maintenance schedules specified in Product Maintenance Procedures shall be followed strictly.

Consumables or certain parts may have their own label with an EFUP value less than the product. Periodic replacement of those consumables or parts to maintain the declared EFUP shall be done in accordance with the Product Maintenance Procedures.

This product must not be disposed of as unsorted municipal waste, and must be collected separately and handled properly after decommissioning.

### Name and Concentration of Hazardous Substances

Table 2-4 Table of hazardous substances' name and concentration

Component name	Hazardous substances' name					
	(Pb)	(Hg)	(Cd)	(Cr(VI))	(PBB)	(PBDE)
Operator console	X	O	O	X	O	O
Gantry	X	O	X	X	X	X
LCD monitor	O	X	O	O	O	O
Power distribution unit	X	O	X	X	X	X
Patient Table	X	O	X	X	X	X

This table is prepared according to SJ/T 11364.

- **O:** Indicates that this hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.
- **X:** Indicates that this hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572
  - Data listed in the table represents best information available at the time of publication.
  - Applications of hazardous substances in this medical device are required to achieve its intended clinical uses, and/or to provide better protection to human beings and/or to environment, due to lack of reasonably (economically or technically) available substitutes.

This product consists of devices that may contain mercury, which must be recycled or disposed of in accordance with local, state, or country laws. (Within this system, the backlight lamps in the monitor display contain mercury.)



**WARNING**

A damaged X-ray Tube Assembly should not be dispatched through the national postal service.

The X-ray tube assembly contains the following potentially hazardous materials:

- Lead: Lead salts are toxic and their ingestion may cause serious problems. The manipulation/handling of lead is subject to regulations.
- Oil: Univolt 54 and Crosstrans 206 mineral oil are not toxic, but the prevailing environmental regulations should be observed for their disposal or recuperation. For example, it is forbidden to dispose of these oils in the wastewater or sewage system or in the natural environment.

Your local GEMS field service will advise you on the suitable means of disposal of equipment.

- The X-ray tube assembly to be discarded should be forwarded to the GEMS Service network, and it will be disposed of in a GEMS recycling center.

**WARNING**

Do not discard the X-ray Tube Assembly among industrial waste or domestic garbage.

### Precautions

Take all the necessary precautions for the personnel handling the recovery or destruction of X-ray tube assemblies, and in particular against the risks due to lead.

These personnel must be informed of the danger involved and of the necessity to observe the safety measures.

# Chapter 3 : Regulatory information

## Applicable Regulations and Standards

This product complies with the requirements of the following regulations and standards:

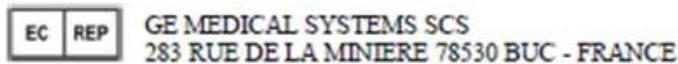
Council Directive 93/42/EEC concerning medical devices when it bears the following CE marking of conformity:



Manufacturer and Place of Origin: WIPRO GE HEALTHCARE PRIVATE LIMITED

122, PART1, Export Promotion Industrial park,  
WHITEFIELD  
BANGALORE 560066, INDIA

Authorized representative for Europe:



Detailed information concerning applicable regulations and standards can be found in the Regulatory Information chapter in the Technical Reference Manual.

The system is classified as a Class I, IPX0 equipment, not suitable for use in the presence of a flammable anesthetic mixture with oxygen or nitrous oxide. It is rated for continuous operation with intermittent loading. No disinfection is applied. The patient table cradle and cradle accessories are considered Type B applied parts. Gantry Bore and the part at the upper side of Table are also defined as parts that can come into contact with the patients.

The system should be used only with GE approved equipment.

Detailed information concerning Electromagnetic Compatibility can be found in the Electromagnetic Compatibility chapter in the Technical Reference manual.

## Intended use of the system

This system is designed for CT image scanning of the head and body.

## Indications for use of the system

Please see the General Information chapter in the Technical Reference Manual.

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# Chapter 4 : Dose Check



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.



**Attention:** consult accompanying documents.

For dose measurements and calculations, refer to the Technical Reference Manual, Quality Assurance chapter, Dosimetry section.

Please refer to your Technical Reference Manual, QA chapter, Dosimetry section for information on dose measurements and calculations.

## [Setting Dose Administrator Role Setting](#)

### [AV Exceeding User Role Configure](#)

#### [the system for dose checking](#)

#### [Configure the system for alert value by age threshold](#)

#### [Configure the system for protocol change control](#)

#### [Building protocols using protocol change control](#)

#### [Building protocols with notification values](#)

#### [Building protocols with notification values by factor](#)

#### [Scan using alert value checking](#)

#### [Scan using Notification Value \(NV\) checking](#)

#### [Using the dose audit tool](#)

## Introduction

The dose check feature intends to notify and alert the operating personnel, generally technologists, that prepare and set the scan parameters, prior to starting a scan, whether the estimated dose index is above the value defined and set by the operating group, practice, or institution to warrant notification to the operator. The dose check feature is designed to comply with the NEMA XR-25 standard.

Dose check is designed to be a tool that enables users to be more aware of the associated dose index of the scan they are prescribing, and provides a "Notification" upon confirming the scan or saving the protocol if that dose index is above the institution's established range for the protocol element. This notification level is intended to be set at a level that would be considered above "routine" or "normally expected" dose, but not at such a high level as to pose a significant risk to the patient. In fact, depending on patient size or imaging need it may be appropriate to scan at a value above the Notification Value in order to achieve the diagnostic intent of the exam.

Notification Values (NV) are not necessarily the same as published "Diagnostic Reference Values" (DRVs), however these may be consulted as a guide in helping determine the appropriate Notification value for your site and patient population. Because routine scanning does involve a range of applicable techniques due to patient sizes and imaging needs, another consideration on where to set the notification level will be the frequency in which your practice would want it posted. GE encourages sites' to establish appropriate Notification values for pediatric scanning.

The dose check feature also provides an "Alert" upon confirming when the dose exceeds a value determined by the institution to represent a value above which the accumulated dose index value would be well above the institution's established range for the examination, potentially excessive, that warrants more stringent review and consideration before proceeding. GE has pre-populate the system level Alert Value (AV) at 1000 mGy CTDIvol in accordance with the FDA November 8, 2010 letter to MITA.

Dose Check should be incorporated into your department QA processes to assure that scan protocols are defined with the "as low as reasonably achievable" ALARA principal in mind and to vary examination protocols to take into account patient body habitus. The feature provides for audit capability and tracking of when Notification and Alert Values are exceeded as well as the ability to output the protocols on the system and the associated Notification Values entered for them.

Dose Check provides the following:

- Checking against a Notification Value if the estimated dose for the scan is above your site typical dose value.
- Checking against an Alert Value where the user needs specific authority to continue the scan at the current estimated dose without changing the scan parameters.
- Defining Alert Values for Adult and Pediatric with age threshold.
- Audit logging and review
- Protocol Change Control

## Protocol considerations

Before using Dose Check, the site physicist, and/or radiation safety officer in collaboration with the Radiologist, should have an understanding of the current dose levels of site scanning protocols and the maximum dose threshold that should not be exceeded in the sites' clinical practice. Using this information, an appropriate starting point for the Notification Value for each protocol and system Alert Value should be set.

Guidance from such bodies as the American College of Radiology (ACR), US Food and Drug Administration (FDA), European Union (EU), International Commission on Radiological Protection (ICRP) and American Association of Physicists in Medicine (AAPM) may be useful in determining Notification and Alert Values. The AAPM Working Group on Standardization of CT Nomenclature and Protocols has agreed to work with the FDA and industry on an initial set of Notification Values based on anatomical location.

## Terminology

### Notification Value (NV)

NV is the dose value that is the site typical dose level for each scan group. NV can be checked by CTDIvol, DLP or both. This value should be set to an average value of all patient sizes that will be imaged using the scan protocol. When setting the NV value consideration should be given to an appropriate upper limit for the NV value to take into account the percentage of exams that you would normally expect the value to be exceeded. Scans that exceed NV values will be logged.

### Alert Value (AV)

AV is the dose value in which specific authority is needed to continue with a scan that exceeds this value. AV can be checked by CTDIvol, DLP or both.

### Dose Check Administrator

Dose Check Administrator is a user role that has the authority to enable Notification and Alert Level checking.

### Dose Check AV Exceeding User

User which has authorization to exceed AV values during scanning.

### Protocol Change Control

Requires user authorization to accept protocol parameters.

## DOSE CHECK

### Setting Dose Administrator Role



Please refer to the [Data privacy](#) chapter of the User Manual for instructions on setting local users, setting an Enterprise server and defining local or enterprise groups.

The Dose Check Administration role is assigned at the group level. Users assigned to a group with Dose Check Administration Role will be able to enable Dose Checking, set Alert Values (AV) and set Alert Value (AV) Age Threshold. It is recommended that only one user who has been given authority after a discussion with the Radiologist, Physicist and department management be assigned to the Dose Check Administration group.

1. Click **Dose Check Management** from Protocol Management.
2. Click **User Admin Tool**.
3. From the EA3 Administration screen, type your Username and Password.
  - Consult your service engineer or Application Representative for user name and password.
4. From the Local Users tab, click **Add Local User**.
5. From the pop-up panel, type information for each of the following:
  - A unique user ID
  - Full Name
  - Password
  - Confirm Password

Figure 4-1 Add user screen

6. Click **Add User**.
7. From the Groups tab, click **Add Local Group**.

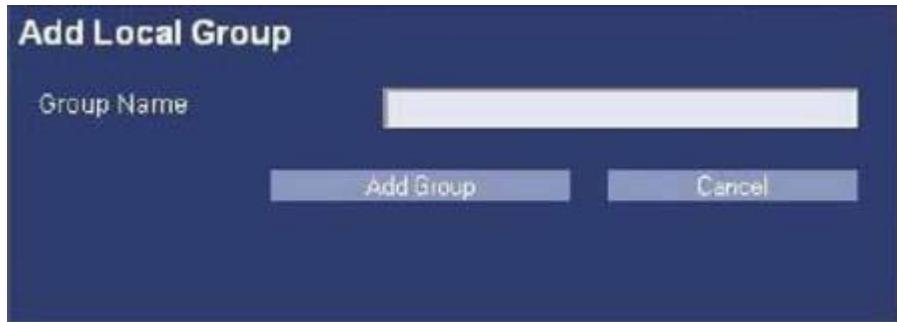


Alternately, the system can be configured for Enterprise groups if Enterprise authentication has been enabled. Refer to the Data Privacy chapter for information on configuring Enterprise authentication.

8. From the Add Local Group window, type and enter a unique group name

**DOSE CHECK**

Figure 4-4 Add Local Group screen

9. Click **Add Group**

- The group is highlighted in the Local Groups list box.
- All information and buttons in the center panel refer to the highlighted group.

10. To change a group's roles, select the Dose Admin Role option box and click **Apply Roles**.

- a. A green label confirms the applied roles.
- b. An error message box displays if it is unsuccessful.

## DOSE CHECK

### Setting AV Exceeding User Role



Please refer to the [Data privacy](#) chapter of the User Manual for instructions on setting local users, setting an Enterprise server and defining local or enterprise groups.

The AV Exceeding User role is assigned at the group level. Users assigned to a group with AV Exceeding User role will be able to approve scanning when an AV value has been exceeded. It is recommended that only one user who has been given authority after a discussion with the Radiologist, Physicist and department management be assigned to the AV Exceeding User group.

1. Click **Dose Check Management** from Protocol Management.
2. Click **User Admin Tool**.
3. From the EA3 Administration screen, type your Username and Password.
  - Consult your service engineer or Application Representative for user name and password.
4. From the Local Users tab, click **Add Local User**.
5. From the pop-up panel, type information for each of the following:
  - A unique user ID
  - Full Name
  - Password
  - Confirm Password

Figure 4-3 Add user screen

The screenshot shows a dark blue 'Add User' dialog box. It contains four text input fields: 'User ID', 'Full Name', 'Password', and 'Confirm Password'. Below these fields are two buttons: 'Add User' on the left and 'Cancel' on the right.

6. Click **Add User**.
7. From the Groups tab, click **Add Local Group**.



Alternately, the system can be configured for Enterprise groups if Enterprise authentication has been enabled. Refer to the Data Privacy chapter for information on configuring Enterprise authentication.

8. From the Add Local Group window, type and enter a unique group name.

Figure 4-4 Add Local Group screen



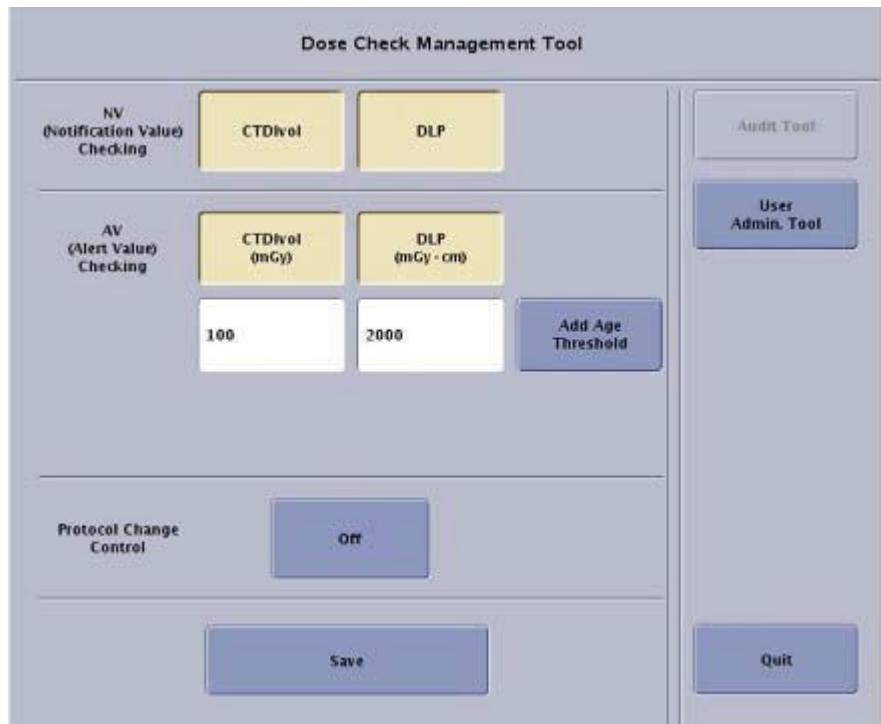
9. Click **Add Group**.
  - The group is highlighted in the Local Groups list box.
  - All information and buttons in the center panel refer to the highlighted group.
10. To change a group's roles, select the Dose Check AV Exceeding User option box and click **Apply Roles**.
  - A green label confirms the applied roles.
  - An error message box displays if it is unsuccessful.

**DOSE CHECK****Configure the system for dose checking**

Use this procedure to configure the system for Dose Checking by Notification Value (NV) and Alert Value (AV) Checking. You must have one user that is assigned to a group with Dose Administrator role to enable confirm Dose Check settings.

1. Click **Dose Check Management** from Protocol Management.

Figure 4-5 Dose checking enabled



2. Set Checking for Notification Value (NV).

- a. In the NV Checking section Click **CTDI<sub>vol</sub>** and/or **DLP**.
- b. Type a value for **CTDI<sub>vol</sub>** and/or **DLP**.
  - The range for NV is 0 to ≤ to the value set for AV.
  - Or, the letter N can be entered to indicate that no checking will be done.



The system default is NV checking **CTDI<sub>vol</sub>** "On" and **DLP** "Off". GE reference protocols will not contain any NV values.

3. Set checking for Alert Value (AV).

- a. In the AV Checking section Click **CTDI<sub>vol</sub>** and/or **DLP**.
- b. Type a value for **CTDI<sub>vol</sub>** and/or **DLP**.
  - The maximum AV value for CTDI<sub>vol</sub> is 2000 mGy.
  - The maximum AV value for DLP is 400,000 mGy-cm.
  - The system default is AV checking by **CTDI<sub>vol</sub>** "On" with a value of 1000 mGy. **DLP** checking "Off" with a value of 0 mGy-cm.



Alert Value should be determined by a collaboration between the Radiologist and Physicist at the site.

4. Click **Save**.

## Configure the system for alert value by age threshold

Use this procedure to configure the system for Dose Checking by Alert Value (AV) Checking by Age Threshold. You must have one user that is assigned to a group with Dose Administrator role to confirm Dose Check settings.

AV Checking by Age threshold allows the setting of AV values for Adult and Pediatric age ranges.

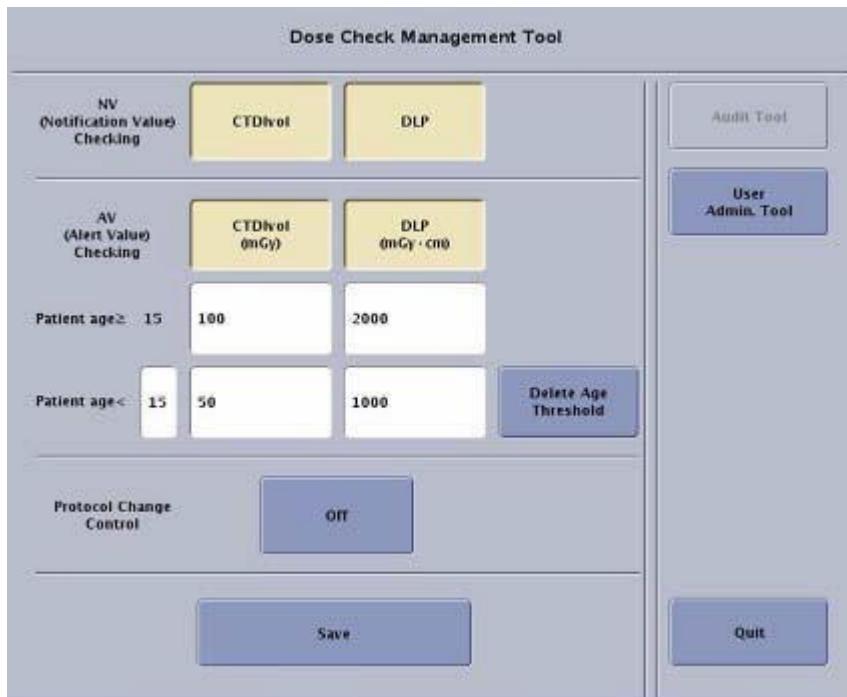
AV value used is based off the following criteria.:

- Age value in New Patient.
- If no age value present then system will default to the higher age range.

In the Protocol Management, the Alert Value under the Age Threshold is always used if it is prescribed.

1. Click **Dose Check Management** from Protocol Management.

Figure 4-6 Checking age threshold



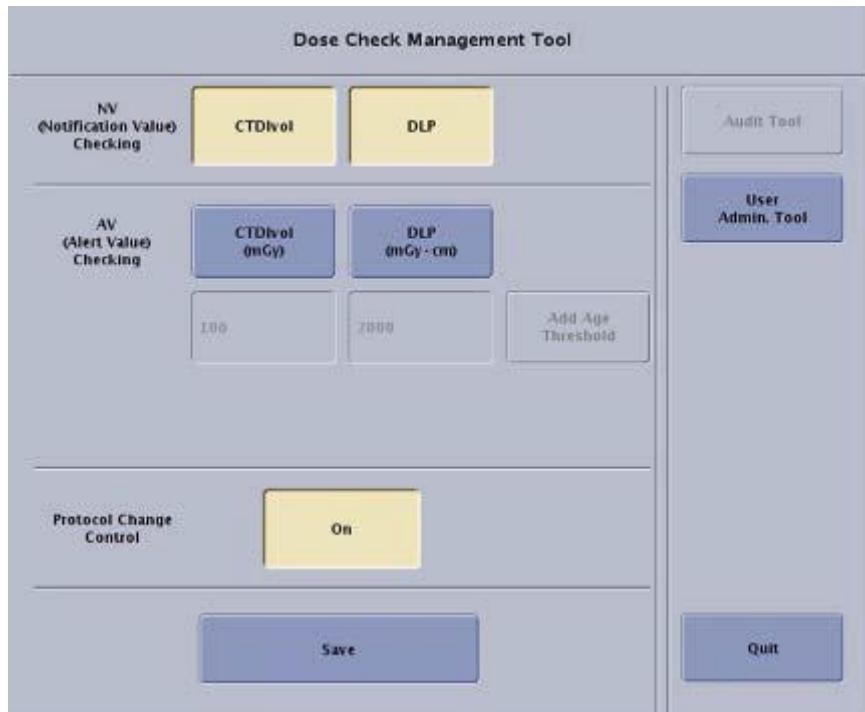
2. In the AV (Alert Value) Checking section, click **Add Age Threshold**.
3. Type the desired Patient Age.
4. Type a value for CTDI<sub>vol</sub> and/or DLP.
  - The maximum AV value for CTDI<sub>vol</sub> is 2000 mGy.
  - The maximum AV value for DLP is 400,000 mGy-cm.
  - The system default is AV checking by CTDI<sub>vol</sub> On with a value of 1000 mGy. DLP checking Off, 0 mGy
  - The value must be lower than the Adult AV value.
5. Click **save**.

**DOSE CHECK****Configure the system for protocol change control**

Use this procedure to configure the system for Protocol Change Control (PCC). You must have one user that is assigned to a group with Dose Administrator role to enable Protocol Change Control.

1. Click **Dose Check Management** from Protocol Management.

Figure 4-7 Protocol change control enabled



2. In the Protocol Change Control section Click **Off** to enable PCC.
3. Click **Save**.

## Building protocols using protocol change control

Use this procedure to build protocols with Protocol Change Control (PCC) enabled. When PCC is enabled the system will require an authorized user to accept protocol parameter updates.

An authorized user can be determined by one of two ways:

- HIPAA is enabled and the currently logged in user has Standard User Role.
  - If HIPAA is not enabled, when Protocol Management is selected the user will be presented with a authorizationscreen.
1. Click **Dose Check Management** from Protocol Management.

Figure 4-8 Protocol Management User authentication



2. Click **Logon Name**.
3. Type the user name.
4. Click **Password**.
5. Type the User password.
6. Click **Logon**.

## DOSE CHECK

### Building protocols with notification values

Use this procedure to set Notification Values (NV) in User protocols. NV values can only be set in Protocol Management.

1. From the scan monitor, click the **Protocol Management icon**.
2. On the Auto Voice and Protocol Management screen, click **Protocol Management**.
3. On the Protocol Selection screen, click **User**.
4. On the User tab click an Anatomical area.
5. In the Anatomical Area click on a protocol.
6. Click **Next Series** to go to the first non-scout series in the protocol.
7. From the Dose Information area click **Set Up**.

**Figure 4-9 NV Value Set Up**

The screenshot shows a software interface for setting dose notification values. At the top, a message says "Unrecognized tube-Dose not validated by GE". Below it, a table displays dose parameters:

Projected Series DLP	IMAGES	CTDIvol (mGy)	DLP (mGy*cm)
DLP (mGy*cm)	1-8	17.71	70.85
275.30	9-16	31.49	204.45

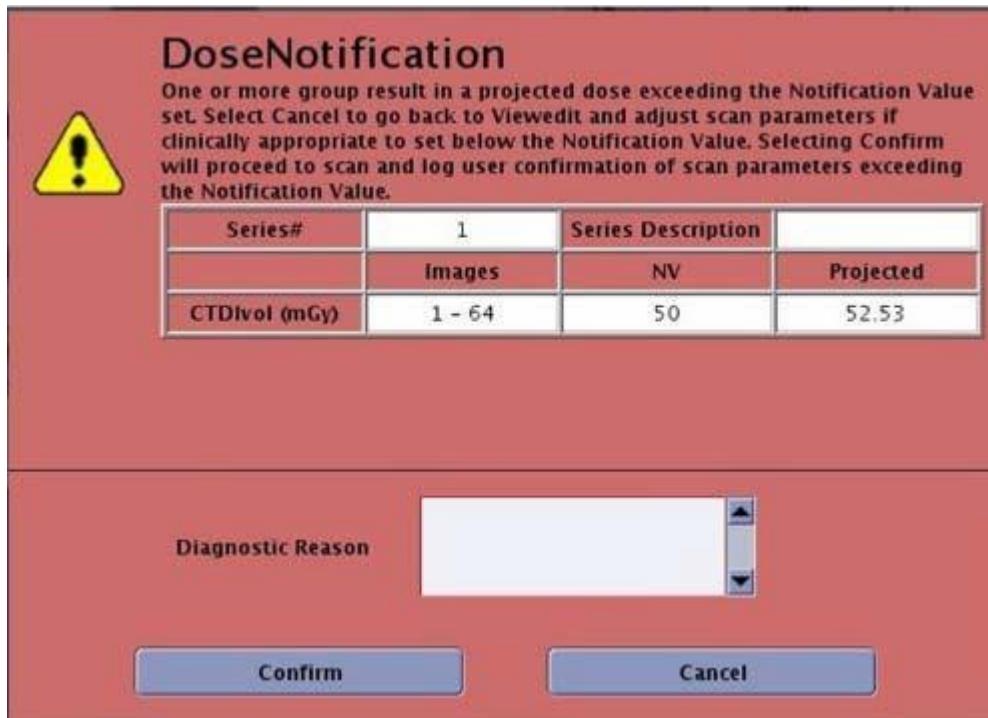
Below the table, there is a table for setting NV values:

CTDIvol	NV	DLP
N	N	N
N	N	N

At the bottom, status messages show "Est. max Z location CTDIvol: 49.20 mGy" and "Accumulated exam DLP: 0.00 mGy\*cm". A "Info" button is located in the top right corner.

8. Type the desired CTDI<sub>vol</sub> or DLP NV value by group.
  - Only one CTDI<sub>vol</sub> or DLP value can be set for SmartPrep scan groups.
9. Click **Info** to return to the Dose Information display.
10. Click Accept to save the protocol parameters.
  - The system compares all the CTDI<sub>vol</sub> and DLP values in the scan groups to the entered NV value.
  - The protocol parameters will not be accepted until the NV value is no longer exceeded or the user has entered a Diagnostic Reason for continuing to accept the scan parameters exceeding the NV Value.

Figure 4-10 Warning NV Value exceeded



- Saving a protocol with a dose level exceeding an NV value demands a high degree of consideration for appropriateness. Therefore, in most cases, you will click Cancel to go back to adjust parameters. However, if there is a true clinical reason to save a protocol exceeding an NV value, then enter a diagnostic reason.
11. Click in the **Diagnostic Reason** text field.
  12. Type the reason for scanning exceeding the NV value.
    - The maximum number of characters is 64.
    - Once the maximum number of characters is reached the system will not accept any additional character input.
  13. Click **Confirm** to accept the protocol scan parameters.



Viewing/exporting Protocol Summary in Audit Tool should be done after any protocols are saved, not during editing.

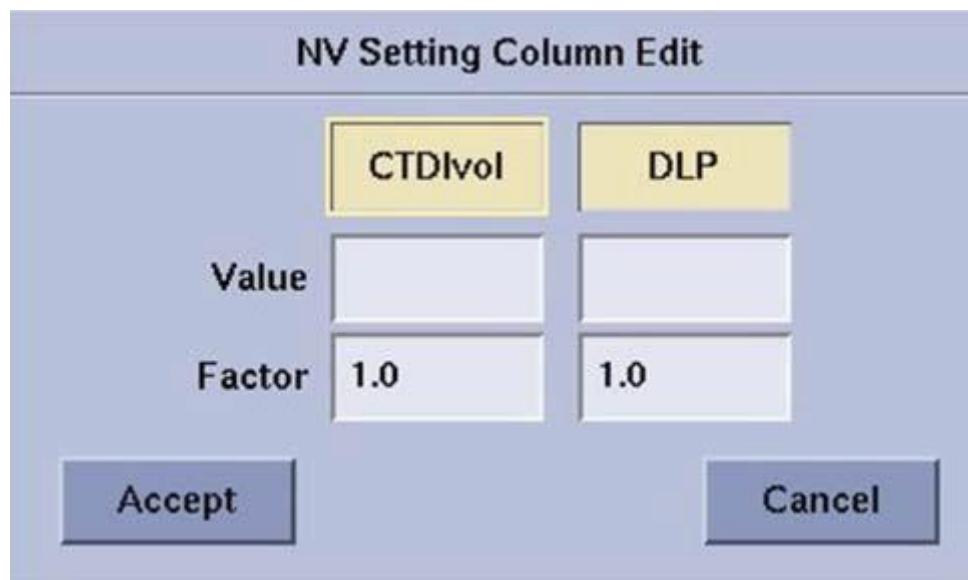
**DOSE CHECK****Building protocols with notification values by factor**

Use this procedure to set Notification Values (NV) in User protocols for all scan groups by a factor. For example if the NV value in a scan group were 5 and a factor of 1.5 was entered, the new NV value for the group would be 7.5.

- Can be entered in increments of 0.1
- Must be greater than 0
- Maximum value of 10

1. From the scan monitor, click the **Protocol Management icon**.
2. On the Auto Voice and Protocol Management screen, click **Protocol Management**.
3. On the Protocol Selection screen, click **User**.
4. On the User tab click an Anatomical area.
5. In the Anatomical Area click on a protocol.
6. Click **Next Series** to go to the first non-scout series in the protocol.
7. From the Dose Information area click **Set Up**.

Figure 4-11 NV Value Set Up by Factor



8. Click **NV** column edit.
9. Type the desired factor.
10. Click **Accept**.
11. Click **Info** to return to the Dose Information display.

## Scan using alert value checking

Use this procedure to scan using AV checking.

The CTDIvol or DLP value will be highlighted when the estimated dose for the protocol exceeds the AV value set for the system.

Figure 4-12 AV exceeded in dose

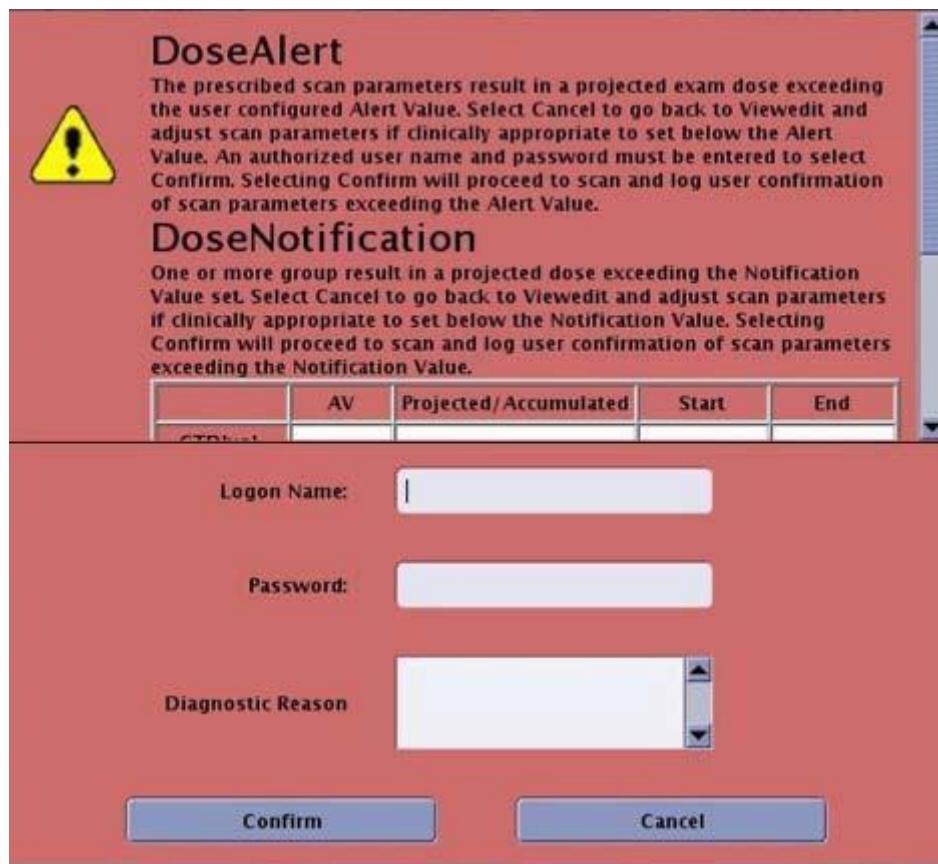
Unrecognized tube-Dose not validated by GE						
Projected Series DLP	IMAGES	CTDIvol (NV) (mGy)	DLP (mGy*cm)	(NV) (%)	DOSE Eff. (%)	PHANTOM (cm)
DLP (mGy*cm)	1-20	74.94 (N)	374.71 (N)	71.30		Head 16
<b>374.71</b>						

Est. max Z location CTDIvol: **74.94 mGy**      Accumulated exam DLP: **0.00 mGy\*cm**

Adjust the scan parameters for the series in which the AV value is exceeded to adjust the dose below the prescribed AV value. If the AV value is still exceeded when Confirm is selected a confirmation pop up will be posted. The scan cannot be confirmed until the AV value is no longer exceeded or a user with a Dose Check AV Exceeding user role has authorized the scan.

Performing a scan exceeding an AV value demands a high degree of consideration for appropriateness. Therefore, in most cases, you will click cancel to go back to adjust parameters. However, if there is a true diagnostic need to perform a scan exceeding an AV value.

Figure 4-13 Warning AV Value exceeded



1. Click in the **Logon Name** text field.
2. Type the User Name.
3. Click in the **Password** text field.
4. Type the user password.
5. Click in the **Diagnostic Reason** text field.
6. Type the reason for scanning exceeding the AV value.
  - The maximum number of characters is 64.
  - Once the maximum number of characters is reached the system will not accept any additional character input.
7. Click **Confirm** to proceed to scanning.

## Scan using Notification Value (NV) checking

Use this procedure to scan using NV checking.

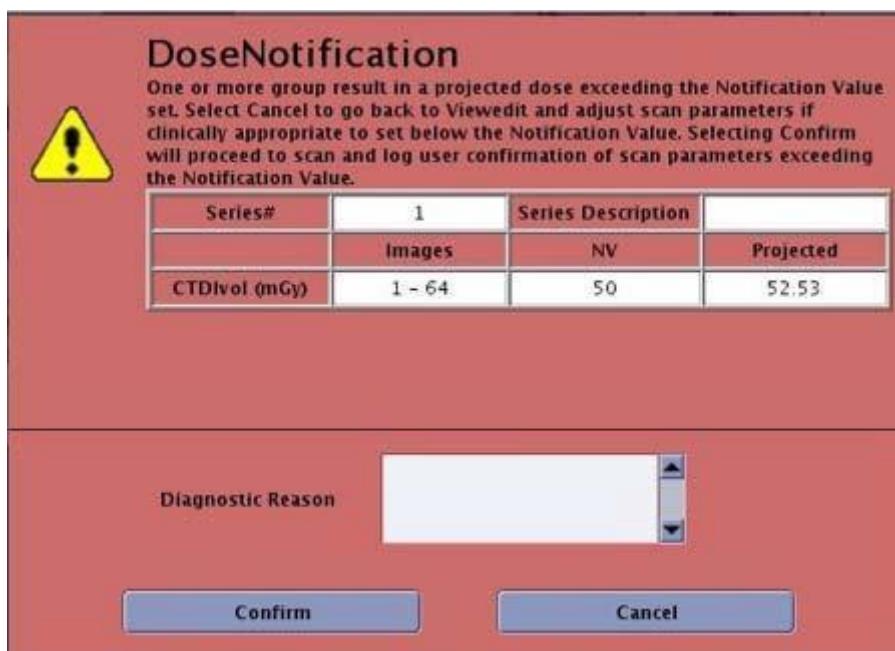
The CTDI<sub>vol</sub> or DLP value will be highlighted when the estimated dose for a scan group exceeds the NV value set for each scan group.

Figure 4-14 NV exceeded in Dose Display

Unrecognized tube-Dose not validated by GE		IMAGES	CTDI <sub>vol</sub> (NV) (mGy)	DLP (NV) (mGy <sup>cm</sup> )	DOSE Eff. (%)	PHANTOM (cm)
Projected Series DLP DLP (mGy <sup>cm</sup> )	1-8	31.49 (10)	204.45 (50)	95.98	Body 32	
<b>204.45</b>						
Est. max Z location CTDI <sub>vol</sub> : 31.49 mGy				Accumulated exam DLP: 0.00 mGy <sup>cm</sup>		

Adjust the scan parameters for the scan group in which the NV value is exceeded to adjust the dose below the prescribed NV value. If the NV value is still exceeded when Confirm is selected a confirmation pop up will be posted. The scan cannot be confirmed until the NV value is no longer exceeded or the user has entered a Diagnostic Reason for continuing the scan exceeding the NV Value.

Figure 4-15 Warning NV Value exceeded



- Click in the **Diagnostic Reason** text field.
- Type the reason for scanning exceeding the NV value.
  - The maximum number of characters is 64.
  - Once the maximum number of characters is reached the system will not accept any additional character input.
- Click **Confirm** to proceed to scanning.

## DOSE CHECK

### Using the dose audit tool

Dose Audit Tool provides:

- Dose Check Log detailing exams which exceeded NV or AV values
- Protocol Summary for protocol NV values
- Export to save Dose Check Log data to media

Use this procedure to display a Dose Check Log.

- On the Auto Voice, Protocol Management and Dose Check Management screen, click **Dose Check Management**.
- On the Dose Check Management screen, click **Log List**.
- From the Dose Audit Tool, click **Audit Tool**.
- On the Log List click on the desired log.
  - If the log data approaches the maximum size, the system will post a message directing the user to export the log data.

Use this procedure to display the Protocol Summary.

- Click **Dose Check Management** from Protocol Management.
- On the Dose Check Management screen, click **Audit Tool**.
- In the Protocol Summary area, click **All Protocols** or **Invalid Protocols**.

Figure 4-16 Protocol Summary Invalid protocols

CTD vol (mGy)	CTD vol (mGy)	DLP (mGy·cm)
NV	1000	10000
Age ≥ 15	1000	10000
Age < 15	500	5000

	CTD vol (mGy)	DLP (mGy·cm)		
Series 2	NV	Projected	NV	Projected
Group 1	50	42.9282	500	257.269
Group 2	10	21.4641	500	127.735

	CTD vol (mGy)	DLP (mGy·cm)		
Series 2	NV	Projected	NV	Projected
Group 1	50	43.1948	500	264.728

Use this procedure to export Dose Check log data.

1. Click **Dose Check Management** from Protocol Management.
2. Insert CD –R media in the DVD RW drive or insert USB media in the USB port of the media tower.
3. On the Dose Check Management screen, click **Audit Tool**.
4. On the Dose Audit Tool, click **Export**.
5. On the Export Media screen, click media type **CD/DVD** or **USB**.
6. On the Export Contents, click 1 or more of the following: **Dose Check Log**, **Protocol Summary** or **User Protocols**
  - If Protocol Summary is selected click **All Protocols** or **Invalid Protocols**.
7. On the Export screen, click **OK**.

# Chapter 5 : Pediatrics and small patients

GE Healthcare strongly suggests reducing radiation dose to ALARA<sup>1</sup> in all patients, especially pediatric and small patients, whenever it is determined that a CT scan is necessary. CT is an extremely valuable tool for diagnosing injury and disease, but its use is not without risk. This chapter discusses the importance of minimizing the radiation dose in small patients and children consistent with ALARA principles.

## Radiation exposure

[Minimize pediatric and small patient doses](#)

## Pediatric and small patient scans

[Set up a pediatric or small patient exam](#)

[Adjust pediatric and small patient scan parameters](#)

---

1. As Low As Reasonably Achievable

## Radiation exposure

### Radiation exposure sensitivity

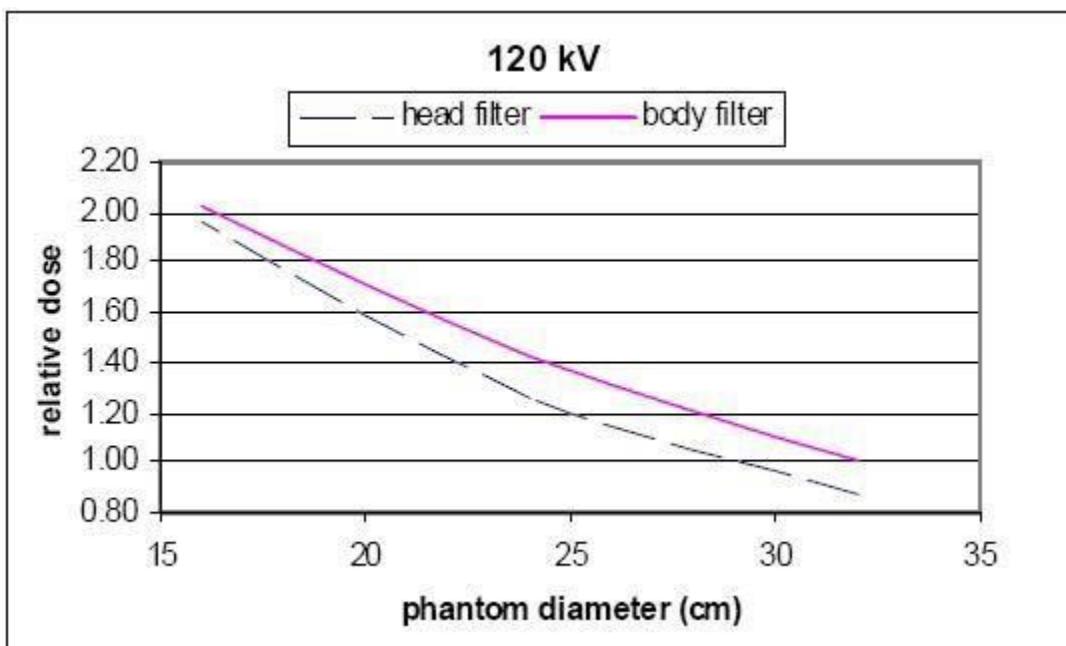
Radiation exposure is a concern in both adults and children. However, children are more sensitive to radiation than adults and have a longer life expectancy. Radiation risk is higher in young patients, as they have more rapidly dividing cells than adults. The younger the patient, the more sensitive they are. Using the same exposure parameters on a child as used on an adult may result in larger doses to the child. There is no need for these larger doses to children, and CT settings can be adjusted to reduce dose significantly while maintaining diagnostic image quality.

The National Cancer Institute and The Society for Pediatric Radiology developed a brochure, *Radiation Risks and Pediatric Computed Tomography: A Guide for Health Care Providers*, and the FDA issued a Public Health Notification, *Reducing Radiation Risk from Computed Tomography for Pediatric and Small Adult Patients* dated November 2, 2001, that discuss the value of CT and the importance of minimizing the radiation dose, especially in children. These documents can be accessed at <http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm115329.htm>.

### Dose reporting considerations

It is widely understood and accepted that adult techniques should never be applied to small patients or pediatrics since smaller objects have higher dose at the same technique. The chart below illustrates the sharp increases in relative dose as the part scanned gets smaller in size using the same technique.

Figure 5-1 Relationship between dose and phantom size for head and body filters at 120 kV. Similar curves are obtained for the 80, 100, and 140 kVs.



Another consideration about dose is since it is not possible to characterize dose given to individual patients, the CT dose indices are provided to help make relative comparisons. These dose index values can be used to compare CT systems and to help select appropriate operating conditions for scanning. However, it is important to recognize that the dose reported by these indices is inversely proportional to phantom size (see the above chart). This means that for the same scan technique, smaller phantoms (patients) will produce a higher absorbed dose than larger phantom (patients). Therefore, it is critical to remember that the body filter uses the 32 cm CTDI<sup>1</sup> phantom and the head filter uses the 16 cm CTDI phantom for dose reporting purposes (CTDIvol is displayed in the Dose Information area on the ViewEdit screen). The table below indicates the phantom size used for calculating dose for each SFOV<sup>2</sup>.

In other words, when looking at the actual absorbed dose to the patient, understand that the dose may be higher than reported if the part scanned is smaller than the phantom tested. Keep this in mind when adjusting scan parameters to fit patients who are smaller than the phantoms tested.

Table 5-1 CTDI phantom used dose report based on SFOV<sup>3</sup> type

SFOV type	CTDI phantom
Ped Head	16 cm phantom
Head	
Small	
Large	32 cm phantom

- 1.Computed Tomography Dose Index
- 2.Scan Field Of View
- 3.Scan Field Of View

## RADIATION EXPOSURE

# Minimize pediatric and small patient doses

There are several steps that can be taken to reduce the amount of radiation that pediatrics and small patients receive from CT examinations. Everyone shares the responsibility of minimizing CT radiation dose. Use the following suggestions for minimizing unnecessary doses.

### Perform only necessary CT examinations

Is CT the most appropriate study? This important communication between the patient's physician and the radiologist is essential in determining the need for the CT examination. The indications and the appropriate technique to be used should be reviewed by the radiologist prior to every scan including the patient's number of previous scans, reasons for the scan, and consideration of other effective lower dose modalities. In all circumstances, the expected benefits of the scan must always exceed the overall risk.

### Scan only the organ or anatomical region indicated

Limitscan coverage to cover only the organ or anatomical region of the body indicated to avoid unnecessary exposure.

### Minimize multi-phase contrast CT examinations

Scan only one series if possible.

- CT studies with and without contrast material are not always needed.
- Multiphase imaging may double or triple the dose and may not add diagnostic information to the study.
- If multi-phase studies are needed, use a lower dose technique for the non-contrast series compared to the contrast series and limit the scan only to the organ or anatomical region indicated.

### Properly center all patients in the gantry

Center all patients in the gantry to allow the bow tie filters to deliver dose where it is needed and filter more where it is not.

- This is especially important using automatic exposure control techniques such as AutomA and SmartmA to further reduce unnecessary radiation exposure.
- Patients not properly centered may be under or over exposed to radiation if the table height is set too high or too low.

### Lower mA settings for chest and bone imaging

Consider using a lower mA setting and higher Noise Indexes if AutomA is used for chest and bone imaging. Higher resolution/dose imaging is typically unnecessary for these types of studies where there is high inherent contrast between the structures being imaged.

### Scan signal-to-noise

Limit the highest quality images requiring the highest radiation dose to very specific indications such as angiography or visualizing small subtle lesions. Studies with higher noise may be just as diagnostic and require lower dose.

### Use pediatric positioning accessories

Use papoose boards and neonatal immobilizers, as needed, with certain patients.

- These accessories are sometimes helpful to secure the patient and keep the patient still.
- Results in less patient motion and therefore, less repeated exams.

## Make a kid friendly environment

Help pediatric patients feel less scared.

- Put pictures of animals on the wall or ceiling.
- Use stuffed animals.
- Play games.
- Depending on the patient age, explain the procedure so they know what to expect when they enter the scan room. This will aid in patient cooperation and potentially less repeat studies and dose due to patient motion.

## Pediatric and small patient scans

### Optimize pediatric protocols for your facility

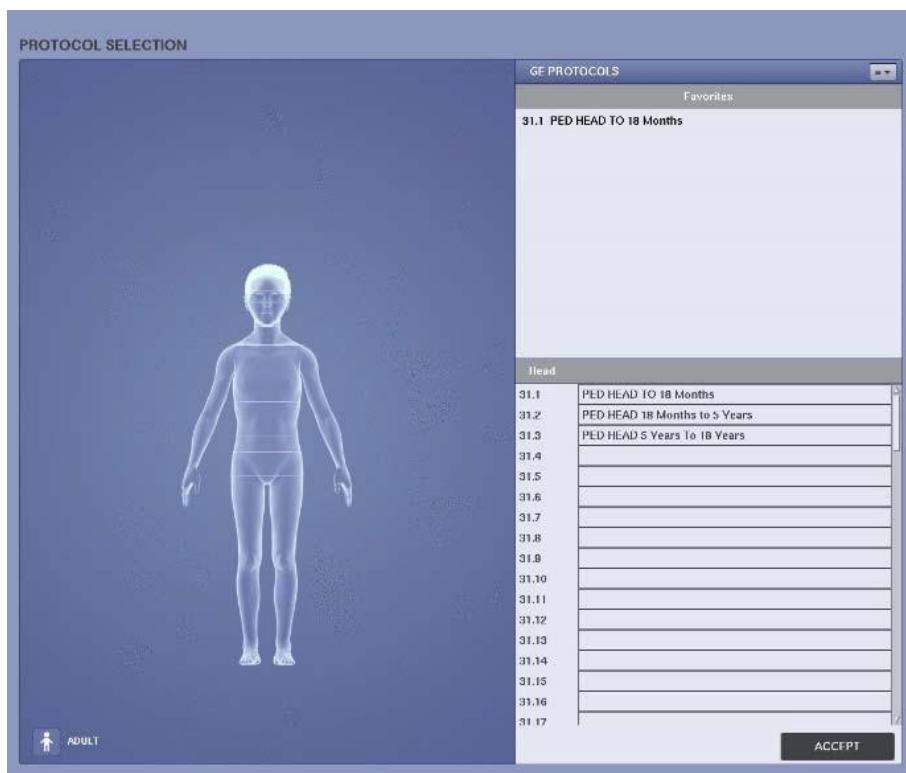
Work with your team of radiologists, medical physicists, and CT technologists to evaluate techniques that may reduce radiation dose and still provide adequate diagnostic information. In addition to the recommended protocols installed on your system and suggestions in this manual, these websites offer excellent sources of additional information on how to optimize scanning protocols:

- American College of Radiology (ACR): <http://www.acr.org/>
- Society of Pediatric Radiology (SPR): <http://www.pedrad.org/>
- National Cancer Institute (NCI): <http://www.nci.nih.gov/aboutnci>
- ImageGently: <http://www.imagegently.com/>
- FDA website: <http://www.fda.gov/>

### Pediatric protocols

The Pediatric Protocol area was designed to help facilitate protocol selection for pediatric patients by providing age based protocol areas for Head, Orbit, and Miscellaneous and color coding system for Neck, Upper Extremity, Chest, Abdomen, Spine, and Pelvis. It is highly recommended to place and select pediatric protocols from the pediatric selector based on age, height, and weight. By entering the pediatric patient's weight in the Exam Rx screen, the system automatically selects the appropriate color code area for the anatomical area selected.

Figure 5-2 Pediatric Selector



## Color Coding for Kids Protocol Selection

Based on the Broselow-Luten Pediatric System, the Color Coding for Kids system was developed to help you select the correct pediatric CT protocol. The system divides the protocols into nine color zones based on height and weight, and incrementally increases scan technique as the patient's size increases. This arrangement of protocols assists you in reducing the variations in pediatric protocol selection. If the patient weight is unavailable, a Broselow-Luten Tape can also be used to obtain the weight based on the length.

Once the anatomical area is selected, the Pediatric Protocol Category screen displays, which contains the Color Coding for Kids based on weight selection. Selectors on the color/weight bar are labeled with the zone ranges for weight and length, with the word of the selected color and with the weight/color zone number.



Weight-specific protocols are enforced for all anatomical areas except Head, Orbit, and Miscellaneous. Protocols in the Head and Orbit categories are usually defined based on patient age as opposed to patient weight/height.

Table 5-2 Color codes

Zone number	Zone color	Zone weight (lbs)	Zone weight (kg)	Zone length (cm)
1	Pink	6.0 to 7.5	13.2 to 16.5	59.5 to 66.5
2	Red	7.5 to 9.5	16.5 to 20.9	66.5 to 74.0
3	Purple	9.5 to 11.5	20.9 to 25.4	74.0 to 84.5
4	Yellow	11.5 to 14.5	25.4 to 32.0	84.5 to 97.5
5	White	14.5 to 18.5	32.0 to 40.8	97.5 to 110.0
6	Blue	18.5 to 22.5	40.8 to 49.6	110.0 to 122.0
7	Orange	22.5 to 31.5	49.6 to 69.5	122.0 to 137.0
8	Green	31.5 to 40.5	69.5 to 89.3	137.0 to 150.0
9	Black	40.5 to 55	89.3 to 121.3	--

Table 5-3 Translated text

	<b>English</b>
1	<b>Pink</b> 6.0 to 7.5 kg (13.2 to 16.5 lbs) 59.5 to 66.5 cm
2	<b>Red</b> 7.5 to 9.5 kg (16.5 to 20.9 lbs) 66.5 to 74.0 cm
3	<b>Purple</b> 9.5 to 11.5 kg (20.9 to 25.4 lbs) 74.0 to 84.5 cm
4	<b>Yellow</b> 11.5 to 14.5 kg (25.4 to 32.0 lbs) 84.5 to 97.5 cm
5	<b>White</b> 14.5 to 18.5 kg (32.0 to 40.8 lbs) 97.5 to 110.0 cm
6	<b>Blue</b> 18.5 to 22.5 kg (40.8 to 49.6 lbs) 110.0 to 122.0 cm
7	<b>Orange</b> 22.5 to 31.5 kg (49.6 to 69.5 lbs) 122.0 to 137.0 cm
8	<b>Green</b> 31.5 to 40.5 kg (69.5 to 89.3 lbs) 137.0 to 150.0 cm
9	<b>Black</b> 40.5 to 55.0 kg (89.3 to 121.3 lbs)

## PEDIATRIC AND SMALL PATIENT SCANS

### Set up a pediatric or small patient exam

Use this procedure each time you start a new patient exam for a pediatric patient. It is recommended that you complete the patient information setup before you get the patient on the table to reduce patient table time. The data can also be input by using **Patient Schedule** or a **bar code reader**.



The "/" and control characters are not valid for entries on the Exam screen.

1. On the scan monitor, click the **Exam Rx** icon.

  - The PATIENT INFORMATION screen displays the new Exam Number.
  - The maximum Exam Number is 49,999, which is reset by your Field Engineer.

2. From the PATIENT INFORMATION area, type data into the appropriate fields.
  - Press **Enter** to advance to the next field. Alternatively, use the mouse to navigate to each field.
  - Patient ID is a required field. If the patient does not have an identification number, type **?** or the word **trauma**.
3. Click **PEDIATRIC**.
4. From the Pediatric Protocol Selection screen, click an anatomical area.
  - With the patient's weight entered, the system automatically selects the appropriate pediatric color code area for the anatomical area selected.
  - Use the arrows to scroll through the list.
  - Click a protocol from the list to download the scan parameter values.
5. From the Pediatric Protocol Category screen, select the weight/length category based on the size of your patient or verify the correct Color category has been selected if you entered a weight.
  - The protocols in the selected color code are then displayed accordingly.
  - The default weight/color selector displays the patient weight entered on the PATIENT INFORMATION screen, or the last weight/color selection (if no patient information was entered).
  - There is no reference protocol for Pediatric areas Neck, Upper Extremity, Chest, Abdomen, Spine, Pelvis, and Lower Extremity.
  - If you enter a patient weight on the Patient Information screen and select a color/weight that is not consistent with the entered information, an error message displays. You must acknowledge that you have chosen a protocol that does NOT match the patient size.



6. Proceed with the [Acquire a Scout scan](#) procedure.

## PEDIATRIC AND SMALL PATIENT SCANS

### Adjust pediatric and small patient scan parameters

Use the following guidelines for adjusting individual exposure parameters by patient.

#### Adjust the parameters by size, age, weight, height, and indications

Use pediatric protocols based on the age, weight, height, and indications to avoid over exposure.

- Recommended **pediatric color coded protocols** are installed on the system and are arranged in colors according to height and weight for easy selection.
- These protocols should be considered as a baseline. It is strongly encouraged that you work with your radiologist and medical physicist to determine the lowest possible dose at the image quality desired.
- Consider the diameter of the part being scanned as a final determination before scanning. For instance, the part may be smaller or larger than what is indicated by the weight of the patient.

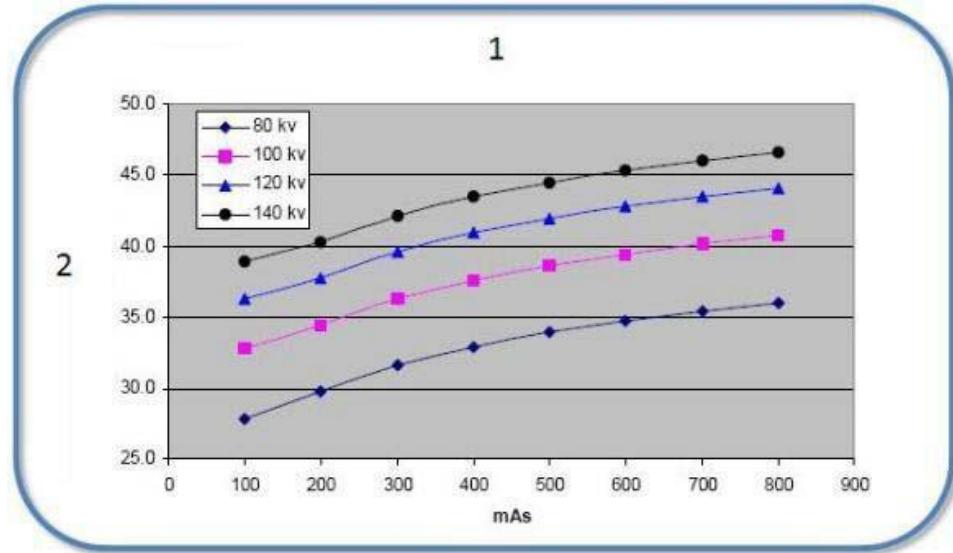
#### Consider decreasing the kVp

Decrease the kilovoltage to 80 or 100 kVp for smaller patients.

- A decrease in kVp should not be done without increasing the mA to maintain noise levels and contrast to noise ratios.
- Lower kV selections increase HU<sup>1</sup> values. Therefore, increase the window width for viewing images to maintain a similar appearance.
- Since lower kVp selections lower X-ray penetration, it is important to not use low kV selections on too large of a patient, which can potentially result in compromised image quality. Work with your radiologist and medical physicist to establish low kV protocols and patient size limits.
- Use the table of kV and mAs adjustment factors as a guide for making adjustments to mAs for changes in kV in a protocol. Refer to Chapter 12, Quality Assurance in the Technical Reference Manual.
- For example, keeping everything constant at a technique of 120 kV at 100 mA for adults you would get the following techniques for pediatric patients:
  - 100 kV at 126 mA
  - 80 kV at 166 mA
  - 140 kV at 63 mA
- To assure sufficient X-ray penetration, the following chart is intended as a relative guide to the maximum patient diameter that can be scanned based on a kV and mAs selection. It does not indicate a recommended technique factor (that is generally higher) since the technique factor also depends on the image quality needed for the diagnostic task.

1.Hounsfield Unit

Figure 5-3 Maximum patient diameter guide for low kV selection (1) and Lateral Patient Diameter in cm (2)



### Center the patient properly when using AutomA

Properly center the patient. This is critical with AutomA.

- Double check and verify the table height is centered to the patient.
- Raise or lower the table as needed before taking the scouts.
- After the scouts are taken and prescription is done, verify the mA table calculations before confirming the scan.
- Make sure minimum mA and maximum mA values are set appropriately.
- See [Set the mA](#) procedure in the Scan chapter.

### Increase the pitch

Increase the pitch.

- Increasing the pitch decreases the amount of radiation needed to cover the region indicated, usually without compromising the diagnostic quality of the scan.
- Increasing pitch from 1.0 to 1.35:1 decreases dose by a factor of about 27%.

Table 5-4 Pitch table travel and slice thickness

Acquisition	0.625:1	0.875:1	1.35:1	1.675:1	0.75:1	1.5:1	1:1
1.25	N/A	N/A	N/A	N/A	N/A	N/A	1.25
5	N/A	N/A	N/A	N/A	3.75	7.5	N/A
10	6.25	8.75	13.5	16.75	N/A	N/A	N/A

Acquisition	16i	8i	4i	2i	1i
1.25	N/A	N/A	N/A	0.625	N/A
5	N/A	N/A	1.25	2.5	5
10	N/A	1.25*	2.5	5	10



\* ACTs EX

## Use Small SFOV Filters

Use the smallest SFOV whenever possible, depending on the exam and size of the patient.

- Matching the appropriate SFOV bowtie filter to the size of the patient ensures the dose is delivered where it is needed, and filtered where it is not needed.
- Small SFOV supports DFOVs up to 25 cm in diameter.
  - **Ped Head** SFOV supports DFOVs up to 25 cm in diameter and uses IBO processing to correct for beam hardening effects. It is particularly useful for infants 18 months or less in age.

# Chapter 6 : Equipment



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

This section helps you to become familiar with your CT system, including the system components and hardware.

## Computer Console

[Monitor](#)

[Operating SCBSV and the Keyboard](#)

[Operate the mouse controls](#)

## Gantry

[Operate the Gantry controls](#)

## Table

[Connect table Tray](#)

## Hardware Components

[Axial detector configuration screen](#)

[Helical detector configuration screen](#)

## Power Distribution Unit

## X-Ray Tube and Generator

## Computer Console

The operator console is comprised of:

### **Monitor**

- Operating SCBSV and the Keyboard
- Mouse

### **Computer**

Figure 6-1 Operator Console



Table 6-1 Operator Console

No.	Description
1	<b>Digital Video Disk Read/Write (DVD-R/W) drive</b> <ul style="list-style-type: none"> <li>• The <b>CD/DVD</b> option uses the DVD-R drive to write to or restore from CD-R or DVD-R.</li> <li>• The <b>Data Export</b> option can save information to CD-R.</li> <li>• Use to export protocols.</li> <li>• Use to save scan files, protocols and service files to DVD-RAM media.</li> <li>• Use to access the electronic copies of the operator documentation.</li> </ul>
2	<b>USB Connection</b> Located at the front of the Computer. <ul style="list-style-type: none"> <li>• Supports connecting a USB storage device to save or restore scan files or DICOM images.</li> <li>• Supports connecting a USB storage device to export the data.</li> <li>• The storage device should have a minimum size of 4 GB.</li> </ul>
3	<b>Computer power switch:</b> located at the front of the computer. <ul style="list-style-type: none"> <li>• Use to <b>start up the system</b>.</li> </ul>

## Computer

The computer is located at the base of the console and it contains all the hardware necessary to operate the system and perform image generation.

It uses a PC based computer system running a Linux based operating system. The system includes system, image and scan data disks and stores up to 150,000 512 images and 72 gigabytes for scan data files.

## Reconstruction Engine

- The reconstruction engine provides advanced processing capabilities for the reconstruction of routine imaging modes and ASiR mode.

## COMPUTER CONSOLE Monitor

There is one monitor for the system:

Figure 6-2 Monitor



**!** If the power is turned off to the monitor by either console off or using the power off button on the monitor, it takes 15 minutes for the monitor to stabilize to their set brightness and contrast levels. During this warm-up time, do not make any adjustments to the brightness or contrast levels.



For systems left on overnight, turn the monitor off to minimize the possibility of burn-in.



If a monitor has experienced burn-in, turn off the monitor and leave it off for the same amount of time as caused the burn-in to occur.



Adjust the time-out period for the screen saver to initiate dependent upon your department workflow using the ScreenSaver Time from the [Tool Chest](#).

## COMPUTER CONSOLE

### Operating SCBSV and the Keyboard

The keyboard and SCBSV<sup>1</sup> consist of a typical alphanumeric keyboard, 10 number keypad, buttons specifically used for initiating scans, and communication with the patient. Standard keyboard keys and SCBSV functions include:

- **Delete** or **Backspace** erases characters
- **Enter** confirms what is typed or selected
- **Tab** moves across the areas on the current screen

For more information on the keyboard and filming, see [Automatic film](#) and [Manual film](#).

Figure 6-3 SCBSV and the Keyboard



Table 6-2 SCBSV Button

No.	Icon	Function	Description
1		<b>Emergency Stop</b>	All table and gantry motions, and X-ray exposure are stopped.
2		<b>Exposure Indicator</b>	Illuminates amber when an exposure is taking place.
3		<b>Volume control (operator to patient)</b>	Controls the volume of the operator's voice to the patient indicated by the numerical volume level label. <ul style="list-style-type: none"> <li>• <b>Upward</b> movement = increases volume</li> <li>• <b>Downward</b> movement = decreases volume</li> </ul>
4		<b>Volume control (patient to operator)</b>	Controls the volume of the patient's voice to the operator indicated by the numerical volume level label. <ul style="list-style-type: none"> <li>• <b>Upward</b> movement = increases volume</li> <li>• <b>Downward</b> movement = decreases volume</li> </ul>
5		<b>Move to Scan</b>	Flashes green for 180 seconds, indicating that the system is ready to advance the cradle to the start position. Press <b>Move to Scan</b> to advance the cradle to the start location.

---

1.Global Scan Control Box

No.	Icon	Function	Description
6		Stop Move	Stops cradle motion in/out. Click Resume from the ViewEdit screen to resume the scan.
7		Home	After completion, return the cradle to its original position, press and hold the Home key, the green light comes on and the cradle moves towards the original position. Releasing the Home key, the green light goes off and the cradle stops moving. The flashing green light indicates that the cradle has returned to its original position.
8		Start Scan	Flashes green for 30 seconds once the tube has reached exposure speed. Press <b>Start Scan</b> to initiate the scan. If it times out, press <b>Start Scan</b> again to bring the system back to the ready state.
9		Stop Scan	Aborts the scan immediately. From the Dynaplan screen, click <b>Resume</b> to restart the scan, if it is possible.
10		Talk	Press <b>Talk</b> and speaking towards the intercom to communicate with the scan room.
11		Reset Button	Stab the E-Reset hole, power to the gantry drives, X-ray system, and table drive will be restored.

### Film keys - F1, F3, and F4

The **F1**, **F3** and **F4** function keys can be used for filming to the Manual Film Composer.

Table 6-3 Film Function keys

F Key	Description	Translated Text
<b>F1</b>	Film Image	Film Image
<b>F3</b>	Film MID	Film MID
<b>F4</b>	Print Series	Print Series

### Preset W/L keys - F5 through F11

The **F5** - **F11** function keys are used to apply preset W/L<sup>1</sup> values in the following applications:

- ImageWorks Viewer, Mini-Viewer, and Reformat. The W/L values are defined from the Viewer User Prefs.
- Exam Rx - The W/L values are defined by pressing Shift and the function key to which you want to assign the value.

Table 6-4 Preset W/L function keys

F Key	Description	Translated Text
<b>F5</b>	Previous	Previous
<b>F6</b>	Abdomen	Abdomen
<b>F7</b>	Head	Head
<b>F8</b>	Lung	Lung
<b>F9</b>	Mediastinum	Mediastinum
<b>F10</b>	Spine	Spine
<b>F11</b>	Vertebrae	Vertebrae

---

1.Window Width and Window Level

## Page Up/Page Down Keys

Figure 6-4 Page up and down keys



The Page Up and Page Down keys allow you to review the next and prior images in a viewport or viewports from the Exam Rx or Image Works desktops.

## W/L control keys

Figure 6-5 Arrow Keys



You can use these keys to manually change the W/L settings for images in the Exam Rx and ImageWorks desktops. The Up/Down keys increase/decrease the window level and the Left/Right keys decrease/increase the window width.

## COMPUTER CONSOLE

### Operate the mouse controls

The three button mouse is used to make selections on the scan and display monitors. It is a hand-operated device that you maneuver across the surface of a pad. As you move it, the on-screen cursor mimics the movement of the mouse, allowing you to move through windows and menus. For example, moving the mouse to the right causes the on-screen cursor to move to the right. The mouse is used to make selections by clicking the left, right, and middle buttons.

Figure 6-6 Left (1), middle (2), and right (3) mouse buttons



Table 6-5 Mouse Actions

Mouse Actions	Description
<b>Click</b>	Click the left mouse button to select a button or icon.
<b>Right-click</b>	Click the right mouse button.
<b>Middle-click</b>	Click the middle mouse button.
<b>Click and drag</b>	Click and hold the left mouse button down while dragging the cursor to the desired location.
<b>Right-click and drag</b>	Click and hold the right mouse button down while dragging the cursor to the desired location.
<b>Middle-click and drag</b>	Click and hold the middle mouse button down while dragging the cursor to the desired location.
<b>Double-click</b>	Click the left mouse button twice in rapid succession.
<b>Triple-click</b>	Click the left mouse button three times in rapid succession.

## Gantry

### Gantry Display

The gantry display provides gantry status information with 7-segment LED.

Figure 6-7 Gantry display



The LED on display will display relative horizontal position of cradle when landmark is set. "S" and "I" leading the 7-segment LED are indication to direction. The "S" will light up when positioned higher than the landmark, and the "I" will light up if the position is lower than the landmark.

The display will switch to table height display when table up/down button pressed.

Except cradle longitude position and table height, the display can display several Error messages related with table operation.

- 1) E-01 indicates the cradle has been unlocked. When the cradle is unlocked, it is "free floating".
- 2) E-02 indicates there is a possibility that the table, cradle and gantry comes in contact with each other.

### Internal components

Table 6-7 Gantry internal components

Component	Description
Tube and Collimator	<p>The anode heat capacity with a MX135CT tube is 2.0 MHU and the cooling rate is 275 KHU/min.</p> <p>MX135CT tube operates at 24kW, depending on configuration</p>
High Frequency Generator	The High Frequency Generator is composed of an auxiliary box and a inverter. The cathode and anode of the MX135CT tube provide 24 kilowatts (kW).
Detector/Data Collection System	<p>The detector is comprised of a solid scintillator material known as HiLight. The HiLight detector offers 98% absorption efficiency. The 5 separate flat panel detector is designed to achieve a 10 mm coverage</p>
Slip Ring	Slip Ring provides data communication path from Detector/DAS to the Digital Interface Processor from there to the system disk.

## Gantry and Console Interfaces

If your system has connections for GE approved accessories, the figures and tables below show where and how to connect your approved accessories (Refer to the **Safety** in the **GE Approved Accessories list** section).

**GANTRY****Operate the Gantry controls**

Use this information to control the table and gantry functions.

Figure 6-9 Gantry controls (Revolution ACTs)



Table 6-9 Gantry controls (Revolution ACTs)

No.	Icon	Function	Description
1		Exposure Indicator	The Exposure Indicator illuminates amber when an actual exposure is taking place.
2		External Landmark	When positioning the patient, these buttons may be used to confirm reference points for the table. These reference points are usually the same as the anatomical reference points used when a patient is placed on the table. For example, if a patient's anatomical reference point is the Suprasternal Fossa, the Suprasternal Fossa should be aligned center with the laser alignment lights.
3		Internal Landmark	<ul style="list-style-type: none"> <li>For External Landmarks, the gantry displays a table location approximately 190mm from the internal landmark, depending on table characteristics.</li> <li>For Internal Landmarks, the gantry displays a table location of 0mm. This sets the zero point for which S and I scan locations are centered around.</li> </ul> <p>A landmark must be set before you click <b>Confirm</b>. Press <b>End Exam</b>, the landmark will be cleared. For scan setup details, see the <a href="#">Set up and position the patient</a> procedures</p>
4		Cradle moves out	When pressed, the cradle moves out, away from the gantry. <ul style="list-style-type: none"> <li>After clicking confirm, Cradle In or Out can be used to move the patient to the scan location. The Cradle In or Out LED will flash for 180 seconds</li> </ul>
5		Fast Speed	When pressed in conjunction with Table Cradle In/Out, causes those functions to perform at a faster speed.

6		Cradle moves in	Moves the cradle towards the gantry.
---	--	-----------------	--------------------------------------

No.	Icon	Function	Description
7		<b>Reset</b>	Stab the E-Reset hole, power to the gantry drives, X-ray system, and table drive will be restored.
8		<b>Laser Alignment Lights</b>	<p>Press to toggle all laser alignment lights on/off and to move the gantry components from the park or idle position to the alignment lights position.</p> <p>Alignment lights are used to establish landmark locations. Displays three alignment lights: axial<sup>1</sup>, sagittal<sup>2</sup> and coronal<sup>3</sup>.</p> <p> <b>CAUTION</b></p> <p style="color: red;">For patient safety, always have patients close their eyes whenever the laser alignment lights are on.</p> <p> The laser alignment light switch is provided as an alternative to beam attenuators</p>

## Table

### 397 Pounds (180 kg) table:

The table has a weight limit of 397 pounds (180 kg) with an incremental accuracy of  $\pm 0.25$  mm.

Scanning range (including axial head holder) is no less than 1200mm.

The maximum scan range depends on table height. The mark on the cradle for maximum scannable range is based on the table center at isocenter. Make sure the patient is positioned within the scannable range.



#### CAUTION

Use of any cradle extension accessory, such as phantom holder, is not accounted for in the table gantry interference matrix.

Therefore, additional care needs to be taken to closely monitor any, in/out movement to avoid contact of the extended accessory with the gantry.

## TABLE

### Fix-position table\*\*

Figure 6-13 Table



#### Function:

The table is used to hold and support the patient during scanning.

- Mobile cradle  
The mobile cradle can be moved into or out of the gantry.
- Latch Button  
The Latch Button is used to lock or release the mobile cradle. When the mobile cradle's status is unlocked, it can be moved manually.
- Vertical distance: 77cm (Mobile cradle height above floor)
- Horizontal mobility range of the mobile cradle: no less than 1500mm
- Scanning range (including axial head holder): no less than 1200mm
- Mobile cradle movement speed: 10mm/second (low speed mode), 100mm/second (high speed mode)
- Table load capability: Maximum weight 180kg table technical indicators

\*\*Fixed-position table: Revolution ACTS

## Hardware Components

### Component

Changes have been made to several pieces of hardware which make this scanner different from other scanners you may have used in the past.

### Collimator

A simplified slot collimator is used in Revolution ACTs with optimal bowtie beam filter which filter and shape the beam to optimize dose and image quality

### Gantry

A shorter scan geometry allows for a 20% mAs reduction from HSA CT/i single slice axial scan techniques. Gantry aperture is 65 cm. The distance from focal spot to isocentric is 54 cm. The distance from focal spot to the detector is 95© cm.

### Matrix Detector (Clarity Panel Detector)

Highly innovative segmented panel designs built with advanced packaging and miniaturization technology for lower power consumption and improved thermal performance.

### Other changes

Changes in the DAS, Slip Ring and Scan/Recon Unit have been made. There are also new reconstruction algorithms for the multi-slice data.

### Coverage

The Axial Detector Coverage/Beam Collimation for Revolution ACTs system are 1.25, 5, and 10 mm beam collimation/detector coverage.

Table 6-10 Axial acquisition modes

Scan Mode	1i	2i	4i	8i	16i
1.25mm	N/A	2x0.625	N/A	N/A	N/A
5mm	1x5	2x2.5	4x1.25	N/A	N/A
10mm	1x10	2x5	4x2.5	8x1.25*	16x1.25Z*

### Axial detector signal collection

2, 4, 8, 16\* signals/channels are collected per gantry rotation. Each of 2 to 16 signals are collected from an individual detector or combination of detectors.

- The number of detectors combined per signal/channel affects the maximum slice thickness.
- 1, 2, 4, 8 or 16\* slices can be generated per rotation.
- The slice thickness can be changed retrospectively.
- The beam collimation/detector configuration at the time of acquisition affects the retrospective choices.
- Multi-slice axial imaging is faster than single slice helical scanner using a 1:1 pitch.

### Axial interval

The interval is equal to the number of images per rotation multiplied by the beam collimation. For example, in

4 x 1.25 mode, 4 images are generated, with each layer 1.25mm thick, for a total coverage range of 5 mm per rotation.

\*Revolution ACTs EX with Advanced Acquisition only.

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## Helical pitch, scan mode, and collimation

Scan modes for helical are expressed in terms of pitch. Helical pitch is defined as the ratio of table travel per rotation in millimeters divided by the beam collimation. Previous systems expressed scan modes with names and defined pitch as table travel per rotation in millimeters divided by the detector row width.

For example:  $13.5/10 \text{ mm} = 1.35:1:1$  (Table Speed (13.5) divided by the Beam Collimation (10 mm) equals a Pitch of 1.35:1.)

Table 6-11 Beam Collimation

Detector Configuration	Beam Collimation
$2 \times 0.625$	1.25mm
$4 \times 1.25$	5mm
$4 \times 2.5$	10mm
$8 \times 1.25^*$	10mm
$16 \times 1.25^*$ (with helical overlapped imaging mode)	10mm

The following pitches are available:

- 1:1 pitch
- 0.75:1 pitch
- 1.5:1 pitch
- 0.625:1 pitch
- 0.875:1 pitch
- 1.35:1 pitch
- 1.675:1 pitch

Interleaved helices minimizes helical artifact, and gives the best detail. Interspaced helices has more interpolation of data and increased helical artifact when compared to interleaved mode. Using interspaced helices compared to interleaved helices will provide lower dose.

## HARDWARE COMPONENTS

### Axial detector configuration screen

The User Interface demonstrates slice thickness choices, number of images per rotation, and retrospective options. The parameters selected to set the detector configuration determine the slice thickness and speed determine the detector configuration.

- Beam Collimation or detector coverage allows selection of 1.25, 5, or 10,
- Axial slice thickness selection range from 0.625 to 10 mm.
- Number of images per rotation are 1i, 2i, 4i, 8i, 16i\*.
- Retro recon selection is the results of thickness and image quantity. For example selecting 8 images when thickness is 1.25 mm, the allowable retro selections are 1.25mm\*, 2.5mm, 5mm and 10mm. When Retro recon is based on 2X0.625, the allowable retro option is 0.625. If the option of Advanced Acquisition is installed, reconstructions based on 16X1.25z can be selected
- Rotation Speed can be adjusted to optimize acquisition time. Rotation Speeds are 0.98, 1.0, 1.2, 1.5, 2.0, 3.0 and 4.0 seconds.
- Button colors change to indicate options.
  - Light yellow color indicates the current selection.
  - Dark blue with black text indicates the available parameters.
  - Light gray with black text indicates available parameters, choosing changes other than displayed parameters.
  - Light gray with gray text indicates parameters not available.

\*Revolution ACTs EX

## HARDWARE COMPONENTS

### Helical detector configuration screen

Parameter selections within the thickness/speed areas on the view edit screen determine the detector configuration. There are five main parameter selections for helical.

- Detector Coverage determines the beam collimation, 5 and 10, in the Z-axis direction.
- Helical Thickness determines the prospective and retrospective image slice thickness.
- Slice thickness choices range from 0.625 mm to 10 mm.
- Pitch / Speed determines the speed of the table per gantry rotation. There are 7 pitch options related to table speed.
- Rotation Time determines the rotation of the gantry.
- Button colors change to indicate options.
  - Light yellow color indicates the current selection.
  - Dark blue with black text indicates the available parameters.
  - Light gray with black text indicates the available parameters (choosing changes other parameters).
  - Light gray with gray text indicates that it is not available.

## Power Distribution Unit

The PDU<sup>1</sup> supplies power to various parts of the system which includes components in the gantry, table and operator console. On the front of the PDU are controls to indicate that power is on to the unit, a push button to turn power on/off to the gantry and table, and an Emergency Stop button.

Figure 6-14 PDU controls

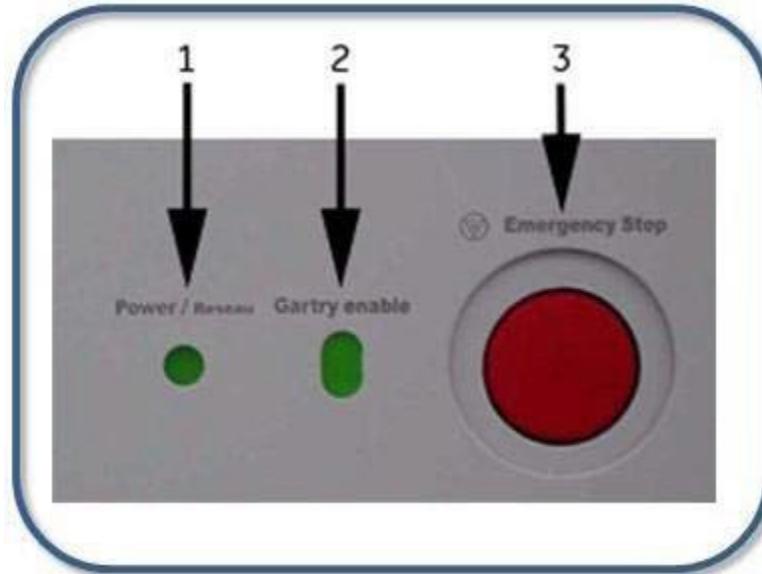


Table 6-12 PDU controls

No.	Function	Description
1	<b>Power Supply</b>	Indicates power is On/Off to the unit
2	<b>Gantry Enable</b>	Enables/disables power to the gantry and table
3	<b>Emergency Stop</b>	When pressed, all table and gantry motions are halted, generation of x-ray is stopped, laser alignment lights are turned off. The system aborts any data collection acquisition in progress and attempts to save all data acquired prior to the abort. Use the Emergency Stop for patient related emergencies. The cradle and base also unlatch and need to be latched before starting a scan.

---

1. Power Distribution Unit

## X-Ray Tube and Generator

### ray tube

- The anode heat capacity of a MX135CT tube is 2.0 million heat units (MHU).
- The cooling rate is 275,000 heat units per minute (KHU/min).
- MX135CT 40 operates at powers of 24kW depending on the configuration.

### High Frequency Generator

The high frequency generator is composed of the cathode and the anode tanks.

Table 6-13 mA range by kVp

kV	24 kW System**
80	10 to 200
100	10 to 200
120	10 to 200
140	10 to 160

\*\*24kW System: Revolution ACTs (40kVA)

# Chapter 7 : Startup and shutdown

This section contains information on how to turn on and off and log into and out of your CT system. It also includes quality control information to make sure your system is operating before scanning a patient.

## System startup and shutdown

- [Logon screen](#)
- [Login/logout](#)
- [Start up the system](#)
- [Shutdown and restart the system](#)

## Daily quality assurance

- [Daily Prep screen](#)
- [Scanner Utilities screen](#)
- [Daily QA workflow](#)
- [Tube warm-up](#)
- [Run Fast Calibrations](#)

# System startup and shutdown

To keep your system operating at optimal performance, restart your system once every 24 hours. It is recommended you shutdown and restart the system at the end of the last shift. If the system has a persistent problem, record the time, circumstances, and error messages, and then call service.

Upon startup, you may see evidence that an automatic software download occurred. The option to automatically install the updates is provided during system startup. See [Download software](#).

Performing a [Quick Snap](#) and/or an [IQ Snap](#) provides additional information to aid the service engineer in the resolution of issues.

## Login/Logout

The login feature requires that you login to access the system for [Data privacy](#). It can be turned on or off by your system administrator or Field Engineer. How your site uses this feature depends on if your site has a central user repository to which the system is connected. Sites with networks are referred to as Enterprise systems, those without are referred to as stand-alone systems. This feature can be used with either configuration, although some features are more applicable to enterprise systems.

Logging off does not prohibit other users from logging in. Logout is designed to protect patient privacy, not stop approved users from logging in. When you or another user logs back in, the system returns to its last known state.

## Prepare the system

- Clean the Accessories and check for damage.
- Check and remove dried contrast agent from
  - Mylar ring (around the gantry opening)
  - Table extension and cradle surfaces – especially the Patient Restraint plastic channels on the table.
  - Accessories (Head holders, pads and cushions, etc.)
- Checksupplies.

## SYSTEM STARTUP AND SHUTDOWN

### Logon screen

The Logon screen displays when either you have rebooted or someone has logged out when Data Privacy (EA3) has been enabled.

Figure 7-1 Logon screen



#### Logon Name

Text field for your system Login Name. Your administrator can set-up a unique Logon Name for you through your hospital Enterprise system.

#### Password

Text field for your password. A password is assigned to you by the system administrator.

#### Emergency Logon

Launches the Emergency Logon screen when Data Privacy (EA3) is enabled. It does not require an ID or password field on your Enterprise system.

Figure 7-2 Emergency Logon screen

**Logon**

Initiates the startup procedure.

**Cancel**

Stops the login or startup procedure.

## SYSTEM STARTUP AND SHUTDOWN

### Login/logout

If **Data Privacy** is enabled, use these procedures to log in and out of the system.

#### Login

1. From the logon screen, type your assigned logon name.
2. Type your password.
  - Click **Emergency Logon** only if you do not have a valid account set up. The Emergency Logon screen is launched, which does not require a ID or password.
3. Click **Logon**.

#### Logout

1. From the monitor, click the **Shutdown** icon.
2. From the Attention Shutdown pop-up screen, click **Logout User and OK**.



Logging off does not prohibit other users from logging in. Logout is designed to protect patient privacy, not stop approved users from logging in. When you or another user logs back in, the system returns to its last known state.

## Start up the system



Wait two minutes after a power interruption, before cycling the power on.



Never reboot the system with a USB device connected.



SmartID verifies the tube ID at start up. If the tube ID verification fails, attention screens display indicating the X-ray tube installed on the system is not recognized. You can continue scanning; however, you need to contact your service representative. ASiR is disabled when a non-GE tube is installed.

Figure 7-3 Tube ID messages



## Routine daily startup

1. From the **monitor**, click **Shutdown**.
2. Click **Restart**.
3. Click **OK**.

## Startup from power off

1. Push the power switch on the front of the operator console and the system automatically restarts.

Figure 7-4 DVD-R/W drive (1), USB (2), iLinq connections (3), and Power switch (4)



- If power was turned off via the computer switch and the Main Disconnect Control A1 Power Panel (Breaker), then
  - a. Turn on power to the Main Disconnect Control.
  - b. Turn on power to the computer.
  - c. Press **Reset** on the gantry controls.
- See **Tubewarm-up procedure** for potential Attention messages. Click **OK** and follow the Attention instructions.

## System start-up failures

If the system fails to startup completely, select **Unix Shell** from the tool chest menu. Place your cursor in the shell and type **startup**.

## Shutdown and restart the system

Shutdown and start up the system every 24 hours to keep your system running optimally.

Figure 7-5 DVD-R/W drive (1), USB (2), iLinq connections (3), and Power switch (4)



1. Disconnect any USB devices from the USB drive before performing a reboot or shutdown.
  - If a save/restore of scan data is in progress, wait for the process to complete, exit Recon Management, and disconnect the USB device before you reboot or shutdown. If for some reason the system should shutdown unexpectedly while a USB drive is connected to the system, disconnect the USB drive before restarting the system.
2. From the **monitor**, click Service
3. From Service, click **Shutdown**.
4. From the Attention Shutdown pop-up screen, click **Shutdown** or **Restart** and **OK**.
5. For system shutdown, when the "System Halted" message displays on the monitor the system can be powered off. Press the power switch on the front of the operator's console to the off position.

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## Daily quality assurance

### Tube warm-up

The system operates most efficiently within certain parameters. These parameters are established by warming up the tube using a preset group of exposures. When you perform a tube warm-up at least once per 24 hour period and at any system prompt, the tube warm-up reduces the possibility of artifacts and may aid in prolonging the life of the tube.

### Calibration

#### Daily Calibration

The system requires that all kV and mA settings be within specific ranges. These ranges are established and maintained by performing air calibrations. The air calibrations are performed as part of the daily system preparation following a tube warm-up procedure.

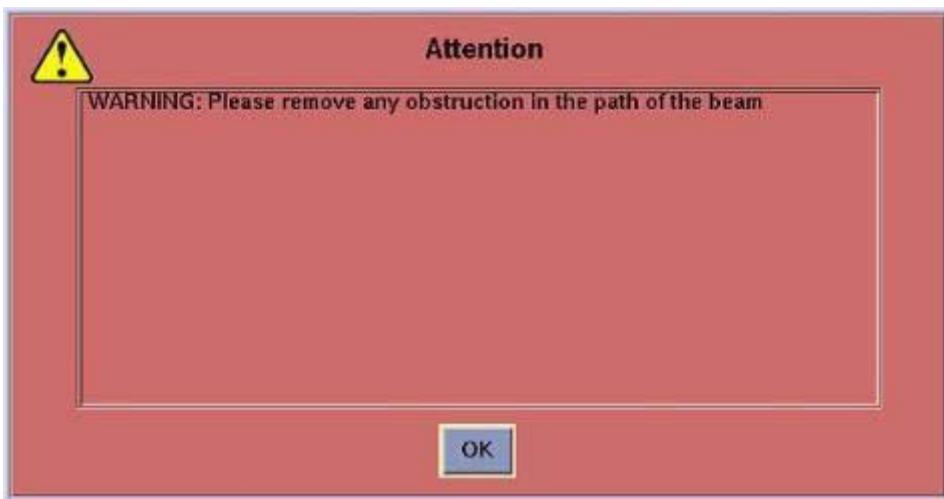
#### Full system calibration

Full system calibrations are normally performed by a qualified engineer following a tube change or as part of preventative maintenance.

The air calibrations (Fast Cals) execute several automatic checks:

- The system displays a message when there is any obstruction in the path of the Beam.

Figure 7-6 Obstruction Check message



- The system displays a message to indicate the balance check is in- progress.

Figure 7-7 Gantry Balance Check message



- Mylar Window Check ensures the window is clean. The Mylar Window must be kept clean. Dirt, contrast material, and other matter could corrupt the calibration files.

Figure 7-8 Mylar Window Check message

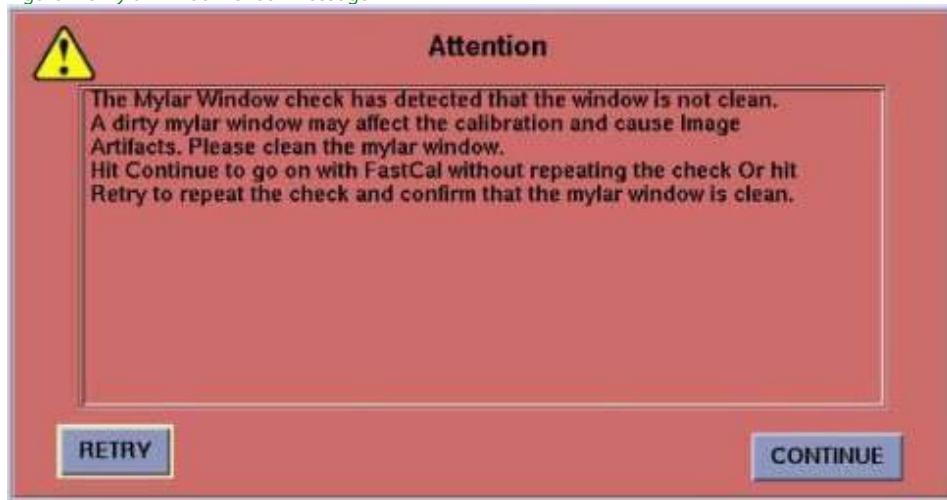


Figure 7-9 Warmup 2 Scan List

Cold Warmup Scan List						
kV	mA	Thickness	Filter	Scan Time	Spot Size	Scans Done
80	80	4.00	Closed	4.00	Large	
80	80	4.00	Closed	4.00	Large	
120	60	4.00	Closed	4.00	Large	
120	60	4.00	Closed	4.00	Large	
120	60	4.00	Closed	2.00	Large	
120	60	4.00	Closed	2.00	Large	

Cancel      Remaining Scans: 6      Resume

- The Interconnectivity Mop Scan List displays. This set of scans check for connectivity between the DAS and the Detector.

The system finishes the Fast Cal procedure by performing the actual Fast Cal air scans from the Fast Calibration Scan List. The default is to perform the Fast Cal scans for 80, 100, 120 and 140kVp.

#### **Non-GE X-ray tube**

When the system is configured as a non-GE tube or if the tube is unrecognized by the system, one of the following messages may alert you during system start-up, tube warmup, and fast calibrations that a non-GE X-ray tube is detected in the system configuration. System configurations with non-GE X-ray tubes will also be notified on the **Dose Report** and in protocol selection and management.



#### **Attention**

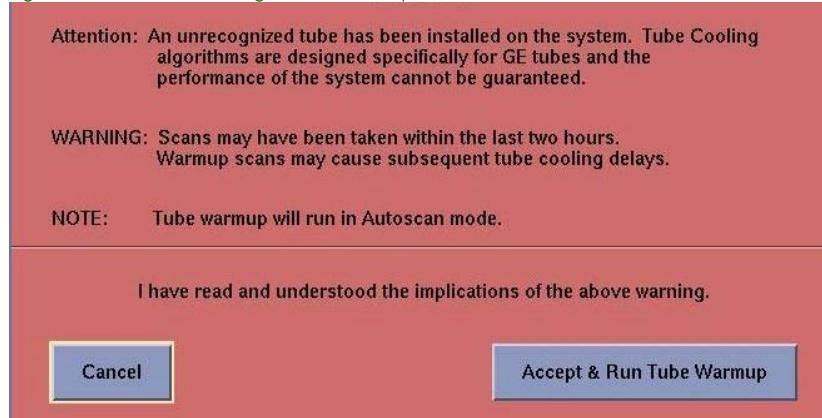
An unrecognized X-ray tube has been installed on the system.

- GE cannot assure that system performance will conform to specifications.
- Advisory messages will be posted to the operator about an unrecognized tube during tube warm-up, during Fast Calibration, and in the dose report.

Figure 7-12 Attention message for unrecognized tube



Figure 7-13 Attention message- Tube Warmup



**!** Attention  
 Attention: An unrecognized tube has been installed on the system. Tube Cooling algorithms are designed specifically for GE tubes and the performance of the system cannot be guaranteed.

**WARNING:** Scans may have been taken within the last two hours. Warmup scans may cause subsequent tube cooling delays.

Note: Tube Warmup will run in AutoScan mode.

**!** Attention  
 An unrecognized tube has been installed on the system. Fast Calibration techniques are designed specially for GE tubes and GE cannot guarantee that the performance of the system will meet specifications with an unrecognized tube.

Figure 7-14 Attention message for Fast Calibrations

**Attention**

An unrecognized tube has been installed on the system. Fast Calibration techniques are designed specifically for GE tubes and GE cannot guarantee that the performance of the system will meet specifications with an unrecognized tube.

**Cancel****Accept & Run Fast Calibration**

## Daily Prep screen



From the monitor, click the **Daily Prep** icon, to display the Daily Preparation screen.

Figure 7-15 Daily Preparation screen



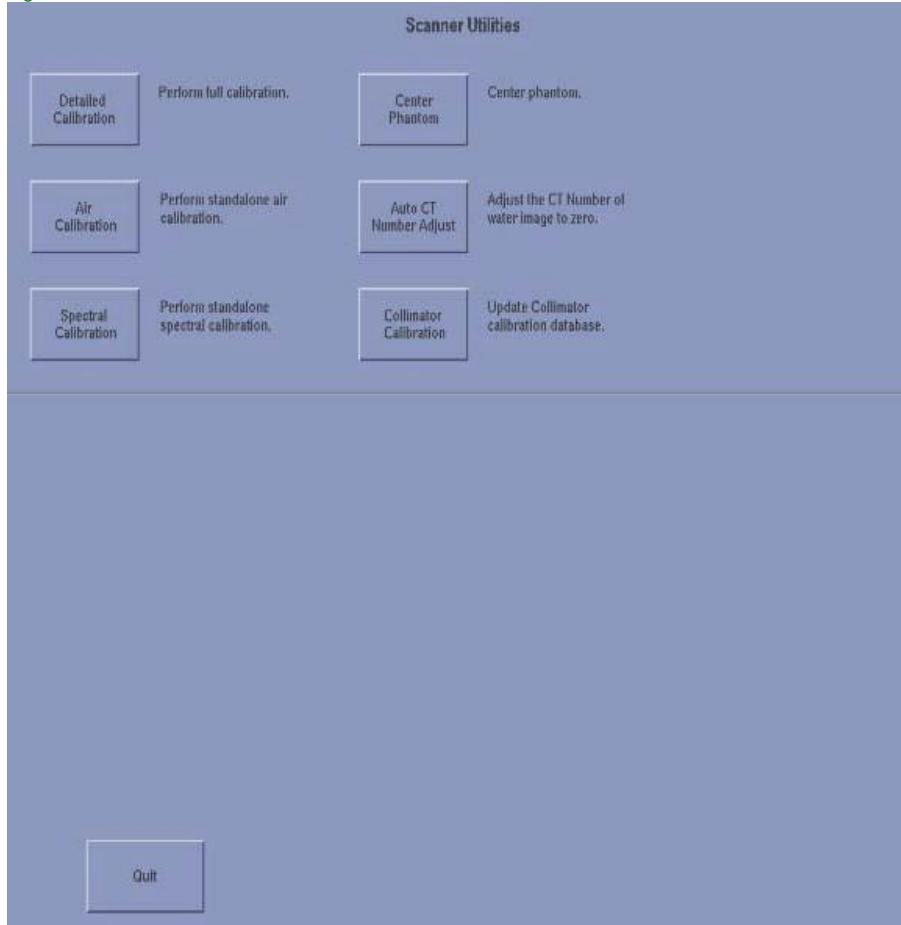
## DAILY QUALITY ASSURANCE

### Scanner Utilities screen

From the **monitor**, click the **Utilities** icon.



Figure 7-16 Scanner Utilities screen



## Daily QA workflow

Execute this workflow every day before patients are scanned.

1. Select Daily Prep - select and run **Fast Cal**.
2. Perform QA scan.
3. Reboot the system if it has not been rebooted in the last 24 hours.

## DAILY QUALITY ASSURANCE

### Tube warm-up



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

The system operates most efficiently within certain parameters. These parameters are established by warming up the tube using a preset group of exposures. When you perform a tube warm up at any system prompt, the tube warm-up reduces the possibility of artifacts and may aid in prolonging the life of the tube.

Full system calibrations are normally performed by a qualified engineer following a tube change or as part of preventative maintenance. Generator calibrations are a detailed and precise tool using phantoms, detectors, and exposure factors that affects image quality and radiation dose.

For optimum performance and consistent image quality, perform a tube warm up if your system has been inactive for two or more hours. The system notifies you at the two hour time limit with a warning dialog box.

- Every 7 days a beam quality check will be run to check the integrity of the x-ray beam. You will be prompted to make sure the beam is clear. This will increase tube Warm up time slightly.
- GE recommends that you warm up the tube after two hours of non-use. Only the tube warm-up scans need to be done at this time.

Figure 7-17 Attention Message



- If the detectors are cold due to the A1 Power Panel (Breaker) being off, turn the system on and wait two hours before performing a tube warm up. This allows the detectors to return to their operating temperature.
  - Failure to perform tube warm-ups when requested by the system may result in serious damage to the tube and system.
  - Failure to perform requested tube warm-up will result in reduction of the maximum mA possible for the exam after a tube warm-up has been cancelled or skipped.
1. From the scan monitor, click [Daily Prep].
    - The screen changes and the system displays blue colored button features for Tube Warm-Up and FastCals (air calibrations) in the upper left corner of the screen.
    - There is also a message area in the upper right corner of the screen.

2. Click [Tube Warm-Up].

## DAILY QUALITY ASSURANCE

- The system displays a warning dialog box. This is because the tube cooling algorithms are established for GE specific tubes. If any other tube is installed, you are responsible.



Refer to the Safety chapter regarding using non-GE-specific tubes.

3. Click [Accept & Run Tube Warm-up] to proceed.

- The system displays a message area detailing each slice concerning kV, mA, slice thickness and exposure duration.



Make sure gantry area is clear of all objects and personnel.

4. Press **Start Scan** on the top of the keyboard.

**The system automatically performs all tube warm-up scans.**

- This procedure takes several minutes.

- The system returns to the Daily Prep menu when scans are completed.

5. Click [Quit] or proceed to Fast Calibrations.

- Choosing quit ends the Daily Prep screen.

## DAILY QUALITY ASSURANCE

### Run Fast Calibrations



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

#### Considerations

- If the detectors are not at operating temperature, a message will post indicating a time when the detectors will be at operating temperature.
- If there is a large shift in room temperature (+/- 10 degrees), perform a FastCal to maintain optimum IQ. Once the room temperature has stabilized perform another FastCal.
- Fast Cal must be run once every 24 hours. It takes approximately 10 to 15 minutes, depending on options installed.
- If you experience a scan abort with resumes during FastCal, notify your service engineer.
  1. Clear the gantry of any objects or personnel. Any obstruction in the gantry may lead to artifacts in scanned images.
  2. Click **Fast Calibration**.
- 3. Press **Start Scan**. Respond to all messages that appear during the approximate 10 to 15 minute calibration. Execute any necessary actions indicated in the messages.
  - If the system detects a dirty mylar window, which may be caused by a beam obstruction, something in the gantry, contrast, dirt, or other matter on the mylar window, a message displays. Clean the mylar window and click **Retry**.
  - The following automated calcheck procedures occur: warm-up, inter-connectivity map scan, and FastCal air scans. Read the screen messages for calibration status.
- 4. When FastCal is complete, the system returns to the Daily Prep menu. Click **Quit** to exit the Daily Prep screen.

## DAILY QUALITY ASSURANCE

# Chapter 8 : Patient Schedule

Use the Patient Schedule feature to pre-program patient information and protocols in advance of the patient's arrival. At scan time, you can select a patient from the created list, enter the patient ID<sup>1</sup> number, enter the Accession number or use the optional bar code reader to call up the patient's information. Patient information can be easily added or deleted from this list.

See the [Patient Information fields](#) table to view the limits for each entry in Patient Information.

With the ConnectPro option, you can retrieve critical patient information from your HIS/RIS<sup>2</sup> using a DICOM<sup>3</sup> connection and then send this information to your Patient Schedule. Connect Pro requires a HIS/RIS system and PACS<sup>4</sup>.

## Patient Schedule

[Schedule screen](#)

[Update Parameters screen](#)

[Add a patient to the schedule manually](#)

[Patient Schedule Preferences screen](#)

[Edit a patient in the schedule](#)

[Delete a patient from the schedule](#)

[Update the patient schedule](#)

[View more patient information on the schedule](#)

[Set patient schedule preferences](#)

[Select a patient from the schedule](#)

[Check a patient's status](#)

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1. Identification

2. Hospital Information System / Radiology Information System
3. Digital Imaging and Communications in Medicine
4. Picture Archiving Communications System

## Patient Schedule

Patient Schedule allows you to preprogram patient information and exam protocols prior to the patient's arrival. At scan time, you can either select from the created list, enter the patient ID number, enter the Accession number, or use the optional Bar Code Reader to call up patient information. Patient information can be easily added or deleted from this list.

### Connect Pro

ConnectPro retrieves critical patient information from your HIS/RIS using a DICOM connection and then sends this information to your Patient Schedule. The patient information from HIS/RIS is referred to as the Modality Worklist.

Connect Pro can be customized to fit your department's needs by using "filters" to pull only the information in which you are interested. It can collect more than standard patient demographic information; for example allergies, pregnancy status, medical alerts,etc.

### Performed Procedure Step

Performed Procedure Step (PPS) is part of the Connect Pro option that requires a HIS/RIS system and PACS. It communicates to PACS and HIS/RIS when a procedure is completed. It improves transfer of data to PACS because it can provide a complete message when all data has been transferred. The browser in Image Works has a MPPS<sup>1</sup> column that lists the PPS status of each exam. There are three states of exam status:

- **COMP** ends the exam and PPS. You can annotate an image or add a series, such as a screen save, but you should not edit the patient information. If you edit the exam (through Edit Patient Data), the exam is no longer recognized by the HIS/RIS system as the exam it requested. This status annotates the exam as COMP.
- **DISC** notifies the HIS/RIS that you are aborting the PPS. Use only if the images you acquired were unacceptable or were not the correct patient. This status annotates the exam as DISC.
- **DEFER** does not end PPS. You can still post process and edit the patient information. If you edit the exam (through Edit Patient Data), the exam is no longer recognized by the HIS/RIS system as the exam it requested. Selecting PPS from the browser menu bar displays a window and allows you to Complete or Discontinue the PPS on the patient. This status annotates the exam as INPR.

### New and completed records

In the patient schedule there is a column labeled Status. In the Status column, an "N" or a "C" is listed next to each patient entry.

- **N** indicates the record is not completed or is a new record. These are records for patient studies that are scheduled in Patient Schedule, but are not yet completed.
- **C** indicates the record is completed. These patient studies were scheduled and have now been completed.



If obtaining your patient using Connect Pro it is best to only have New Records in your schedule list. Having Completed Records may cause inadvertent scanning of a patients with the wrong accession number. Set Delete Completed Exams to 0 days in the Connect Pro preferences. This setting assures that Completed Records are not added to the schedule list.

---

1.Modality Performed Procedure Step

## PATIENT SCHEDULE

### Schedule screen



Click the **Patient Schedule icon** to display the Schedule screen.

Figure 8-1 Schedule screen

Status	Accession No.	Patient ID	Patient Name	Date	Time
C	000000			11/26/2013	17:57
C	000001			11/26/2013	18:27
C	21			11/26/2013	20:03
C	23			11/26/2013	21:04
C	32			11/26/2013	21:34
C	23			11/26/2013	22:02
C	21			11/26/2013	22:15
C	12			11/26/2013	23:17

#### PatientSchedule

Closes the Schedule screen.

#### Select Patient

Allows you to select a patient for scan.

#### View More Info

Opens the More information screen, which allows you to view other valuable information about a patient such as allergies, pregnancy status, and medical alerts. This information is pulled from the HIS/RIS using a DICOM connection.

#### Add Patient

Opens the Patient Schedule information screen, where you can enter the patient's information and add the number of a specific protocol.

#### Edit Patient

Allows you to change patient information if it is entered incorrectly in the Patient Schedule.

#### Delete Selected

Deletes the selected patients that are selected in the list.

#### Delete All

Deletes all the patients from the list.

#### Preferences

Opens [Patient Schedule Preferences screen](#).

**Update**

Opens [Update Parameters screen](#).

## Update Parameters screen



Click the **Patient Schedule icon** and select **Update Parameters** to display the Update Parameters screen, where you can update your Patient Schedule list with information from HIS/RIS.

Figure 8-2 Update Parameters screen

Update Parameters			
<b>Get Patient List For:</b>	<input type="radio"/> This System	<input checked="" type="radio"/> All CT Systems	<input type="radio"/> All Systems
<b>Date Range</b>	From <input type="text"/>	To <input type="text"/>	mon/ day/ yr      mon/ day/ yr
<b>Requested Proc. ID</b>	<input type="text"/>		
<b>Accession Number</b>	<input type="text"/>		
<b>Patient Name</b>	<input type="text"/>		
<b>Patient ID</b>	<input type="text"/>		
<b>Continue Update</b>		<b>Cancel Update</b>	

### Get Patient List For

- **This system** populates the Patient Schedule for the current scanner you are on.
- **All CT Systems** populates the Patient Schedule for all of the CT systems on the HIS/RIS connection.
- **All Systems** populates the Patient Schedule for all the systems on the HIS/RIS connection.

### Data Range

Populates the Patient Schedule from the defined date range. Use the month/day/year format.

### Requested Proc ID, Accession Number, Patient Name, Patient ID

Additional ways to populate the Patient Schedule.

### Continue Update

Applies the criteria chosen and updates the Patient Schedule.

### Cancel Update

Closes the Update Parameters screen without saving any new selections.

## PATIENT SCHEDULEE

### Patient Schedule Preferences screen



Click the Patient *Schedule* icon and select *Preferences*.

Figure 8-3 Preferences screen

**Preferences**

<b>Update Schedule Automatically?</b>	<input type="button" value="Yes"/>	<input checked="" type="button" value="No"/>	<b>Sort By:</b>	<input checked="" type="button" value="Date/ Time"/>	<input type="button" value="Name"/>	<input type="button" value="ID"/>
<b>Show Update Parameters?</b>	<input checked="" type="button" value="Yes"/>	<input type="button" value="No"/>	<b>Delete Completed Exams After:</b>	<input type="text" value="3"/>	<input type="button" value="d"/>	
<b>Use Study UID?</b>	<input type="button" value="Yes"/>	<input checked="" type="button" value="No"/>	<b>Edit Modality Worklist?</b>	<input checked="" type="button" value="Yes"/>	<input type="button" value="No"/>	

---

**Default Update Parameters**

<b>Get Patient List For:</b>	<input type="button" value="This System"/>	<input type="button" value="All CT Systems"/>	<input checked="" type="button" value="All Systems"/>
<b>With a Date Range:</b>	<input checked="" type="button" value="Today"/> <input type="button" value="Days Before Today"/> 0		
	<input type="button" value="Days After Today"/> 0		
	<input type="button" value="All Dates"/>		

---

<input type="button" value="OK"/>	<input type="button" value="Cancel"/>
-----------------------------------	---------------------------------------

#### **Update Schedule Automatically**

Yes updates the schedule when you click **Patient Schedule**. The updates are based on the parameters selected in Update.

#### **Show Update Parameters**

Yes shows the Update screen every time the system starts to automatically update. This allows you to edit the Update parameters, if desired.

#### **Use Study UID?**

Yes uses a study instance UID from HIS/RIS.

No assigns the study instance UID to the exam.

#### **Sort By**

Allows you to sort the schedule by date/time, name, or patient ID.

#### **Delete completed exams after days.**

The number of days after which you would like the scanner to delete the completed exams. The valid range is 0 to 30 and the default is 3. A completed record is not added to the Patient Schedule if the number of days is set to 0.

***Edit Modality Worklist?***

No prevents you from editing any patient information from HIS/RIS.  
Yes allows you to edit any patient information from HIS/RIS.

## Add a patient to the schedule manually



1. Click the **Patient Schedule** icon.
2. From the **Schedule screen**, click **Add Patient**.
3. From the Schedule Patient screen, complete all relevant fields.
  - Entering even weights may be rounded up to the next odd pound because weights are stored as kilogram units then converted back to pounds.
  - If adding a patient where Exam Split is going to be used, an exam description must be entered for those entries to be used with Hard Exam Split.
  - If desired, add the number of the specific protocol under Protocol Number.
  - If desired, type in the date and time in appropriate fields to be able to sort the Patient Schedule by scheduled times.
4. Click **Accept** to add the patient to the schedule.

## PATIENT SCHEDULE

**Edit a patient in the schedule**

A patient record cannot be edited if it came from HIS/RIS and Edit Modality Worklist on the Preferences screen is set to **No**.



1. Click the **Patient Schedule** icon.
2. From the Schedule screen, select a patient.
3. Click **Edit Patient**.
4. Change the patient information as needed.
5. Click **Accept**.

## Delete a patient from the schedule



1. Click the **Patient Schedule** icon.
2. From the Schedule screen, select patients to be removed.
3. Click **Delete Selected**.
  - Alternatively, choose one of the following options.
  - Click **Delete All** to remove all the patients from the list.
  - Click **Delete All Completed** to remove all the completed patients marked with "C" from the list.
4. Click **OK** to the confirmation prompt.

**PATIENT SCHEDULE****Update the patient schedule**

Use this procedure with the ConnectPro option and Modality Work List to update the Patient Schedule.



1. Click the **Patient Schedule** icon.
2. From the Schedule screen, click **Update**.
3. From the Update Parameters screen, select one of the following options from the Get Patient List to populate the schedule from your HIS/RIS.
  - Select **This system** to pull the patient schedule for the current scanner.
  - Select **All CT Systems** to pull the patient schedule for all of the CT systems on the HIS/RIS connection.
  - Select **All Systems** to pull the patient schedule for all the systems on the HIS/RIS connection.
4. Enter values for the Date Range.
5. Enter a Requested Procedure ID, accession number, patient name or ID to narrow the search. These are optional fields.
6. Click **Continue Update** to continue or click **Cancel Update** to exit and make no changes.

## View more patient information on the schedule

Use this feature with the Connect Pro option to view other valuable information about a patient such as allergies, pregnancy status, and medical alerts. This information is pulled from the HIS/RIS using a DICOM connection.



1. Click the **Patient Schedule** icon.
2. From the Schedule screen, select a patient.
3. Click **View More Info**. The screen is populated from your HIS/RIS.
4. Click **Cancel** to close the More Information screen.

**PATIENT SCHEDULE****Set patient schedule preferences**

Use this procedure to set your preferences for the Patient Schedule for items such as sort order and deletions of completed exams.



1. Click the **Patient Schedule** icon.
2. From the Schedule screen, click **Preferences**.
3. From the Preferences screen, complete fields as needed.
  - **Update Schedule Automatically?**: If you have Connect Pro, click **Yes** to update the schedule when you click Patient Schedule based on the parameters selected in Update.
  - **Sort By**: Click the **Date/Time**, **Name**, or **ID** sort option.
  - **Show Update Parameters?**: If you have Connect Pro, click **Yes** to display the **Update Parameters screen** every time the system starts to automatically update.
  - **Delete Completed Exams After**: Set a number of days (0 to 30) to delete exams. Set the value to 0 when the schedule is updated from a HIS/RIS system so that completed exams are not added to the patient schedule. This eliminates the selection of completed accession being selected causing patient reconciliation issues on a PACS system.
  - **Use Study UID?**: If you have Connect Pro, click **Yes** to use a study instance UID<sup>1</sup> from HIS/RIS.
  - **Edit Modality Worklist?**: If you have Connect Pro, click **Yes** to be able to edit any patient information from HIS/RIS.
  - **Default Update Parameters**: Choose a location and date range.
4. Click **OK**.
  - Close the Preferences screen before switching between Patient Schedule and Exam.

1.UniqueIdentifier

## Select a patient from the schedule

Use this procedure to select a patient from the Patient Schedule to begin an exam.

1. Click the **Exam Rx** icon.



2. Click the **Patient Schedule** icon.
3. From the Patient schedule list, select the desired patient and click **Select Patient**.

- The Patient Information screen fields are populated.
  - Multiple records for the same patient can be selected.
  - Multiple records must be selected in order to use **Exam Split**.
4. If a protocol is not tied to the patient, select the protocol. The system displays the first series.

**PATIENT SCHEDULE****Check a patient's status**

Use this procedure to check the status of a patient.

1. Click the **Patient Schedule**  icon.
2. View the Status column.
  - N = New Record or Not Completed
  - C = Completed
3. Click  or  arrows to page through the list.

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# Chapter 9 : Scan



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

This section includes the workflow and parameters required for scan. It contains guidelines on the user-friendly graphic areas and describes the basic features of the scan parameters with instructions to help you navigate through the required areas.

## Exam workflow

- [Patient Information screen](#)
- [Patient Information preset selection screens](#)
- [Auto Exam Description](#)
- [Patient Position/Series Level Functions area](#)
- [ViewEdit screen](#)

## Scan workflow

- [Exam workflow procedure](#)
- [Set up and position the patient](#)
- [Set up the patient's information](#)
- [Enter patient information with the bar code reader](#)
- [Modify the Patient Information presets](#)
- [Acquire a scout](#)
- [Adjust the Graphic Rx](#)
- [Enter contrast descriptions](#)
- [Start the scan](#)
- [Repeat a series](#)
- [Stop a scan](#)
- [End the exam](#)

## Scan Parameters

- [Scan Type screen](#)
- [Thickness Speed screen](#)
- [Scan parameters workflow](#)
- [Choose the Scan Type](#)
- [Set Axial and Helical scan parameters](#)
- [Set the Start and End locations](#)
- [Set a specific number of images](#)
- [Choose the Thick Speed options](#)
- [Set the Image Interval](#)
- [Digital Tilt](#)
- [Set the Scan FOV](#)
- [Set the kV](#)

Set the mA

Organ Dose Modulation

## Timing parameters

- [Timing tab](#)
- [Timing parameters workflow](#)
- [Set a Prep Group delay time](#)
- [Set the Interscan Delay time](#)
- [Set a Breath Hold time](#)
- [Set a Breathe Time](#)
- [Set the Voice/Lights/Timer options](#)
- [Change the Auto Voice preset delay](#)

## RECON parameters

- [Recon parameters Concept](#)
- [Recon Parameters tab](#)
- [Recon Option screen](#)
- [Slice Thickness screen](#)
- [Recon parameters workflow](#)
- [Set the Display FOV](#)
- [Set the R/L Center coordinates](#)
- [Set the A/P Center coordinates](#)
- [Set the Recon Type](#)
- [Set the Recon Options](#)

## Auto Voice

- [AutoVoice screen](#)

## Auto Voice workflow

- [Set the Auto Voice language](#)
- [Record a message](#)
- [Delete a message](#)

## Additional scan features

- [Add/split/delete a group/One More](#)
- [More scan information](#)
- [Optimize technical parameters](#)
- [Optimize patient dose](#)
- [View the Dose Report](#)
- [Dose Information screens](#)

## Precuations

- If you encounter a message that you need to remove images to be able to scan the current series, first remove images to create space for scanning.
- In general, if a scan fails and a request to Resume is posted, click **Resume** to continue. Click **Resume** again if the first action fails. If a failure still occurs, reset the scanning hardware through System Resets from the Service desktop. If scan still fails to restart, shutdown and Restart the system.
- Complete these steps if images fail to reconstruct:
  1. Click **Recon Status** to display Recon Management screen.
  2. From the Recon Management screen, click **Unsuspend Entries**.
  3. If images still fails to recon click **Restart Queue**.
  4. If images still fails to recon, **shutdown and reboot** the system.

## Exam workflow

See the [Exam workflow](#) for procedures included in a typical exam.

### Positioning patients

Before placing patients in the system each day, the accessories that may be used during the day while scanning should be inspected, such as the head holder, table extension, patient positioning sponges and straps to make sure they are in good working condition.

Positioning pads and straps should be inspected and cleaned to prevent possibility of artifacts being introduced due to foreign matter such as contrast on the surfaces of these items. Do not use accessories that maybe broken or torn.

Make sure patients are comfortable as possible on the table or in the head holder. Use positioning sponges and pads along with positioning straps to aid in the positioning of the patient to help them hold the position needed to complete the exam. If patients are comfortable, they will be able cooperate and hold still during the exam. If arm support or catheter bag hanger is used make sure they are placed securely on the table to support the arm or hold the catheter bag.

Monitor the location of the arm support or catheter bag holder to prevent any collisions with the gantry. Make sure any sheets, blankets and patient clothing or gowns are not allowed to get caught as the table is moving. Use the positioning straps to help contain these items so they are not loose or hanging off the cradle. If a protective slicker is installed on the table, make sure, it is folded in and not allowed to hang. Otherwise, artifacts may occur. Make sure to explain the procedure to the patient so they understand what is going to happen and what to expect. This will reduce incidences of patient moving because they are surprised by the position they are put in the gantry or the movement of the table.

### Using protocols

All parameters for scanning a patient can be set up in a protocol. This saves you time when prescribing scan parameters for each patient. When a new patient is to be scanned, type in the patient information and choose a protocol. The protocol may be adjusted on a per patient basis without permanently altering the original set of parameters. Once the parameters are set and the prescription is confirmed, scanning can begin.

See [Protocols](#) for more information.

### Using contrast

When IV<sup>1</sup> contrast is to be used, make sure the injector or syringes of contrast are set up before performing the localizer (scout) scan. The contrast (syringe) icon on the lower-left corner of the ViewEdit screen must be selected. When the icon is selected, there is a "+C" annotation on the images next to the image number, indicating that IV contrast was used for that exam.

See [Enter contrast descriptions](#) for more information.

---

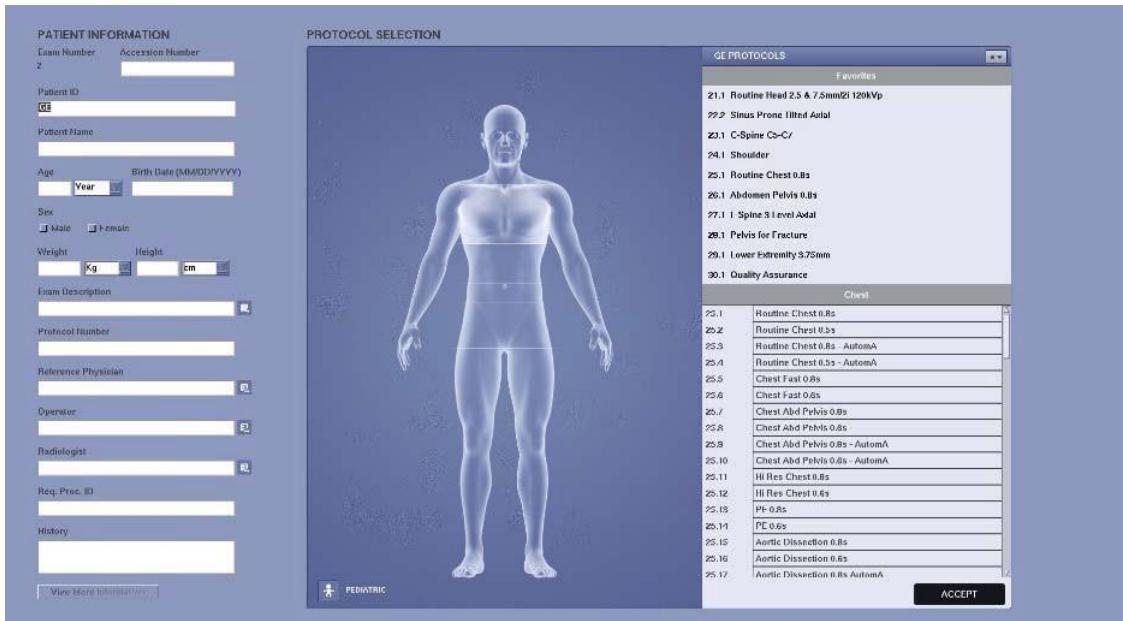
1. Intravenous

## EXAM WORKFLOW

### Patient Information screen

Click **Exam Rx** [Exam Rx], to check the scanning screen

Figure 9-1 Patient Information screen



See the [Set up the patient's information](#) procedure for character limits on each field.

#### Preset Descriptions

Exam Description, Referring Physician, Operator and Radiologist have **preset selections** that can expedite data entry for frequently used entries. You can Add, Delete, and change the information in these areas. It is possible to Sort the entries for the presets.

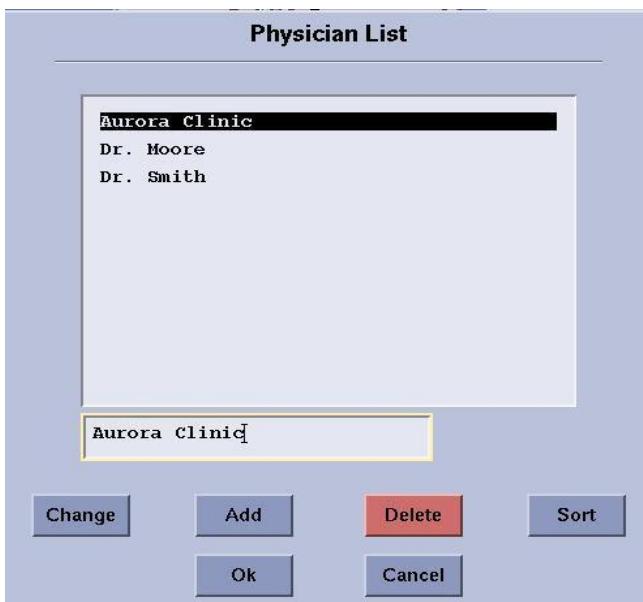
## Patient Information preset selection screens

Click **Exam Rx** | **Exam Rx** to display patient information screen. Select one of the preset fields:

- Exam Description
- Referring Physician
- Operator
- Radiologist

Information in the Referring Physician List is listed in the order it is entered with last entry displayed at the top of the list.

**Figure 9-2 Physician List**



### **Change**

Allows you to change an item on the list.

### **Add**

Allows you to add a name to the list.

### **Delete**

Allows you to remove an item from the list.

### **Sort**

Allows you to sort the Exam Description list.

### **Text field**

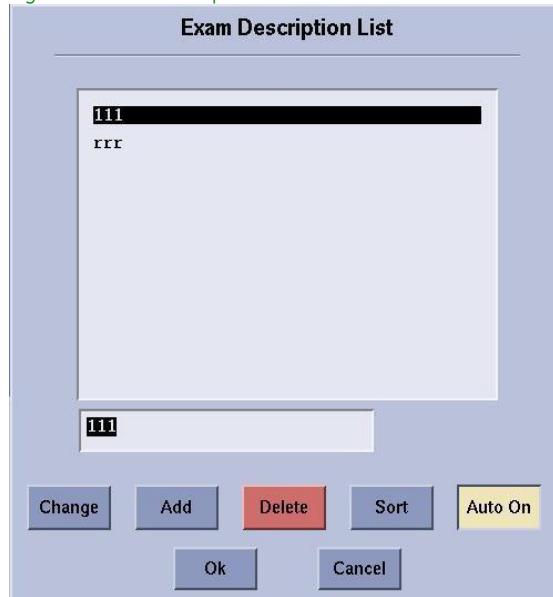
Displays the item that is to be changed, added, or deleted.

## EXAM WORKFLOW

### Auto Exam Description

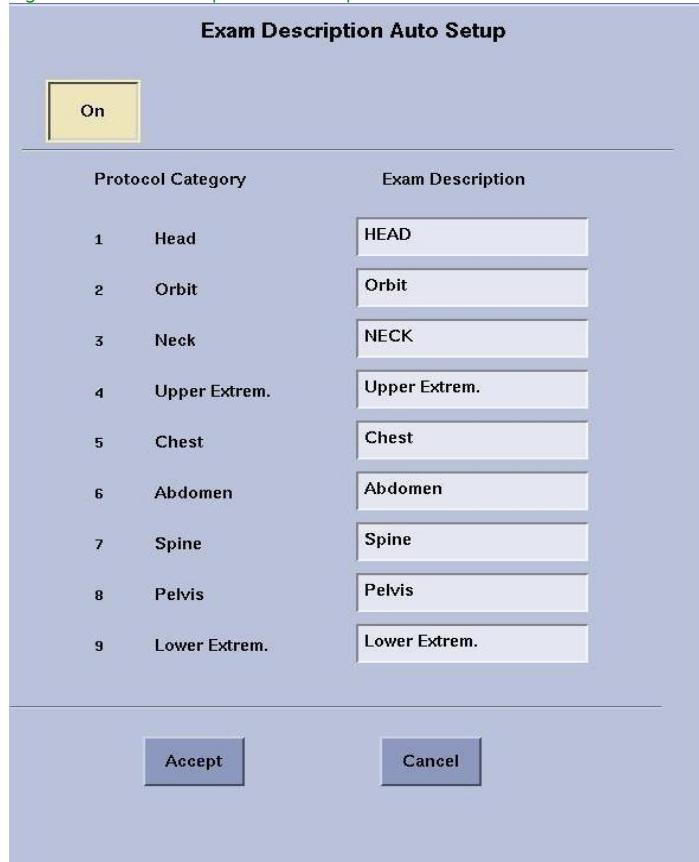
When Auto Exam Description is enabled, Auto On/Off selection is shown on the Exam Description List on PatientInformation.

Figure 9-3 Exam Description List



The preset exam description is displayed for the exam automatically based on the Protocol Category when Auto On is enabled. You can edit Exam Description on Auto Setup screen.

Figure 9-4 Exam Description Auto Setup



## Patient Position/Series Level Functions area

The Patient Position/Series Level Functions area is on the [Scan Setup screen](#).

Figure 9-5 Patient Position/Series Level Functions area



### **Auto Store/Auto Transfer**

If these features were set for the scout image, they are automatically set for this series. If they were not selected for the scout series, they may be activated in this series and the scout images are included in the storage/transfer. Click **Auto Store** to automatically send the image data to the system storage device. Click **Auto Transfer** and a window displays where you can select the IP address to send the images.

### **Dose Report Auto Transfer**

Auto Transfer for Dose Report can be set individually. Click **Dose Report Auto Transfer** to select a remote host to automatically send the reports.

### **Auto Scan**

Automatically moves the table and scans the confirmed series.

- If Auto Scan is disabled, you must press Move to scan for every scan before Start Scan becomes available.
- If you select Auto Scan for a group prescription, it remains on for every group in that series.
- Auto Scan is automatically enabled for a SmartPrep series.

## PatientPositioning

To set the correct patient position, click on the arrow direction on top of the patient's body  to change the head forward / foot forward direction, click on the arrow direction on top of the patient's body



to rotate the model, for a rotation of 90°.

## Anatomical Reference Point

Choose one of the preset center points or designate with a two letter abbreviation your center or 0 point. This should be set the same as your scout images.



## *Copy Pt. Orient. Pt. Position Anat. reference*

To copy the Patient Position and Patient Orientation, click **Copy Pt.Orient Pt.Position Anat.Ref**. When the protocol is used in New Patient, the fields where Copy Forward have been defined will be outlined in green. If copy forward for Patient Position/Patient Orientation is selected, Copy Pt. Orient. Pt. Position Anat. Ref. will be highlighted.

## Create New Series

Opens the Select New Series Type screen, where you can create a new series in the exam.

Figure 9-6 Select New Series Type screen



### Repeat Series

Repeats a series that has already been scanned.



SmartPrep is disabled for Repeat Series.

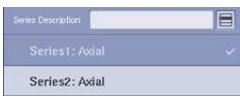


The Prep Delay for group 1 is set to zero.

### Select New Protocol

Allows you to select a new protocol for the patient's exam.

### Scan Task List

Scan tasks List  shows all scan sequences included in the current examination, of



which the highlighted item is the current scan sequence, with  symbol to indicate that it has completed the scan sequence.

## EXAM WORKFLOW

### ViewEdit screen

The View Edit screen is an area on the [Scan Setup screen](#). The contents of the ViewEdit screen changes dependent on the active application.

Figure 9-7 View/Edit screen



#### End Exam

Completes the exam and sends any prescribed PMR<sup>1</sup> Recon 2 and 3 for the last series to be reconstructed. It also starts AutoStore and AutoTransfer by Exam.

#### Next Series

Transitions to the next series if additional series are programmed in the protocol.

#### Confirm

Takes you out of the prescription preview mode so you can begin a scan. Confirm is not available if the patient has not been landmarked or if invalid parameters exist on the ViewEdit screen.

---

1. Prospective Multiple Reconstruction

## SCAN WORKFLOW

### Exam workflow procedure

Use this procedure for an overview of scanning a patient, from patient setup to image management.

#### *Set up and position the patient.*

1. Set up the patient's information.
2. Acquire a scout.
3. Define the Series setup parameters.

#### *Set the Auto Store option.*

- a. Set the Auto Transfer option.
4. Acquire the scan data.

#### *Set the scan parameters.*

- a. Adjust the Graphic Rx.
- b. Set the timing parameters.
- c. Set up Auto Voice.
- d. Set the Recon parameters.
- e. Set the film parameters.
- f. Apply any additional scan features.
- g. Enter contrast descriptions.
- h. Start the scan. Check the following before you Confirm:
  - the start/end locations for each recon
    - direction of scan
  - mA table for Auto or SmartmA

#### *Repeat a series, if necessary.*

5. End the exam.
6. View the images.
7. Manually film the images.
8. Manually archive the images.
9. Manually network the images.

## SCAN WORKFLOW

### Set up and position the patient

It is best to prepare the scan room before bringing the patient into the room. Make sure that you have all the necessary supplies and accessories. While in the scan room the operator should stand by the table and follow the steps below.

Go into the scan room, the operator should stand beside the table.

1. Connect the head holder or foot extension on the cradle facing the gantry.
  - If the head holder cannot be securely locked onto the cradle, please contact your service representative to install the parts inside the tool bag 2327335 (P9230JV).
2. When preparing to move the patient onto the table, step on the 'home' pedal under the bed to adjust the height of the table.
  - The cradle moves to home and to a minimum height of 44 cm.
3. Transfer the patient to the table.
  - Make sure to follow the manufacture directions for use of a protective table slicker when scanning, otherwise artifacts may be seen in images.
  - Blocked reference channels may cause image artifacts. Make sure that there are no blankets, clothing, tubing, or straps hanging down below the table when scanning that could cause a blockage. Please use the patient positioning strap to secure miscellaneous items beside the table.
4. Make the patient comfortable and immobilize as needed. Connect body straps to the cradle and wrap them around the patient.
  - For head scans, confirm that the patient's head is completely in the head holder. If the patient has not entirely entered into the head holder, then light and dark images can be seen at both ends of the collimated rays during the two rotations.
  - When the scanning is at the head of the bed surface, make sure that the head is not at the connection of the cradle's extension. The head should be fully placed on the cradle.
  - Always use the head holder straps to immobilize the patient's head during head scans.
  - Make sure items such as blankets and straps are not left hanging off the table or head holder, allowed to touch, or be dragged through the gantry while scanning otherwise artifacts may be seen in images.

5. From the **gantry controls**, press the following buttons as needed to refine the patient's position.

- Cradle moves out



- Cradle moves in



6. On the gantry control panel, click the **laser alignment light** button to switch on the laser: align the laser with the center of the anatomic site.

- A poorly positioned and centered patient can impact the mA values calculated for AutomA/SmartmA.
- Do not position the patient with the laser lights in their eyes.



7. On the gantry control panel, click the **external** icon or the **internal** icon. Confirm remains gray (unselectable) until the landmark button has been pressed.

- The landmark sets a known anatomical reference for the radiologist to correlate anatomy.
- The landmark sets the zero location. When scanning towards the patient's head, you are scanning superior to the zero location. When scanning towards the patient's feet, you are scanning inferior to the zero location. You should set the zero location to known anatomy. For example, when scanning a head, the landmark or zero location is typically the orbital meatal line.
- A landmark or zero reference point is required before you scan a patient. It can be set before or after you click **Exam RX**.
- When using the laser alignment light for patient positioning purposes, be aware that the patient's elevation may be slightly lower with the cradle extended than with the cradle fully retracted. The cradle might bend slightly because of the patient's weight. This difference should be taken into consideration for applications where patient position information is critical, such as Treatment Planning.



8. From **SCBSV**, set **patient-to-operator** and **operator-to-patient** volume. Press **Talk**

**control**

and test the volume levels. **AutoVoice** communication control volume is adjusted on the software interface.

9. Proceed to **Set up the patient's information**.

**SCAN WORKFLOW****Set up the patient's information**

Use this procedure each time you start a new patient exam by either sitting or standing in front of the CT operator console. It is best to setup the patient information before you get the patient on the table. This reduces the amount of time the patient has to be on the table, possibly in a difficult position. When entering patient information, the only field required for scanning is patient ID. This task introduces manual data input. The data can also be input by using [Patient Schedule](#) or a [bar code reader](#).



The "/" and control characters are not valid for entries in the PATIENT INFORMATION screen.



If mouse selections fail, press **Escape** to clear backlogged requests.



The system may not show typed information on the PATIENT INFORMATION or ViewEdit screen. The system updates after a short time.

- Emergency Patient**
1. Click **Exam Rx** icon or **Emergency Patient**
    - The Patient Information screen displays the new Exam Number.
    - The maximum Exam Number is 49,999, which is reset by your Field Engineer.

***Emergency Patient screen only:***

Emergency Patient screen automatically assigns the Patient ID and Patient Name. Both fields can be modified.

**Table 9-1 Patient Information fields**

Field name	parameters
Accession Number	Up to 16 characters
Patient ID*1	Up to 16 characters
Patient Name*1	Up to 32 characters
Age	Years, Months, Weeks, Days
Birthdate	Day, Month, Year
Gender	M (Male) or F (Female)
Weight	Kgs or Pounds
Height	Feet, Inches, or Centimeters
Exam Description	Up to 22 characters
Protocol Number	Up to 5 characters
Referring Physician*1	Up to 32 characters
Operator	Up to 3 characters
Radiologist	Up to 32 characters
Req. Proc. ID	Up to 16 characters
History	Up to 60 characters
Date*2	Exam Date, Month, Day, Year
Time*2	Exam Time Hour, Minute

\*1 : If the information is entered from a RIS system, these areas support up to 64 characters.

\*2 : These are available in Patient Schedule

2. From the Patient Information area, type data into the appropriate fields.
  - Press **Enter** to advance to the next text field. Alternatively, use the mouse to navigate to each field.
  - The mouse cursor must be within the Patient Information area for the input to be accepted.
  - Patient ID is a required field. If the patient does not have an identification number, type **?** or **the word trauma**.
  - Once an identification number has been assigned to the patient, the exam information may be edited using **Edit Patient** after End Exam.
  - Set Delete Completed Exams to zero when Patient Information is updated from the HIS/RIS. This assures that Completed Accession numbers are not inadvertently selected for scanning a second time causing Patient reconciliation issues on the PACS<sup>1</sup>.
  - DICOM<sup>2</sup> users must input the patient name according to the following method: surname, given name, middle name, use "<sup>^</sup>" to separate each field. For example: Doe<sup>^</sup>John<sup>^</sup>M.
  - Input patient date according to the following method: month: 12, date: 2, year: 1987. If the birth date is after 2000, then the "year" field can be entered with two digits. Birth dates can only be entered for the past 150 years. The format of the date is determined by your system settings: MM/DD/YYYY, YYYY/MM/DD, DD/MM/YYYY.
  - Patients in Japan may know their birth date only by Emperor reign year. Configure the birth date fields to yyyy/mm/dd date format and enter the reign year in the year field. For example, if the patient is born on the 26th year of the Showa reign (corresponding to the year 1951), then enter **S26**. The era codes are Heisei (H), Showa (S), Taisho (T), Meiji (M). The system stores the converted birth year in the birth date field on the Patient information and Patient Schedule screens and in the image header.
  - If desired, select an item from any of the Preset Selection screens (Referring Physician, Radiologist, Operator, Exam Description) and click **OK**. To modify any of the preset window items, see **Modify patient information presets**.
3. When all the desired patient information is entered, select a protocol from the Anatomical Selector area, using one of the following methods.
  - Type a protocol number in the Protocol Number field.
  - From the Protocol Selection screen, click an anatomical area. Click a protocol from the list to download the scan parameter values or click a reference protocol.
4. Proceed to **Acquire a Scout**.

- 
- 1. Picture Archiving Communication System
  - 2. Digital Imaging and Communications in Medicine
-

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## Modify the Patient Information presets

Use these procedures to modify the Preset fields on the Patient Information screen. The Presets are saved across software loads from the saved System State.

From the Patient Information screen, click any of the preset fields to open the Preset screen.

- Exam Description
- Referring Physician
- Operator
- Radiologist

### Change an item on the list

1. From the Preset fields screen, select the item you want to change.
2. Type the information in the text field.
3. Click **Change**.

### Add an item to the list

1. From the Preset fields screen, enter new information in the text field.
2. Click **Add**.
  - 100 is the maximum number of entries.
  - Items are listed with the newest entry at the top of the list.

### Delete an item from the list

1. From the Preset fields screen, select the item you want to delete.
  - The item is displayed in the text field.
2. Click **Delete**.

### Sort items in the list

1. From the Preset fields screen, click **Sort**.
  - The list is sorted alphabetically or numerically, e.g., 1, 10, 100 to 9, 90, A to Z, or a to z.

### Close the Preset screen

Click **OK** to accept your changes and close the screen.

## SCAN WORKFLOW

### Acquire a scout

Use this procedure to acquire a localizer from which you can prescribe the scan locations.

1. Confirm that the orientation of the patient matches the orientation of the patient in the Patient Position and Series Level Functions area of the Scan desktop.



- Click the arrow direction on top of the patient's body to change the direction of the head/leg.



- Click the arrow direction on top of the patient's body to rotate the body in 90 degrees increments.

2. From the ViewEdit screen, confirm the start/end locations, kV, mA, and Auto Voice (if applicable). To change a parameter value, click the box and type in the new value.

- Click an individual cell under a parameter column to adjust only the factor in that group.
- Click the parameter column from the top row to select all of the factors directly below the selected column and to adjust that factor in all of the images.
- Click +/- to increase or decrease the number of positioning images.
- Technique factors are set low (120 kV and a low mA are common), since these scans are normally only used for planning purposes.

3. Set the Scout Plane to designate the type of scout to acquire.

- 0 = 12 o'clock, 90 = 3 o'clock, 180 = 6 o'clock, or 270 = 9 o'clock
- Show Localizer is only available if the scout has been acquired at 0, 90, 180, or 270.

4. Click **Scout WW/WL** and type desired values in the field and click **OK**.

5. Clear the scan room of any unauthorized personnel.

6. Click the **Confirm** icon.

7. Press **Move to Scan**.

- The button illuminates on the SCBSV and flashes green, indicating you need to press the Move to Scan button.
- If you need to stop table movement, press **Stop Move**.

8. Press **Start Scan**.

- If you need to stop the scan, press **Stop Scan**.
- If you need to pause the current scan, press **Pause Scan**.
  - This finishes the current scan, and then pauses the next scan. A Resume button displays on the screen. Click **Resume** when you are ready to scan.
    - In Axial scans, the scan stops after the next scan.

9. Repeat steps 8 and 9 to acquire the second Scout scan.

10. Proceed to [Set the scan parameters](#) procedure to acquire the scan data.



If you change the Landmark after the scout has been taken, Graphic Rx does not allow this scout to be used for Graphic Rx. AutomA/SmartmA will be disabled. Acquire a new scout when the landmark is changed.



Bands and lines may be seen on scout images if there is a tube spit or the reference channel is blocked

during the acquisition.

## Adjust the Graphic Rx

Use this procedure to adjust the graphic prescription to set up a scan series. If your protocol is set up correctly, you may not have to make many changes. You will be able to adjust the graphic lines representing the series and confirm.



**Graphic Rx** may fail to start. No image will be shown for Show Localizer. Check to see if the Scout images are in the browser. If the images are in the browser, toggle **Show Localizer** on and off. Use the Restart Show Loc button in the browser menu bar on Image Works desktop

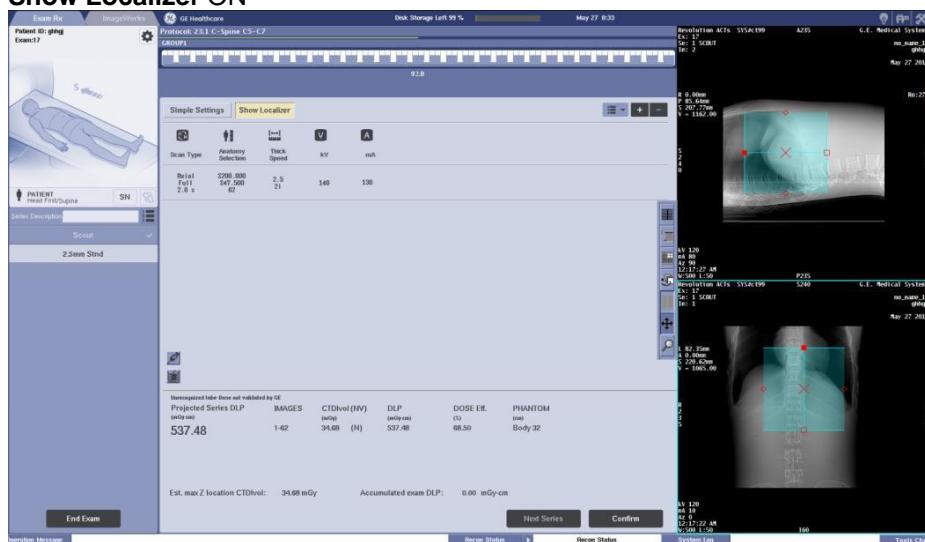


If the Scout image still does not display, use the crosshair cursor on the Scout to explicitly define the start/end locations and offsets. This only works if Continuous Report Cursor is on in the Exam Rx Display preferences.

### Show Localizer off



### Show Localizer ON





At any time while you are in Show Localizer, you can press **page** or **page down** to scroll through the valid scout images for the landmark within the series.

1. Press **Shift** and simultaneously click and drag the center red X to position the graphic lines over the anatomy you want to cover.
  - The slices are represented as a group of lines on the scout image. The start location is demonstrated with a solid square in the middle of a line. The end location is demonstrated by an open square box in the middle of a line.
  - The red X allows you to move the lines up and down on a lateral scout, as well as from side to side on a AP<sup>1</sup> scout.
  - By moving the lines, you are adjusting the start and end location, and the RAS<sup>2</sup> coordinates.
  - If you change the landmark after scout has been taken, Graphic Rx will not allow you to change A/P centers on lateral Scout. Since the landmark changed, a new Scout should be acquired so Graphic Rx can be used and a more accurate calculation of the mA requirements can be performed for AutomA or SmartmA, if enabled.
  - Clicking the red X moves the slices in the slice direction only.
2. Click and drag the solid box to the starting position.
3. Click and drag the empty box to the ending position.
  - Press **Shift** and simultaneously click and drag either the solid or empty box to adjust both the starting and ending locations at the same time.
4. Click and drag the diamond key to set the DFOV<sup>3</sup> equally around the center of the DFOV.
  - Alternatively, press **Shift** and simultaneously click and drag the diamond key to adjust the DFOV and the R/I or A/P center on the selected side.
5. Click and drag the circle to adjust the tilt, if needed.
  - To return the tilt parameter to 0°, press **Shift** and simultaneously click the circle only applies to helical scans.
6. From Localizer Tools of the Graphic Rx control panel, choose some options.

- 
1. Anterior/Posterior
  2. Right Anterterior Superior
  3. Display Field Of View

Figure 9-8 Localizer Tools

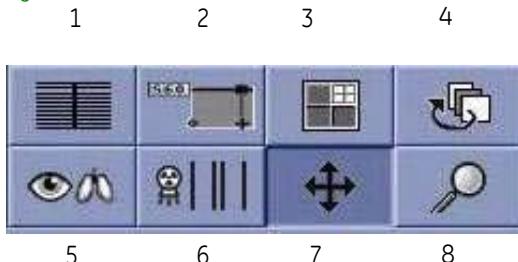


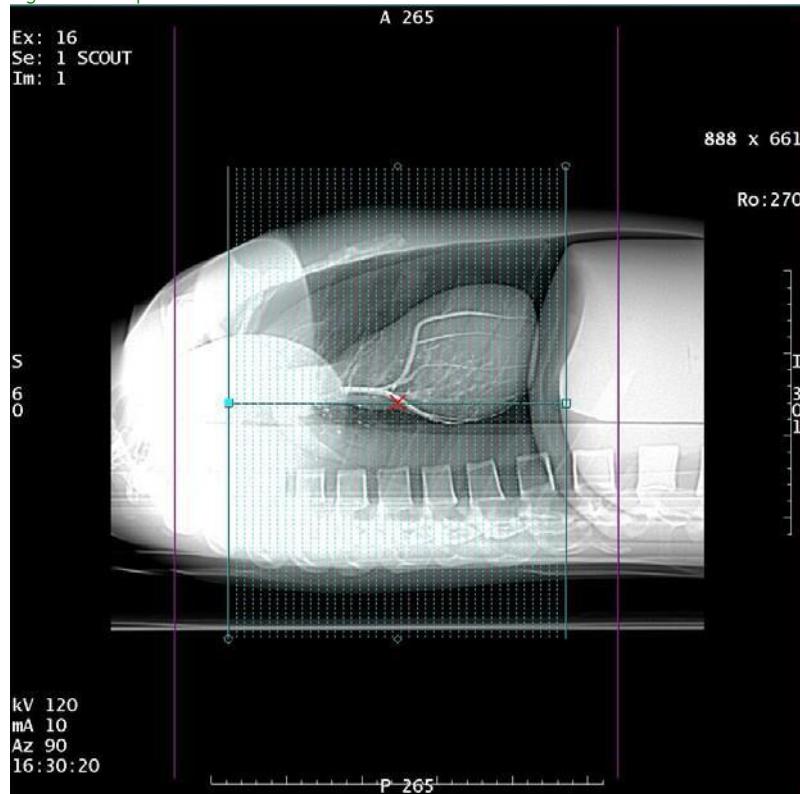
Table 9-2 Localizer Tools Function

Button	Function
1	Turn On to show a line for each image reconned. Turn Off to show a transparent area of coverage with no slice lines.
2	Turn On <b>Show Dimension</b> to show Start/End location, DFOV and Gantry Tilt. These parameters are editable.
3	Change Layout – Turn On <b>Change Layout</b> to switch to 2 screen mode.
4	Display Normal – Turn On <b>Display Normal</b> to return Roam/Zoom condition to the normal.
5	Adjust ODM – Turn On <b>Adjust ODM</b> to activate ODM regions.
6	Hide/Show Irradiation Lines – Click to <b>hide or show</b> the irradiation lines. For helical groups, the full range for X-Ray ON will be shown in Graphic Rx. The X-ray irradiation lines will be displayed in a magenta color for each helical group prescribed for the series. The X-ray irradiation lines will be hidden when Start or End locations are being modified. For prescriptions with multiple helical groups, the X-ray irradiation lines can be hidden. The button is insensitive when there is a single helical group.
7	Roam – Place the cursor on the image and click and drag it to a new location.
8	Zoom – Click and drag to magnify or minify images.

7. From the Graphic Rx control panel, review the irradiated area.

- The length of the irradiation lines are representative of the SFOV.
- For helical acquisitions, the full X-ray irradiated area is shown for all groups using a pair of magenta lines that are the length of the SFOV.
  - For multiple helical groups, Graphic Rx supports Hide/Show Irradiation Lines. After you close Graphic Rx and re-enter, the irradiation lines default on.
  - For single helical groups, irradiation lines cannot be hidden.
- Irradiation lines are hidden when adjust the Graphic Rx scan range.

Figure 9-9 Graphic Rx Irradiation Lines



8. Review the Graphic Rx values on the ViewEdit screen to make sure they are correct.
9. Proceed to [Set the Scan parameters](#).

## SCAN WORKFLOW

### Enter contrast descriptions

Use this procedure to enter contrast descriptions for the scan if you are using IV<sup>1</sup> or GI<sup>2</sup> contrast.



When IV contrast is to be used, make sure the injector or syringes of contrast are set up before performing the localizer (scout) scan. The **IV Contrast** icon must be selected.

#### Input instruction



1. From the ViewEdit screen, click the **IV contrast**  or the **GI contrast**  icon.
2. In the IV or GI text fields, type a description of the contrast.
3. Select a contrast option, if needed.
  - Click **Change** to edit the currently selected description.
  - Click **Add** to add new descriptions.
  - Click **Delete** to remove a description.
  - Click **Sort** to order the items on the list 1, 10, 100 to 9, 90, A to Z, or a to z.
4. Click **OK**.



When contrast is selected, a "+C" annotation displays on the images next to the image number, indicating that IV contrast was used for that exam.

1. Intravenous
2. Gastro-Intestinal

## Start the scan

Use this procedure to start a scan.

1. Review the following items for every acquisition before confirming to scan:

- the start/end locations for each recon
- direction of scan
- the mA table for Auto or SmartmA



If the Patient Orientation changes from a previous series, an Attention message posts to inform you that AutomA will be disabled and the mA button displays red. You can enable AutomA again once the patient orientation matches with that of the last Scout series.

2. To start a scan, click the **Confirm** icon
3. Press **Move to scan**.
4. Deliver breathing and table move instructions, as needed.
5. Press **Start Scan**.

## Precautions

- Press **Stop Scan** to stop scans between multiple helical groups and do not press **Stop Move**.
- Scan aborts may occur during Axial or Helical scanning. Always be aware of the scan progress during an Exam and select **Resume** to continue.
- Scan may fail to confirm posting a message that not enough image space exists, even though the image space shown in the Feature Status Area indicates there is enough space. This is due to the fact that images are stored on the system disk in more than one partition. Remove consecutive exams to free up image space for confirm to proceed.



If you encounter the message that you need to delete images to be able to scan the current series, first remove images to create space for scanning, next if Scouts have not been taken, end the exam and start a new exam. However, if scouts have been acquired, use Select New Protocol and prescribe the series again.

## SCAN WORKFLOW

### Repeat a series

Use this procedure to repeat a series that has already been scanned.

1. On the Scan desktop, click **Repeat Series**.
  - When more than one series has been scanned, a list of all scanned series displays.
  - If only one series has been scanned, the series list does not display.
2. On the Series List screen, select which series you want to repeat.
3. Click **OK**.
  - SmartPrep is turned off.
  - The Prep Delay for group 1 is set to zero.

## Stop a scan

### Abort a scan in progress

Use this procedure to abort the X-ray and stop the gantry and table movement.



1. From the **SCBSV**, press **Stop Scan**.
2. Click **Resume** from the Scan Progress screen to resume the scan.

### Pause a scan in progress

Use this procedure to pause the current scan. This finishes the current scan, and then pauses the next scan.

1. From the Scan Progress screen, click **Pause** scanning.
2. Click **Resume** from the Scan Progress screen to resume the scan.

### Emergency stop scan, electronics, and x-radiation

Use this procedure in the event of a patient related emergency or if the cradle, table, or gantry starts to move unexpectedly.



1. From the SCIM or gantry, press **Emergency stop**.
  - All table and gantry motions, and X-ray exposure are stopped.
2. On the gantry, press **E-Reset** to clear the Emergency Stop.



For a helical scan, you need to evaluate each situation. Pause will not stop a helical scan in progress. The scan will complete and the system will stop and not scan any additional groups. Stop Scan will stop a helical scan in progress at the point Stop Scan is pressed. Resume will resume the helical scan from the point it was stopped.

## SCAN WORKFLOW

### End the exam

1. When an exam is completed, click **End Exam**.
  - End Exam sends any prescribed R2 to R10 for the last series to be reconstructed.
  - End Exam starts AutoStore for the exam.
  - End Exam starts AutoTransfer by Exam.
2. If you have the PPS<sup>1</sup> ConnectPro option, click one of the following options.
  - Click **Complete** if the exam is complete.
  - Click **Discontinue** if the exam has been discontinued (the exam cannot use PPS again).
  - Click **Defer** to complete the exam at a later date. To complete the exam, select the exam from the Image Works browser patient list, and select **Tools > MPPS > Complete** or **Discontinue**.



Due to screen stacking issues, if PPS is enabled, the dialog box to complete the PPS state may be hidden. A system reboot will be required to recover.

1. Performed Procedure Step

## Scan Parameters

See the [Scan parameters workflow](#) for procedures on how to set the following scan parameters.

### Scan Type

The Scan Type is set on the [Scan Type](#) screen.

#### Axial

Axial scanning is the traditional "step and shoot" method of acquiring data. The X-ray tube and DAS<sup>1</sup> expose and rotate one 360° loop. The table and patient move a preset distance (interval) and the process is repeated.

#### Cine

Cine is a method of scanning that uses full or partial rotations of the gantry while gathering input from one location over time. You may set the acquisition in groups expanding the time to be scanned. This is especially beneficial when determining the function of anatomy and physiology (i.e., hemangioma).

#### Helical

Helical or spiral scanning is a method of acquiring images in a continuous data set. The X-ray tube and DAS expose and rotate continuously through 360° while the patient is passed through the area of exposure at a set rate of movement (pitch). The information gathered is then reconstructed into images of the prescribed slice thickness and interval.

#### Rotation Times

The variability of the rotation times gives you the ability to adjust the parameters for patient size and different applications.

- Axial – 0.98s, 1.0s, 1.2s, 1.5s, 2.0s, 3.0s, 4.0s
- Cine – 1.0 s.
- Helical– 0.98s, 1.0s, 1.2s, 1.5s, 2.0s

#### Rotation Length

There are two rotation lengths on the system.

- Full rotation is used most often.
- Segment rotation is good for applications require high speed.

#### CT Perfusion



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

Please refer to your Technical Reference Manual, QA chapter, Dosimetry section for information on dose measurements and calculations.

#### Purpose of CT Perfusion

Computed tomography (CT) perfusion is a technique used to assess tissue level perfusion and delivery of blood to the organ and/or tissues of the organ. The linear relationship between CT numbers or Hounsfield units (HU) and the amount of iodinated contrast material in an image pixel, together with the spatial and temporal resolution characteristics of the scanning paradigm, make CT perfusion a valuable tool for evaluating blood supply to neoplastic and non-neoplastic tissue (including normal and ischemic tissue). In particular, the evaluation of cerebral ischemia or the angiogenesis state of a tumor is readily performed with

1. Data Acquisition System

CT perfusion imaging. CT perfusion should be performed only for a valid medical reason and with the minimum radiation dose necessary to achieve an optimal study.

Scan techniques for CT Perfusion should be different (lower) than those used for routine diagnostic scanning of the same anatomical area. This is because only the visualization of intensity change over time in blood vessels and brain tissue is needed for the perfusion post processing software to calculate and display the perfusion parameter maps; high resolution images of the anatomy is not needed. 80kV should always be used in for head perfusion and 120 kV for body perfusion. In almost all cases the manufacturer's reference perfusion protocol should be followed as these will reflect the kV, lower mA, and appropriate scan times for a perfusion acquisition.

### ***Components of a CT Perfusion Study***

A study for assessment of tissue perfusion for brain stroke includes a diagnostic quality non-contrast brain series, optional CT Angiogram of Circle of Willis that may include the Carotids, and a CT Perfusion series and may include a post contrast series of the brain for assessment of residual lesion enhancement.

In the assessment of tumors, a non-contrast series for localization of the area of interest is often done followed by CT Perfusion series.

In all cases the CT perfusion series should have technique factors that are lower than those used for the diagnostic portions of the study. By its nature the perfusion series must be performed over a longer period of time (typically 45-50 seconds for stroke and up to 3min for tumor) covering the same anatomy in order to gather the time dependent perfusion information as dictated by the physiologic process of blood flow through the brain. Scan times are also impacted by the contrast agent's concentration, volume, and rate of delivery.

The necessity for repeated scanning of the same location for extended times results in higher skin doses than those associated for routine diagnostic scanning. Factors that will influence this dose are kV, mA, scan time, perfusion acquisition type and if there is any table movement during the perfusion acquisitions. In all cases however, 80 kV should be used for heads and 120 kV used for bodies at an equivalent mAs (mA times gantry rotation speed) to that of the cine acquisition.

In all cases scanning through the orbits should be avoided if at all possible by use of patient positioning and/or tilting the gantry. The lenses of the eyes are more radiosensitive than the skin.

### **Perfusion Acquisition types:**

Not all perfusion acquisitions are done in a continuous or "cine" mode where the table does not move. Other techniques and reference protocols will/may include an "axial" mode where the table still does not move but the x-ray is alternately turned on and off during the total scan time. This method can be used to reduce the dose by half if the temporal sampling rate remains adequate for the post processing software.

### **KV effects on dose:**

The effect on dose from kV is non-linear. Going from 80 kV to 120 kV will result in approximately a 3x increase in dose. Consult the Technical reference manual for more details.

### **mA effects on dose:**

mA and mAs have a linear effect on dose. Doubling the mA or mAs will double the dose.



The effects of kV and mA or mAs on dose are multiplicative. A 3x increase in dose from increasing kV along with a doubling of mA will result in a 6x increase in dose.

### ***Required Image Attributes for Perfusion Imaging***

The purpose of a CT Perfusion series is to assess tissue level perfusion and delivery of blood to the organ and/or tissues of the organ, the acquisition parameters are different from those needed for clinical diagnostic studies. The intrinsic noise level in CT Perfusion acquisitions is higher than those routinely used of diagnostic imaging. If a single location or limited coverage area is prescribed in the head, the use of automated exposure control (AutoMA/SmartMA) is not useful because the shape/size of the anatomical area does not vary.

Protocols need to be adjusted accordingly to patient age, injection rate, injection volume, and exam type (stroke versus tumor evaluation and head versus body).

The kV for neurology applications should use 80kV and for body applications use 120kV. The use of 80kV in the brain improves sensitivity to detect changes in tissue density as the contrast bolus transits through the brain. A kV of 120 is used in the body to provide adequate penetration due to difference in body habitus between the head and body.

CT Perfusion series need acquire data that covers the physiology process of the transit of the contrast bolus through the vascular system. The acquisition duration for a stroke study must cover prior to the arrival of the contrast bolus and through the return of the venous signal to baseline. The duration is directly dependent on the volume of contrast injected, the rate of injection and cardiac output for the patient. If contrast volumes or injection rate change exam to exam, the duration will need to be adjusted accordingly.

The user should consult the perfusion post processing software manuals for more detailed imaging and CT perfusion information. Because CT perfusion requires specialized post processing software a CT perfusion acquisition should not be performed unless this software is available. All users should be trained in both CT perfusion acquisitions and post processing and follow the ACR perfusion practice guidelines. Before any changes are made to the manufacturer's reference protocols, both a radiologist and health physicist familiar with CT perfusion must be consulted and any changes to the protocols evaluated with respect to dose of the original manufacturer's reference perfusion protocols.

*As a general reference:*

- As strength of contrast decreases, volume needs to increase to deliver a similar amount of contrast enhancement.
- For Volume Shuttle and Volume Helical Shuttle the injection rate should not exceed 4cc/sec due to long temporal sampling periods.

The temporal sampling rate varies based on the Scan Type selected for the acquisition that additionally impacts the total dose for the acquisition. The following Scan Types can be used for acquisition of perfusion data:

Table 9-3

scan type	Coverage	Temporal Sampling Rate	Advantages/Disadvantages
axial	10 mm	2 Sec	Lower dose due to intermittent scanning Limited coverage
cine	10 mm	0.7 Sec	Highest temporal sampling Higher dose due to continuous scanning

The acquisition duration for tumor whether in the head or body needs to cover prior to arrival of the contrast bolus and for a period of approximately 3 to 3.5 minutes to adequately support the collection data for the computation of permeability maps. The initial phase must include the first pass of contrast and should provide temporal sampling as acquired with stroke protocols. The second phase can be more sparsely sampled with temporal intervals from 5 to up to 20 seconds.

## Other considerations and references

Due to the necessity to obtain data over time in order evaluate and calculate perfusion parameters, repeated scanning of the same location is unavoidable. This makes a CT perfusion acquisition have peak skin doses higher than routine diagnostic CT imaging. Deterministic effects (skin reddening, hair loss) are a threshold phenomena that can appear with skin entrance doses  $>2\text{Gy}$ . For any CT scanning the CTDI<sub>vol</sub> value displayed on the operator console should always be confirmed prior to the scan. For CT perfusion without table motion the CTDI<sub>vol</sub> will over predict the peak skin dose. The technical reference manual has an informative section that describes methods for a skin dose metric based on CTDI<sub>100 peripheral</sub> or the peak of the dose profile. In any case, a normal CT perfusion study should not result in a CTDI<sub>vol</sub> of 1000 mGy to any part of the anatomy. Care should be taken and consideration/evaluation be performed prior to rescanning a patient within a short time period with a perfusion acquisition of the same anatomy due to concerns with the possibility of reaching a peak skin dose level greater than the deterministic threshold.

Sites should have a QA program implemented for oversight and review of any protocol changes. As with other scan types, the dose for a CT perfusion acquisition is record in both the DICOM screen capture and the DICOM CT structured dose report and should be used for QA follow up for all scanning.

Additional information on CT perfusion may be obtained in the user manuals for the CT perfusion post processing software, from the ACR practice guide for CT perfusion, and from the AAPM website that contains reference perfusion protocols as well as other perfusion related information.

All the reference protocols provided within the software of this system, including those for CT perfusion are included in the Applications Protocol document supplied with the system. These protocols provide a concise description of each scanning series with the protocol along with the technique factors and dose information for each.

## Total Exposure Time

The Total Exposure Time is automatically set by the system and is determined by the number of images and type of scan. This setting can only be changed by resetting one of the other factors. The Total Exposure Time is useful for determining breath-hold times and contrast injection timing.

- For helical scans, the displayed Total Exposure Time is exactly what is shown. The Total Exposure Time lists the X-ray on time only and does not reflect any ISD applied.
- For axial scans, when calculating breath hold times, the ISD for each scan must be added to the Exposure Time displayed to reflect the total amount of time the patient would need to hold his/her breath.

## Reference Noise Index and Noise Index Values

The Noise Index (NI) is a parameter that corresponds to the relative noise in the image. A higher Noise Index means the images will contain more noise and will be obtained with lower mA (kV is not altered) and therefore lower dose. A lower Noise Index means the images will contain less noise and will be obtained with higher mA (kV is not altered) and therefore higher dose.

The Noise Index is the operator input parameter for AutomA that controls the x-ray output (mA) within the bounds established by the operator settings for minimum and maximum mA. However, the Reference Noise index does not affect the x-ray output. The Reference Noise Index is only a noise value referenced to a particular slice thickness as described below.

There are three different tables of Reference Noise Index values. Reference noise index table 2 for system's factory configuration. If necessary, GE service representatives can modify it. Table 2 is configured to deliver average noise in the images at an average mA value.

Table 1 is configured to deliver lower noise in the images at a higher mA value. Table 3 is configured to deliver higher noise in the images at a lower mA value. The Reference Noise Index tables are included in the appendices of the Technical Reference Manual.

However, the Reference Noise Index is unchangeable (grayed-out) when the protocol is used for scanning. When Create New Series is used in Building Protocols, the Reference Noise Index is always based on a slice thickness of 0.625 mm for the protocol category (anatomical area) the protocol is being built in.

Any value between 0.5 and 70 can be entered for the Reference Noise Index or Noise Index when building a protocol. However, once that protocol is saved and is selected for a scan, the Reference Noise Index cannot be changed unless you go back into Protocol Management.

For the GE reference protocols that use AutomA, the Reference Noise Index is based on the slice thickness defined in the protocol, which is not always 0.625 mm slice thickness. For a GE reference protocol with AutomA/SmartmA enabled, the Reference Noise Index and Noise Index are identical. If the slice thickness defined in the protocol is 5 mm and is changed to 0.625 mm, the Noise Index will adjust according to the formula shown in "Noise Index Formula" on page 9-40.

If AutomA is enabled for a manual mA GE reference protocol, the Reference Noise Index will be populated from the Reference Noise Index Table based on 0.625 mm slice thickness, which may not necessarily be the same as the slice thickness defined in the protocol, and the protocol category (anatomical area). For example, when AutomA is chosen for a head protocol, the Reference Noise Index field will be populated with 7 based on the Reference Noise Index Table 2 for 0.625 mm slice thickness in the head category. If the slice thickness is changed in Create New Series from the original value of 0.625 mm to a slice thickness of 5 mm, the Noise Index will change to 2.47 based on the Reference Noise Index Table 2 but Reference Noise Index will remain at 7. For a head protocol, NI=7 for 0.625 mm slice thickness gives approximately the same dose as NI=2.47 for 5mm slice thickness. The Noise Index should always be reviewed and adjusted as needed by the user to match the clinical image quality needed for the specific examination.

For procedures where lower mA and higher noise may be appropriate you should ensure that the Noise Index value is adjusted from the Reference Noise Index values from the tables described above. For example, if a GE reference protocol or a user-defined protocol is selected and altered by enabling Auto mA (not recommended by GE for brain perfusion), the Reference Noise Index cannot be changed. However, the Noise Index (NI) used in the automatic exposure control calculation to define the mA output should be changed based on the individual exam type and clinical need. Examples of the mA control pop-up provided in Figures below demonstrate what happens when the slice thickness is changed:

- Reference Noise Index - remains the same
- Noise Index - changes (based on the formula shown in "Noise Index Formula" on page 9-40.)

Figure 9-10 Slice thickness= 0.625 mm, Reference Noise Index=21, NI (Noise Index)=21

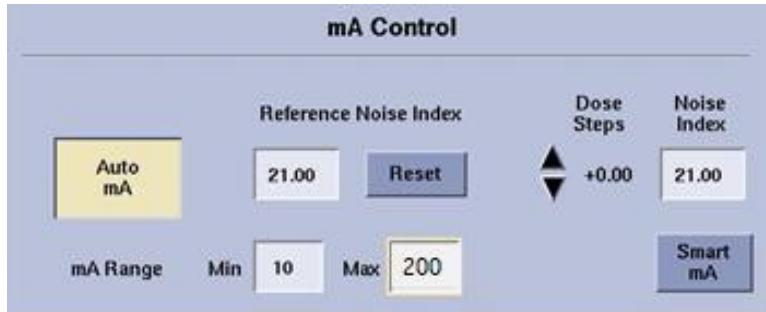
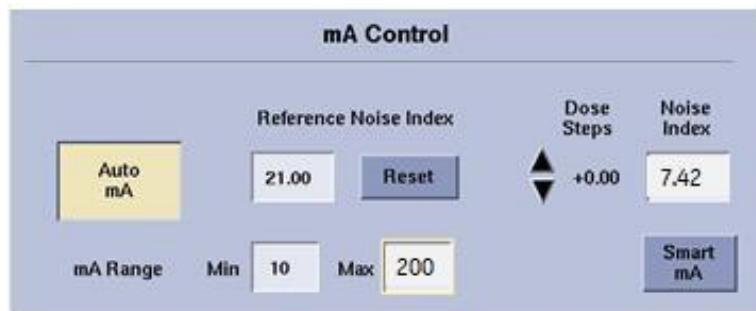


Figure 9-11 Slice thickness= 5.00 mm, Reference Noise Index=21, NI (Noise Index)=7.42



The Reference Noise Index does not affect the machine's mA output (dose). The Reference Noise Index does not change when slice thickness is changed, but it can be reset to show the preset table value for the prescribed slice thickness by using the Reset button in the Auto mA popup. However, unlike the Reference Noise Index, the Noise Index is updated when the slice thickness is changed and does affect the machine's mA output (dose). The Noise Index should always be reviewed and modified if needed to meet the clinical need. The difference between the Reference Noise Index and the Noise Index is displayed as a value next to the Dose Step arrows. The Dose Steps can be used to adjust the Noise Index value in 5% steps and better understand the difference between the Reference Noise Index and the Noise Index values and its affect on image quality and dose. Only the Min mA, Max mA, Noise Index, kV and patient size affect machine mA output (dose) when using AutomA/SmartmA. User preference for image quality should be considered.

Examples:

- Select Create New Series and the head category
  - Slice thickness= 0.625 mm, Reference Noise Index=7, NI (Noise Index)=7
- Change the slice thickness to 5 mm
  - Slice thickness= 5.00 mm, Reference Noise Index=7, NI (Noise Index)=2.47
- Click on the Dose Step downward arrow, in this example twice, to decrease the dose, thus increasing the NI value
  - Slice thickness= 5.00 mm, Reference Noise Index=7, NI (Noise Index)=3.17



Dose Steps may be incremented up or down as needed by the user.

The higher the Noise Index value, the lower the overall mA that is required. These images are noisier with lower mA values. The lower the Noise Index value, the higher the overall mA that is required. These images have less noise.

## AutomA

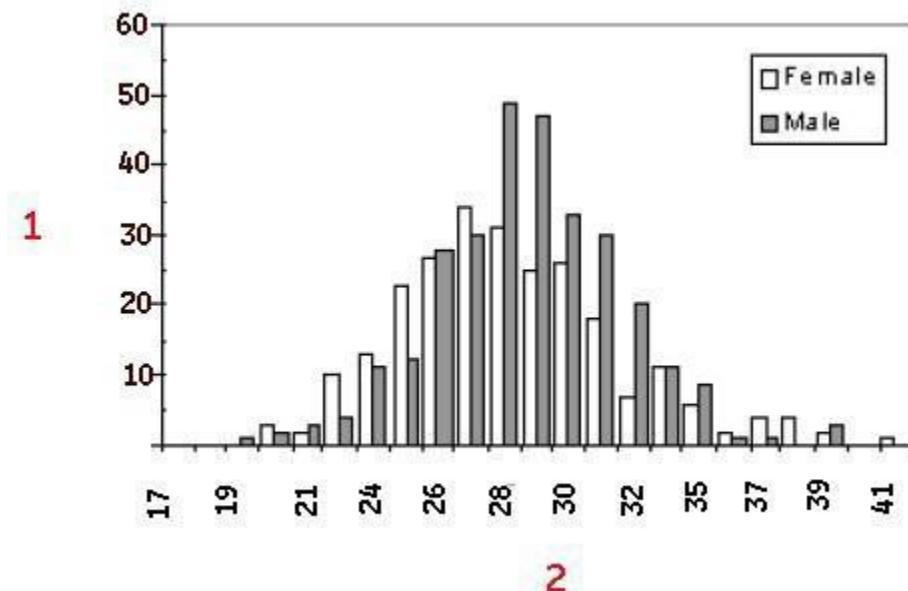
### *AutomA background*

A significant factor in the quality of a CT image is the amount of X-ray quantum noise contained in the scan data used to reconstruct the image. Most technologists know how the choices of x-ray scan technique factors affect image noise. Noise decreases approximately inversely with kVp and noise decreases with the inverse square root of the mAs and slice thickness. For example, increasing the mA from 50 to 200 (a factor of 4) will decrease quantum noise by a factor of 2 (the square root of 4). Quantum noise also increases with increasing helical pitch; however, the exact relationship is dependent on the details of the helical reconstruction process.

The most significant factor that influences the quantum noise in the scan data is the x-ray attenuation of the patient section being scanned. The x-ray attenuation is related to the size and tissue composition of the patient section. The figure below shows a distribution of PAA<sup>1</sup> values for adult abdominal images that ranges from 19 to about 41 with a mean of 27.6 (for this patient sample set). The PAA (also called the PAI<sup>2</sup>) is computed for the patient section as the square root of the product of the sum of raw pixel attenuation values times the pixel area.

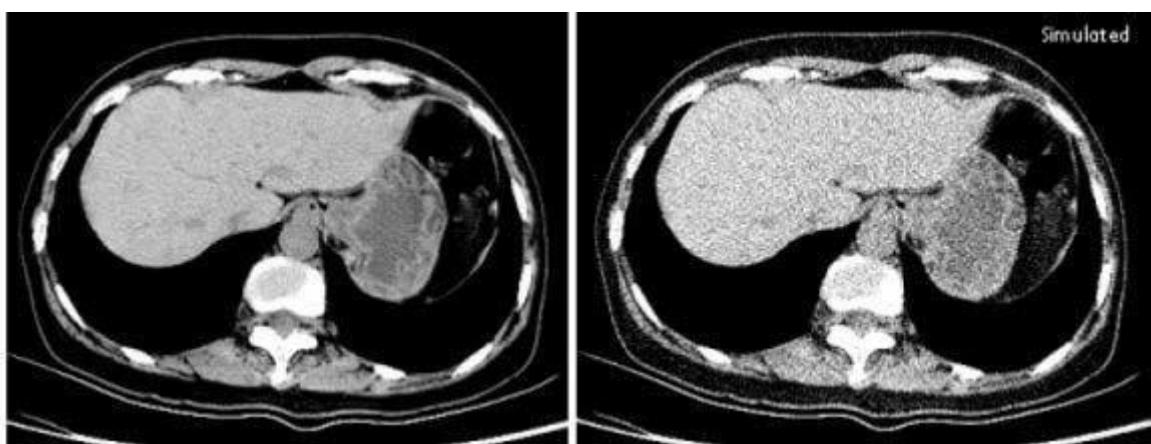
1. Patient Attenuation Area
2. Patient Attenuation Indicator

Figure 9-12 Adult abdominal patient distribution in terms of average patient attenuation: 1 = number of patients, 2 = average PAI



1. T Toth, Z Ge, and M Daley, "The influence of bowtie filter selection, patient size and patient centering on CT dose and image quality", Poster SU-FF-I42, 2006 AAPM Conference (MedPhy, Vol 33, No.6, June 2006)

Figure 9-13 Example small patient (PAI = 20, 120 kVp, 1.25 mm, 0.5 second axial) with factor of 5 noise increase (simulated): left = SD 640 mA, right = SD 40 @ 25 mA



When using a fixed scanning technology, the quantum noise, from minimum to maximum patient attenuation varies based on a 5x multiplier (PAI range 17-41). The figure above shows an example of a five times noise increase simulated for a small patient (20 PAI). With a fixed mA scan protocol, the technologist must select the mA using a qualitative estimate of the patient attenuation. This may be accomplished using patients weight, diameter measurements, body mass index, or just as a qualitative visual classification. Because these methods provide very rough x-ray attenuation estimates and do not account for attenuation changes within the patient region being scanned, the technologist must use a high enough technique margin to avoid the possibility of compromising the diagnostic quality of the images with too much noise. Since dose is inversely related to the square of the noise, many patients are likely to be receiving more dose than necessary for the required diagnostic quality using such manual methods.

Automatic tube current modulation: AutomA is an automatic tube current modulation function. This function can perform the necessary mA adjustment, its accuracy far exceeds the manually estimated value for the patient. Therefore, even when the patient has a very wide body shape, it can still obtain a rather consistent

desired image noise. Since image noise variability is substantially reduced, a significant overall patient dose reduction is possible with proper scan parameter selection.

AutomA (Z-axis modulation) adjusts the tube current to maintain a user selected quantum noise level in the image data. It regulates the noise in the final image to a level desired by you. AutomA is the CT equivalent of the auto exposure control systems employed for many years in conventional X-ray systems. The goal of AutomA is to make all images contain similar x-ray quantum noise independent of patient size and anatomy.

The AutomA tube current modulation is determined from the attenuation and shape of scout scan projections of the patient just prior to CT exam sequence.

SmartmA (angular or xy modulation) has a different objective than Z-modulation. It adjusts the tube current to minimize X-rays over angles that have less importance in reducing the overall image noise content. In anatomy that is highly asymmetric, such as the shoulders, X-rays are significantly less attenuated in AP<sup>1</sup> direction than in the lateral direction. Thus, the overwhelming abundance of AP x-rays can be substantially reduced without a significant effect on overall image noise.

Angular modulation was first introduced on GE single slice scanners in 1994.<sup>2,3</sup>

2. L. Kopka and M. Funke, "Adaptive CT tube current: Dose reduction and image quality of models and patient examinations," *Radiology* 197 (P), 292 (1995).

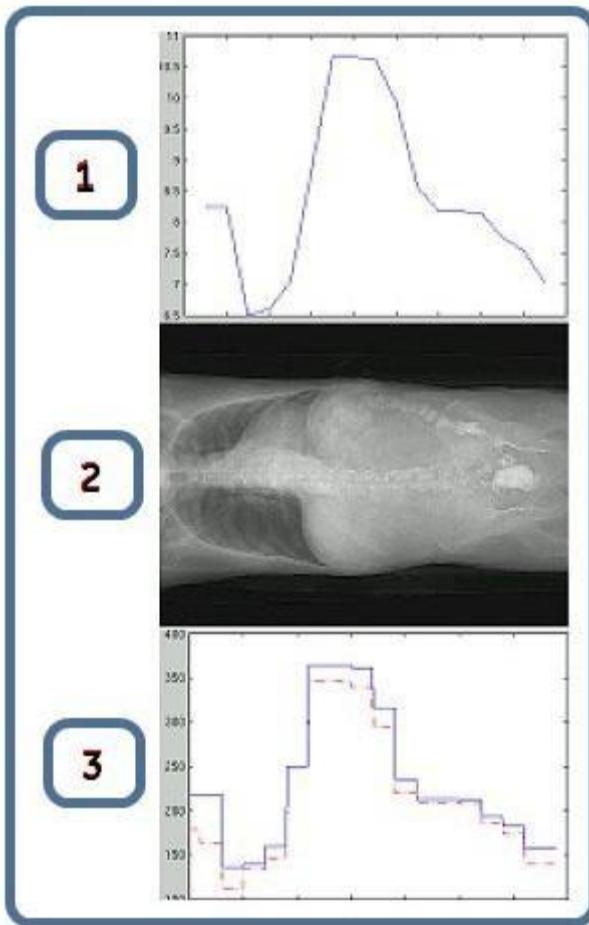
3. D. R. Jacobson, W. D. Foley, S. Metz and A. L. Petersen, "Variable mA CT: Effect on noise and low contrast detectability," *Radiology* 210(P), 326 (1996).

### **AutomA Theory**

AutomA is an automatic exposure control system that employs Z axis tube current modulation and is available on all GE Multislice CT scanners. A noise index parameter allows you to select the amount of X-ray noise that will be present in the reconstructed images. Using a single patient scout exposure, the CT system computes the required mA to be used based on the selected noise index setting. The noise index value will approximately equal the standard deviation in the central region of the image when a uniform phantom (with the patient's attenuation characteristics) is scanned and reconstructed using the standard reconstruction algorithm.

1. Anterior/Posterior

Figure 9-14 Example of noise variation when using the preset mA and mA variation when using the AutomA with "noise index" setting:  
 1 = 6.5 HU to 10.5 HU noise variation, z-axis 500 mA, 2 = medium to small body type, PAI = 26.7, 120 kv, 5mm, 0.5 s, 3 = z-axis AutomAZ  
 12.5 noise index, AutomA, SmartmA



The system determines the tube current using the patient's scout projection data and a set of empirically determined noise prediction coefficients for a reference technique. The reference technique is the selected kVp, and an arbitrary 2.5 mm slice at 100 mAs for an axial reconstruction using the standard reconstruction algorithm. The scout projections contain density, size, and shape information about the patient. The total projection attenuation (projection area) contains the patient density and size information and the amplitude and width of the projection contains the patient shape information. These patient characteristics determine how much x-ray will reach the detector for a specified technique and hence predict the image standard deviation due to x-ray noise for the standard reconstruction algorithm.

To predict the image noise at a given z position for the reference technique, the projection area and oval ratio are obtained from the patient's scout. The oval ratio is an estimate of the patient asymmetry that is determined from the amplitude and width of the projection data. Then it is possible to set the expected x-ray noise of the reference technology (reference noise) as a function of the positioning image's projection area and ellipticity, to be calculated using polynomial coefficients. The determination of the polynomial coefficients is achieved by finding the minimum square of the suitable noise measurements in a set of models representing the clinical range of the patient's head and body type.

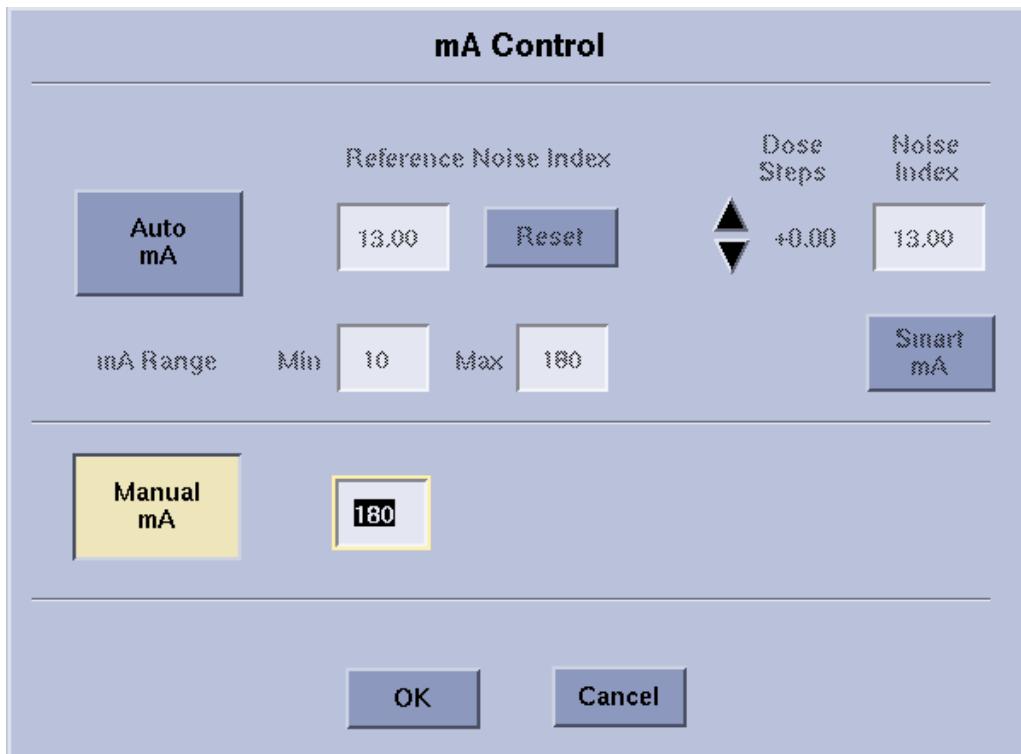
After understanding reference noise and the difference between the reference technology and the selected specified technology, mA need to obtain the specified noise index. This index is calculated using the famous x-ray physics equation. That is, the noise is inversely related to the square root of the number of photons and the number of photons is proportional to the slice thickness, slice acquisition time, and mA. In the GE AutomA design, an adjustment factor for helical pitches is also incorporated in the calculation to account for noise

differences that scale between helical selections and the axial reference technique.

## mA Control

On the [ViewEdit screen](#), click **mA** to display the mA Control screen.

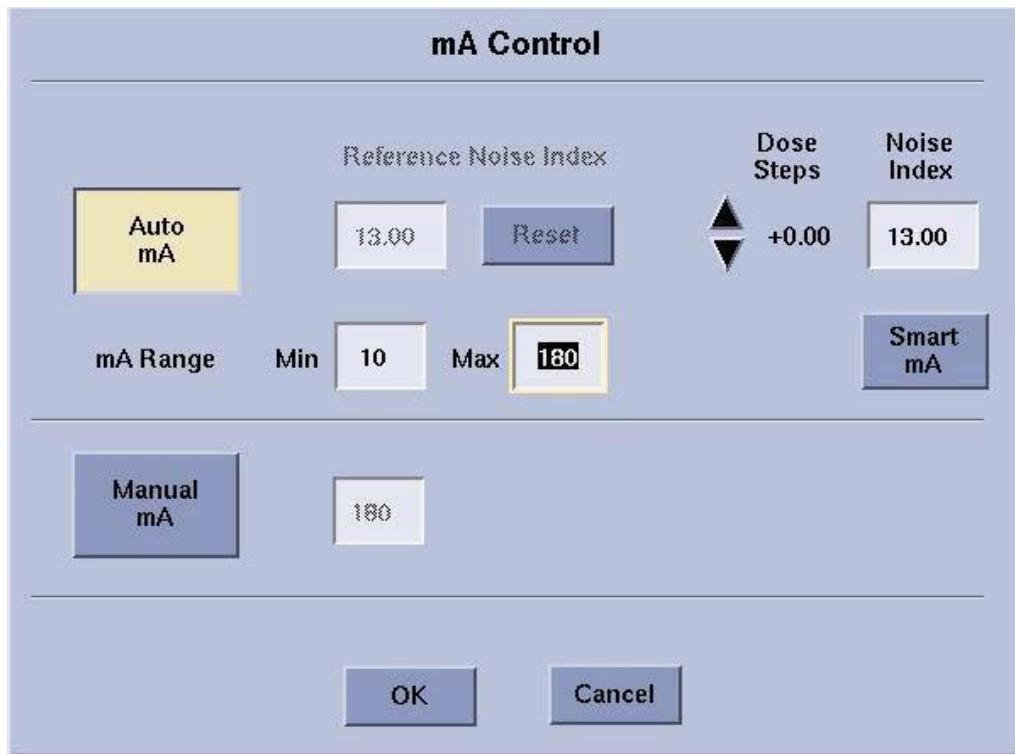
Figure 9-15 mA Control screen for Manual mA



### Manual mA

Allows you to scan without enabling the AutomA mode. You can enter a mA value for each group prescribed. When building protocols, make sure the Manual mA value field has a reasonable mA entered in it even if the protocol will use AutomA in case AutomA is turned off.

Figure 9-16 mA Control screen for AutomA and SmartmA



### AutomA and SmartmA

When AutomA is selected, the mA annotation on the ViewEdit screen is annotated with the maximum mA in the mA range prescribed for the scan group. The system uses the data collected from the most recent Scout scanned for the exam.

When possible, the kVp setting for the scout should be taken using the same kVp that the axial or helical scan is taken.

You can view the list of mA values that will be used for each rotation for the acquisition if you select the [mA Table](#). This is a read-only table showing the mA for each rotation or scan separated by groups. The calculation of the mA Table is based on the last scout, so the Patient Orientation for the series must match the scout. If there is no scout or the orientations do not match, AutomA will be unavailable.



Even if you are using AutomA, the Manual mA field should be filled in with a reasonable value in case AutomA should be turned off.

### mA Range

Allows you to enter values to specify a Min and Max mA range. The Max mA value sets the clipping (maximum allowed) mA value. This mA value can also determine the focal spot size. The Max mA value can be used to limit system to a small focal spot. You need to enter the correct mA value for focal spot you wish to use based on See "mA range by kVp" on page 9-34.

Table 9-4 mA range by kVp

kV	Large Focal Spot
	24 kW System
80	10 to 200
100	10 to 200
120	10 to 200

140	10 to 160	
-----	-----------	--

## Reference Noise Index

Default or baseline Noise Index for the given protocol. Any changes to Dose Steps, Slice Thickness, or Noise index are referenced to this value. This value can only be prescribed or changed while in protocol management.

## Noise Index

The noise level required for the study. As the Noise Index increases the required mA decreases and image noise increases. The Noise Index value displayed automatically updates as you change the dose steps. The dose step change is relative to the Reference Noise Index. You can prescribe your own Noise Index value.

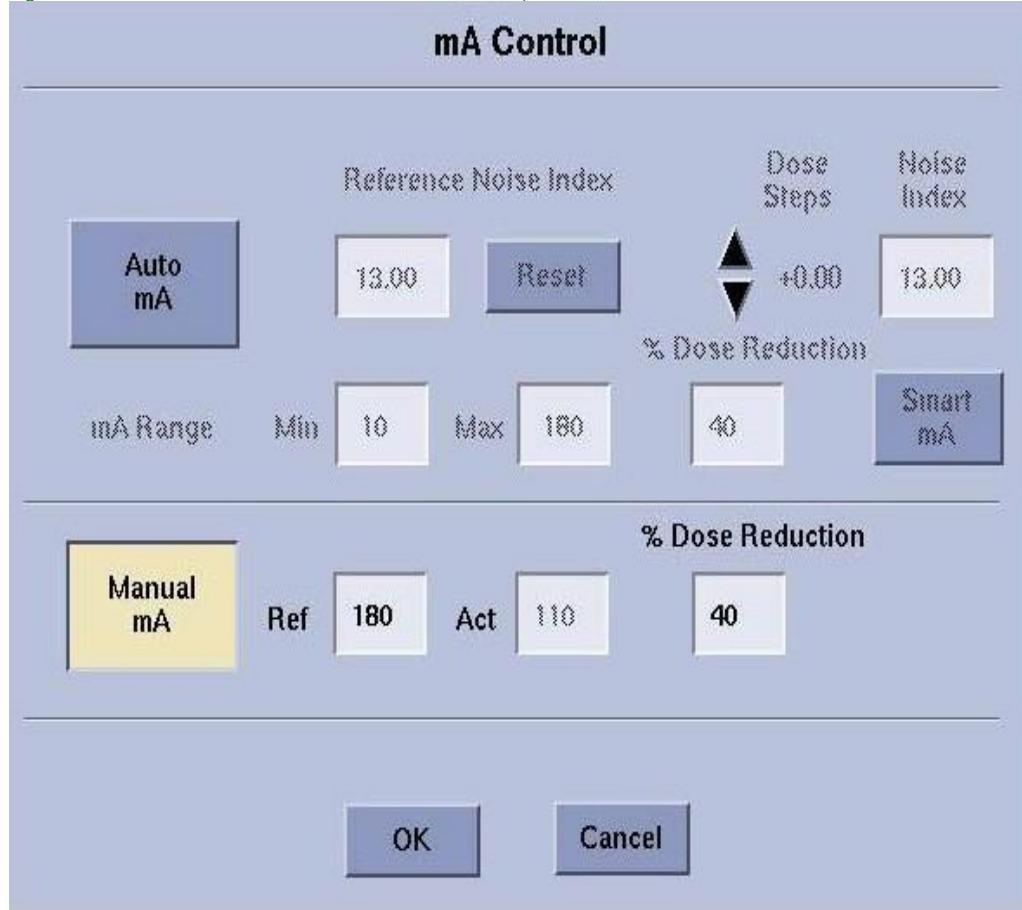
## Dose Steps

Adjusts Noise Index by steps of 5%. Dose steps can be increased or decreased. Plus values decrease image noise thus increasing required mA. Minus values increase image Noise index, thus decreasing required mA. A Dose step value of 0 indicates that the prescribed Noise index is equal to the Reference Noise index for the protocol.

## Reset

Resets the Reference Noise Index to the GE Target Noise Index Default for the anatomical area and slice thickness chosen in the protocol. Reset is available while in Protocol Management.

Figure 9-17 mA Control screen for Manual mA when ASiR option installed



## Ref(Reference)

Baseline mA that has not been dose reduced.

## Act(Actual)

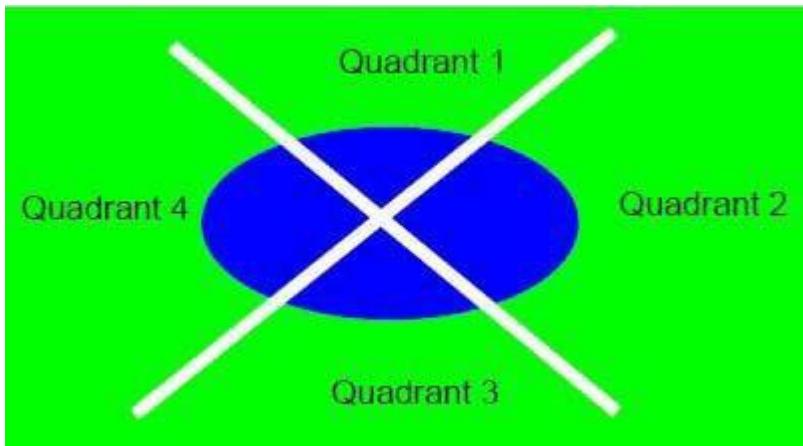
System calculated mA value that will be used for scanning. This value is a percentage of the Reference mA.

The value is shown on the viewedit screen with DR to indicate % Dose Reduction has been prescribed.

## SmartmA

SmartmA modulates four times during a rotation. Because of this, the mA varies four times during each exposure. The mA ramp up time is about 100 milli-seconds.

Figure 9-19 Modulation example



SmartmA is variable mA in the X-Y direction. For each rotation along Z, the system calculates each X and Y mA value from the ratio of the long and short axis of the patient. This is shown in the SmartmA head and body examples. The low and high mA are calculated from the long and short axis ratio. The SmartmA tables show examples of low and high mA values per scan.

Figure 9-20 SmartmA Head (1) and Body (2) tables

**mA Table Information**

Scan #	A	L	P	R
1	36	38	36	38
2	32	32	35	35
3*	29	50	34	28
4*	37	66	48	41
5*	42	72	58	50
6	59	68	61	71

**mA Table Information**

Scan #	A	R	P	L
1	43	46	43	46
2	38	38	43	43
3*	34	60	41	34
4*	45	79	58	49
5*	51	86	70	60
6	71	82	73	85

**OK**

The noise increase from using SmartmA compared to AutomA is minimal. The dose reduction from using smart mA is dependent on the shape and centering of imaged object.

Figure 9-21 SmartmA Note: 1=Tilde Symbol indicating SmartmA is selected



Figure 9-22 SmartmA note when regulated dosage reduced %: 1 = dosage reduction symbol.

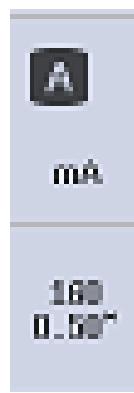


Figure 9-23 AutomA (1) and SmartmA (2) Dose tables

Unrecognized tube-Dose not validated by GE					
Projected Series DLP	IMAGES	CTDIvol (NV) (mGy)	DLP (mGy*cm)	DOSE Eff. (%)	PHANTOM (cm)
DLP (mGy*cm)	1-73	5.94 (N)	234.94	97.40	Body 32
<b>1 234.94</b>					
Est. max Z location CTDIvol:	9.35 mGy		Accumulated exam DLP:	0.00 mGy*cm	

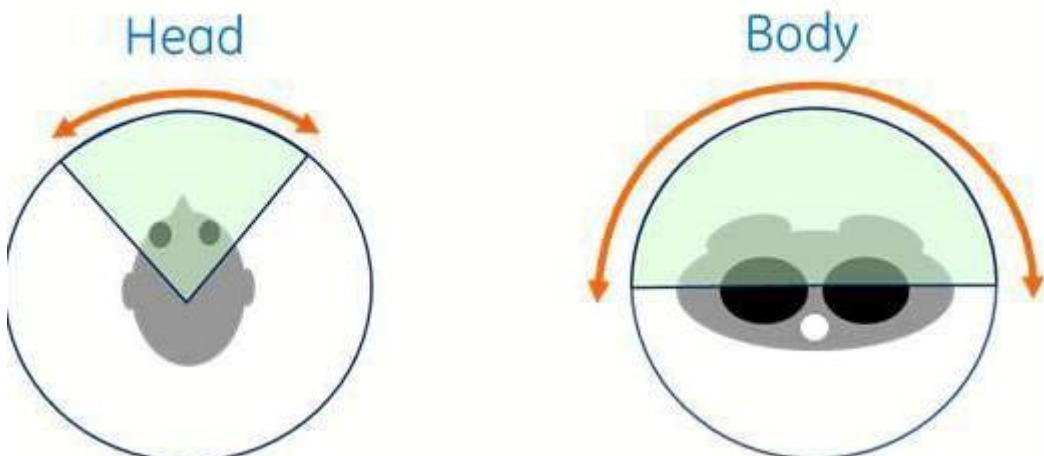
Unrecognized tube-Dose not validated by GE					
Projected Series DLP	IMAGES	CTDIvol (NV) (mGy)	DLP (mGy*cm)	DOSE Eff. (%)	PHANTOM (cm)
DLP (mGy*cm)	1-73	5.03 (N)	198.60	97.40	Body 32
<b>198.60</b>					
Est. max Z location CTDIvol:	9.35 mGy		Accumulated exam DLP:	0.00 mGy*cm	

**2**

### Organ dose modulation (ODM)

Organ Dose Modulation provides a mode to reduce X-ray tube current (mA) in anterior direction of the patient where the most radiation sensitive organs are located while maintaining overall pixel noise standard deviation levels in other areas by modulating X-ray tube current (mA) according to the X-ray tube angle.

Figure 9-24 ODM modulation example: 1 = Ray tube current reduction zone



The mA reduction rate on front side of the patient and the mA reduction tube angle are in Table 9-5.

Table 9-5 For ODM mA reduction rate for ODM

SFOV	mA reduction rate in front side	mA reduction range (tube angle)
Head, Ped Head	Maximum 30%.	90
Small, Large	Maximum 40%.	180



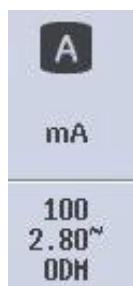
When patient is in prone position, the mA is reduced from table side as it is the direction of the front side of the patient.

ODM is variable mA from A (anterior), P (posterior), R (right) and L (left). For each rotation along Z, the system calculates mA value for P, R and L and A from ODM calculation. This is shown in mA Table.

Figure 9-25 mA Table with ODM for Head First (1) and Feet First (2)

The noise increase from using ODM compared to SmartmA is minimal. The dose reduction from using ODM is dependent on the selected SFOV.

Figure 9-26 ODM annotation



When SmartmA is selected on the ViewEdit screen, the mA is annotated with the tilde symbol (~), indicating that SmartmA is selected. When ODM is selected on the ViewEdit screen, the mA is annotated with an asterisk mark. The images are annotated with a tilde symbol (~) next to the Noise Index value, indicating SmartmA was used, and the symbol for ODM is asterisk (\*).

Figure 9-27 AutomA (1), SmartmA (2) and ODM (3) image annotation



AutomA must be selected first, then SmartmA is enabled.



AutomA and SmartmA are disabled if the patient orientation does not match the Scout orientation. Once the patient orientation matches the Scout, AutomA/SmartmA can be enabled.

Figure 9-28 AutomA disabled message



The mA button turns red and only manual mA values can be entered until the patient orientation matches the Scout orientation.

## AutomA FAQs

### *What suggestions do you have for a new AutomA user?*

- If you are not familiar with the concept of noise index (image noise) you can use the GE reference protocols that have AutomA enabled. As a starting point, use the standard deviation from an acceptable image for approximation of a noise index, or consult the literature until you find the highest noise index value that provides acceptable diagnostic quality. Experiment by scanning some phantoms with different noise index values to gain some confidence. A 30 cm diameter water phantom or a 35 cm diameter low density polyethylene phantom have an attenuation similar to the average adult abdominal patient (27.6 PA).
- It is important to review the quality of images obtained. When collecting these images, the mA range and noise index values have been optimized correspondingly. You should also check the mA table on the scan set up menu to see what mA is actually being used. If you see that it is frequently at the maximum mA range, consider increasing the noise index if more noise can be tolerated in your reconstructed images without compromising the diagnostic value, or increase the maximum mA limit if it is not at the maximum limit of the X-ray generator and you have determined that you require lower noise in your images than you are currently obtaining. Each dose step decrease will increase the Noise Index by 5% and reduces the mA in the mA table about 10%.
- If you normally reconstruct images with thin sections for 3D reformatting and thicker slices for axial viewing it is important to understand that the first prospective reconstructed slice thickness is used for calculating AutomA. Generally you would want to set the noise index for the thicker slice images. For example, you might want a noise index of 10.0 for 5 mm thick images for viewing but you may also want 0.625 mm slices for 3D reformatting. If you prescribe the 0.625 mm slice recon first followed by the 5 mm recon, AutomA will calculate the mA needed to obtain an image noise of 10 for the 0.625 mm slices since it is prescribed first. In this case, to avoid excessively high mA and high dose, you need to readjust the noise index using the following approximation.

Figure 9-29 Noise Index Formula

$$RxNoiseIndex_{thin} = RxNoiseIndex_{thick} \times \sqrt{\frac{ViewingSliceThickness}{FirstRxSliceThickness}}$$

Examples:

$$28.3 = 10 \times \sqrt{\frac{5mm}{0.625}}$$

**Why is the standard deviation I measure in the image sometimes different than the noise index I selected for the scan?**

- There are many factors that can account for this. But, first consider that the noise index setting you make only causes the tube current to be adjusted so that the system projects a similar X-ray intensity through the patient to the detector. Hence it regulates the X-ray noise or quantum noise in the scan data. The noise in the image depends on other factors as well. The selection of reconstruction algorithms, reconstructed slice thickness selection (if different than your prospective selection), and the use of image space filters will also change the noise in the image. In addition, it is very difficult to make standard deviation measurements on patient data since the standard deviation is affected by small CT number variations of the anatomy and by patient motion or beam hardening artifacts. Even with uniform phantoms, standard deviation measurements will produce some variability in measured results because of the inherent nature of quantum statistics.
- Another situation that can cause significant differences between the selected noise index and the image standard deviation is when very large patients provide insufficient detector signal. In these cases, electronic noise sources can become the dominant image noise source instead of X-ray noise. In these cases at various threshold levels, special projection data dependent filters begin to be applied to help preserve image quality. The highest kVp is recommended when excessively large patients are to be scanned.
- Another factor is how well the patient is centered in the SFOV. Image noise can increase significantly if the patient is mis-centered. This occurs because the bowtie filter projects maximum x-rays intensity at isocenter since this is the region of maximum attenuation if the patient is centered. If the patient is mis-centered, there are fewer x-rays projected to the thickest part of the patient, and hence image noise will increase. The optimum strategy is to find the highest noise index sufficient for the clinical task and let AutomA select the mA without using significant constraints.

**Will I get a dose reduction when I use AutomA?**

AutomA will use a dose that depends on the noise index you select and the size of the patient you are scanning. If, you do not obtain a dose reduction over a population of patients, you may have selected a lower noise index than you really need and this results in higher mA values on average than your fixed mA protocols. One strategy to avoid using more dose is to set the max mA parameter to the same level as your fixed mA protocols. This will cap the maximum dose to the same level as your fixed mA protocol. Hence, AutomA will never be allowed to use more dose than you previously used. However, image noise will increase in regions where the mA is limited by the max mA selection and the IQ will degrade with increasing patient size. The optimum strategy is to find the highest noise index sufficient for the clinical task and let AutomA select the mA without using significant mA limits.

### **Why do my images seem noisier when I use AutomA?**

- AutomA will produce an X-ray intensity to maintain the noise index you select. Thus, you may need to use a lower noise index. This may be the case if you find that the average mA for your population of patients is generally lower than your previous fixed mA protocols. This situation indicates you are using lower dose and hence higher noise levels would be expected.
- Certain patient images may also be noisier than your experience suggests. For example, your experience tells you to expect significantly lower noise in thin patients than obese patients. Since AutomA makes the image noise approximately the same for all patients, you may have to re-learn what to expect. What is most important, is to find the highest noise index that allows you to make a confident diagnosis for the clinical problem since this results in the lowest patient dose.
- If you desire somewhat lower noise in small patients, you may want to create Small, Nominal, and Large patient protocols. You can use a slightly lower noise index for the small patients and a slightly higher noise index for large patients.
- A conditional noise limiting strategy you can employ, is to increase the low mA range parameter. If you find that images are generally not acceptable to you below some minimum mA value, then you may set this value as the low mA range limit. This will prevent AutomA from using lower mA values than you desire. Note, however, that this defeats the purpose of AutomA and causes the image noise to decrease below the selected noise index and thereby increases the dose.
- Yet another possibility for higher noise than you might expect is if you are looking at multiple reconstructed images that have thinner slices than the prospective scan Rx slice thickness. AutomA uses prospective slice thickness as a factor when the mA table is generated. You need to be sure the noise index is set for the first prospective image based on image thickness you will use for axial image viewing (see [FAQ 1](#)). This caveat applies equally for fixed mA as well as AutomA scanning.
- Higher noise images can also occur when patients are not well centered in the scan field of view. The bowtie filter attenuation increases with distance away from isocenter. Hence the thickest part of the patient should be approximately centered in the scan field of view. Otherwise image noise will increase since the patient thickness adds to the bowtie filter thickness. This is especially important for highly asymmetric anatomy such as through the shoulders. Again, this effect is no different with AutomA than with fixed mA.
- Recognize also that there are some obese patients that exceed the capabilities of the tube and generator to satisfy the selected noise index. This is also no different than fixed mA scanning. For such obese patients, one strategy is to select a higher kVp setting when possible.

### **Why is the mA that is annotated on the image sometimes slightly different than the mA I see in the mA table?**

The mA displayed on the image is determined by measuring the generator mA during the scan and averaging the measured result over the total number of views used to reconstruct the image. The number of views used to produce the image may be more than one gantry rotation for a helical scan. Hence the annotated value is a combination of the mA table values that depends on how many views from each rotation were used for the image. In addition, the generator is automatically adjusting the filament current to account for changing conditions during the scan to keep the mA within the desired tolerance of the commanded mA table. For example, this is why you may see an mA value of 41 in the image where the mA table indicated 40.

### **I understand that noise in the image changes with reconstruction parameter selections, but why is the noise sometimes different when I retro reconstruct the same scan data at a different display FOV?**

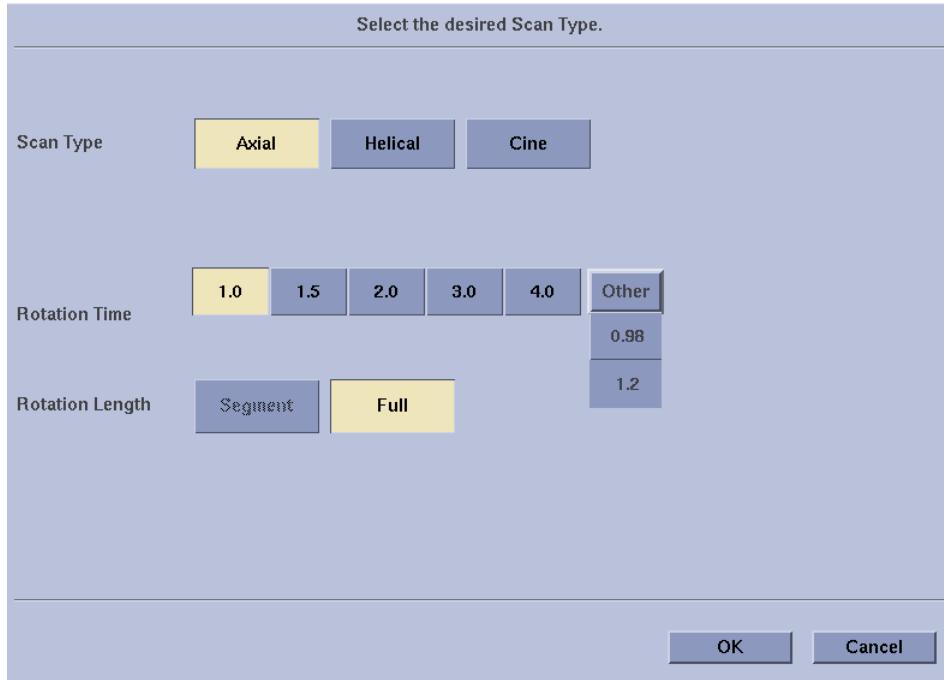
When you select a reconstruction algorithm, the system may sometimes re-adjust the actual filter kernel. This readjustment will change the image standard deviation. This will happen if the display field of view selection exceeds a certain size and is especially apparent with higher resolution algorithms such as bone and edge. The change in kernel is required when the DFOV selection makes the pixel size too large to support the intended spatial resolution. This characteristic is independent of AutomA.

## SCAN PARAMETER

### Scan Type screen

On the [ViewEdit screen](#), click **Scan Type** to display the Scan Type screen.

Figure 9-30 Scan Type screen - Axial



#### **Scan Type**

Enable a certain type of the following scan: [Axial](#), [Helical](#), [Cine](#).

#### **Rotation Time**

The available rotation times depend on the scan type selected. See [Rotation Time](#).

#### **Rotation Length**

Segment is a partial scan. Full is a 360° rotation of data. See [Rotation Length](#).

## SCAN PARAMETER

### Thickness Speed screen

On the **ViewEdit screen**, click **Thick Speed** to display the Thickness Speed screen.

Button and text colors indicate the following.

- Yellow indicates current selections.
- Dark blue with black text indicates the available parameters.
- Light gray with black text indicates available parameters that may change based on other parameter selections.
- Light gray with gray text indicates parameters not available.

Figure 9-31 Thickness Speed screen - Axial

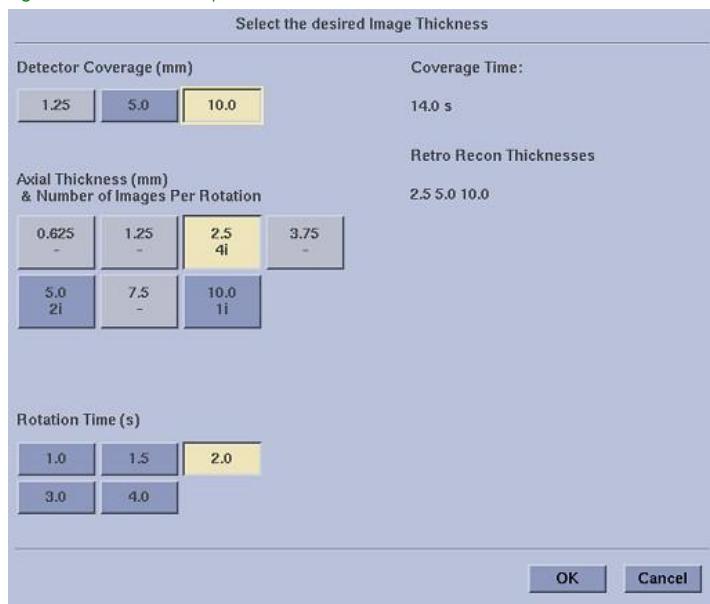


Figure 9-32 Thickness Speed screen - Cine

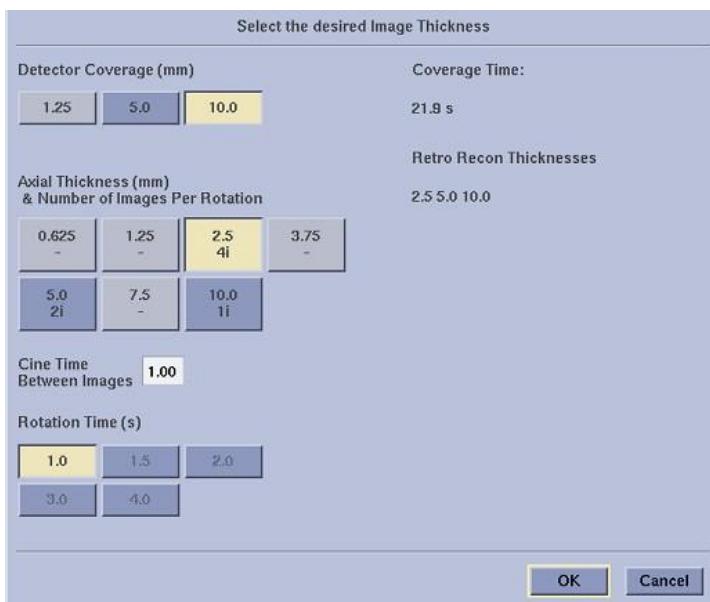
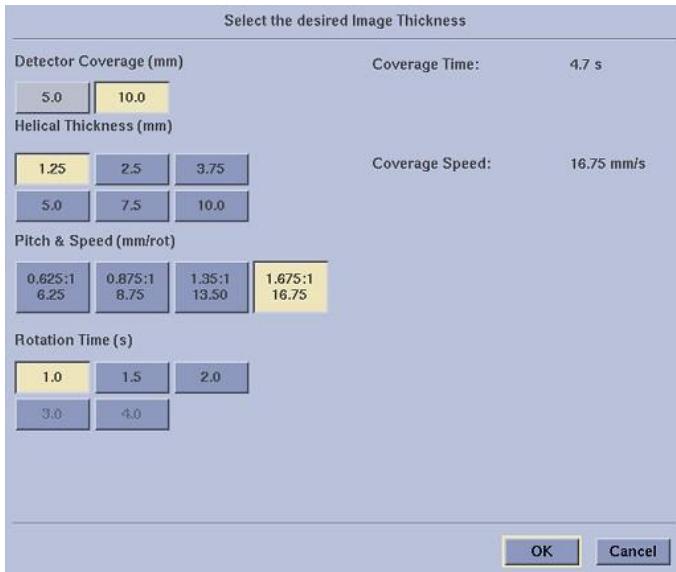


Figure 9-33 Thickness Speed screen - Helical



### DetectorCoverage

See also [Detector Configuration](#).

axial

- 1.25 mm beam - 0.625mm
- 5.0 mm beam - 1.25 mm, 2.5 mm, 5.0 mm
- 10 mm beam - 1.25 mm, 2.5 mm, 5.0 mm, 10.0 mm

cine

- 1.25 mm beam - 0.625mm
- 5.0 mm beam - 1.25 mm, 2.5 mm, 5.0 mm
- 10 mm beam - 1.25 mm, 2.5 mm, 5.0 mm, 10.0 mm

Helical

- 1.25mm beam - 0.625mm\*
- 5mm beam - 1.25mm, 2.5mm.
- 10 mm beam - 1.25 mm, 2.5 mm, 3.75 mm, 5.0 mm, 10mm

\*With Sub-MM Imaging Mode

### Pitch and Speed

- 1:1 to 1.25mm/rot (1.25mm detector coverage)
- 0.75:1 to 3.75mm/rot (5mm detector coverage)
- 1.5:1 to 7.5mm/rot (5mm detector coverage)
- 0.625:1 to 6.25mm/rot (10mm detector coverage)
- 0.875:1 to 8.75mm/rot (10mm detector coverage)
- 1.35:1 to 1.35mm/rot (10mm detector coverage)
- 1.675:1 to 16.75mm/rot (10mm detector coverage)

### Rotation Time

- Axial – 0.98s, 1.0s, 1.2s, 1.5s, 2.0s, 3.0s, 4.0s
- Cine – 1.0 s
- Rotation – 0.98s, 1.0s, 1.2s, 1.5s, 2.0s

## SCAN PARAMETER

### Scan parameters workflow

Use this procedure to set the scan parameters according to your patient's size and the anatomy you are scanning. These parameters determine the image quality you achieve. Always make sure you remove any objects that may cause artifacts. Review the Scout image to view objects that might cause artifacts.

#### Precautions

- If patient orientation is different from the previous scan, the system will display the following message: "Your patient orientation has changed from the previous series. Please verify or change orientation if needed."
  - If the icon has been changed, then it will display the following message: "The table landmark has changed. This changes the location of all scans you have prescribed. Double check all scan location before you start scanning."
1. From the Scan desktop, click **Next Series** in the protocol or click **Create New Series**.
    - If you are building a protocol, the next series button moves you around in the protocol.
    - There may be times that you want to skip a series in the protocol. For example, a series involving a patient that was scanned for contrast only and your current series is built for no contrast.
  2. Make sure the orientation of the patient is the same as the Scout.
    - If necessary, click the picture of the patient to change the patient position.
    - There may be times that you change the patient's position from the way that the protocol was built. Under this circumstance, you must change the patient orientation on the screen each time you continue to construct the next sequence.



- You can also build the protocol with Copy Patient Orientation and Patient Position Anatomical Reference.

#### Choose the Scan Type.

- For an Axial or Helical scan, see [Set Axial and Helical scan parameters](#).
3. Set the start and end locations.
    - To graphically set the locations, see the [Adjust the Graphic Rx](#) procedure.
    - To explicitly set the locations, see the [Set the Start and End locations](#) procedure.
    - To set a specific number of images, see the [Set a specific number of images](#) procedure.

#### Choose the Thick Speed options.

4. [Set the Image Interval](#).
5. [Set the SFOV](#).
6. [Set the kV](#).
7. [Set the mA](#).
8. Proceed to [Set the timing parameters](#) procedure.

## Choose the Scan Type

Use this procedure to choose a Scan Type to specify how the scan data is acquired.

1. From the ViewEdit screen, click **Scan Type**.
2. From the Scan Type screen, choose the desired Scan Type.
  - Click **Axial** for a step and shoot method.
    - Routine head studies typically use axial scans acquired with a 1 or 2 second rotation time.
    - Hi-Res chest studies may use axial scans acquired with a sub-millimeter (0.625 mm) slice or with a single 1.25 mm slice.
    - In Axial scan mode, the scan direction may not be maintained when scanning inferior to superior when a group is added. When adding a group for axial scan mode, be sure to verify that the scan direction is correct.
  - Click **Helical** for a continuous table movement method.
    - A wide range of exam types use helical scans.
    - When scanning, press **Stop Scan** to stop scan between multiple helical groups not **Stop Move**.
  - Click **Cine** when one location needs to be scanned over a period of time, such as for hemangioma studies.
    - Full is continuous exposure that supports table movement equal to the beam collimation or no table movement, where the scan is taken at one table position.
    - Segment is a partial scan with continuous exposure.
    - If the scan type is changed to SnapShot Cine from another scan type, the mA value automatically updates. Review it to be sure it is acceptable.
3. Click a **Rotation Time**.
4. Click a **Rotation Length** if acquiring a Cine scan.
  - Full rotation is used most often.
  - Segment Rotation is used for applications require high speed.
5. Click **OK**.

**SCAN PARAMETER****Set Axial and Helical scan parameters**

Use the following tables as a guide when prescribing an axial or helical scan. Because the data for a helical image is weighted over more than one rotation, to provide the best possible image quality the nominal image slice may differ slightly from your selection dependent on table speed, pitch, and slice selection.

Table 9-6 typical slice thickness 16 layers: helical scanning mode (mm)

Aperture	Selected Slice Thickness						
	0.625	1.25	2.5	3.75	5	7.5	10
10	N/A	1.36	2.12	N/A	4.5	N/A	10.6
5	N/A	1.36	2.12	N/A	4.5	N/A	N/A
1.25	0.72	1.36	N/A	N/A	N/A	N/A	N/A

Table 9-7 Rotational Scan Modes (FWHM in mm)

Aperture	10mm						
	pitch	1.25	2.50	3.75	5.00	7.50	10.00
0.625:1	1.25	2.50	3.75	5.00	7.50	10.00	
0.875:1	1.25	2.50	3.75	5.00	7.50	10.00	
1.35:1	1.25	2.50	3.75	5.00	7.50	10.00	
1.675:1	1.25	2.50	3.75	5.00	7.50	10.00	

Aperture	5mm	
pitch	1.25	2.50
0.75:1	1.25	2.50
1.5:1	1.25	2.50

Aperature	1.25mm
pitch	0.625
1:1	0.625

## Set the Start and End locations

Start and End Locations are set in millimeters superior to, and/or inferior from, the anatomical reference point. The locations designate the points of anatomy to be scanned. The easiest way to set the Start and End locations for a scan **adjust the scan range graphically**. If specific locations are known, use this procedure to designate the beginning and end points of the anatomy to be scanned.

1. From the ViewEdit screen, click **Anatomy Selection**.
2. Type a beginning point location.
  - The numbers must be preceded by the correct designation of "S" for superior (towards the head) from the centering point, or "I" for Inferior (towards the feet).
  - Plus (+) can be used for superior and minus (-) for inferior.
  - The Start location from a the previous scanned series is copied if **D** or **d** was enabled in Protocol Management.
3. Type a end point location.
  - The numbers must be preceded by the correct designation of "S" for superior (towards the head) from the centering point, or "I" for Inferior (towards the feet).
  - Plus (+) can be used for superior and minus (-) for inferior.
  - The End location from the previous scanned series is copied if **D** or **d** was enabled in Protocol Management.

## SCAN PARAMETER

### Set a specific number of images

The Number of Images, which set automatically by the system, is determined by the combination of Anatomy Selection, Slice Thickness, and Image Interval. Use this procedure if you require a specific number of images for the scan prescription.

1. On the ViewEdit screen, click **No. of Images**.
2. Type the desired value.
  - System will automatically adjust Anatomy Selection.

## Choose the Thick Speed options

Use this procedure to set the Thick Speed options for detector coverage, image slice thickness, pitch, table speed, and rotation speed.

1. On the ViewEdit screen, click ***Thick Speed***.
2. On the Image Thickness screen, choose the slice thickness for the detector coverage.
3. Select a slice thickness.
  - In the Axial mode, the 1i mode, the High Resolution Chest mode is available with 1.25 mm thickness with one image per rotation.
  - Under helical mode, select between 1.25 mm detector coverage or 5 mm detector coverage, 10 mm detector coverage.
  - Beam collimation:
    - CT HU for the 1.25 mm 2i mode may not be the same as in 10 beam acquisitions.
    - In the Cine mode, the Cine Time Between Images is the time between each image that can be created in a Cine acquisition. Cine Time Between Images is dependent on rotation time selected.
    - The smaller the slice thickness, the more technique you need to use. The thinner the slice thickness, the higher the noise will be in the slice. Adjust protocol factors to provide desired image quality and noise level for the acquisition.
    - Thinner slice thickness gives you better detail. However, contrast resolution will be decreased.
4. Choose the pitch and speed for the Helical mode.
  - The pitch is the table travel in millimeters per rotation divided by the beam collimation.
    - 4 Row Interleaved provides a 40% mAs reduction, and is 1.5 to 3 times faster than single slice helical and has minimal helical artifacts, but interleaved pitch 0.5:1 provides only one third of the coverage compared to interspaced mode.
    - 4 Row Interspaced provides data acquisition 2 to 6 times faster than single slice helical, but requires more interpolation, more helical artifact, and only a 20% mAs reduction.
  - Under rotation mode, helical pitch includes 1:1, 0.75:1, 1.5:1, 0.625:1, 0.875:1, 1.35:1, 1.675:1,
5. Choose the images per rotation for Axial and Cine modes.
  - In Axial mode, the number of images per rotation can be 1, 2, 4, 8\*16z\*.
  - The choice for one determines the choices for the other. Some combinations are not allowed.
  - The choice for number of images determines the beam collimation and slice thickness. Some combinations are not allowed.
  - The choices you make for thickness and images per rotation determine the available reconstruction thicknesses.
6. Note the coverage time and coverage speed.
7. Click **OK**.



The coverage time shown in the Thickness/Speed window does not account for breath hold and breathe times that have been prescribed in the protocol.

\*Revolution ACTs EX

**SCAN PARAMETER****Set the Image Interval**

The Image Interval is for helical scans only and is automatically set to match the slice thickness by the system. For Axial or Cine scan type, the interval is set to equal the detector coverage. The interval value can be increased but not decreased. If the interval is greater than the detector coverage, the gap is between each rotation of data, not between the slices. This is known as contiguous (back to back) scans. Use this procedure to set an Image Interval if you want a contiguous, overlapped, or spacing (skip) in the scan prescription.

1. On the ViewEdit screen, click **Interval**.
2. Type an interval value in mm.
  - Type **D** or **d** in the Image Interval field to copy the locations from the previously scanned series.
  - In the Helical mode, the table moves in mm per rotation, while exposing the patient.
    - The image interval defaults to equal the slice thickness.
    - The maximum interval is twice the slice thickness.
    - The interval can be less than or greater than the slice thickness.



The interval of 7.5mm and 10.0mm thickness is available to only integral multiple of 2.5mm.

- In the Axial mode, the interval or spacing defaults to the equal number of images per rotations multiplied by the slice thickness.
  - The interval for axial scanning can be zero, equal to, or greater than the width of the detector configuration. Typical intervals used are 10 mm.
  - Axial interval with skip refers to a gap between scan groups. This can be useful, for example, when performing a survey exam, such as a high resolution chest exam.
  - For the single slice High Resolution Chest Mode, the minimum scanning interval between slices is 5 mm.
- In the Cine mode, for an interval greater than zero, scans are created at several locations and the end location changes.
  - The usual interval is 10 mm.
  - You can change the interval when setting up prospective multiple recons.
- IQ Enhance is compatible with 1.25 mm slice thickness. Interval for acquisitions with IQ Enhance must be equal to the slice thickness (1.25 mm) or an overlap of 50% (0.625 mm).

## Digital Tilt

Digital tilt allows the user to acquire tilted images without Gantry tilt. This is done by reconstructing the 0 degree images through Background Algorithm.

### Characteristics

- Determines proper scan conditions according to user's setting automatically.
- Auto displays the non-tilt (0 degree) images on a dedicated viewer and the tilt images during the scan process.
- Supports retrospective reconstruction with scanned tilt angle to non-tilt (0°) angle.
- Tilt Images' position can be shown on 90° scout image when displaying or printing.
- Supports current DICOM image data output or other format (JPEG, PNG, AVI, MPEG, MOV).
- Optimized reconstruction methods provide diagnostic image quality.

### Precautions

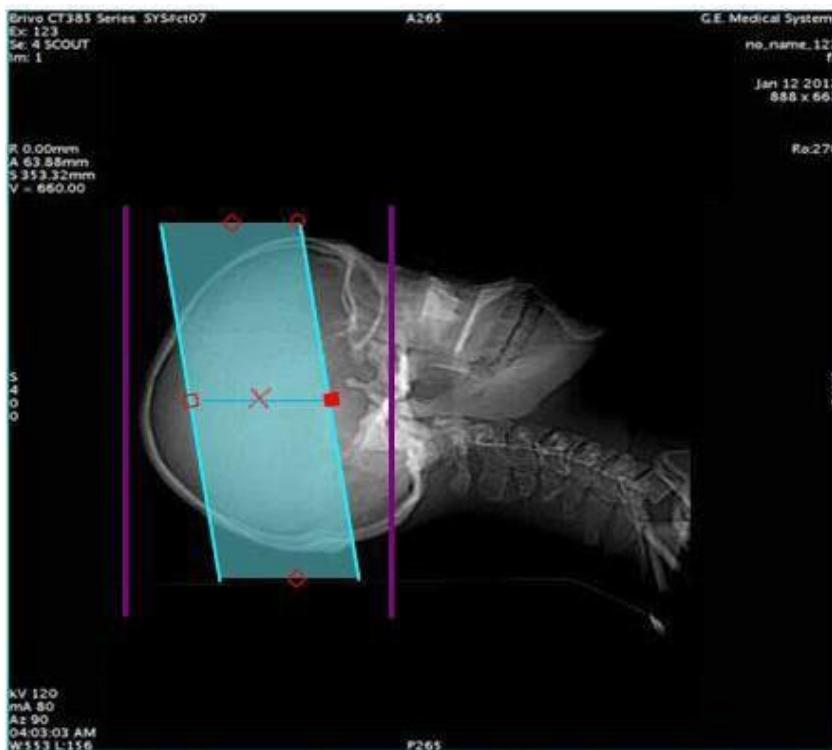
- Available for Helical scan type only.

## Set the Tilt angle

The Tilt angle can be set manually or graphically to a range between -30°~ 30°. The most common way to set the tilt is graphically.

### Graphically set the Tilt angle

1. View a lateral Scout image.
2. Click and drag the circular handles on the Start and End locations to adjust the lines on the Scout to the desired tilt.



### Explicitly set the Tilt angle

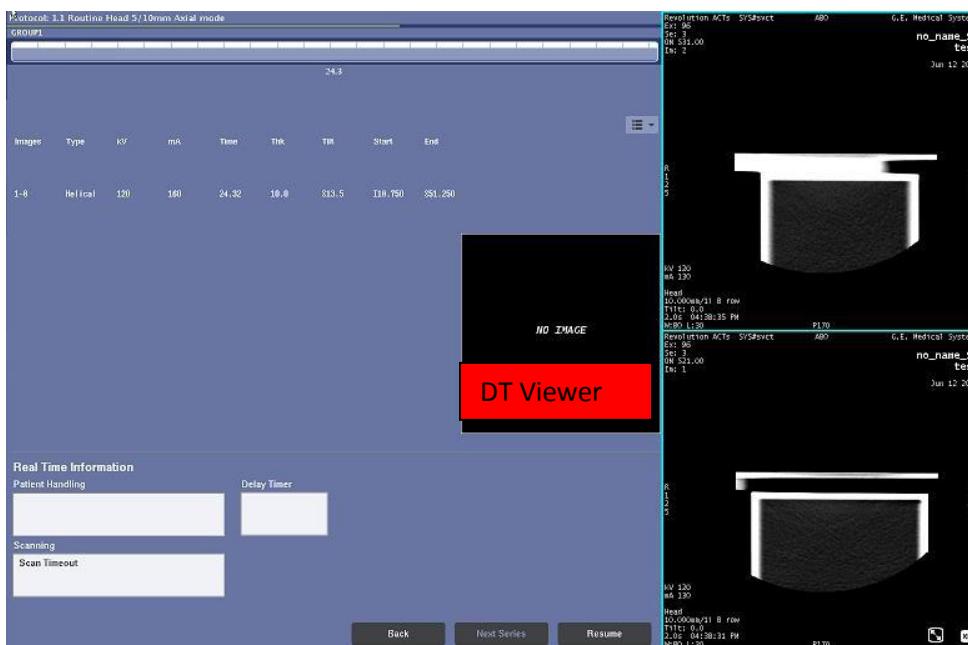
If a specific tilt is wanted, use this procedure to set the gantry tilt.

1. On the ViewEdit screen, click **Tilt**.
2. In the Tilt field, type an **S** or **I** prefix and the desired value.

Images	Scan Type	Anatomy Selection	No.of Images	Thick Speed	Interval	Tilt	SFOV	kV	mA	Timing	Recon	Filming
1-8	Helical Full 1.0 s	S0.000 I35.000	8	5.0 11.25 0.562:1	5.000	\$10.0	Head	120	160 DR	0.0 1.3 9.41	Stdnd	Off
9-16	Helical Full 1.0 s	I40.000 I75.000	8	5.0 11.25 0.562:1	5.000	I30.0	Head	120	160 DR	1.0 1.3 16.75	Stdnd	Off

## Digital Tilt Viewer

Digital Tilt Viewer shows non-tilt (0 degree) images when Digital Tilt scan is started. It is a 512x512 viewer on right lower corner of Exam Rx next to auto link and auto view.



- DT Viewer is posted when [Confirm] is clicked for Digital Tilt scan.
- DT Viewer is closed when the left screen is turned to any other than scan progress screen.
- Image thickness and interval are fixed to 5mm.
- Recon kernel, Recon type, DFOV and AP/RL center of the DT Viewer images are the same as Recon1.
- When DT Viewer is focused, the frame is red, otherwise it is white.
- In order to set focus on DT Viewer, click on it. During it is focused, following operations are supported on DT Viewer:
  - Change WW/WL by middle button of mouse
  - Change WW/WL by F6-F11
  - Change WW/WL with Up/Down/Left/Right Keyboard
  - Zoom (Right Button of Mouse)
  - Roam (Left Button of Mouse)
  - Back to Normal ("Space" key)
- DT Viewer images are not available on browser/Viewer, and removed when [End Exam] is clicked.
- On DT Viewer, the last DT Viewer image is shown.
- The maximum DT Viewer image is 800. If it is over 800 images, images from the first image will be removed.
- Annotations on DT Viewer are:
  - "DT Viewer" at the bottom-middle of viewer
  - WW/WL

- ESI Information
- ScanParameter



Digital Tilt is enabled only if Helical scan mode is selected and is disabled in Axial/Cine scan mode. If Axial/Cine is selected, the system automatically adjusts the tilt angle to 0 degree and the message area displays the following message "Digital tilt cannot be applied in Axial scan." or "Digital tilt cannot be applied in Cine scan."



SmartPrep cannot be used simultaneously with Digital Tilt. If Digital Tilt mode is enabled, the system automatically changes the tilt angle to 0 degree once SmartPrep is enabled and the message area displays the following message "Digital tilt cannot be applied in SmartPrep scan."



In Digital Tilt the system automatically sets the actual scan parameters according to the user input of locations and parameters of tilt images. The slice thickness and start/end locations of 0 degree scan parameters are calculated from those of tilt images. In order to obtain a tilt image with the preset DFOV, the 0 degree scan range will be slightly larger than the tilt image reconstruction range. The actual scan range of 0 degree scan is determined by the range and DFOV of tilt images. Therefore, DFOV should be as small as possible. When the DFOV is too large, the system will prompt the user that the current DFOV may use more dose. Either select [Confirm] to start the scan or re-adjust the parameters.



When  $DFOV \geq 20$ , There will be a Notice, "DFOVs larger than 20cm will increase scan range to achieve prescribed digital tilt angle, resulting in an increase for the series total DLP". Please review prescription and make sure DFOV is clinically relevant.



When performing an acquisition with Digital Tilt, time to first image is longer than with non-digital tilt. The length of the time depends on the tilt angle and DFOV.



#### Prospective Multiple Recon (PMR):

- Image thickness, image interval, DFOV, AP/RL Center and Recon Mode (Full/Plus) of PMR are always the same as Recon1.
- PMR images are not shown on DT Viewer.



Priority Recon: Priority Recon is not compatible with Digital Tilt.

## Set the Scan FOV

The SFOV<sup>1</sup> determines how much anatomy is scanned. Use this procedure to select a SFOV that covers the anatomy of interest. The SFOV should always be larger than the circumference of the patient, regardless of what part is being imaged.

1. On the ViewEdit screen, click **SFOV**.
2. Choose an SFOV.
  - Click **Ped Head** to image infants 18 months or less in age. It allows you to enter up to a 25 cm DFOV. It has a special processing to correct for beam hardening effects.
  - Click **Head** to image an adult head at a maximum of 25 cm. It has a special processing to correct for beam hardening effects.
  - Click **Small** to image small bodies, extremities that are centered middle of the gantry and the QA phantom. It allows you to enter up to a 25 cm DFOV.
  - Click **Large** to image most adult body work. If you measure the anatomy that you are scanning and it measures over 25 cm, you need to use the large SFOV. It allows you to enter up to a 43 cm DFOV.



It is recommended to use the same beam collimation through the entire acquisition when scanning the head.



---

1. Scan Field Of View

## SCAN PARAMETER

### Set the kV

Use this procedure to set the kVp for the imaging study.

1. On the ViewEdit screen, click **kV**.
2. Choose the desired factor.
  - Click **80** kV for Bone Mineral Densitometry and Perfusion imaging in the brain.
  - Click **100** kV for pediatric and small patient imaging.
  - Click **120** kV for routine imaging of the chest, abdomen, and pelvis areas.
  - Click **140** kV for imaging the posterior fossa, thick areas, and heavy patients.

## Set the mA

### Precautions

- AutomA and SmartmA are disabled if the patient orientation does not match the Scout orientation. Once the patient orientation matches the Scout, AutomA/SmartmA can be enabled.

Use this procedure to set the mA for the scan prescription.

- On the ViewEdit screen, click ***mA***.
- On the mA Control screen, choose an mA value.
  - Click Manual mA and type an mA value.
  - Type a value, in increments of 5, from 10 mA up to 200 mA depending on the kVp selected with the MX135CT X-ray tube.



For the value of max mA, see **High Frequency Generator** in X-ray tube and Generator.

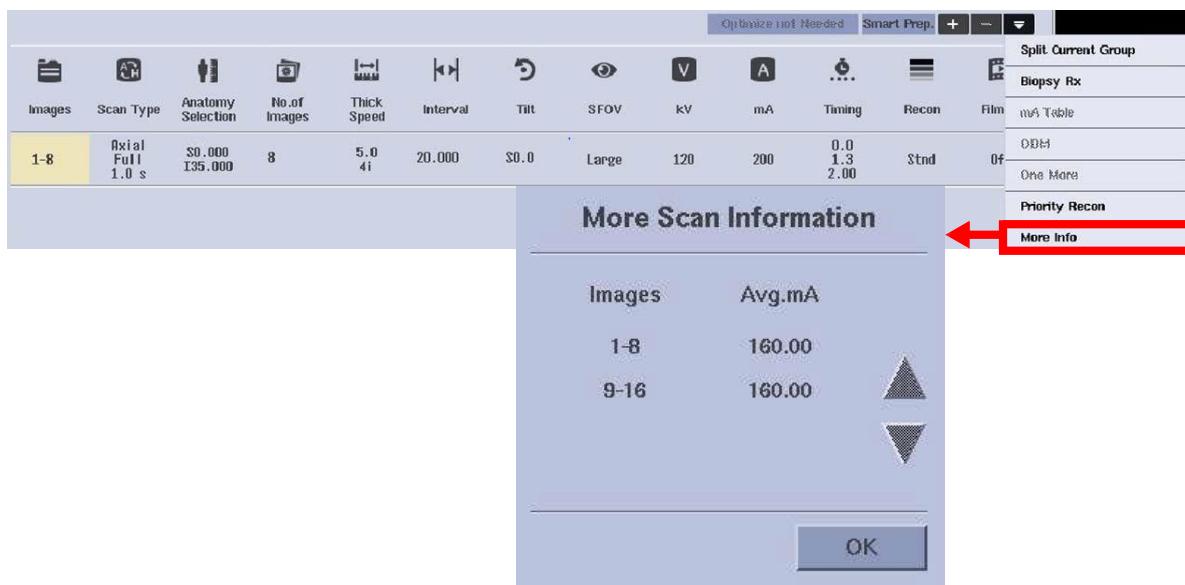
- Click AutomA to enable mA modulation in the Z-direction.
  - Type a Noise Index value that provides acceptable diagnostic quality. As the Noise Index increases the required mA decreases and image noise increases. The optimum strategy is to find the highest noise index sufficient for the clinical task and let AutomA select the mA without using significant constraints. Use a slightly lower noise index for the small patients and a slightly higher noise index for large patients.
  - Type a Min and Max value, which constrains the mA range used during the scan.
  - Select **SmartmA** to enable mA modulation in the XY-direction.
- Click **OK**.
  - Review: From the Scan desktop, click the ***mA Table*** to view the calculated Z or X and Y values.
    - This can only be done at the time of scan set up and not in Protocol Management.

Figure 9-34 Example of a head mA table indicating low and high mA values

mA Table Information				
Scan #	A	L	P	R
1	133	133	133	133
2	137	137	137	137
3	147	147	147	147
4	148	148	148	148
5	151	151	151	151
6	151	151	151	151
7	154	154	154	154
8	158	158	158	158
9	152	152	152	152
10	154	154	154	154
11	144	144	144	144
12	120	120	120	120
13	111	79	111	79
14	50	50	50	50

**OK**

5. Additional information for mA can be displayed prior to scanning and after scanning using the [More Info] button on the ViewEdit and Dynaplan screens. The More Scan Information pop-up will display the average mA for the acquisition when selected after the scan is completed.



## Organ Dose Modulation



**Important:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

**CAUTION:** Effectiveness of Organ Dose Modulation is impacted by patient centering. To realize expected dose reduction, the patient should be positioned in the center of the Scan-Field-of-View.

Organ Dose Modulation provides a mode to reduce X-ray tube current (mA) in anterior direction of the patient where the most radiation sensitive organs are located while maintaining overall pixel noise standard deviation levels in other areas by modulating X-ray tube current (mA) according to the X-ray tube angle.

1. On the [View/Edit screen](#), click **ODM** to display the ODM screen.

Figure 9-35 ODM button on View/Edit screen



Figure 9-36 ODM screen

ODM Information		mA Table Information					
	On	Scan #	mA	A	L	P	R
	<input type="checkbox"/>						
		start location	end location				
1	<input type="checkbox"/>	560.00	160.00				
		Add ODM	Delete ODM				
		Ok					Cancel

The mA Table Information section contains a table with 15 rows. Rows 8\*, 9\*, 10\*, 11\*, 12\*, 13\*, and 14\* are circled in red. The table has columns for Scan #, mA, A, L, P, and R.

Scan #	mA	A	L	P	R
1	95	88	95	88	
2	82	77	82	77	
3	104	99	104	99	
4	122	121	122	121	
5	142	147	142	147	
6	154	161	154	161	
7	153	161	153	161	
8*	50	150	143	150	
9*	50	139	133	139	
10*	50	128	122	128	
11*	50	122	116	122	
12*	50	117	110	117	
13*	50	126	116	126	
14*	50	128	117	128	
15	117	128	117	128	

***On/Offbutton***

Turns ODM on or off. On enables ODM and display of the ODM region on the Scout.

***Start/Endlocation***

Displays start and end location of the ODM region.

***Add Region / Delete Region***

Add or Delete an ODM region. The maximum number is 3. ODM area cannot batch overlap.

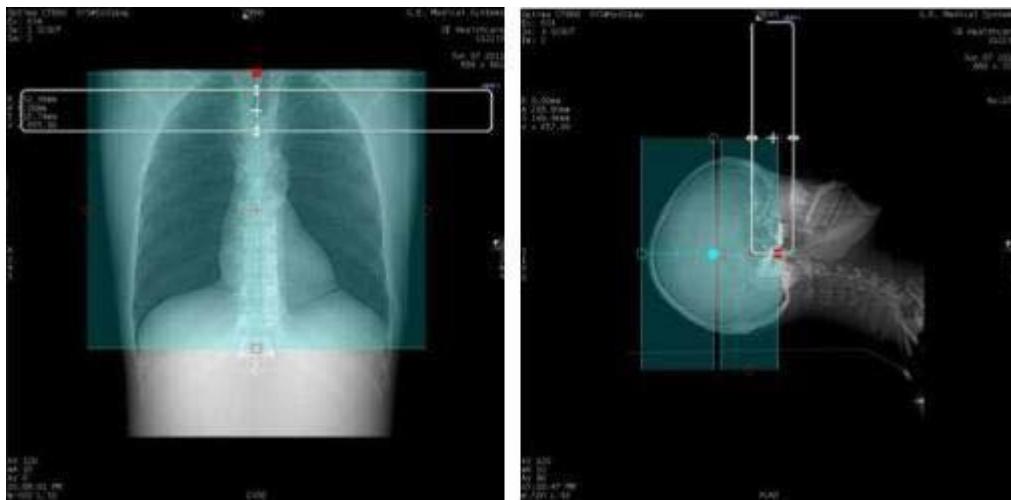
***mA Table Information***

Displays the mA per rotation. An asterisk mark indicates which scan rotations ODM is applied On. Patient A: forward, P: posterior, L: left and R: Right Side. An example of mA Table with a patient in Head First is shown in 9-34 above. If the patient is in Feet First, then the position of L and R reversed.

ODM can be set in Protocol Management.

2. On the Localizer, ODM region is displayed in white.

Figure 9-37 ODM region on Localizer



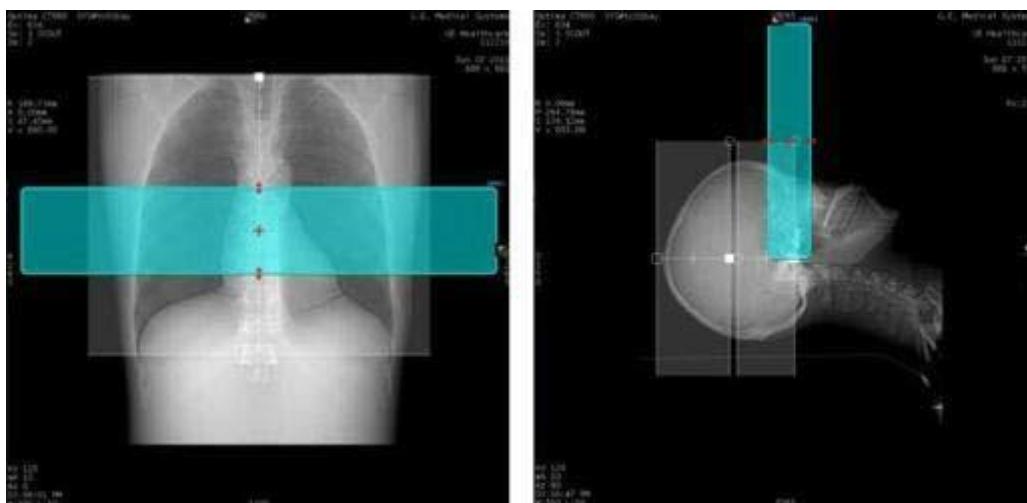
ODM region is displayed in white and shown as inactive when scan prescription is being adjusted.

3. On the Localizer Tools, click **ODM** to activate ODM regions.

Figure 9-38 Localizer Tools



Figure 9-39 Enable ODM region



ODM region is displayed in aqua and scan range is in white and shown as inactive.

ODM region can be moved only in Z-direction, not for A-P or R-L direction.

Minimum length of an ODM region is 10mm.

ODM regions cannot overlap each other.

4. When ODM is applied, "ODM" is displayed in mA button. This means ODM scan is set in one or more tube rotation in this scan group. It does not mean all the rotations in this scan group have ODM applied.

Figure 9-40 ViewEdit screen with ODM applied

Images	Scan Type	Anatomy Selection	No.of Images	Thick Speed	Interval	Tilt	SFOV	KV	mA	Timing	Recon
1-21	Helical Full 1.0 s	\$100.750 \$0.750	21	5.0 11.25 0.562:1	5.000	\$0.0	Large	120	100 2.80~ ODM	0.0 1.3 11.55	Stand

Smart mA must be ON to enable ODM. ODM is not available with Biopsy Rx.

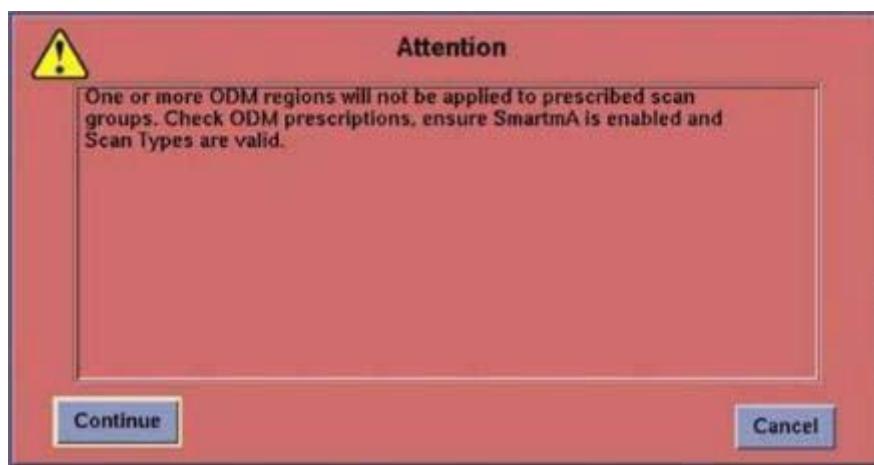
ODM is not available for Cine Segment scan types.

ODM is not available for scan groups which are not compatible with automatic exposure control (SmartmA) such as baseline and monitor scan phase in SmartPrep.

When Smart mA is Off, or Scan type is not valid, the system posts an Attention popup.

Information is: "One or more ODM regions will not be applied to prescribed scan groups. Check ODM prescriptions, ensure SmartmA is enabled and Scan Types are valid." One or more ODM regions will not be applied to prescribed scan groups.

Figure 9-41 Attention popup



### Image Annotation

When an image is with ODM scan, an asterisk mark (\*) is added after Noise Index value.

Figure 9-42 asterisk mark of an image with ODM scan

```

KV 80
mA 200
Noise Index: 5.0~*
Head
2.500mm/8.75 0.875:1
Tilt: 0.0
1.0s /HE 03:32:13 PM/00.21
W:100 L:30

```

## TIMING PARAMETERS

### Timing tab

From the View/Edit screen, click the **Timing Parameters** icon to display the Timing Parameters tab.

Figure 9-43 Timing tab



*PrepGroup InterscanDelay BreathHold BreathTime Voice/Lights/Timer  
CineDuration*

Cine Duration defines the period of time the system will scan at one location. This period of time is dependent upon the clinical purpose of the scan.

## TIMING PARAMETERS

### Timing parameters workflow

Use this procedure to set up the timing parameters in the scan prescription. The patient's condition has a large effect on timing. Make sure that you know how long the patient can hold his/her breath. This helps when working with **Auto Voice**.

It is very important to utilize injection delays. You can only inject once and you must get it right the first time. Different anatomy enhances at different times. Check with your radiologist for the right injection delays.



1. From the ViewEdit screen, click **Timing**.
2. On the Timing Parameters tab, if an injection delay is needed, **set a Prep Group time**.
  - The valid range is 0 to 300 seconds for the first group and 600 seconds for any additional groups.
  - Auto Voice automatically sets Prep Group time based on message length and Preset Delay Time set for the Voice, Lights, Timer selection.
3. If scanning in the axial mode, **set an Interscan Delay time (ISD<sup>1</sup>)**.
4. For breath hold scans, **set a Breath Hold time** and **set a Breathe Time**, as needed.

#### **Set the Voice/Lights/Timer options.**

- Multi-language selection in 9 languages are available for selection for Auto Voice messages 1, 2, or 3.
- **Preset Delay Time**, sets a delay from the time message ends until the X-ray turns on. This is helpful for patients who need a longer time to follow breathing instructions.



If you are prescribing a Cine scan, the system automatically updates the Cine Duration value and the time set between the neighboring images.

1. Interscan Delay

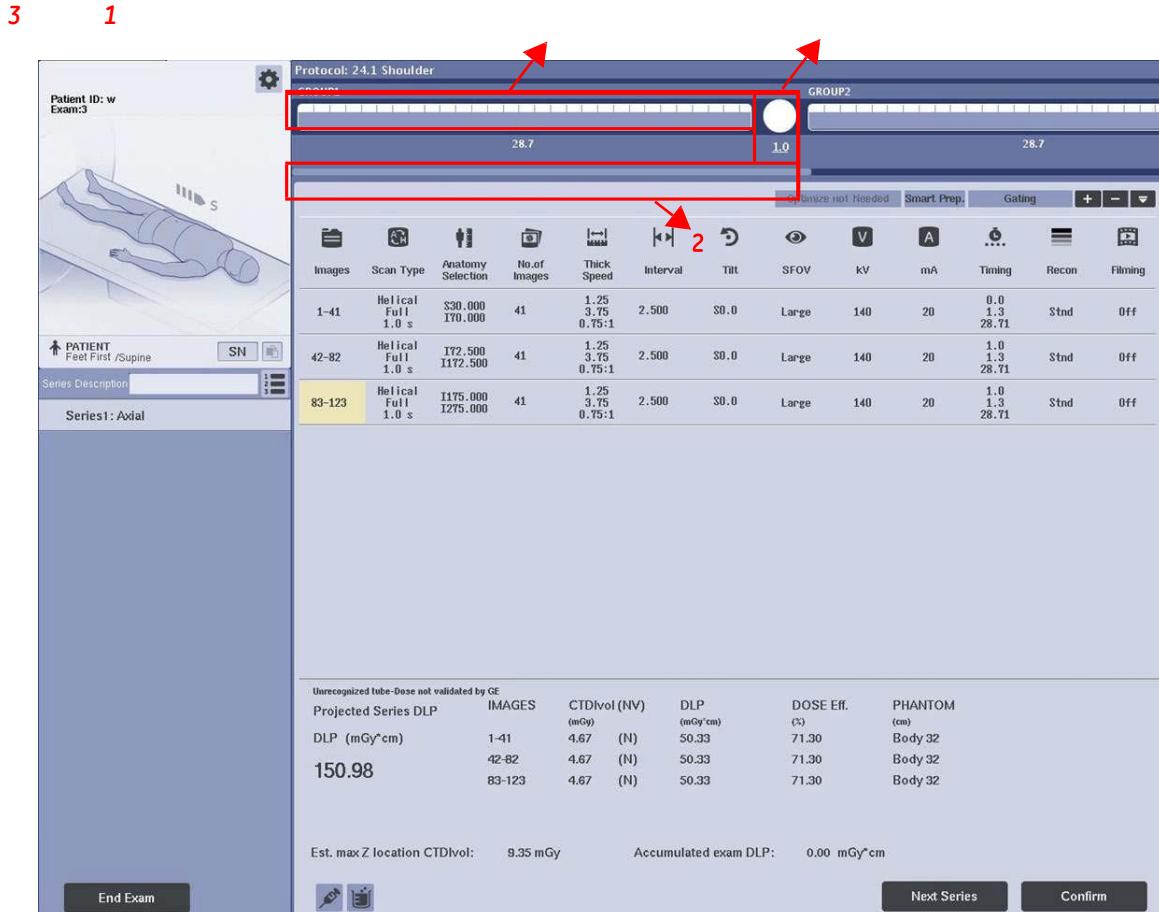
The scan progress bar allows you to view graphically how the combination of breath hold and breathe time affects your system.

Region 1: Click to directly set preparation group time.

Region 2: If the examined shape exceeds the width of the screen, you can drag the image to make it easier for viewing.

Region 3: Graphically indicates the type of scan.

Figure 9-44 Scan progress bar screen.



## TIMING PARAMETERS

### Set a Prep Group delay time

The Prep Group establishes how long the system waits before turning the X-ray on for a given group of scans. Use this procedure to set a Prep Group delay time for giving contrast with a timed delay or timing of Auto Voice instructions.



The minimum Prep Group delay will be impacted by parameter selection: related to the AutoVoice, SFOV, Rotation Time, Pitch and Start Location of the previous group. The system updates the group delay at Preview or Confirm to meet system requirements. Please check the operator console message bar on the ViewEdit screen before scanning.

1. In the ViewEdit screen, click **Timing** or click **scan timeline pre group** icon - "insert icon".
2. On the Timing tab, click **Prep Group**.
3. Type a scan delay time in seconds.
  - Valid ranges:
    - Group 1: 0 to 300 seconds
    - Group 2: 1 to 600 seconds, depending on scan modes. Helical requires a minimum 5 second delay and Cine requires a 1 second delay.
  - The delay time can change to accommodate Auto Voice.
  - If you are using the SmartPrep option, this field is replaced with SP and the time for the Diagnostic Delay.



The system starts to acquire the scan after you press **Start Scan** and the Prep Group delay time counts down to zero.



Start the injection at the same time as starting the scan to insure accuracy of when the IV<sup>1</sup> bolus arrives in the appropriate anatomy.



The Prep delay will be set to zero upon **Resume** after **Stop Scan** or **Pause** is selected during the Prep Delay countdown.

1. Intravenous

## Set the Interscan Delay time

When the scan type selected is Axial, the ISD<sup>1</sup> becomes available. ISD allows time for the table to move the correct amount of millimeters set for the Image Interval. It can also be used to help with tube cooling by increasing the value, extending the time between exposures allowing the heat units to dissipate. Use this procedure to set an Interscan Delay time for an axial scan prescription.

1. From the ViewEdit screen, click **Timing**.
2. On the Timing tab, click **ISD**.
3. Type a scan delay time, in seconds, between each axial scan.
  - This is the amount of time that you want to wait between each scan.
  - This can be useful when the optimizer is red. You can increase the ISD to allow for more tube cooling.
  - Typically, the ISD is set at 1 to 1.3 seconds so the exam is done as fast as possible.
  - The valid range is 1 to 300 seconds.



ISD is not available with Helical or Cine scan types.

---

1. Interscan Delay

## TIMING PARAMETERS

### Set a Breath Hold time

The Breath Hold parameter is the amount of time, in seconds, that your patient can hold his or her breath. Breath Hold, along the Breathe Time parameter, automatically divides all of your prescribed scans into Breath Hold scanning clusters. Use this procedure to set a Breath Hold time for how long the patient must hold his/her breath for each exposure.

1. From the ViewEdit screen, click **Timing**.
2. On the Timing tab, click **Breath Hold**.
3. Type a value, in seconds, for how long you want the patient to hold his or her breath.
  - Breath Hold and **Breathe Time** can be used in conjunction in order to cluster scans within a group.
  - The valid range for Breath Hold is N (None) or 1 to 120 seconds for Axial scans and 1 to 60 seconds for Helical scans.
  - The valid range is N (None) or 1 to 120 seconds.
  - For better registration of the patient's anatomy on the scan, use a longer Breath Hold time.
  - It is important that you practice with your patient to determine how long they can hold their breath.
  - Typical Breath Hold times are 10 to 12 seconds.



The coverage time shown in the Thickness/Speed pop-up does not account for breath hold times that have been prescribed in the protocol.

## Set a Breathe Time

Breathe Time is the amount of time, in seconds, you allow your patient to breathe in between breath hold clusters. Use this procedure to set a Breathe Time to allow the patient to breathe normally between breath holds.

1. From the ViewEdit screen, click **Timing**.
2. On the Timing tab, click **Breathe Time**.
3. Type a value, in seconds, for how long you want to give the patient to breathe between groups of scans.
  - **Breath Hold** and Breathe Time can be used in conjunction in order to cluster scans within a group.
  - The valid range is N (None) or 1 to 60 seconds.
  - It is important that you practice with your patient to determine how long they can hold their breath.
  - Typical Breathe Times are 10 to 12 seconds.
  - If there is IV contrast being injected, it is important to consider the appropriate length of this delay and its effect on patient comfort. Make sure that the patient can breathe, but do not make the time gap between breaths too long otherwise you lose the IV contrast.



The coverage time shown in the Thickness/Speed pop-up does not account for breath hold times that have been prescribed in the protocol.

## TIMING PARAMETERS

### Set the Voice options

Use this procedure to set the Voice/Light/Timer settings so that the system will automatically give the breathing instructions to the patient according to the Breath Hold, Breathe Time, and Total Exposure Time. If the Total Exposure Time is less than the Breath Hold time, the system uses only the time needed for the exposure. The Light and Timer features are visible on the gantry if these features are selected for use.



If the Voice/Light/Timer feature was selected for the scout series, it must be selected for the axial series as well.

1. From the ViewEdit screen, click ***Timing***.
2. On the Timing tab, click ***Voice Lights Timer***.
3. Select the commands you want to use for breathing instructions.
  - Three pre-recorded voices are available in 9 languages.
  - You can record an additional 17 voice instructions. See [Record an Auto Voice message](#).
  - You can set an Auto Voice preset delay. See [Change Auto Voice preset delay](#).
  - You can choose breathing lights and/or a timer.
  - If Auto Voice pre-recorded message 1, 2, or 3 is selected, the following languages can be selected: English –Male, English–Female, Japanese, French, German, Spanish, Mexican Spanish, Italian, Korean, and Chinese.

### Change the Auto Voice preset delay

The Preset Delay adds a delay between the completion of the Pre-scan message and X-ray on. This delay can be set per protocol. Use this procedure to set the preset delay before the ***Auto Voice*** message is played.

1. From the ViewEdit screen, click ***Timing***.
2. On the Timing tab, click ***Voice Lights Timer***.
3. On the Auto Voice screen, click the time next to ***Preset Delay Time***.
4. On the Preset Delay screen, click the desired delay time.
  - The valid range is 0 to 7 seconds.
5. Click ***OK***.

## RECON PARAMETERS

### Recon parameters Concept

See the [Recon parameters workflow](#) for procedures on how to set the following Recon parameters. The Recon parameters are set on the Recon Parameters tab and the Recon Option screen.

#### Recon type

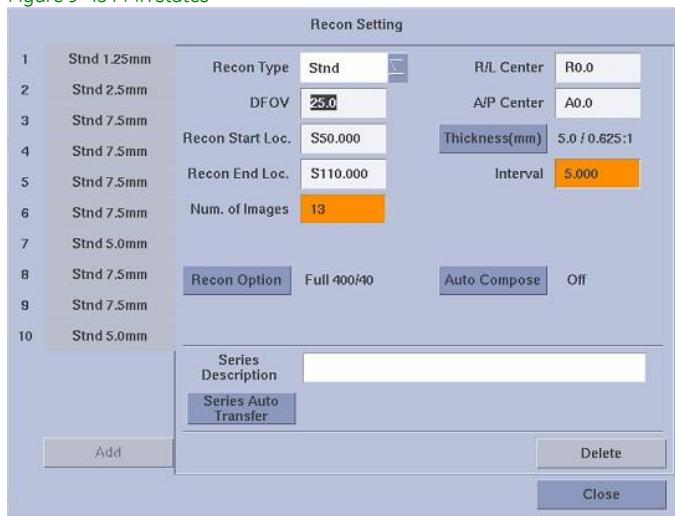
Available Recon Types are 8 algorithms.

#### Prospective Multiple Reconstruction

The system allows you to have up to nine additional reconstructions of your scan groups that uses all or any portion of a group to change several of the scan parameters. These parameters include DFOV<sup>1</sup>, Algorithms, Recon Modes, Window Width/Window Level, Image Center, Start and End Locations for each group, Image Interval, Slice Thickness, and Series Description. Copy Forward can be used to automatically fill in fields equal to PMR1, which can increase productivity and reduce errors. Rather than relying on retrospective reconstruction for additional data sets, you are able to create these sets prospectively.

PMRs are assigned sequential series numbers based on the series they are prescribed in, e.g., Series 2 has three additional PMRs prescribed for R2, R3, and R4. These reconstructions become Series 3, 4, and 5 in the exam.

Figure 9-45 PMR states



**Add** - open a new PMR group      **Close**-delete the most recently added PMR group **Deep blue** = prescribed **Yellow** = selected **Red** = prescribed with invalid values **Orange** = prescribed with values updated by the system



PMR is not compatible with Digital Tilt acquisitions.

## Full and Plus Recon modes

The system provides the ability to manage dose, slice profile, and helical artifact through the Full and Plus recon modes.

- Full mode provides a thinner slice profile but requires 10 to 15% more mA<sup>2</sup> than Plus mode with equal image noise.
- Plus mode has up to a 20% wider slice profile than Full, but requires 15 to 20% less mA with equal noise. At the same mA, Plus mode provides reduced image noise.
  - Reduction of helical artifacts can be seen with Plus mode.
  - Plus mode uses additional views of data to reconstruct an image.
  - When acquiring images in Plus mode, exposure time increases slightly to assure that enough views are collected to reconstruct all image locations prescribed.

- 
1. Display Field Of View
  2. Milliampere

Both modes can be used prospectively and retrospectively including PMR. Data acquired in Plus mode can be retrospectively reconstructed in Full mode or data acquired in Full mode can be reconstructed in Plus mode.

In general, every data channel will contribute to at least one image during helical image reconstruction. Some data channels are not used at the beginning and end of helical scan due to the physics of multi-slice scanning and helical view weighting algorithms.



Plus recon is only available for helical scan types.

For scan parameter recommendations, see the [Set axial and helical scan parameters](#).

## IQ Enhance

IQ Enhance is a special reconstruction process that can be prescribed to minimize artifacts commonly seen in thin slice helical acquisitions. If Helical scan type is selected, when slice thickness is 0.625 mm or 1.25 mm, IQ Enhance will appear on the [Recon Options screen](#). Intervals must be set equal to the slice thickness (0.625 or 1.25) or half the slice thickness (0.312 or 0.625).

Figure 9-46 Image Enhance images

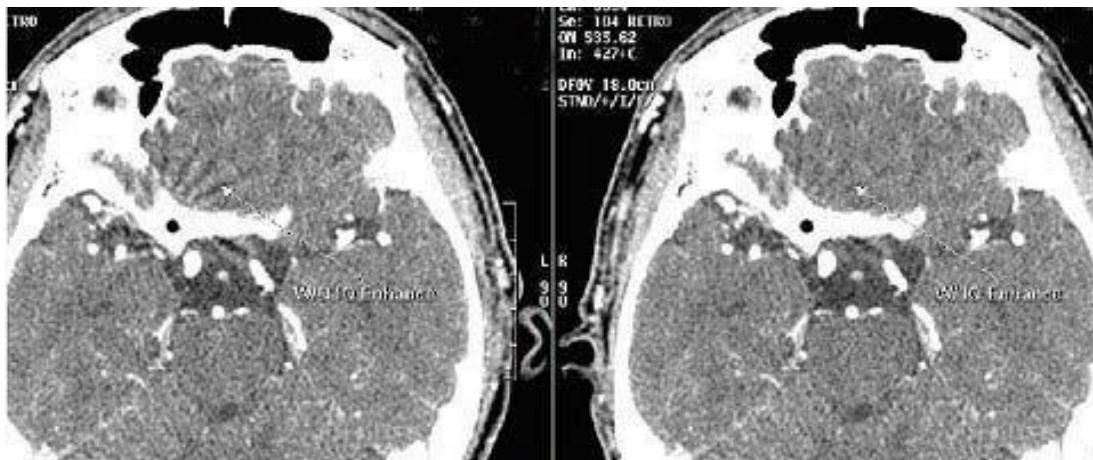


Figure 9-47 IQ Enhance enabled on ViewEdit screen

**Plus-E 400/40 None**

An "E" displays on the image next to annotation for recon algorithm to indicate IQ Enhance was enabled for the acquisition.



IQ Enhance is not compatible with Axial or Cine scan types.

## Flip Rotate

The reconstructed orientation of an image can be changed from the default mode in Recon by selecting one of the following flip/rotate options on the Recon Option screen. The flip option selected is shown on the ViewEdit screen.

- None
- FLR(Flip Left/Right)
- FTB(Flip Top/Bottom)

- FLR/FTB (Flip Left/Right and Top/Bottom).

The default orientation is based on a view from patient's feet. The reconstructed image orientation may differ from preferred anatomical viewing presentation where the patient's Right is on the viewers Left and the patient's Left is on the viewers Right.

The RAS information annotated on the image is applied according to the Flip R/L, Flip T/B or both Flip R/L and T/B selected for reconstruction of the image. Annotation indication that Flip/Rotate selection was applied to the reconstruction is displayed in the upper-left corner of the image.



Flip/Rotate options cannot be selected for images being acquired in the decubitus patient positions.



Flip/Rotate options are only available after service checks that the viewing stations will display the data correctly.

## Copy Forward

Copy Forward can be defined as a set of parameters to copy from Recon 1 to Recon 3: Orientation, Start and End Locations, Interval, DFOV and RL/AP Center. You can input (or copy) "D" or "d" into the parameter text box with a green border, to apply Copy Forward.

Where Copy Forward has been used in Recon 2 and Recon 3 for the Start and End Locations, the system keeps the range equal to that of Recon 1.

Figure 9-48 ViewEdit screen

To copy the Patient Position and Patient Orientation, select the Copy Patient Position, Patient Orientation, and Anatomical Reference button. When the protocol is used in New Patient, the fields where Copy Forward have been defined will be outlined in green.

To override Copy Forward, click in the text box and type the desired parameters.

## Series Split

Series Split provides to split multi groups prescribed in a View Edit series to separated series by groups. This capability allows the workflow improvement to diagnose an examination to compare groups taken with same location.

Figure 9-49 Series Split button



- In an example above, the first group will be in a series and the second and third group will be in the following series.



Series Split is not compatible with Neuro3D filter, Split Current Group.

## RECON PARAMETERS

### Recon Parameters tab



From the ViewEdit screen, click the **Recon Parameters**  icon to display the Recon Parameters tab.

Figure 9-50 Recon Parameters tab

Recon Setting					
1	Stnd 1.25mm	Recon Type	Stnd	R/L Center	R0.0
2	Stnd 2.5mm	DFOV	25.0	A/P Center	A0.0
3	Stnd 7.5mm	Recon Start Loc.	S50.000	Thickness(mm)	7.5 / 0.625:1
4	Stnd 7.5mm	Recon End Loc.	S110.000	Interval	15.000
5	Stnd 7.5mm	Num. of Images	5		
6	Stnd 5.0mm				
7	Stnd 7.5mm	Recon Option	Full 400/40	Auto Compose	Off
8	Stnd 7.5mm	Series Description			
9	Stnd 7.5mm	Series Auto Transfer			
10	Stnd 5.0mm				
<input type="button" value="Add"/> <input type="button" value="Delete"/> <input type="button" value="Close"/>					

#### DFOV

#### R/L Center

#### A/P Center

#### Recon Type

#### Matrix Size

Default is 512 for best image resolution.

#### *Click [Recon Option]*

#### Auto Apps

The Auto Apps feature allows you to create thick slice axials from thin data sets without image reconstruction while the scan is in progress. **Neuro 3D Filter**.

## Recon Option screen



From the ViewEdit screen, click **Recon Parameters** icon. Click **Recon Option** to display the Recon Option screen.

Figure 9-51 Recon Option screen

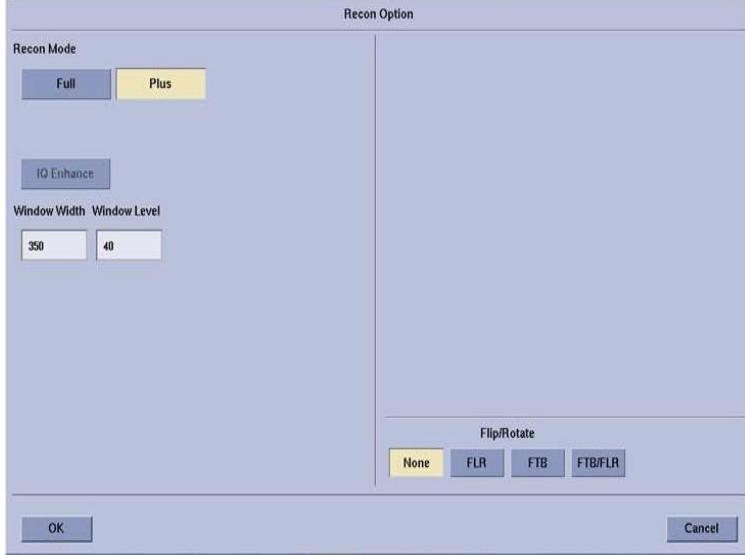
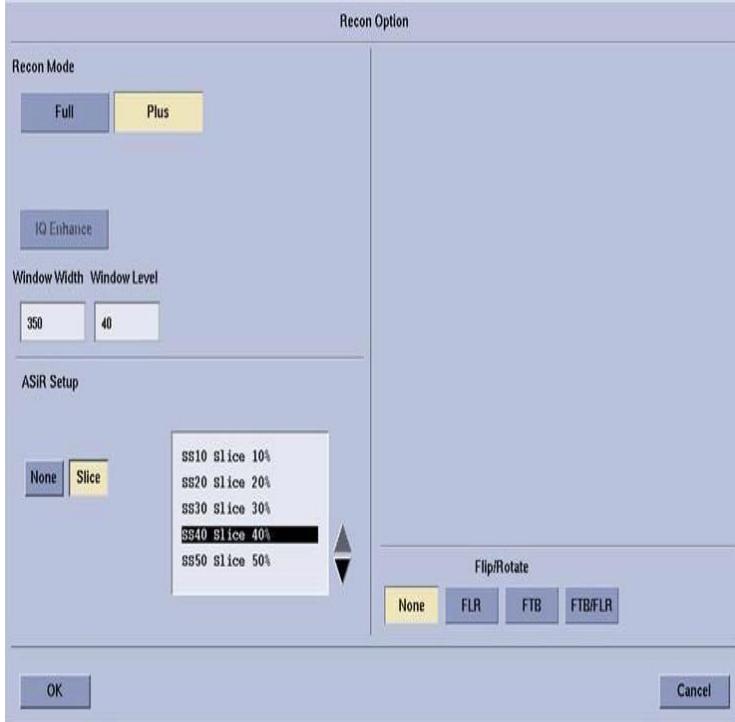


Figure 9-52 Recon Option screen with ASiR



## Recon Mode

*Full Plus  
segment  
IQ Enhance*

## Window Width and Window Level

Window Width/Level can be defined for the different groups. Window Width and Window Level values entered on the Recon Option screen are also added to film Set 1 on the AutoFilm tab.

## ASiR Setup

ASiR Setup allows you to select the desired ASiR<sup>1</sup> noise reduction in your images. Click Slice and then select the desired blending level.

- Slice mode:
  - can be applied to acquisitions of any slice thickness and any acquisition mode where noise reduction is in X and Y (2D).
  - can be applied to a range of slices.

See ASiR for more information.

## Flip/Rotate

Flip/ Rotate allows you to specify the image presentation to be flipped/rotated from the system default presentation in Recon opposed to apply to image in display. See [Flip Rotate](#).



## Slice Thickness screen

From the Scan Parameters screen, click ***Slice Thickness***.

Figure 9-53 Slice Thickness screen- Axial

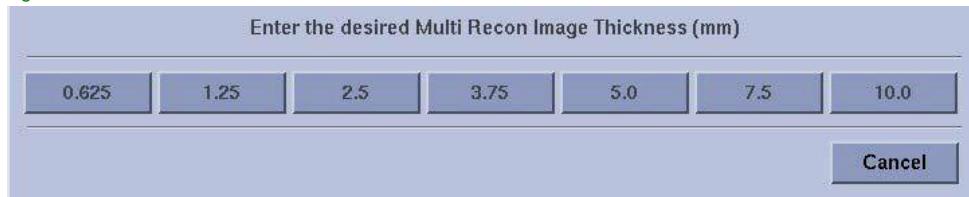
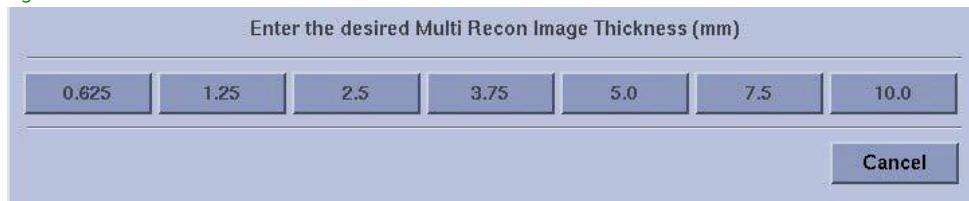


Figure 9-54 Slice Thickness screen- Cine



Figure 9-55 Slice Thickness screen- Helical



### Slice thickness

- axial
  - 1.25 mm beam - 0.625mm
  - 5 mm beam - 1.25 mm, 2.5 mm, 5.0 mm
  - 10 mm beam - 1.25 mm, 2.5 mm, 5.0 mm, 10.0 mm
- cine
  - 1.25 mm beam - 0.625mm
  - 5 mm beam - 1.25 mm, 2.5 mm, 5.0 mm
  - 10 mm beam - 1.25 mm, 2.5 mm, 5.0 mm, 10.0 mm
- Helical
  - 1.25mm beam - 0.625mm\*
  - 5mm beam - 1.25mm, 2.5mm
  - 10 mm beam - 1.25 mm, 2.5 mm, 3.75 mm, 5 mm, 7.5mm, 10mm

\*With Sub-MM Imaging Mode

## RECON PARAMETERS

### Recon parameters workflow

Most of the recon parameters are already set from the protocol and from the adjustments that you made with the graphic lines on the scouts. When setting the recon factors, it is important to know why you are scanning the patient and what you are looking for. To look for fractures, a series of parameters different from looking for tumors should be used. Use PMR R1 to R10 to reconstruct image according to 10 different methods.

#### Precautions

- Non-contiguous groups may be created when add group and Recon 2 to 10 is on. Prior to confirming the scan, check that the interval between the end location of group 1 and start location of group 2 for Recon 2 to 10 is equal to the selected slice thickness.



- From the ViewEdit screen, click the **Recon Parameters** icon.
- On the Recon Parameters tab, **set the DFOV**.

#### **Set the Right/Left Center coordinates.**

- Set the Anterior/Posterior Center coordinates.**



If **D** was selected in Protocol Management, DFOV, A/P Center, R/L Center for reconstruction is updated automatically to the values used in the previously scanned series. R2 to R10 values are copied from R1.

#### **Set the Recon Type.**

- The **Matrix Size** is set at 512 for best image resolution.

#### **Set the Recon Option.**

- For a second reconstruction, set R2.
  - Click **Show R2**.
    - You can change your start and end locations as long as they do not exceed R1.
    - You can change the slice thickness, interval, DFOV, R/L, A/P, and Recon Type to a different value than R1.
    - If you want a different Series Description than R1, type the desired description in the Series description field. If the description is blank, it will use the same description as R1 and add Recon 2 or Recon 3 to the beginning of the description.
  - Click **Yes**.
    - If it is not already selected in the protocol.
    - When Yes is selected, the Start/End Locations, Interval, DFOV, R/L Center, and A/P Center parameters are copied from Recon 1.



If Duplicate has been enabled, do not select Yes as this will clear Duplicate mode.

- If Duplicate is not enabled in the protocol and you want to enable it, type **D** in the fields (Start/End Locations, Interval, DFOV, R/L Center, and A/P Center) you want to duplicate.
- Repeat steps with Recon 3 to 10 if additional reconstructions are desired.
- To transfer Recon 1 to 10 to another workstation or PACS, click **Series Auto Transfer**.
- Select the host to which you want to network Recon 2 to 10 and click **OK**.



Up to 10 reconstructions of data from one exposure can be programmed. To set up the other reconstructions, click **the desired PMR (R2 to R10)** and enter appropriate values in the parameter columns or cells, as needed.



To transfer Recon 2 to 10 to another workstation, click **Series Auto Transfer**. All 10 recons can be sent to a different place than set in the Exam Transfer Level.

## Set the Display FOV

Use this procedure to enter a DFOV that covers the anatomy of interest. This allows you to target a particular piece of anatomy for display and determines how much of the SFOV is reconstructed into an image. Within the DFOV, an image center must be set with the **R/L Center** and **A/P Center**.



1. From the ViewEdit screen, click **Recon Parameters** icon.
2. On the Display Parameters tab, click **DFOV**.
3. In the field, type and Enter the value of the patient's measurements.
  - Measure and increase by 2 cm at the patient's widest point. This will display the entire anatomy and all soft tissues around.
  - If an R, L or A, P value is more than half of the DFOV, then the R/L, A/P image annotation does not display on the images. For example, if DFOV is set as 10 cm, R value as 56 mm, then the image annotation will display R R. Using an R-L or A-P value (mm) smaller than half the DFOV can prevent situations like this.
  - If D was enabled for Recon 1 in Protocol Management, the DFOV will be copied from the previously scanned series.
  - The minimum DFOV is 9.6 cm.
  - The maximum DFOV depends on the selected SFOV.



Alternatively, set the DFOV graphically. On the Show Localizer image, click and drag the diamond handles to increase or decrease the DFOV. The system automatically updates the value in the feature area.



In certain situations when the signal-to-noise for an acquisition is low and depending on resolution for the image, faint rings may be seen in axial and cine images. If the DFOV and slice thickness are increased, the rings may be diminished.

## RECON PARAMETERS WORKFLOW

### Set the R/L Center coordinates

Use this procedure to set the R/L Center parameter, which allows you to define the DFOV center of the image in the Right/Left directions relative to iso-center of the SFOV. This is useful for minor adjustments to imperfections in centering the patient on the table or if an offset structure such as the spine or kidney is what you want centered. If large adjustments are needed, then you should consider re-positioning the patient on the table.



1. From the ViewEdit screen, click the **Recon Parameters** icon.
2. On the Recon Parameters tab, click **R/L Center**.
3. To find the coordinates, place the mouse over the Show Localizer AP<sup>1</sup> scout image and look at the R<sup>2</sup> and L<sup>3</sup> readout at the bottom of the image.
  - Continuous Report Cursor in Exam Rx Display Preferences must be turned on.
4. In the field, type and Enter an R or L prefix and the R/L center coordinates, in millimeters.
  - The range of values can be from 0 to one-half the SFOV (e.g., Head SFOV is 25 cm so the maximum offset R/L is 12.5 cm or 125 mm). Typically, you would not want the offset to exceed one-half the DFOV or the resulting image does not show a right or left marker, it does show markers as R-R or L-L.
  - Entering a value other than zero off centers the image in the right and left axes of the patient.
  - Plus (+) can be used for R values and Minus (-) for L values for faster data entry using the ten key pad.
  - If D was enabled for Recon 1 in Protocol Management, the R/L Center will be copied from the previously scanned series.



Alternatively, the R/L Center may be set graphically by using the X annotation on the AP scout image reference lines. Press and hold **Shift**, and then click and drag the X to center over the area of interest.

---

1. Anterior/Posterior

- 2. Right
- 3. Left

## Set the A/P Center coordinates

Use this procedure to set the A/P Center parameter, which allows you to define the DFOV center of the image in the Anterior/Posterior directions relative to the SFOV. This is useful for minor adjustments to imperfections in centering the patient on the table or if an offset structure such as the spine or kidney is what you want centered. If large adjustments are needed, then you should consider re-positioning the patient on the table.



1. From the ViewEdit screen, click the **Recon Parameters** icon.
2. On the Recon Parameters tab, click **A/P Center**.
3. To find the coordinates, place the mouse over the Show Localizer lateral scout image and look at the  $A^1$  or  $P^2$  readout at the bottom of the image.
4. In the field, type and Enter A or P prefix and the A/P Center coordinates, in millimeters.
  - The maximum offset for A/P Center is one half the SFOV from isocenter selected (e.g., Head SFOV is 25 cm so the maximum offset A/P is 12.5 cm or 125 mm).
  - Entering a value other than zero off centers the image in the anterior and posterior axes of the patient.
  - Plus (+) can be used for A values and Minus (-) for P values for faster data entry using the ten key pad.
  - If D was enabled for Recon 1 in Protocol Management, the A/P Center will be copied from the previously scanned series.



Alternatively, the A/P Center may be set graphically by using the X annotation on the lateral scout image reference lines. Press and hold **Shift**, and then click and drag the X to center over the area of interest.

- 
- 1. Front
  - 2. Posterior

## RECON PARAMETERS WORKFLOW

### Set the Recon Type

Use this procedure to set the Recon Type to designate the algorithm used for reconstruction of the images.



1. From the ViewEdit screen, click the **Recon Parameters** icon.
2. On the Recon Parameters tab, click **Recon Type**.
3. Select the appropriate algorithm for the primary or first reconstruction.
  - The algorithms going from top to bottom increase spatial resolution and decrease low contrast detectability.
  - Click **Soft** for tissues with similar densities, but not useful for un-enhanced scans.
  - Click **Stnd** for routine exams, e.g., chest, abdomens, and pelvis scans.
  - Click **Lung** for interstitial lung pathology.
  - Click **Chest** for mediastinum and lung detail studies. It provides soft tissue resolution and contrast when viewing the images in a soft tissue/mediastinal W/L<sup>1</sup> and high resolution of the lung tissue when viewing the images in a lung W/L.
  - Click **Detail** for post myelograms, where hybrid tissue detail and bone edges are important.
  - Click **Bone** for High resolution exams and sharp bone detail.
  - Click **Bone Plus** for sub mm detailed head work. It can be used for any study that normally used the bone algorithm, but is very useful in cases where the Edge algorithm was used. This is because the Bone Plus algorithm has no reconstruction penalty and is very close in standard deviation to Edge.
  - Click **Edge** for small bone work in the head, as well as high resolution scans.
  - Click **Ultra**: Used for inner ear scan. It can improve the image and the details of the inner ear.

1. Window Width and Window Level

## Set the Recon Options

Use this procedure to set the Recon Option for the reconstructed images.



Recon

1. From the ViewEdit screen, click the **Recon Parameters** icon.
2. On the Recon Parameters tab, click **Recon Options**.
3. On the Recon Option screen, select the desired options.
  - If the scan type is Helical, click **Full** or **Plus**. For Axial, the Recon Mode is set to Full.
    - When using Helical scan, if the slice thickness is 0.625 mm, then it can only be used when the pitch is 0.5X:1 at full and plus modes. For other pitch values, only the Plus mode can be used on the 0.625 mm slice thickness.
  - If the scan type is Cine, click **Full** or **Segment**.
  - Click **IQ Enhance** to minimize helical artifacts seen in helical thin slice images.
    - Image Enhance is compatible with 1.25 mm slice thickness.
    - Intervals must be set equal to the slice thickness (1.25) or half the slice thickness (0.625).
    - An "E" is added to the Recon Mode option display to indicate IQ Enhance is enabled.
    - IQ Enhance annotation is added to the left side of the image.
  - To enable ASiR, click **Slice** mode and select the desired ASiR percent of noise reduction.
  - Type Window Width and Window Level values. These values are also added to Film Set 1.
  - To flip or rotate the image in recon so the image will be reconstructed in the orientation desired for viewing, click **FLR** (flip left to right), **FTB** (flip top to bottom), or **FTB/FRL** (flip both top to bottom and left to right).
    - The Flip/Rotate option is turned off when software is delivered. A service representative can enable Flip/Rotate once you are sure that remote viewing stations display the flipped and rotated images correctly.
    - Images are annotated with Fl:LR, Fl:TB and Fl:Rotate 180 on the left side of the image when prescribed in recon.
    - Flip/Rotate and non Flip/Rotate images cannot be mixed in the same series.



If Flip/Rotate in Recon and Continuous Cursor are enabled on a system, the RAS<sup>1</sup> coordinates displayed on the left side of the image have the Flip/Rotate annotation intermixed with the RAS information. If Flip/Rotate was not applied to the image, there is a blank space in between the RAS information.



Plus Recon mode is not annotated on the Series Text Page.

---

1. Right Antererior Superior

---

## AutoVoice

AutoVoice provides automated breathing instructions to your patient and pre-message with SmartPrep. This allows for consistent breathing instructions, which assists in more precise timing in the exam. Your system also comes equipped with microphones at the console and gantry for communication with the patient.

The system has three pre-recorded AutoVoice message sets in nine selectable languages that cannot be deleted. You may record up to 17 additional messages on your system.

The default language for AutoVoice 1, 2 and 3 is set by service in Reconfig. The default language can be set to one of the following languages:

- English Male
- English Female
- Japanese
- French
- German
- Spanish
- MexicanSpanish
- Italian
- Korean
- Chinese



AutoVoice may fail to function, especially during system simultaneity. Make sure that you can hear the AutoVoice to recognize if AutoVoice has quit. Manually breathe the patient when this occurs.

## AUTO VOICE

### AutoVoice screen

The AutoVoice screen has three pre-recorded voice messages and 17 blank areas.

Figure 9-56 AutoVoice screen

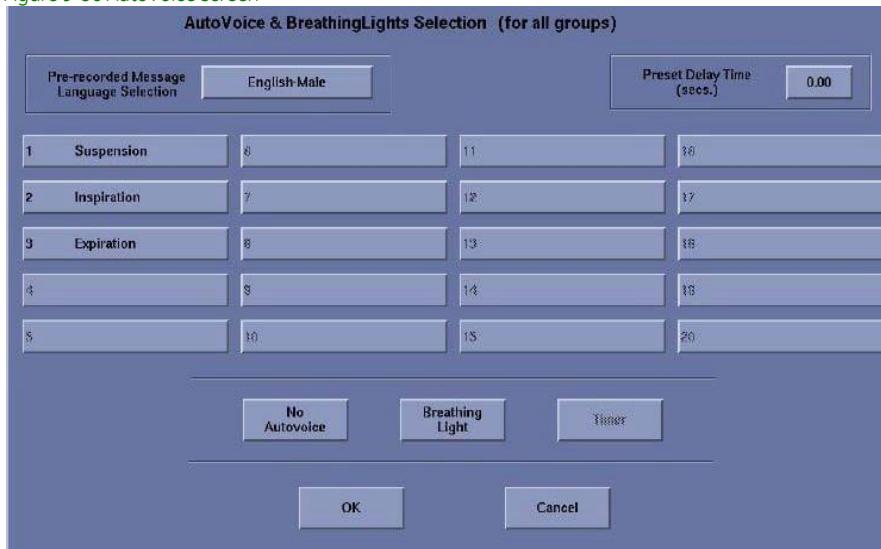
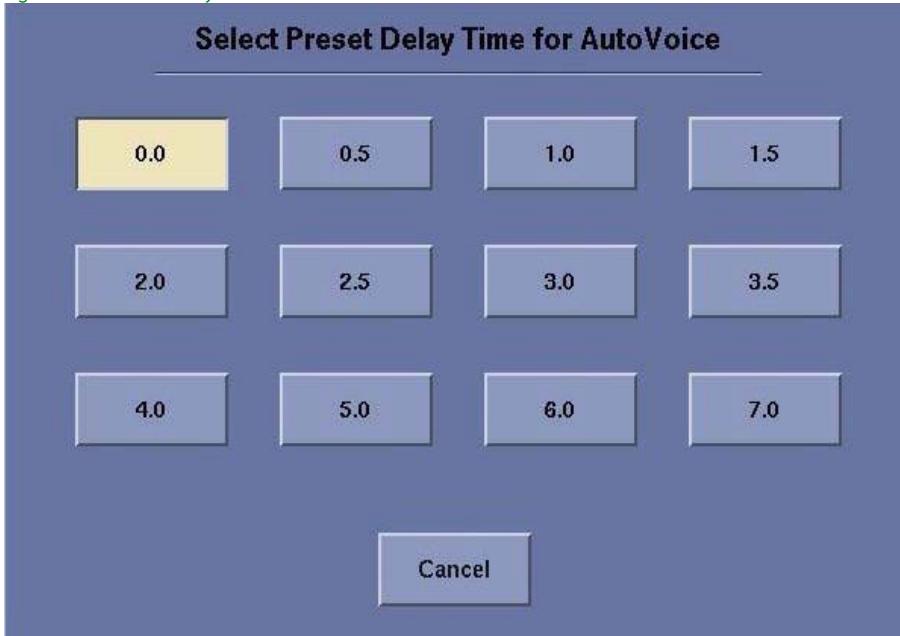


Figure 9-57 Preset Delay screen



## AutoVoice workflow

Use the Auto Voice feature to provide your patient with automated breathing instructions.

1. [Set the default language](#), if necessary.

*Record an Auto Voice message.*

2. [Change Auto Voice preset delay](#).
3. [Control the Auto Voice volume](#).
4. [Delete an Auto Voice message](#), if necessary.

## Precautions

Auto Voice messages brought onto a your console from other GE CT systems may not transfer correctly due to system hardware differences. Review messages before using them with patients. Any messages that are incorrect need to be recorded again on the your console.

## Set the Auto Voice language

Use this procedure to set the language for Auto Voice 1, 2, and 3.

1. From the ViewEdit screen, click **Timing**.
2. On the Timing tab, click **Voice Lights Timer**.
3. On the **Auto Voice screen**, click **English Language-Male**.
  - There are nine different languages to choose from: English-Male, English-Female, Japanese, French, German, Spanish, Mexican Spanish, Italian, Korean, or Chinese.
4. On the Auto Voice Language Selection screen, select the desired language.
  - When using the multi-language options for Auto Voice 1, 2, and 3, any of the 9 available languages can be selected for the exam. Once an exam is completed, the system will reset the Auto Voice language back to the default language set in Reconfig.
  - The Auto Voice language displayed at the time the system is booted up is the default language set by your Field Engineer in Reconfig.
5. Click **OK**.



You will no longer be able to click **Play** or select a voice message in Message Management if the Auto Voice language is changed while a voice message is playing. If this occurs, click **Record**, and then **Stop** to enable selection of a voice message, and then click **Play**.



The Prep Group delay will not update to the minimum delay for the Pre message voice to play when the Auto Voice Language is changed. Update the prep group delay manually prior to confirming the scan.

**AUTO VOICE WORKFLOW****Record a message**

The system has three pre-recorded voice message sets in nine selectable languages that cannot be deleted. Use this procedure to record up to 17 additional Auto Voice messages on your system.

1. From the **Monitor**, click the **Protocol Management** icon.
2. Click **Auto Voice Record**.
3. To record a message, type a name and press **Enter**.
  - Every selection must have a name.
  - Title the name it so it is easily identifiable (i.e., Mary S. Inspiration), that way you know whose voice is being used and the content of the message, especially if the message entered is in another language.
4. Click **Record** and begin message.
  - Click and hold **Record** until you are ready to begin your message. Normally, you are recording a pre-message first, e.g., "Take in a breath and hold it." When you release the mouse button, the recording starts as indicated by the clock to the right of the button.
  - Begin your message right away.
  - Speak clearly toward the microphone located on the SCBSV.
5. Click **Stop** as soon as you finish speaking.
  - The total time of the message is displayed in the clock.
  - If you make a mistake, simply click **Stop** and then repeat these steps.
  - The length of a recorded Auto Voice message may be shorter after it is recorded and saved than during the recording of the message.
  - Try to start and stop the recording as quickly as possible to avoid adding time to the beginning or end of a message.
6. Click **Pre-Message** next to the name you just entered.
7. Click **Save Message**.
8. Click **Record** and begin your Post-Message.
  - Repeat the steps to record a message for post instructions (e.g., Breathe normally).
9. Click **Post-Message**.
10. Click **Save Message**.
11. To hear a recorded message, click the selection's Pre- or Post- message and then click **Play** in the Message Management area.



The length of a recorded Auto Voice message may be shorter after it is recorded and saved in comparison to when it was recorded.



See [Change Auto Voice preset delay](#) to change the delay time between the completion of the Pre-scan message and X-Ray on.



See [Control the Auto Voice volume](#) to adjust the Auto Voice volume level in the scan room.

### Delete a message

It may be necessary to remove old or unwanted messages from the system as employees change or as different languages are required. Use this procedure to delete an Auto Voice message.

1. From the **Monitor**, click the **Protocol Management** icon.
2. Click **Auto Voice Record**.
3. On the Auto Voice screen, select the title of the message you want to delete.
  - The three pre-recorded messages cannot be deleted.
4. Click **Delete Set**.
5. Click **Done**.

## *Additional scan features*

Use the following additional scan features as needed. They can be used during a patient scan.

Figure 9-58 View edit screen: Other functional regions



1. Optimize
2. Smart Prep
3. Add/delete group
4. Split Current Group
5. Biopsy Rx
6. mA Table
7. Organ dose modulation
8. one more
9. Priority Recon
10. More Info

### *Add/split/delete a group/One More*

The following procedures can only be used during a scan.

#### *Add a group*

Use this procedure to insert another set of images following the prior group with all of the same factors, except for the Start and End locations within the same series.

1. From the ViewEdit screen, click **Add Group**.
  - Each time the button is clicked, a new group is added.
  - The start location of the new group automatically set contiguous to the end of the prior group.
  - The end location is determined by the number of slices, slice thickness, and image interval.

#### *Split the current group*

Use this procedure to split a selected group into separate groups. This is helpful for tube cooling issues or breath hold scans.

1. Click the first box (with image numbers) at the start of the group of the group you want to split.
2. Click **Split Current Group**.
3. Choose to split the group by image number or location.

#### *Delete the selected group*

Use this procedure to remove an entire group from a series.

1. Click the first box (with image numbers) at the start of the group of the group you want to delete.
2. Click to **delete the selected group**.

#### *One More*

Allows you to scan one more of the prescribed series.

For Axial scans, one more group of images is acquired for a group, and collect the last group of images for multiple sequences.

For Helical scans, one more image is acquired.

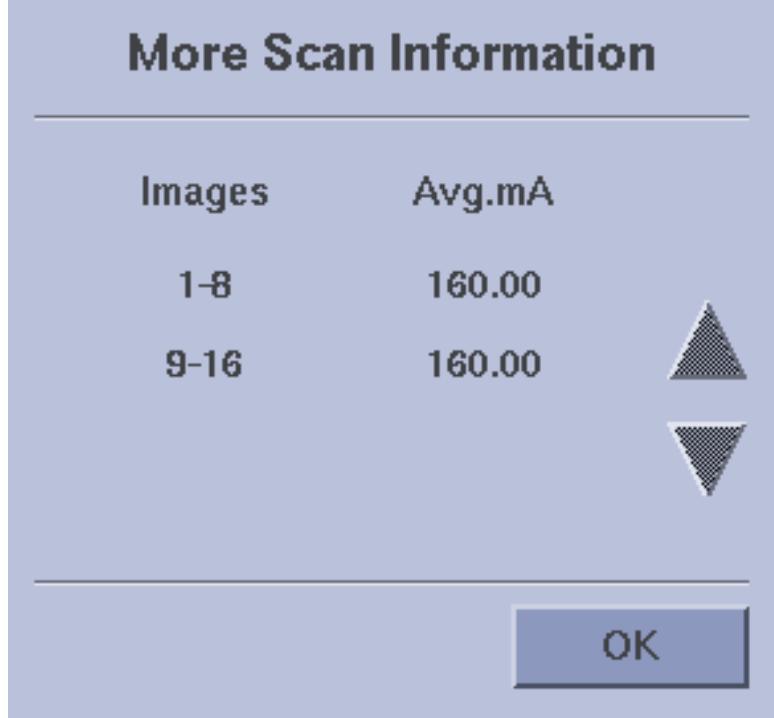
For Cine scans, the entire scan prescription repeats.

## ADDITIONAL SCAN FEATURES

### *More scan information*

Additional information for the average mA for the acquisition can be displayed prior to scanning and after scanning using the More Info button on the ViewEdit and Dynaplan screens. The More Scan information screen displays the average mA for the acquisition when selected after the scan is completed.

Figure 9-59 More scan information



### *Optimize technical parameters*

If the system cannot complete the entire scan prescription with the technical parameters that you have selected, the Optimize icon displays in red. At this point, you can select the Optimize icon to open the Technique Optimize screen and adjust your technique.

1. From the **ViewEdit screen**, click the red Optimize icon.
  - The Optimize screen calculates and displays in real time up to three factors that can be changed to allow the system to continue.
2. On the Technique Optimize screen, select a parameter that you feel is best for your prescription.
  - Only one parameter (Up Front Delay, mA, or Group Delay) has to change for the scan to continue.
  - Up Front Delay is the time before you can proceed with scanning.
    - This parameter can be changed by the amount shown in the Up Front Delay column.
    - The Start Scan button is not active until the Up Front Delay time expires.
  - The mA parameter can be changed to what displays in the mA column.
    - If you choose to reduce mA, you may be reducing image quality.
    - Make sure that you always use enough mA to get the best image quality.
  - The Group Delay parameter can be changed to what displays in the Group Delay column.
  - If multiple groups are prescribed, the Optimize screen updates for each group, allowing you to make choices for each group.
  - Once you have made choices that satisfy the system without compromising image quality, a message displays that tube cooling is no longer needed and the Optimize in Progress icon is highlighted in blue.
3. Click the blue **Optimize in Progress** icon.
4. Click the **Confirm** icon to start the scan.

## ***ADDITIONAL SCAN FEATURES***

### ***Optimize patient dose***

For years GE has followed the ALARA<sup>1</sup> principle in helping our customers optimize dose. GE has provided many tools to help the clinician minimize dose while achieving clinically diagnostic image quality.

GECT is a proven leader in delivering dose efficiency in every scanner category. GE has achieved this position through a "total system" approach. The following features are some of the features that contribute to our "total system" approach and affect patient dose. Not all features are available on each system.

If you want to know more information in this area, you can order our brochure "Dose in Computed Tomography: Basics, Challenges, Solutions (01-7192)" through the following website:  
<http://www.gemedicalsystems.com/rad/ct/optidose.html>.

### ***Pediatric protocols***

The pediatric protocols are based upon a child's size, age, and weight and tailor the dose or treatment to the size of the patient.

The Head and Orbit categories are aged based. The rest of the categories are height and weight based protocols.

### ***AutomA/SmartmA***

AutomA/SmartmA modulates X-ray tube mA to account for specific patient anatomy – based upon data gathered from the scout image. The system predicts the optimal setting for the exam and adjusts mA to these settings. This maintains the best image quality at the lowest dose.

### ***SmartHelical***

SmartHelical is integrated into all GE CT systems. It decreases image noise as measured by pixel standard deviation.

### ***Automated Reviewer for Faster R&D***

This specialized reading tool automatically has reviewed millions of images to help GE engineers optimize algorithms and pitch settings and is still in use today.

*Presented as RSNA Paper 2001*

### ***Advanced Artifact Reduction (AAR)***

A low-signal magnification tool that allows low-dose protocols to be used in highly attenuating regions. AAR is automatically enabled as needed.

### ***Advanced Noise Reduction (ANR)***

A low-signal correction algorithm that allows low-dose protocols to be used in highly attenuating regions. ANR is automatically enabled as needed.

digital oblique images.

### *HiLight Matrix Detector*

The HiLight Matrix Detector material was developed by GE specifically for CT scanning, offering a 98% absorption efficiency. It also offers the capability of more slices without increasing dose.

- 
1. As Low As Reasonably Achievable

### ***Tracking Collimator***

Developed originally for the LightSpeed systems, the tracking collimator keeps the beam focused only on the active detector cells, and makes sub-millimeter scanning possible with high dose efficiency.

### ***Protocol Wizard***

Automatically adjusts affected parameters to keep image noise constant, dose optimized and within specifications of the scanner.

### ***Neuro3D Filters***

Noise reduction filters for thin slice acquisitions for applications where data will be manipulated in 3D modes such as reformat or maximum intensity projections for neuro applications.

### ***ASiR (Adaptive Statistical Iterative Reconstruction)***

A reconstruction technology that may enable reduction in pixel noise standard deviation. The ASiR reconstruction algorithm may allow for reduced mA in the acquisition of diagnostic images, thereby reducing the dose required.\*

ASiR is also a reconstruction technology that may enable improvement in low contrast detectability.\*

\*In clinical practice, the use of ASiR may reduce CT patient dose depending on the clinical task, patient size, anatomical location and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task.

### ***Dose Reports***

CTDIvol<sup>1</sup>, DLP, and Dose Efficiency displays during scan prescription and provides patient dose information. The CTDIvol, DLP, and Phantom size used to calculate dose is automatically saved once you select End Exam. TDose Report is kept as the second-level screen capture of DICOM<sup>2</sup> 999 sequence. This sequence can film, archive, and connect to a network after completing the scan.

A DICOM Structured Dose Report generates a CT Dose Report which can enable tracking of dose for the patient by the hospital radiation tracking system/RIS/HIS.

### ***No Post Patient Collimation***

GE uses only pre-patient collimation, providing excellent detector efficiency in sub-millimeter mode.

- 
1. Dose length product
  2. Digital Imaging and Communications in Medicine

## ADDITIONAL SCAN FEATURES

### *View the Dose Report*

Use this information regarding patient dose.

CTDIvol<sup>1</sup>, DLP, and Dose Efficiency displays during scan prescription and provides patient dose information.

### Precautions

The Dose Text page displays a message for non-GE tubes that the dose information may not be correct because the calculations are based on known GE tube response.

### *Prerequisite*

Before DICOM Structured Dose Report is turned on, confirm that your PACS or receiving station you want it sent to supports structured reports.

### *End exam*

1. Contact your service representative to enable DICOM SR Dose Report.
  - For more information, refer to section 9.5 in the DICOM Conformance Statement available for this release of software.
2. Click **End Exam**.
  - The CTDIvol, DLP, and Phantom size used to calculate dose is automatically saved.
  - A DICOM Structured Dose Report generates a CT Dose Report which can enable tracking of dose for the patient by the hospital radiation tracking system/RIS/HIS.
  - DICOM SR Dose Report is saved as part of the patient's exam in Series 997. It can be configured to either a Radiation Dose SR SOP or an Enhanced SR SOP.
  - DICOM SR dose report cannot be opened on the scanner at present, it can be reviewed and printed using Reporting Tool on the Advantage Windows workstation or any station that can read a DICOM Structured Report format. It cannot be saved to DVD or CD on the AW<sup>2</sup> system (4.4 or lower).
  - The phantom size for dose calculation for SmartPrep Monitor scans is not shown. The same size phantom used to calculate dose for the series is used for the SmartPrep images.
  - Dose report is kept as the second-level screen capture in sequence 999, which can film, archive, and connect to a network after completing the scan.
3. If desired, film the report.
  - Manual Filming: Launch ImageWorks and film the secondary image capture.
  - You may need to adjust the W/L for the Dose Report saved series to make the information visible when transferred to a PACS or workstation.



Dose information at "Confirm" may be different in all scan types from actual dose displayed in Dose Report. In the case, the corresponding dose information could exceed the Notification/Alert Value without any confirmation popup and the dose information and Notification/Alert Value will not be logged. Need to understand the case could happen due to the scan technique characteristics.



If Edit Patient is performed on an exam, the Dose Report and Dose SR report will be excluded from the Edited Patient information due to the format of these files.

1. Dose length product
2. Advantage Workstation

## ADDITIONAL SCAN FEATURES

### Dose Information screens

Figure 9-60 1 = Dose on Scan screen, 2 = Scan parameters, 3 = Dose report

Series	Type	Scan Range (mm)	CTDlvol (mGy)	DLP (mGy·cm)	Phantom cm
1	Axial	50.000-557.500	93.37	560.24	Head 16
1	Axial	560.000-5135.000	63.88	511.06	Head 16

Total Exam DLP: 1071.30

Attention  
Unrecognized tube in use. The reported dose information is calculated based on empirical observations of systems with GE tubes. GE cannot assure the accuracy of reported dose information for any configurations that include tubes other than GE tubes.

1  
2  
3

The Dose Information screen in ViewEdit displays the following Attention message when an unrecognized tube is in use.



### Attention

Unrecognized tube - Dose not validated by GE.

Figure 9-61 Dose Information screen

Unrecognized tube-Dose not validated by GE

Projected Series DLP	IMAGES	CTDlvol (mGy)	DLP (mGy·cm)	DOSE Eff. (%)	PHANTOM (cm)
DLP (mGy·cm)	1-8	0.89 (43)	3.54 (20)	95.98	Body 32
10.63	9-16	0.89 (43)	3.54 (20)	95.98	Body 32
	17-24	0.89 (43)	3.54 (20)	95.98	Body 32

Est. max Z location CTDlvol: 0.89 mGy      Accumulated exam DLP: 0.00 mGy·cm

The Dose Text page displays the following Attention message when an unrecognized tube is in use.



### Attention

Unrecognized tube is in use. The reported dose information is calculated based on empirical observations of systems with GE tubes. GE cannot assure the accuracy of reported dose information for any configurations that include tubes other than GE tubes.

**Figure9-62 Dose Report**

Patient Name:	Exam no: 24											
Accession Number:	Nov 08 2011											
Patient ID: Dose SR												
Exam Description:												
<b>Dose Report</b>												
Series	Type	Scan Range (mm)	CTDvol (mGy)	DLP (mGy-cm)	Phantom cm							
1	Axial	50.000-557.500	93.37	560.24	Head 16							
1	Axial	560.000-5135.000	63.88	511.06	Head 16							
Total Exam DLP:		1071.30										
Attention												
Unrecognized tube in use. The reported dose information is calculated based on empirical observations of systems with GE tubes. GE cannot assure the accuracy of reported dose information for any configurations that include tubes other than GE tubes.												
1/1												
W:1 L:-2												





# Chapter 10 : Scan applications



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

The following applications can be applied in Scan. If an application is not available, it may not be included in your systems options.

## ANRT

[ANRT Reconstruction](#)

[Acquire a scan using mA Reduction Guidance](#)

## ASIR

[Acquire a scan](#)

[Acquire a scan using Dose Reduction Guidance](#)

## Biopsy Mode

[Biopsy Rx screen](#)

[Acquire a scan](#)

## Direct Multi Planar Reformat (DMPR)

[Session Selection screen](#)

[Session Setup screen](#)

[Acquire a DMPR scan with Auto Batch Direct](#)

[MPR Interactive Review screen](#) [Acquire a](#)

[DMPR scan without Auto Batch Direct](#) [MPR](#)

[BatchRx screen](#)

[Manipulate DMPR images](#)

## Exam Split

[Split exams with ConnectPro](#)

## Neuro 3D Filter

[Filter Auto Transfer by Series screen](#)

[Apply a Neuro 3D Filter](#)

## SmartPrep

- [SmartPrepscreen](#)
- [SmartPrep scan desktop](#)
- [SmartPrep Display Screen](#)
- [Set up a scan](#)
- [Acquire a scan](#)
- [Acquire a scan with Dynamic Transition](#)
- [Display images](#)

## SmartPlan

- [SmartPlan workflow](#)

## Motion Correction

- [Motion Correction workflow](#)

## Gray Scale Enhancement (GSE)

- [GSE workflow](#)

## Image Filter

- [Image Filter workflow](#)
- 
-

## ANRT

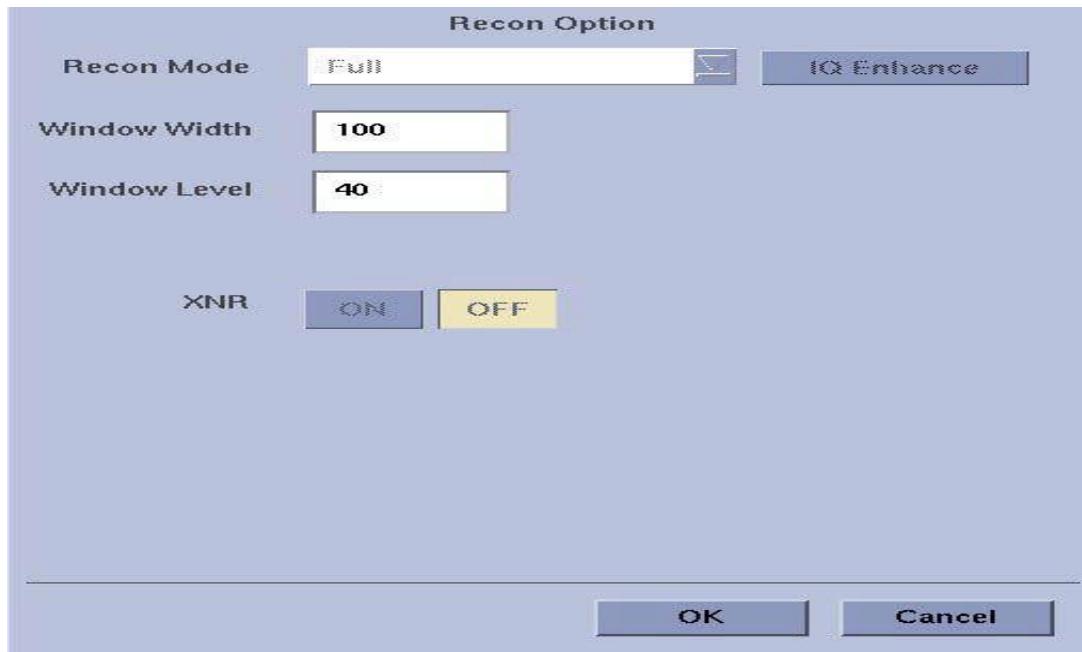
ANRT is a reconstruction technology used for decreasing the noise of diagnostic images while preserving the structural detail information of these images. ANRT noise-reduction technology can, while maintaining image noise level, lessen the dose of some X-ray testing, or improve image noise level and image quality.

**ANRT**

# ANRT Reconstruction

Reconstruction of ASiR images can be set in advance during Recon1, and can be set in advance during Recon2, Recon3... Recon10, or set during post-reconstruction. If the post-reconstruction method is adopted, a new series should be selected when applying ANRT reconstruction data.

ANRT is located in the Recon Option area, appearing as "XNR"



There are several constraints that apply to the acquisition of data where ASiR will be applied:

- ANRT can only be used for digital tilted images, tilt angle cannot be 0 degree.
- When ANRT is being applied, 5 reconstruction calculation methods can be used, [STND], [STD+], [BONE], [EDGE] and [DETL].
- ANRT is not compatible with any real-time interactive image modes, for example the SmartPrep (baseline and monitoring images) and Biopsy modes.
- ANRT is not compatible with the AutomA mode.
- ANRT cannot be used when the actual scanning current is less than 50mA.

## ANRT Image annotation

Use "ANRT" character string annotation on the bottom left corner of images.

```
Revolution ACTs SYS#bay7
Ex: 38
Se: 1
SN $30.00
Im: 1

DFOV 25.0cm
STND

XNR
```

## Enable ANRT scanning

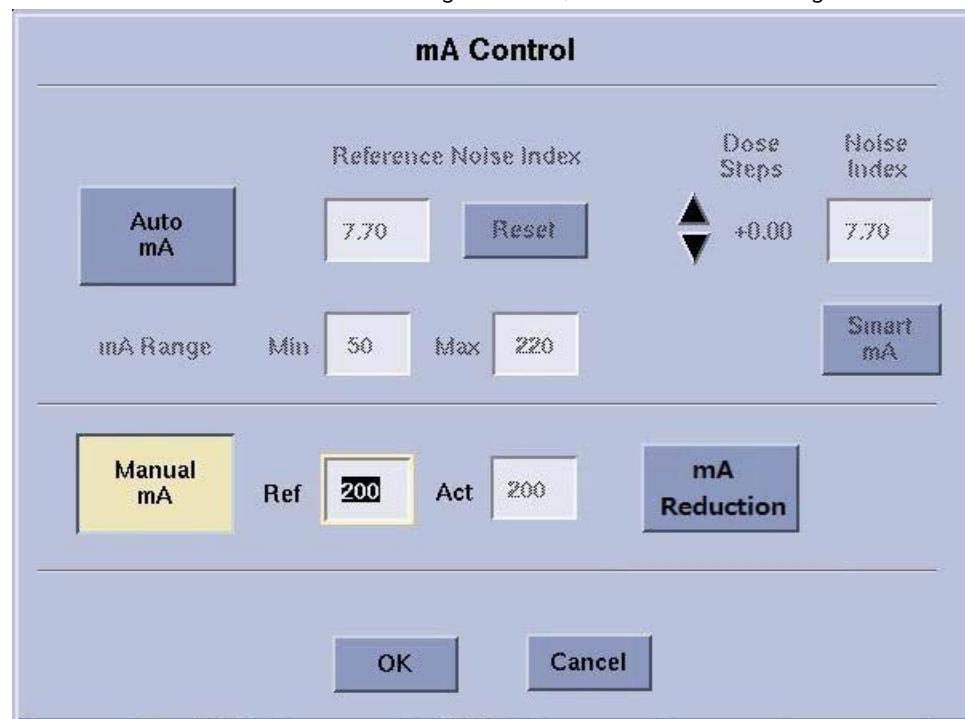
1. Set up a scanning plan.
2. In the ViewEdit area, press Recon.
3. In the Recon Setting area, press Recon Option.
4. In the XNR area, press On.
5. Continue to proceed with scanning according to the original plan. "XNR" will be displayed on the top left corner of an image

**ANRT**

## Acquire a scan using mA Reduction Guidance

Applying this program, pressing the Reduce mA value button can make the system's ANRT function automatically effective. Based on scanning protocols, mA reduction percentages will vary. When scanning a head, the default mA value reduction percentage is 20%. When scanning the lumbar and cervical vertebrae, the default mA value reduction percentage is 30%.

Giving an example, if the reference mA value is 160, pressing [mA Reduction] the actual mA value during lumbar and cervical vertebrae scanning is 110mA, or 130 mA when doing a headscan.



When utilizing reduced mA values for guidance, pay attention to the following:

- When the desired mA value is less than 50mA, the mA value reduction function will be ineffective.
- When scanning the lumbar and cervical vertebrae, and the necessary mA value is between 50mA and 75mA, when doing a headscan and the necessary mA value is between 50mA and 65mA, [mA reduction] is effective, but when you press [Ok], [mA reduction] will not be usable and will return an operational message. Further, the actual mA value displayed over the mA table is the necessary mA value. The operational message will be displayed on the Message Board: The mA reduction function cannot be used, because the requested mA value reduction is less than 50mA.

- When [mA Reduction] is pressed, if the actual mA value and the necessary mA value are inconsistent, DR and the actual mA value will be displayed in the mA row.



- When [mA Reduction] is pressed, the [ANRT] button located in the **Recon Option** area will be enabled automatically.

## Utilize reduced mA value guidance to conduct scanning

1. Set up a scanning plan.
2. Press mA in the ViewEdit area.
3. Press mA Reduction in the mA control area.
4. Enter the desired mA value.
5. Press OK in mA control.
6. Continue scanning according to the original plan

## ASiR\*

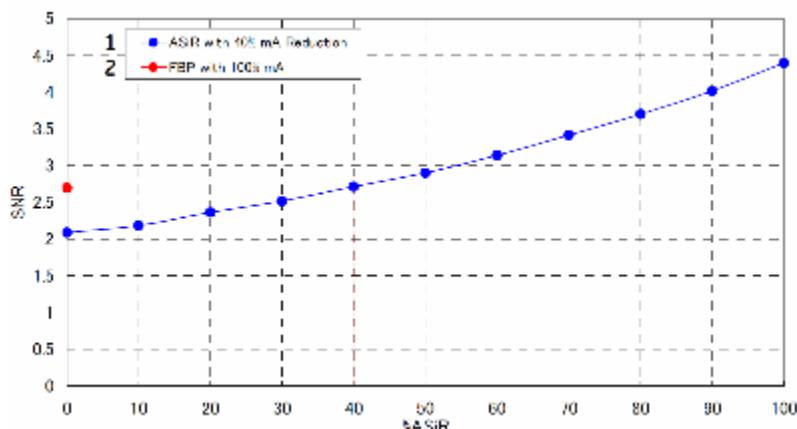


ASiR™ is licensed for use with a GE X-ray tube. Use of a third party X-ray tube will require the purchase of an additional license for this feature.

Adaptive Statistical Iterative Reconstruction (ASiR) is a reconstruction technique designed to reduce noise in diagnostic images while preserving the structure details in the image. ASiR noise reduction technique may allow for the reduction of the x-ray dose in some studies while maintaining image noise levels or be applied to improve images with an unacceptable level of noise.

As shown in Figure 10-1 Signal to Noise Ratio (SNR) is equal when no ASiR is applied compared to 40% ASiR at a 40% mA reduction.

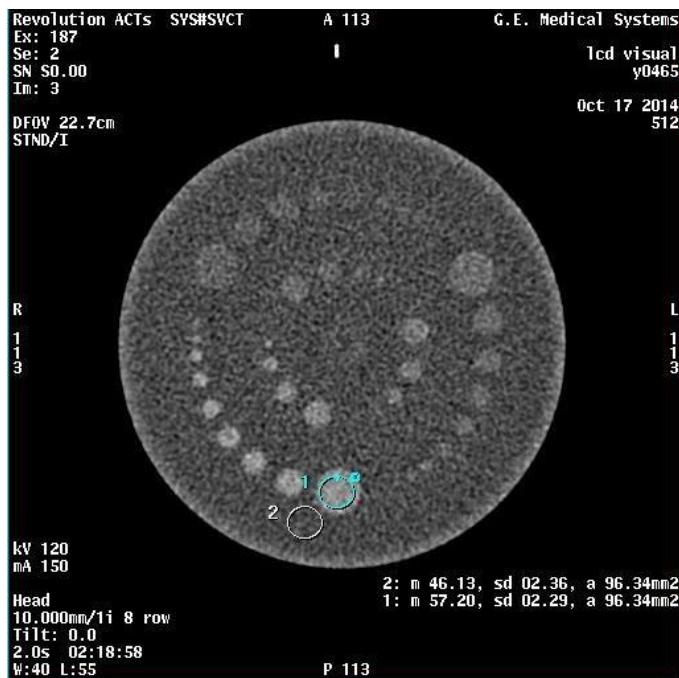
Figure 10-1 SNR as the applied ASiR level increases: 1= ASiR with 40% mA Reduction, 2 = FBP with 100% mA



The SNR<sup>1</sup> metric presented relative to the % ASiR in Figure 10-1 was measured on the Low Contrast Section (CTP515 Section) of the CatPhan® 600 phantom. The measurement involves calculating a signal delta divided by the standard deviation (noise). On the CatPhan® 600 phantom, the difference in the mean CT Number between the 15mm size 1% contrast object versus its immediate background is divided by the measured pixel standard deviation in the image. The calculation is illustrated in Figure 10-2 below.

- 
- 1.Signal to Noise Ratio
  - 2.Revolution ACTs EX

Figure 10-2 Illustration of ROI measurements to calculate SNR



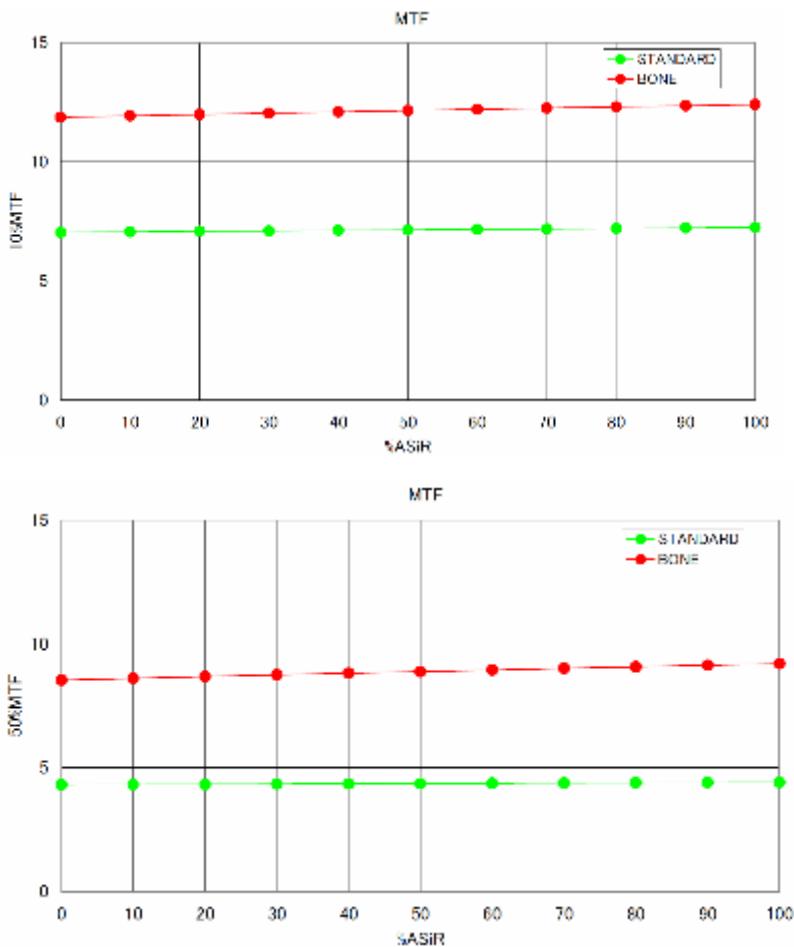
The calculation of SNR is described in formula below:

Equation 10-1 SNR

$$SNR = \frac{Mean_1 - Mean_2}{SD_1}$$

As shown in Figure 10-3 MTF remains constant as the ASiR level is increased.

Figure 10-3 10% and 50% MTF performance and % ASiR



Keep the following in mind when selecting an ASiR recon mode:

- ASiR is not compatible with Neuro 3D Filters (N1, N2, N3).
- ASiR is not compatible with any of the real time interactive image modes such as Smart Prep or Biopsy mode.

A warning is posted when ASiR is set to None reminding the user to check the mA and Noise Index prior to scanning without ASiR enabled.

Reconstruction of ASiR images involves defining the level of noise reduction desired for the parameters used for various applications. Image reconstruction is a blending of the original images and a percentage of an image with 100% noise reduction. There are 10 blending levels available which are simply the amount of noise reduction based on the maximum of the 100% image reconstructed with the original image data. It is expected that confidently selecting the optimal amount of noise reduction and integrating the reduction in dose possible will require some adapting on how this reconstruction technique works.

The software does not make the noise level changes or mA adjustment automatically when ASiR is enabled. These changes need to be calculated using the following tables to make changes to noise index or manual mA values. Refer to Table 10-1 and Table 10-2 for guidance in making parameter step adjustments during ASiR evaluation process.

Before using ASiR, the site physicist, in collaboration with the Radiologist, should conduct image quality evaluations with varying degrees of ASiR and different scan techniques, both at routine dose and with decreased dose. This should be done using your site's preferred method and phantoms. Using this information, an appropriate starting point for ASiR level and diagnostic scanning techniques can be incorporated into your site's protocols.

When ASiR is used for dose reduction or image quality improvement, parameter settings should be made in steps and then reviewed for diagnostic image quality until the desired clinically appropriate image quality is achieved.

## Dose Adjustment Factors - Noise Index Adjustment method when using Auto/Smart mA

When using Soft, Standard, Detail, Lung, Bone or Bone Plus reconstruction algorithm use the following chart to calculate dose reduction for Noise Index (NI) based on the ASiR level selected.

The Noise Index Adjustment Factors in Table 10-1 are intended to help you enter the Noise Index values when using AutomA and SmartmA. These factors were derived based on calculating the relative difference in measured noise standard deviation (SD) with Filtered Back Projection (FBP) and ASiR on a 20cm water phantom as follows:

Equation 10-2 Noise index factor

$$\text{Noise Index Factor} = \frac{\sigma_{FBP}}{\sigma_{ASiR}}$$

Table 10-1 Noise index adjustment factor

ASiR Level	Noise Index Factor
10%	1.06
20%	1.14
30%	1.23
40%	1.32
50%	1.44
60%	1.56
70%	1.70
80%	1.87
90%	2.05
100%	2.24

For example, if 40% ASiR is selected, multiply the noise index value displayed on the mA control screen by 1.32, as indicated in Table 10-1, to obtain the new noise index for the protocol using ASiR, this value needs to be entered into the Noise Index (NI) field on the mA control screen.

## Dose adjustment Factor - Manual mA method

When using Soft, Standard, Detail, Lung, Bone or Bone Plus reconstruction algorithm use the following chart to calculate dose reduction for mA based on the ASiR level selected.

The mA Adjustment Factors in Table 10-2 are intended to help you enter the mA settings in manual mA protocols. These factors were calculated based on a simple inversion of the squared NI Adjustment Factors found in Table 10-1 as follows:

Equation 10-3 mA factor

$$mA\ Factor = \frac{1}{\text{Noise Index Factor}^2}$$

Table 10-2 mA adjustment factor

ASiR Level	Normal
10%	0.89
20%	0.77
30%	0.66
40%	0.57
50%	0.49
60%	0.41
70%	0.34
80%	0.29



90%	0.24
100%	0.20

For example, if 40% ASiR is selected, multiply the mA displayed in the mA control screen by 0.57, as indicated in Table 10-2 to obtain the new mA for protocol using ASiR, that needs to be entered into the mA field on the mA control screen.

Multiply the Noise Index or manual mA values that were adjusted for an ASiR applied protocol by the adjustment factors in Table 10-3.

Use the following factors to return any Noise Index or manual mA values adjusted for ASiR to non-ASiR value.

Table 10-3 Return to a value for a non-ASiR protocol

ASiR Level	Return to non ASiR manual mA value	Return to non ASiR Noise Index Value
20%	1.30	0.88
30%	1.50	0.82
40%	1.75	0.76

## Reconstruction

Reconstruction of ASiR images involves defining the level of noise reduction desired for the parameters used for various applications. Image reconstruction is a blending of the original images and a percentage of an image with 100% noise reduction. There are 10 blending levels available that are the amount of noise reduction based on the maximum of the 100% image reconstructed with the original image data.

Reconstruction of ASiR images can be prescribed prospectively for Recon 1 or as a PMR<sup>1</sup> for R2 to R10 or retrospectively in Retro Recon. If reconstructing data retrospectively, a New Series should be selected for each reconstruction of the data with ASiR applied so comparisons and identification of series with ASiR can be made more easily.

ASiR is located on the Recon tab under **Recon Options**. ASiR modes are None or Slice.

- Slice mode:
  - can be applied to acquisitions of any slice thickness and any acquisition mode where noise reduction is in X and Y (2D).
  - can be applied to a range of slices.

## Image annotation

ASiR level and mode are annotated on the image using a character string that defines the mode and level. It is displayed in the upper-right corner of the image next to the Recon Type.

The annotation logic is as follows:

- SS - Slice mode ASiR
- 10 - 100%, which is the percent of the 100% ASiR image that was reconstructed with the original to reduce the noise in the ASiR images.

---

1.Prospective Multiple Reconstruction

## ASiR

### Acquire a scan

Use this procedure to acquire data where ASiR<sup>1</sup> noise reduction reconstruction will be used. ASiR is a reconstruction technique designed to reduce pixel noise standard deviation in clinical images while preserving the structure details in the image. The ASiR noise reduction technique may allow for the reduction in X-ray dose, while maintaining image noise levels or be selected to improve images with an unacceptable level of noise. ASiR reconstruction is available in Slice Mode. ASiR is prescribe in 10% steps for 10 to 100. Slice Mode is annotated SS xx.

Keep the following in mind when selecting an ASiR recon mode:

- ASiR:
  - is not compatible with Neuro 3D Filters (N1, N2, N3).
  - is not compatible with any of the real time interactive image modes such as Smart Prep or Biopsy mode.
- Slice mode:
  - can be applied to acquisitions of any slice thickness and any acquisition mode where noise reduction is in X and Y (2D).
  - can be applied to a range of slices.

### Scan with ASiR

1. Prescribe a scan.
2. Click **Recon Options** and from the Recon Options screen, select an ASiR mode (Slice) and an ASiR % value. As the percentage value increases, the noise reduction increases.
  - If you want to use ASiR to maintain image quality but reduce dose, from the mA Control screen, reduce mA or increase noise index value.
3. Proceed to scan.

### ASiR reconstruction

#### Prospective reconstruction

1. Prescribe a scan.
2. From the ViewEdit screen, click **Recon Tab**.
3. From the Recon tab, click any prescribed PMR **R2** to **R10**.
4. From the Recon Option screen, select an ASiR mode: **Slice** and an ASiR % value. Click **OK**.
5. Continue with your prescription and proceed to scan.

#### Retrospective reconstruction

1. On the Exam Rx desktop, click **Retro Recon**.
2. From the Retro Recon screen, select exam and series and click **Select Series**.
3. From the Retro Recon Setup screen, click **New Series Number**.
4. Click **Recon Options**.
5. From the Recon Option screen, select an ASiR mode: **Slice** and an ASiR % value. Click **OK**.
6. Click **Confirm**.

1.Adaptive Statistical Iterative Reconstruction

**ASIR****Acquire a scan using Dose Reduction Guidance**

Use this procedure to have the system automatically select the ASiR level by selecting a dose reduction percentage.



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

When utilized with manual mA a Reference mA is entered, the Reference mA is the baseline, nondose reduced mA. When a % Dose Reduction value is entered the system calculates the actual mA that will be used for the acquisition and selects the appropriate ASiR level to maintain image quality at the dose-reduced mA. For example if a Reference mA value of 200, a % Dose Reduction of 50% is entered, the actual mA for the scan acquisition will be 100.

When utilized with Auto mA, a % Dose Reduction value is entered. The system will calculate the mA for the scan taking into account the % Dose reduction value. The dose-reduced mA will be shown in the mA table and the system selects the appropriate ASiR level to maintain image quality at the dose-reduced mA.

Keep the following in mind when using Dose Reduction Guidance:

- Dose Reduction is not selectable if ASiR is enabled in Recon Options.
- Actual mA used is a percentage of the Reference mA and is calculated by the system.
- ASiR level selected is optimized based on Standard algorithm and the DFOV prescribed.
- The maximum Dose reduction percentage is 50%. If more than a 50% dose reduction is desired, set Dose Reduction to 0% and follow the [Scan with ASiR](#) procedure.
- A warning is posted when ASiR is set to None reminding the user to check the mA and Noise Index prior to using Dose Reduction Guidance.
- A warning is posted when ASiR level is modified from the system recommended value.

**Scan with Dose Reduction Guidance**

1. Prescribe a scan.
2. From the ViewEdit screen, click **mA**.
3. From the mA, control screen click **% Dose Reduction** in either manual mA or Auto mA.
4. Enter the desired dose reduction percentage.
5. From the mA control screen in Manual mA click **Reference mA**.
6. Enter the desired mA value.
7. From the mA control screen, click **OK**.
8. Continue with your prescription and proceed to scan.

## Biopsy Mode

Biopsy Mode improves the efficiency of setting up and acquiring slices during a biopsy. All biopsy scan parameters are available on a single screen from which you can launch the biopsy scan. You are able to choose which direction the scanner acquires images from a centering point as well as how many images to acquire. You can change slice thickness and/or interval. You can enter a specific location for a slice if required.



AutomA is turned off when Biopsy Mode is entered, Review the Manual mA value prescribed.

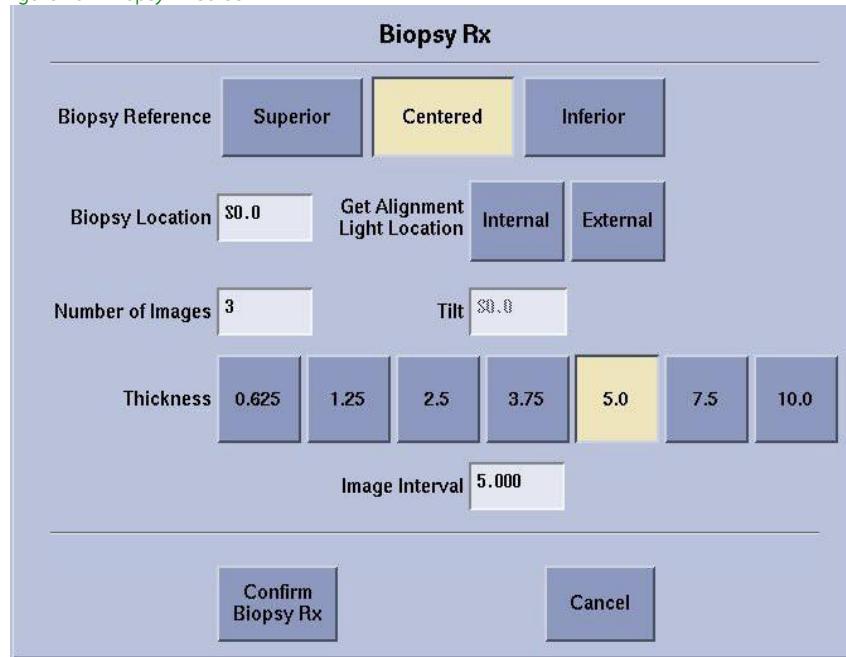


All scans taken in Biopsy Mode are the Axial Scan Type.

**BIOPSY MODE****Biopsy Rx screen**

From the ViewEdit screen or the Scan Progress screen, click **Biopsy Rx** to display the Biosy Rx screen.

Figure 10-4 Biopsy Rx screen

***Biopsy Reference***

The Biopsy Reference tells the system how to accquire images based on the Biopsy Location.

- **Superior** means all images are acquired from the Biopsy Location, superiorly.
- **Centered** means the system acquires images above, at and below the Biopsy Location, If you enter an even numbers of slices, the system places the extra image in the syperior portion.
  - **Inferior** means the images are acquired from the Biopsy Location inferiorly.

***Biopsy Location***

Used when you have a specific location chosen from the localizer scans.

***Get Alignment Light Location***

Use this method when a needle is necessary for aligning internal or external alignment lights. This method is especially effective when placing a needle or tubes.

***Number of Images***

Any value may be entered, It represents the number of images acquired for each pass.

***Thickness***

For axial mode, the slice thickness is restricted to 2.5mm or 5.0mm.

***Image Interval***

The distance between images. This value is typically the same value as the Thickness.

**BIOPSY MODE****Acquire a scan**

Use this procedure to improve setup and acquisition efficiency during a biopsy. Biopsy Mode™ only allows the Axial scan type. The system automatically sets the scan type to Axial when the Biopsy Mode is selected.



**IMPORTANT:** Please refer to the *Safety* section for important safety information regarding the use of the equipment and software on this system.



Scan technical factors such as kV, mA, and rotation time are based on the last group scanned. The scan type is always Axial, regardless of the last group's scan type. If AutomA/SmartmA was used in the prior group, it is turned off and manual mA is used. It is important to review the manual mA value prior to confirming the scan. If ASiR was used in the prior group, it is turned off. If Auto Voice was used in the prior group, it is still on for the biopsy scans.

1. From the ViewEdit screen or the Dynaplan screen, click **Biopsy Rx**.
  - The images remain in the same series.
2. From the Biopsy Rx screen, complete the following selections:
  - a. Select a Biopsy Reference.
    - Click **Superior** to make the biopsy reference location the first scan, with subsequent images acquired superiorly from that location.
    - Click **Centered** to make the biopsy reference location the center slice, with the other images acquired above and below that location. Typically, select an odd number for Centered to split the images evenly above and below the location.
    - Click **Inferior** to make the biopsy reference location the first scan, with subsequent images acquired inferiorly from that location.
  - b. Select a biopsy location.
    - Type a specific table location in the Biopsy Location field.
    - In order to obtain positioning light position, the table must be moved to align the positioning lights, then click **Internal** or **External**.
  - c. Type the number of images for each pass in the Number of Images field.
  - d. Select a slice thickness. Axial mode only allows 2.5, 5.0, or 10.00 mm.
3. Click **Confirm Biopsy Rx** to activate the biopsy scan.
4. Optional: manually film the biopsy images.
5. When the biopsy scan is finished and if additional groups are being scanned in the same series, re-activate AutomA. is turned off with Biopsy Mode.

# Direct Multi Planar Reformat (DMPR)

Direct Multi Planar Reformat (DMPR) allows reformat protocols to be prescribed prospectively in a scan protocol. Productivity is improved by providing real time display of oblique, sagittal, and coronal images in addition to the axial images. Applications include:

- fast review of scan prescription
- combined with AutoView for trauma imaging and automated multiplanar reformat protocols
- surgical planning assessment of trauma
- CT angiography
- as a supplement for other diagnostic information

While in DMPR, you can move from the usual 2D image review mode to a prospective 3D image review mode in the axial, sagittal, coronal, and oblique planes. You can also automatically create batch reformats using predefined reformat protocols and network reformatted images to selected reading locations, reducing total exam time and increasing productivity.

DMPR displays images in anatomical orientation where A<sup>1</sup> is at the top, P<sup>2</sup> is at the bottom, R<sup>3</sup> is on the left and L<sup>4</sup> is on the right. For example, if you have a data set where the patient was scanned prone, the image display is automatically set to this orientation.

To combine groups the following parameters must be identical within each group:

- Slice Thickness
- Interval
- SFOV
- DFOV
- Scan Type
- Rotation Speed
- image center
- algorithm
- ASIR Level

## Considerations

Each group must be contiguous to be able to be combined with the prior group in a DMPR session. A DMPR Auto Apps session can be programmed for only Recon 1. DMPR sessions are limited to 2,000 images. Additional reformat protocols can be added using the Reformat application or Volume Viewer in the General category from ImageWorks.

Any scans acquired after scanning has completed on the original scan group using Add Group or One More scan are not added to the DMPR session. Remember to include all of the desired coverage area in the original scan prescription.

If the patient orientation is prescribed as Decubitus (right or left), you will observe that the Paging slider for the sagittal image will scroll images in DMPR coronal viewport and vice versa. This is because in Decubitus orientation, patient's sagittals and coronals are switched. Hence, the DMPR sagittal viewport contains the coronals from patient's reference axis, and the DMPR coronal viewport contains the sagittals from the patient's reference axis.

---

<sup>1</sup>Anterior

<sup>2</sup>Posterior

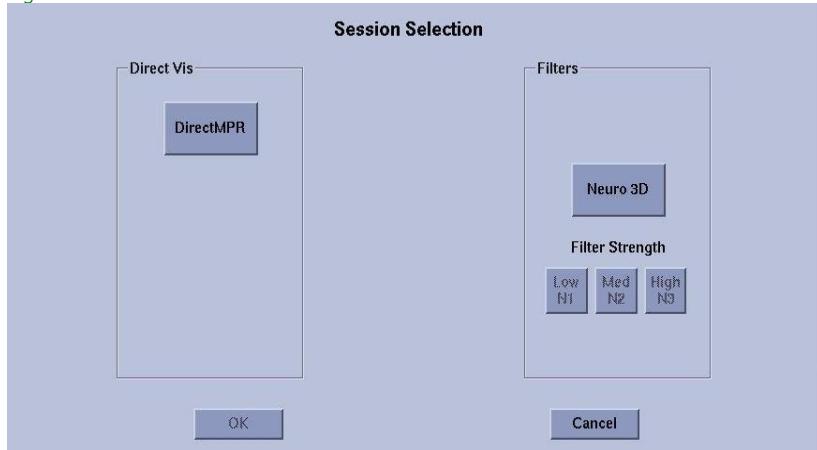
56417871EN  
© 2015 General Electric Company

3.Right  
4.Left

## DIRECT MULTI PLANAR REFORMAT (DMPR)/NEURO 3D FILTER Session Selection screen

From the ViewEdit screen, click the **Recon** tab to display the Recon parameters. In the Auto Apps column, click Off to display the Session Selection screen.

Figure 10-5 Session Selection screen



### DirectMPR

Starts a DMPR session, which allows you to prospectively prescribe reformat protocols in a scan protocol. See [Acquire a DMPR scan with Auto Batch](#) and [Acquire a DMPR scan without Auto Batch](#).

### Neuro 3D

Starts a Neuro 3D Filter session, which removes noise from the image while preserving image resolution. See [Apply a Neuro 3D Filter](#).

### Filter Strength

#### Low N1

Applies a low strength noise filter. The processed images are saved in a series that is the original series number plus 30.

#### Med N2

Applies a medium strength noise filter. The processed images are saved in a series that is the original series number plus 40.

#### High N3

Applies a high strength noise filter. The processed images are saved in a series that is the original series number plus 50.

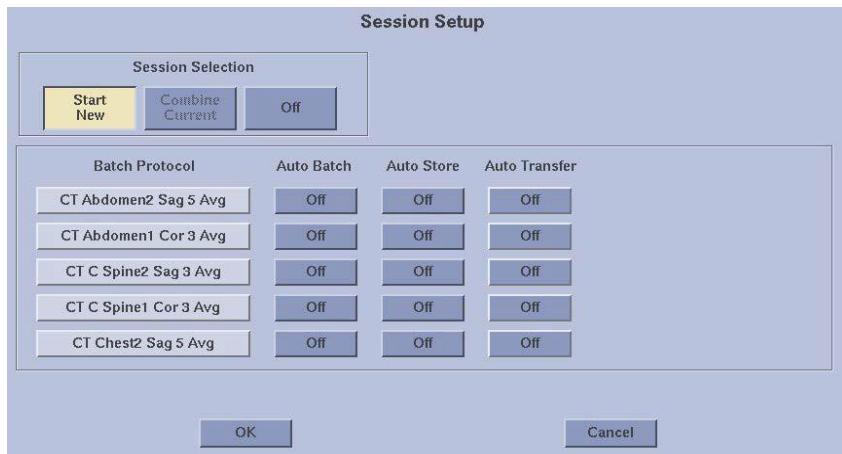
### OK

Accepts the selection and opens the [Session Setup screen](#) for DMPR and the [Filter Auto Transfer by Series](#) screen for Neuro 3D.

# Session Setup screen

From the **Session Selection screen**, click **DirectMPR** to display the Session Setup screen, where you can set up the protocols that you want to use and the parameters for filming. You can also turn Auto Batch, Auto Store, and Auto Transfer on or off.

Figure 10-6 Session Setup screen



## Start New

Starts a new DMPR session.

## Combine Current

Combines the next group with the prior group. Parameters for the groups to be combined are locked to the previous group prescription.

## Off

Turns DMPR off for the series/group.

## Batch Protocols

This area is where reformat protocols to be used in DMPR are selected from a list of available reformat protocols. Up to five reformat protocols can be selected. Use the Next/Prior arrows to move through the list of available protocols. The protocols will be listed in the order selected.



Remove Protocol only removes a protocol from the Batch Protocol List, not from the system. Protocols found in the Batch Protocol List can be modified permanently in Reformat or Volume Viewer in the General category.



The protocol name is used as the Series Description name for any Batch and Auto Batch DMPR series created.

## Filming Setup

This allows you to define camera, formats, and start options for filming reformatted images to the Direct Film Composer.



## Auto Batch

Automatically creates reformatted images based on the Batch Protocol List once reconstruction is complete. In Auto Batch, a special edge detection algorithm is used. This edge detection algorithm detects the outer edge of the anatomical structures and sets the reformat range based on the object size and the WW and WL of the images. Set an appropriate WW and WL value for the image set in **Recon Options**. Too narrow of a WW and WL may clip data and too wide of a WW and WL may create blank images.



You will have the ability to set the localizer lines on the reference image.

## Auto Store

Allows you to set up a protocol so the system will automatically archive reformatted images to the default archive device selected for the system after they are created. On enables this feature and Off disables it.

## Auto Transfer

Allows you to set up a protocol so the system will network the reformatted images to desired network location. Up to four remote hosts can be selected. Apply All copies the selected list of host to all the protocols prescribed.

# Acquire a DMPR scan with Auto Batch

Direct MPR (DMPR) provides a prospective auto multi planar image review mode in the axial, sagittal, coronal, and oblique planes.

## Considerations

- DMPR displays image anatomical orientation within a viewport as follows: A is at the top, P is at the bottom, R is on the left and L is on the right. If you have a data set where the patient was scanned prone, the image display is flipped to this orientation.
- DMPR sessions are limited to 2,000 images.
- Reformat protocols used in DMPR must be built in Reformat or Volume Viewer in the General category as Single Step protocols. Multiple Step protocols are excluded from the list of available protocols for selection in DMPR.
- For AutoBatch, the reformat protocol cannot use the Oblique viewport.
- A DMPR Auto Apps session can be programmed for each of the 10 PMR1s. A DMPR session can be a single group or combined groups.

## During scan considerations

- If DMPR is enabled under the Recon tab, Add Group displays some insensitive fields because it is combined with the current DMPR session. Turn DMPR off for the added group if you no longer want it to be included as part of the DMPR session. This allows changes to any of the acquisition parameters.
- The W/L of the axial source images affect the edge detection of the auto batch. If the W/L is too narrow, then anatomy is cut off from the auto batch. If the W/L is too wide, then undesired anatomy is included in the auto batch. Make sure to set the appropriate W/L in Recon Options.
- If you prescribed auto batch protocols and then quit DMPR before the auto edge detection starts, the reformatted images are not completed.
- To page/scroll through images during DMPR reconstruction, use the Oblique view for paging. Once the reconstruction is complete, the image may change DFOV to accommodate all the data in 3D.
- If a scan stops before all DMPR images for a session are acquired, it may not be possible to activate the interactive mode because all the images are not yet available. Quit the DMPR session to return to Exam Rx display and generate any reformatted images you want in Reformat from ImageWorks desktop.
- DFOV for AutoBatch axial images defaults to the DFOV of the scan range instead of the DFOV in the protocol.
- When multiple sessions of MPR are stacked, you cannot get to the next one until you finish the previous session. Click **Start Direct MPR Review** to get to the Interactive display screen and select **Quit**. If you do not want to quit the current DMPR session, you can still see the reconstructed axial images. Click **Auto Link** and view the images in the viewport.
- You are not able switch to another AutoView layout until reconstruction for the DMPR session is complete. To review images for another exam while images are being reconstructed, go to the Image Works desktop and use the Viewer.
- If you want to leave the DMPR session available once the reformat model is built, click **AutoReview Layouts** to change the focus from DMPR. This allows review of images on Exam Rx display without ending the DMPR session.
- Do not quit until auto batch is started, as indicated by the auto batch in the reference image or until auto edge detection is done, which is indicated by the black line directly under the **Start Direct MPR Review** button.



Be sure to include complete coverage in the original scan prescription. Any scans acquired after scanning has completed on the original scan group using Add Group or One More Scan are not be added to the DMPR session.

1. Prescribe a scan.
2. Click the **Recon** tab.
3. From the Recon tab, click **Off** for group under the Auto Apps column.
4. From the Session Setup screen, click **Direct MPR** and then click **OK**.
5. From the Session Setup screen in Session Selection, click **Start New** to setup a DMPR session.
  - You can combine groups or set each group as a new session. To combine groups the following parameters must be the same: slice thickness, interval, SFOV, DFOV, scan type, rotation speed, image center, and algorithm. The groups must be contiguous. If you want to change parameters between groups, click **Start New** instead of **Combine Current**.
  - If you want to change parameters between groups, click **Start New** instead of **Combine Current**.
6. To select reformat protocols to be used in the DMPR session, click **Unused** under Batch Protocol to open the list of available protocols.
  - Reformat Protocols built in Reformat or the General category in Volume Viewer are displayed in the Batch Protocol List.
  - Multi-step reformat protocols do not appear in the list.
7. Select up to five protocols from the Batch Protocol List, and click **OK**.
  - Use the Next and Prior arrows to move through the list of GE reference reformat protocols and user define reformat protocols.
  - The order you select the protocols is the order they are listed for Batch Protocol and the order Auto Batch applies them.
8. Prescribe Filming, Auto Batch, Auto Store, and Auto Transfer as needed for each protocol.
  - a. Click Auto Batch **Off** to turn on Batch Reformats to be created automatically once all the images for the DMPR series have been reconstructed.
    - If Auto Batch is enabled, an automatic edge detection algorithm detects the outer edges of the object and sets the range for Batch Reformats.
    - Auto Batch is not available if the reformat protocol was created in the Oblique viewport.
  - b. Click Auto Store **Off** to automatically have Batch Reformats archived to designated archive device.
  - c. Click Auto Transfer **Off** to select up to 4 host to automatically transfer the DMPR Batch Reformats by series.
9. Click **OK** to close DMPR Session Setup screen.
10. Click **Confirm**.
11. Press **Move to Scan**.

12. Press **Start Scan**.

- The **Start Direct MPR Review** button displays the Auto Batch progress in the Exam Rx control panel.
- After four images have been reconstructed, the currently selected AutoView layout is replaced with the DMPR AutoView layout. In this layout, the following image types are displayed in specific viewports:
  - upper left = oblique (or AutoFilm accessed by clicking on the page turn icon)
  - upper right = axial
  - lower left = sagittal
  - lower right = coronal

13. Click **Start Direct MPR Review** to open the **Direct MPR Interactive Review screen**.

- This step is only necessary if you want to review the data.

14. From the upper-left viewport, use the crosshair cursors, click and drag, or use the review controller to interact with the displayed images.

15. Once all tasks are finished, including all Batch Reformats, click **Quit** and then, click **Yes** to end the DMPR session.

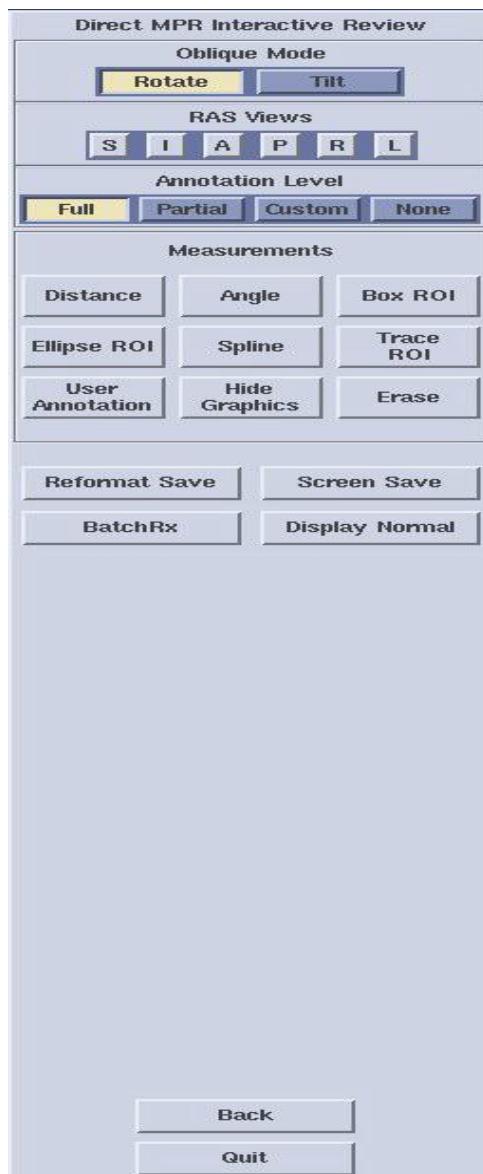
16. For details on manipulating the DMPR image, see [Manipulate DMPR images](#).

# DIRECT MULTI PLANAR REFORMAT (DMPR) REVIEW

## Direct MPR Interactive Review screen

After a DMPR scan with Batch Reformat on is completed, click **DMPR** to display the Direct MPR Interactive Review screen.

Figure 10-7 Direct MPR Interactive Review screen



### Oblique Mode

Activates the Rotate or Tilt modes to rotate or tilt the reformat model in all directions.

### RAS Views

Sets the image orientation. Click an Image Orientation icon to change the plane.

S = Superior

I = Inferior

A = Anterior

P = Posterior

L = Left

R = Right

## Annotation Level

Sets the image annotation level: Full, Partial, Custom, or None.

## Measurements

Allows you to select a tool to apply distance and angle measurements, ROIs, and annotation. You can also choose to hide the applied graphics or erase them from an image.

## Reformat Save

Saves the reformat image as a DICOM<sup>1</sup> image and lists it as series type RFMT in the browser. It does not save any user added annotation or measurements to the image.

## Screen Save

Saves the image in primary focus, including zoom, cursors, measurements, flip, or annotation. Screen saved images are listed as a series type SSave in the browser.

## BatchRx

Opens the [Direct MPR BatchRx screen](#).

## Display Normal

Restores the image to its original size and orientation.

## Back

Returns you to the previous screen or menu.

## Quit

Closes the Direct MPR Interactive Review screen.

1.Digital Imaging and COnnunications in Medicine

## DIRECT MULTI PLANAR REFORMAT (DMPR)

# Acquire a DMPR scan without Auto Batch

Use this procedure to manually prescribe batch protocols if you have not selected auto batch when setting up a DMPR session.



Read the **DMPR** considerations before executing this procedure.

1. Prescribe a scan.
2. Click the **Recon tab**.
3. From the **Recon** tab, click **Off** for group under the Auto Apps column.
4. From the Session Setup screen, click **Direct MPR** and then click **OK**.
5. From the **Session Setup screen**, click **Start New** to setup a DMPR session.
  - You can combine groups or set each group as a new session. To combine groups the following parameters must be the same: slice thickness, interval, SFOV, DFOV, Scan Type, Rotation Speed, image center, algorithm, and ASiR Level. The groups must be contiguous.
  - If you want to change parameters between groups, click **Start New** instead of **Combine Current**.
6. To select reformat protocols to be used in the DMPR session, click **Unused** under Batch Protocol to open the list of available protocols.
  - Reformat protocols built in Reformat or the General category in Volume Viewer are displayed in the Batch Protocol List.
  - Multi-step reformat protocols do not appear in the list.
7. Select up to five protocols from the Batch Protocol List, and click **OK**.
  - Use the Next and Prior arrows to move through the list of GE reference reformat protocols and user define reformat protocols.
  - The order you select the protocols is the order they are listed for Batch Protocol.
8. Prescribe Filming, Auto Store, and Auto Transfer as needed for each protocol.
9. When generation of the DMPR session is complete, the **Direct MPR BatchRx screen** automatically displays.
10. From the Direct MPR BatchRx screen, select a protocol from the list of protocols.
  - If you use a protocol, it propagates the batch prescription to the viewport with the Slice Thickness, Spacing Between Views, FOV, and Number of Slices programmed in the protocol.
  - Confirm that the Mode is Oblique.
11. Set the parameters for Thickness, Spacing Between Views, FOV, and Number of Views.
12. Prescribe the Reformat range. For details on manipulating the DMPR image, see **Manipulate DMPR images**.
13. Click **Preview** and then **Apply** to review the reformat prescription.
  - Click **Pause** to pause the review.
  - Click **Resume** to continue the review.
  - Click **Stop** to end the review.
14. Click **Save** and then **Apply** to save the prescribed DMPR reformat series.
  - The following actions can be applied together with Save:
    - Click **Film** to film the DMPR Reformat series based on camera selection and setup in Session Setup.

- Click **Store** to automatically archive the reformat series to designated archive device.
  - Click **Show** to view the reformat images as they are being created in the review viewport in the lower-right corner of the viewport.
  - Click **Transfer** to network reformat images to Host selected in Session Setup.
15. Repeat steps 6 to 14 to create additional batch reformats.
16. Click **Back** to exit Direct MPR BatchRx.
17. Click **Quit** and then, click **Yes** to close the DMPR session or click **Back** to continue to Direct MPR Review at a later time.

## DIRECT MULTI PLANAR REFORMAT (DMPR)

# Direct MPR BatchRx screen

When Batch Reformats is off, the Direct MPR BatchRx screen opens after DMPR generation is complete for you to manually prescribe batch reformats.

Figure 10-8 Direct MPR BatchRx screen



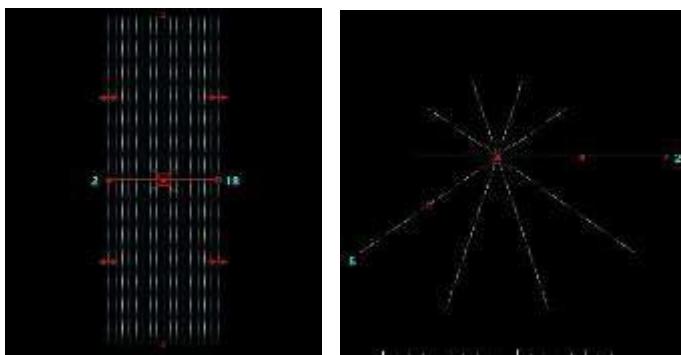
### Protocols

Allows you to select the protocol that you prescribed to manipulate, apply, and save.

### Mode

Allows you to choose an Oblique or Rotation graphic prescription.

Figure 10-9 Oblique GraphicRx and Rotation GraphicRx



## Render Mode

### Average

Displays the reformat model using the average density values of the slice taken along the lines perpendicular to it.

### Min-IP

Displays the reformat model using the Minimum Intensity Pixel mode. In this mode, the density of each point on the screen is the minimum density along a line perpendicular to the screen.

### MIP

Displays the reformat model using the Maximum Intensity Projection mode. In this mode, the density of each point on the screen is the maximum density along a line perpendicular to the screen.

### Preview

Displays the reformat series in a preview mode.

### Store

Archives the reformat series to designated archive device.

### Transfer

Networks the reformat images to the Host selected in Session Setup.

### Show

Displays the reformat images as they are being created in the review viewport in the lower-right corner of the viewport.

### Film

Films the DMPR Reformat series based on camera selection and setup in Session Setup.

### Apply

Applies the Direct MPR BatchRx changes.

### Pause/Resume

Pauses or resumes the Direct MPR BatchRx review.

### Stop

Ends the Direct MPR BatchRx review.

**Back**

Closes the Direct MPR BatchRx screen.

## DIRECT MULTI PLANAR REFORMAT (DMPR)

# Manipulate DMPR images

Use the DMPR Review Controller to interact with the DMPR model.

Figure 10-10 DMPR Review Controller



Table 10-4 Review controller procedures

No.	Function	Icon	Procedure
1	Scroll		Click and drag (1) the slider to change the slice thickness of the images being displayed. Click and drag (2) to scroll images within the series.
2	Minimize		Click to minimize the review controller around the image viewport.

No.	Function	Icon	Procedure
3	Zoom		Click to activate zoom and then click and drag to magnify or minify images. This affects all images in the series.
4	Pan/Roam		Click to activate pan/roam mode. Place the cursor on the image and click and drag it to a new location. This affects all images in the series.
5	Display normal		Click to return the image to the original display parameters.
6	Render Mode		Click the arrow to view menu and select a render mode: <ul style="list-style-type: none"> <li>• Average (the default), displays the average density values of the slice taken along lines perpendicular to it.</li> <li>• MIP displays the maximum density value of the slice taken along lines perpendicular to it.</li> <li>• Min IP display the minimum density value of the slice taken along the lines perpendicular to it.</li> </ul>
7	Annotation Level		Click the arrow to display the menu and select an annotation level: Full, Partial, Custom, or None.
8	Measurements		Click the arrow to display the menu and select a measure tool.
9	Screen Save		Click to screen save the image in the primary viewport as a secondary capture.
10	Save		Click to save the image as a RFMT type.
11	Cine Paging Speed		Click to activate paging and click and drag the slider to change the speed and direction of the images.
12	Loop		Displays images in a continuous loop, for example, 1 to 30, 1 to 30, etc.
13	Rock		Displays images in a rocking or back and forth motion, for example, 1 to 30, 30 to 1, 1 to 30, etc.

## Exam Split

Exam Split gives you the capability to "split" a series of patient images into separate groups. These new smaller image groups can be networked to desired reading stations for multiple "reads" and multiple billings on select patient exams.

Using Exam Split allows for split images from a single acquisition and assign them to a Requested Procedure ID or accession number retrospectively. On the imageWorks desktop using Exam Split, all the images of the scan will be loaded. You can also use the mouse to select a range of images to be sent to a specific exam procedure.

At scan time, all patient records that you wish to have available to split to must be selected from the Patient Schedule when selecting New Patient. Your system is configured in one of two modes for Exam Split. The mode configured is dependent on the capabilities of the system you are sending images to review.



Exam Split requires that the Connect Pro option installed.

### Virtual mode

Your remote station must support PPS<sup>1</sup> and GSPS<sup>2</sup>. Images will be Auto Transferred to the Remote station. In Exam Split, ranges of images are assigned to each accession number or procedure code and a GSPS object is created and transferred when selected.

### Hard mode

Hard Exam Split creates a new series of images for each accession number or procedure code ranges of images are assigned to. For this reason, images will not be Auto Transferred to the Remote Station. Your GE Field Engineer will configure your site for the mode of Exam Split based on input from your sites IT<sup>3</sup> and PACS<sup>4</sup> administration.

---

1. Performed Procedure Step  
2. Gray Scale Presentation State



**EXAM SPLIT****Split exams with ConnectPro**

Use the Exam Split option to split images from a single acquisition and assign them to a Requested Procedure ID or accession number retrospectively. The smaller image groups can be accessed at reading stations for multiple reads and multiple billings on select patient exams.

Use ConnectPro option to select multiple Requested Procedure IDs or Accession numbers from the Modality Work List for images from a single acquisition and then assign them to a Requested Procedure ID or accession number.

1. From the **Browser**, click the **Exam Rx** icon.



2. Click the **Patient Schedule** icon.
3. From the Patient Schedule screen, select the desired patient exams to which you want to apply Exam Split once the images are reconstructed.
  - A maximum of 15 procedures can be selected.
4. Click **Select Patient**.



If multiple accession numbers are selected, the last accession number selected is listed in the images header. The accession number is stored in a different DICOM<sup>1</sup> field (0040,0275) when multiple records are selected. Use Exam Split to send images to the PACS<sup>2</sup> with the associated accession number for a particular procedure.

- 
- 1.Digital Imaging and COnnunications in Medicine
  - 2.Picture Archiving Communications System

## Neuro 3D Filter

Neuro 3D Filter is a noise reduction filter optimized for thin slice data that is intended for post processing in Reformat to create Average and MIP images. Volumetric Rendering and 3D models for Neurological studies such as Circle of Willis, Carotids, Sinuses, Orbita, Mandible and helical Brain. The Neuro 3D Filter can be used to reduce noise in images or reduce dose while maintaining image quality. It may be possible to reduce dose depending on the level of filtering applied.

Neuro 3D Filter removes noise from the image while preserving image resolution. Retrospectively, Neuro 3D Filter is selected in the Browser on image Works desktop. There are three levels.

- Low- processed images are saved in a series that is the original series number plus 30.
- Medium- processed images are saved in a series that is the original series number plus 40.
- High- processed images are saved in a series that is the original series number plus 50.

A minimum of three images are required for Neuro 3D Filter.

Neuro 3D Filter is only compatible with series that have a single group without repeated image locations. It is not possible to select a subset of a series. A message displays if the series is not compatible with Neuro 3D Filter (See "Incompatibility message" on page 10-31). Neuro 3D Filter is not compatible with ASiR.

Figure 10-11 incompatibility message

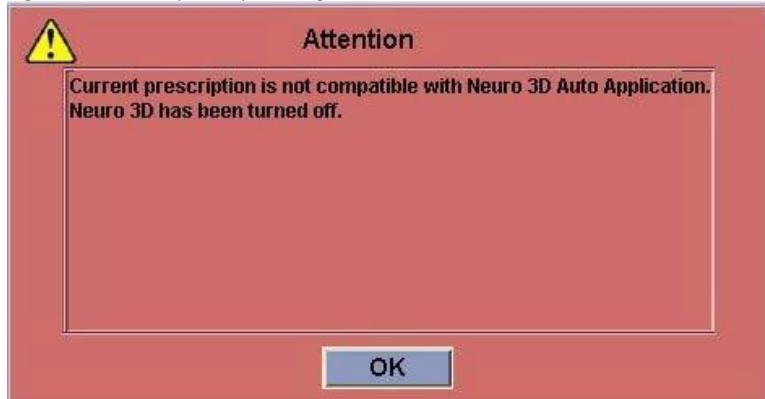


Figure 10-12 invalid data set message



1. Maximum Intensity Projections

## NEURO 3D FILTER

## Filter Auto Transfer by Series screen

Click **OK** from the [Session Selection screen](#) to display the Filter Auto Transfer by Series Host Selection screen.

Figure 10-13 Filter Auto Transfer by Series Host Selection screen



Table 10-5 Filter Auto Transfer by Series screen text and translation

Screen text	Translation	Description
FilterAutoTransfer by Series Host Selection		Screen title
Host 1		The host to which you want to retransfer a series,
Host 2		The second host to which you want to transfer a series.
Host 3		The third host to which you want to transfer a series
Host 4		The fourth host to which you want to transfer a series.
Next		Click to move down the host list.
Prior		Click to move up the host list.
OK		Accepts the selection and closes screen.
Cancel		Closes the screen with no acceptance of selections.

## NEURO 3D FILTER

### Apply a Neuro 3D Filter

Neuro 3D Filter can be used to reduce pixel noise standard deviation or reduce dose while maintaining image quality. It may be possible to reduce dose depending on the level of filtering applied.

Use this procedure to enable Neuro 3D Filter to reduce noise for thin slice data intended for post processing for neurological studies such as CT angiography of the circle of wills, carotids, sinuses, orbits, mandible, and helical brain.

### Considerations

- Nuero 3D Filter is not compatible with series that have duplicate slice locations.
  - To complete groups the following parameters must be the same: Slice Thickness, Interval, Tilt, SFOV, DFOV, Scan Type, Rotation Speed, image center, and algorithm. The groups must be contiguous.
  - Two series are reconstructed: the original and a series with Neuro 3D Filter applied.\
  - Maximum number of images for Neuro 3D Filter is 500.
  - Images are annotated with the applied filter: N1, N2 or N3.
  - Images processed with Low N1- series plus 30.
  - Images processed with Med N2- series plus 40.
  - Images processed with High N3- series plus 50.
  - Images can be set to automatically transfer to up to four hosts.
  - Neuro 3D Filter is not compatible with ASiR.
1. Prescribe a scan for a neuro application.



2. Click the Recon icon  , in the Auto Apps column for the group.
3. Click off to display the Session Selection screen.
4. From the **Session Selection screen**, under Filters, click **Neuro 3D**.
5. Set the Filter Strength.
  - a. Click **Low N1**, **Med N2**, or **High N3**.
  - b. Click **OK**.
6. From the **Filter Auto Transfer by Series screen**, set Auto Transfer destination for up to four network hosts.
  - a. Click **Host1**.
  - b. Click the network host in the list of availale destinations.
  - c. Click **OK**.
7. Click **Confirm**.
8. Press **Move to Scan**.
9. Press **Start Scan**.

## SmartPrep

SmartPrep™ allows intermittent monitoring of IV<sup>1</sup> contrast enhancement in one particular section of anatomy that is in the area of interest. The contrast flow is monitored by low-dose scans until the contrast enhancement reaches the preferred point and the operator initiates the scan prescription.

If SmartPrep is enabled for a series, the system cancels the AutoView display for any images in the recon queue when the SmartPrep series is started. These images are selected from the browser for review once they have been reconstructed. Only images from the series with SmartPrep and those after the SmartPrep series are displayed in AutoView viewpoint.

There are three phases to a SmartPrep scan.

- **Baseline phase** - a single unenhanced image is acquired in the anatomy where the monitoring occurs and the ROI<sup>2</sup> is established.
- **Monitor phase** - uses the ROI defined in the baseline phase to display a graph that helps you determine the peak enhancement value. Up to 40 low-dose scans can be taken during the injection of IV contrast.
- **Scan phase** - acquires the scan data based on the scan setup parameters. You start the scan when the contrast is at the peak on the curve or by a preset Hounsfield value is reached.

Setting the SmartPrep parameters does not need to be done each time SmartPrep is used. The parameters can be included in any protocol using SmartPrep. The system holds the last values entered if SmartPrep is activated for an individual study. SmartPrep parameters allow for checking the IV enhancement both visually and graphically.

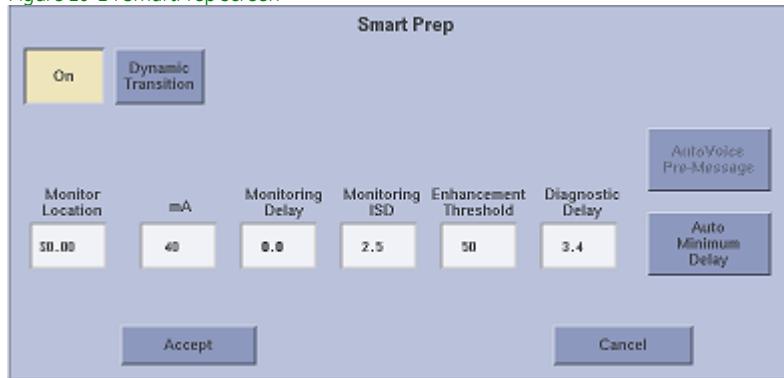
- 
- 1.introvenous
  - 2.Region Of Internet

## *SMART PREP*

### SmartPrep screen

From the SmartPrep scan desktop, click SmartPrepRx.

Figure 10-14 SmartPrep screen



#### *Dynamic Transition*

If Dynamic Transition is On, the system will automatically transition from Monitor phase to Scan phase when the contrast enhancement level for the Transition ROI reaches the Enhancement Threshold HU value.

#### *Monitor Location*

The Location where the monitoring images are scanned and where the ROIs are placed. Precede the value with an S or + for superior | or - for inferior.

#### *mA*

The system defaults to a low mA value, which keeps heat units to a minimum. This is the mA used during the Monitor phase. The mA value can be adjusted depending on patient size. The mA selected should be adequate to provide images that allow the detection of contrast but do not need to be of high diagnostic quality.

#### *Monitoring Delay*

The delay time before you acquire the Monitoring images. The time varies based on the anatomy being monitored.

#### *Monitoring ISD*

The time between each SmartPrep image.

#### *Enhancement Threshold*

The threshold horizontal bar at which you want to transition to the Scan phase. It is set in Hounsfield units.

#### *Diagnostic Delay*

- This value allows time for the table to move into the Scan Phase Start Location and to ready the

system for the Scan phase. It is generally set to minimum values possible for arterial studies and 10 or greater seconds for venous/routine studies.

- The Diagnostic Delay can be entered explicitly or the system can automatically calculate the minimum value.
- The Diagnostic Delay is entered in seconds. The range is 3 to 60 seconds in 0.1 second increments.
- For Explicit Manual entry of the Diagnostic Delay, the delay time selected needs to meet clinical needs and include time for the initial breathing instructions to the patient. Or, an AutoVoice Pre- Message can be selected. Selecting an AutoVoice Pre- Message to be played prior to scanning in some case may increase the Diagnostic Delay value to allow the message to be played.
- When Auto Minimum Delay is selected, the diagnostic delay time is set automatically to be the minimum time possible.
- The minimum delay possible is uploaded to adjust for table movement between the Monitor location and the Scan Phase. If Scan Location is changed after the SmartPrep Pop-up window is closed, the Diagnostic Delay time is automatically updated to the minimum time possible when Auto Minimum Delay is in and if the value for the Diagnostic Delay is less than the minimum value entered.
- The value for the prescribed Diagnostic Delay is displayed in Attention messages.

#### *AutoVoice Pre-Message*

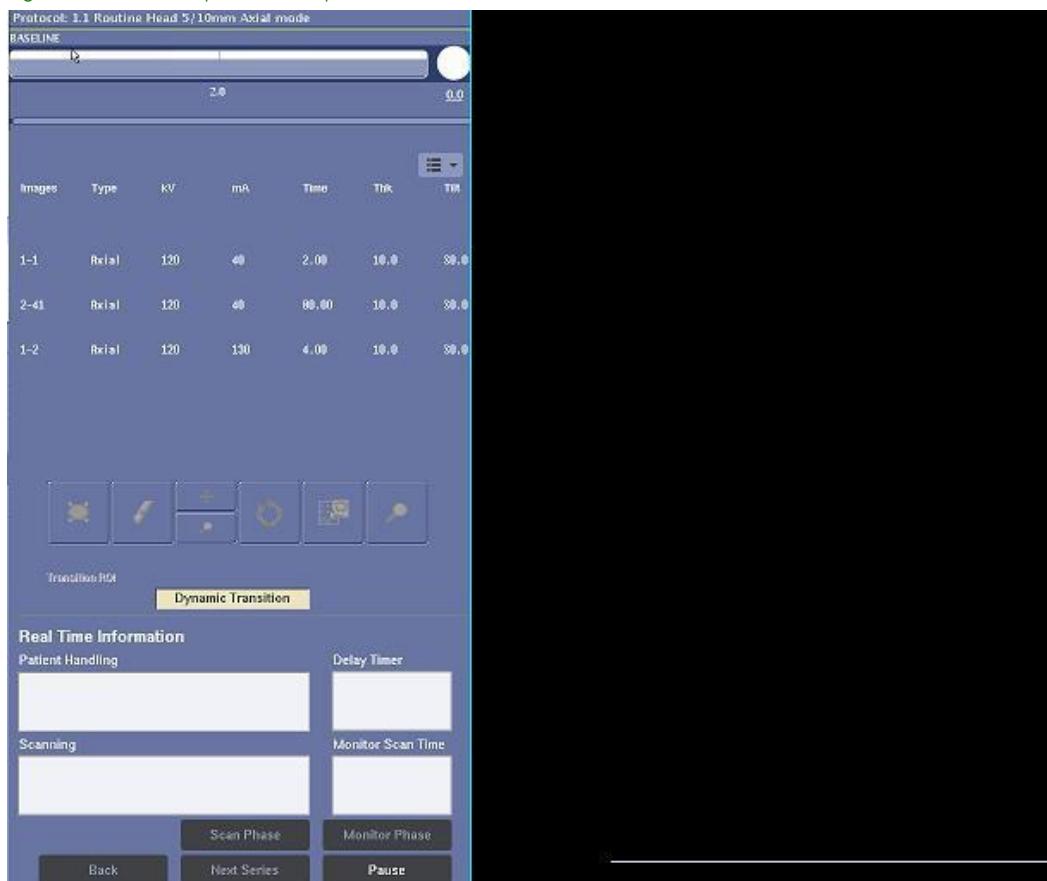
If AutoVoice is enabled for the series, the pre-message will be played as part of the diagnostic delay. The diagnostic delay will be increased to accommodate the length of the AutoVoice message.

## **SMART PREP**

### **SmartPrep scan desktop**

The SmartPrep scan desktop displays when a **SmartPrep scan** is prescribed.

Figure 10-15 SmartPrep scan desktop



#### *Real Time Information*

Displays up-to-date information concerning Patient Handling, and imaging during the Monitor Phase (interscan delay time between Monitor images and the total Monitor scan time).

#### *Scan Progress*

Displays the progress of the SmartPrep scan.

#### *End Exam*

Stops the scan.

#### *Next Series*

Initiates the next series.

#### *Monitor Phase*

Initiates the monitoring phase.

*Scan Phase*

Initiates the scan phase.

*Report Last Group*

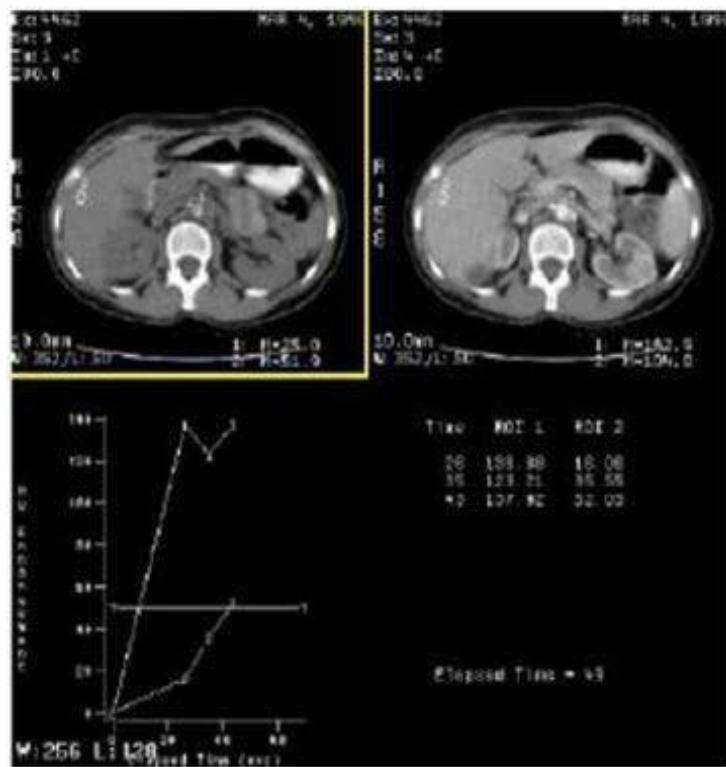
Allows you to repeat the last group scanned with the same scan parameters.

## **SMARTPREP**

### **SmartPrepDisplayScreen**

The SmartPrep Display screen appears once the monitor phase is started.

Figure 10-16 SmartPrep Display screen



#### ***Upper left viewport***

Display the baseline image with the ROIs.

#### ***Upper right viewport***

Displays the real time monitoring image as it reconstructs along with the ROIs.

#### ***Lower left viewport***

Displays in real time, the time that each monitoring scan was acquired based on the beginning of the monitor delay as well as showing the ROI values for each scan. The lower right quadrant also displays on elapsed time clock. This displays, in real time, the time from when StartScan was selected for the monitor phase until the Scan Phase icon was selected. This is the inject to scan delay for this series of scans.

## SMART PREP

### Set up a scan

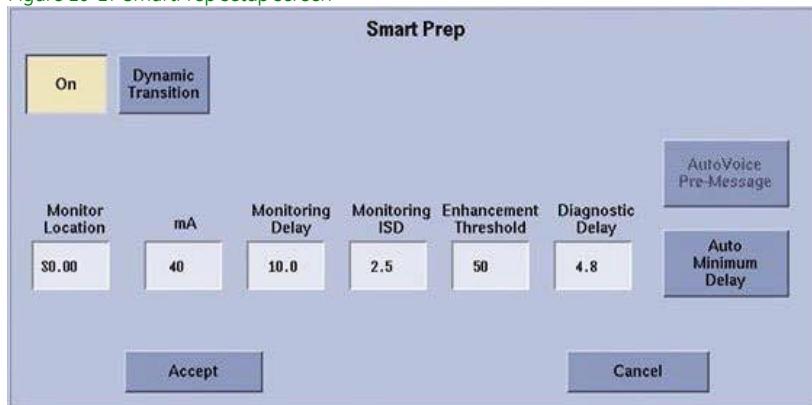
Use the following procedures to scan with SmartPrep™, which allows intermittent monitoring of IV<sup>1</sup> contrast enhancement in an area of interest. The contrast flow is monitored by Low-Dose scans until the contrast enhancement reaches the preferred point and the operator initiate the scan prescription when in Dynamic Transition is OFF. When Dynamic Transition is ON, the system will automatically transition from Monitor phase to Scan phase when the contrast enhancement level for the Transition ROI reaches the Enhancement Threshold HU value.

Use this procedure to set up a SmartPrep series to acquire contrast-enhanced images with a bolus tracking technique.

### Scan prescription

1. From the ViewEdit screen, click **SmartPrepRx**.
2. Click **On**, if SmartPrep is Off.
3. To automatic transition from Monitor Phase to Scan Phase when Transition ROI reaches threshold, click **Dynamic Transition**.

Figure 10-17 SmartPrep setup screen



4. From the scout localizer on the display monitor, click and drag the red X on the slice line to define the Monitor location. Alternatively, type in the S/I location in the Monitor Location text field, for example, **S110**.
5. From the SmartPrep screen, enter the following values:
  - **mA** (range 10 to 100 in 10 mA increments), typically enter 40 mA for most studies.
  - **Monitoring Delay** (0 to 60 seconds in 1 second increments) sets the time before monitoring scans begin.
  - **Monitoring ISD** (1 to 60 seconds in 1 second increments) sets the time between monitoring scans.
  - **Enhancement Threshold** (0 to 1,000 in steps of 1) sets the bar on the graph to monitor threshold enhancement. With Dynamic Transition is On, the Scan Phase starts automatically when the HU value of the Transition ROI reaches the Enhancement Threshold.
  - **Diagnostic Delay**, (range 3 to 60 in 0.1 second increments) typically set to the minimum value (automatic) for arterial studies and 10 seconds or longer for venous studies.



- Allow enough time to deliver breathing instructions if Auto Voice is not being used.
  - The minimum time may vary when Auto Voice is turned on and depending on the monitor location relative to the start location.
  - If Scan Location is changed after the SmartPrep screen is closed, to accommodate the new table location, the Diagnostic Delay time is automatically updated to the minimum time possible when Auto Minimum Delay is on. Respond to the confirmation prompts that indicate a Diagnostic Delay change.
  - The Diagnostic Delay time is displayed in Prep Group for Group1 on the Timing Tab, for example SP11.2.
  - **Auto Voice Pre-message** is available if Auto Voice is prescribed in the Voice Lights Timer in Timing parameters.
  - **Auto Minimum Delay** sets the Diagnostic Delay to the most minimum value possible, taking into consideration location of the monitor phase, start phase location, and Auto Voice Pre-message length.
6. From the SmartPrep screen, click **Accept**.
7. Proceed to [Acquire a SmartPrep scan](#).

## *SMART PREP*

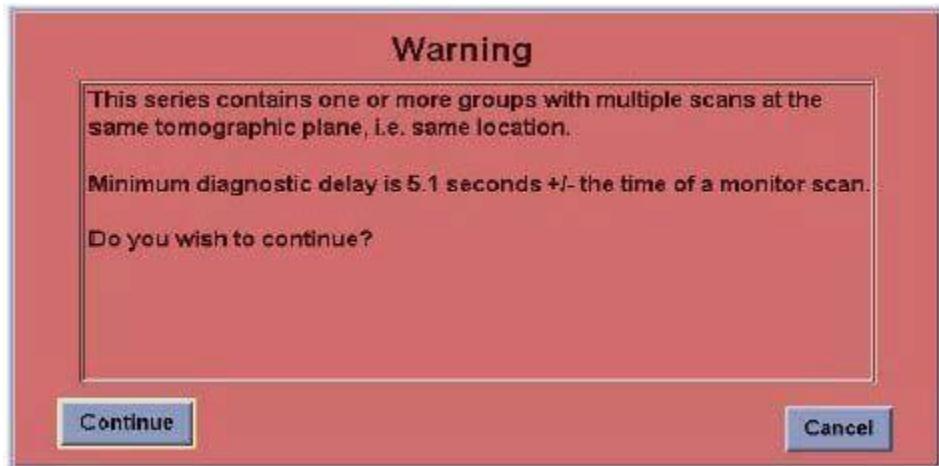
### *Acquire a scan*

Use these steps to acquire contrast-enhanced images with a bolus tracking technique.

#### *Baseline phase*

The Baseline phase acquires one non contrast scan and allows you to establish an area to monitor contrast enhancement.

1. From the ViewEdit screen click the **Confirm** icon to proceed to scan.
2. Review and respond to the warning message.



#### **WARNING**

This series contains one or more groups with multiple scans at the same tomographic plane, i.e. same location.

Minimum diagnostic delay is 3.2 seconds +/- the time of a monitor scan.

Do you wish to continue?

3. Review the values on the DynaPlan screen for all three phases: baseline, monitor, and phase.
4. Press **Move to Scan** to advance the table to the monitoring location.
5. Press **Start Scan**.
6. From the reconstructed image on the display monitor, click **Ellipse ROI** and place a maximum of three ROIs over areas of interest. For example, if scanning a liver, place an ROI in liver parenchyma away from vessels, if evaluating a vessel place the ROI over the vessel.
  - Use, as needed, the zoom, roam, display normal, hide/show graphics, erase, or explicit mag (factor range: 0.5 to 2.0) from the SmartPrep display control panel.



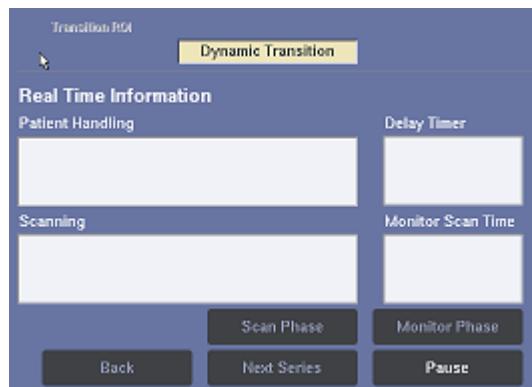
If the space bar and the Alt key are depressed during SmartPrep baseline scan, Dynaplan disappears. Open and close Retro Recon to redisplay the Dynaplan screen.

#### *Monitor phase*

The Monitor phase acquires images at the monitoring location during the delivery of intravenous iodinated contrast material and graphically displays the images, charts the enhancement thresholds, and displays a clock with the time since monitoring began.

During SmartPrep, if the ROIs set on the baseline image fail to display during the monitoring phase, use the ROI statistics to monitor elapsed time and visually determine transition point to Scan Phase. If ROIs fail to display, they will not be on the screen saved SmartPrep image.

1. From the **Scan Progress screen**, click **Monitor Phase**.
2. Simultaneously press **Start Scan** and start the **IV contrast injection**. A maximum of 40 monitoring images are available.
  - If all 40 monitoring scans have been used, you must press **Move To Scan** to move the table to the start location and press **Start Scan** to initiate the scan prescription plan.
  - The system waits the time set in the Monitoring Delay area and then begins acquiring images at the time set for the ISD<sup>1</sup>.
  - The total SmartPrep monitor scan time and Interscan Delay time between monitor images is displayed on the Real Time Information screen



3. View the **display monitor** and track the IV contrast graph.
  - Four viewports display from top left to bottom right: baseline image, real time images, graph, time stamp for each real time image.
  - A horizontal line indicating the enhancement threshold only appears on the graph if an ROI is placed on the baseline image.
  - The tick marks on the SmartPrep graph may not show equal spacing, which is due to time between acquisition rounding issues. The SmartPrep scans are acquired at the correct timing interval, as prescribed.

### *Scan phase*

The Scan Phase is the start of the actual Scan Prescription following the Monitor Phase.

1. When the desired enhancement threshold is achieved, from the Scan Progress screen, click **Scan Phase**. Deliver the *first* breath hold instructions if Auto Voice Pre-Message is not turned on.
  - The table moves to the scan prescription start location and, according to the Diagnostic Delay selected, the scan starts.
  - The real time updating in the quadrants stops.
  - A screen save image of the four SmartPrep viewport display is automatically captured and saved in series 99 for the exam.



If an Auto Voice Pre-Message is not enabled, the initial breathing instructions to the patient for the start of the exam scan prescription must be delivered by the operator during the Diagnostic Delay. The system then provides the rest of the breathing instructions if Auto Voice has been selected.

**SMART PREP*****Acquire a scan with Dynamic Transition***

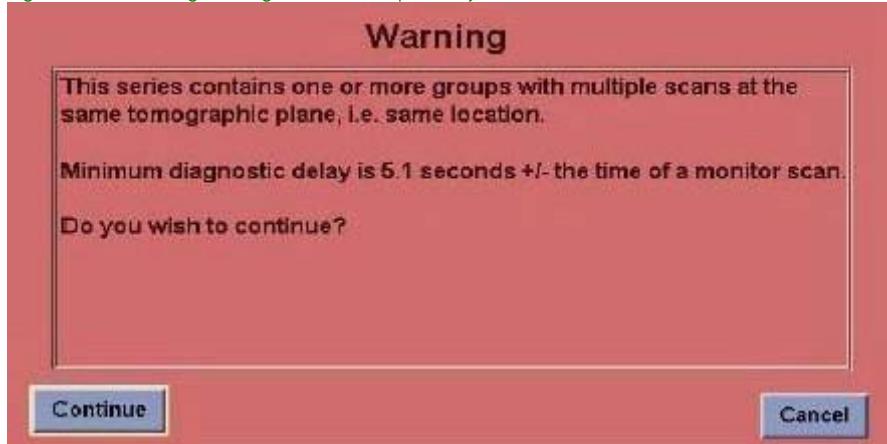
Use these steps to acquire a contrast-enhanced images with a bolus tracking technique.

**Baseline phase**

The Baseline phase acquires one non contrast scan and allows you to establish an area to monitor contrast enhancement.

1. From the ViewEdit screen click the **confirm** icon to proceed to scan.
2. Review and respond to the warning message.

Figure 10-18 Warning message for SmartPrep with Dynamic Transition

**WARNING**

This series contains one or more groups with multiple scans at the same tomographic plane, i.e. same location.

Minimum diagnostic delay is 5.1 seconds +/- the time of a monitor scan.

Do you wish to continue?

3. Review the values on the Scan Progress screen for all three phases: baseline, monotor, and phase.
4. Press **Move to Scan** to advance the table to the monitoring location.
5. Press **Start Scan**.
6. From the reconstructed image on the display monitor, click Ellipse ROI and place a maximum of three ROIs over areas of interest. For example, if scanning a liver, place an ROI in liver parenchyma away from vessels, if evaluating a vessel place the ROI over the vessel.
  - Use, as needed, the zoom, roam, display normal, hide/show graphics, erase, or explicit mag (factor range: 0.5 to 2.0) from the SmartPrep display control panel.
7. From **SmartPrep Display control panel**, select the ROI to be used for the Transition ROI. The last ROI placed on the image will be designated as the Transition ROI or set the desire ROI using Transition ROI selection in the SmartPrep Display control panel.
  - The Transition ROI will be displayed in yellow when inactive and in blue when active, the other ROIs will be displayed in white.

Figure 10-19 SmartPrep display in baseline phase



If the space bar and the Alt key are depressed during SmartPrep baseline scan, Scan Progress screen disappears. Open and close Retro Recon to redisplay the ScanProgress screen.

### *Monitorphase*

The Monitor phase acquires images at the monitoring location during the delivery of intravenous iodinated contrast material and graphically displays the images, charts the enhancement thresholds, and displays a clock with the time since monitoring began.

During SmartPrep, if the ROIs set on the baseline image fail to display during the monitoring phase, use the ROI statistics to monitor elapsed time and visually determine transition point to Scan Phase. If ROIs fail to display, they will not be on the screen saved SmartPrep image.

1. From the Scan Progress screen, click **Monitor Phase**.
2. Simultaneously press **Start Scan** and start the **IV contrast injection**. A maximum of 40 monitoring scans are available.
  - If all 40 monitoring scans have been used, you must press **Move To Scan** to move the table to the start location and press **Start Scan** to initiate the scan prescription.
  - The system waits the time set in the Monitoring Delay area and then begins acquiring images at the time set for the ISD<sup>1</sup>.
  - The total SmartPrep monitor scan time and interscan Delay time between monitor images is displayed on the Real Time information screen.

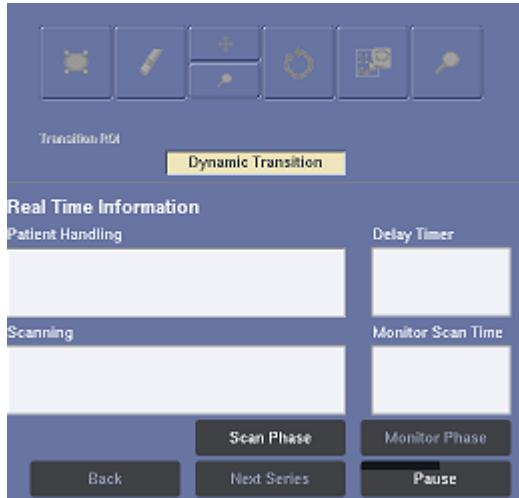
Figure 10-20 Real Time information screen



3. View the display monitor and track the IV contrast graph.
  - Fourviewports display from top left to bottom right: baseline image, real time images, graph. time stamp for each real time image.

- A horizontal line indicating the enhancement threshold only appears on the graph if an ROI is placed on the baseline image.
- The tick marks on the SmartPrep graph may not show equal spacing, which is due to time between acquisition rounding issues. The SmartPrep scans are acquired at the correct timing interval, as prescribed.
- When Dynamic Transition is On, the **Dynamic Transition** button is displayed in yellow on Scan Progress screen. If you want to disable Dynamic Transition, click **Dynamic Transition** on Scan Progress screen. Then click Scan Phase to start **Scan phase** manually.
- When Dynamic Transition is on, the time density curve of Transition ROI is displayed in yellow, while the others are in white.

Figure 10-21 Scan Progress screen with Dynamic Transition On



### Scanphase

The Scan phase is the start of the actual Scan Prescription following the Monitor Phase.

1. When HU value of Transition ROI reached to the desired enhancement threshold in the time density curve, Scan phase will start automatically.
  - The table moves to the scan prescription start location and, according to the Diagnostic Delay selected, the scan starts.
  - The real time updating in the quadrants stops.
  - A screen save image of the four SmartPrep viewpoint display is automatically captured and saved in series 99 for the exam.
  - You can start Scan phase manually to click **Scan Phase** in Scan progress screen, if you want to start Scan phase.



If an Auto Voice Pre-Message is not enabled, the initial breathing instructions to the patient for the start of the exam scan prescription must be delivered by the operator during the Diagnostic Delay. The system then provides the rest of the breathing instructions if Auto Voice has been selected.

***SMART PREP******Displayimages***

The system places the baseline image, the monitoring images and the screen save image with the exam in the browser. These images are denoted as series 200 prospective and screen save images. If an additional baseline image was acquired these images are in series 201.



# SmartPlan

SmartPlan is designed to provide user with a more efficient way for localizer setting. SmartPlan provides following information on localizer: initial start/end scan location, tilt angle (if applicable), DFOV and anterior/ posterior or right/left for exam series based on different anatomies. User needs to check the results before deciding if the parameters need to be adjusted.

## Indications for use

SmartPlan helps with localizer setting up. Detections made by SmartPlan should be used as a starting point. Result should be reviewed by users to determine if further adjustment is needed to meet clinical requirements.

## Precautions

In following conditions, SmartPlan may not function properly. Please adjust localizer according to indication on Operation Message bar (at bottom left of screen) to make sure SmartPlan function properly.

1. Scout image is not matching the protocol which user selected. For example: User chooses head protocol, but acquires chest scout image rather than head scout image. Following message will pop up: SmartPlan has failed to localize the desired organ, please confirm the scan coverage manually.
2. For head scan, if SmartPlan detects that the to-be-set tilt angle is greater than 30 degree, system will automatically change the tilt angle to Non-tilt algorism. Following message will pop up: SmartPlan modify the scan range based on maximum tilt limitation, please confirm the scan coverage.
3. Localizer does not include entire anatomy, due to incorrect operation during scout scan. Following message will pop up: SmartPlan cannot localize the desired organ, please double confirm the Scout image.
4. For head scan, SmartPlan is applicable only when patient is placed in supine position. If patient is placed in other positions, following message will pop up: SmartPlan only support Patient Position of Head First, Feet First Supine for Head Scan.
5. For chest/abdomen/pelvis scan, SmartPlan is applicable only when patient is placed in supine or prone position. If system detects that patient is placed in decubitus position, following message will pop up: SmartPlan doesn't support Patient Position of Left or Right for Chest, Abdomen and Pelvis scan.
6. When applying SmartPlan in head scan, at least one Lateral scout is needed. When applying SmartPlan in chest/abdomen/pelvis scan, at least one AP scout is needed. If the scout is not detected, following message will pop up: SmartPlan is not allowed in this series because there are no valid Scouts in this exam.

## SmartPlan Setting

User need to preset SmartPlan in Protocol Management.

SmartPlan can provide localizers on following anatomies.

-Single anatomy: Head, Chest, Abdomen, Pelvis

-Combination anatomies: Chest + Abdomen, Abdomen + Pelvis

User is able to turn on/off SmartPlan when editing a protocol.



Figure 10-22 Protocol Management

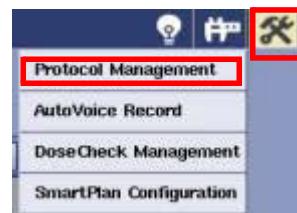


Figure 10-23 Turn on/ off SmartPlan

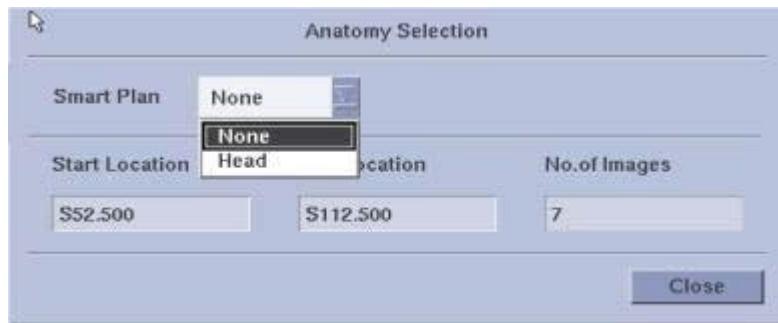


Figure 10-24 Anatomy selection

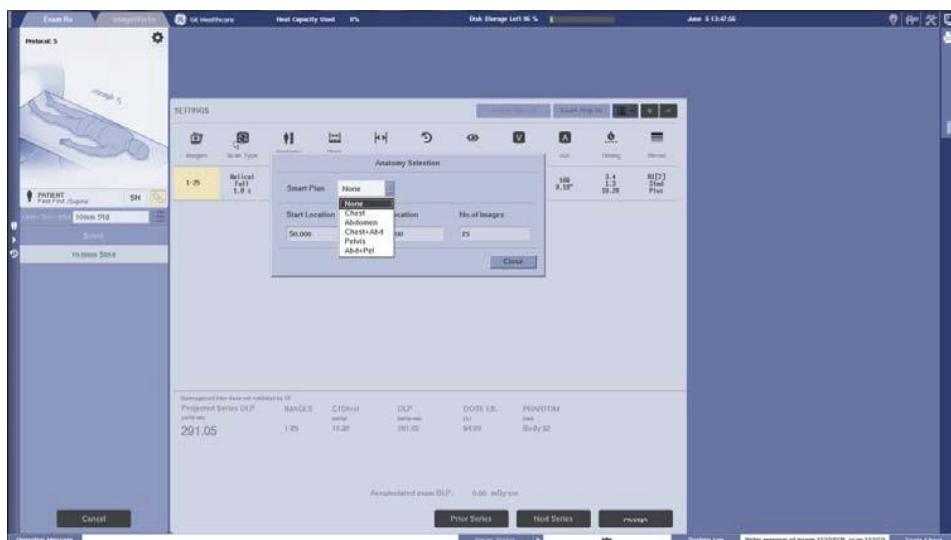
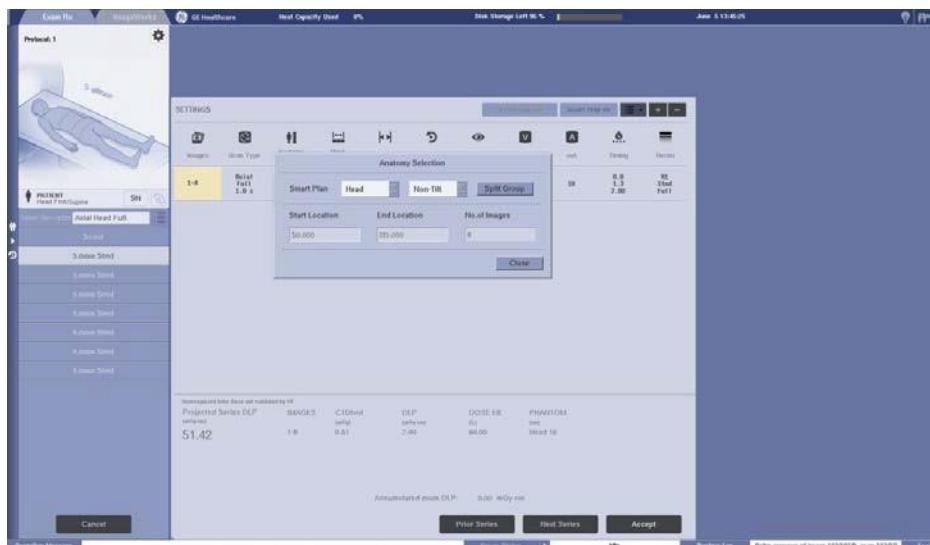


Figure 10-25 Axial head scan



Digital Tilt is applicable only during helical scan mode. For axial scan mode, system only allows user to set up the tilt angle to zero degree. In helical scanning mode, the tilt angle is calculated by the detection algorithm.

Figure 10-26 4 different reference lines for helical head scan.

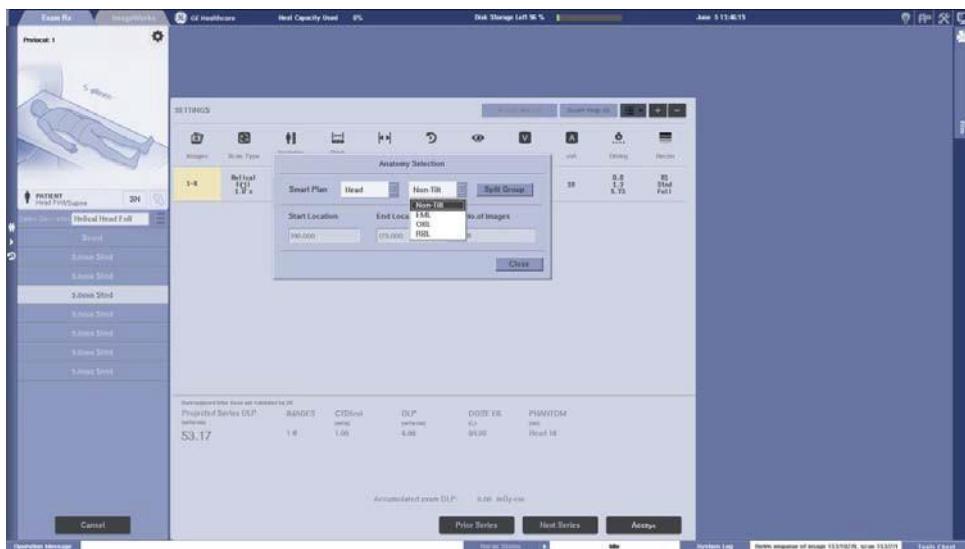
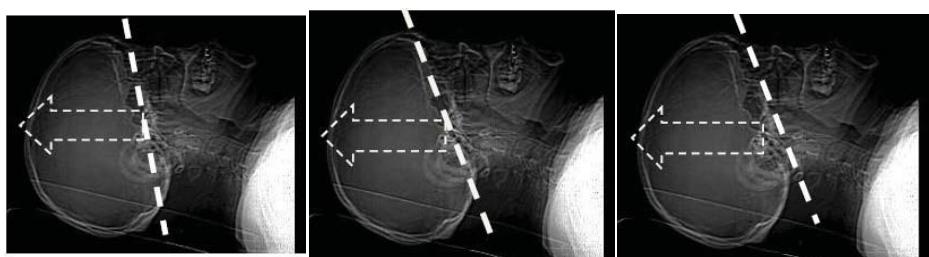
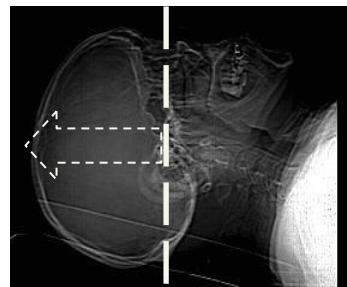


Figure 10-27 Detail of the reference lines for head scan.



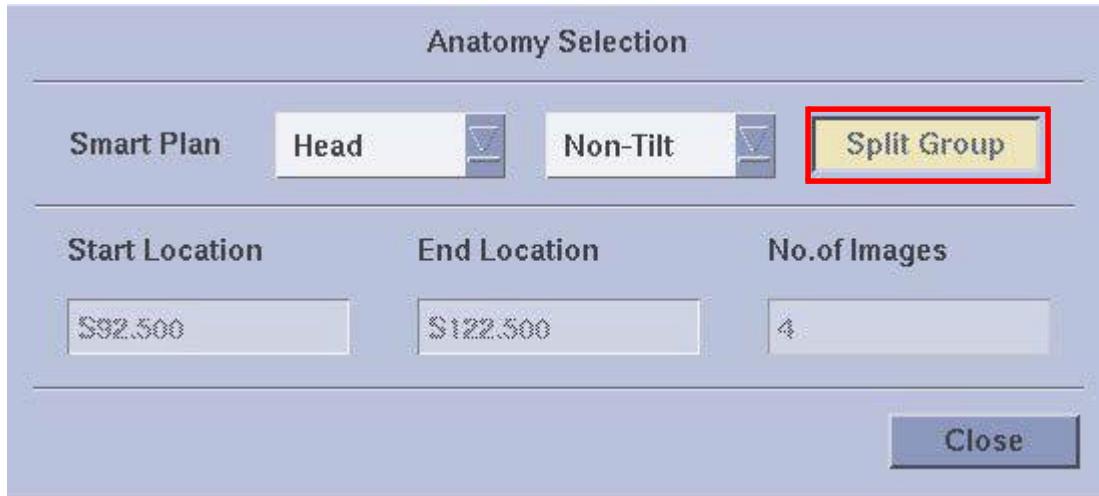
Left: Classical OM Line (OML); Middle: Skull Base(Bottom) Line (EML); Right: Full Skull Base Coverage (RBL)  
Below: Routine Head without tilt angle



For head scan, SmartPlan provides Split Group function to break head scan series into two continuous scan groups. The scan range for the 1st group is 40mm.

If current series is helical scan, Split Group is not available for head with reference line "OML"/"EML"/"RBL".

Figure 10-28 Split Group



## SmartPlan Configuration

User can modify the length of the localizers by editing the value under SmartPlan Configuration. Click SmartPlan Configuration. Smart Configuration window will pop up. Base on system preset, user can elongate the length of the localizer by entering length in Superior Margin or Inferior Margin.

For head scan, user can turn on User Customizing DFOV to modify DFOV value under Protocol Management. If user turns it off, system will use preset DFOV value.

Figure 10-29 SmartPlan Configuration



Figure 10-30 SmartPlan Configuration

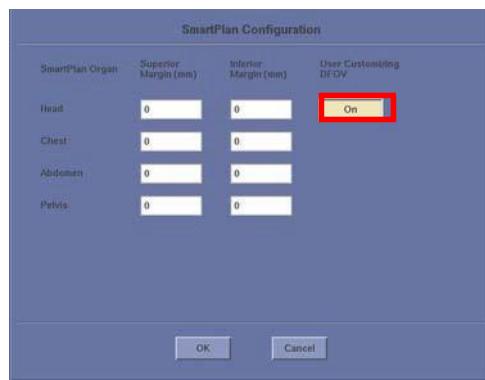


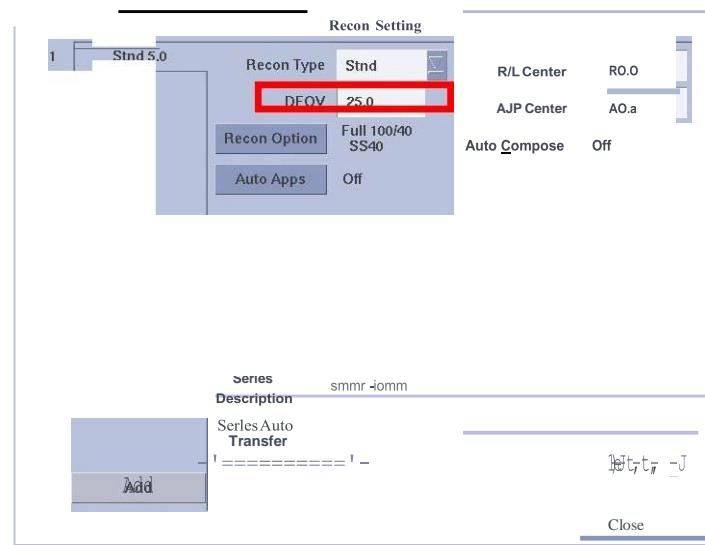
Figure 10-31 Editing protocols



Figure 10-32 Head scan settings

SETTINGS											Smart Prep Rx	More	+	-
Images	Scan Type	Anatomy Selection	Thickness Speed	Interval	Tilt	SFOV	kV	mA	Timing	Recon				
1-10	Axial Full 2.0 s	Head Non-Tilt	5.0 2i	10.000	SO.0	Head	120	90 DR	0.0 1.0 10.00	R1 Std Full				
11-17	Axial Full 2.0 s	Head Non-Tilt	10.0 1i	10.000	SO.0	Head	120	80 DR	1.0 1.0 14.00	R1 Std Full				

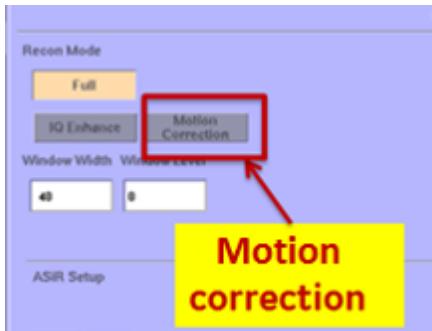
Figure 10-33 Adjust DFOV value



## Motion Correction

This feature minimizes Lateral Motion in Axial Head Scans. Available in all PMRs and RetroRecon.

Note : Motion Correction does not apply to the following cases. Helical/Cine scans and Segment Rotation Length



## Gray Scale Enhancement (GSE)

This feature is available for all Head Scans. Improves Gray Scale in Head Images. Available in Prospective and Retro Recon Modes.



## Image Filter

This feature is available for all Scan Modes. Available in Prospective and Retro Recon Modes

Smooth (S1, S11, S2, S21, S3), Edge (E1, E2, E21, E22, E23, E3), Lung (Lu)



# Chapter 11 : Retro reconstruction

This section provides the information you need to work with raw scan data for retro reconstructions.

## Retro Recon

- [Retro Recon screen](#)
- [List Select screen](#)
- [Recon Management screen](#)
- [Create new images from scan data](#)
- [Graphically prescribe Retro Recon](#)
- [Find unreconstructed images](#)
- [Pause/resume the queue](#)
- [Remove data from the queue](#)
- [Reserve/release acquired scan data](#)
- [Save anonymous patient scan data](#)
- [Save/restore scan data to/from a USB/DVD-RAM](#)

## Considerations

Recon Management may hang while trying to display the menu. Finish the current exam if scanning and shutdown and restart the system to correct the problem.

## Retro Recon

The following Retro Recon features are found on the Recon Management screen.

### Scan (raw) data

With each rotation of the gantry, X-rays are emitted that pass through a portion of anatomy and strike the detectors. The signal from the detector is converted by the DAS<sup>1</sup> to an analog signal that is then part of the scan file. This information is known as the scan or raw data. It contains all of the information gathered during an exposure.

### Suspended entries

Sometimes the system for a variety of reasons may not be able to complete the reconstruction of a particular image. This data is then automatically placed in a queue, where you can attempt to reconstruct it again or delete it.

### Save scan data

It may be necessary on occasion to retain the scan data for reconstruction at a later time or for a diagnostic inspection of the system components. This is usually done if the scan data must be kept for an indefinite period of time or if the scan data is being sent elsewhere for diagnostic review.

The media scan data is saved to is dependent on your operator console type. Personal computer-based systems save scan data to DVD<sup>2</sup>-RAM<sup>3</sup> media. The scan data can be stored to DVD-RAM 9.4 GB dual sided cartridge or DVD-RAM bare media depending on peripheral media tower type. Or, scan data can be saved to an external USB<sup>4</sup> 2.0 hard drive.

### Restore scan data

Scan data that has been stored on a DVD-RAM or external USB hard drive can be placed back onto the system disk. Once on the system disk, the scan data can be reconstructed using any of the scan parameters, i.e., image interval (if acquired helically), DFOV, A/P and R/L centers, or algorithm.



Only scan data from a Revolution ACTs system can be restored on a Revolution ACTs system.



The system overwrites the oldest file on the system when restoring scan data. If you have several files to restore, make sure to reserve each scan files as it is restored to make sure it is not overwritten.

### Reserve scan data

The system temporarily saves the scan data in an electronic queue. These entries are written over in order, with the oldest scans being written over first. Prior to this occurring, you can have the system place a lock on a given scan file to prevent it from being overwritten. The system then goes to the next oldest unlocked scan file to write over. It is important that when the scan data files are reserved, the remaining number of available scan files for use are reduced by the number reserved.

If you do reserve scan files, when you no longer need the scan data you should release the scan files.

---

1. Data Acquisition System

- 2. Digital Versatile Disc
- 3. Random Access Memory
- 4. Universal Serial Bus

## Release scan data

Once scan data files that have been reserved are no longer needed, you can release them so they can be overwritten with new data. Releasing the files increases the available scan data files accordingly. The scan data files are written over in the usual manner.

## Graphic Retro

Graphic Retro provides the capability to graphical prescribe your retrospective reconstructions using an existing axial plane image as a reference image.

## New Series

New Series can be used to assign a new series number to a retro reconstruction. Normally 100 is added to the series number of the original scan. If multiple reconstructions are done, they will be all added to this series. Selecting New Series provides the ability to have each retro reconstruction placed in a separate series. The system assigns the series number beginning with 301 and updates it based on the number of addition retro reconstructions done in the exam. The maximum number is 399, if additional series are created, they will be listed as 399 with a unique UID.

## Overlapped axial imaging mode (w/ Advanced Acquisition)

PMR 2-10 and Retro Recon supports the reconstruction of overlapped data from Axial scan type 10 mm detector coverage. The reconstruction of overlapped axial data can improve reformatted data. The interval cannot be adjusted.

Images reconstructed with the 1.25 Z recon mode will be annotated with a Z in the upper-left area of the images.

Figure 11-1 Image annotation for Overlapped Axial mode



Figure 11-2 Image Thickness screen on PMR and RetroRecon

Enter the desired Image Thickness (mm)							
1.25 Z	1.25	2.5	3.75	5.0	7.5	10.0	<b>Cancel</b>

Figure 11-3 Retro Recon screen

Series Number:	301	Matrix Size:	512	New Series Number							
Retro	Scan Type	Anatomy Selection	Thick (mm)	Interval	Tilt	SFOV	FOV	Recon Type	Recon Option	Graphic Retro	
Y	Axial Full 2.0 s	I39.000 S31.000	8	1 x 10	10.000	30.0	Read	25.0 R0.0 P45.3	Soft	Foil (0/3) None	8

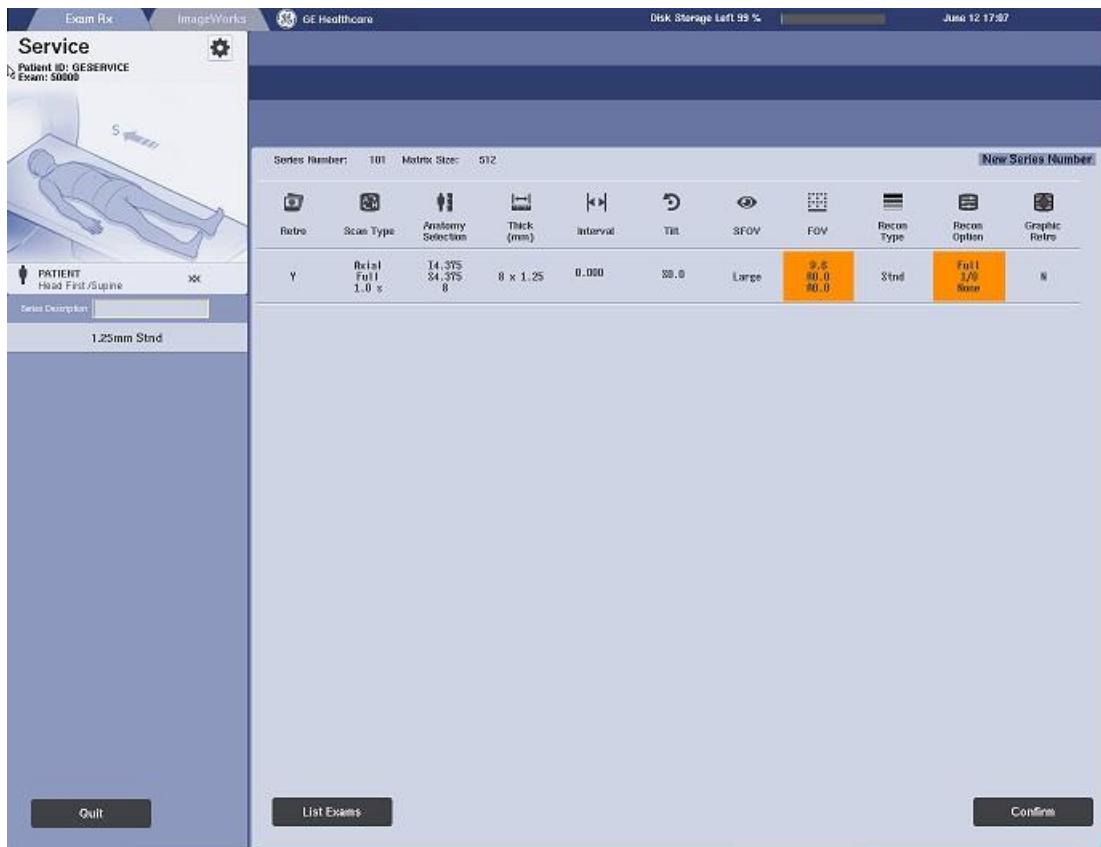
## RETRO RECON

### Retro Recon screen



Click the **Retro Recon** icon, select patient, exam and series. Then, click **Select Series** to display the Retro Recon screen.

Figure 11-4 Retro Recon screen



### Slice Thickness

Figure 11-5 Slice Thickness screen- Axial

Enter the desired Image Thickness (mm)						
1.25 Z	1.25	2.5	3.75	5.0	7.5	10.0
						<b>Cancel</b>

Figure 11-6 Slice Thickness screen- Cine

Enter the desired Image Thickness (mm)						
1.25 Z	1.25	2.5	3.75	5.0	7.5	10.0
						<b>Cancel</b>

Figure 11-7 Slice Thickness screen- Helical

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Enter the desired Image Thickness (mm)

1.25 Z	1.25	2.5	3.75	5.0	7.5	10.0	Cancel
--------	------	-----	------	-----	-----	------	--------

- Axial
  - 1.25 mm beam – 0.625mm
  - 2.5 mm beam – 1.25 mm, 2.5 mm
  - 5 mm beam – 1.25 mm, 2.5 mm, 5.0 mm
  - 10 mm beam – 1.25 mm\*, 1.25 mm\*, 2.5 mm, 5.0 mm, 10.0 mm
- Cine
  - 1.25 mm beam – 0.625mm
  - 2.5 mm beam – 1.25 mm, 2.5 mm
  - 5 mm beam – 1.25 mm, 2.5 mm, 5.0 mm
  - 10 mm beam – 1.25 mm, 2.5 mm, 5.0 mm, 10.0 mm
- Helical
  - 1.25mm beam – 0.625mm\*\*
  - 5mm beam – 1.25mm, 2.5mm
  - 10 mm beam – 1.25 mm, 2.5 mm, 3.75 mm, 5 mm, 7.5 mm, 10.0 mm

\*Revolution ACTs EX only

\*\* With Sub-MM imaging

## List Select screen



Click the **Retro Recon** icon to display the exams with available scan data on the Retro Recon List Select screen.

Figure 11-8 Retro Recon List Select screen

Patient ID	Patient Name	Exam #	Date	Time	Series
12		11	11/26/2013	22:01	BJ66
21		10	11/26/2013	22:05	BJ66
23		9	11/26/2013	22:01	BJ66
32		8	11/26/2013	21:14	BJ66
23		7	11/26/2013	20:56	BJ66
21		3	11/26/2013	19:59	BJ66
sdfasd		2	11/26/2013	19:21	BJ66
dadasd		1	11/26/2013	17:56	BJ66

### Exams

Displays the list of exams available for reconstruction.

### Series

Displays a list of series associated with the selected exam.



Use the arrows to scroll through the exams or series if more than one screen of data exists.

### Select Series

Adds the series to the retro reconstruction queue.

### Update

Updates the list to include any exams added since entering the Retro Recon List Select screen.

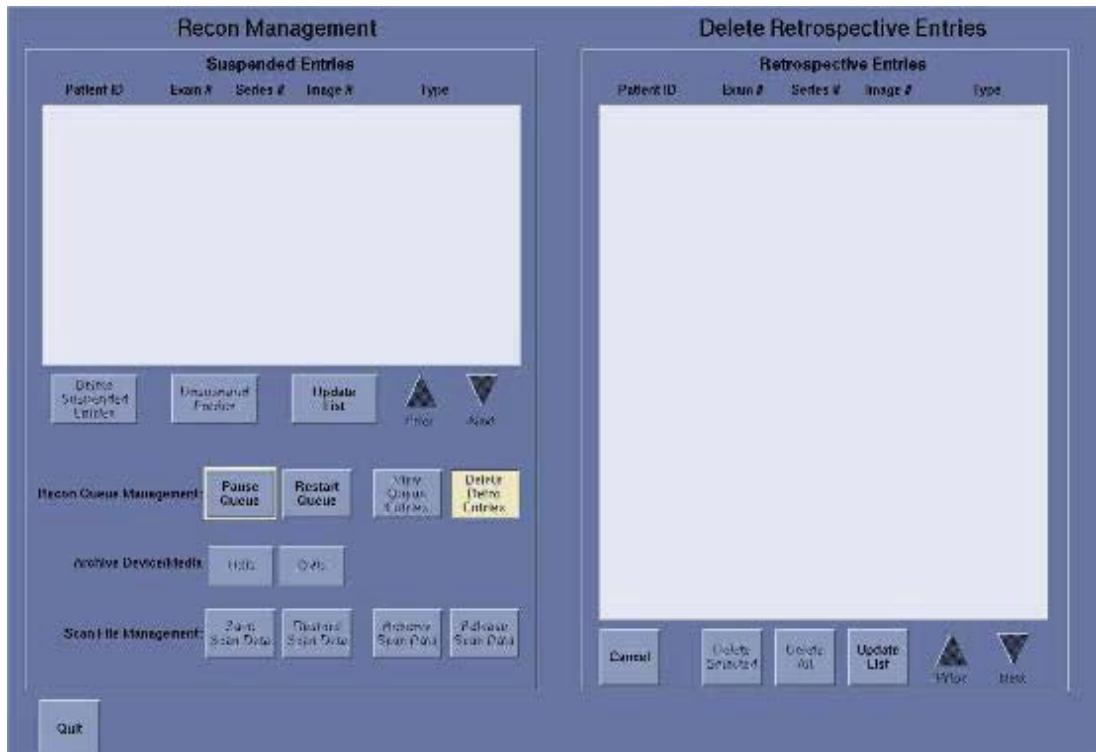
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**RETRO RECON**

# Recon Management screen

On the **monitor**, click **Recon Status** to display Recon Management.

Figure 11-9 Recon Management screen



## Create new images from scan data

Use this procedure to create new images retrospectively.



Retro Recon may not be able to recon the same image locations as prospective recon due to rounding in the start and end location. To avoid this mismatch, prescribe start and end locations that are even numbers.

1. Click **Retro Recon**.
2. From the Retro Recon List Select screen, select the appropriate patient, exam, and series.
3. Click **Select Series**.
4. On the Retro Recon screen, type a new series description in the Series Description area if desired.
5. Click **New Series Number** to reconstruct images in a system-assigned new series number between 301 and 399.
  - If more than 399 series are already reconstructed, series 399 is repeated with a unique UID.
  - If not selected, the new series number will be original series number +100 (e.g., original series is 6, recon series is 106).
6. Click **Retro** to select all groups and click **Yes** or click **Y** for an individual group.
  - If you select Retro, a confirmation message, "Retro this group?" displays. Click **Yes** to proceed.
  - The system assumes all available data is to be reconstructed. If there are multiple groups, you must determine which groups have data you wish to reconstruct.
7. Type in Retro Start and Retro End locations.
  - Cine images do not need a S or I designation. All others do.
8. Click **Thick** and select an image thickness. Click 0.625Z to generate overlapped 0.625 mm thickness axial images.
9. Click **Time** and type the Start and End times.
  - For cine, specify a time period.
10. Click **Interval** and type in an image interval.
11. Click **DFOV** and type in desired value.
12. Click **R/L Center** and/or **A/P Center** to set image offset.
  - Place the real time cursor in image to display the values in upper left corner of the image. You may also click **List>Select** to highlight the correct exam and series or use **Graphic Retro recon**.
13. Click **Recon Option** and select one of the options on the Recon Option screen.
  - For details, see the **Set the Recon Options** procedure.
  - Set the W/L, ASiR level, Flip/Rotate if enabled.
    - If Flip/Rotate is applied, New Series should be selected.
    - Flip/Rotate and non Flip/Rotate images cannot be mixed in the same series.
14. Click **Recon Type** and select one of the available algorithms.
  - A window displays with all of the available algorithms from which you can choose the appropriate algorithm.
  - Soft and Standard are only available if Segment recon mode is selected.
  - Soft, Standard, Detail, Lung, Bone, Bone Plus and Edge are available if Full recon mode is selected.

15. Click **Graphic Retro Y** to graphically prescribe the reconstructions, one group at a time.

- Click and drag the blue circle on the reference image to the desired location. The SFOV is indicated by a red circle.

16. Click **Confirm** to generate images.



Image Thickness, Image Interval, DFOV, R/L and A/P Center can be changed for the entire group or for individual groups.



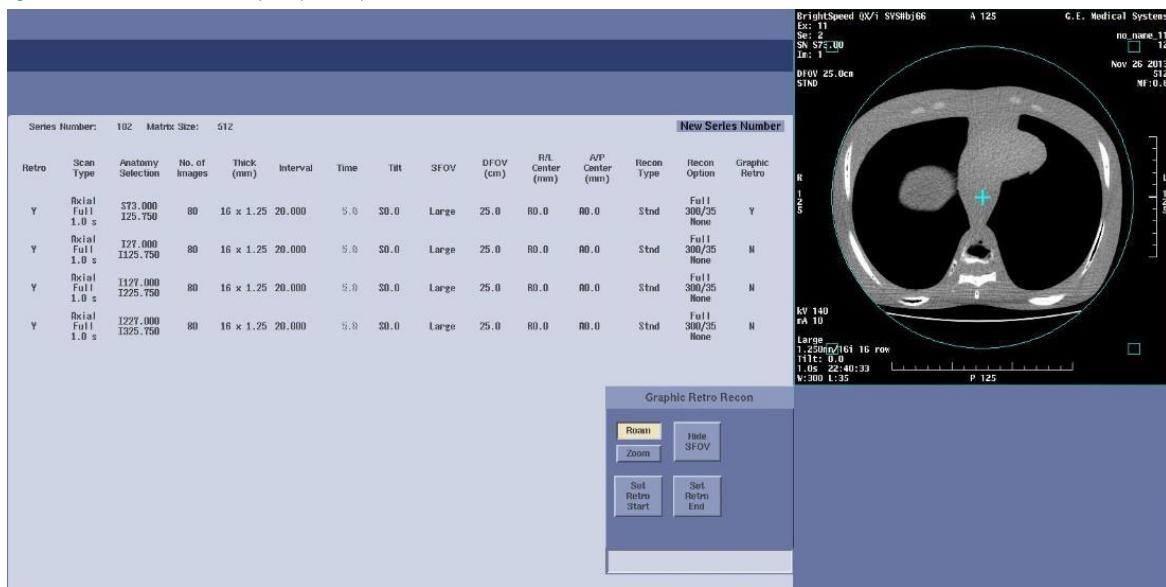
Segmenting uses 225° of data from different times within the rotation. Helical scans using 225° of data, can be segmented. This is useful in segmenting out Aortic dissection artifact caused by the pulsation of the vessel. Cine scans using 225° of data creates images with a shorter temporal resolution. This is useful in following contrast through a tumor.

## Graphically prescribe Retro Recon

Use this procedure to graphically prescribe your retrospective reconstructions using an existing axial plane image as a reference image.

1. Select an exam and series from the Patient List.
2. Click **Retro Recon**.
3. Click Graphic Retro so that the button reads **Y**.
4. Click and drag on the blue boxes (seen inside the red squares on the image below) to change the size of the circle which represent the DFOV for your reconstruction.
5. Click on the + (seen inside the yellow square on the image below) to define the RL and AP centers for your reconstruction.
6. Click **Hide SFOV** to hide the red circle which indicates the scan field of view.
7. Click **Roam** so you can click and drag the reference image.
8. Click **Zoom** to magnify the image.
  - Display the image where you want the reconstruction to begin and click **Set Retro Start**.
  - Display the image where you want the reconstruction to end and click **Set Retro End**.

Figure 11-10 Retro Recon Graphic prescription



## RETRO RECON

### Find unreconstructed images

Use this procedure to find the images that have not been reconstructed.

1. Click **Recon Status** to display the Recon Management screen.
2. On the Recon Management screen, click **Delete Suspended Entries** if you do not want to reconstruct the images or **Unsuspend Entries**.
  - Unsuspend entries retries the reconstruction and places images in the correct exam and series if reconstruction was successful.
  - Delete Suspended Entries displays a window to confirm deletion. Click **OK** to remove the selected entry.
3. Click **Update List** to see images that may have been deleted or added.
4. Click **Quit** to exit.

## Pause/resume the queue

Use Pause Reconstruction Queue to stop and resume image reconstruction.

### Pause

Images being prospectively reconstructed cannot be deleted from the queue. Images being produced retrospectively can be removed from the queue.

1. Click **Recon Status** to display the Recon Management screen.
2. On the Recon Management screen, click **Pause Queue**.
  - The recon queue can always be paused or restarted.
  - Only the entries listed in the Retro queue can be deleted.
3. Click **Quit** to exit Recon Management screen.

### Resume

The reconstruction queue is not automatically started, you must resume the queue for reconstruction to restart.

1. Click **Recon Status** to display the Recon Management screen.
2. On the Recon Management screen, click **Restart Queue**.
3. Click **Quit** to exit Recon Management screen.

## RETRO RECON

### Remove data from the queue

Use this procedure to remove data from the Retro Reconstruction queue.

1. Click **Recon Status** to display the Recon Management screen.
2. On the Recon Management screen, click **Pause Queue**.
3. Click **Delete Retro Recon Entries**.
4. On the Delete Retrospective Entries screen, click on each job you want to remove and click **Delete Selected**.
  - Click **Delete All** to delete all data, independent of what you have selected.
  - If an entry is in reconstruction process, it may not delete. Restart the queue and try again.
  - Do not delete queued retros while scanning is active, scanning could stop.
5. Click **Restart Queue**.
6. Click **Quit** to exit.

## Reserve/release acquired scan data

Use this procedure to prevent or allow the deletion of raw scan data. These instructions cover reserving the data. To release data, follow the same steps, except use the release buttons.

1. Click **Recon Status** to display the Recon Management screen.
2. On the Recon Management screen, click **Reserve Scan data**.
3. To reserve exams, click **Reserve All Scanfiles, Select All Exams Listed** or select individual exams.
  - If you Reserve All Scanfiles you cannot scan if the scan disk is full.
4. To reserve series, click **Select All Series Listed** or select individual series.
5. To reserve scans, click **Select All Scanfiles Listed** or select individual scans.
6. Click **Reserve Selected Scanfiles**.
7. Click **Quit** to exit.

## RETRO RECON

### Save anonymous patient scan data

Use this procedure to save scan data with patient information removed. This procedure does not guarantee that data will be rendered anonymous in compliance with applicable data privacy laws. Review the scan data before sharing the data with third parties to ensure compliance with applicable privacy laws or regulations.

Raw data saved anonymously and then restored will reconstruct with patient identifying information removed.



Scan must be idle when you start this procedure. This procedure can take from 60 seconds (helical scan) to 1.5 hours to save to DVD-RAM.

Make sure the selected scan files do not exceed the space available on the DVD<sup>1</sup>-RAM<sup>2</sup>. Only one scan file fits on one side of the DVD-RAM.

1. Place a DVD-RAM media into the DVD-RAM drive or connect a USB<sup>3</sup> device into the USB port on the front of the media tower.
2. Click **Recon Status** to display the Recon Management screen.
3. From the Recon Management screen, select **USB** or **DVD**.
4. Click **Save Scan Data**.
5. Select the exam/series/scans you wish to save anonymously.
6. Click **Save Selected Annon. Data**.
7. Click **Quit** to exit.
8. Do not eject the device until the light is out on the DVD-RAM drive.
9. Once the save is complete to the USB device, exit Recon Management and disconnect the USB device. Then, scanning can resume.

---

1.Digital Versatile Disc

- 2.Random Access Memory
- 3.Universal Serial Bus

## Save/restore scan data to/from a USB/DVD-RAM

### Considerations

- The only validated USB drive is the Seagate 1 terabyte drive. If the device is not formatted correctly, software asks if you want to format it. It takes about 1 minute per 100 GB, so a 1 terabyte device takes 10 minutes to format.
- As with Save/Restore to DVD-RAM, scanning is not possible until the save/restore of data is complete. A helical scan file contains a large amount of data even though it is one scan file. It can take up to 30 minutes or more to save. Since you are unable to scan patients while saving or restoring Scan Data, make sure that you have ample time to complete the save or restore before beginning.
- Before saving or restoring scan data make sure the system is idle and no Archive, Network or Filming is active. No other features should be accessed until the save or restore is complete.

### Prerequisite

Make sure the selected scan files do not exceed the space available on the DVD-RAM.

- Scan data can only be restored on the same system model that it was acquired on.
- Verify that you have enough time to complete the save uninterrupted. You cannot scan while saving scan files.
    - Saving a 60-second helical acquisition could take up to 1.0 to 1.5 hours on a DVD-RAM. Canceling will only stop when the current scan save is finished.
  - Connect the external USB device to the USB port or insert the DVD-RAM.
  - Click **Recon Status** to display the Recon Management screen.
  - Select the USB or DVD.
  - Click **Save Scan Data**.
  - Select the exam you wish to save in the exam screen.
  - Select the individual scan files for the series in the series screen.
  - Select individual scans or click the scans you want to save by clicking **Select All Scanfiles Listed**.
  - Optional, click **Save Selected Anon. Data** to save the data with no patient information in the image header.
  - Click **Quit** when the save is complete.
    - If cancel a Save or Restore of scan data, the cancel activates after the current scan file is saved or restored.
    - If you are using an external USB hard drive, disconnect the USB device 1 minute after exiting Recon Management and the software indicates that scan data save is complete. Do not leave the USB drive connected once the transfer of scan data is complete.
    - Eject only after all the lights on the media are no longer illuminated. Scan File Save does not finish even though the Saved File message is posted. The problem is due to the time taken to unmount the DVD. It may take 5 to 7 minutes or longer for the DVD to unmount. Please note: the save is complete when the light on the DVD drive has turned green and then, the DVD is unmounted.

# Chapter 12 : View Images

ImageWorks applications have a variety of display tools and contain a large viewing area to display images.

## Procedures

[Open Workspace](#)

### Annotations

[Add annotations](#)

[Remove annotations](#)

[Modify Annotation Level](#)

[Expand annotations](#)

### Cross-reference

[Cross-reference added layers](#)

[Cross-reference all layers](#)

[Cross-reference first/last layer](#)

[Cross-reference layer intervals](#)

[Cross-reference layer scale](#)

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### Normal procedures

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[Color Change Program](#)

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[Erase or Hide Object Program](#)

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[Reference Image Activation Program](#)

[Scroll Images Program](#)

[Series Binding Program](#)

[Viewer: Exam/Series/Image Selection Program](#)

[Text Page Display Program](#)



## Matte

- [Activate a matte](#)
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## Measurements

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## Expand

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- [Expand ROI](#)

## ROI

- [Activate ROI](#)
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## Window Width and Window Level

- [Adjust W/L values](#)
- [User defined presets](#)

## Viewer: Open workspace procedures

Use this procedure to open ImageWorks from which you can access the browser program.

1. Click the **ImageWorks** icon to open the ImageWorks workspace
2. From the browser patient list, select the desired images.
3. From the browser list of applications, click **Viewer** to open the Viewer workspace.
4. Click the **Display** tab to open the Display control panel. You can also double click the series or thumbnail to start the viewer.



If the number of images in a series is more than 20,000, then the viewer can not start this series. Select an image subset from the patient schedule, then click Viewer to view these images.

When finished viewing images, close Viewer and select the remaining images, then click Viewer.

Further, you may also open two Viewers, every Viewer has one image subset.

### Related topics

[Viewer Guide](#)

## Viewer workspace

Figure 12-1 Viewer workspace

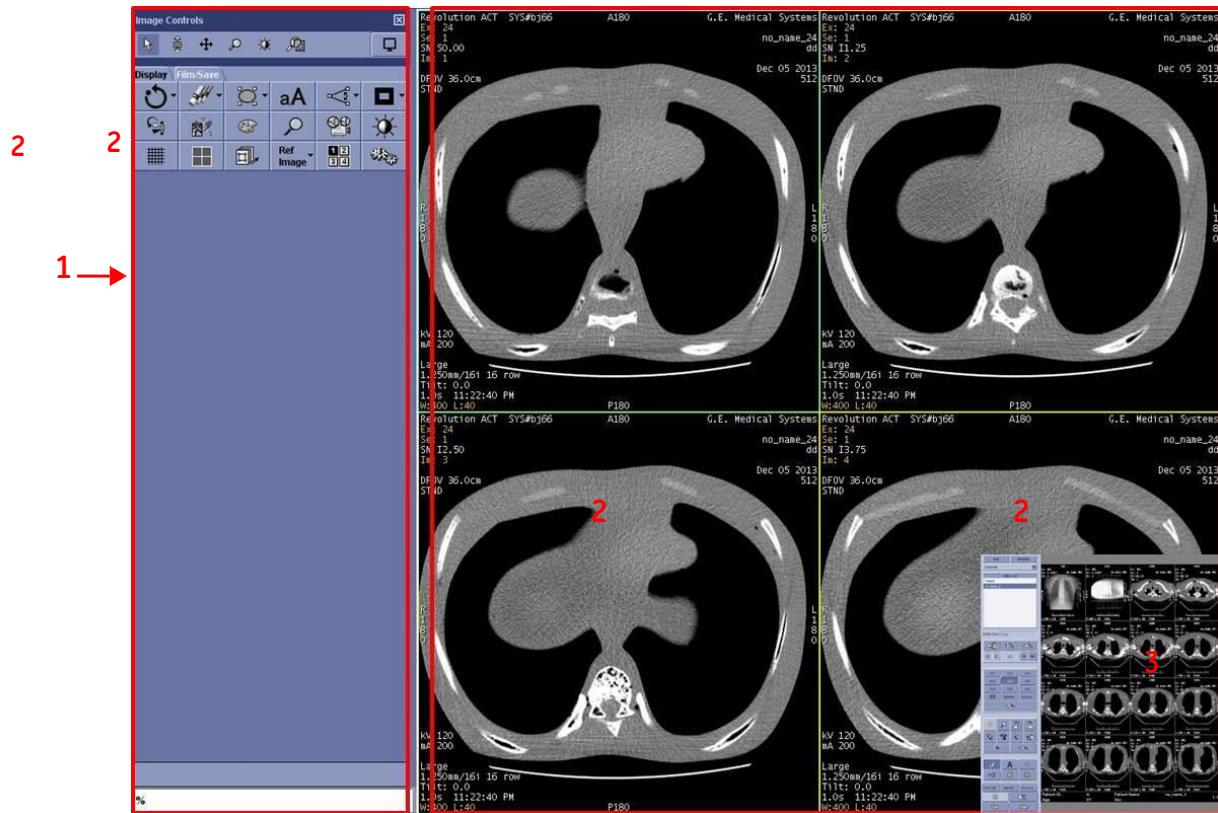


Table 12-1 Viewer workspace legend

#	Description
1	Viewer Control Panel
2	Viewport
3	Film Designer

### Related topics

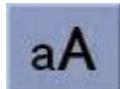
[Viewer Guide](#)

## VIEWER ANNOTATION PROGRAM

### Add annotations

Using the following steps can add Annotation to your images, allowing you to make commentary when landmarking, or draw attention to a certain area of interest.

1. Open [Viewer](#).
2. Click the viewport for which you want to compose messages.



3. In the Display tab, click the **Annotation** icon.
4. In the Annotation text box, edit annotations as necessary.



- Click and drag the empty red box to specify the size of the text box.
- Move the cursor to a text box and enter a message. This tool automatically surrounds the text and expands textbox size as you type.
- Move the cursor to insert a string of text and enter information.
- Select existing text, you can also enter over it or press Delete.



5. If you must add or remove an arrow in the text box, click **Select Object** in the Annotation screen or remove the selection **Include Arrow**.



- Click and drag the arrow tip to position the arrow.
- Clicking and dragging arrow lines will move arrows and boxes as a single unit.
- Click and drag the solid red box to move the text box.



- Click and drag the empty red box to change the size of the text box.



### Related topics

[Modify Annotation Level](#)

[Expand annotations](#)



## VIEWER ANNOTATION PROGRAM

### Adjust font size

Using the following steps can change the font size for the patient's name, identification number, registration number and scan date as displayed on the image or film,. When the view image format is larger than 1 X 1, these changes are most noticeable.

Figure 12-2 Model example of large fonts for patient name and scan date



1. Open [Viewer](#).



2. From the Display tab or Film/Save tab, click the **Tools** icon. Select the appropriate tag in accordance with the fonts needed for changing film (Film/Save tab) or view (View tab).
3. In the menu, select **Large Font**.
4. Check the option box with the fields requiring the larger font.
5. Click **Apply**.



Clicking **Save as Default** can save annotation font size status after restarting.

#### [Related topics](#)

#### [Viewer Guide](#)

## VIEWER ANNOTATION PROGRAM

### Modify Annotation Level

Using the steps below can change the annotation level of images displayed or on film.

#### Change annotation level on the display image.

1. Open [Viewer](#).



2. On the Display tab, click the **Display Preference Settings** icon.
3. On the Set Display Preference screen, from the menu select **Screen Annotation Settings**.
4. Select the desired annotation option.
  - **No Annotation** deletes all annotations and graphics. It does not delete Window Width and Window Level.

Figure 12-3 No annotation



- **Partial Annotation** displays a subset of the full annotations.



- **Full Annotation** displays annotations in full.

Figure 12-5 Full Annotation



- Select **Customize** to display item lists of what can be selected for display. Select the necessary annotation option, then click **OK**.
    - View the Annotation screen to view the images with confirmed customized annotation area.
5. Click **Save as Default** to save annotation settings, in order to view the sessions in the future.

### Change annotation level on the film

1. Open **Viewer**.



2. From the Film/Save tab, click the **Film Annotation Settings** icon.
3. Select the desired annotation option.
  - **No Annotation** deletes all annotations and graphics. It does not delete Window Width and Window Level.

Figure 12-6 No annotation



- **Partial Annotation** displays a subset of the full annotations.

Figure 12-7 Partial Annotation



- **Full Annotation** displays annotations in full.

Figure 12-8 Full Annotation



4. Select **Customize** to display item lists of what can be selected for display. Select the necessary annotation option, then click **OK**.
  - View the Annotation screen to view the images with confirmed customized annotation area.
5. Click **Save as Default** to save annotation settings, in order to view the sessions in the future.

### Related topics

[Add annotations](#)

[Expand annotations](#)

[Remove annotations](#)

## VIEWER ANNOTATION PROGRAM

## Expand annotations

After you have already [added annotation \(Add annotations\)](#) on to your image, you can use the following steps to copy an annotation.

1. Open [Viewer](#).

### [Add annotations](#)



2. In the Display tab, click the **Selected Object** icon.
3. Enact the necessary selection.
  - Select **All Images in series** to apply annotation changes to all images in a series.
  - Selecting **This Image Forward** only applies annotation changes to images in the series following this serial number.
  - Select **Range** to designate a layer plate range.
4. Click **Apply**.

### Related topics

[Add annotations](#)

[Expand annotations](#)

[Remove annotations](#)

## VIEWER ANNOTATION PROGRAM

### Remove annotations

Using the steps below you can remove Annotations from images.

1. Open [Viewer](#).

#### [Add annotations](#).

2. Ensure annotations are active (yellow). If not, please click annotations to put them into an active state.



3. In [Erase Hide Menu](#), click the **Erase** icon.



To remove all annotation messages from all images in the current series, click the Erase All



icon.

#### Related topics

##### [Add annotations](#)

[Modify Annotation Level](#)

[Expand annotations](#)

## Activate a matte

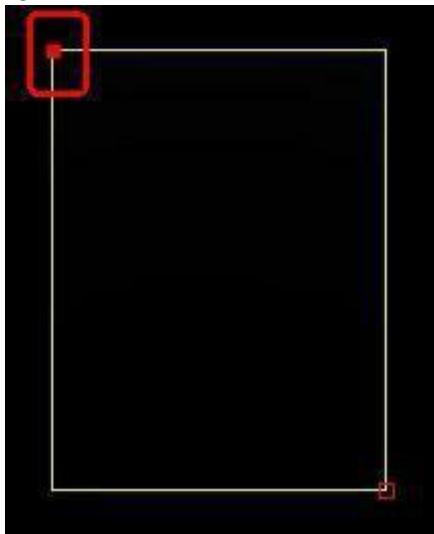
Using the Matte tool will remove displayed images or images on film or unwanted messages or artifacts surrounding them.

1. Open **Viewer**.
2. Click the viewport for which you want to use the matte on the images.



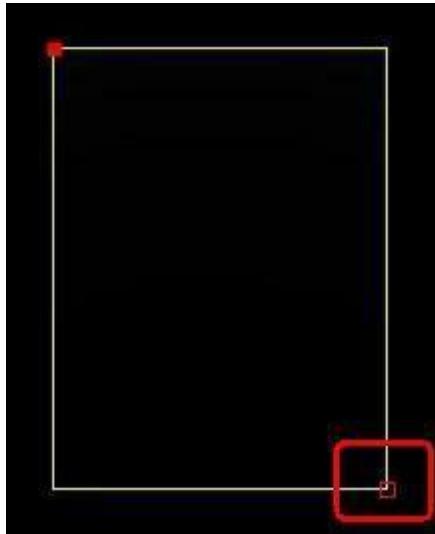
3. From the Display tab, click the **arrow** icon next to the **Matte** icon and select **Rectangular Matte** icon or **Elliptical Matte** icon.
4. Click and drag the solid red box to move the matte.

Figure 12-9 Move Matte



5. Click and move the empty red box to change matte size and shape.

Figure 12-10 Matte size and shape



6. Click on the outside of images (on the matte) to display the red box allowing you to adjust their size or move them. Click on the image (inside the matte) to fix the matte.

### Related topics

[Expand matte](#)

[Remove matte](#)

## Expand matte

You can use the following steps to generate copied mattes for all images in a series.

1. Open [Viewer](#).

### Activate a matte

2. Click on the outside of images (on the matte) to display the red box, indicating the matte is activated.



3. In the Display tab, click the **Selected Object** icon.

4. Carry out expand selection.

- Select **All Images in series** for making changes to one image change all images in that series.
- Selecting **This Image Forward** only changes the images in a series following the current series number.
- Select **Range** to establish the layer plate range for matte copying.

5. Click **Apply**.

### Related topics

[Activate a matte](#)

[Remove matte](#)

## VIEWER MATTE PROGRAM

### Remove matte

Using the steps below can remove Matte from images.

1. Open [Viewer](#).

#### Activate a matte.

2. Click on the outside of images (on the matte) to display the red box, indicating the matte is activated.
  - To remove an activated matte from a single image, execute one of the following operations. Press **Delete**.



Click the **Erase** icon.

- If you want to remove an activated matte from all images in the current series, click the **Erase All** icon.



*All* icon.

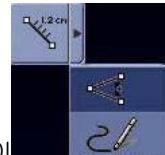
#### Related topics

[Activate a matte](#) [Expand matte](#)

## Measurement Area

You can use the following steps to activate a Measure tool, in order to obtain information, volumes, areas and statistics of anatomy or pathology.

1. Open [Viewer](#).
2. Click the viewport where you want to place a measurement.



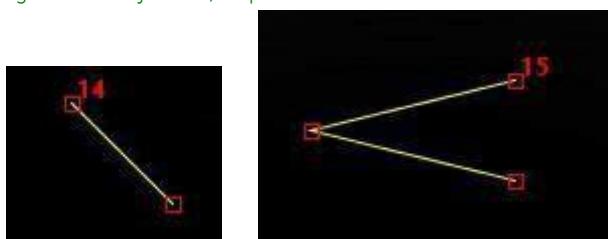
3. In the Display tab, click the Measure arrow and select a Measure ROI icon.

  - Measurement distance is shown in mm.
  - Measurement is displayed on the bottom right corner.

4. Adjust the size and shape of Measure ROI and move the Measure ROI.

  - For straight line and angle measurement:

Figure 12-11 Adjust size, shape and move measurement



Click and drag on empty to expand the box to adjust measurement shape.

Click and drag the line segment to move the measurement.

- For a free draw image measurement, place the cursor in the viewport and click to place a starting point.

Figure 12-12 Free drawing measurement



Click and drag on solid to expand the box to create trace lines.

Click the borders of trace lines to move the trace lines.



Click anywhere on a cyan (unactivated) measurement border, making it turn yellow and activated.

### Related topics

[Expand measurement](#)

[Remove measurement](#)

[Viewer Guide](#)

## VIEWER MATTE PROGRAM

### Expand measurement

You can use the steps listed below to generate copied measurement ROIs for all images in a series.

1. Open [Viewer](#).

#### [MeasurementArea](#).

2. Click anyplace on a cyan (unactivated) measurement border, making it turn yellow and activated.



3. In the Display tab, click the [Selected Object](#) icon.

4. Carry out expand selection.

- Select **All Images in series** for making changes to one image change all images in that series.
- Selecting **This Image Forward** only changes the images in a series following the current series number.
- Select **Range** to specify the range of slice for the extended measurements.

5. Click [Apply](#).

#### Related topics

[MeasurementArea](#)

[Expandmeasurement](#)

## Remove measurement

You can use the steps listed below to remove a measurement from images.

1. Open [Viewer](#).

### [MeasurementArea](#).

2. Click anywhere on a cyan (unactivated) measurement border, making it turn yellow and activated.

- To remove an activated measurement from a single image, execute one of the following operations.  
Press **Delete**.



Click the **Erase** icon.



- If you want to remove multiple images from an active viewport, click the **Erase All** icon.

### Related topics

[MeasurementArea](#)

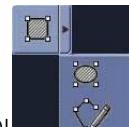
[Expandmeasurement](#)

## VIEWER ROI PROGRAM

### Activate ROI

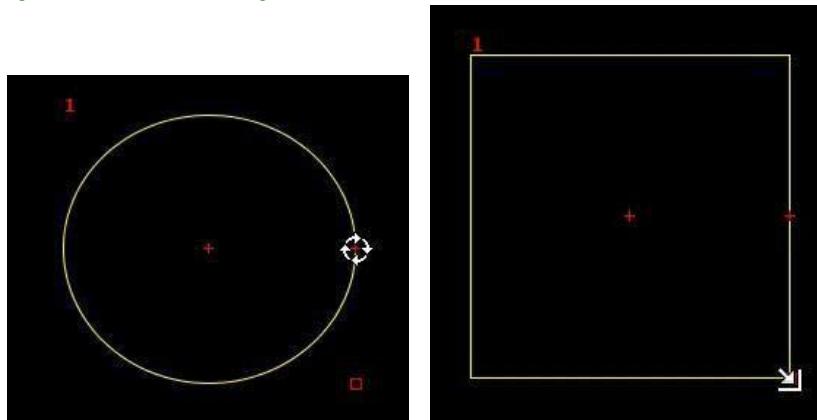
The steps below can be used to activate a ROI, in order to obtain information related to the standard deviation, average value and area.

1. Open [Viewer](#).
2. Click the viewport where you want to place a ROI.



3. In the Display tab, click the ROI arrow and select a ROI icon.
4. Adjust ROI size, shape and move ROI.
  - For an oval or rectangular ROI:

Figure 12-13 Oval and rectangular ROI



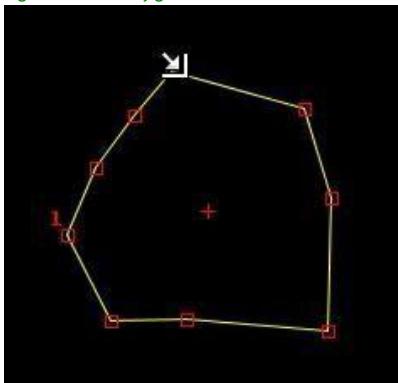
Click and drag on empty to expand the box to adjust ROI size.

Click and drag on the center cross or border to move the ROI.

If the ROI box must be rotated, click a border having a cross hair cursor, place the cursor on a cross hair cursor, a white rotating symbol appears. Click and drag the rotation cursor to rotate the rotating frame pointer.

- For a polygonal ROI, place the cursor in the viewport and click to place every point.

Figure 12-14 Polygon ROI



□ Click and drag a square box to adjust ROI shape.

Right button click on a box to remove this box.

Click and drag a center cross to move ROI.

□ Place the cursor on a line between two adjacent solid red boxes and right-click to place another box.

Click anywhere on a cyan (unactivated) ROI border, making it turn yellow and activated.

### Related topics

[Expand ROI](#) [Remove ROI](#)

## VIEWER ROI PROGRAM

### Expand ROI

You can use the steps listed below to generate copied measurement ROIs for all images in a series.

1. Open [Viewer](#).

#### [Activate ROI](#).

2. Click anywhere on a cyan (unactivated) ROI border, making it turn yellow and activated.



3. In the Display tab, click the **Selected Object** icon.

4. Carry out expand selection.

- Select **All Images in series** for making changes to one image change all images in that series.
- Selecting **This Image Forward** only changes the images in a series following the current series number.
- Select **Range** to specify the range of slices to duplicate ROI.
- Click **Apply**.

#### Related topics

[Activate ROI](#)

[Remove ROI](#)

## VIEWER ROI PROGRAM

# Remove ROI

Using the steps below can remove a ROI from images.

1. Open [Viewer](#).

### [Activate ROI](#).

2. Click anyplace on a cyan (unactivated) ROI border, making it turn yellow and activated.
  - To remove an activated ROI from a single image, execute one of the following operations.  
Press **Delete**.



Click the **Erase** icon.



- If you want to remove multiple ROIs from an active viewport, click the **Erase All** icon.

### Related topics

[Activate ROI](#) [Expand ROI](#)

## Adjust W/L values

Use one of the four following methods to adjust Window Width/Window Level, in order to control image brightness and contrast.

### Requirements

Open **Viewer**.

### Method 1: Middle mouse button

By using the steps below you can make use of the middle mouse button to adjust Window Width/Window Level.

1. Place the cursor on any image, click the middle mouse button and drag up or down to change window level.
2. Place the cursor on any image, click the middle mouse button and drag left or right to change window width.

### Method 2: Left mouse button

You can use the steps listed below to make use of the left mouse button for adjusting Window Width/Window Level.



1. Click the **W/L (Window Width/Window Level)** icon on the Image Controls Panel, change the left mouse button into the Window Width/Window Level control keys.

Figure 12-15 Image controls panel



2. Place the cursor on any image, click the left mouse button and drag up or down to change window level.
3. Place the cursor on any image, click the left mouse button and drag left or right to change window width.

### Method 3: Presets

You can use the steps listed below to make use of the presets for adjusting Window Width/Window Level.

1. Place the cursor in the lower right corner of the viewport's orange window width and window level position.
2. Click the right button and select a preset window width and window level.

Figure 12-16 Preset W/L menu



#### Method 4: Control panel

By using the steps below you can make use of the **Keyboard** to adjust Window Width/Window Level.



1. Click the **W/L (Window Width/Window Level)** icon on the Viewer Control Panel.
2. Enter a specific value in the window width and window level text box.

#### Method 5: Keyboard

By using the steps below you can make use of the **Keyboard** to adjust Window Width/Window Level.

1. Place the cursor on any viewport.
2. Press and hold or quickly press and release the up/down arrow keys to change Window Level.
3. Press and hold or quickly press and release the left/right arrow keys to change Window Width.

Figure 12-17 Arrow keys



4. Press the shift key and one of the following keys to edit preset W/L: F6, F7, F8, F9, F10, F11.
5. Press one of the following keys to activate the preset window: F6, F7, F8, F9, F10, F11.

Figure 12-18 Function Keys



**Related topics**

[Define W/L \(Window Width/Window Level\) presets](#)

## User defined presets

You can use the steps below to self-define W/L (Window Width/Window Level) preset settings.

1. Open [Viewer](#).



2. In the Display tab, click the **W/L (Window Width/Window Level)** icon.
3. In the Windowing area, select a preset value.
4. Click **Edit**.
5. In the Apply Windowing area, complete the following operations:
  - a. Select the preset from the Presets menu.
  - b. If required, in the Name field, enter the preset W/L name.
  - c. Please enter a value in the Width field.
  - d. Please enter a value in the Level field.
  - e. Click **Save** and give a response to any prompts.

### Related topics

[Adjust W/L values](#)

## VIEWER CROSS REFERENCE PROGRAM

### Add layer

You can use the steps below to add a Cross Reference line to an image already displaying having a cross reference.

1. Open [Viewer](#).
2. Click the viewport where you want to add additional cross reference scan lines.
3. In the Command Line, enter **xra**, then enter the series number you want to add and the layer plates or layer plate range, for example if you want to add layers 10-16 from series 3, enter **xra 3 10-16**. Press the **Enter** key.

#### Related topics

[All layers in added series Add first/last layer](#)

[Add layer interval](#)

[Add layer range](#)

[Remove layer](#)

## Add all layers

You can use the steps below to place a Cross Reference line on all layers in a series.

1. Open [Viewer](#).
2. Click the viewport where you want to paste up cross reference scan lines.
3. In the Command Line, enter the **xr** command, follow by adding the series number, for example: **xr 2**. Press the **Enter** key.

**Figure 12-19 All layers added**



### Related topics

[Add layer](#)

[Add first/last layer](#)

[Add layer interval](#)

[Add layer range](#)

[Remove layer](#)

## VIEWER CROSS REFERENCE PROGRAM

### Add first/last layer

You can use the steps below to apply a first or last layer Cross Reference line to images.

1. Open [Viewer](#).
2. Click the viewport where you want to paste up cross reference scan lines.
3. In the Command Line, enter the **xr** command, follow by adding the series number and extrema, for example: **xr 2 extrema**. Press the **Enter** key.

Figure 12-20 First and last layers added



### Related topics

#### [Add layer](#)

[All layers in added series](#)

[Add layer interval](#)

[Add layer range](#)

[Remove layer](#)

## Add layer interval

You can use the steps below to place a Cross Reference line on the intervals of a series or even/odd layer positions.

1. Open [Viewer](#).
2. Click the viewport where you want to paste up cross reference scan lines.
3. In the Command Line, enter the **xr** command, follow by adding the series number, the colon symbol (:) and interval. For example, if you want to display every third layer in series 2, please enter **xr 2:3**. Press the **Enter** key.

### Related topics

[Add layer](#)

[All layers in added series](#)

[Add first/last layer](#)

[Add layer range](#)

[Remove layer](#)

## VIEWER CROSS REFERENCE PROGRAM

### Add layer range

You can use the steps below to display the cross reference line series of images in a common series.

1. Open [Viewer](#).
2. Click the viewport where you want to paste up cross reference scan lines.
3. In the Command Line, enter the **xr** command, follow by entering the first image-last image, for example: **xr 2 1-6**. Press the **Enter** key.
  - If necessary, use the % symbol to mark the last image in a series.

Figure 12-21 Layer range added



#### Related topics

##### [Add layer](#)

[All layers in added series](#)

[Add first/last layer](#)

[Add layer range](#)

[Remove layer](#)

# Remove layer

You can use the steps below to remove a Cross Reference line placed on an image.

1. Open [Viewer](#).
2. Cross reference lines displayed on an image.
3. In the Command Line, enter **noxr**. Press the **Enter** key. All reference lines have been removed.

## Related topics

### [Add layer](#)

[All layers in added series](#)

[Add first/last layer](#)

[Add layer interval](#)

[Add layer range](#)

## Cine play program

Use the Cine tool to turn pages in an image, like you're currently watching a video.

1. Open **Viewer**.
2. Select the series you want to view in Cine mode.



3. In the Display tab, click the **Movie** icon.
4. In the Cine area, click the Play icon, this will use all default settings. Additionally, you can conduct selections from the Cine area.
  - The system will automatically change the format to 1-on-1.
  - Define layer range  
Click **Play All** to place all images in a series into the Cine.  
Click **Play Range** and enter a From and To image number in the text.
  - Define Image Interval. This is usually maintained at the default value 1. When displaying a cine from a multi-phase series, within the image range enter a number representing the number of phases.
  - Select an image interval, this interval will allow you to skip some images in the series when the images are being displayed in cine mode. For example, if your series is a 4 phase acquisition, you may want to view one phase one time, therefore you will enter a 4 interval.
  - Select a view mode.



When displaying a Cine, the **Loop** icon will go from start to end, then again from start to end. For example, if there are 20 images in a Cine, the image display method is 1-20, 1-20, 1-20, etc.



When displaying a Cine, the **Rock** icon will go from start to end, then again from end to start. For example, if there are 20 images in a Cine, the image display method is 1-20, 20-1, 1-20, 20-1 etc.

- Select a Frame Rate, it indicates the number of images displayed in a second.
- Click the **Play** icon to *play backwards or forwards*. From the cine stop or pause point start playing the cine.



- Click the **Pause** icon to stop the movie from playing.



- Clicking the **End** icon can take the last image in a cine and place it in the active viewport.



- Clicking the **Beginning** icon can take the first image in a cine and place it in the active viewport.



- Clicking the **Step Forward** icon can increase a step from forwards to backwards to an image. Using this icon can increase a step from the image to a certain start point of the first image not within the cine layer range.



- Clicking the **Step Back** icon can increase a step from backwards to forwards to an image. Using this icon can increase a step from the image to a certain start point of the first image not within the cine layer range.



## Command Line Entry Program

1. Open [Viewer](#).
2. At the bottom of the Control Panel, in the Command Line enter **?** and press the **Enter** key.
  - The Command Line screen opens, listing all hotkey commands.
3. In the Command Line window, select the desired command.
4. Click **Accept**.
5. Place the cursor at the end of the command character string in the Command Line, and press the **Enter** key.
  - This command is then applied to all displayed viewports.
  - As next and prior images are selected, the command will be applied to all of these images as well.

### Related topics

[Viewer Guide](#)

## Color Change Program

Use the Color Map tool for scheduled acquisitions, DWI ADC images, histograms and dynamic enhanced viewing, in order to change the color of all viewports.

1. Open [Viewer](#).



2. In the Display tab, click the Color Map icon and select an option from the menu.



To remove a color map, from the Color Map menu, select **none** or **gray**.

### Related topics

[Viewer Guide](#)

## Compare Images Program

By using the steps below, you can open multiple grouped images in the Viewer for comparison.

Comparison mode can be started through the three following kinds of workflows:

### From the Data Apps list start and compare

1. Navigate to the ImageWorks desktop.
2. Press and hold the **Ctrl** key, and at the same time in the Series List click 2, 3 or 4 series.
  - The selected series will be highlighted and displayed in the Series List.
3. In the Data App list, click the **Viewer**, in order to display the selected series in a single viewport.

### View Compared Images

1. Pressing **Page Up** and **Page Down** can at the same time go up the page or down the page in these series.
2. The Window Width/Window Level of every viewport can be controlled separately.
3. The Maximize button in View Controller can not be used in the comparison mode.
4. All available options in the Viewer Control Panel can be controlled in every viewport.
5. Page turning can only be used in two series.

### Undo Link/Re-link viewport

1. Click the viewport to be viewed alone.
2. In the View Controller, click the **Ports** icon to undo a series link.

Figure 12-22 View Controller linking



- Pressing the **Page Up** button and **Page Down** button can scroll through the browser series.
- 3. If you need to re-link a viewport, please click on the **Ports** icon.

### Related topics

[Define screen layout](#)

[Viewer Guide](#)

## Display normal procedure

You can use the steps below to restore an image to its original state.

1. Open [Viewer](#).



2. In the Viewer Display tab, clicking the **Display Normal** icon can return the image to its original image state and erase the display functions below:
  - Flip/rotate
  - Zoom in or zoom out
  - Image enhancement(filter)
  - Scroll or pan
  - Color



Display Normal has no effect on the Rectangular Matte, Annotation or Graphic operations. Using the [Erase All](#) button can remove these elements from images.

### Related topics

[Viewer Guide](#)

## Erase or Hide Object Program

Using this program when one or more graphical objects are placed in any or all viewports, can Erase/Hide the objects.

1. Open [Viewer](#).
2. Display an image object, for example an [Annotation information](#), [Measurements](#), [Mask](#), [ROI](#) string, etc.
3. Click the arrow next to the Erase/Hide icon to select the icon that matches the desired operation.



- Clicking the **Hide All** icon can temporarily hide annotations or image objects.



- Clicking the **Show All** icon can restore annotations or image objects, making them visible.



- Clicking the **Erase Single** icon can erase the currently selected image object. Using this erase option can erase one graphics element once.



- Clicking the **Erase All** icon can remove all graphical objects from all viewports.



Clicking **Ctrl** and **X** at the same time can erase the selected graphical objects.

### Related topics

[Viewer Guide](#)

## Filter Image Program

Using the steps below can use one of the Filters in the Viewer in order to enhance margin or pulmonary area or render images smooth.

1. Open [Viewer](#).
2. Click the viewports where you want to change the filter.



3. In the Display tab, click the *Filter* icon.
4. Select a filter from the menu.

### Related topics

[Greyscale adjustment](#)

[Viewer Guide](#)

## Flip/Rotate Images Program

Use the Flip/Rotate tool to change the direction of the displayed images.

1. Open [Viewer](#).



2. In the Display tab, click the **Flip/Rotate** icon.

3. In the Flip and Rotate Images areas, click the icon matching the desired operation.

Figure 12-23 Flip/rotate images

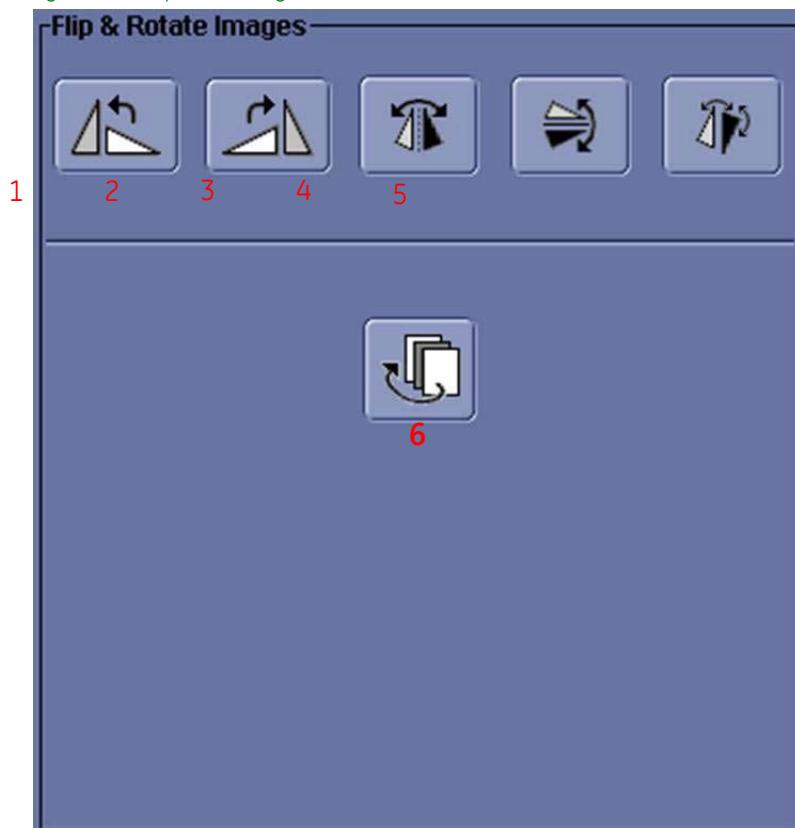


Table 12-2 Flip/rotate legend

#	Description
1	Rotate counterclockwise 90°
2	Rotate clockwise 90°
3	Flip from left to right
4	flip top bottom
5	Flip image from left to right and from top to bottom
6	Restore image to its orientation when acquired

Related topics

[Viewer Guide](#)

## Format Display program

Using the steps below can change the viewport display format.

1. Open [Viewer](#).



2. In the Display tab, click the **Format** icon.
3. On the Format display, scroll the cursor to view the available formats.
4. Click to select the desired format.

### Related topics

[Viewer Guide](#)

## Gray Scale enhancement contrast program

Use the Gray Scale tool to enhance the contrast of an image in order to give the image more of a black and white appearance.

1. Open [Viewer](#).
2. Click the viewports where you want to change the gray scale.



3. In the Display tab, click the **Gray Scale** icon.
4. In the Filters area, select a Gray Scale filter.

### Related topics

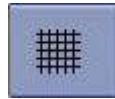
[Filter Images](#)

[Viewer Guide](#)

## Grid display procedures

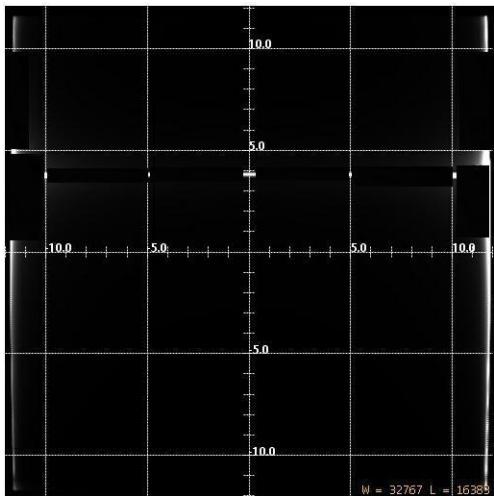
Using the steps below can place a grid (matrix) on the main image, in order to measure the anatomical points or pathological area on an image.

1. Open **Viewer**.
2. Click the viewport in which you want to display the grid.



3. In the Display tab, click the **Grid** icon to open the grid, and then click again to close it.

Figure 12-24 Grid on



## Remove grid

Using the steps below can move the grid in the viewport.

1. Click a grid, making it active status (blue).
2. Place the cursor on a grid cross reference point and drag it to a new position.

Figure 12-25 Grid reference point= 1



## Adjust grid preferences

Using the steps below can set grid preferences.



1. In the Display tab, click the **Tools** icon.
2. From the pull-down menu, select **Grid Preferences**.
3. From the Grid Preferences screen area, select the options you need.
  - Matrix Lines: Open or close the lines for the four-corner grid pattern formed by the central horizontal and vertical lines.
  - Line Style: Turn grid lines into solid lines or virtual lines.
  - Grid Spacing: In units of millimeters, changes the spacing between grid lines.
  - Tick Spacing: In units of millimeters, changes the spacing between tick lines.
  - Tick length: In units of millimeters, changes the length of tick lines.
4. Clicking **Save as defaults** can permanently save the content of the selections.
  - You can also click **Apply** to apply the selected options. This is a temporary selection, only applicable to the currently displayed image.

## Related topics

[Filter Images](#)

[Viewer Guide](#)

## Image Controls Program

Using the steps below you can change the control of the left mouse button.

1. Open **Viewer**.
2. Select the Image Controls icon on the Control Panel.

Figure 12-26 Image Controls



- Clicking the **Slice number control** icon can use the left mouse button to scroll through the images in the current series. Click and drag up/down or left/right in order to advance to higher or lower series numbers.



- Clicking the **Magnifying Glass** icon can use the left mouse button as a magnifying function. Click and drag up to increase the magnification factor, click and drag down to decrease the magnification factor. Magnification factor is annotated on the upper right area of an image. Zoom is applied to the images in the active viewport and the viewport forward.



- Clicking the **Scroll** icon can use the left mouse button to scroll images. Click and drag images in the active viewport to a new location.



- Clicking the **Selection** icon can use the left mouse button for a selection function and disable all other image controls.



- Clicking the **W/L (Window Width/Window Level)** icon can use the left mouse button for Window Width and Window Level images. Click and drag the cursor in the directions below to change Window Width/Window Level:
  - Move up to make image brighter (reduce Window Level value)
  - Move down to make image darker (increase Window Level value)
  - Move right to make Window Width wider
  - Move left to make Window Level more narrow.



- Clicking the **Minimize/Maximize** icon can change the viewport area to a 1-on-1 display, then reset format, for example, change to a 4-on-1 display.

Figure 12-27 1-on-1 display

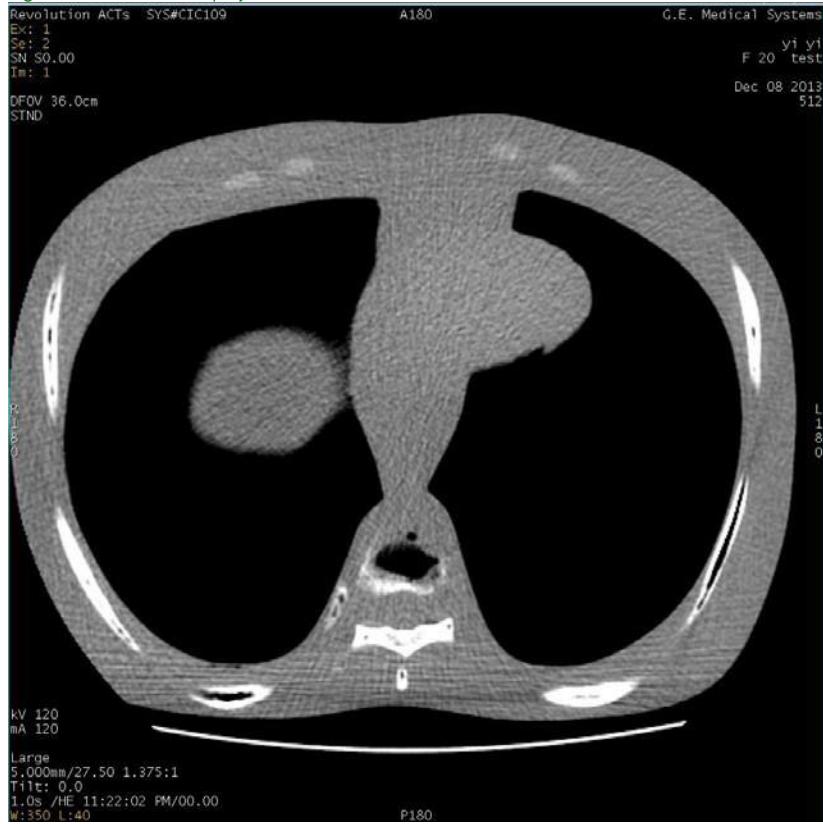
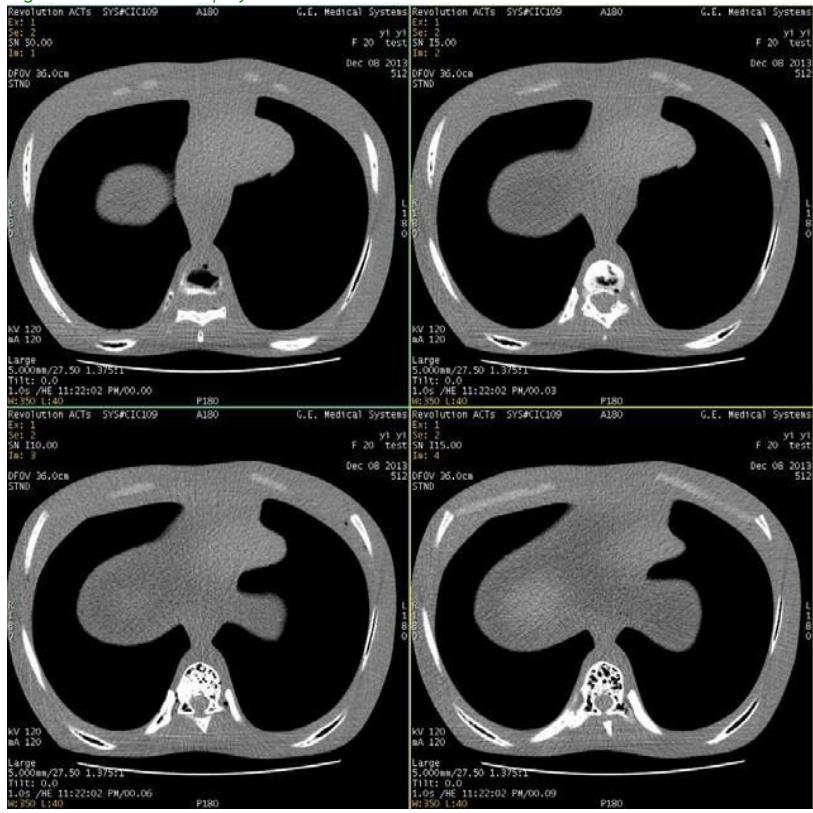


Figure 12-28 4-on-1 display



[Related topics](#) [Select Series](#) [Scroll Images](#) [Zoom Images](#) [Adjust W/L values](#) [Viewer Guide](#)

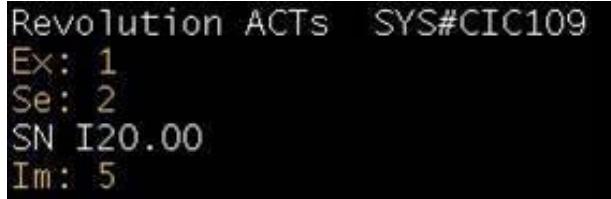
## ***Image Select Program***

Use one of the programs below to select the images displayed in the Viewer.

### ***Method 1: Active image annotations***

1. Open [Viewer](#).
2. Place the cursor on an orange Image Number annotations on the upper left of a viewport.

Figure 12-29 Orange image number annotations



Revolution ACTs SYS#CIC109  
Ex: 1  
Se: 2  
SN I20.00  
Im: 5

3. Click to progressively add current images.
4. Right button singel click, decrease current images.

### ***Method 2: Command Line***

1. Open [Viewer](#).
2. Place the cursor on the Command Line.
3. Enter **I XX** and press **Enter**, here XX is the desired image number. This image number will appear in the left side of an active viewport.

### ***Method 3: Keyboard***

1. Open [Viewer](#).
2. Press **Page Up** to add the current image.
3. Press **Page Down** to decrease the current image.
4. Press **Home** to display the first image.
5. Press **End** to display the last image.

### ***Method 4: Image controls panel***

1. Open [Viewer](#).



2. Clicking the ***Image Page*** icon (located in the [Image Controls Panel](#)) to change the left mouse button into the layer number control.
3. Place the cursor in the viewport, then drag up or right/down or right/left, to advance to a higher or lower image serial number.

### ***Related topics***

[Image Control Modification Select Series](#)

[Viewer Guide](#)

## Invert Image Program

You can use the steps below to invert image display.

### Method 1: Window Width and Window Level icon

1. Open [Viewer](#).



2. On the Display tab, click the **Window Width and Level** icon.



3. In the Windowing area, click the **Invert** icon.

- The Invert icon is a toggle icon; click it again to reset it.

### Method 2: Command Line

1. Open [Viewer](#).
2. In the Command Line, enter **invert**.
  - Clicking **invert** again can reset the icon and return it to its normal state.

## Related topics

[Viewer Guide](#)

**Minimize/MaximizeImageProgram**

Using the Minimize/Maximize tool can change the format to 1-on-1 display (Maximize), then return the format to the previously selected value.

1. Open [Viewer](#).



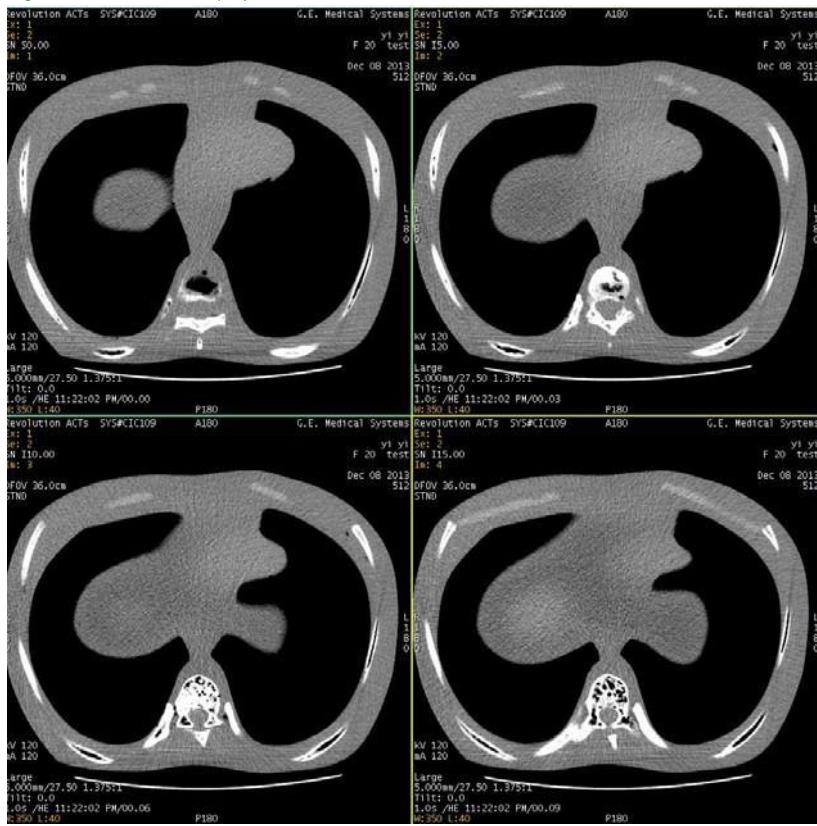
2. In the Display tab, click the **Minimize/Maximize** icon to change the viewport area to a 1-on-1 display.

Figure 12-30 1-on-1 display



3. Click the Minimize/Maximize icon again, restore format. In this example, restore a 4-on-1 display.

Figure 12-31 4-on-1 display.



*Related topics*

[Viewer Guide](#)

## *Copy Object Program*

[Mask](#), [Measurements](#), [ROIs](#) and [Annotation](#) program functions all have copying functions.

Using the following steps can use the Command Line to expand objects in all or selected viewports.

1. Open [Viewer](#).
2. Generate a graphic: [Annotation](#), [Mask](#), [Measurements](#), [ROI](#), [Grid](#).
3. Click the graphic you want to copy (annotation box, matte, measurement, ROIs, grid) and make it into an active state (yellow).



4. In the Display tab, click the **Selected objects** icon and select the propagation option.
  - Select **All Images in series** to apply annotation changes to all images in a series.
  - Selecting **This Image Forward** only applies annotation changes to images in the series following this serial number.
  - Select **Range** to designate a layer plate range.
5. Click **Apply**.

## *Command Line backup method*

1. Place cursor in the Command Line.
2. Enter one of the following commands:
  - Enter **prop a** and press **Enter**, copying graphics in all viewports.



To erase copied objects, in the [Erase Hide Menu](#), click the **Erase All** icon.



## *Related topics*

### [Viewer Guide](#)

### *Reference Image Activation Program*

Use the Reference Image tool to display an image, define the original image within the small viewport according to the image.

1. Open [Viewer](#).

*Select the image that you want to view.*

2. Clicking **Ref Image > All On** to display reference images on all images in a series.
  - Select **Selected On** to only display a reference image on the primary viewport.
  - Reference images must be on a different level from the main image.
  - These two images (main image and reference images) must come from the same exam, and must have the same horizontal boundary line, the same patient location and the same patient entry method.
  - Viewport images and reference images cannot be Screen Save, 3D rendered images or members of an image group.
  - All Reference Image viewports display the same image. You can not place a different image in a single or different viewing areas. If an image in a Reference Image viewport is changed, all other Reference Image viewports will update to the same image.
  - Inverse Video at the same time effects the main image and reference images.
  - Click the Reference image to change focal point and adjust window width/window level, magnification, panning, flip/rotate and display normal. When you initiate these changes on a reference image viewport, all reference images will update.
  - Series Binding cannot be applied to reference images.



If you want to erase reference images from a series, please click **Ref Image > All Off**.

### *Related topics*

#### *[Viewer Guide](#)*

### Report cursor procedure

You can use the steps below to display a cursor, reporting anatomical position and CT value on the upper left corner of an image.

Figure 12-32 Cursor Annotations

R 91.50mm  
A 71.40mm  
I 20.00mm  
V = -796.00

1. Open [Viewer](#).



2. In the Display tab, click the **Tools** icon.
3. From the menu, select **Guides Settings**.
4. Select **Report Cursor**.
5. Click and drag the cursor to view updated location and CT values.



Clicking **Save as Default** can save the report cursor status during the restart process.

### Related topics

#### [Viewer Guide](#)

## *ScrollImagesProgram*

Using the steps below can change the left mouse button into the scrolling or panning control in order to move images in a viewport.

1. Open [Viewer](#).



2. From the [Image Controls Panel](#), click the **Scroll** icon.

3. Click and drag images in the active viewport to a new location.



Clicking the **Display Normal** icon can cancel scrolling on the images.

### *Related topics*

[Image Control Modification Viewer Guide](#)

## Screen Layout Program

Using the steps below can define the layout of a viewport, and from which every main viewport can define a format.

1. Open **Viewer**.



2. In the Display tab, click the **Screen Layout** icon.

3. In the Screen Layout area, select one of the available main screen layouts.



4. In the Display tab, click the **Format** icon and select the desired format.
  - This image format will be applied to the selected main viewport.
5. Select the main viewport where you want to place the screen layout image. This operation will activate the viewport.
6. In Data Selector, select the desired series and click **View**.
  - Images in the selected series appear in the selected format in the current viewport.
7. Since each main viewport can use a single series and format, please repeat steps 4-6 for every main viewport.

Like the example below selected a 4-on-1 screen layout and every main viewport adopts a single format.

Figure 12-33

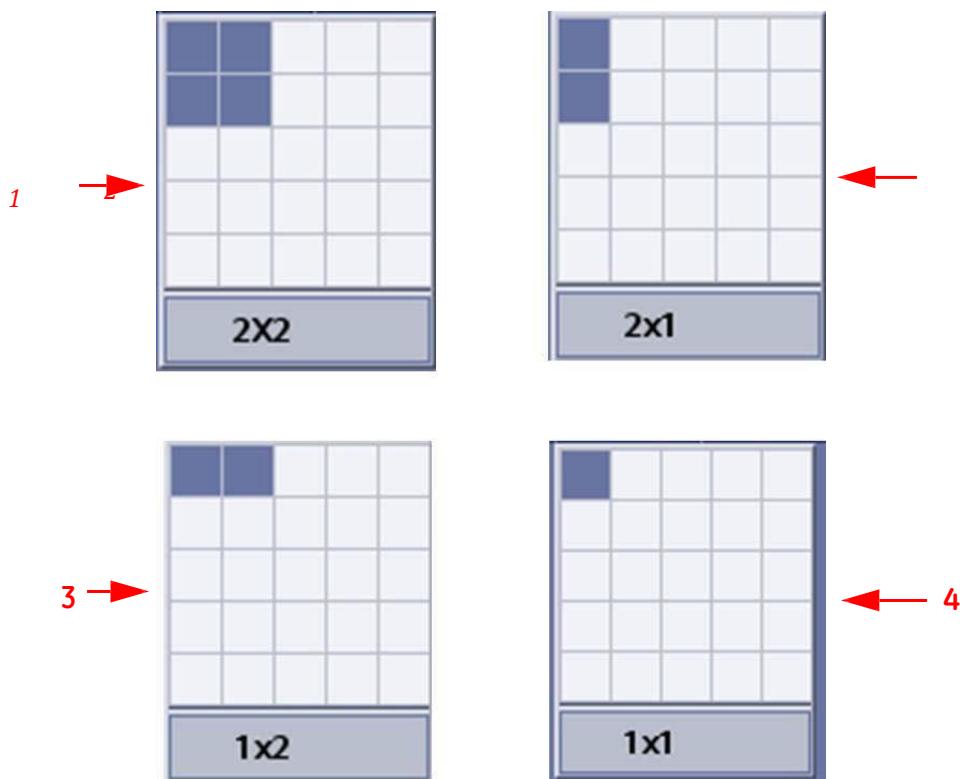


Table 12-3 Legend

#	Description
1	Upper left viewport as 4-on-1 format
2	Upper right viewport as 2-on-1, vertical side-by-side format
3	Bottom left viewport as 2-on-1, up and down vertical segmentation format
4	Bottom right viewport as 1-to-1 format

#### Reset Viewports

1. Select Format icon and select 1-on-1 format display.
2. Select the Screen Layout icon and select 1-on-1 viewport format.

#### Related topics

[Viewer Guide](#)

## Screen Save Image Program

Use the Screen Save tool to save a image in a series. Saved images can be viewed from the ImageWorks workspace.

Figure 12-34 SSAVE Series

Series ▲	Type	Images	Description	Modality
1	SCOUT	2		CT
2	PROSP	41		CT
99	SSAVE	2	Screen Save	CT
100002	GSPS	2	Presentation Series	PR

1. Open **Viewer**.
2. Click the image to be screen saved to make it active.
3. Click the Film/Save tab.



4. Click the **Screen Save** icon.
- On the Screen Save image you can still adjust W/L (Window Width/Window Level) and magnification values.
  - Once a screen is saved, all random annotations to an image can not be erased, because it is a "snapshot" of the screen and cannot be changed.
  - Screen saved images have post-processing limits, for example filtering can not be performed on them.
  - Screen save images saved in a SSAVE screen save series, they can perform archiving and network transferring.



### WARNING

#### Image Zoom-in/Zoom-out operation

- 1) May cause image annotations to move outside the viewport's detectable area.
  - 2) May cause image magnification annotation and actual magnification ratio to become mismatched
  - 3) May cause image annotations to become unreadable
  - 4) May cause a decrease in image quality due to image interpolation processing
- When filming for diagnostic purposes or when saving the image, always ensure that patient identification, direction annotation (like left-right, front-rear and up-down) and size annotations (like DFOV, zoom) can be read on all viewed images.
- All measurements based on images, for example measured length and area, are only applicable to being performed on the original (non-magnified) image.



### WARNING

The Image scroll (pan/roam) operation can move image annotations (for example patient name, exam protocol name, parameters and exam date) outside of the viewport's viewable area. When filming for diagnostic purposes or when saving the image, always ensure that patient ID, direction annotation (like left-right, front-rear and up-down) and size annotations (like DFOV, zoom) can be read on all viewed images.

[Related topics](#)

[Viewer Guide](#)

### *Series Binding Program*

Using the steps below can turn Series Binding on or off.

1. Open [Viewer](#).



2. In the Display tab, click the **Tools** icon.
3. From the tools pull-down menu select **Series Binding**.
4. Select **ON** or **OFF**.
  - When Series binding is open, after the last layer in a series, click **Image +(next image)** or press **Page Down** to display the first layer of the next series.
  - When Series binding is off, after the last layer in a series, click **Image +** or press **Page Down** to display the last layer of the same series. And it will not automatically advance to the next series.
5. Click **Save as defaults** to permanently save selected content.

### *Related topics*

[Viewer Guide](#)

*Viewer:Exam/Series/Image SelectionProgram*

*From ImageWorks, open the Viewer*

Using the steps below can view sessions and open the Viewer.

1. Navigate to the ImageWorks desktop.
2. Select the desired exam, series or image.
3. Click Viewer.

*Related topics*

*[ViewerGuide](#)*

### Text Page Display Program

Using the Text Page tool can display a specific patient exam's Exam Text Page or Series Text Page or ROI text page.

1. Open [Viewer](#).
2. Click the **Film/Save tab**.

3. Click the **Text Page**  icon.

4. Click the desired Text Page. **Exam Text page, Series Text page, ROI text page**.

5. Select one option from among those at the bottom of the page.

- Clicking the **Film**  icon can place the page in the next available film frame in the film desinger.
- Clicking the **Screen Save**  icon can add the SSAVE image type to the patient exam.
- Use the **Next/Prior arrow**  to navigate the text page.
- Click the **Quit**  icon to close the window.

### Related topics

#### [Viewer Guide](#)

## *TickMarkDisplay Program*

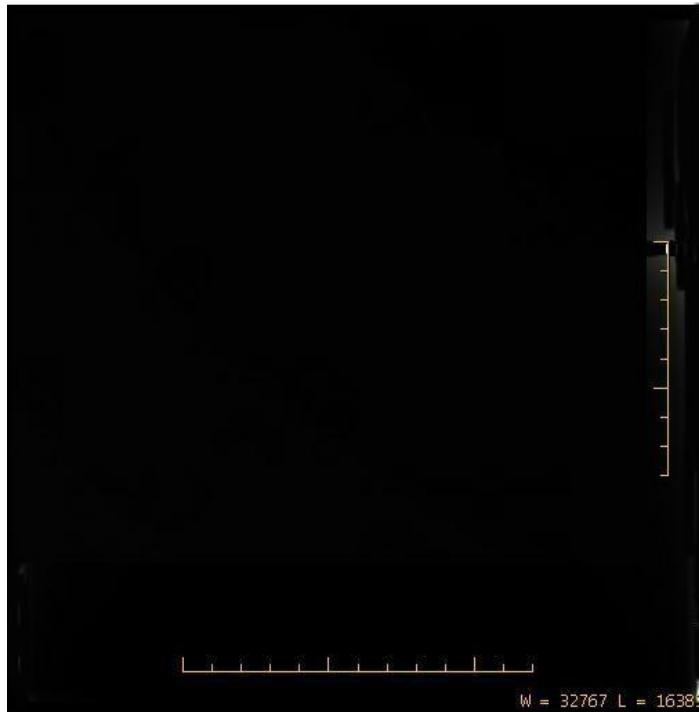
Using the steps below can use small ruler vertical or horizontal Tick Marks on your image.

1. Open [Viewer](#).



2. In the Display tab, click the **Tools** icon.
3. In the Set Display Preferences area, from the menu select **Guides Settings**.
4. Select **Vertical Tick Marks** and/or Horizontal Tick Marks to open them.

Figure 12-35 Tick marks on



5. Clicking **Save as Default** can save restarted tick mark status.



Tick marks is a toggle option. Once they are opened, they will always maintain an On status, until you select this option again and turn it off.

### *Related topics*

#### [Viewer Guide](#)

## **Zoom Image Program**

Chose one of the following program to Zoom the image, in order to best display the targeted area. If the selected view is set as the main view, and axillary views follow after, then zoom will be applied to all images in the series. If the selection of other views is canceled, then zoom is only applied to the main view.

### **Method 1: Display Tab**

1. Open **Viewer**.
2. Click the viewport for which you want to zoom the images.



3. In the Viewer Display tab, click the Zoom icon.
4. In the Zoom area, enter a factor in the text box or use the slider to determine the zoom factor.



Click the **Display Normal** icon to cancel the zoom on the image.

### **Method 2: Image controls panel**

1. Open **Viewer**.
2. Click the viewport for which you want to zoom the images.



3. From the **Image Controls Panel**, click the Zoom icon.
4. Place the cursor in an active viewport, click and drag to change the zoom factor.



Click the **Display Normal** icon to cancel the zoom on the image.

### **Method 3: Screen Annotations**

1. Open **Viewer**.
2. In the image viewport, place the cursor on orange Mag and click the right mouse button to display the **Zoom slider** in the image viewport.



3. Clicking and dragging the slider can change the zoom factor.
4. Click anywhere in the viewport except the slider to close the slider.

#### **Method 4: Magnifying Glass**

1. Open [Viewer](#).
2. Click the viewport for which you want to use the Magnifying Glass.



3. In the [Image Controls Panel](#), click the **Magnifying Glass** icon.
4. Place the cursor in an active viewport, click and drag to view the magnified area.

#### *Related topics*

[Image Control Modification Viewer Guide](#)

## *Save State Program*

Use the **Save State** tool to save the current window width and window level, image controls and all image annotations and graphics to a GSPS in the Patient List.

### *Method One*

1. Open **Viewer**.

#### *Select the image that you want to view.*

2. Display images as per the necessary state.
  - Places annotation text far away from the viewport margin. If the edge of the text box is near the edge of the viewport, then the displayed image on another viewer (for example, a PACS viewer) may not display the text box.
3. Place the cursor in the command line and enter ss, press the Enter key to save image state.
  - PROSP series and GSPS series can perform network transfers and archiving, so that when they are displayed on remote systems, they can display saved image controls and images. These two types of series must be simultaneously sent to the terminal destination. If only the original image is sent, then the image controls will not be sent, because the image controls are located in the GSPS series.
  - Archiving and network transfers of original series and GSPS series can be performed both manually and automatically. If you want to perform automatic archiving or network transfer of GSPS series, you must open Auto Archive or Auto Transfer by Exam, then create a GSPS series before the exam is completed. You must manually perform archiving or network transfer on any GSPS series acquired after an exam has been completed.

### *Method Two*



1. On the Film/Save tab, click the **Save State** icon.
2. Enter text as necessary in the Presentation Label text box.
3. Select image range.
4. Click **Save State**.

### *View Save State image (GSPS)*

1. Open the ImageWorks desktop.
2. Select a GSPS series.

Figure 12-36 Example of single GSPS series during the exam

Series	Type	Images	Description	Modality
1	SCOUT	2		CT
2	PROSP	41		CT
99	SSAVE	2	Screen Save	CT
100002	GSPS	2	Presentation Series	PR

3. Click **Viewer**.

### *Related topics*

#### *Viewer Guide*



# Chapter 13 : Display applications



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

The following display applications can be used with images after they have been acquired in Scan.

## Add/Subtract

[Add/subtract images](#)

[Bind series](#)

[Create images with min/max values](#)

## Exam Split

[Exam Split screen](#)

[Split exams when the scan is completed](#)

## Neuro 3D Filter

[Create Neuro 3D images](#)

## Considerations

### Add/Subtract

- Applications such as DentaScan and Add/Subtract can only load 1,000 images. Hi-light the desired image range of 1,000 images by selecting the first image desired, hold the shift key down and hi-light the last image desired then select the desired range.
- Add/Subtract images are displayed in the series type column as either Proc or Comb.
  - **Proc** is the result of processing pairs of images that have identical locations in the patient's body. Proc series can be used like any other series of acquisition images, i.e., geometrical measurements, reformatting, 3D reconstructions, etc.
  - **Comb** is the result of a combination of images having different locations in the patient's body. The absolute anatomical coordinates accompanying Comb series are not accurate and therefore only *relative* geometrical measurements (i.e., distance, angle, or area) made within a resulting image are accurate.

## Add/Subtract

### Image addition

Image addition adds image intensity values by pixel and is useful for adding thin slices together to get a thicker slice.

### Image subtraction

Image subtraction subtracts image intensity values pixel by pixel and is useful to evaluate contrasted vessels.



Remember, patient movement and breathing between the images can affect the quality of the subtraction.

### Maximum pixel value extraction

Maximum pixel value extraction consists of finding minimum image intensity values pixel by pixel and is useful for contrasted vessels or calcifications.

### Minimum pixel value extraction

Minimum pixel value extraction consists of finding maximum image intensity values pixel by pixel. This could be useful to evaluate soft tissue.

## Binding Series

Binding Series creates a new series which consists of copies of selected images from one or more existing series. This could be useful if you had images in two separate series and wanted to have them in one series to perform 3D Reformat.



Save State information is not maintained in the new series generated with Binding Series.

### Accept negative pixels

Accept negative pixels allows negative pixel values in the resulting image. If this function is not enabled, all negative pixel values are set to zero.

## The difference between "Proc" and "Comb" series

Proc appears in the browser series list type column if the images in the series are the result of precessing pairs of images that have identical locations in the patient's body. Proc series can be used like any other series of acquisition images, i.e., geometrical measurements, reformatting, 3D reconstructions, etc.

Comb appears in the browser series list type column if the images in the series are the result of a combination of images having different locations in the patient's body. The absolute anatomical coordinates accompanying Comb series(shown both in the browser and on the displayed images) are not accurate. Only relative geometrical measurements (i.e., distance, angle, or area) made within a resulting image are accurate.

## Ratio slide

When both Select Set buttons are used during addition or subtraction, equal weighting is applied to the two pixels in each pair. You can change it via the Ratio slider.

## ADD/SUBTRACT

### Add/Subtract and Image Combination screen

On the right side of the browser, click **Add/Subtract** to open the Add/Subtract(Image Combination) screen.

Figure 13-1 Add/Subtract screen

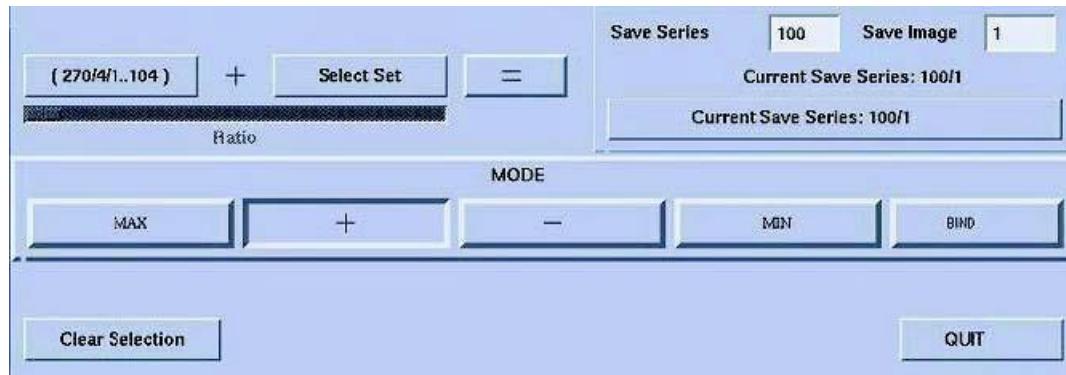
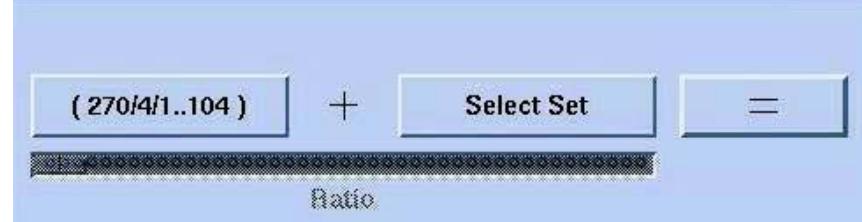


Figure 13-2 Image Combination area



#### Select Set 1

Defines the first image set.

#### Select Set 2

Defines the second image set.

#### Equal(=)

Performs the selected operation and generate the new images.

#### Ratio slider

Increases pixel weighting of the left(first) image when moved to the left and increases pixel weighting of the right(second) image when moved to the right. The slider is only available during addition and subtraction when both Select Set buttons are selected.

#### Save Series

Displays the current series and starting image number of the saved series. By default, images resulting from subsequent operations are added onto the end of the same series unless you click **New Save Series**.

Figure 13-3 Save Series area

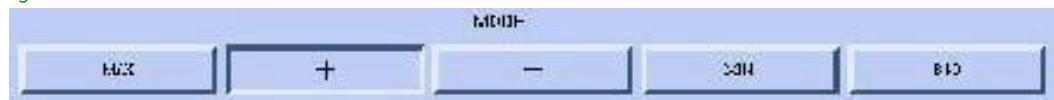


### New Save Series

Places images resulting from subsequent operations into a new series in the Patient List. If you do not select this option, the images are saved in the current saved series.

### Mode

Figure 13-4 Mode buttons



**Max** creates a new series that finds the highest corresponding signal intensity values in the selected set or sets of images.

**Plus (+)** creates a new series that adds the image intensity values of the selected image sets.

**Minus (-)** creates a new series that subtracts the image intensity values of the selected image sets.

**Min** creates a new series that finds the lowest corresponding signal intensity values in the selected set or sets of images.

**Bind** creates a new series that consists of copies of the selected images from one or more existing series.

### Accept Negative Pixels

Allows negative pixel values in the resulting images. If this function is not enabled, all negative pixel values are set to zero. This operation is useful on pre-and post- contrast studies of the same slice location.

### Clear Selection

Erases the selections so that both Select Set buttons have no prior values associated with them.

## ADD/SUBTRACT

### Add/subtract images

Use this procedure to create a new image set, for example add thin slices together or subtract pre/post contrast series. The resulting images are annotated with the day on which the addition/subtraction was performed.

#### *OpenImageWorks.*

1. From the browser list of applications, click **Add/Sub**.
2. Select the desired images.
  - If only one set is selected, each operation performed produces one resulting image.
  - If two sets are selected, images in the two sets are paired according to physical location in the patient's body. Unpaired images in either set are ignored.
3. On the Image Combination screen, click **Select Set** on the left.
4. If you are adding/subtracting two sets of images, select the second set of images, and click **Select Set** on the right.
  - By default, equal weighting is applied to the two pixels in each pair, but you can change the weighting via the Ratio slider.
  - Drag the slider to the left to increase the pixel weighting of the images on the left Select Set button. Drag the slider to the right to increase the pixel weighting of the images on the right Select Set button.
5. Click **+** (addition) or **-** (subtraction).
6. For subtraction, click **Accept Negative Pixels** unless you want the negative pixel values set to 0 in the resulting image.
7. Typically, use the system provided series number.
8. Click **=** (equal) to generate the images in the exam defined by the left Select Set button.
9. Optional: Click **New Save Series** to repeat the add/subtract procedure with a new series number and description.

**ADD/SUBTRACT****Bind series**

Use this procedure to combine images from different series to create a new series. The resulting images are annotated with the day on which the addition/subtraction was performed.

***OpenImageWorks.***

1. From the browser list of applications, click **Add/Sub**.
2. Select the desired images.
3. On the Image Combination menu, click **Select Set** on the left side of the menu.
4. Click **Select Set** on the right side of the menu.
5. Click **Bind**.
6. Typically, use the system provided series number, or type a new series description and number in the Save Series text field.
7. Click = (equal) to generate the images in the exam defined by the left Select Set button.
8. Optional: Click **New Save Series** to repeat the add/subtract procedure with a new series number and description.

## ADD/SUBTRACT

### Create images with min/max values

Use this procedure to create a new image using only the minimum or maximum CT numbers. The resulting images are annotated with the day on which the addition/subtraction was performed.

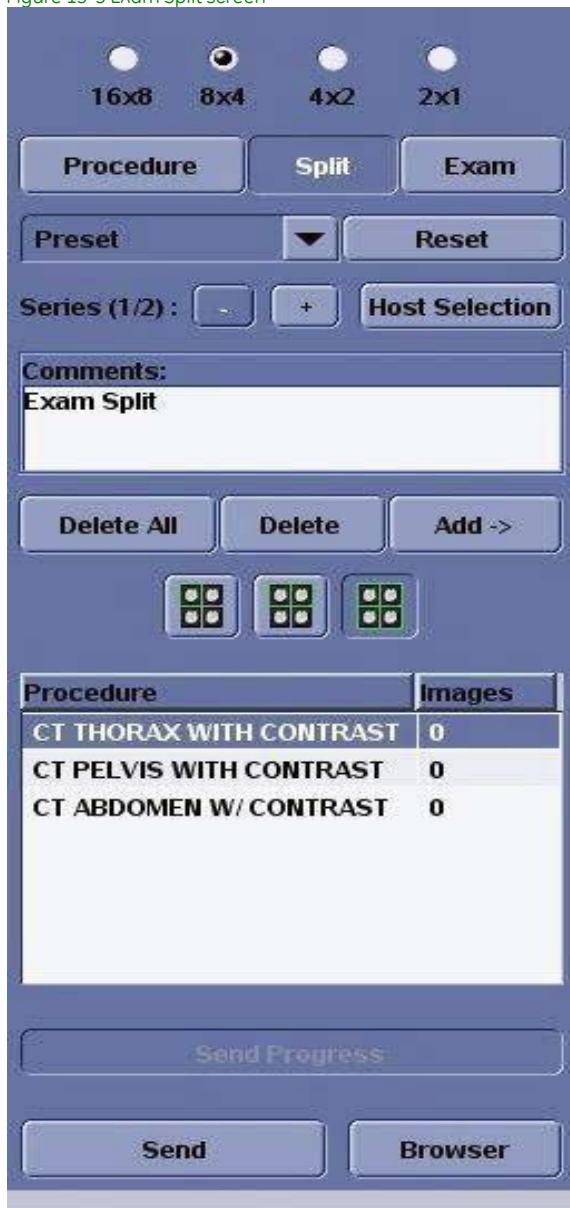
#### *OpenImageWorks.*

1. From the browser list of applications, click **Add/Sub**.
2. Select the desired images.
3. On the Image Combination menu, click **Select Set** on the left side of the menu.
4. Click **Min** (minimum) or **Max** (maximum).
5. Typically, use the system provided series number.
6. Click **=** (equal).
7. Optional: Click **New Save Series** to repeat the add/subtract procedure with a new series number and description.

## Exam Split screen

Click the ImageWorks icon  . From the browser list of applications, click Exam Split to display the Exam Split screen.

Figure 13-5 Exam Split screen



### Screen format

Lists the Exam Split display options.

### Procedure/Split/Exam

Displays a list of requested Procedure IDs or Accession Numbers for the same patient.

**W/L presets**

Allows selection from a Preset menu and to Reset the W/L to the last selected values.

**Comments**

An area in which you can add a comment that is attached to the file you have selected to solit.

**Delete All/Delete/Add**

After a range of images has been selected, click an option to define how you want your primary port displayed.

**Procedure**

A list Requested Procedure ID or Accession numbers.

**Send**

Saves your selections sends the files to the selected host.

**Browser**

Cancels your selection, ends the Split Exam session and returns you to the browser.

## Split exams when the scan is completed

Use this procedures to split a series into separate groups that can then be used for multiple reads and billing. Exam Split is only available if your system has ConnectPro.

1. Complete an exam where multiple Requested Procedure ID or Accession Numbers have been selected.
  - All Patient records that you wish to split, must be selected from the Patient Schedule when you selected **New Patient**. You cannot add procedures after the exam is ended.

2. Click the **ImageWorks** icon.

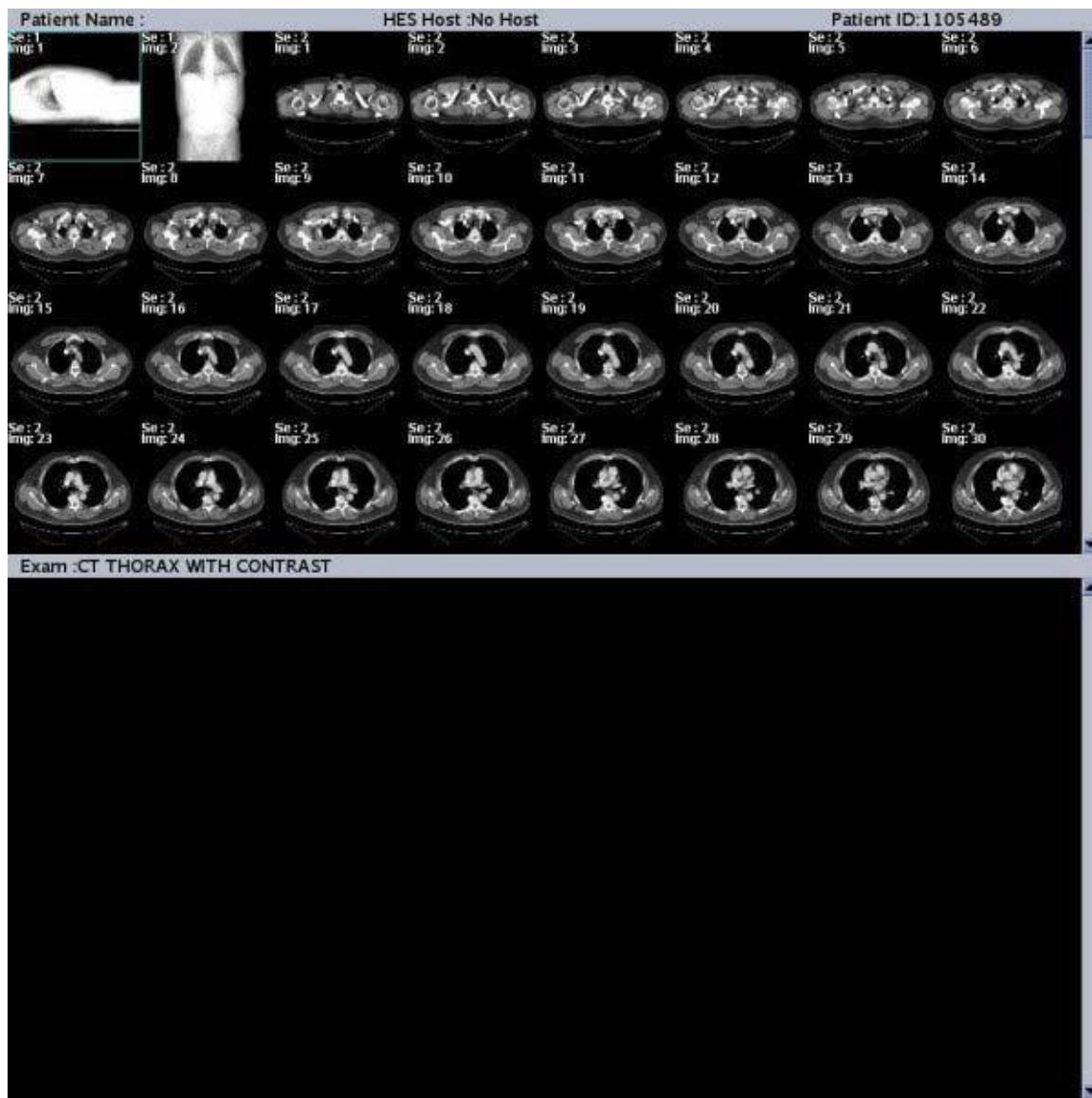


3. From the browser, click the exam you wish to split.
4. Select the series to split.

5. From the browser list of applications, click **Exam Split**.

- The Exam Split menu appears with the selected images displayed in the upper viewports. The system may display every image or skip some images depending on the total number of images selected.
  - If the exam you selected does not have Multiple Procedures, a dialog message is posted and Exam Split exits.
6. From the Exam Split screen, click first image, press **Shift**, and click the last image to select the desired range of images to be grouped together per procedure code.

Figure 13-6 Example of the first slice highlighted for Exam Split range selection procedure



7. From the Procedures list area, select the desired procedure from the available list, which reflects the procedures selected from Patient Schedule.
8. From the Exam Split control panel, click **Add**.
  - Add desired images to the procedure.
9. Adjust the W/L as needed in the exam area of the display.
  - To adjust the W/L use either the W/L Presets on the Exam Split control panel or use the mouse.
10. From the Exam Split control panel, click **Host Selection**.
11. Select the receiving host and click **Save**.

Figure 13-7 The left column reads GSPS if configured in VES mode and it reads HES if configured in HES mode



12. From the list of procedures on the Exam Split control panel, select the procedures you wish to send to the host and click **Send**.

- To select multiple procedures, simultaneously press **Shift** and click each procedure.
- For systems configured for VES, send exams prior to splitting and it sends GSPS objects.
- For systems configured as HES, images are sent after splitting and sends a new series.

13. Click **Browser** to exit from Exam Split.

## NEURO 3D FILTER

### Create Neuro 3D images

Use this procedure to create images with a Neuro 3D Filter, which removes noise from an image while preserving image resolution. Neuro 3D Filter is optimized for thin slice data that is intended for post processing in Reformat to create Average and MIP<sup>1</sup> images, Volume Rendering and 3D models for Neurological studies such as Circle of Willis, carotids, sinuses, orbits, mandible, and helical brain.

#### ImageWorks

1. Click the **ImageWorks** icon.
2. Select the desired exam/series/images. The selected series:
  - must have at least three non-duplicate location images
  - must be less than 500 images
  - must be a single group or multiple groups if the following parameters are the same : slice thickness, interval, tilt, SFOV, DFOV, scan type, rotation, speed, image center, and algorithm. The groups must be contiguous.
3. From the browser list of applications, click **Neuro 3D Filter**.
4. Click **Low**, **Med**, or **High**.
5. Series are numbered in the browser as follows:
  - Low filter = series number plus 30 (for example, series 427 becomes 457).
  - Medium filter = series number plus 40 (for example, series 427 becomes 467).
  - High filter = series number plus 50 (for example, series 427 becomes 477).
  - The series description is "3D Filtered".
6. Click **Go**.
7. Click the **Close** icon to close the screen when filtering is complete.







# Chapter 14 : Reformat

Use the Reformat software, located on the ImageWorks desktop, to display and manipulate Reformat data sets.



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

## Indications for use

Volume Viewer is a medical diagnosis software that allows the processing, review, analysis, and communication of 3D reconstructed images and their relationship with originally acquired images for CT, MR, X-ray Angio, and PET scanning devices. The combination of acquired images, reconstructed images, annotations, and measurements performed by the clinician are intended to provide to the referring physician clinically relevant information for diagnosis, surgery, and treatment planning.

## User profile

As with any medical imaging process, only qualified personnel should use this equipment. You must be aware of the limitations of the basic imaging modality and of ensuing image processing. This includes understanding the limitations of the initial series acquisition, image processing technology used, and image display methods.

## Requirements for Reformat

Certain requirements need to be met before you can perform reformat.

- A valid image set for reformat must have the same:
  - Matrix size
  - Display center
  - Orientation
- Four or more images must be selected before selecting Reformat.
- You cannot have two images with identical locations.
- Spacing must be less than 10 mm.
- The image set can only include axial, sagittal, or coronal images.
- Different Display Field Of Views and Digital Tilts can be loaded, however you have to select between different sources of images to view them. The source annotation is located in the upper-left corner of the image. You can change between sources by clicking on the red annotation.

## Reformat

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- [Use the Reformat Image Controls](#)
- [Use the keyboard shortcuts](#)
- [Use the right-click functions](#)

## Display

- [Modify red annotation](#)
- [Review Controller screen](#)
- [Display tab](#)
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- [ROI Preferences screen](#)
- [Annotate an image](#)
- [Save preset annotation](#)
- [Measure](#)
- [Manage color maps](#)
- [Add an ROI](#)
- [Set ROI preferences](#)

## View types

- [Create a Curved view](#)
- [Create an X Section Histogram view](#)
- [Create an MPVR view](#)
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## Volume Render

- [Attach/detach objects](#)
- [Cut planes](#)
- [Work with colors](#)
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- [Zoom in/out](#)

## Segment

- [Segment tab](#)
- [Scalpel screen](#)
- [Advanced Processing screen](#)
- [Combine segmented objects](#)
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[Threshold an image](#)

## Batch Film

[Film/Save tab](#)

[Batch screen](#)

[Save Image screen](#)

[Film/Save Options screen](#)

[Set up a batch oblique](#)

[Batch film images](#)

[Save a curved parallel plane or rotating curve batch](#)

## Considerations

- Volume Viewer may hang due to an error dialog that is hidden. To avoid this situation, do not switch desktops until you start to see the model build.
- If a message is displayed indicating images are too far apart or failed to build a reformat model for series with a large number of images, wait several seconds and launch Reformat again. When the series has a large number of images, the system may not have identified how many images are in the series before Reformat tries to start.
- Reformat does not include the slice location for axial images. If axial slice location is needed, generate the images in PMR or Retro Recon of the data.
- If the W/L<sup>1</sup> values selected from the pull down menu in reformat do not match your W/L Users Prefs, follow these steps:
  1. [OpenImageWorks](#).
  2. Click **User Preferences**.
  3. Review saved values and correct them if necessary. See [Set W/L preset preferences](#).
  4. If this does not resolve the issue contact your service representative.

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1.Window Width and Window Level

## Reformat

Reformatting allows you to define and display cross-sections of a 2D stack or 3D volume of image data that are oriented differently from the original acquisition images.

A baseline view is a basic axial, coronal or sagittal view. Of these, the acquisition view displays the images in the acquisition plane of the original image set, the other two are the corresponding orthogonally reformatted views. They can be moved to show any location in the 3D volume, but remain aligned parallel to the three main axes of the RAS<sup>1</sup> coordinate system. An oblique view is a plane reformatted view that can be both moved and rotated to any location and orientation within the 3D volume.

If a feature of interest extends beyond a single plane, standard baseline or oblique view reformatting cannot show the entire feature no matter how you position the oblique plane. To create a single view that includes the entire feature, use curved reformatting to create a curved cross-section.

1.Right Anterior Superior

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## REFORMAT

### Open Reformat

1. Click the **ImageWorks**  icon.
2. From the browser, select the desired exam/series/images to reformat.
  - To select a subset of images, click on the first image and simultaneously press and hold the **Shift**, select the last image.
  - To select specific images click on the image numbers and simultaneously press and hold **Ctrl**.
3. From the browser list of applications, click **Reformat**.
  - An oblique, axial, sagittal, and coronal are displayed in the four viewports.
  - My Tools tab can be customized to display any display icons. Therefore, the instructions in this chapter are for accessing a particular icon from the tab on which it originated. On your system, the icon may be on your My Tools tab.
4. Change the view type by selecting a view type from the red annotation.

## Use the Reformat Image Controls

The Image Controls display when you start Reformat.

Figure 14-1 Image Controls area



Click a button in the top row to set the action of the left mouse button when placed over the image. Changing the selection on the icon updates the icon-view menu selection.

The buttons can be in one of three states:

1. Selected (depressed)
2. Unselected (light blue)

### Rotate freehand or page images



1. Click the ***Rotation/Paging*** icon to activate a freehand rotation or to page through images.
2. Click and drag to rotate 3D/Oblique views and page axial/sagittal/coronal views.
  - No rotation handle is displayed on 3D/oblique views when this mode is selected.

### Zoom (magnify) images



1. Click the ***Zoom*** icon to activate zoom mode.
2. Click and drag to zoom the image in or out.

### Pan (roam) images



1. Click the ***Pan*** icon to activate a roaming mode.
2. Click and drag the image to move it up and down and left and right (only applicable if the image has been zoomed in).

### Select objects



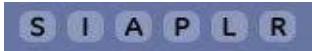
1. Click the ***Selection*** icon to activate the selection mode.

## W/L images



1. Click the **W/L** icon to activate the W/L mode.
2. Click and drag over an image to adjust the window width (left-right motion) or the window level (up-down motion).

## Change the image orientation



Click an Image Orientation icon to change the plane or a 3D or oblique reformat image.

S = Superior

I = Interior

A = Anterior

P = Posterior

L = Left

R = Right

## Activate the Oblique mode



The **Multiple Oblique Mode** button (left) displays three oblique planes defined by three adjustable color axis (orange, green, blue).

1. Adjust any axis to update the two other oblique planes.
2. Click again to de-activate the Multiple Oblique mode, which keeps the orientations defined in oblique viewports.

The **Single Oblique Mode** button (right) displays a line cursor in Reformat, which is used to define a new plane.

1. Set the function of one viewport to Oblique.
2. Make another viewport primary and then click the **Single Oblique Mode** button.
  - A solid yellow line appears, which represents the plane of the Oblique reformat.
3. Place the cursor on the solid yellow line and click and drag it to tilt the yellow line to the desired plane.

## Use the keyboard shortcuts

Figure 14-2 Keyboard



Table 14-1 Keyboard shortcuts

Indicator/key	Description
Film keys	Press <b>F1 - F4</b> for manual filming with the Manual Film Composer.
Preset Window Width / Window Level Keys	Press <b>F5 – F11</b> for preset Window Width and Window Level. These presets are equivalent to the presets that are in ImageWorks Viewer and Mini-Viewer.
Page Up / Page Down Keys	Press these keys to scan through the images in a viewport. 
Window Width / Window Level Control Keys	Press these keys to change the WW/WL settings for images in the Exam Rx and ImageWorks desktops. The Up/Down arrow keys increase/decrease the window level, respectively. The Right/Left arrow keys increase/decrease the window width, respectively. 
Tab Key	Press <b>Tab</b> to swap between image control modes.
Space Bar	Press the <b>Space Bar</b> to show/hide the MyTools palette.
Ctrl Key + moving the mouse	Press <b>Ctrl</b> and simultaneously move the mouse to page through the slices.
Shift	Press <b>Shift</b> to place the cursor at the mouse location.
Shift + click and drag	Press <b>Shift</b> and simultaneously click and drag to draw a trace line as you move the mouse.
Alt	Press <b>Alt</b> and click to edit a trace area.
Alt + s	Press <b>Alt</b> and <b>s</b> simultaneously to save the image as you name it.

**REFORMAT****Use the right-click functions**

Place the cursor over the viewport and right-click to display the on-view menu. Move the cursor down the menu until your choice is selected.

Not all choices are available under all conditions.

**Table 14-2 Right-click menu selections**

Command	Description
Save	[Save Image] - To save the image as a DICOM image [Save Image As] - To save the image and assign it a description [Save Screen] - To save all images displayed on the screen as DICOM images.
Send to Report	[Send Image to Report]/[Send Screen to Report] - To send the selected image or whole screen to the Report Tool (if applicable)
Display Properties	[Hide 3D cursor] - To remove the 3D cursor from the screen. Toggles back with Show 3D cursor [Reference Image] - To display a small reference image showing the plane orientation and position of the current image [Lock Orientation] - locks image orientation (3D and 2D oblique only). It is not possible to change the orientation with the mouse in the locked view. [Center on Cursor] - To center the image on the cursor [Center on FOV] - To center the image on the FOV [Center on Object] - To center the image on an object (very useful after segmentation).
Annotations	[No Annotation] - To hide all annotations including the right and left markers [Partial Annotation] - To hide or show part of the image annotations (scan parameters) [Custom Annotation] - To show the annotations which have been checked in the Annotation tab of the Display options Panel [User Graphics] - To show only user graphics including measurements and annotations. [Full Annotation] - When full annotations are not shown, then there will be an option to select full annotations in order to show all annotations.
Trace	When a trace has been defined (using Display/Trace tool or using "Create trace" from contextual menu), a new section appears in the contextual menu. [Create Trace] - creates a new trace [Clear Last point] - deletes the last point deposited [Clear trace] - deletes all points [Lock cursor to trace] - use this option to lock the 3D cursor on the trace
Mouse Modes	Left Mouse Button Modes - Sets the action of the left mouse button. Active mode is indicated by ">" sign
Enlarge	To change the view to full Screen
Reset pointer	To return the object back to the center of the viewport. Use this tool when you have blank viewports/
Delete ROI	Deletes or duplicates ROIs or edits ROI's label or changes the viewing of ROI statistics.
Delete all ROIs	Cursor must be centered on an active ROI to view this menu.
Duplicate	
Edit ROI's label	
Hide/Show Statistics	

## Display

In most respects, a 3D display view is like any other view. You can adjust window width and level as required, zoom, and scroll the image. You can add text annotations and change the color of the displayed object. In theory, you can also perform measurements or define and perform a scalpel cut on a 3D view since you can mark points and create traces on it. In practice, this is highly inadvisable, because on the 3D view you have no indication how deep into the 3D object the 3D cursor is located, and the result may not be at all what you wanted or expected.

A 3D view is different in that it displays an image of the 3D model (which may consist of one or more 3D objects), and that you can manipulate this 3D model.

On a 3D view, you can:

- Rotate and tilt the 3D model in all directions.
- Define one or more cut planes and display the 3D model with part of it removed, showing a cross section of the 3D model at the location of the cut plane.
- Place a spherical shutter (mask) on the view to show only an essential part of the 3D model, with the remainder masked out.
- Use colors, in particular to distinguish merged 3D models in merged 3D views.
- Extract a 3D object or volume of interest from the original 3D models using the Segment tools.

## Annotation

There are two types of annotation:

- System annotation which is automatically supplied by the system and is always displayed in the same place. The type and amount of annotation displayed can be modified but not moved.
- User annotation which is annotation you add. This annotation can be text or measurements and can be placed anywhere on the viewport.

### *Text annotation*

You can add notes and comments directly on the views, and use a marker with the annotation to point out anatomical features. User text annotations can be edited, moved or deleted as necessary. When images are saved, any annotations shown on the images are saved with them.

### *Preset annotation*

Preset annotations are those which have already been created and saved for future use. These annotations can consist of text or text with measurement annotations. The preset measurement annotations vary depending on the current protocol. In addition to the supplied default annotations supplied, you can create and save annotations.

### *Measurement annotation*

You can create and view various measurements (voxel value, distance, angle, area, volume) on the views. Like text annotations, they can be moved, deleted or edited as necessary.

### *ROI*

The ROI<sup>1</sup> tools exist in 2D and 3D. Several shapes are available to measure a region of interest in any view plane/volume: circle, elliptic, rectangle, and cubic for 3D ROIs. You can use the ROI tools to obtain information, volumes, areas and statistics of anatomy or pathology. The ROI tools allow you to:

- measure the pixel intensity value at a specific point on the image
- display the area or volume
- display the mean, standard deviation and minimum and maximum pixel values within the ROI

In order to perform measurements on an image that can be expressed in absolute values (mm), the image must be calibrated, i.e, the relationship between image pixels and true anatomical distance in the patient's body(the scale factor) must be known. For images such as CT and MR this information is automatically recorded during image acquisition and stored with the image. Measurements on such images can therefore be expressed directly in mm, using the patient- based RAS<sup>2</sup> coordinate system.

- 
- 1.Region Of Interest
  - 2.Right Anterior Superior

## Modify red annotation

All active (red) annotations on the image indicate adjustable fields. Red Numerical values can also be adjusted with left/right-click to decrease/increase values. Other red annotations can be modified selecting options from menu.

Figure 14-3 Active annotation

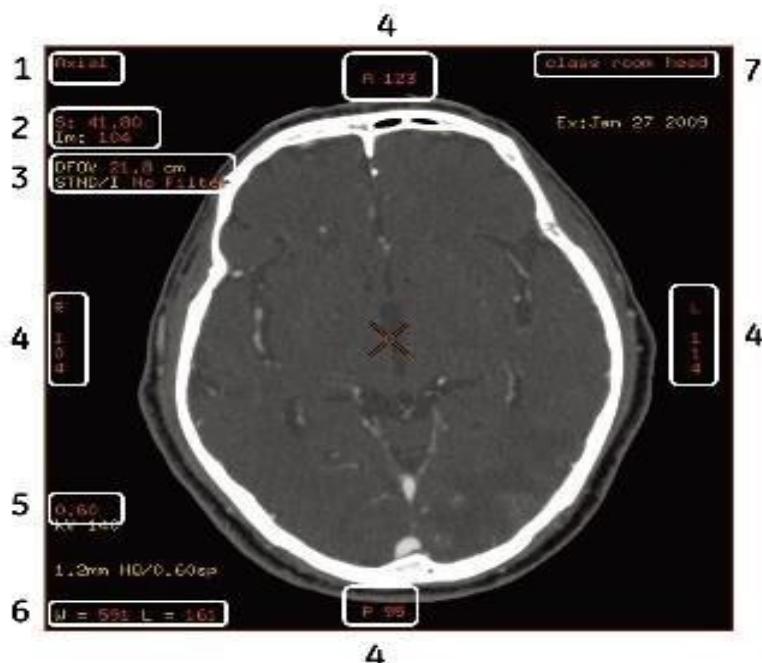


Table 14-3 Red annotation descriptions

No.	Annotation	Description
1	Plane or View Type <b>3D</b> <b>VR</b> <b>Axial</b> <b>Sagittal</b> <b>Coronal</b> <b>Oblique</b> <b>Oblique/3D</b> <b>Curved</b> <b>Profile</b> <b>Histogram</b> <b>X-Section</b> <b>Navigation</b> <b>Lumen</b>	Click and select from the drop down menu to change the plane or select a 3D model.
2	Image Location	Press the middle mouse button and drag horizontally to scroll through the 2D images or left-click to increment and right-click to decrement one image at a time.
3	DFOV	Press the middle mouse button and drag horizontally to magnify the image in real-time or left-click to increment and right-click to decrement the magnification factor.
4	Image Filter	Smooth 1 to 3, Edge 1 to 3 and Lung filters are 2D display filters and are available only on Axial, Sagittal, Coronal and Oblique viewports. Smooth 3D Plus is a 3D anisotropic filter which smoothes the whole volume. It can be applied on any 2D or 3D viewport. Important: The filter effect is purely visual and any statistics performed on a filtered image will be performed on original volumes (non filtered). Note: CT Filters can be applied on thick slabs only when rendering is set to "Average".
5	Image Roam	Press the left mouse button and move the image within the viewport.
6	Slice Thickness	Middle-click and drag horizontally to change the slice thickness or in real-time or left click to increment and right-click to decrement the slice thickness (2D images).
7	Window Width and Window Level	Press the middle mouse button and drag horizontally to change the W/L in real-time or left click to increment and right-click to decrement the W/L. Left click to select predefined WW/WL setting.
8	Patient Name	Click and select from the menu to show or hide the patient name.

## Review Controller screen

The Review Controller screen contains the following selections.

Figure 14-4 Review Controller

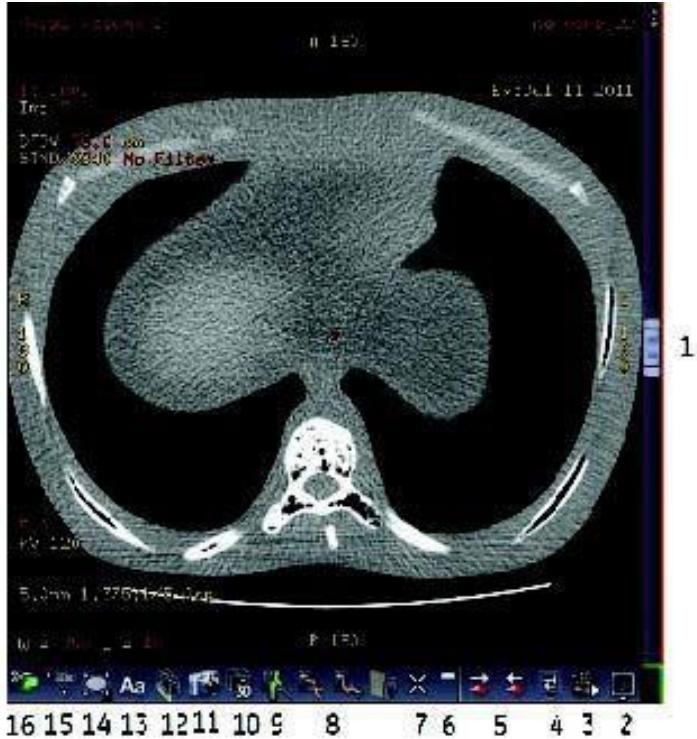


Table 14-4 Review Controller functions

No.	Options	Description
1	<b>Paging and thickening</b> a b a	a = Click and drag either side buttons to change the thickness of the MIP image. b = Click and drag the slider to page through the image set. To page you can also press the "Ctrl" key while moving the mouse up and down.
2	<b>Enlarge</b> 	Click to view an image full screen and then click again to restore the initial display. When mouse mode is set to Page/Rotate, Zoom or Pan, it is also possible to double click on a view to enlarge it.
3	<b>Movie Controls</b> 	Click the Movie controls button to switch to phase browsing.

4	<b>link/unlink</b> 	<p>Click to link/unlink views for manual registration of volumes. For example, to register multiphase liver series when breathing is abnormal.</p> <p>Click once to unlink volumes and visually correct automatic coordination of the two series by moving the cursor position.</p> <p>Click again to link volumes keeping new registration.</p>
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No.	Options	Description
5	<b>Bookmarkscrolling</b> 	Click to scroll to the next/previous ROI, bookmark and report cursor. For more details about ROI and report cursor, see "Volume Viewer Desktop" section – step 9 ("Display tools") above. To insert a bookmark, use the "Insert" key when the mouse cursor is over the structure of interest. Use the "Delete" key to delete a bookmark.
6	<b>Controllercontrol</b> 	Click "-" to minimize Review Controller. Click "+" to maximize Review Controller.
7	<b>Report Cursor</b> 	Click the [Report Cursor] button deposit a point on the viewports to display a RAS coordinate and vector ROI for the current cursor position.
8	<b>Quick AVA</b> 	Allow vessel tracking in one click (CT, MR) and two clicks (CT, MR, XA).
9	<b>Auto Select</b> 	Click the [Auto Select] button to display Auto Select panel with the buttons of Small Vessel, Any structure, Bones and Pick from VR. Provides to segment Vessel/any structures/Bone.
10	<b>MPR/3D</b> 	Guides the user through the creation of MPR and 3D views. Adjustment of slab thickness is possible from this panel as well as a selection of rendering modes such as MIP, Average, MinIP, and Volume Rendering.
11	<b>Save Image</b> 	Saves a clicked image using the current description.
12	<b>Batch Film</b> 	Creates Rotation, Loop or Oblique batch images based on user prescriptions.
13	<b>Annotate</b> 	Click the [Annotation] button to display the annotation panel. Many of the options are linked to measurement tools. For example, the Distance Annotation allows you to link an annotation with a measurement, (e.g., Stenosis: xx.x mm).
14	<b>2D Region Of Interest</b> 	Displays statistics for average, minimum and maximum voxel values, Standard Deviation, and Area (mm <sup>2</sup> ) within the ROI. (Click the arrow in the lower right corner of the button to change from an elliptic to a rectangular area and vice versa.)
15	<b>Distance Measurement</b> 	Straight and Curved measurements are selectable from this panel. Click on the image to deposit the first and last points.
16	<b>Scalpel</b> 	Draw a structure to cut holding the left mouse button, then select if you want to cut inside or outside the contours. It is also possible to Double click in the view to apply an inside cut. Depth of the cut can be adjusted from the panel.

## Display tab

The Display tab contains the following tools.

Figure 14-5 Display tab

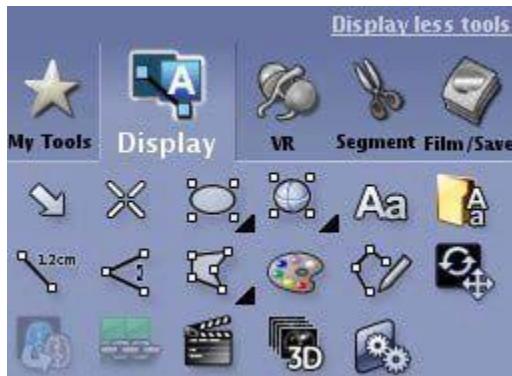


Table 14-5 Display icons

Icon	Description
Arrow Tool	Click the [Arrow Tool] button to deposit an arrow on the screen. Grab the end of the arrow to resize and rotate it. Grab anywhere on the arrow to move it.
Report Cursor	Click the [Report Cursor] button deposit a point on the viewports to display a RAS coordinate and vector ROI for the current cursor position.
2D Region Of Interest	Displays statistics for average, minimum and maximum voxel values, Standard Deviation, and Area ( $\text{mm}^2$ ) within the ROI. (Click the arrow in the lower right corner of the button to change from an elliptic to a rectangular area and vice versa.)
3D Region Of Interest	Displays statistics for average, minimum and maximum voxel values, Standard Deviation, and Volume ( $\text{mm}^3$ ) within the ROI. 3D color ROI provides the ability to colorize voxels inside the ROI based on ranges of voxel value. Additional Statistics such as volume can be calculated for each colored area. (Click the arrow in the lower right corner of the button to select the 3D box ROI, the 3D Color ROI, or the Spherical ROI.)
Annotate	Click the [Annotation] button to display the annotation panel. Many of the options are linked to measurement tools. For example, the Distance Annotation allows you to link an annotation with a measurement, (e.g., Stenosis: xx.x mm).
PresetAnnotations	Allows you to use preset annotations.

Icon	Description
<b>Distance Measurement</b> 	Straight and Curved measurements are selectable from this panel. Click on the image to deposit the first and last points.
<b>Angle Measurement</b> 	Click on the image to deposit three points.
<b>Area Measurement</b> 	Click on the image to deposit points around the region of interest. Right click to convert to ROI* or display results.
<b>Set Color</b> 	Select a Color Map or a Custom Color to apply it to all non-VR viewports. Maps such as Inverse Gray for inverting gray levels.
<b>Trace</b> 	This tool offers a guide to create a Curved reformation, a Profile or a X-Section.
<b>Rotate / Translate</b> 	To rotate and translate an image from a specific angle and set degrees.
<b>Cine</b> 	Allows the user to automatically page through all the slices of a single phase series or control a 4D Cine of multiphase series.
<b>MPR/3D</b> 	Guides the user through the creation of MPR and 3D views. Adjustment of slab thickness is possible from this panel as well as a selection of rendering modes such as MIP, Average, MinIP, and Volume Rendering.
<b>Display options</b> 	Allows the setup of user display preferences.

**REFORMAT****My Tools tab**

**Open Reformat** and then click **My Tools** to view the icons placed on this tab. Unlike the other tabs, this tab cannot be hidden.

The Basic mode only displays the My Tools palette. This palette is customizable and contains most frequently used tools. Click **More Tools** to switch to an Advanced mode, where you have access to all the grouped under tabs. Click **Display Less Tools** to switch to the Basic mode.

My Tools palette is a customizable tools palette. It is recommended to place in My Tools most frequently used tools so they are all grouped together and accessible at any time.

Figure 14-6 My Tools tab

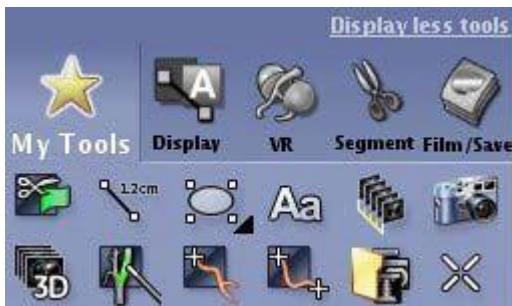


Table 14-6 My Tools icons

Icon	Description
	Draw a structure to cut holding the left mouse button, then select if you want to cut inside or outside the contours. It is also possible to Double click in the view to apply an inside cut. Depth of the cut can be adjusted from the panel.
	Straight and Curved measurements are selectable from this panel. Click on the image to deposit the first and last points.
	Displays statistics for average, minimum and maximum voxel values, Standard Deviation, and Area (mm <sup>2</sup> ) within the ROI. (Click the arrow in the lower right corner of the button to change from an elliptic to a rectangular area and vice versa.)
	Click the [Annotation] button to display the annotation panel. Many of the options are linked to measurement tools. For example, the Distance Annotation allows you to link an annotation with a measurement, (e.g., Stenosis: xx.x mm).
	Creates Rotation, Loop or Oblique batch images based on user prescriptions.
	Saves a clicked image using the current description.

<b>MPR/3D</b>	Guides the user through the creation of MPR and 3D views. Adjustment of slab thickness is possible from this panel as well as a selection of rendering modes such as MIP, Average, MinIP, and Volume Rendering.
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Icon	Description
	Click the [Auto Select] button to display Auto Select panel with the buttons of Small Vessel, Any structure, Bones and Pick from VR. Provides to segment Vessel/any structures/Bone.
	Allow vessel tracking in one click (CT, MR) and two clicks (CT, MR, XA).
	Click to open VR Presets panel.
	Click the [Report Cursor] button deposit a point on the viewports to display a RAS coordinate and vector ROI for the current cursor position.

#### **Remove a tool**

To remove a tool from My Tools palette, drag and drop the tool outside the palette and right-click the tool and select **Remove from My Tools**.

#### **Add a tool**

To add a tool to My Tools palette, go to the tab where the tool to add is, then drag and drop it to the My Tools palette or right-click the tool and select **Add to My Tools** (for example to add annotations preset tool go to Display tab).

#### **Move or hide the palette**

The My Tools tab can be floated anywhere in the interface. Click and drag the top part of the tab to move it. Press the **space bar** to show or hide at a mouse location.

**DISPLAY****Color Map Table screen**

When you draw a colored ROI, the Color Map Table screen displays.

Figure 14-7 Color Map Table: Statistics tab

**Color Map Table**

Statistics	Configuration	Presets		
Color	Range Name	#1	#2	#3
Blue	low density	4.8 % 1461.9 mm <sup>3</sup>	1.3 % 397.6 mm <sup>3</sup>	1.3 % 394.3 mm <sup>3</sup>
Green	parenchyma	32.2 % 9890.4 mm <sup>3</sup>	10.4 % 3182.8 mm <sup>3</sup>	13.6 % 4158.4 mm <sup>3</sup>
Magenta	sub-solid tissue	34.5 % 10611.1 mm <sup>3</sup>	16.7 % 5099.8 mm <sup>3</sup>	46.7 % 14331.0 mm <sup>3</sup>
Yellow	solid tissue	28.5 % 8750.8 mm <sup>3</sup>	71.6 % 21873.6 mm <sup>3</sup>	38.5 % 11804.2 mm <sup>3</sup>
	Total	30714.2 mm <sup>3</sup>	30553.8 mm <sup>3</sup>	30688.0 mm <sup>3</sup>

Close this panel to modify ROIs on the viewport. **OK**

**Color/Range Name**

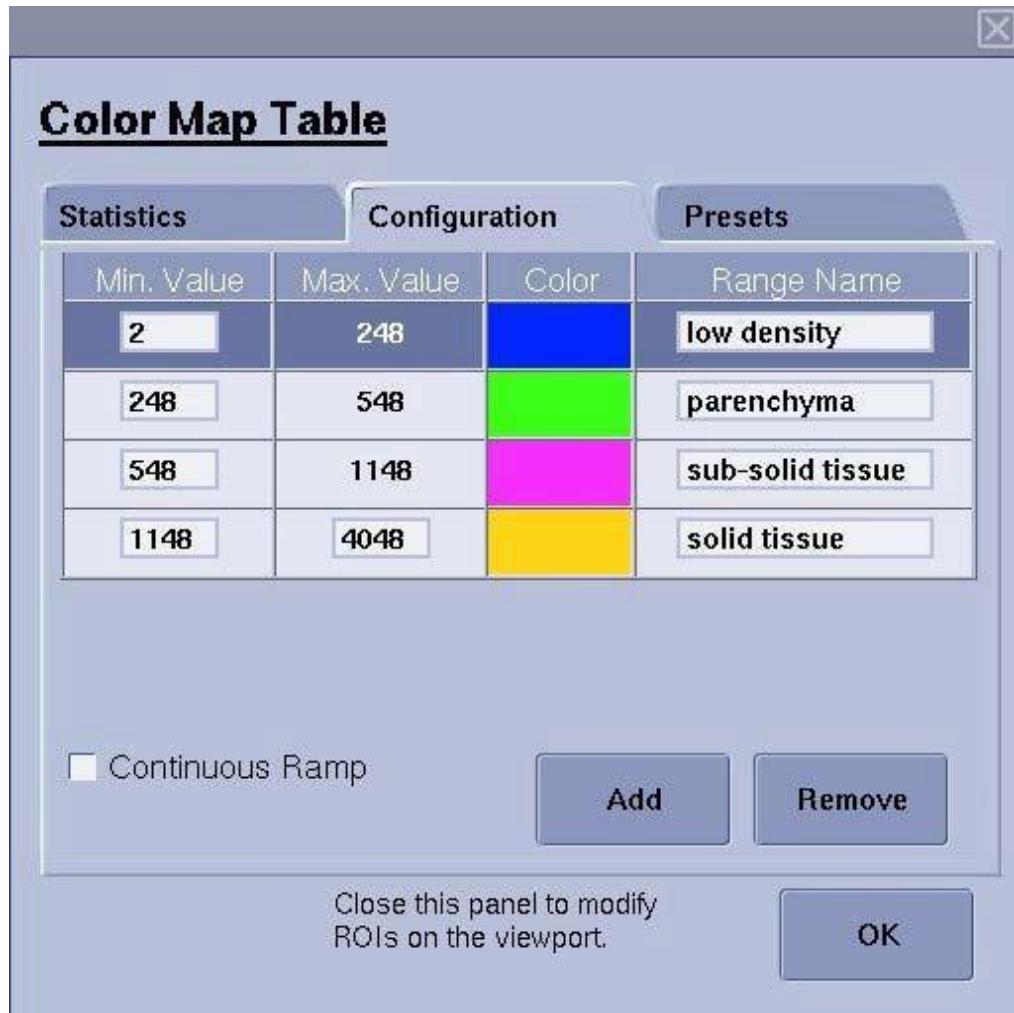
The range name, color, and values can be changed on the Configuration tab.

**Percentages**

Displays the percentage and area of each VOI<sup>1</sup> corresponding to each color-coded LUT range. Areas of an image can be made to display color discrete LUT<sup>2</sup> values by placing a LUT ROI on the image.

- 
- 1.Volume of Interest
  - 2.Look Up Table

Figure 14-8 Color Map Table: Configuration tab



### Min/Maxvalues

Defines the range for Min/Max values. You can change the values and range name by typing in the text field.

### Color

Click one of the color blocks to display the New Color screen from which you can change the shade of the selected color.

### Range Name

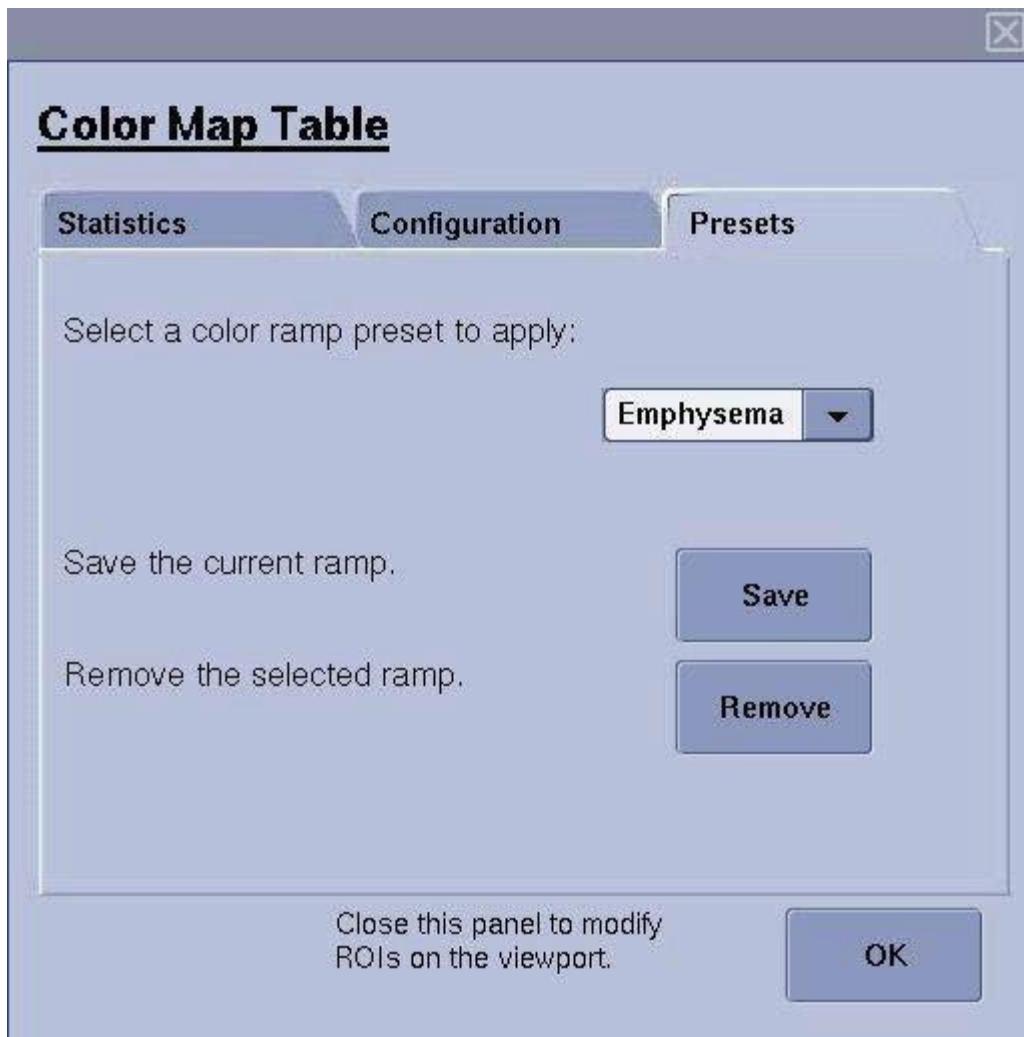
You can change the color name by typing in the text field.

### Continuous Ramp

Displays LUT<sup>1</sup> values as a continuous ramp of colors. Statistics are not available in the continuous mode.

1.Look Up Table

Figure 14-9 Color Map Table : Presets tab



### ***Color map presets***

The menu lists presets for particular diagnostic investigations: Plaque, Emphysema, MonoColorCT and Perfusion.

#### ***Save***

Adds a new color ramp.

#### ***Remove***

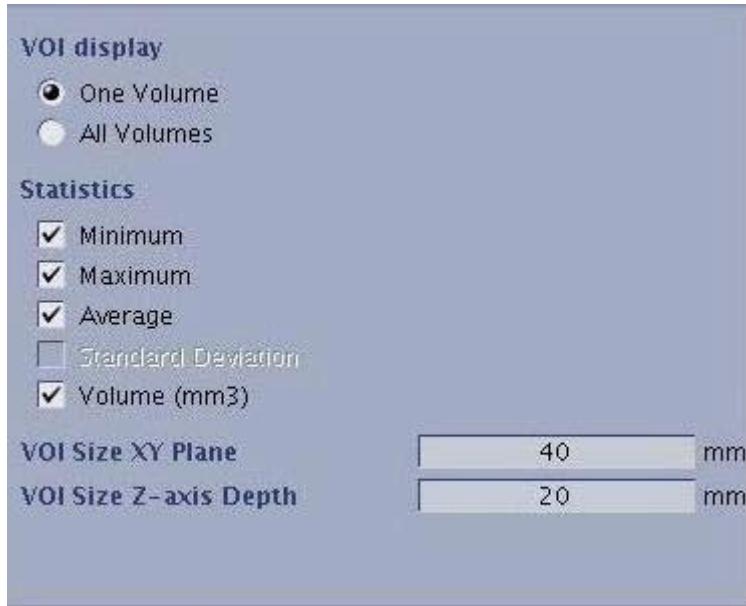
Deletes a user created color ramp.

## DISPLAY

### ROI Preferences screen

From the **Review Controller**, click the **ROI** icon to display the ROI Preferences screen.

Figure 14-10 ROI Preferences screen



#### *VOI display*

Sets the display of the VOI on one or all viewports for 3D images.

- **One Volume** displays the VOI on only the viewport on which the VOI was placed.
- **All Volumes** displays the VOI and statistics on all viewports.

#### *Statistics*

Allows any combination of minimum, maximum, average, standard deviation and volume values.

#### *Size*

Type in a height, width and depth. There is no depth for the sphere ROI. This will become the default size of the ROI, but it can be modified directly on the image.

## Annotate an image

Use this procedure to add specific and unique annotation to an image or apply a pre-set annotation that is saved on your system.

[Open Reformat.](#)

1. Click the *Display* tab.



2. Click the *Annotation icon*.
3. On the Annotation screen, click the annotation type (simple, linked or measure).
4. Place the cursor on the image and click to deposit the cursor and default text.
5. Enter new text in the Annotation text screen.

**DISPLAY****Save preset annotation**

Use this procedure to add a custom pre-set annotation to the Preset Annotation list.

[Open Reformat.](#)



1. From the Display tab, click the **Annotation icon**.
2. On the Annotate screen, type text in the Annotation Text field.
  - The preset name automatically fills in with part of the text from the annotation text field.
3. Change the preset name.
4. Select the text.
5. Press **Backspace**.
6. Type in a new name.
7. Click **Use for other anatomy** if you want the annotation available for other anatomies or **Use for other protocol** if you want the annotation available for other protocols.
8. Click **Save as preset** to add annotation to preset annotation list.

## Measure

Use these procedures to activate a measure tool to obtain information, distances, and areas of anatomy or pathology.

### *Open Reformat.*

1. Click the **Display** tab.
2. Follow one of the measure procedures below.

### Measure distance



1. Click the **Measure Distance** icon.
2. Make one selection for each menu choice.
  - Measure:
    - **From Volume (3D)**: to view the true distance in the 3D volume. Endpoints can be positioned at different depths in the volume. Rotate 3D volumes to check the exact position.
    - **Projection (2D)**: to view the length of the projection. When used in 3D images, the measurement will correspond to the projected red distance in the plane of the screen.
  - Display:
    - **On one Viewport**: to view the measurement on only one viewport.
    - **On all Viewports**: to place a measurement on different slices or volumes of a multi-phase scan at the same time.
    - **On one slice**: to view the measurement on only one slice.
    - **On all slices**: to view the measurement on all slices.
3. Position cursor for start of measurement and move cursor to end point of measurement and click.

### Measure angle



1. Click the **Measure Angle** icon.
2. Click and drag the squares to adjust the three points.

## Measure area



1. Click the **Measure Area** icon.
2. Click and drag the squares to adjust the points around the region of interest.
3. Right-click to display results.

## Measure volume



1. Click the Measure Volume icon.
2. Segment an object of interest.
3. Click the viewport of the segmented object.
4. Click any of the corners to size the volume.

## Manage color maps

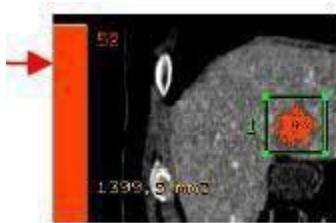
Use this procedure to manage color maps on reformatted images.

### *OpenReformat.*

1. Click the **Display** tab.



2. Click the **colored ROI** icon.
3. Click the image to deposit the ROI.
4. Click the color ramp displayed on the left side of the image to open the Color Table screen.



5. Click the **Statistics** tab to view range percentages for each color.
6. Change the values of the ROI on the viewport.
  - a. Click the **Configuration** tab to change the values of the ROI on the viewport.
  - b. Click a value in the **Min Value** column, and enter a new value.
  - c. Do the same for the **Max Value** and **Range name**.
7. Select a color.
  - a. Click a color in the Color column to view the Select new color screen.
  - b. Drag and drop the cursor on the color wheel.
  - c. Click **Apply**.
8. Click **Add** or **Remove** to change the viewed colors.
9. Click **Presets** tab to load and save Color map presets.
10. Click **Save** to save setting adjusted in the Configuration tab.
11. To load a color map preset, select the color ramp from the list.

## DISPLAY

### Add an ROI

Use this procedure to add an ROI on an image to obtain information, volumes, areas, and statistics of anatomy or pathology. The ROI allows you to:

- measure the pixel intensity value at a specific point on the image
- display the area or volume
- display the mean, standard deviation, and minimum and maximum pixel values within the ROI

#### *Open Reformat.*

1. Click the **Display** tab to view the ROI selections.

Figure 14-11 ROI selections



2. Click the desired ROI tool.
  - 3D color ROI is available 1 color MR or multi-color CT.
3. Set the ROI statistics, default size, and display location on the ROI preferences screen.
4. Click the desired anatomy to deposit an ROI and view the measurements at the bottom of the image.
5. Adjust the size by clicking and dragging on an ROI corner.



To delete the ROI, right-click on the ROI and select **Delete**.

## Set ROI preferences

Use this procedure to set the type of information displayed in the viewports for an ROI.

*Open Reformat.*

1. From the Main Control screen, click **More Tools**.
2. Click **Display** to view the measurement tools.
3. Select the desired view on which you want to place the ROI.
4. Click the ROI icon on the Review Controller to view the ROI preferences screen.
5. For a 3D ROI, one of the following options.
  - Click **One Volume** to view the VOI on only the viewport on which the VOI is displayed.
  - Click **All Volumes** to view the VOI and statistics on all viewports.
6. Click one or more Statistics option buttons to view any combination of minimum, maximum, average, standard deviation and area (2D) or volume (3D).
7. Type in the Vertical and Horizontal direction fields: (2D) or ROI height, width and depth (3D). The sphere VOI does not have a depth entry.
8. To hide the ROI statistics, click on the edge of the ROI to make it active, then at the center of the ROI, right-click on the center dot, and select Hide/Show statistics.

## View types

The following table contains the available view types in Reformat and their function.

Table 14-7 View Types

View Type	Function
3D	Displays the volume in 3D with different rendering. Default rendering is High density MIP. Other modes are available from the rendering mode red annotation.
Volume Rendered (VR)	Displays the volume in 3D color rendering.
Axial	An image plane representing a cross-sectional slice of anatomy.
Sagittal	An image plane dividing the body into left and right portions.
Coronal	An image plane through the body, dividing it into anterior and posterior portions (lengthwise).
Oblique	An image plane that has been tilted through the body rather than following the long axis. It can look like a axial image.
Oblique 3D	A 3D image plane created by defining points along an anatomical feature.
Curved	An image plane created by defining points along an anatomical feature.
Profile	A graph showing CT number intensity across a location.
Histogram (3D data)	A graph showing the percentage of occurrence and numerical statistics of each voxel intensity value in an object and total object volume. It also determines boundaries around a class of similar voxel intensities and can highlight pixel values. Statistics are not valid if used on 2D data.
X Section	A histogram (graph) showing the percentage of occurrence and numerical statistics, and area calculations in a user-defined surface area on a reformatted slice. It also determines boundaries around the class of similar pixel intensity values in this area.

## Create a Curved view

Use this procedure to display a reformat of a curved, complex view of tortuous vessels or organs. The curved view does not need to lie along a single orthogonal or oblique plane but can follow anatomical lines.

### *OpenReformat.*

1. In one of the viewports, right-click on the view type active annotation and select **Curved**.
2. On an axial, sagittal, or coronal image, press and hold **Shift** as you deposit points along the anatomy.
3. As you trace, the curved image updates automatically in the curved reformat viewport.

## VIEW TYPES

### Create an XSection Histogram view

A histogram graph shows the percentage of occurrence of each voxel value, either in a user-defined surface area on a reformatted slice (cross-section histogram) or in the entire 3D object (volume histogram). It also determines boundaries around the class of similar voxel intensities.

#### *OpenReformat.*

1. In one of the viewports, right-click on the view type active annotation and select **Histo** or **X Section**.
  - If you select a view type of histogram, you will immediately view a volume histogram which includes the entire 3D model. No other action is required. Place the cursor on the voxel reference line and hold **Shift**. The image displays the range of voxel class boundary lines by highlighting them in green.
  - If you select a view type of X Section, the view will display *Undefined histogram* until you start to define the trace.
  - Both the volume and cross-section histograms contain the same information with the exception of the name and measurement units. Cross-section histograms show total area, while volume histograms show the total volume for the entire object without cut planes.
2. For a cross-section (X Section) histogram, in the viewport containing the anatomy of interest, press **Shift** and simultaneously click the image to deposit points on the area of interest to create a trace.
3. Click **Exit**.
4. Click **OK**.



The histogram values and statistics are those of the current 3D model, not those of the original exam. If the 3D model contains only a given range of voxel values, only voxels within that range will appear in the histograms. Statistics and computed values of surface area or volume displayed on the histograms are subject to the same accuracy limitations as other on-view measurements. This tool can be used for cross-section and volume measurements of specific anatomic features if the feature to be measured can be clearly defined by a range (class) of voxel values.

### Create an MPVR view

Use this procedure to create an *MPVR*<sup>1</sup> view. This type of thick slab reformatted image is often used to see vessels in CTA<sup>2</sup> scans.

#### OpenReformat.

1. Click the red annotation in the upper-left corner of the viewport and select **3D** or **MIP** render mode. The selections available are dependent on the view type.
  - MIP is used most often in CTA models to demonstrate the most intense voxels.



2. Click the **Oblique Mode** icon.
3. Click and drag the yellow line on the image.
4. Place the cursor over the red thickness annotation do one the following options.
  - Type the desired thickness and press **Enter**.
  - Middle-click and drag to the desired thickness.
5. Click **Exit** and **OK** to finish.

- 
- 1.Multi Projection Volume Reformation
  - 2.Computed Tomography Angiography

## VIEW TYPES

### *Create a Profile view*

A profile graph shows the voxel value along a 3D trace (profile). This allows you to analyze the voxel value distribution of a 3D object in various ways, as an aid in setting up 3D processing (e.g., thresholding).

### *OpenReformat.*

1. Select the **Profile Layout** preset, if available.
2. In one of the viewports, right-click the view type active annotation and select **Profile**.
3. On an axial, sagittal, or coronal image, press and hold **Shift** as you deposit points along the anatomy.
  - As you trace, the profile view displays the pixel intensity along the trace.
4. On the profile view:
  - The horizontal axis is the position in millimeters along the trace and the vertical axis is the pixel intensity values as a function of that position.
  - Press **Shift** to display the pixel intensity from the location of the 3D cursor. Click and drag the white line to move it, which in turn, moves the cursor on the image.
  - The mean and standard deviation are displayed on the bottom.
5. Click **Exit** and **OK** to return to the browser.

## Volume Render

Volume Rendering uses the concept of Opacity. For different density levels, each voxel transmits a certain amount of light, which is reflected on the following voxel, and only the residual light reaches the following layer. The resulting image is the total sum of the reflection from each layer of tissue through which the light has passed. The effect of using Volume Rendering on a dataset is that it makes highly opaque objects more visible and at the same time it makes less opaque objects more transparent.

Figure 14-12 Opacity curve with the Up ramp

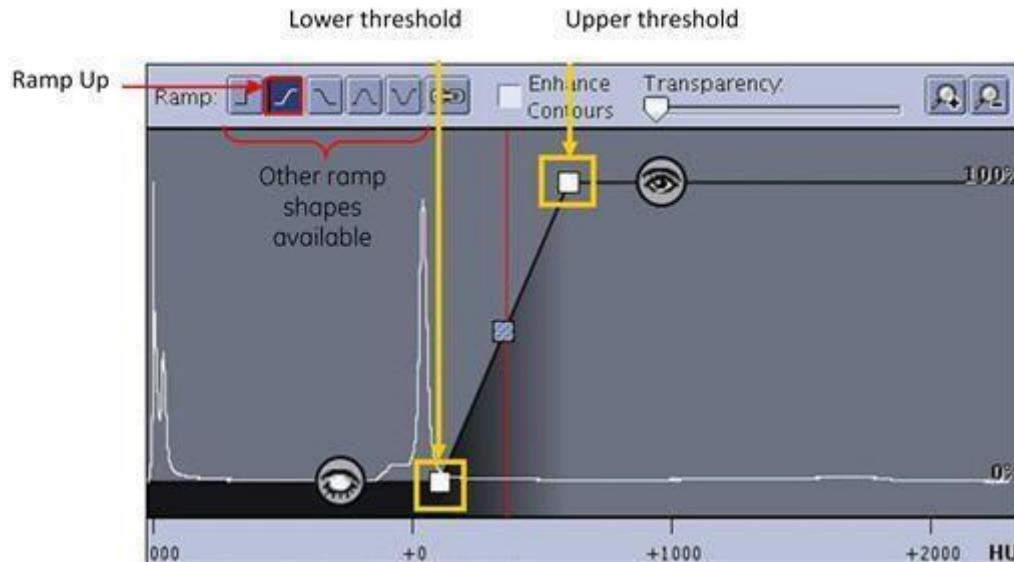
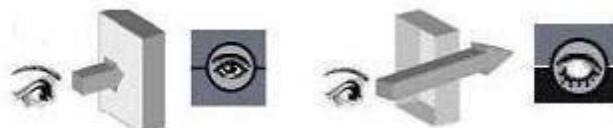


Figure 14-13 Left = Structures presenting density value associated with high opacity reflect light: they are visible. Right: = Structures presenting density value associated with low opacity transmit light: they are translucent



### Up ramp VR adjustments

1. To decrease background noise, increase the value of the lower threshold.
2. To increase visualization of soft tissues structures, decrease the value of the lower threshold.
3. Max opacity can be reduced: structures become more translucent.

Threshold Values constant: (50 to 800); Opacity values are changed.

Figure 14-14 Left = 100% Opacity; Middle = 50% Opacity; Right = 25% Opacity



Opacity Values constant: (100); Threshold values are changed.

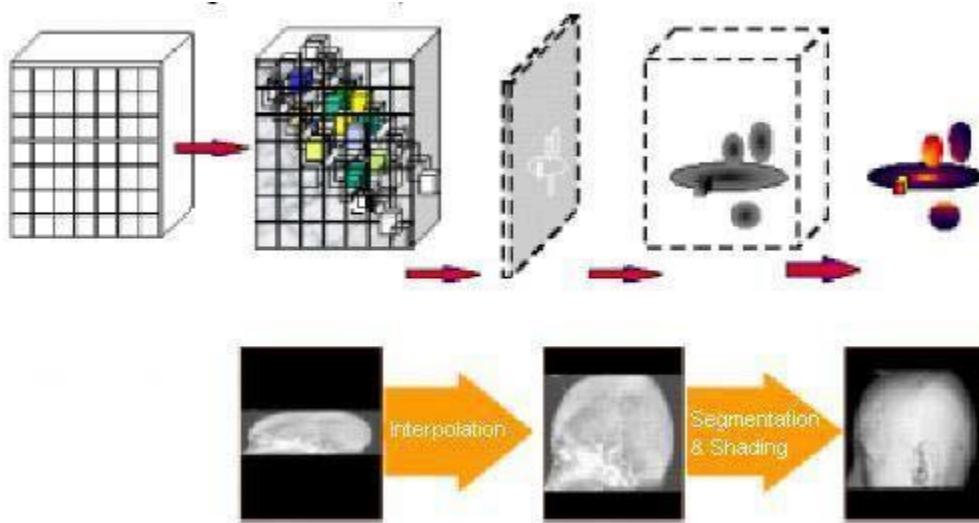
Figure 14-15 Threshold values from left to right: (-200 Low Threshold); (-100 Low Threshold); (0 Low Threshold); (50 Low Threshold); (100 Low Threshold)



### *Surface rendering*

Surface Rendering is similar to Volume Rendering except that it first separates the VOI from the original data set and then it creates the rendered image.

Figure 14-16 Surface Rendering



### *Render modes*

The Render modes consist of Volume Rendering, HD MIP, MIP, Min IP, Ray Sum, and Integral.

Table 14-8 Render modes

Mode	Function
VolumeRendering	Exists only if the model was built using volume mode and is used to display the surface of a model.
HD MIP	Displays the model using the High Definition Maximum Intensity Projection mode. The mode is identical to the MIP mode as described below, except that image definition is greater but the system speed is slower.
Weighted MIP	Displays MIP rendering enhancing front voxels and fading voxels in the back.
MIP	Displays the model using the Maximum Intensity Projection mode. In this mode, the density of each point on the screen is the maximum density along a line perpendicular to the screen.
Min IP	Displays the model using the Minimum Intensity Pixel mode. In this mode, the density of each point on the screen is the minimum density along a line perpendicular to the screen.



**Reformat**

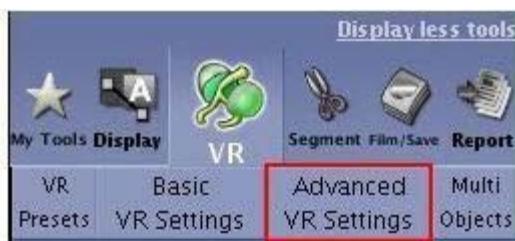
<b>Ray Sum</b>	Displays the model by summing the model's intensity along lines perpendicular to the screen. This mode simulates conventional radiography images.
<b>Integral</b>	Displays only the surface of the model, but the density of each surface point is equal to the sum of densities along a shallow depth below the displayed surface point.

## *Attach/detach objects*

### *Open Reformat.*

1. With a VR image displayed, click the **VR** tab.
2. Click **Advanced VR Settings**.
  - Read the text on the tab for more information.

Figure 14-17 VR tab



3. Click a color to activate.
4. Click the **Attach Mode** icon.
 
 A screenshot of the VR Controls screen. It shows a "Ramp" color palette with several colored squares. To the right of the ramp are four buttons: "Remove", "Add", and "Attach". The "Attach" button is highlighted with a red box.
5. Click **Attach** at the bottom, center of the VR Controls screen.
6. Adjust the opacity of the colored voxels by clicking on the colored box at the top of the ramp and drag up or down.
7. Attach another color by repeating the steps above.

## VOLUME RENDER

### Cut planes

When structures of interest are hidden on a 3D or VR view, use cut planes to display them prominently.

### Open Reformat.

1. Move the 3D cursor to the location of where you want the cut plane reference point.
2. On a reformatted image, right-click on the **No cut** red annotation and select a plane cutting the 3D view.
3. Rotate the view to 3D view to display structures of interest in cut area.
4. Select **Cut planes off** to deactivate.

Figure 14-18 Bottom: Left Anterior Superior Cut selected on 3D VR View



## Work with colors

Use the following procedures to apply colors to your images.

### Open Reformat.

1. With a VR image displayed, click the **VR** tab.
2. Click **Advanced VR Settings**.
  - Read the text on the tab for more information.

Figure 14-19 Advanced VR Settings screen



### Add colors

1. Place the 3D cursor on the anatomy of interest.
2. Click **Add**.

### Assign a range of colors

1. Click the box next to the word Color.
2. In the Transition area, click **Step**.
3. Adjust the diamonds between the colors to the desired value.

### Change a color

1. Click the box next to the word Color.
2. Click the arrow on the **Colors** button.
3. Select a color, or click **More Colors** to display the color wheel.
4. On the color wheel, drag the black circle in the color wheel to the desired color.
5. Click **Done**.

## VOLUME RENDER

### Autofit

Use this procedure to refine the VR opacity in an image.

#### *OpenReformat.*

1. With a VR image displayed, click the **VR** tab.
2. Click **Basic VR Settings**.
3. Place the 3D cursor on the anatomy of interest in any multiplanar view.
4. Click **AutoFit**.
5. Hold down the middle mouse button and move the mouse up and down to refine the VR opacity.
6. Click **Save New VR Settings** to save setting as a new VR preset.

Figure 14-20 Autofit on a vessel (top); Autofit on the trachea (bottom)



### Create a multi-VR object

You can merge multiple objects into a single VR model into a single view or model to perform more complex VR views with multiple object segmentation and visualization.

#### *OpenReformat.*

1. Click the **Segment** tab.

Figure 14-21 Segment tab



2. Select **Auto Select**.
3. Select the button corresponding to the structure to add (Small Vessel / Structure / Bone) and click **Add**.
4. Click **Yes** to clear the upper left viewport.
5. From any 2D view, click and hold the left mouse button on the object you want to add.
  - A green filter will fill the object while this object is being reconstructed in the upper left viewport.



6. Set left mouse to **Select mode**.
7. Drag the VR viewport and drop it on the top left viewport of the isolated object where "Drop here to merge view" appears.
8. Click the **VR** tab.

Figure 14-22 VR tab



9. Click **Multi Objects**.
10. On the Multi-object screen, roll over **Object 1** and **Object 2**. The corresponding object appears in the left window.
11. Select one object and adjust its transparency.
12. Click on the eye to hide or show the corresponding object on the active viewport.

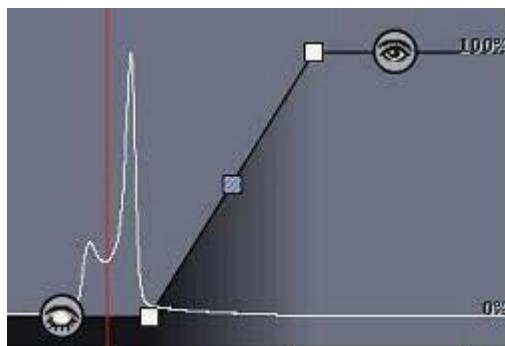
## VOLUME RENDER

### *Modify the opacity ramp*

#### *OpenReformat.*

1. With a VR image displayed, click the **VR** tab.
2. Click **Advanced VR Settings**.
  - Read the text on the tab for more information.

Figure 14-23 Transparency portion of Advanced VR setting screen



3. Click and drag the solid white boxes left or right to independently modify the upper or lower range of the ramp.
4. Click and drag the lower white box to the right to remove soft tissue or noise from an image.
5. Click the white box at the top and drag up or down to modify the overall opacity of the ramp. This affects the opacity of all visible voxels.
6. Click the solid blue box on the ramp and drag left or right to change the upper and lower values applied to the ramp.

### *Zoom in/out*

#### *Open Reformat.*

1. With a VR image displayed, click the VR tab.
2. Click **Advanced VR Settings**.
  - Read the text on the tab for more information.
3. Click and drag the red box in the lower window (which represents the scale of voxel values displayed) left or right to shift the display.
4. Click the **zoom icons**  in the upper right corner to zoom in and out of the image.
  - Or, click on top-right button (zoom display), and then click and drag on the main VR Control Display (a red mask will appear) to define a range of interest.
5. Right-mouse click to return to the original histogram range.

## Segment

To display a specific feature within the image, you can define what part of the exam data should be visible, and what part should not. The main tools you will use for this are:

- **Thresholding:** to extract a region of interest by selecting a range of voxel values that represents a specific tissue or anatomical feature.
- **Scalpel:** to perform cuts in the 3D volume to define the region of interest.
- **Paint:** to mark the region of interest with colored paint and then display only this region.
- **Auto Select:** to select an object and add it on or remove it from the selected view.

The process of removing structures is sometimes referred to as volume segmentation because the 3D volume is segmented, or split, in two parts: the volume of interest that is currently displayed, and the remainder that is removed from view.

After volume segmentation, the displayed part of the 3D model consists of one or more 3D objects. A 3D object is a part of the 3D model that is separate from other parts. Two 3D objects are separate if there is at least one voxel width of empty space between them.

Sometimes two seemingly separate objects still act as one, because they are still connected somewhere by a bridge of voxels. It is also possible that a seemingly single object turns out to consist of two or more parts, separated by narrow gaps. **The tools on the Advanced Processing screen** can help you to manage these effects.

## *Segment tab*

The Segment tab contains Advanced Processing Tools used to refine segmented objects or combine them using Boolean operations.

It is mandatory before using the tools to perform an initial segmentation with any of the segmentation tools (Threshold, AutoSelect, Paint, etc.).

Figure 14-24 Segment tab



## *Auto Select*

Opens a screen from which you select an object and add or remove it from the selected view.

## *Threshold*

Opens a screen from which you extract a region of interest by selecting a range of voxel values that represents a specific tissue or anatomical feature.

## *Remove object*

Opens a screen from which you remove or keep isolated objects or display removed structures.



## *Scalpel*

Opens a screen from which you cut the 3D volume, split an object into separate object, define a volume of interest or remove part of the 3D volume.



## *Paint on slice*

Opens a screen from which you trace contours on the baseline (axial, sagittal and coronal) views, to outline and mark the region of interest on the slices that intersect the region.



## *Quickpaint*

Opens a screen from which you paint with an adjustable sphere-shaped cursor on reformatted slices to define the volume of interest.

*Advanced Processing*

Opens the **Advanced Processing screen** that consolidates many advanced segmenting processes.

## SEGMENT

### *Scalpel screen*



On the **Segment tab**, click the **Scalpel** icon to display the Scalpel screen.

Figure 14-25 Scalpel screen



### *Cut Inside/Cut Outside*

Click and drag around the object of interest and then click the appropriate button to either cut inside or outside the trace. The trace may appear either red or green.

### *Cut on Trace*

Applies the cut along the trace.

### *Clear*

Clears the latest trace.

### *Cut Depth*

Allows changing the scalpel from Infinite to Restricted depth.

***Undo***

Allows you to undo the last operation performed. If the View on which the last operation was performed is changed, the possibility of undoing the last operation is permanently lost.

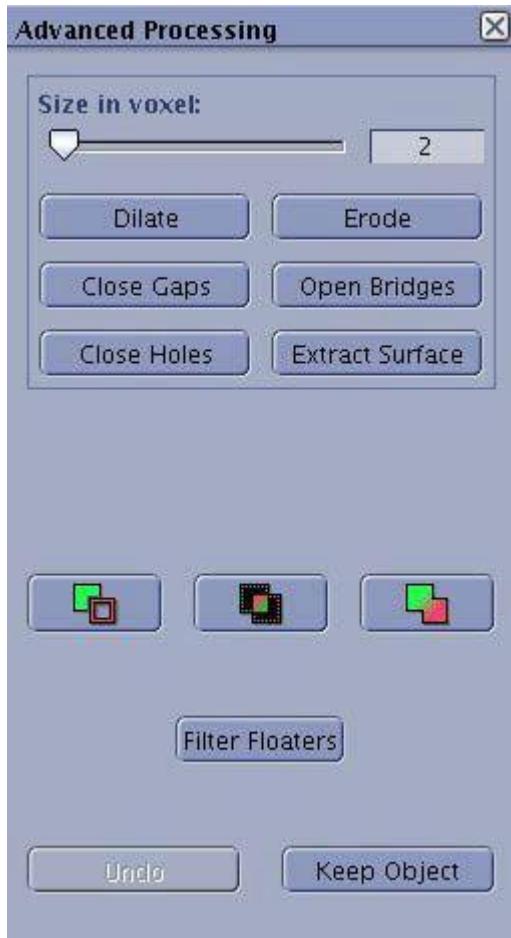
***Keep Object***

When the cursor is on the object of interest, this function keeps all the voxels that are attached to the object of interest.

## *Advanced Processing screen*

From Reformat, click the **Segment** tab and then click **Advanced Processing**.

Figure 14-26 Advanced Processing screen



### *Size in Voxels*

Determines the number of "layers" you want to add or remove. Change the value by using the slider or by typing in a value in the adjacent box.

### *Dilate*

Adds one or more layers (20 maximum) of voxels to the surface of the current 3D objects. This feature can restore voxels that were removed by some operations like thresholding, erosion, or opening bridges.

### *Erode*

Removes one or more layers (20 maximum) of voxels from the surface of the current 3D objects.

### *Close Gaps*

Fills in the gaps and connects the adjacent features. Adjacent features in the 3D volume that appear to consist of a single object may be composed of more than one 3D object when you try to use Keep Object or

Remove Object. This can be caused by the presence of narrow gaps, often only a few voxels in size, that separate the features. This mostly occurs when using thresholding to define a feature of interest, when the threshold setting is marginal. You can try to modify the threshold setting or alternatively use Close Gaps to fill in the gaps and connect the adjacent features. You set the size in voxels of the gaps you want filled in.

This function resembles the Dilate function, but only gaps up to the specified size are filled in; the rest of the objects are not dilated.

This function consists of performing a dilation followed by an erosion. Since erosion does not totally remove the voxels added by dilation, some small gaps or holes are filled in. A closing size of N is obtained by N dilations followed by N erosions. This means that small gaps or holes having one of their X, Y, or Z dimensions less than  $2N$  are filled in. For example, a closing size of 3 is obtained by three dilations followed by three erosions. This means that small gaps having one of their three dimensions less than six are filled in.

Open Bridges describes the opposite function.

### *Open Bridges*

Removes residual bridges and separates adjacent features in the 3D volume. You set the size in voxels of the bridges you want removed. This function resembles the Erode function, but only the bridges up to the specified size are eroded, not the rest of the objects.

This function consists of performing an erosion followed by a dilation. Since dilation does not totally restore the voxels removed by erosion, some fine structures remain eroded. An opening size of N is obtained by N erosions followed by N dilations. This means that fine structures having one of their X, Y, or Z dimensions less than  $2N$  are removed. For example, an opening size of 3 is obtained by three erosions followed by three dilations. This means that fine structures having one of their three dimensions less than six are removed.

Close gaps describes the opposite function.

### *Close Holes*

Resets any such inner holes to the original voxel values. When using thresholding, this can result in holes appearing inside the 3D volume (i.e., closed spaces inside the 3D volume where the voxel value is outside the selected range).

By default, the voxel value inside such inner holes will be set to the same value as the outside of the 3D volume (empty space).

If you have used the Scalpel or Paint tools to remove part of the 3D model, any holes enclosed within the 3D volume resulting from these operations will also be re-filled when you use this feature.

### *ExtractSurface*

Removes all data from the inside of the current 3D objects, leaving only the surface. Since the inside of the objects no longer contain any data, little if any further processing is possible.

Use this function to speed up the display after you have fully defined your region or objects of interest; e.g., during rotation or batch filming, or to modify 3D shading. Enter a surface thickness of at least 2 to guarantee connectivity information for any further operations such as selecting or removing objects. With a value of 1, the result appears visually correct, but the surface is too thin to be considered as one or more coherent objects.



### *Intersection*

Intersection keeps only the voxels that exist in the same location in both objects. The values of the resulting voxels are those of the original object in the primary view.



### *Set Addition*

Set Addition keeps all the voxels that exist in either of the objects. If a voxel belongs to both objects, its value in the primary view is kept. Use set addition to combine structures obtained using different processing tools.

For example, you may need different tools and settings to process a vessel from the left side of the patient and another vessel from the right side. By treating the two vessels separately and storing the results in the Save/Recall panel, you can optimize the processing for each side.

After recalling both from the Save/Recall panel in two separate views, the set addition operation allows you to join and display them as a single object.



### *SetSubtraction*

Set Subtraction removes all the voxels in the primary view that also exist in the secondary view. In other words, the secondary view is subtracted from the primary view.

Using a set operation on the data from two 3D models results in a single object (3D model). As an example, you can start by using thresholding to select the entire hip bone structure and store the result in the Save/Recall panel. Next, isolate and select only the femur (using paint or scalpel) and store the result separately. Subtracting the femur from the complete bone structure may now allow you to see the extent of a hip bone fracture that was obscured by the femur.

This is different from the merge operations, which allow you to display more than one 3D model at the same time and show their spatial relation by means of cut planes and different levels of transparency. Merge operations are strictly a display feature; they do not combine the separate 3D models.

### *Filter Floaters*

Filter Floaters allow you to remove small residual objects in the 3D model that can appear after thresholding, usually resulting from noise in the original image set.

### *Undo*

Undo becomes active after you have performed an action.

### *Keep Object*

Place the cursor over pixels representing the pixel intensities you want to keep. Keep Object keeps all pixels with the selected intensity; all other pixels are discarded.

## SEGMENT

### Combine segmented objects

Use this procedure to combine 3D segmented objects together.

#### Open Reformat.

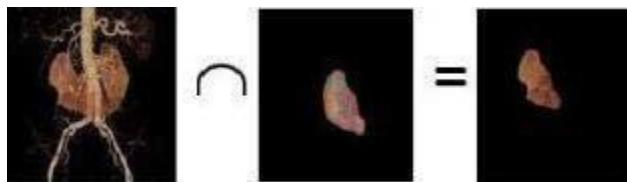
1. Select and view the images to be used for combining objects.
  - All objects must originate from the same master volume.
2. Click the **Segment** tab.
3. Perform segmentation to generate objects to combine using any segmentation technique (threshold, Auto Select, paint, etc.).
4. Display objects to combine in separate views.
5. Set the mouse mode to **Select mode**.
6. Double-click to isolate first view of interest.
7. Single-click to isolate second view of interest.
  - Views of interest display red and green borders. Other views should not have color borders.
  - To adjust red and green borders, click the view to set red, the other view will turn green.
8. Select an operation (results of the operation display in the red views).
9. Click **Advanced Processing**.



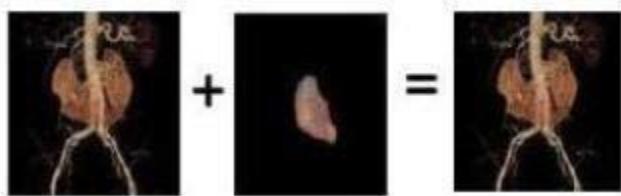
- Click the **Subtraction** icon to remove all the voxels in the primary view that also exist in the secondary view.
  - Before subtracting, make sure the borders of the view are displayed as: Red - Green = Red.



- Click the **Intersection** icon to keep only the voxels that exist in the same location in both objects.



- Click the **Addition** icon to keep all the voxels that exist in either of the objects.



### *Paint on slices*

Use this procedure to draw contours of the structure of interest on different slices. The volume to keep will be interpolated based of the defined contours.  
interpolated based of the defined contours.

### *OpenReformat.*

1. Click the **Segment** tab.



2. Click the **Paint on slices** icon.
3. Move the 3D cursor to the edge of the feature of interest.
4. If desired, click **Edge Attraction** to automatically refine the drawn contours, adjusting them to nearby structure edges.
5. Press **Shift** and click to deposit the cursor.
6. Release **Shift** and click and drag the 3D cursor to define the area.
7. Release the left-mouse button to connect last point to first point.
8. Move to the next slice on which you want to paint.
  - It is not necessary to define contours on every slice.
  - The contours interpolates to the intermediate slices.
9. Repeat the process until your reach the last slice containing the structure to contour.
10. Click **Apply**.

## SEGMENT

### Add/Remove anatomy with Auto Select

Use this procedure to automatically remove anatomy from reformatted images.

#### Open Reformat

1. Click the **Segment** tab.
2. Click **Auto Select**.
3. Select a tool for segmenting.
  - Click **Any structure** for vessels greater than 5 mm or soft tissue. Click and hold until area of interest is filled.
  - Click **Small vessel** (if available) for vessels less than 5 mm. Click once to fill and track vessel.
  - Click **Bones** (if available) to segment bones.
  - Click **Pick from VR**.
4. Click **Add** or **Remove** depending on the desired outcome.
5. Scroll through the axial images at minimum slice thickness.
  - If any vessels are contoured in green, put the cursor on the missing vessel in the 2D view and click and hold until the area of interest is filled.
6. Repeat steps to complete all missing vessels.

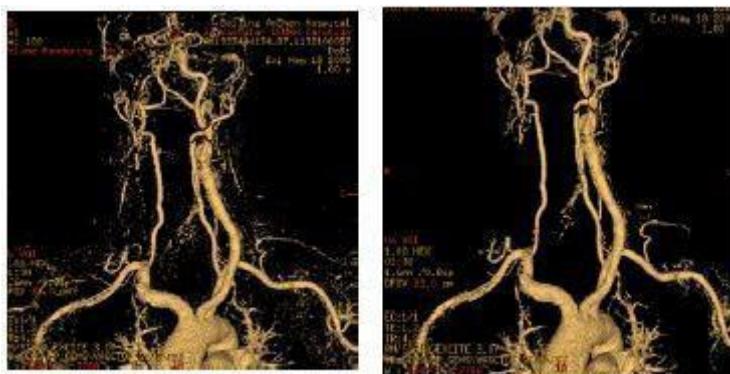
### *Remove floaters*

Filter Floaters removes small residual objects in the 3D model that can appear after thresholding, usually resulting from noise in the original image set.

### *Open Reformat.*

1. Perform a segmentation.
2. Click the **Segment** tab.
3. Click the **Advanced Processing** icon.
4. Click the view of interest and click **Filter Floaters**.
5. Click **Filter Size** and select Small, Medium, Large, or Custom.
6. Click **Apply**.

Figure 14-27 Left = no filter; Right = filter applied



## SEGMENT

### *Threshold an image*

Use this procedure to threshold the image and keep only voxels within a specified range of value.

#### *Open Reformat.*

1. Click the **Segment** tab.
2. Click **Threshold**.
3. On the Threshold screen, select the desired image from which you want to threshold.
4. Adjust the range of voxel values using either the sliders or typing in a minimum and maximum value.
5. Click **Apply Threshold** to display only the part of the 3D volume with voxel values inside the set range.
6. To further refine segmentation, select the object on the viewport and click:
  - **Remove Object** to remove all voxels connected to the object.
  - **Keep Object** to remove all objects not connected to the object.

## *Batch Film*

The Batch function allows you to rapidly set up a set of regularly spaced images, preview the set as an animated sequence (batch loop) and film and/or save it.

### *Batch types*

A batch can be one of the following types:

- Parallel oblique batch: a series of parallel oblique slices along a common center line
- Radial oblique batch: a series of oblique slices generated radially around a common axis
- 3D batch: a series of 3D images obtained by rotating a 3D object around an axis
- Batch loop: a series of 3D images obtained by rotating a 3D object in a continuous mode
- A batch loop allows you to rotate the 3D model, to adjust the display speed and to stop it in any position. You can select the number of views making up the loop, the FOV to use, etc. A batch image set can be viewed step-by-step or as a batch loop. It can be filmed, and/or saved on the image disk as a new series in the exam. To set up a batch you typically start with a batch protocol. A default batch protocol is provided for each of the three types of batches. You can use these as a starting point for your own custom batch protocols which you can save and re-use.

### *Batch protocol*

To set up a batch you typically start with a batch protocol. A default batch protocol is provided for each of the three types of batches. You can use these as a starting point for your own custom batch protocols which you can save and re-use.

A batch protocol defines:

- Batch mode: oblique or rotation
- Number of views and spacing between views (mm or degrees)
- Spacing between views
- Display field of view
- Slice thickness (and render mode for thick slices)
- Output mode: this can be preview only, film, archive, film+archive, filmer images or filmer movies. If you select film mode, you can also define the film layout.

When creating and saving your own custom batch protocol, you have two options:

- Add it to the list of existing batch protocols for the current loading/processing protocol.
- Combine it with the current loading/processing protocol to create a new loading/processing protocol. Create a custom multiple-batch protocol by combining two or more batch protocol setups.

### *Preview, film, or save a batch*

Once you have defined the batch, you can:

- Preview the resulting batch as an animated sequence (batch loop). The controls allow you to set the display rate (frames per second), to pause and restart the sequence, and to move through the set step-by-step.
- Film the batch, i.e., send image set to a hardcopy device such as a laser camera. The format (image

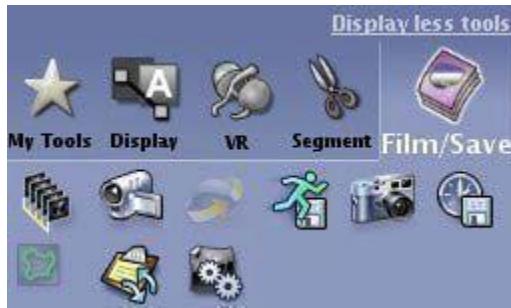
layout on the film) is defined in the batch protocol or can be selected in the Modify Batch panel.

- Save the batch on the image disk of the workstation. A new series is created in the current exam and can be used later for viewing and/or processing.

**BA TCH FILM*****Film/Savetab***

The Film/Save tab contains the following selections.

Figure 14-28 Film/Save tab

***Batch***

Creates rotation, loop or oblique batch images based on your prescription.

***Movie***

Creates a comprehensive movie including different rotations, zoom and pan of the volume.

***QTVR***

Not applicable in reformat.

***Quick Export***

Exports in a single click a batch of rotations of a 3D view or a full batch of contiguous images for 2D images.  
NOTE: Video Export does not work on the Operators Console.

***Save Image***

Saves selected image with user-selected format.

***Save State***

Saves current status of Volume Viewer (3D Model, displays, ROIs...) as an additional series of the exam. A One-Touch protocol entitled "Save State" will appear in the Application field providing the ability to restore Volume Viewer State.

***Save/Recall***

Opens a clipboard where to drag and drop objects to store temporarily within current Volume Viewer session.

***Film/Saveoptions***

Saves format type and other film options.

**BATCH FILM****Batchscreen**

Click the **Film/Save tab** and then click **Batch** to display the Batch screen.

Figure 14-29 Batch screen - Loop tab

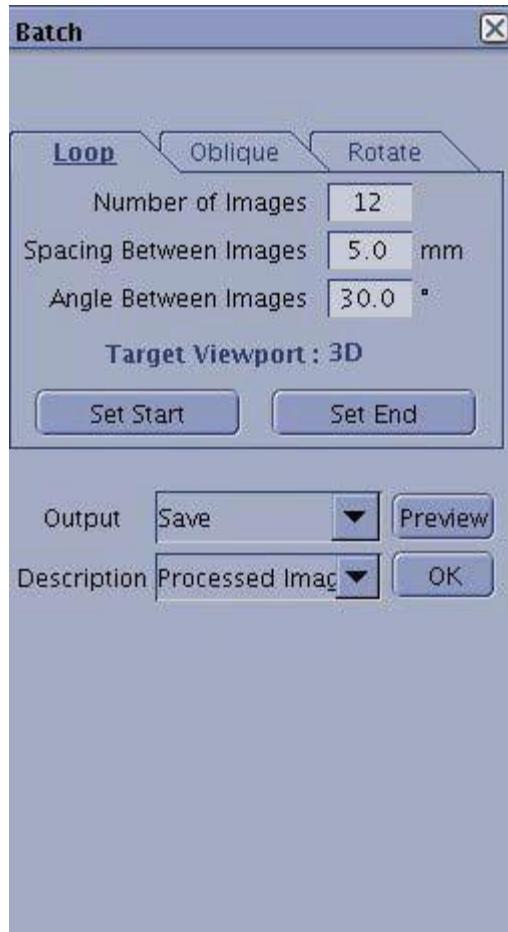


Figure 14-30 Batch screen - Oblique tab

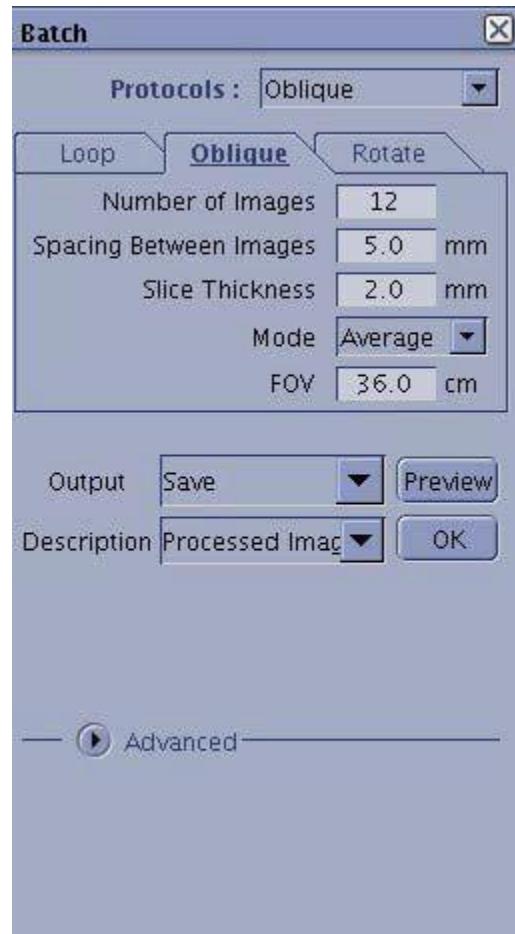
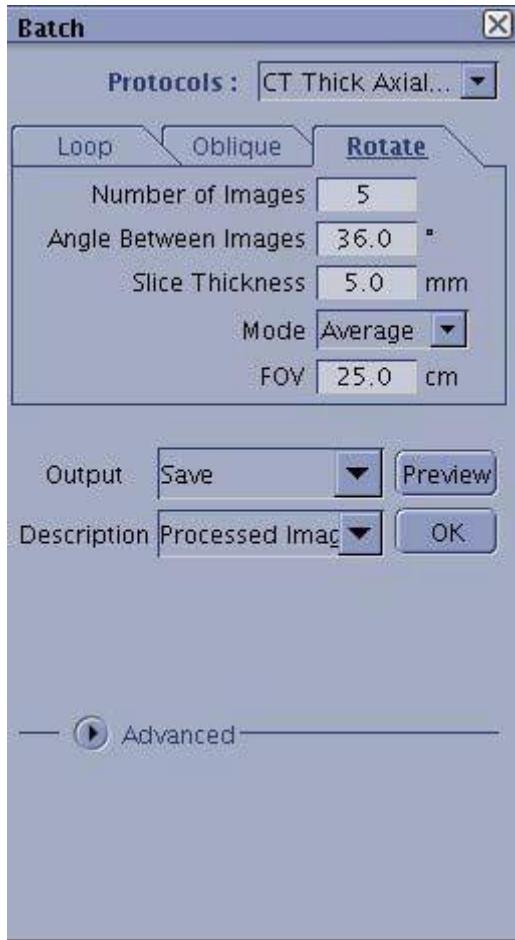


Figure 14-31 Batch screen - Rotate tab



### *Prescription mode*

- **Oblique** displays a set of lines to define the reformat planes.
- **Rotation** defines projection planes. The defined planes rotate 180°.
- **Loop** defines the first and last slices of your projection planes that can be set to any degree of rotation.

The displayed values are those of the current protocol and can be modified. The text fields change depending on the mode you select (oblique, rotation or loop).

### *Copies*

Appears only if **Print** or **Print & Save** are selected as an Output mode. Enter a value in the text field.

### *Output Modes*

- **Print** allows filming of the projection images and makes the Format and Reference Image buttons available. Select a film format and select the film that you want the reference image to appear on.
- **Save** creates a new series in the browser. The series type is determined from the Film/Save Options screen. Note that if **Color Save** has been turned on from the Film/Save Options screen, the projections will be saved as SSAVE images even if **Rfmt** is selected as the image type. Screen saves cannot be filtered or measured.

- **Filmer Images** drops all generated images into the filmer (AW only).
- **Print/Save** allows for both filming the generated images and saving a new series to the browser.
- **Filmer Movie** drops the generated images in the filmer as a movie to be exported as mpeg or avi image type.

### **Format**

Appears only if **Print** or **Print & Save** are selected as an Output mode. The Format menu allows you to make a format selection.

### **ReferenceImage**

Appears if **Print** or **Print & Save** are selected as an Output mode. Select which film you want the reference image to appear on: the first film, all films, or no film. The reference image is the first image of a rotation that has the following items displayed on it: number of views, rotation degrees, and the direction arrows icon.

### **Preview**

Displays the planes in a movie prior to filming or saving the images.

### **OK**

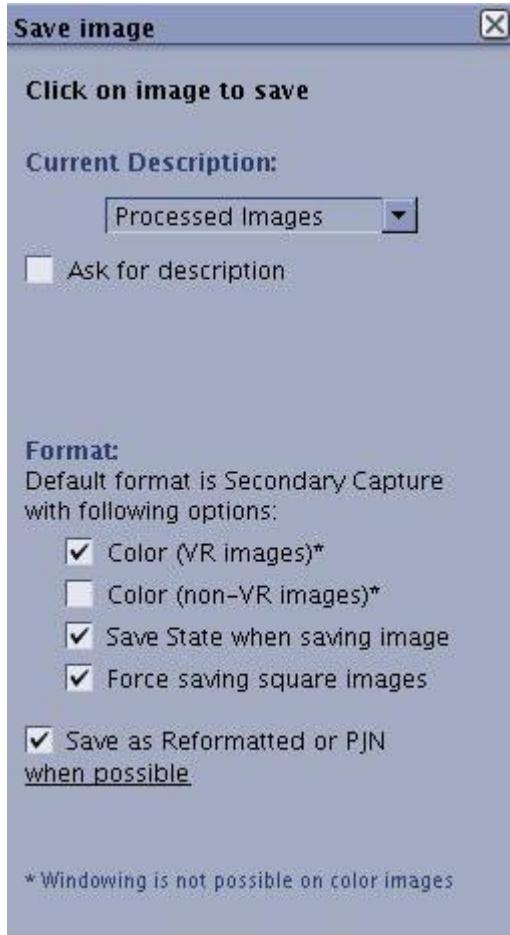
Saves and previews the images simultaneously. If **Save** or **Print & Save** is the selected as output mode, a new series is created in the Patient List.

### **Advanced**

Displays a drop down that allows you to add a new batch step for oblique or rotation. Click the arrow button and set parameters as desired.

**BATCH FILM***SaveImage screen*

Figure 14-32 Save Image screen

*CurrentDescription*

Choose either an existing description from the drop down box, or be prompted to enter a new description before saving. Each new description gets stored in the drop down box.

*Format*

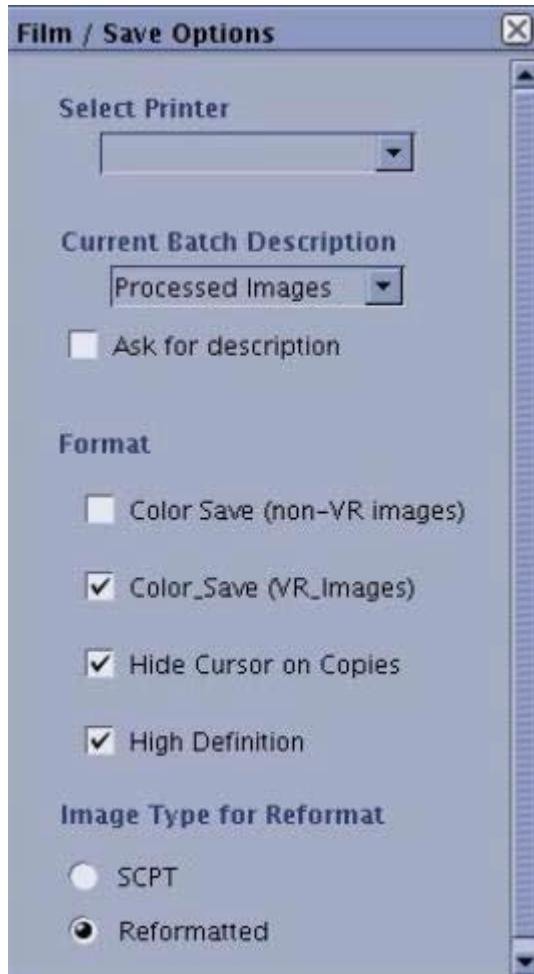
- Format Color (VR images) saves the image as a volume rendered color image. Leave it unchecked to save it as a black and white image.
- Color (non-VR images) saves the images as color. Window Level and Width of color images cannot be modified.
- Save State Saves current status of Volume Viewer (3D Model, displays, ROIs...) at the same time as saving the image. This Saved State can be used later on to restore Volume Viewer State.
- Save a Reformatted or PJP when possible saves the image as a reformatted or screen save image whenever possible.
- Reformatted and projection images can be used for further measurements and loading. Saving as reformatted is possible for axial, sagittal, coronal, oblique images and thick slabs except for volume rendering and X-ray or nuclear med images.

- Color and Save state options are not compatible with Reformatted DICOM format and cannot apply to images saved as Reformatted. Uncheck this option to benefit from Color and Save State capabilities.
-

### *Film/Save Options screen*

Click the **Film/Save tab** and then click **Film/Save Options** to display the Film/Save Options screen.

Figure 14-33 Film/Save Options screen



#### *Select Printer field*

Printer options are displayed in the menu. Note that the camera selected from this menu can be different from the camera selected from the Film Composer.

#### *Hide cursor on copies*

The option button hides or shows the cursor on the saved or filmed image.

#### *Image Type Format*

When saving reformatted images, you can select the image type: ScreenSave or Reformat which determines the functions that can be performed on the image and how the annotations are stored.

Reformatted:

- Allows W/L adjustments, measurements, and filtering of saved images.

- Automatically saves all system annotations with the view, even if they are hidden at the moment that you save the image. However, the user annotations (text and measurements) are saved only if they are shown at the moment that you save the image.

SCPT:

- Allows W/L adjustments of saved images.
- Saves only annotation (system or user entered) that is currently visible on the view. These annotations are part of the image: they can no longer be edited or deleted.

***Name Batch Series***

Allows you to provide a Patient List series description name for the saved series.

***HighDefinition***

Allows you to film images along the Z direction in high definition.

***Color Save VR Images***

Allows you to save your Volume Rendered images in color.

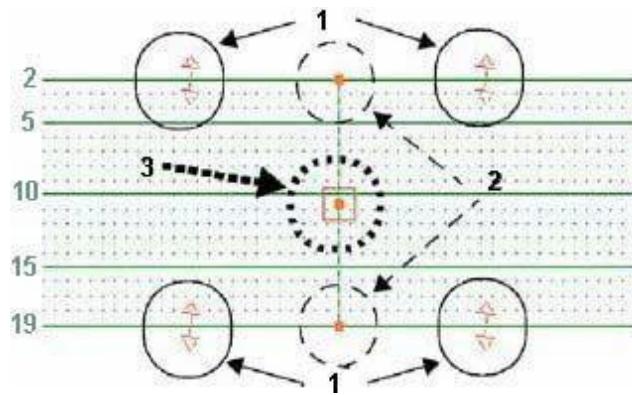
### *Set up a batch oblique*

Use Batch Oblique to define a set of oblique planes adjusting settings (range, angle, position) from a grid on a reference image.

#### *OpenReformat.*

1. Click **Film/Save** tab.
2. Click **Batch**.
3. On the Batch screen, click the view to be used as the reference image.
4. Click the **Oblique** tab to display a grid used to define the oblique planes.
5. Enter a value for the Number of Images, Spacing Between Images, Slice Thickness, Mode (Average, MIP, MIN, VR), and FOV.
6. Select the desired output mode from the menu.
  - Choose **Print** to send generated images to default printer (setup the Format and the display of a ReferenceImage).
  - Choose **Save** to save generated images in a new series in the Browser.
  - Choose **Print/Save** to film the generated images from a default printer and save them in a new series.
7. Click **OK**.
  - The Spacing between views and slice thickness can be set independently of each other creating a gap, contiguous or overlapped images.

Figure 14-34 Oblique tool: 1 = add slice handle, 2 = tilt handle, 3 = move handle



***BA TCH FILM******Batchfilm images***

Use this procedure to set up a batch rotation of images to film/save.

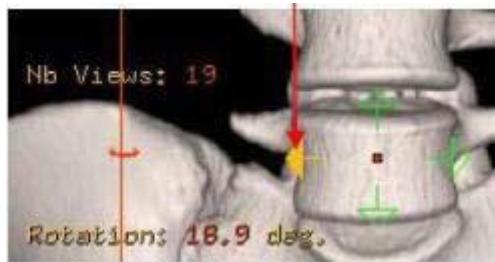
***OpenReformat.***

1. Click the **Film/Save** tab.
2. Click **Batch**.
3. On the Batch screen, click **Rotate**.

***Pre rotating 3D images***

1. Click the appropriate arrow to indicate rotation direction.

Figure 14-35 Rotation direction

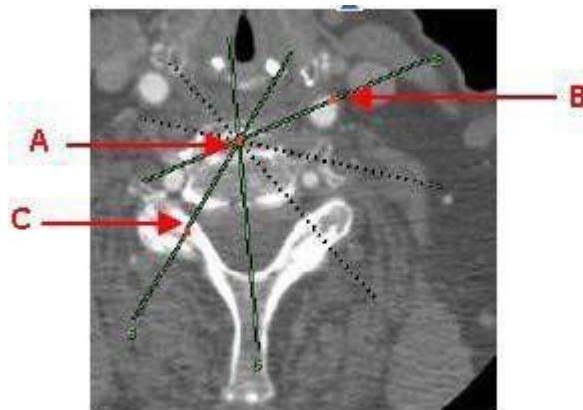


2. Type in the number of images or angle between images in the appropriate field.
  - Modifying one of these parameters updates the other.
3. Type in the FOV.
4. Select the desired output mode from the menu.
  - Choose **Print** to send generated images to default printer (setup the Format and the display of a ReferenceImage).
  - Choose **Save** to save generated images in a new series in the Browser.
  - Choose **Print/Save** to film the generated images from a default printer and save them in a new series.
5. Click **OK**.

***Radial planes on 2D views***

1. Adjust the center of radial slices (A), first radial plane location (B), and the number of radial planes (C) on the 2D reference image.

Figure 14-36 Radial prescription



2. Enter the Number of Images, Spacing between Images, Slice Thickness, Rendering Mode, and FOV.
3. Select the desired output mode from the menu.
  - Choose **Print** to send generated images to default printer (setup the Format and the display of a ReferenceImage).
  - Choose **Save** to save generated images in a new series in the Browser.
  - Choose **Print/Save** to film the generated images from a default printer and save them in a new series.
4. Click **OK**.

**BA TCH FILM****Save a curved parallel plane or rotating curve batch**

Use this procedure to set up a Loop batch for a curved parallel plane or rotating curved batch.

***Open Reformat.***

1. Click the **Film/Save** tab.
2. Click **Batch**.
3. On the Batch screen, click **Loop**.
4. Prescribe one of the following.
  - For a curved parallel plane batch:
    - Scroll to the first image to be saved and click **Set Start**.
    - Scroll to the last image to be saved and click **Set End**.
  - For a rotating curved batch:
    - Adjust the angle of the first image from the red Angle annotation on the curved viewport and click **Set Start**.
    - Set the angle of the last image and click **Set End**.
5. Enter the number of images to be saved.
6. Press **Enter**.
7. To save the new series, set Output to **Save**.
8. Click **OK**.



# Chapter 15 : AW Server Client on the Operator Console (Option)

The AW Server client on the CT console is a software option that provides access to applications hosted on an AW Server, from the CT console. It offers customers the use of applications on the CT console for improved workflow and productivity. Some of the benefits of having access to the applications on the AW Server is reduces the need to have applications installed on the CT console or having to go to a workstation which might be in another area.

For the troubleshooting support of AW Server client on the CT console, please contact GE Service. GE Service can provide information on the supported AW Server software version. If the AW Server software version needs to be upgraded, please contact GE Service.

This chapter explains the workflow and steps necessary to use the AW Server client application on the CT consoles successfully.

- Start the AW Server client on the CT console
- Exit the AW Server client on the CT console



Loading images with the Results Viewer application within the AW Server client on the CT console may slow down the console processing because the images are transferred to the memory of the CT console. Avoid launching the Results Viewer while other processing steps are executed, such as scanning or image reconstruction. When the console becomes slow, exit the AW Server client and login again.

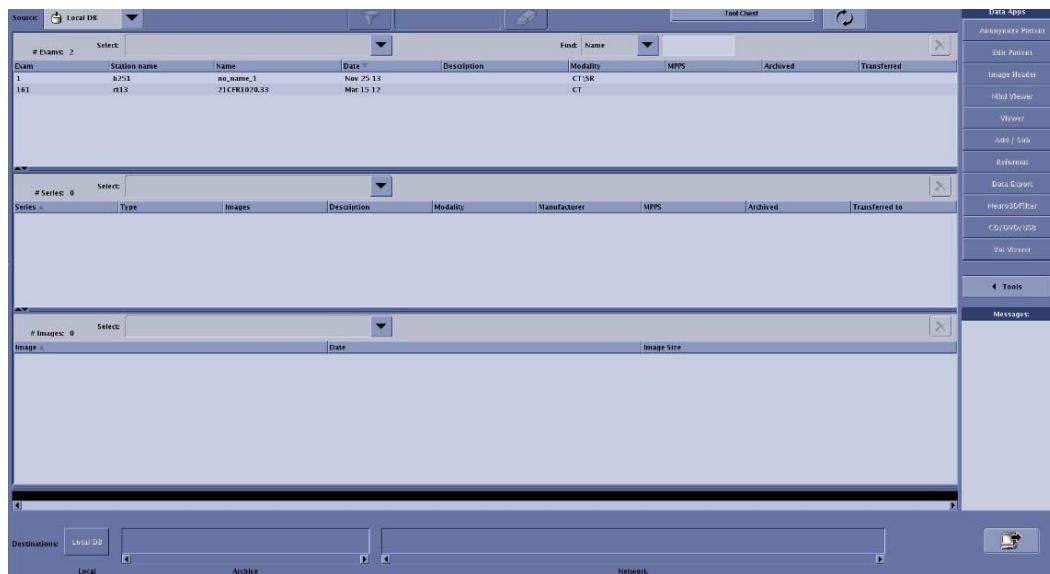


When you are viewing images with the Results Viewer within the AW Server client on the CT console, do not choose the Save to my PC option from the right-click menu. The images may be saved into an unknown directory.

Use this procedure to start the AW Server client on the CT console.

1. Select ImageWorks desktop.
2. From the exam list browser, select the exam and series of interest for post processing.
3. Click **Applications** in the Data Apps list.

Figure 15-1 Starting the AW Server client



- The AW Server client main window is opened and the same exam selected in the browser is selected automatically in the AW Server exam list. If the exam and series selected in the console exam list browser doesn't exist in the AW Server exam list, a pop-up warning is displayed.

Figure 15-2 AW Server client main window

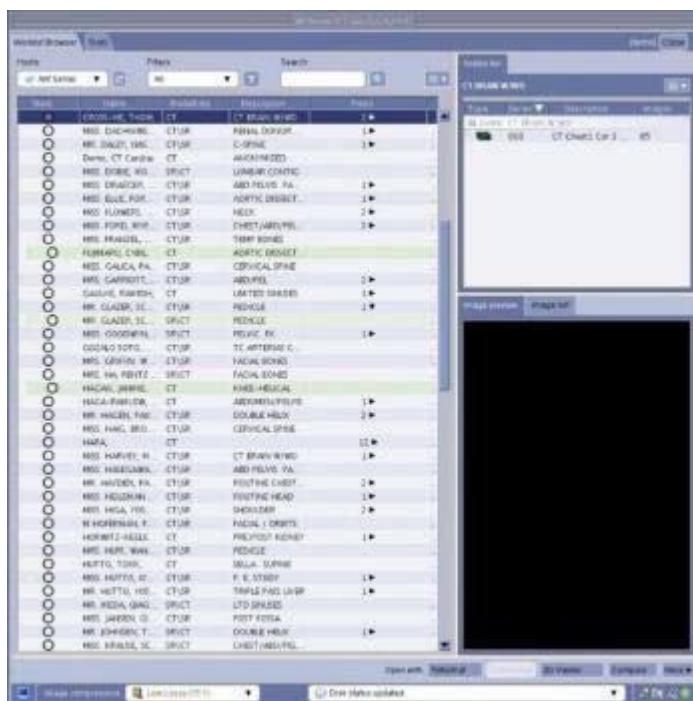
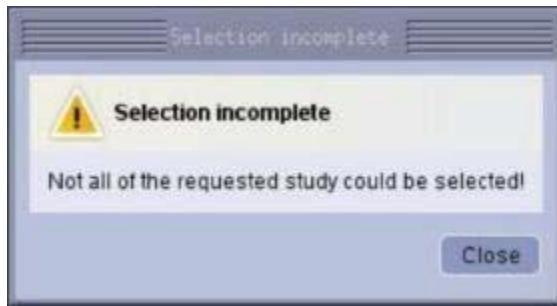


Figure 15-3 Pop-up warning window



Use this procedure to exit the AW Server client on the CT console.

- Exit the applications that are running.
- Click the **Close** button to log out of the AW Server client.

# Chapter 16 : Film

The **Film Composer** is the interface with your camera that allows you to automatically or manually film images. The available film formats are determined by your camera. This section presents the procedures necessary to successfully film images.

## Manual filming

[Film Composer screen](#)

[Print Series screen](#)

[Set the Print Series parameters](#)

[Manually film images](#)

[Semi-automatic Filming](#)

[Set Print parameters](#)

[Exports](#)

[Use the right-click functions](#)

[EditAnnotation](#)

[Film History](#)

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# Manual filming

The Film Composer is the interface with your camera that allows you to film images.

The manual film composer features support existing F keys (F5-F11) for Setting Window Width and Level. Presets functions F1, F2, F3 and F4 to film images. The Film Composer can be opened from the browser, the Viewer, the Mini Viewer, Exam Rx, and Reformat.

The manual film composer supports following functions:

- 1.Select the images from image browser by exam, series or image level.
- 2.Organize the multiple patients' filming jobs at the film interface.
- 3.Setup the film layout easily.
- 4.Copy/cut/paste/insert/delete the images on the composer.
- 5.Review the film job from the film history.
- 6.Edit the image annotation.

## Function keys

The **F1-F4** function keys are used for Manual Film Composer procedures.

Figure 16-4 Film Function keys



Table 16-9 Function keys

F key	Description
<b>F1</b>	Film image
<b>F2</b>	Film screen
<b>F3</b>	Film MID
<b>F4</b>	Print series



Images placed in the film composer using the F Keys, can not be edited. Only the layout can be changed.

## MANUAL FILMING

### Film Composer screen

Open the Film Composer to view the Film Composer screen.

Figure 16-5 Film Composer screen (Minimized)

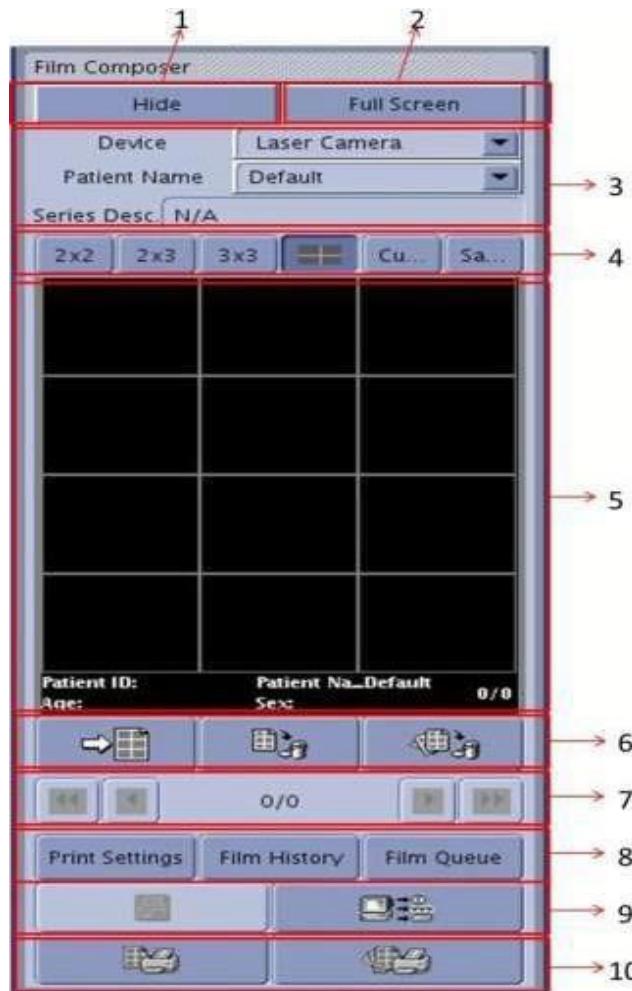


Table 16-10 Function keys with description (Minimized)

#	Selection	Description
1	Hide	Hide the Manual Film Composer
2	Fullscreen	Switch to full screen
3	Select Camera	Select the camera for film print.
3	Patient Name	Display the Patient Name that has been loaded to film composer
3	Seriesdescription	Display the current information of the series

#	Selection	Description
4	Layout preset	Select one of the fixed layout configurations: 1x1, 1x2, 2x2, 2x3, 2x4, 3x3, 3x4, 3x5, 4x4, 4x5, 4x6, 5x5, 5x6, 5x7, 5x8. By clicking right mouse button on the layout selection, you can open another popup screen for layouts to show on the composer. Customer can set up Special layout configuration by click [Customize] button and save the layout by click [Save Layout] button.
5	Image layout	Show print page layout.
6	Add/Delete page(s)	Add a page, delete the current page or all pages.
7	Page #, Page up/down	Current page # / total page # in the middle and view first page, previous page, next page and the last page.
8	Print Setting	Set print parameters.
8	Film history	Allows user to save the print jobs to a persistent storage space with the ability to search and retrieve the print job from persistent storage space.
8	Film Queue	Allows to pause/resume/delete printing jobs
9	Export	Export the JPEG film to USB.
10	Print	Print the film, page by page or all the pages.

Figure 16-6 Film Composer screen (Full)

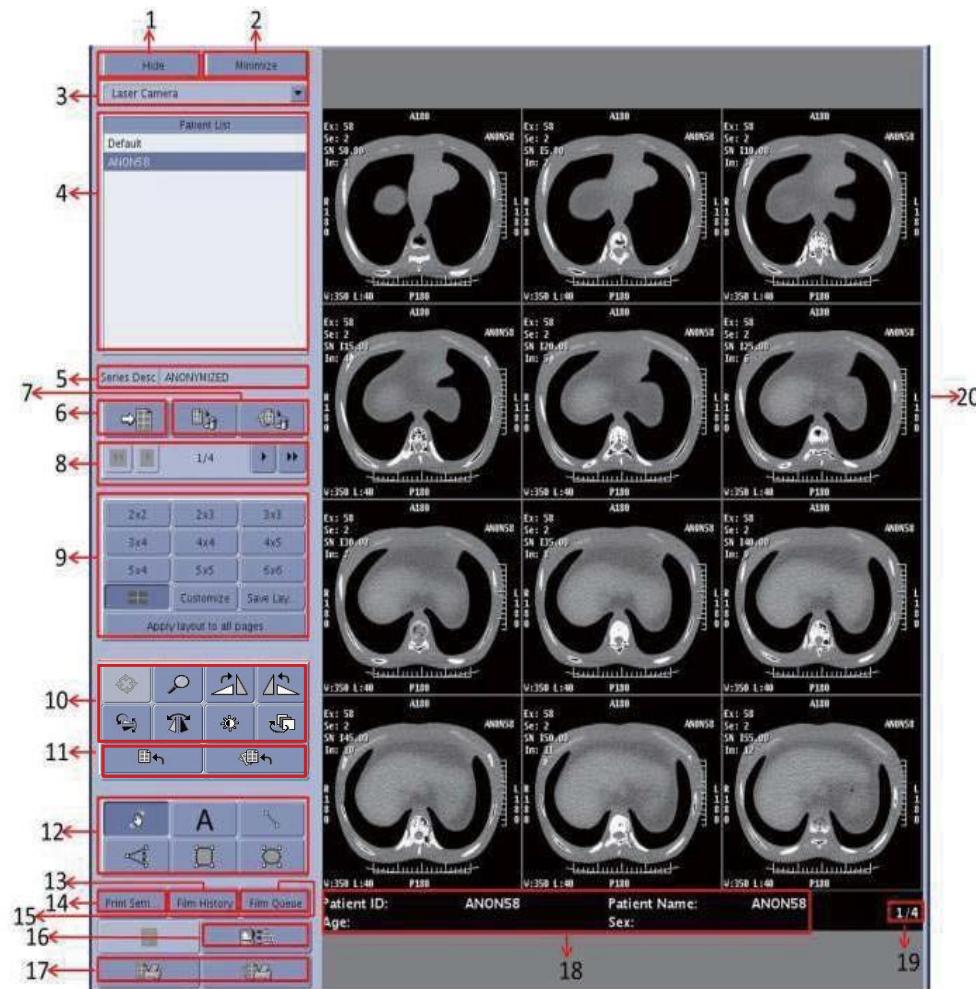


Table 16-11 Function keys with description (Full)

#	Selection	Description
1	Hide	Hide the Manual Film Composer
2	Minimize	Minimize the Manual Film Composer
3	Select Camera	Select the camera for film print.
4	Patient list	Display the Patient information that has been loaded to film.
5	Seriesdescription	Display the current information of the series to film.
6	Add page	Add a blank page to add images for filming.
7	Delete page	Delete the current page or all pages.
8	Page number, Page up/down	Current page number of total page number in the middle and view first page, previous page, next page and the last page.

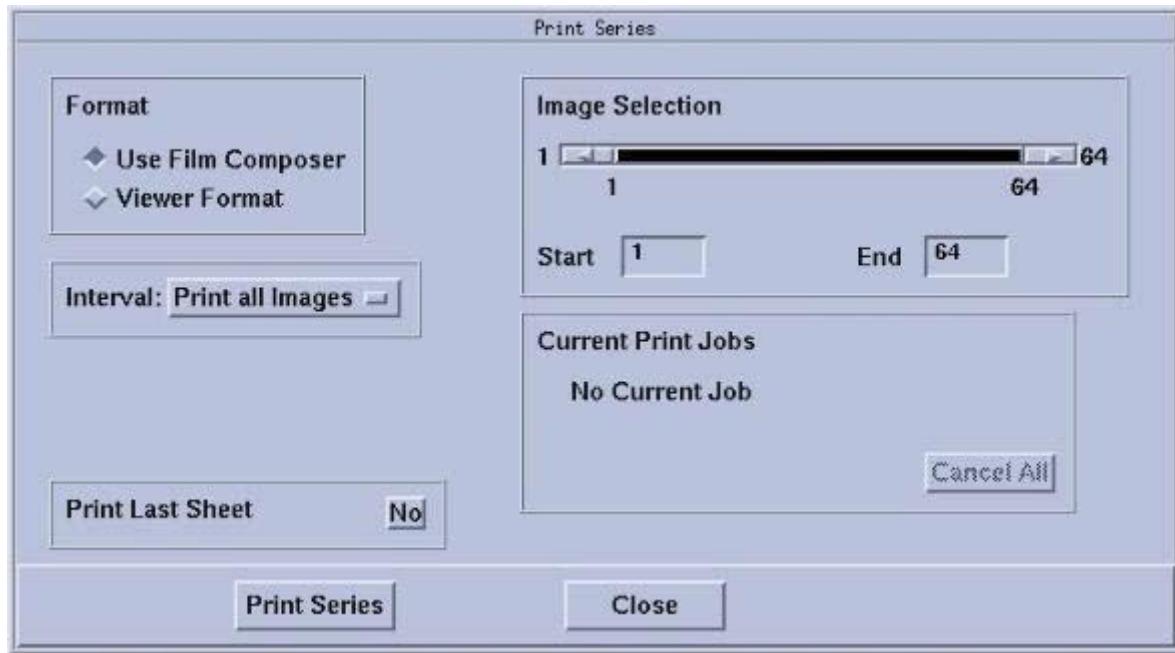
#	Selection	Description
9	Layout preset	Select one of the fixed layout configurations: 1x1, 1x2, 2x2, 2x3, 2x4, 3x3, 3x4, 3x5, 4x4, 4x5, 4x6, 5x5, 5x6, 5x7, 5x8. Customer can set up Special layout configuration by click [Customize] button and save the layout by click [Save Layout] button. Customer can apply the layout to all pages by click [Apply layout to all pages] button.
10	Adjust	Zoom In/Out ROIs, Flip, WW/WL, Display normal.
11	Apply to page/all pages	Apply the edit of one image to page or all pages.
12	Routine operation	Including distance, angle, area Measurement Put label/text on the images.
13	Film history	Allow user to save the print jobs to a persistent storage space with the ability to search and retrieve the print job from persistent storage space.
14	Print setting	Set print parameters.
15	Film Queue	Allow to pause/resume/delete printing jobs.
16	Export	Export the JPEG film to USB.
17	Print	Print the film, page by page or all the pages.
18	Patient Information	Display the patient information at the bottom of film(s).
19	Page number	Show the current page number of the total printing pages.
20	Image layout	Show print page layout.

## MANUAL FILMING

### Print Series screen

Press **F4** to open the Print Series screen.

Figure 16-7 Print Series screen



#### *Format*

Select the format of the printed series, using either the same format as the Film Composer or the Viewer.

#### *Image Selection*

Move the Image Selection slider to include the number of images to be printed.

#### *Interval*

Select an Interval to print the images or choose to print all images in the series.

#### *Current Print Jobs*

The Current Print Jobs area displays messages about the job currently being executed and gives you the option to cancel the print job.

#### *Print Last Sheet*

Yes automatically prints the last sheet of film. Select No to manually click the **Print** button on the Film Composer.

#### *Print Series*

Prints the series with the chosen selections.

#### *Close*

Closes the Print Series screen without printing the series.

## Set the Print Series parameters

Any portion of a series may be filmed using the Print Series (**F4**) key. This is a great time saving feature if, for example, films are lost, duplicate copies are needed, or if auto filming was not utilized. All images need to be filmed in the same window width and level. If multiple window widths and levels are needed (i.e., soft tissue and bone) the Print Series can be used for each window width and level.

1. On the display monitor, click in one of the lower viewports.
2. Click List Select.
3. Select an exam, series, and image.
4. Click the **Manual Film Composer icon**.
5. Place the cursor in the image/series to be used for Print Series.
6. Press **F4**.
7. Set the Print Series parameters.
8. Click **Print Series**.



To cancel a Print Series request, press **F4** and click **Cancel** from the Current Print Job.

## MANUAL FILMING

### Manually film images

#### Considerations

- If the composer is closed by selecting iconify icon in the upper right corner of the composer, it may open when **Confirm** is selected for scanning.
- It is best to resolve any paused queue entry as soon as possible.

#### ImageWorks

1. From the **Manual Film Composer screen**, complete the following:

##### *Set Print setting.*

- a. Select layout.
2. Place the cursor over the image you want to film and use one of the following film methods:
    - **Film single image:** press **F1** and the currently active image is placed in the next available film frame.
    - **Film Screen:** Set the image display format to the number of views you want displayed according to the layout you have opened, then press **F2**.
    - **Film MID:** set the image display format to the number of views you want displayed within each film frame, then press **F3**.

## Semi-automaticFilming

1.Click the **ImageWorks**  icon.

2.From the browser patient list, select the desired images.

 When an Exam is high-lighted, all images in the first series are selected. When a Series is high-lighted, all images in the series are selected.

 If you want to select multiple series or exams, you can use [**Shift**] or [**Ctrl**] button.

3.Click [**Filming**] button from the Data Apps area. Film composer will display and the selected images will be loaded to film composer.

4.Edit the images in the film composer.

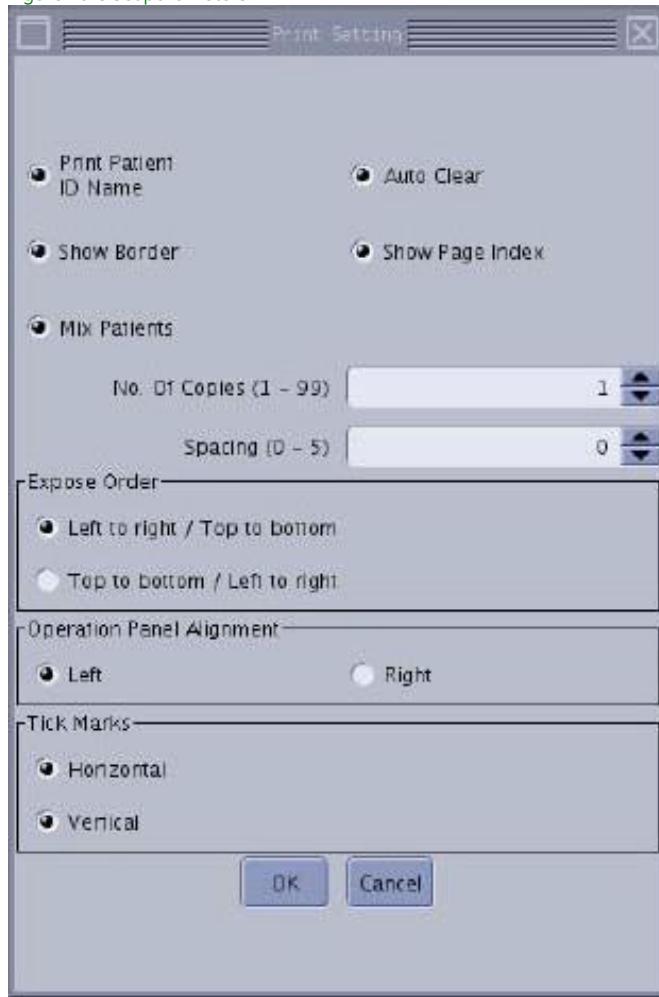
5.When the Film Composer screen is ready for print, click **Print**.

## MANUAL FILMING

### Set Print parameters

Several settings are available on the Manual Film Composer. The system retains the changes until next change is made. Settings may be changed prior to actual printing of the images in the composer. Click **[Print Settings]** button. A dialog window opens allowing you to set up the print preferences.

Figure 16-8 Set parameters



#### **Print Patient ID Name**

Print the Patient Name and Patient ID

#### **Auto Clear**

Automatically clears the printed pages of the Film Composer after printing. When off, you must click **Delete** to manually clear the film composer.

#### **Show Border**

Show border lines for each image frame

#### **Show Page Index**

Show page index

#### **Mix Patients**

Allow to print different patients on a film

**No. Of Copies**

Adjust the number of copies to be printed.

**Spacing**

Adjust the vertical and horizontal blank space between images.

**Expose Order**

Left to right / Top to bottom: Images fill in the pages from left to right, row by row and top to bottom.

Top to bottom / Left to right: Images fill in the pages from up to down, column by column and left to right.

**Operation Panel Alignment**

Set the operation panel on left side or right side.

**Tick Marks**

Horizontal, image show horizontal

Vertical, image show vertical

## MANUAL FILMING

### Exports

To export images in the film composer to jpeg format and copy to USB device, click [**Export**] button. A dialog window opens, allowing the export of each film to 1 jpeg file. If you wish to export each images as a jpeg file set the film format to 1X1.

Figure 16-9 Export patient images



#### *Refresh*

Refresh available USB device.

#### *Export*

Export the jpeg files to the selected USB device.

#### *Cancel*

Cancel.

## Use the right-click functions

Place the cursor over the viewport and right-click to display the on-view menu. Move the cursor down the menu until your choice is selected.

Figure 16-10 Right-click on the scout image



Figure 16-11 Right click on the axial image



### Cut

Removes the image you select.

### Copy

Copies one image

### Paste

Pastes one image to the desired location, covering any image already there.

### Insert empty

Inserts an empty image allowing the desired image to be pasted.

### Insert patient info

Inserts one blank image containing only patient information.

### Grayscale enhancement

Select g1, g2, g3 scale levels or a scale level of none to adjust the gray scale within the image.

**Filter**

Adjust the images by selecting a smooth filter (s1, s2, s3) and edge enhancement level (e1, e2, e3).

**Cross Reference**

Displays the cross reference lines for different series.

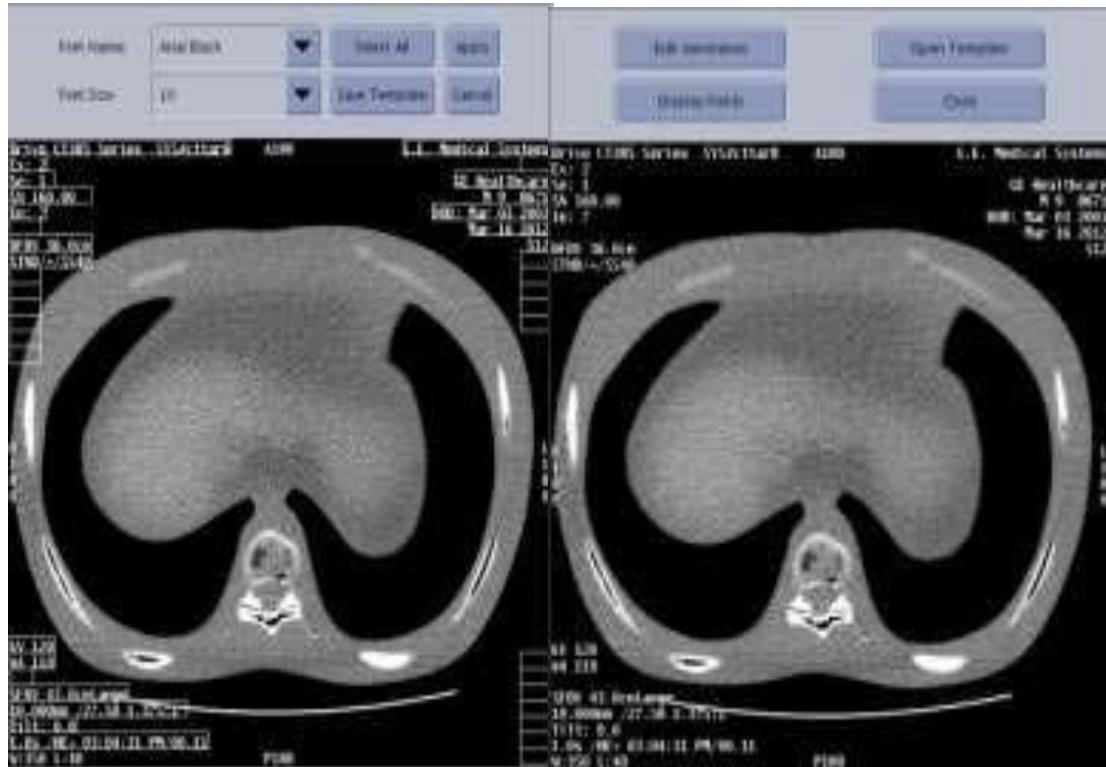
**Editor**

Edit the image.

## Edit Annotation

Right click on the mouse and then select the Edit Annotation. A window with image and editing function will open. The Font Name and Font Size can be edited from the drop down menu. The annotation location can be changed by dragging the annotation to the location with the red frame; Desired image annotations can be selected from the drop down menu too. When finished, click the **[Apply]** button again. Click **[Cancel]** to exit.

Figure 16-12 Image annotation edit



## MANUAL FILMING

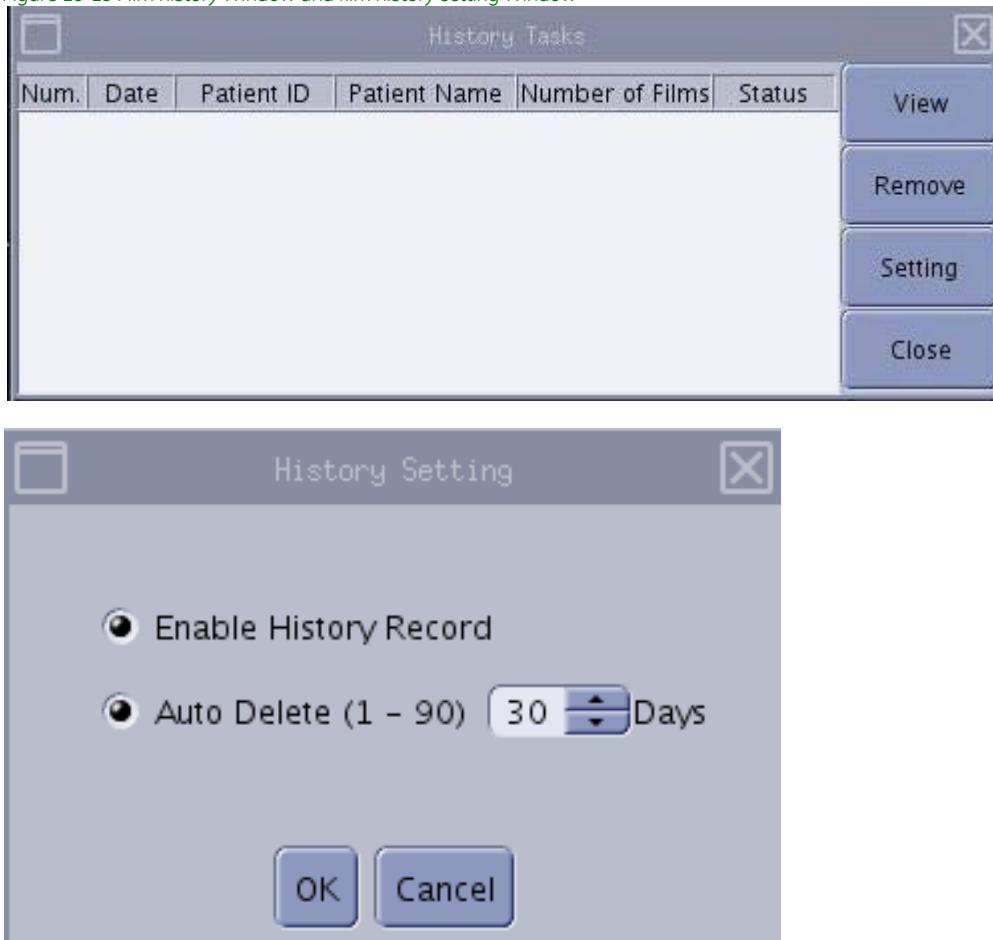
### Film History

Click [Film History] button to display a history of what jobs have been printed, the history window opens.

View the list jobs you have printed, or remove jobs by Patient Name or ID from the history list which have finished printing.

Click [Setting] button, to set up the auto delete period in days. For example, if you set 30, the system will delete jobs from the history list after 30 days.

Figure 16-13 Film history Window and film history setting Window



## Film Queue

Click [Film Queue] button, the printing queue window opens.

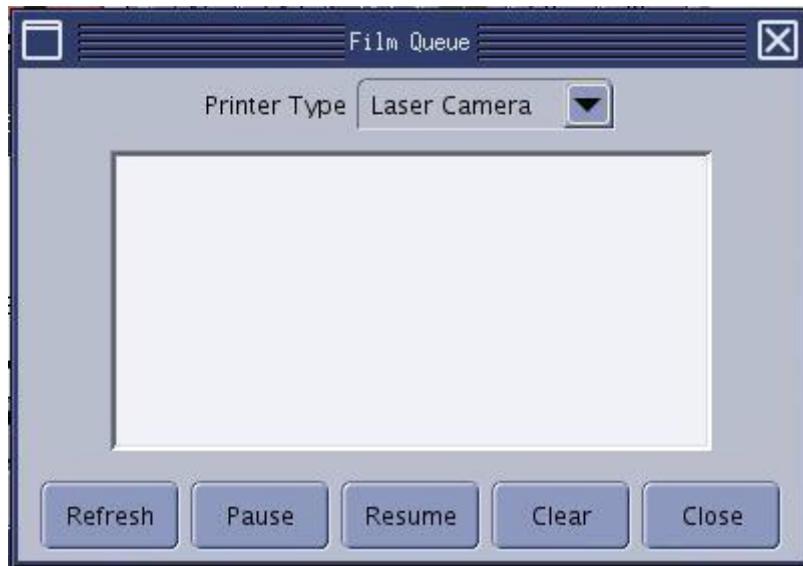
Click [Pause] to pause the selected printing jobs.

Click [Resume] to resume the jobs which be paused.

Click [Refresh] to refresh the printing job list.

Click [Clear] to delete the selected printing jobs.

Click [Close] to close.



# Chapter 17 : Image Management

The **ImageWorks** desktop allows you to manage your acquired images. This section contains information on how to save, restore, delete, and network images from the Data Apps or the Tools list. It also includes procedures on how to make an anonymous patient and edit patient data.

The features or processes that can be applied to an exam/series/image once they are in the Patient List are divided into two categories:

- Data Apps - when a Data application is launched, it gets opened in the ImageWorks desktop, which allows you to access the Patient List and simultaneously view the application. The programs in the Data Applications list may vary based on the options purchased.
- Tools - when an option from the Tools list is selected, a floating screen opens.

## ImageWorks desktop Job

### Management screen

#### Patient List

- [Filter Data screen](#)
- [Add a Filter](#)
- [Filter the list](#)
- [Remove a filter](#)
- [Refresh database](#)
- [Find an exam](#)
- [Remove exams/series/images](#)
- [Sort the list](#)
- [Size the exam/series/image areas](#)
- [Adjust images](#)
- [Keyboard shortcuts](#)

#### Archive/Network

- [Configure Network Hosts screen](#)
- [Network Remote Host screen](#)
- [Configure a host](#)
- [Define a host](#)
- [Local DB retrieve images](#)
- [Manually send exam/series/images](#)
- [Archive/Network a GSPS series](#)
- [View the backlog/queue](#)
- [Detach media](#)
- [Check the network history Work-arounds](#)

## CD/DVD/USB Interchange

- [Media Creator screen](#)
- [How to handle CD/DVDs](#)
- [Save images](#)
- [Restore images](#)
- [View images on a PC or laptop](#)
- [Remove DVD RAM cartridge](#)

## Data Export

- [Compose tab](#)
- [Export tab](#)
- [Compose a report](#)
- [Export a report](#)
- [View a report on a PC](#)
- [Delete items](#)

## Patient Data

- [Edit Patient Data screen](#)
- [Edit patient data](#)
- [Make a patient anonymous](#)
- [Install a SMPTE pattern](#)
- [Display a DICOM header](#)

## Tools

- [Reorder the Data Apps list](#)

## ImageWorks desktop

Click the **ImageWorks** icon to open the ImageWorks desktop.

Figure 17-1 ImageWorks desktop

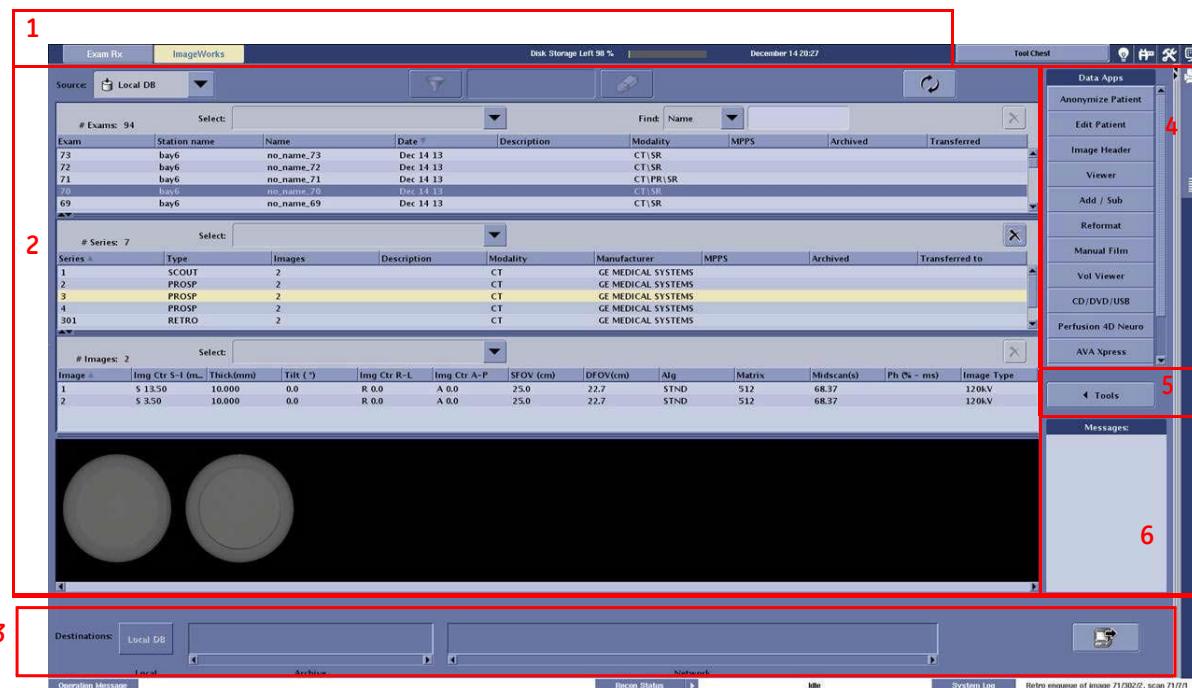


Table 17-1 ImageWorks desktop

#	Description
1	Patient List controls
2	Patient List
3	Archive/Network destinations
4	Data Apps list
5	Tools
6	Message area

## Patient List controls

### Source menu

The Source menu controls the contents of the Patient List and displays the host databases to which you are currently connected. The host data base names are also visible at the bottom of the Image Management work area. The default source list is the Local data base of your scanner.

Figure 17-2 Source menu



Table 17-2 Source menu icons

	<b>Archive device</b>	The Archive device icon identifies the node as a <i>DICOM</i> <sup>1</sup> device that can be used as an archive device. Not all hosts can be used as archive nodes (for example, another CT system cannot be used as an archive node, but a <i>PACS</i> <sup>2</sup> can be used as an archive node). To be a successful archive node, the node must meet certain DICOM requirements so that when the data is transferred from the host system to the node, the DICOM handshake can be successful. This is not necessary for networking images. The same handshake is not required. This icon is assigned if Archive node is selected on the Archive Node Settings area of the <a href="#">Configure Network Hosts</a> screen.
	<b>Network node</b>	The Network node icon indicates that the node is identified as a network and not archive node. The network icon is assigned if Archive node is not selected on the Archive Node Settings area of the <a href="#">Configure Network Hosts</a> screen.
	<b>CD/DVD/USB</b>	The CD/DVD/USB icon indicates that the node is identified as a media device that is currently installed or connected to the system.

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2.Picture Archiving Communications System

### Filter menu

Table 17-3 Filter menu icons

	<b>Filter</b>	The Filter icon opens the <a href="#">Filter Data</a> screen.
	<b>Eraser</b>	The Eraser icon removes the filter and display all of the exams in the active remote Patient List.

### Refresh

Table 17-4 Patient List controls

	<b>Refresh</b>	The Refresh icon updates the currently active data base that is listed next to Source.
--	----------------	--

## Patient List

The Patient List contains the information in the following order:

- Exams
- Series
- Images
- Thumbnail

The size and sequence of every data area can be modified. For more information, see the [Exam/Series/](#)  
[Image areas in Patient List.](#)

Figure 17-3 Patient List

The screenshot shows a software application window titled "Patient List". It features three vertically stacked tables:

- Exams:** Shows 2 exams. The first exam has a status name of "b73" and a date of "Nov 25 12". The second exam has a status name of "ct33" and a date of "Mar 15 12".
- Series:** Shows 0 series.
- Images:** Shows 0 images.

Below the tables, there is a "Destinations" section with options for "Local DB", "Local", and "Network". A "Tool Chest" bar is at the top with various icons, and a "Data Apps" sidebar on the right lists various modules like "Annotate Patient", "Edit Patient", etc.

Figure 17-4 Exam title area



Table 17-5 Exam options

Function name	Description
# Exams	Displays the total number of exams listed in the currently selected data base.
Select	Selects all exams, all archived exams, all unarchived exams, or no exams.
Find	Finds a category or a descriptive word of the specific exam you are trying to locate.
Delete	Removes a selected exam from the local data base.

Figure 17-5 Series title area



Table 17-6 Series options

Function name	Description
# Series	Displays the total number of series listed in the currently selected exam.
Select	Selects all series, all archived series, all unarchived series, or no series.
Delete	Removes a selected series from the local data base.

Figure 17-6 Image title area

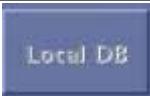


Table 17-7 Image options

Function name	Description
# Images	Displays the total number of images listed in the currently selected series.
Select	Selects all images or no images.
Delete	Removes a selected image from the local data base.

## Destinations

Table 17-8 Destination options

	The Destination icon displays the name of the data base that is currently active in the Patient List. In this icon example, the local database is active.
---	---

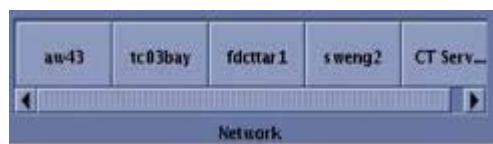
The Archive destination area displays all the available Archive Nodes. The slider becomes active when more than three archive nodes are available.

Figure 17-7 Archive destinations



The Network destination area displays all the available Network Nodes. The slider becomes active when more than one node is in the list.

Figure 17-8 Network destinations



## Job Management

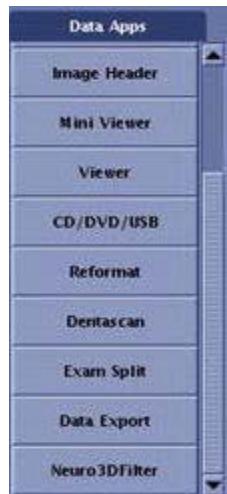
Table 17-9 Job Management

	The Job Management icon opens the <b>Job Management</b> screen from which you can view jobs in a queue and jobs that are completed.
---	---

## Data Apps

The Data Apps list contains a list of applications that can be launched on the ImageWorks desktop. The programs in the Data Apps list may vary based on the options purchased.

Figure 17-9 Data Apps



## Tools

When an option from the Tools menu is selected, a floating screen opens. See "Tools" on page 77.

Figure 17-10 Tools



## Messages

The ImageWorks Message area displays messages related to archive, network, and image display.

Figure 17-11 Message area



## Job Management screen

Click the **ImageWorks** icon to open the ImageWorks desktop. Click the **Job Management icon** to open the Job Management screen.

Figure 17-12 Job Management screen



### Show jobs

Figure 17-13 Jobs menu



The Show jobs menu filters the list of Registered jobs and Completed jobs displayed in the tables. The selections include:

- All jobs
- All PPS jobs (only for sites with PPS/HIS/RIS systems)
- All Network jobs
- All Archive jobs

- Network push

- Network retrieve
- Archive record (Not Applicable)
- Archive restore (Not Applicable)
- Remote archive

### **Job Queue**

The Job Queue area displays the list of registered jobs as defined from the Show All Jobs menu.

Click and drag the edges of each title in the menu bar to expand or contract the field.

Click a title in the menu bar to sort the list.

The job status types include:

- Paused - indicates that stops the progress of a transmission
- Failed
- Running - indicates the job is active

Figure 17-14 Registered jobs

<b>Job Queue</b>							
E/S/I	Job Type	Status	Progress	Submitted On	Source	Destinati...	
15	push	Runni...	173 of 638 pushed.	30 03 2011	Local DB	t10	
14	push	Pendi...	N/A	30 03 2011	Local DB	t10	
13	push	Pendi...	N/A	30 03 2011	Local DB	t10	
12	push	Pendi...	N/A	30 03 2011	Local DB	t10	
11	push	Pendi...	N/A	30 03 2011	Local DB	t10	
10	push	Pendi...	N/A	30 03 2011	Local DB	t10	
9	push	Pendi...	N/A	30 03 2011	Local DB	t10	

### **Completed Jobs**

The Completed Jobs area displays when a successful transfer is completed the job is listed. The most recent job is listed at the top of the list.

Click **Clear** to remove all jobs from the Completed Jobs list.

Figure 17-15 Completed jobs

<b>Completed Jobs</b>						
E/S/I	Job Type	Completion ...	Submitted On	Source	Destination	
257	push-STC	N/A	Wed Oct 25 ...	Local DB	MRARCH	

### Queue Controls

- Click **Pause** to place the selected items in the list into a paused state. To resume the job, select the item and click **Resume/Retry**.
- Click **Resume/Retry** to initiate the job of the selected items in the list.
- Click **Delete** to remove a transmission from the Registered Jobs list. A pop-up requires your confirmation for deletion.
- Click **Clear** to delete all items from the Completed Jobs list.

See [View the backlog/queue](#).

### Network History

The Network History tab lists the jobs that have been transferred. The entries are listed by how the job was queued for transfer, i.e., by exam, series, or image.

See [Check the network history](#).

Figure 17-16 Network History tab



## Patient List

The Patient List contains the exam, series, and image information on patient's in the database.

The Patient List contains several series types. These include:

- **SCOUT** Scout: acquired scan data that can be viewed, W/L<sup>1</sup>, measured, etc.
- **PROSP** Prospective: acquired data that can be viewed, W/L, filtered, post-processed, measured, etc.
- **COMB** Combined: result of a combination of image data that can be W/L. Produced by Add/Sub from images at different locations.
- **SSAVE** Screen Save: screen capture data that can be W/L. Produced by the Viewer, 3D, and Reformat applications. Dose Report: generated by each exam if Dose Report is enabled on the system. CTDI<sub>vol</sub>, DLP, and Dose Efficiency displays during scan prescription and provides patient dose information.
- **PROC** Processed: post-processed data that can be W/L and measured. Produced by Add/Sub from images at the same location.
- **REFMT** Reformat: post-processed data that can be W/L, filtered, and measured.
- **3D** Three-dimensional: post-processed data that can be W/L. Produced by Volume Analysis.
- **SR** Structured Report: generated by each exam if Structured Dose Report is enabled on the system. A CT Dose Report can enable tracking of dose for the patient by the hospital radiation tracking system/HIS/RIS.
- **GSPS** Gray Scale Presentation State: produced by the Viewer to be used in conjunction with the original series to capture presentation information (W/L, flip, rotate, zoom). It can be networked to review stations that support this DICOM type.
- **RETRO** retrospective: acquired data retrospectively.

---

1.Window Width and Window Level

## PATIENT LIST

### Filter Data screen

Click the **ImageWorks** icon to open the ImageWorks desktop. Click the **Filter** icon to open the Filter Data screen.

Figure 17-17 Patient List Filter Data screen



#### Available filters

The **Available Filters** list displays the filters you created. When you select a filter, all the fields completed by you are automatically populated.

#### Filter fields

Complete all desired fields and click **Save** to create an available filter. The text you enter must be an exact match for the patient to appear in the filtered list. The entries are case sensitive.

## PATIENT LIST

### Add a Filter

Use these steps to add a filter to the Available Filters.

1. Click the **ImageWorks** icon.



2. Select a remote host from the Source menu.

- The Filter feature is only available on remote hosts.



3. From the Patient List controls, click the **Filter** icon to open the **Filter Data** screen.

4. Enter all desired fields. In the Filter Name field, enter a descriptive name for the filter.

5. Click **Save**.

- When the filter has been saved, a confirmation screen displays.

6. Click **OK** to save the filter.

## PATIENT LIST

### Filter the list

Use these steps to filter the List.

1. Click the **ImageWorks** icon.
2. Select a remote host from the Source menu.
  - The Filter feature is only available on remote hosts.
3. Select a filter from the Available Filters.
4. Click **OK**.

## PATIENT LIST

### Remove filter

Use these steps to remove a Patient List filter. The filter features are only available on remote hosts.

1. Click the **ImageWorks** icon.

2. From the Source menu, select a remote host.



3. From the Patient List controls, click the **Filter** icon to open the **Filter Data** screen.
4. From the **Available filters** menu, select a filter.
5. Click **Remove**.
6. Click **Yes** to remove the filter.

## PATIENT LIST

### Refresh database

Use these steps to update the Patient List.

1. Click the **ImageWorks**  icon.

2. From the Patient List controls, click the **Refresh**  icon.
  - The database from the currently selected source, updates.

## PATIENT LIST

Use these steps to search by exam number in the Patient List.

### ImageWorks

1. Click the **ImageWorks** icon.
2. In the Exam area, click **Find** and select a category. For example, **Exam**.
3. In the Find text box, type the exam number you want to locate. For example, **121**.
  - The exam is selected in the Exam list if it is in the active data base.
  - If the exam is not in the data base, it locates a number that starts with the entered number.

## PATIENT LIST

### Remove exams/series/images

Use these steps to remove images from the Patient List.

#### ImageWorks

1. Click the **ImageWorks** icon.
2. From the Patient List, select the exams/series/images you want to send to remove.
  - Click an individual item.
  - Press **Shift** and simultaneously click the first and last item.
  - Press **Ctrl** and simultaneously click individual items.



3. Click the **Delete** icon located above the Exam, Series, or Image list.
4. Click **Yes** to remove the exams/series/images.

## PATIENT LIST

Sort the list

Use one of the following methods to sort the data in the Patient List.

*Sort menu items in ascending or descending order*

ImageWorks

1. Click the **ImageWorks** icon.
2. From the Patient List, click a menu bar title.
  - The Patient List is sorted by menu item. For example, if you click Name, the list is sorted alphabetically by patient name.
  - The menu item with the arrow **Exam ▾** is the active sort method.
3. Click the arrow next to the menu item to change the sort order.
  - An up arrow indicates an ascending sort order.
  - A down arrow indicates descending sort order.

*Sort the series numerically or with related series*

ImageWorks

1. Click the **ImageWorks** icon.
2. Click Tools > Series Sort Configuration.

Figure 17-18 Series Sort Configuration screen



3. From the Series Sort Configuration screen, select a sort method.
  - Numeric Sort sorts the series by number, e.g., 1, 2, 3, 200, 300.
  - Related Series Sort sorts the series by related numbers, e.g., 1, 2, 200, 3, 300.

**PATIENT LIST****Size the exam/series/image areas**

Use these actions to resize areas in the Patient List.



All systems may not have the same Patient List fields.

Figure 17-19 Patient List area

Exam	Station name	Name	Date	Description	Modality	Archived	Transferred
5	OWt11	CSPINEEFGRE3D15TCT_	28.03.2011		MR	No	Yes
6	OWt11	EFGRE3D_Breast_1ST_	28.03.2011		MR	No	Yes
7	OWt11	EFGRE3D_Cardiac_GEM	28.03.2011		MR	No	Yes
8	OWt11	EPI_0002_DV2_Wholebody_	28.03.2011		SIR	No	Yes
9	OWt11	EPI_0002_DV2_BHRBRA_	28.03.2011		MR	No	Yes
10	OWt11	EPI_0002_DV2_HEAD_G_	28.03.2011		MR	No	Yes
		FGRE_Cardiac_PC_GEM	28.03.2011		MR	No	Yes

Table 17-10 Image legend

#	Procedure
1	Click and drag the double line divider between each data group to customize the size of the work area.
2	Click the up/down arrows to collapse or expand a data group area.
3	Click and drag vertical line between titles within each data area to change the size of the column.
4	The column heading with the arrow is the currently active sort mode. Click it to reverse the sort order, for example from descending to ascending.

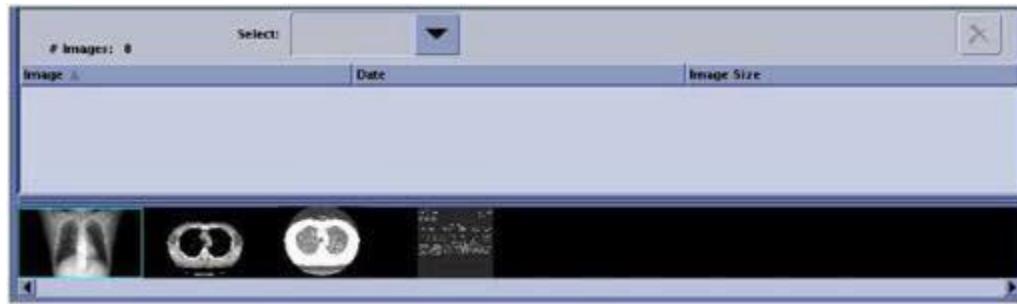
## Adjust images

Use these procedures to adjust the W/L, magnification, and center placement of images in the Patient List.

### W/L the images

1. Click the **ImageWorks** icon.
2. Click an image in the Image List areas.

Figure 17-20 Image List area on Patient List



3. Adjust the W/L.
  - Middle-click and drag the cursor.
  - You must start the W/L adjustment with the cursor within the image, but with the mouse button held down, you can move the cursor outside the image.
  - All images in the list are adjusted. You cannot independently adjust the W/L for a single image.

### Zoom the images

1. Click the **ImageWorks** icon.
2. Click an image in the Image List area.
3. Adjust the zoom.
  - Right-click and drag the cursor up to magnify the image and move the cursor down to minify the image.
  - You must start the zoom adjustment with the cursor within the image, but with the mouse button held down, you can move the cursor outside the image.
  - All images in the list are adjusted. You cannot independently adjust the zoom for a single image.

*Scroll the images* ImageWorks

1. Click the **ImageWorks** icon.
2. Click an image in the Image List area.
3. Adjust the scroll.
  - Click and drag the cursor in the direction you want to move the image.
  - You must start the scroll adjustment with the cursor within the image, but with the mouse button held down, you can move the cursor outside the image to adjust the scroll.
  - All images in the list are adjusted. You cannot independently adjust the scroll for a single image.

### **Keyboard shortcuts**

The following shortcuts apply when selecting items from the Patient List.

- **Delete** key deletes selected items and displays a prompt. Click **Yes** or **No** to the delete confirmation prompt.
- Press **Ctrl** and simultaneously press **A** to select all items in the patient list. For example, with an exam selected, press **Ctrl+A** to select all series within the exam.
- Press **Shift** and simultaneously click the first and last item to select a contiguous range of items.
- Press **Ctrl** and simultaneously click individual items to select a non-contiguous range of items.

## *Archive/Network*

### *Archive*

An archive device is a network device set up as an archive destination by your service personnel. When an image is archived, an archive flag displays in the [Patient List](#). The archive flag does not display when an image is saved to a CD<sup>1</sup>/DVD<sup>2</sup>.

There are two methods of archiving. You can manually archive images, which allows you to save only those specified by you. You can also automatically archive images. In this case, all exams are auto archived upon scan completion.

The archive status on the Patient List contains the following information regarding the archive or network status:

- The icon(A) indicates the images have been archived to the default archive device.
- The blank indicates the images have not been archived.

When saving images to a remote archive device such as a PACS, items queued to be saved to the device will be listed on the [Job Management screen](#).

The archive status is displayed in the Job Management screen and the [Feature Status Area](#) of the screen.

### *Network*

Networks link image acquisition systems and workstations together, providing a way to quickly and easily transfer images between your scanner, remote workstations, and other image acquisition systems. You may view images that are supported by your scanner from any station, or view images from other stations networked to your scanner.

You can network images between your system and any DICOM compatible device. Images transferred from your system can be automatically networked upon reconstruction or manually networked upon your initiation. You may also get images from another networked device. Before networking images, check to see that there is enough room on the receiving system's disk to accommodate the images being transferred.

Network status information is displayed on the Job Management screen and in the Feature Status area of the screen.

## *Archive/Network queues: Job Management*

The archive and network queues are viewed from the Job Management screen. When you choose to view an archive or network job, the queues provide a snapshot of the status of the archive or network tasks occurring on the system. You are able to pause, resume, and delete the archive and network tasks.

The Job Management feature also provides a history of archive and network events. The list allows you to check and verify that an exam/series/image has been sent to an archive or network node. If an entire exam or series has been selected, only one transfer is executed and one entry is displayed in the queue. If specific series or images have been selected, a separate transfer is executed and a separate entry is displayed for each selection. When saving images to a remote archive device such as a PACS, items queued to be saved remotely will be listed in the Archive Queue under the Remote archive list.



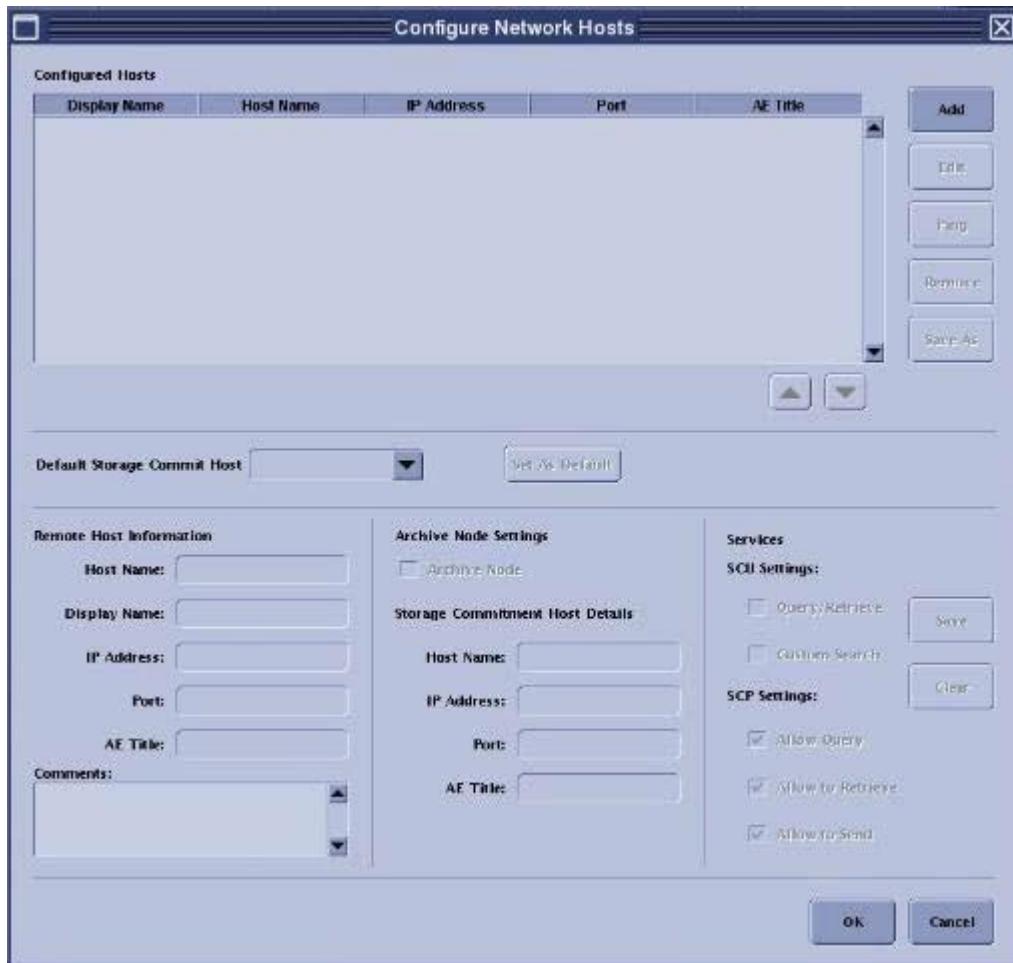
After a system crash or reboot, check the queue status and restart if necessary. The restore and save queues are maintained even after a shutdown has been performed.

- 
- 1. Compact Disc
  - 2. Digital Versatile Disc

***ARCHIVE/NETWORK******Configure Network Hosts screen***

Click the **ImageWorks** icon to open the **ImageWorks** desktop. From the **Tools** menu, click **Network Configuration**.

Figure 17-21 Configure Network Hosts screen

***Configured Hosts***

The Configured Hosts area lists of all the archive and network nodes. See [Configure a host](#).

You can size the columns and move/remove the nodes on the list.

Figure 17-22 Configured Hosts

Configured Hosts				
Display Name	Host Name	IP Address	Port	AE Title
fourier	fourier	3.45.4.184	4006	fourier
t12	t12	3.7.25.12	4006	t12
StoreSCP	StoreSCP	3.45.21.98	5000	StoreSCP
t5	t5	3.7.25.5	4006	t5
konark	konark	3.70.200.113	4006	konark
t10	t10	3.7.25.10	4006	t10
Ix-bay10a	Ix-bay10a	3.45.82.84	4006	Ix-bay10a
Ix-bay13a	Ix-bay13a	3.45.82.113	4006	Ix-bay13a
tara	tara	3.45.4.208	4006	tara
davids_pc	davids_pc	3.87.165.242	4006	davids_pc

### Remote Host Information

Figure 17-23 Remote Host Information

**Remote Host Information**

<b>Host Name:</b>	t18
<b>Display Name:</b>	t18
<b>IP Address:</b>	3.7.25.18
<b>Port:</b>	4006
<b>AE Title:</b>	t18
<b>Comments:</b>	

**Host Name:** the name given to the network node of the currently selected node. This name is typically entered by the service engineer.

**Display Name:** the name that is shown in both the source menu and Archive and Network destinations listed in the footer of the ImageWorks desktop.

**IP Address:** the location of the node within the network. You must enter the *IP*<sup>1</sup> address correctly or the connection can not be made. Your service engineer can help you determine the IP address.

**Port:** a predetermined number that is specific to the type of host and the protocol used. Your service engineer can provide you with this number.

**AE title:** This title is provided by the service engineer.

**Comments:** a space to enter text that is associated with the selected node.

---

1.Internet Protocol

### Archive Node Settings

Select the **Archive Node** option to place the selected node in the Archive destinations located at the bottom of the ImageWorks desktop. Only devices or nodes that have this option checked can be used as an archive device. Not all hosts can be used as archive nodes (for example, another CT system cannot be used as an archive node, but a PACS system can be used as an archive node).

To be a successful archive node, the node must meet certain DICOM requirements so that when the data is transferred from the host system to the node, the DICOM handshake can be successful. This is not necessary for networking images. The same handshake is not required.

The storage commitment host details are populated from the selected Remote Host information. These fields can be edited.

Figure 17-24 Archive Node Settings area



### Services area

The Services area contains settings for SCU<sup>1</sup> and SCP<sup>2</sup>.

- 
- 1.Service Class User
  - 2.Service Class Provider

Figure 17-25 Services area



In the **SCU Settings** area:

- Select **Query Retrieve** to ping and retrieve images from the currently selected node.
- Select **Custom research** to filter the patient list of the selected node. When you select the current node from the Source menu, the **Filter Data screen** automatically appears.

In the **SCP Settings** area:

- Select **Allow to retrieve** to give the currently selected remote node the ability to query your host system.
- Select **Allow to query** to give the currently selected remote node the ability to retrieve from your host system.
- Select **Allow to send** to give the currently selected remote node the ability to send to your host system.

#### *Save*

Click **Save** to save the settings for the currently selected node.

#### *Clear*

Click **Clear** to clear the settings for the currently selected node so that you can enter new values.

#### *Reset*

Click **Reset** to reset the values to the previous settings.

## ARCHIVE/NETWORK

### Network Remote Host screen

The configured remote networks can be viewed from several areas on the ImageWorks desktop.

#### Source menu

For details, see [Source menu](#). The Patient List displays the exams from the selected source.

Figure 17-26 Source menu



#### Network slider

For details, see [Destinations](#).

Figure 17-27 Network destinations with slider



#### Configured Hosts list

For details, see [Configure Network Hosts screen](#).

Figure 17-28 Configured Hosts list

Configured Hosts				
Display Name	Host Name	IP Address	Port	AE Title
fourier	fourier	3.45.4.184	4006	fourier
t12	t12	3.7.25.12	4006	t12
StoreSCP	StoreSCP	3.45.21.98	5000	StoreSCP
t5	t5	3.7.25.5	4006	t5
konark	konark	3.70.200.113	4006	konark
t10	t10	3.7.25.10	4006	t10
Ix-bay10a	Ix-bay10a	3.45.82.84	4006	Ix-bay10a
Ix-bay13a	Ix-bay13a	3.45.82.113	4006	Ix-bay13a
tara	tara	3.45.4.208	4006	tara
davids_pc	davids_pc	3.87.165.242	4006	davids_pc

## ARCHIVE/NETWORK

### Configure a host

Use these steps to configure, ping, or delete an archive node or network host or to manipulate the order of the archive node or network hosts in the footer area of the screen.

1. Click the **ImageWorks** icon.

**Click Tools > Network Configuration.**

### Add or edit a host

1. From the **Configure Network Hosts screen**, click **Add**.
2. In the **Remote Host Information area**, complete all fields.
3. In the **Archive Node Settings area**, complete all fields.
4. In the **Services area**, select the desired options.
5. Click **Save** to save the settings for the currently selected node.
6. Click **OK**.

### Move nodes on the configuration list

1. From the **Configured Hosts List**, select the node you want to move.



2. Click the **up/down arrows** to move the selected node to a new destination on the configuration list.
3. Click **OK** to update the Archive and Network destinations located at the bottom of the ImageWorks desktop.

Figure 17-29 Archive destinations



Figure 17-30 Network destinations



### *Adjust the column size on the Configured hosts menu bar*

From the **Configured Hosts List**, click and drag the line that divides two items on the menu bar to change the space allowed for a column of data.

Figure 17-31 Column size adjuster

Host Name	IP Address
3.7.25.23	

### *Remove nodes from the Configuration Host list*

1. From the **Configured Hosts List**, select the node you want to remove.
2. From the **Configure Network Hosts screen**, click **Remove**.
3. Click **Yes** to the confirmation prompt.

### *Ping a remote host*

1. From the **Configured Hosts List**, select the node you want to ping.
2. From the **Configure Network Hosts screen**, click **Ping**.
3. Click **OK** to the message prompt.
4. If a failure occurs, read the prompt to help determine the cause of the failure.

## ARCHIVE/NETWORK

### Define a host

Use these steps to add an archive node or network host to the footer area of the screen.

1. Click the **ImageWorks** icon.

**Click Tools > Network Configuration.**

2. From the **Configure Network Hosts screen**, select a host in the Configured Hosts list that you want to add to the **Archive destinations** located at the bottom of the ImageWorks desktop.
3. Click **Edit**.
  - If the node you want to define as an archive node is not on the Configured Hosts list, you must add it to the list.
4. In the Archive Node Settings area, select **Archive Node**.
5. Click **Save** to add the node to the Archive destinations.
6. Click **OK**.

***Local DB retrieve images***

Use these steps to restore images to your system from a remote host.


**ImageWorks**

1. Click the **ImageWorks** icon.
2. Click **Source** and select a remote Archive host.
  - If the host is not available, a message appears. Read the message and click **OK**.
  - The host must be configured to receive a query. Check the **SCP Settings** on the **Configure Network Hosts screen** to verify that all the **SCP<sup>1</sup>** settings have been checked (Allow to query, Allow to retrieve, Allow to send).
3. Optional: Refine the remote Patient List.
 
  - a. Click the **Filter icon** to open the **Filter Data screen**.
  - b. Click **Available Filters** and select a filter or type text into the desired fields.
  - c. Click **OK** to apply the filter.
    - The filtered Patient List displays.



- d. To return to the non-filtered Patient List, click the **Erase icon**.
4. From the remote Patient List, select the exam, series, or images you want to retrieve.
  - Click an individual item.
  - Press **Shift** and simultaneously click the first and last item.
  - Press **Ctrl** and simultaneously click individual items.
5. In the Destinations area of the Patient List, click **Local DB** to begin the restore process.
6. View the archive or network status in the **Feature Status area** to view the state of the images as they are transferred to the local database.
  - Jobs are performed in a first come first served basis.
  - When the data has been successfully transferred to the Local DB, the archive device label is displayed in the series Archived On column.
  - When the data has been successfully transferred to a network host, the label of the host is displayed in the series Transferred To column.
  - Roll the cursor over the names displayed in the Archived On or Transferred To columns to see more details.

---

1.Service Class Provider

## ARCHIVE/NETWORK

### Manually send exam/series/images

Use these steps to send an exam/series/image to a an archive or network host as an alternative to auto archive.

#### ImageWorks

1. Click the **ImageWorks** icon.
2. From the Patient List, select the exam, series, or images you want to send.
  - Click an individual item.
  - Press **Shift** and simultaneously click the first and last item.
  - Press **Ctrl** and simultaneously click individual items.
3. Click the corresponding button in the destination group that represents where you want to send the data.
  - The data transfer process begins.
4. View the **Job Management screen** or the archive and network status in the **Feature Status area** to view the state of the images as they are transferred to the archive or network host.
  - Jobs in the queue are performed in first come first served basis.
  - When saving images to a remote archive device such as a PACS, items queued are performed in first come first served basis.
  - When the data has been successfully transferred to an archive device, the archive device label is displayed in the series Archived On column.
  - When the data has been successfully transferred to a network host, the label of the node is displayed in the series Transferred To column.
  - Roll the cursor over the names displayed in the Archived On or Transferred To columns to see more details.

*Archive/Network a GSPS series*

Use these steps to archive or network a GSPS<sup>1</sup> series when you have saved images with the [Save State](#) function.

1. Press **Ctrl** and simultaneously select the source series and the associated GSPS series from the Patient List.

Figure 17-32 GSPS series

Series	Type	Images	Description	Modality	Manufacturer	Archived on	Transferred to
3	PROSP	72	Ax T2MAP	MR	GE MEDICAL SYS..	False	t10, t27..
4	PROSP	16	Ax 3D SPGR fat sat	MR	GE MEDICAL SYS..	False	t27, t27..
100003	GSPS	1	Presentation Series	PR	GE MEDICAL SYS..		t27, t27..
100004	GSPS	1	Presentation Series	PR	GE MEDICAL SYS..		t27, t27

- For example, select *PROSP*<sup>2</sup> series 2 and GSPS series 10002.
2. To archive or network, continue with the [Manual archive/network](#) procedure.
    - If a host other than the one displayed is desired, before you send the series, [define a host](#).
    - If networking to a PACS, the system must be able to receive GSPS objects.



When restoring a GSPS series, you must also restore the original PROSP series.

---

1.Gray Scale Presentation State

2.Prospective

## ARCHIVE/NETWORK

### View the backlog/queue

Use these steps to view a backlog of archive or network activity or to delete an archive or network job.

1. Click the **ImageWorks** icon.



2. Click the **Job Management** icon.
3. From the **Job Management screen**, click **Show Jobs** and select an option to refine the lists.
4. From the Registered Jobs list, select the jobs you would like to change.
  - Click an individual item.
  - Press **Shift** and simultaneously click the first and last item.
  - Press **Ctrl** and simultaneously click individual items.
5. Choose the desired job action:
  - Click **Pause** to place the selected items in the list into a paused state.
  - Click **Retry/Resume** to initiate the job of the selected items in the list.
  - Click **Delete** to remove a transmission from the queue. A message confirms the deletion.
  - Click **Clear** to delete Completed Jobs from the list.
6. Click **Close**.

### Delete jobs from the Completed Jobs list

1. Click the **ImageWorks** icon.



2. Click the **Job Management** icon.
3. From the **Job Management screen**, click **Clear** to remove the selected jobs from the list.
4. Click **Close**.

### *Detach media*

Use these steps to detach a CD, DVD, or USB media device.

1. Make sure a CD, DVD, or USB is inserted in the appropriate drive.
2. Check the [Archive/Network backlog](#) to verify that all image transfer from the device is complete.
3. Click the **ImageWorks** icon.
4. Click **Tools > Detach Media**.
5. From the Detach Media screen, select the media to detach from the menu.

Figure 17-33 Detach Media



6. Click **Detach** and wait for the "Media Detached" message before ejecting the device from the drive.
7. Click **Close** to exit.

## ARCHIVE/NETWORK

*Check the network history*

1. Click the **ImageWorks** icon.



2. Click the **Job Management** icon.



3. From the **Job Management screen**, click the Network History tab.

4. Look through the log to find the exam number of the network history you wish to see.

- Entries are listed how the job was queued for transfer. If by Exam, then only the exam number is listed. If by Series, then the exam and series are listed. If by Image, then the exam, series, and image are listed.

5. Type a specific exam/series/image number into the Search ESI or Host field.

- The history file for all matches to the exam/series/images you typed displays.



6. Click the Refresh icon to update the network history log.

7. Click **Close**.

### ***Work-arounds***

When archiving images, consider the following and use the work-arounds as necessary.

- Images archived on an Advantage Windows system may fail to restore on the system. Use Network to transfer images from the Advantage Windows to the system.
- Restoring exam, series, or images that already exist on the system disk will not post a message that the images are restored or that they already exist. If you have restored images, but do not get a message that they have been restored, verify that they do not already exist on the system disk.
- To minimize corruption of MODs, it is extremely important the MOD media be detached and removed from the MOD drive before doing a shutdown or recycling power to the system.
- If the system is unable to read the media, remove the write protect and see if the system is able to perform a recovery of the media to access the data.

## *CD/DVD/USB Interchange*

CD/DVD/USB interchange is used to write or recall images from a CD-R<sup>1</sup> or DVD-R<sup>2</sup> in a DICOM<sup>3</sup> format. CD/DVD/USB cannot be selected as the default archive device. Exam, series, or images will not be marked as archived. A DICOM viewer is stored on the media so the images can be viewed on a PC<sup>4</sup>.

Only CD -R or DVD -R media can be used for CD/DVD/USB Interchange. For CD-R, write speed should be at least 4X and storage size of 700 MB. The media is write once and all selections must be queued at the same time. Approximately 7,000 images can be stored to a 4.7 GB DVD-R.

In order to view the information placed on media using CD/DVD/USB interchange, the PC must running Windows XP, Windows Vista, or Windows 7 operating system and containing Java 1.5 or higher versions. The first time the reader of the Interchange media tries to access the data, the security setting in Advanced Settings on the PC must be set to "Allow active contents from CDs to run on My Computer." A log file is created on the PC used to read the media, which tracks the reading of the media to record issues for troubleshooting. The log file is limited to six files and overwrites data once the limit is reached.



If your Field Engineer is trying to load this option, it is listed in the options list as "Copy Composer".



CD/DVD/USB Interchange feature is available for recording DICOM images onto below media, but so far CD/DVD/USB Interchange is not be considered as a way for long-term images storage.

## *Media/device requirements*



Pay attention to the following declarations about Media requirements and Operation requirements when you use the CD/DVD/USB Interchange function.

- Only support single layered CD-R and DVD-R media. No other media types are supported, including but not limited to DVD-RW.
- Also, dual layered CD-R and DVD-R media are not supported.
- Only support 700 MB single layer CD-R media.
- Only support 4.7 GB single layer DVD-R media.
- GEHC recommends using the following media brands have been qualified by GEHC FCT:
  - Verbatim 4.7 GB 4X commercial DVD-R media
  - Maxell 4.7 GB 1X-4X Compatible DVD-R
  - SONY 650 - 700 M CD-R
  - SONY 1X-4X Compatible 4.G media
  - TDK 4.7 GB commercial DVD-R media
- Other high quality CD-R and DVD-R media may also work but GEHC FCT has only qualified the media types listed above.
- The format of USB device must be VFAT.
- No limitation of USB capacity.

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1. Compact Disc-Recordable

- 2.Digital Versatile Disc-Recordable
- 3.Digital Imaging and Communications in Medicine
- 4.Personal Computer

*Operation requirements*

- DVD-R only support single-session write mode, not support multi-session mode, cannot append write data on DVD-R have been burned.
- DVD Interchange are NOT INTENDED for archive or backup purposes! These features make only "temporary copies" for interchange purposes. GEHC will not "recover" any interchange media (it should just be burned again if necessary using patient data restored from authorized/provided archive media).
- It is advised not to write CD/DVD/USB during scan operations.
- It is advised not open post processing applications requiring high computer usage while writing to CD/DVD/USB.

## CD/DVD/USB INTERCHANGE

### Media Creatorscreen

Click the **ImageWorks** icon to open the **ImageWorks** desktop. From the **Data Apps**, click **CD/DVD/USB** to open the Media Creator screen.

Figure 17-34 Media Creator screen

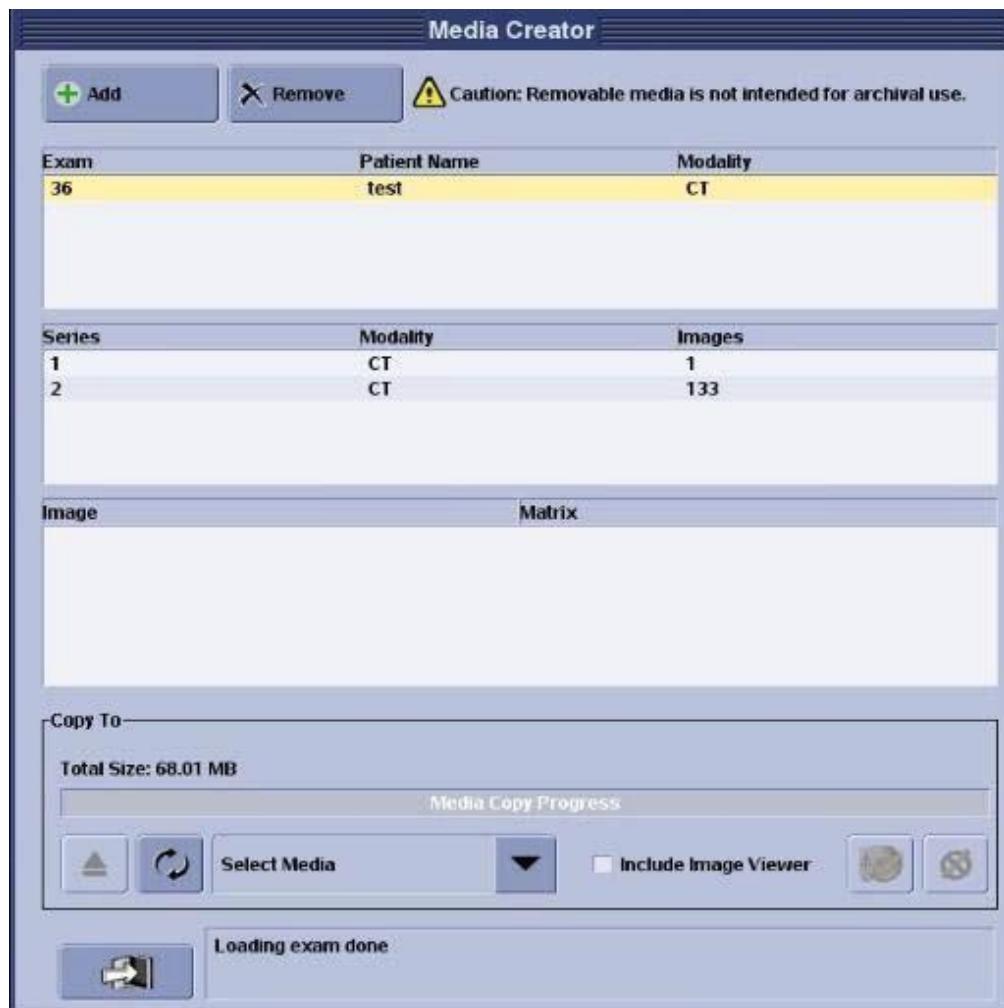


Table 17-11 Media Creator selections

Icon	Function name	Description
	Add	When an exam is selected in the Patient List, click <b>Add</b> to add it to the exam to the list. Select a single or multiple series and click Add to add the selected series to the list.
	Remove	Click <b>Remove</b> to delete selected items in the list.
	Eject	Click the <b>Eject</b> icon to eject the CD/DVD from the drive. Eject also makes it safe to detach a USB device from the drive.
	Refresh	Click the <b>Refresh</b> icon to update the contents of Select Media menu.
<b>Select Media</b>	Media menu	Media menu displays the CD/DVD drives and USB drives.
<input type="checkbox"/> <b>Include Image Viewer</b>	Include Image Viewer	When the Include Image Viewer is selected, a Viewer is saved with the image to the identified device (CD/DVD or USB).
<b>Total Size: 68.01 MB</b>	Disk Capacity	The <b>Total Size</b> display shows the size of the items that have been added to the list. It updates as you add more items.
	Stop	Click the Stop icon to halt the copy process.
	Close	Click the <b>Close</b> icon to close the Media Creator screen.

## *CD/DVD/USB INTERCHANGE*

### *How to handle CD/DVDs*

Recordable CDs (CD-R) are considerably more sensitive to damage than the conventional CD-ROM<sup>1</sup> that you may be familiar with. Respect the handling instructions below.

--< **CAUTION**

To avoid image loss, never touch the recording surface of a recordable CD (CD-R). Handle the disk only by the outer edge or central hole. Do not place it face down on a hard surface. Fingerprints or scratches will make the disk unusable.

- Store the disc in the protective case. Proper storage helps protect the data from damage due to scratches on the disc surface.
- Do not leave the disc in direct sunlight or in a hot, humid environment. These conditions can warp and damage the disc.
- Use only a felt tip permanent pen when labeling. Write only on the clear inner diameter of the disk (or the printed area of a CD-R). Never use a ballpoint or hard point writing tool as it may damage the disc. Do not use adhesive labels.
- Use a soft, lint-free cloth to remove spots, dust, or fingerprints from the disc. Always wipe from the center to the outside edge of the disc. Never wipe the disc in a circular motion.
- Do not use any chemical-based cleaners. These can damage the disc.
- Do not use the **CD/DVD/USB** program to permanently store your data. If the CD/DVD/USB is scratched there is no recovery of the data.

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1.CompactDisc-Recordable

## CD/DVD/USB INTER CHANGE

### Saveimages

**!** **IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

Use these steps to save images from your system to a CD/DVD or USB device.



You can record DICOM image data to either a blank, **compatible CD/DVD** that is placed in the CD/DVD read/write external drive or to a USB device inserted into one of the USB drives. If saving to CD/DVD, once you close the drawer with the CD/DVD in it, wait until the CD/DVD drive light turns off. This is an indication that the CD-R or DVD-R is spinning up to speed.

- A CD-R or DVD-R can only be recorded once. All image data that you want to record on a given CD-R or DVD-R must be selected beforehand. The data will be recorded in a single pass. It is not possible to add data on a CD-R or DVD-R.
  - Image data can also be recorded on CD-R in *PDF*<sup>1</sup> or *HTML*<sup>2</sup> format, using the [Data Export](#) function.
  - You cannot load images on a USB device that already has stored data stored. A prompt appears indicating that if you continue, it will erase all data on the USB device. It is advisable to only use a USB device with no data on it.
1. From the [Data Apps list](#), click **CD/DVD/USB**.
  2. From the [Media Creator screen](#), select the media type from the Media menu.

- If you opened the Media Creator screen before you inserted a device into a drive, click the **Refresh**



icon to update the Select Media menu.

Figure 17-35 Media menu



3. To save a Viewer with the images, select **Include Image Viewer**.

If you do not select **Include Image Viewer**, you will not be able to view the images on a PC or laptop. The purpose of saving the images without the Viewer is to transport them to another compatible system.

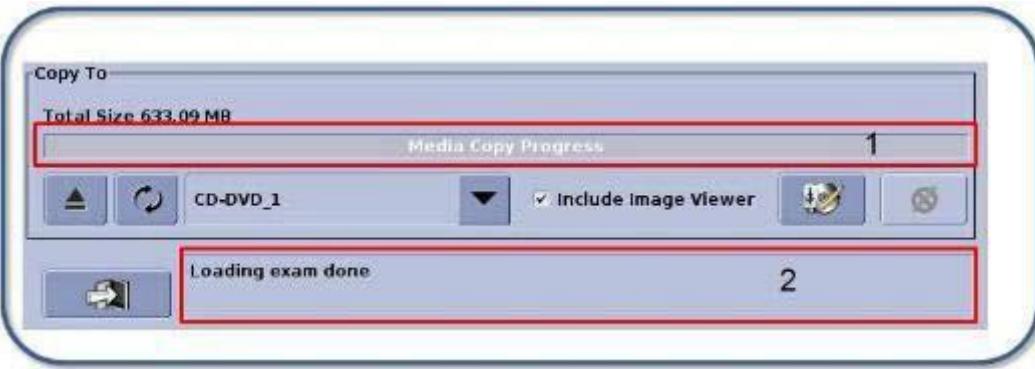
- 1.Portable Document Format
- 2.HyperText Markup Language

Figure 17-36 Include Image Viewer option



4. Select the desired exams or series from the Patient List.
  - Click an individual item.
  - Press **Shift** and simultaneously click the first and last item.
  - Press **Ctrl** and simultaneously click individual items.
5. From the Media Creator screen, click **Add**.
  - The selected exam/series/images are added to the Media Creator list.
  - The Total Size display updates as more exams/series/images are added to the list. Toggle Include Image Viewer on/off to see updated Total Size display.
  - A message displays if the size of the exams/series/images exceeds the space on the CD/DVD or USB device.
  - You cannot add the same exam to the screen more than once. A message displays that you have entered the same patient more than once. Remove one of the exams.
6. Optional: Clear exams or series from the Media Creator list.
  - a. From the Media Creator screen, select the desired series and/or exams you wish to clear.
    - Press **Ctrl** and simultaneously click individual items to remove non-contiguous items on the list.
    - Press **Shift** and simultaneously click the first and last item to remove contiguous items on the list.
  - b. click **Remove**.
7. Click the **Copy icon** to start the recording process.
  - Do not begin recording until all desired series have been added to the list. You cannot record more data to the CD-R or DVD-R once you have started the recording process.
  - The message/progress bar displays messages and a progress bar indicating the progression of the copy activity.

Figure 17-37 Progress bar (1) and message area (2)



- Error prompts may appear if the media is damaged, if the media is not blank, the files are too large for a single media, etc.
- The progress bar displays 100% and a message appears in the message area when recording is completed.
- Very large data sets can take a very long time (more than one hour) to copy to CD. If you change your mind about copying the files to CD/DVD, you can quit copying and start it over at a time more convenient. Click **Quit** to cancel the copy process and upon clicking **OK** to the confirmation prompt, the copy process is stopped and the Media Creator screen closes. An alternative is to click **Cancel**.



8. Once the recording is finished, click **Close icon** .

- If you click Close before the completion of the save process, a confirmation prompt appears. If you confirm the Close, then the save process is canceled.



- The **Stop icon** stops burning data.

9. To view the Media Creator screen again, click **CD/DVD/USB** from the Data Apps list.

- View the progress bar to note if the burning process is finished.

10. When the contents have been burned to the media, a message posts in the Message area. It is now safe to remove the CD/DVD or USB.



11. Click the **Eject icon** to remove the media from the drive.

- The CD/DVD drive automatically opens when the CD/DVD save is finished. Only click **Eject** to stop the CD/DVD save process.
- Removing the USB device without ejecting it can result in errors that may require the device to be reformatted.
- Do not remove the USB device during copy process. Make sure you first Stop the copy process before you remove the device from the drive.

## CD/DVD/USB INTERCHANGE

### Restoreimages

Use these steps to restore images from a CD/DVD or USB device to your system.

1. Place a **CD-R** or **DVD-R** in the CD/DVD external drive or place a USB device into one of the USB drives. Wait until the drive light turns off, which is an indication that the CD-R or DVD-R is spinning up to speed.

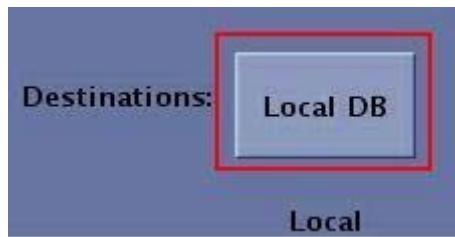
2. Click the **ImageWorks** icon.
3. From the header area, click **Source** and select the drive that has the CD/DVD or USB device in it.
  - Since you can restore a CD/DVD from either drive, if you select one drive and it is not the drive with the CD/DVD in it, then select the other drive.

Figure 17-38 Source menu



4. From the Patient List, select the exam/series/images you want to restore.
  - Click an individual item.
  - Press **Shift** and simultaneously click the first and last item.
  - Press **Ctrl** and simultaneously click individual items.
5. In the Destinations area of the Patient List screen, click **Local DB** to begin the restore process.

Figure 17-39 Destinations area of Patient List screen

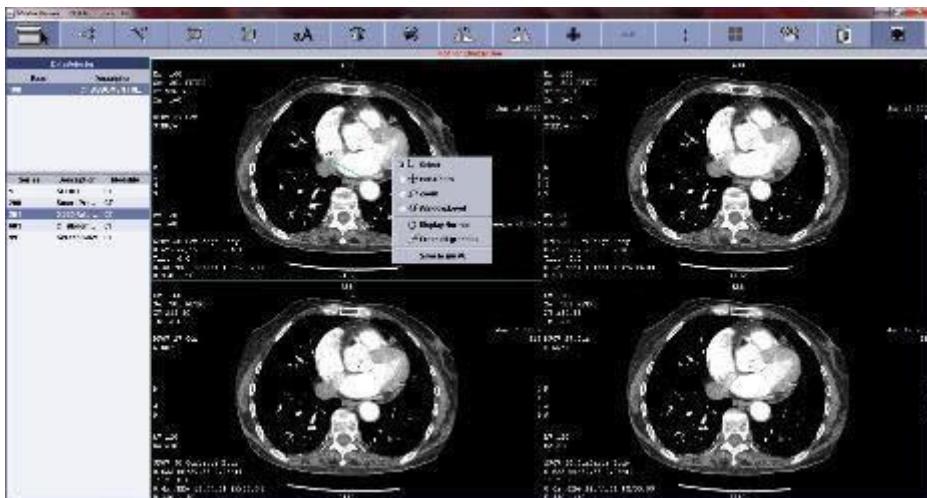


6. To view the restore process status, see the [View the backlog/queue](#) procedure.
7. When the restore process is finished, indicated by a message, eject the device. From the ImageWorks desktop, click **Tools > Detach Media**.
  - It is now safe to remove the USB device from the drive and to remove the CD/DVD from the drive.

### *View images on a PC or laptop*

The Media Viewer is automatically loaded onto a CD-R or DVD-R that is burned from the CD/DVD/USB program. Use these steps to view images from a CD/DVD inserted in your PC or laptop.

Figure 17-40 Media Viewer



1. Load a recorded CD-R or DVD-R into the drive of your PC or laptop running Windows XP, Windows Vista, or Windows 7 operating system and containing Java 1.5 or higher versions.
  - The CD Viewer automatically launches.
  - If an Auto Play window displays, click **Run CDViewer.exe**.
  - Media Viewer is not supported on an Apple computer.
2. Click **Accept** to the license agreement.
3. From the DataSelector, select an exam and wait until the data is loaded.
  - Your PC or laptop must contain Java run time environment as JRE1.5\_14 or higher version. If not, the Java, bundled with the application, is installed on demand.
4. Select a series to view.
5. Use the Media Viewer image controls, located at the top of the Media Viewer, to manipulate the images.

Table 17-12 Media Viewer image controls

Icon	Description
	Adds an angle measurement on the selected viewport.
	Adds a line measurement on the selected viewport.
	Adds an ellipse ROI on the selected viewport.

	Adds a rectangle ROI on the selected viewport.
---	--

Icon	Description
	Hides/Shows a grid on the selected viewport.
	Hides/Shows a horizontal tick mark for all viewports.
	Hides/Shows a vertical tick mark for all viewports.
<b>Icons for Graphic Operation</b>	
	Adds user annotation on the selected viewport.
	Erase All Graphics (right-click menu), removes all the Graphics (ROIs, User Annotation, Grid) from the selected viewport.
<b>Icons for Image operations</b>	
	Flips the image left to right on the selected viewport.
	Flips the image top to bottom on the selected viewport.
	Rotates the image counter-clockwise by 90° on the selected viewport.
	Rotates the image clock-wise by 90° on the selected viewport.
	Zoom (right-click menu), selects the left mouse drag operation as zoom.
	Roam (right-click menu), selects the left mouse drag operation as roam.
	Window/Level (right-click menu), selects the left mouse drag operation as window/level.
	Display normal (right-click menu), resets image operations on the selected viewport.
<b>Icons for other operations</b>	
	Viewer format adjusts viewport format.
	Turns the screen annotation off/on.
	Inverts Grayscale for selected viewport.
	Starts cine or movie.
	Stops cine or movie.
<b>Save to myPC</b>	Right-click menu item, exports the image of the selected viewport to the local system in JPEG/PNG format.
	Hides/Shows the DataSelector panel.

## *Remove DVD RAM cartridge*

Use this procedure to remove media from a DVD RAM cartridge for use in the Peripheral Media Tower equipped with a single DVD multimedia drive.

- For use with Operator Console utilizing a single bay Peripheral Media Tower (DVD-Multimedia drive only).
- DVD-Multimedia drives cannot accept cartridge type DVD-RAM media. Use the following procedure for removing the DVD-RAM media from the cartridge if so equipped.
- Handle bare DVD-RAM media with care. Do not touch the recording surface. Fingerprints, dirt, dust and scratches on the recording surface can destroy previously recorded data and prevent recording of additional data.
- If required, use only approved CD/DVD media disk cleaning solution (not supplied) to clean any disks that become contaminated with fingerprints, dirt, and dust. Do not use alcohol, antistatic, or other cleaningsolutions.
- Take care with placing bare DVD-RAM media without cartridge. Do not scratch.
- Always return a DVD-RAM media to its cartridge for storage.



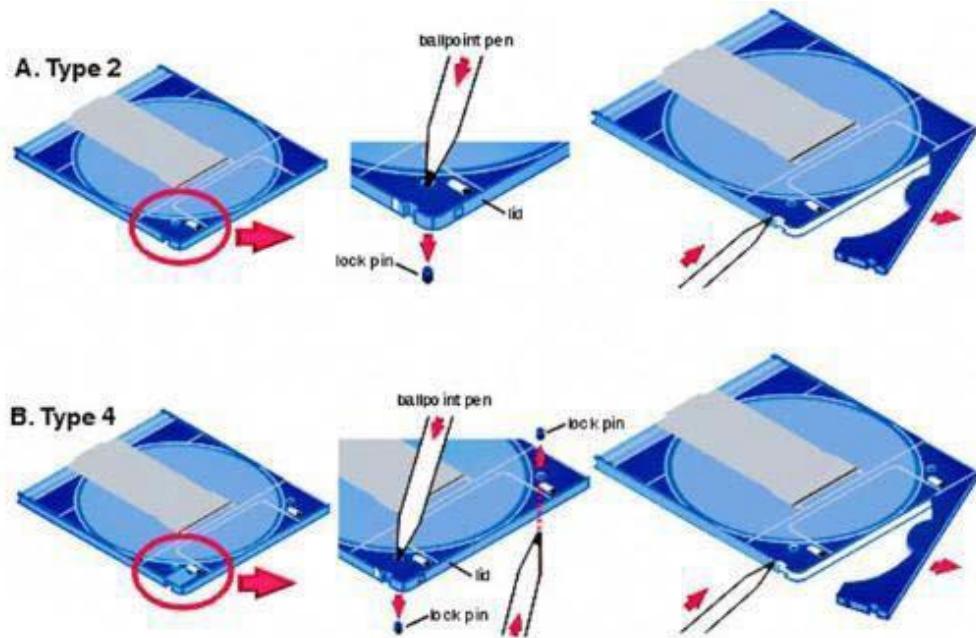
In the case of double-sided DVD-RAM media, take care to insert the media back into cartridge with the same orientation as it was removed. If media is inserted upside down, any labeling on the cartridge will not be consistent with data on the disk.

Follow the procedure and precautions outlined below to remove the disc from the cartridge.

1. Remove the disc.
  - a. Push and remove the cartridge-locking pin with a sharp-tipped object, such as a ballpoint pen.
  - b. Open the cover by pushing the sharp-tipped object into the gap on the left-front side of the cartridge.
2. Do not touch the recording surface.
  - Fingerprints, dirt, dust and scratches on the recording surface can destroy previously recorded data and prevent recording of additional data.
3. Open the cover with care.
  - If you damage the cover, you my not be able to close it again.
4. Use a felt-tipped marker to write on the label.
  - Never stick a new label on a disc.
5. Store only DVD-RAM disc cleaner and cleaning fluid (not included).
  - Do not use benzene, paint thinner, or anti-static cleaners.
6. Always return a disc to its cartridge for storage.
  - Clean dirty discs only with the special DVD-RAM disc cleaner and cleaning fluid (not included).
  - Do not use benzene, paint thinner, or anti-static cleaners.

7. Make sure the printed side of the shutter and the printed side of the disc is facing the same side when returning the disc to its cartridge. Also, note the setting of the write-protect tab.
8. Place bare DVD-RAM media back in cartridge for storage.
9. Close cartridge lid once DVD-RAM media is fully inserted into cartridge.

Figure 17-41 DVD RAM cartridge removal



## Data Export

Data Export allows you to store images on a CD-R<sup>1</sup> or FTP<sup>2</sup> images as JPEG, PNG, AVI, MPEG, or MOV formats. The files can only be burned to a CD-R and only one report can be burned at a time. Once a CD-R has been burned, you cannot add more reports at a later time. It is not a rewritable process.

The JPEG, PNG, AVI, MPEG, or MOV images can be viewed from a PC<sup>3</sup> or laptop with a Windows™ 2000 or XP operating system using Internet Explorer 5.5 or later.

There are two tabs on the Data Export window:

- **Compose** tab - allows you to define the compression factor, annotation level, W/L, scroll, zoom, and output format for the series you want to export.
- **Export** tab - allows you to view a list of all the examinations and series you have in the Data Export program.
  - You can compose a series and then export it to either a CD or FTP site at a later date.
  - Examinations and series stay in the Export program until they are actively deleted.

- 
- 1.CompactDisc-Recordable
  - 2.File Transfer Protocol
  - 3.PersonalComputer

**DATA EXPORT****Compose tab**

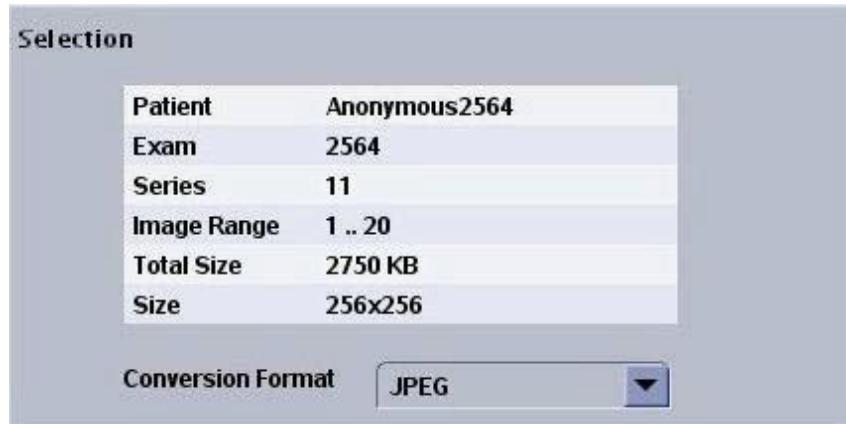
Click the **ImageWorks** icon to open the ImageWorks desktop. From the **Data Apps list**, click **Data Export > Compose** to open the Compose tab.

Figure 17-42 Data Export - Compose tab

**Selection**

Displays the patient name, exam and series number, the number of images in the series, the file size of the images with the current compression selection, and matrix size.

Figure 17-43 Selection area



### *ConversionFormat*

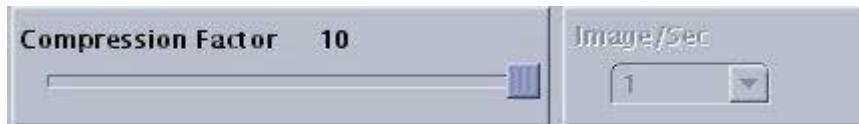
Click the Conversion Format menu to select the image format for the currently selected data set. Format choices include: JPEG, PNG, AVI, MPEG, and MOV. AVI, MPEG, and MOV are all movie-type formats. Choose the format that is compatible with the movie player on your PC or laptop.

### *Compression Factor and Image/Sec*

Move the Compression Factor slider to choose a compression value for JPEG and MPEGs. The lower the number, the less the compression, the higher the image quality but the larger the file.

Select an Image/Sec rate for the movie play back speed. It is only applicable for MPEG, AVI, or MOV files.

Figure 17-44 Compression Factor and Image/Sec areas

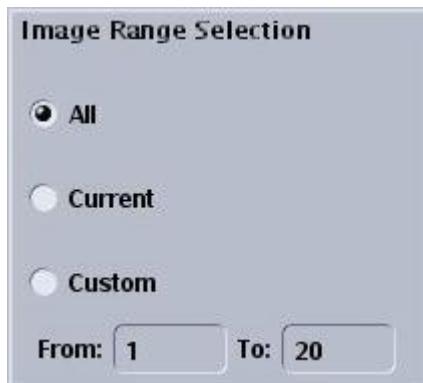


### *Image Range Selection*

In the Image Range Selection area, choose the images you want to place in the designated folder. For example, if you have a multi-phase series selected and all you want is the first phase in the MPEG, then select the range of images representing phase 1 of your data set.

The ability to select a subset of images from the selected series is particularly important if you plan to FTP the files rather than burn a CD.

Figure 17-45 Image Range Selection area



### *Annotation*

In the Annotation area, choose the level of annotation for the images: none, full, partial (a subset of the full annotation), or custom. Click Customize to turn on specific annotation fields.

Figure 17-46 Annotation area

Annotarion

None

Partial

Full

Custom

[Customize](#)

***Series + or -***

Click **Series +** or **-** to navigate through series within the exam.

Select **Propagate Image Operations** to apply the image manipulations (W/L, zoom, scroll) you have performed on all images forward from the currently displayed image within a series.

Figure 17-47 Series area

***Play/Stop***

Click **Play** to preview the MPEG, AVI, or MOV file.

Click **Stop** to quit playing the movie.

***Image Viewport***

The image viewport displays the current images by scrolling through them in a cine loop. Press **Page Up** and **Page Down** to move through the images manually.

***Image Conversion***

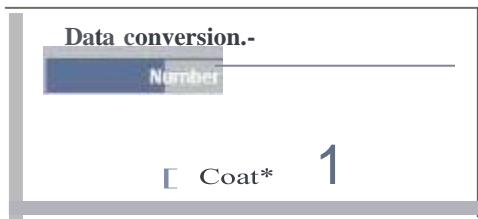
Figure 17-48 Image Conversion area



- In the Report Name menu, select or type a name to display at the top of the report once you execute the data export. The name also appears in the Export Data list. Typically the patient's name and type of file are entered as the Report Name. There can be no spaces or characters other than alpha numeric.
- In the Folder Name menu, select or type a name of the folder to which you want to file the Report Name. From the Export tab, you can view the data listed within each folder. The data within a folder is sorted by file type. For example, if you added 10 JPEGs from the T1 series and 20 JPEGs from the T2 series you will see a list of 30 JPEGs in that folder. If you want these JPEGs separated, you must place them in separate folders.
- Select **Save Preferences** to save the changes you have made on Data Export screen.
- Select **Anonymous** to have the patient's name replaced with Anonymous and the exam number when the images are added to the report.
- Click **Add to Report** to add the current data set to the report from which you can either burn the information to a CD-R or FTP it to an IP<sup>1</sup> address. A Data Conversion progress window displays the status.

- Click ***Cancel*** if you want to stop the data conversion.
- 

## 1. Internet Protocol

**Figure 17-49** Ooto conversion progress

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17-58

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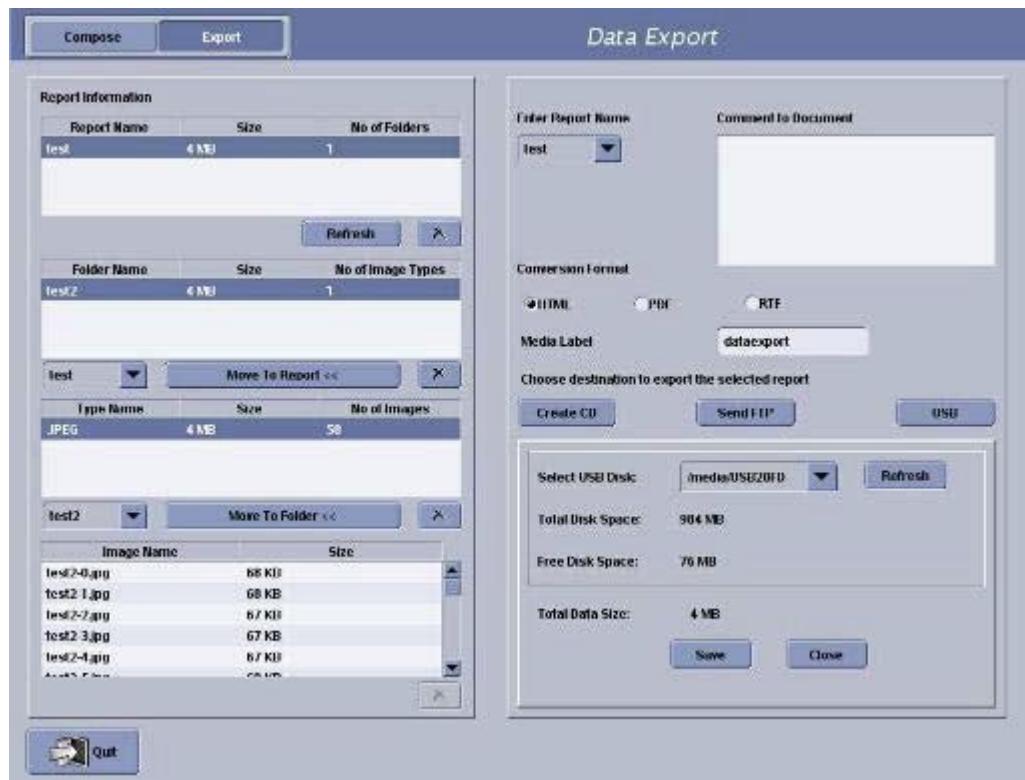
© 2015 General Electric Company

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**DATA EXPORT****Export tab**

Click the **ImageWorks** icon to open the ImageWorks desktop. From the **Data Apps list**, click **Data Export > Export** to open the Export tab.

Figure 17-50 Data Export - Export tab

**Report Name list**

Contains all the report names in the data base.



Click the **Delete icon** to remove selected items from the list. Items remain on the list after you click **Quit Data Export** until they have been deleted through this method.

Figure 17-51 Report Name list

Report Name	Size	No of Folders
test	65 KB	1

***Folder Name list***

Identifies all the folders associated with the report name. Check the file size to make sure you can FTP the file or store it on a single CD-R.

Figure 17-52 Folder Name list

Folder Name	Size	No of Image Types
s1	65 KB	1

test **Move To Report <<**

Click **Move to Report** to move the selected item to a destination of your choice. For example, you can select an item in the Type list and add it to a particular folder in the Folder list. The size of the data that comprises each folder is listed.



Click the **Delete icon** to remove selected items from the list. Items remain on the list after you click **Quit Data Export** until they have been deleted through this method.

***Type Name list***

Contains of all the file types within the selected folder. Keep in mind that the only items displayed in the list are the item types. If, for example, you added 20 T1 JPEG images to Folder 1 and then added another 20 T2 JPEG images to Folder 1, the number of JPEGs in folder 1 is 40. The quantity and size of each data type is listed.



Click the **Delete icon** to remove selected items from the list. Items remain on the list after you click **Quit Data Export** until they have been deleted through this method.

Figure 17-53 Type Name list

Type Name	Description	No of Images	Size
PNG	Exam 16156 Se...	1	65 KB

s1 **Move To Folder <<**

***Image Name list***

Contains of all the images within the selected file type.



Click the **Delete icon** to remove selected items from the list. Items remain on the list after you click **Quit Data Export** until they have been deleted through this method.

Figure 17-54 Image Name list

Image Name	Size
Mary-0.jpg	51 KB
Mary-1.jpg	51 KB
Mary-2.jpg	51 KB
Mary-3.jpg	51 KB
Mary-4.jpg	51 KB
Mary-5.jpg	51 KB

### Enter Report Name

In the Enter Report Name text box, select the report that you are going to export.

Type in a comment that appears on the report. Do not apply a carriage return when typing. The text will wrap automatically for the finished report.

Figure 17-55 Report Name area

<b>Enter Report Name</b>	<b>Comment to Document</b>
Test1	

### Conversion formats

In the Conversion Format area, choose a file type. Typically select HTML.

In the Media Label text box, type a name for the CD.

Figure 17-56 Conversion Format area

<b>Conversion Format</b>	<input checked="" type="radio"/> HTML <input type="radio"/> PDF <input type="radio"/> RTF
<b>Media Label</b>	<b>dataexport</b>

### Media type

Select an available media type to which you want to export the data.

Figure 17-57 Media type destination

Choose destination to export the selected report

Create CD

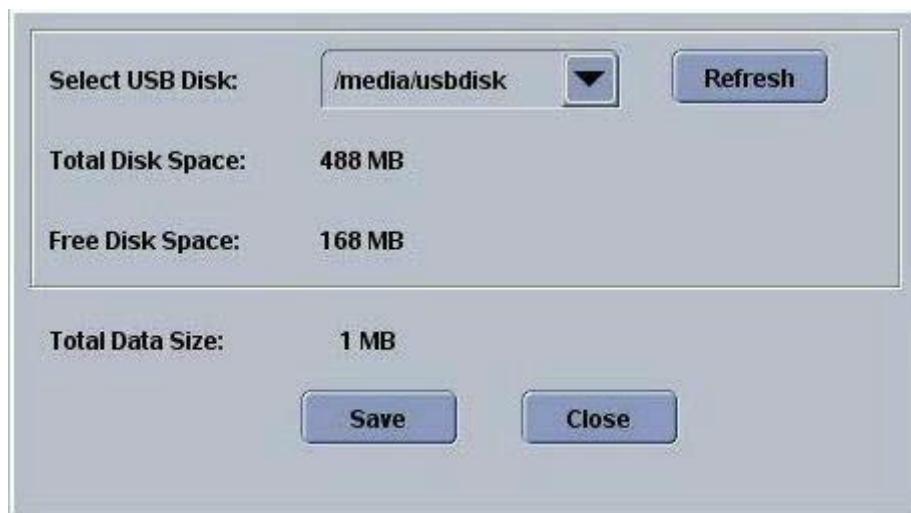
Send FTP

USB

### Media information

This area of the Data Export tab changes based on the media selection.

Figure 17-58 Media information area



Click the **Select USB Disk** menu to select a specific USB device if more than one device is inserted into the USB ports.

Click **Refresh** to update the Select USB Disk menu if you insert another USB device into a second port after you have opened the Data Export window.

The Total Disk Space, Free Disk Space, and Total Data Size displays provide important information about space available on the currently selected USB device. Be certain that you have sufficient space on the device before you click Save.

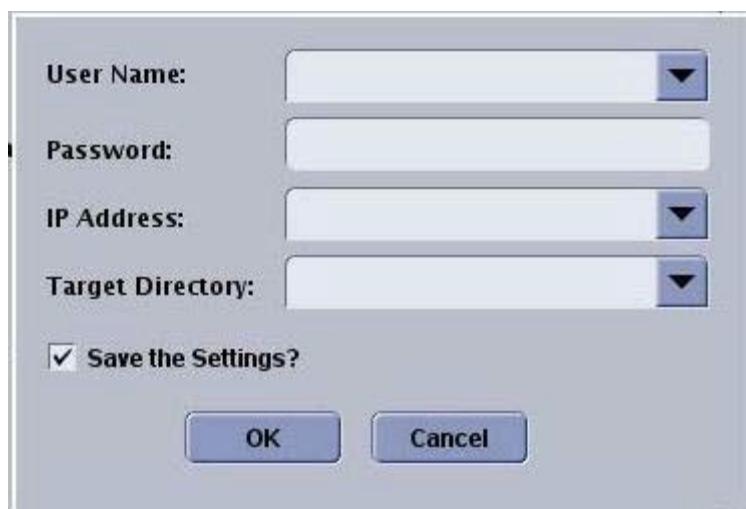
Click **Save** to initiate the transfer process.

Click **Close** to close this area of the Data Export window.

### FTP selections

The User Name, Password, and IP Address fields are for the FTP destination site. Select **Save the Settings** to save only the target directory information. There must be a target directory at the IP address to successfully transfer files.

Figure 17-59 FTP selection area



**DATA EXPORT*****Compose a report*****ImageWorks**

1. Click the **ImageWorks** icon.
2. From the **Patient List**, select the series you want to export.
  - Only one series can be exported at a time.
3. From the **Data Apps list**, click **Data Export**.
  - Click **Compose** if it is not selected.
4. Review the images in the Compose image viewport.
  - Middle-click and drag to adjust the W/L<sup>1</sup>.
  - Right-click and drag to adjust zoom factor.
  - Click and drag to scroll.
  - Press **Page Up** or **Page Down** to navigate through the images.
  - Click **Play** to view the images in a cine loop.
5. Click the **Conversion Format** menu and select an image format for the currently selected data set that is compatible with the movie player on your PC or laptop.
6. In the Image Range Selection area, choose your desired image range.
  - If you want a subset of the images, select **Custom**, and then type the range in the text box.
7. Move the **Compression Factor** slider to select a value.
  - The smaller the number, the higher the image quality and the larger the file size.
8. In the Annotation area, choose your desired annotation display format.
  - If you want the patient name to be displayed as Anonymous with the exam number, select **Anonymous**.

9. Once you are satisfied with the image appearance (W/L, zoom, scroll), select **Propagate Image Operations**.
10. Type a name for both the report and the folder (use no spaces or characters other than alpha numeric).
11. Click **Add to Report**.
  - If you change your mind and decide not to add the data to the report, click **Cancel** from the progress bar screen.
12. To add another data set to the report, repeat these steps.
13. Click the Export tab to export the report (for details see the **Export a report** procedure) or click **Quit**

to exit the Data Export application.

---

1.Window Width and Window Level

## *Export a report*

This procedure assumes that you have composed a report in Data Export. If not, first complete the steps in the [Compose a report](#) procedure.

1. Click the **ImageWorks**  icon.
2. From the **Patient List**, select the series you want to export. Only one series can be exported at a time.
3. From the **Data Apps list**, click **Data Export**.
4. Click the **Export** tab to open the Data Export Export screen.
5. In the Export Report Name list, select the desired report.
6. In the Folder Name, Type Name, and Image Name lists, select the desired data set.
7. Optional: Type a message in the Comment text field. Do not press Enter, the system will adjust the text for the final report.
8. Choose a Conversion format, typically **HTML**.
9. Create a CD, if desired.
  - a. To burn the report to a CD, place a compatible CD-R into the DVD-RW drive.
    - This is not the drive housed in the computer cabinet but rather the box that houses the CD/DVD drives located on the desk.
    - The only compatible media for Data Export is CD-R 700 MB with at least 4X write speed. DVD-R is not supported. If a DVD-R is placed in the drive, the system will write to this media, but the integrity of the data cannot be guaranteed and the time for the system to recognize the media will be excessive.
10. FTP the data, if desired.
  - a. Click **Send FTP** to send the data to an IP address.
  - b. Complete all the fields on the FTP window and click **OK**.
  - c. Click **OK** to the Successful File transfer prompt.
11. Copy the data to **USB**, if desired.
  - a. Select an USB device.
  - b. Click **Save**.
12. Click **Quit**.
  - Reports stay listed in the Export tab until you remove them.
  - Consider the length of time you need to keep the file in the program based on if you need to, more

than once, burn another CD or FTP the report again.

## DATA EXPORT

### *View a report on a PC*

1. Place the CD in the CD drive of a PC or laptop running Windows 2000 or XP.
2. The CD launches automatically.
  - If it does not automatically start, click on the **My Computer** icon and open your CD or USB drive. Click **INDEX** to open the file.
  - The report opens and displays from an Internet browser.
    - Use the scroll bar to view images.
    - Place the cursor over an image and click to magnify the image. Click the Back arrow on menu bar to return to the report.
3. When finished viewing the report, select **File > Close** to close the Internet browser.
4. Remove the **CD** from the drive and store it.

*Delete items*

1. From the **Data Export screen**, click the **Export** tab.
2. From the Export tab, select an item on any of the lists (Report, Folder, Type, or Image).

3. Click the **Delete**  icon.

- Items not deleted/removed remain on the list after you click **Quit**.

## Patient Data

### Removal of patient identifiers

The Anonymous Patient feature assists you in removing patient identifiers by electronically removing certain exam information and replacing it with anonymous information. An Anonymous Patient can be created by exam, series, or image.

There are two modes available for you to remove patient identifiers: Full and Partial.

- Full mode removes most patient identifiers from an exam, image, or series. However, use of Full mode does not guarantee exams, series, or images will be rendered anonymous in compliance with applicable data privacy laws. You should review the exam, series, or image data processed by the feature to ensure compliance with applicable data privacy laws before sharing the information with third parties.
- Partial mode removes a subset of patient identifiers including, but not limited to patient name, patient ID, patient date of birth, and patient age. Site name, exam, and series descriptions remain unchanged.

The level of annotation for Anonymous Patient is controlled by Anonymous Patient Level in the **Tool Chest**. This is done after the patient has been scanned, thus you must enter a name when you start a new patient.



Screen Save images such as Exam or Series Text pages or Dose Report text page are not anonymized.

**Table 17-13 Full or Partial modes**

Field	Full mode	Partial mode
Exam Number	ANON or ANONYMIZED	ANON or ANONYMIZED
Patient ID	ANON or ANONYMIZED	ANON or ANONYMIZED
Patient Name	ANON or ANONYMIZED	ANON or ANONYMIZED
Exam Description	ANON or ANONYMIZED	Shown
Series Description	ANON or ANONYMIZED	Shown
Birth date	Removed	Removed
Age	Removed	Removed
Weight	Removed	Removed
Operator Name	Removed	Removed
Site Name	Removed	Shown
Sex	Blank	Blank
Referring Physician	Blank	Blank
Referring Physician	Blank	Blank

Anonymizing an exam is useful when:

- your radiologist wants to take the films to a conference
- you have scanned a test patient or volunteer and do not want the name displayed
- anytime you do not want the patient's name on the films (For example, films that are in a marketing display or in a trade show.)
- anytime you send images to GE

### *Edit patient information*

Edit Patient allows you to edit certain patient information once the exam has been completed. You can only edit exams that were created on your system.

You cannot access Edit Patient if the exam you want to edit is currently in use. An exam is currently in use if New Patient, Network Send, Archive Save, 3D, Reformat, Denta Scan, Navigator or Viewer is active. You cannot use Edit Patient if the exam displayed is in a free viewport in the ExamRx desktop. If you try to use Edit Patient when an exam is currently in use, which means the exam is on the archive, film, or network queue, an error message displays.

- Use Edit Patient during idle times in network receive, active recon, or archive restore. The system may hang if Edit Patient is started while the following operations are in progress:
  - Network Receive
  - Prospective or Retrospective reconstruction
  - Archive Restore
  - Film
- You cannot edit contrast or patient weight.
- Edit Patient will not update scan data files or completed patient information.
- If you edit an exam that has a saved 3D model, the 3D model is deleted from the exam. If you edit an exam and you have the 3D model selected when you select Edit Patient, you will not be able to edit the exam.
- There must be sufficient disk space available.
- All images should be reconstructed before editing. All remove images and post-processing (screen saves, reformat, 3D surface) should be done before editing. All images created after the edit do NOT contain the edited information.
- Any DICOM secondary screen captures such as Dose Report and SmartPrep screen save will be deleted from the exam with Edit Patient Data.

**PATIENT DATA****Edit Patient Data screen**

From the [Edit Patient Application](#) screen, click **Edit Patient Data**.

Figure 17-60 Edit Patient Data screen

**Edit Patient Data**

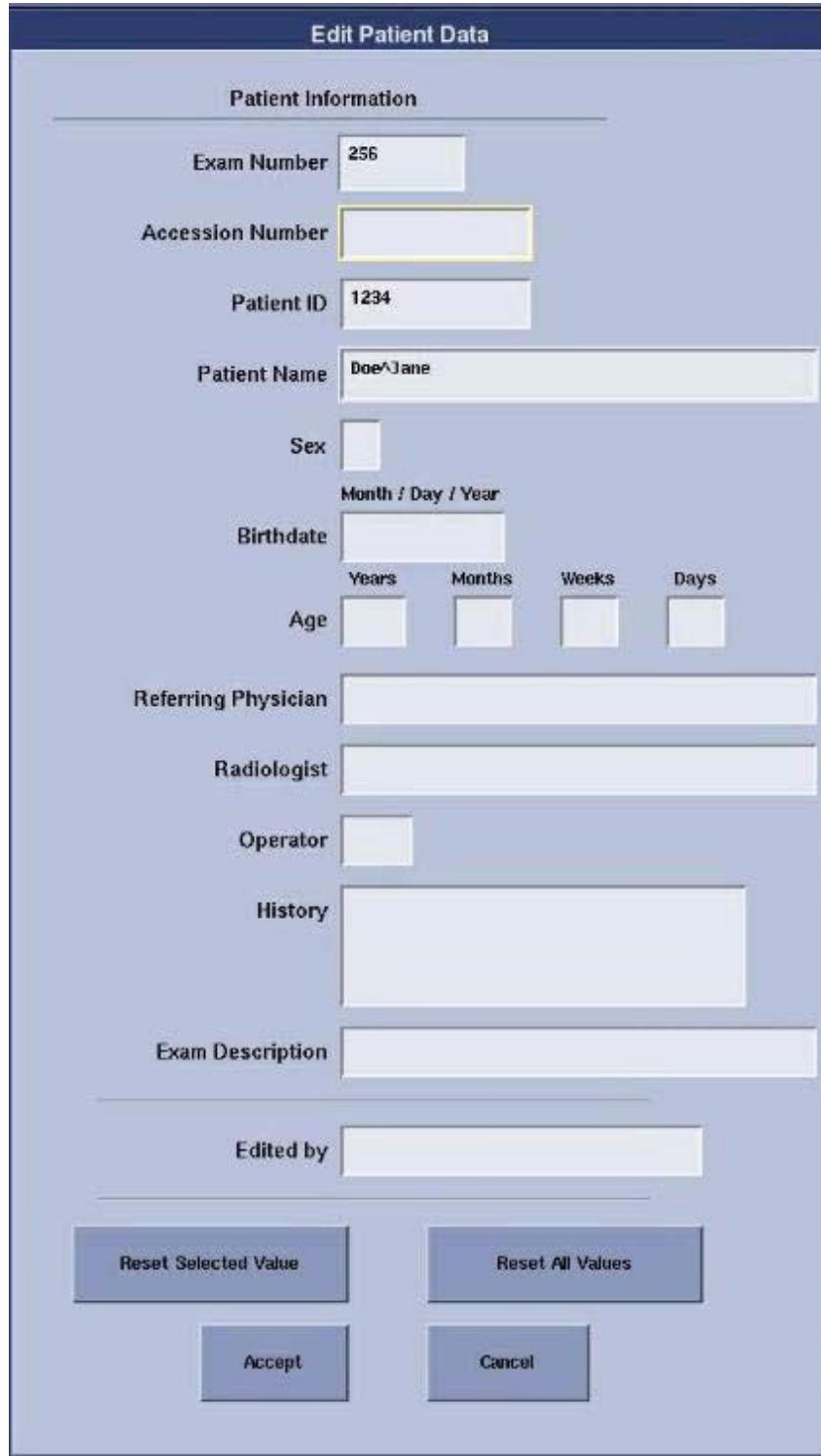
**Patient Information**

Exam Number	256
Accession Number	
Patient ID	1234
Patient Name	Doe^Jane
Sex	
Birthdate	
Age	Years Months Weeks Days
Referring Physician	
Radiologist	
Operator	
History	
Exam Description	
Edited by	

**Buttons:**

Reset Selected Value    Reset All Values

Accept    Cancel



- If the text box is empty, click in the text box, and type in the new data.
- If the text box already contains data, place your cursor in the text box and select the text you want to change. Once the text is selected, either press **Delete** or immediately begin typing in new data.
- If you make an error, you can reset the individual text box or all the text boxes. Click **Reset Selected Value** or **Reset All Values**. The Exam Number text box is the ONLY text box displayed that CANNOT be edited.
- When entering data in the Birthdate field, the month, day, and year can be separated by a dash (-), slash (/), comma (,), or period (.). The year must contain four digits, for example 2007.

**PATIENT DATA****Edit patient data**

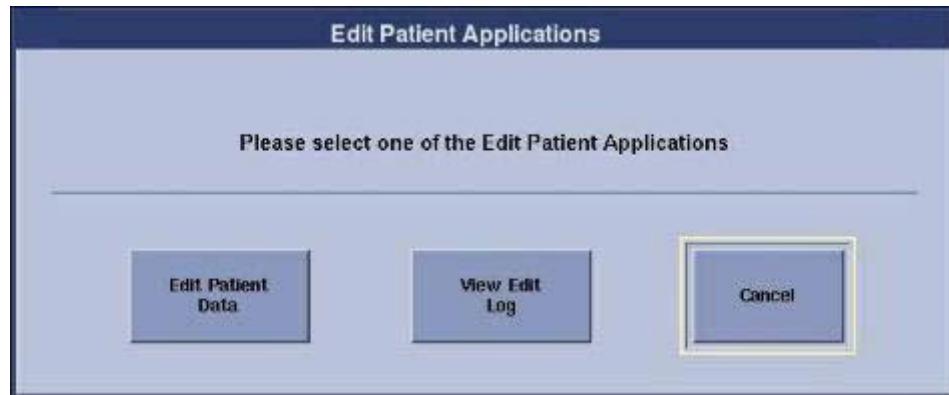
Use this procedure to correct improperly entered patient information or add information that was previously unavailable at the time the patient data was entered into the system.



Any 3D Models, GSPS, DICOM SR, or secondary screen captures in the exam will be deleted in the edited exam.

1. Click the **ImageWorks** icon.
2. From the **Patient List**, select the exam to be edited.
  - Only one exam number can be selected.
  - The exam must be closed or ended.
  - Exams can be edited multiple times.
  - You can only edit exams that were created on your system.
  - Edit Patient is not accessible if the exam you want to edit is currently in use. An exam is currently in use if New Patient, Network/Archive/Film queues, Save, 3D, Reformat, Denta Scan, Navigator, Exam Rx viewport, Viewer, or Mini Viewer is active. An error message displays.
  - To create a blank viewport in Exam Rx, select the viewport and type and Enter "blank" in the Accelerator Line.
3. From the **Data Apps list**, click **Edit Patient**.

Figure 17-61 Edit Patient Applications screen



4. From the Edit Patient Applications screen, click **Edit Patient Data**.
  - Edit Patient Data opens the Edit Patient Data screen.
  - View Edit Log displays a log of the most recent edit events.
  - Cancel closed the Edit Patient Application.
5. Read the cautions and then, click **Accept** to continue.

Figure 17-62 Edit Patient Data warning

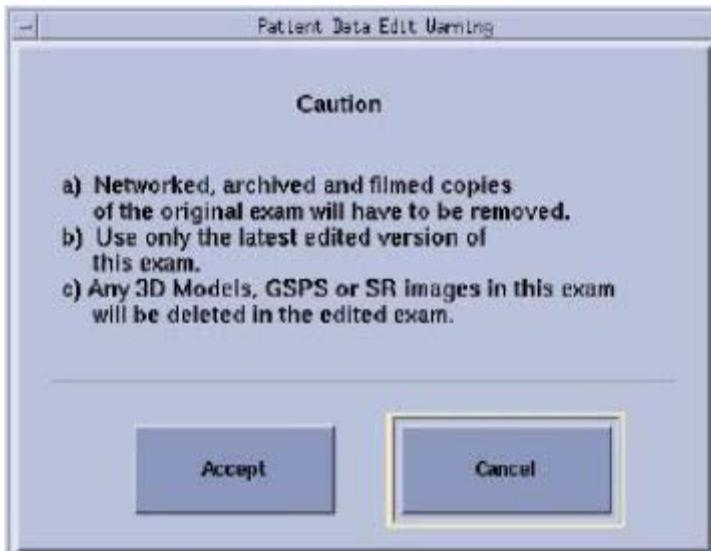
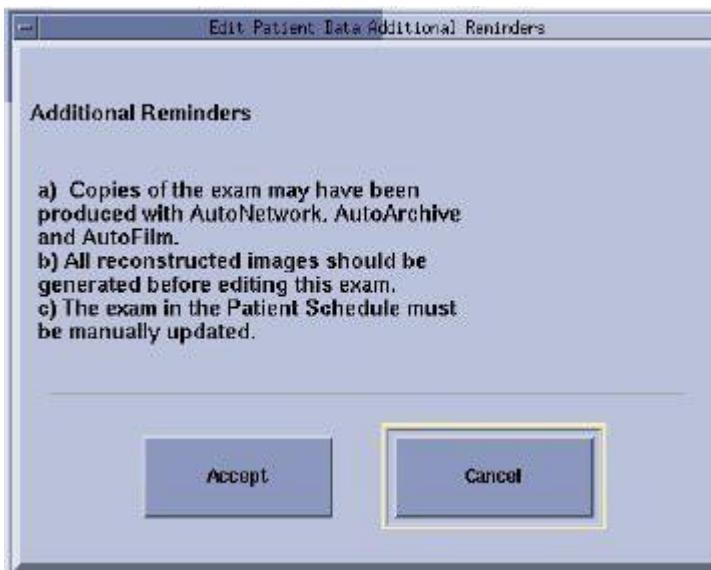


Figure 17-63 Edit Patient Data additional reminders



6. From the **Edit Patient Data screen**, complete the text fields.
  - Click the text you want to change and type new text.
  - To reset the values to the original text, click **Reset All Values** or **Reset Selected Values** and then enter new text.
  - You must enter your name or initials (a minimum of three characters) in the Edited by text field.
  - The Exam Number text box is the ONLY field displayed that CANNOT be edited.
  - Edit Patient is not accessible if the exam you want to edit is currently in use.
7. Click **Accept** when you are satisfied with the changes.
8. Click **Accept** to the confirmation prompt.

- A percentage countdown menu displays until the Edit Patient feature is closed and the Patient Information Edit Log is updated.
- It takes approximately one minute and 45 seconds to update a 100 image exam.
- The original exam is replaced with the edited exam and is indicated by "e+1" in the description field in the browser. The number indicates how many times the exam has been edited.

### *Make a patient anonymous*

Use this procedure to remove certain exam information and replace it with anonymous information. An Anonymous Patient can be created by exam, series, or image. This procedure provides the capability to remove most patient identifiers from exams, series, or images; however, this procedure does not ensure compliance with applicable privacy laws. You should review exams, series, or images processed under this procedure to ensure compliance with applicable privacy laws before sharing with third parties.

To set the annotation level to Full or Partial, see the [Set the anonymize patient annotation level](#) procedure.



#### **ImageWorks**

1. Click the *ImageWorks* icon.
2. From the [Patient List](#), select a patient's exam/series/images you want to be anonymous.
3. From the [Feature Status area](#), confirm that there is enough disk space to create an anonymous exam. This is not done automatically by the application.
4. Make sure there is plenty of disk space before creating an anonymous patient exam.
5. From the Data Apps list, click **Anonymize Patient**.
  - A progress bar displays the creation status of the anonymous exam/series/images.

**PATIENT DATA*****Install a SMPTE pattern***

Use this procedure to install a SMPTE pattern to view BRH or quality assurance images. Once installed the images are in exam 1000, which can be selected from the ImageWorks desktop or List Select in Exam Rx. The patient Name is listed as SMPTE.

1. Click **Service**.
2. Click **Image Quality**.
3. Click **Install SMPTE Image**.

### Display a DICOM header

Use these steps to open a DICOM<sup>1</sup> image header in a floating Mozilla window (an HTML<sup>2</sup> browser). The browser displays all image DICOM header information, including the DICOM tag, value, and description.

#### ImageWorks

1. Click the **ImageWorks** icon.
2. On the **Patient List**, select an image from the image list.
3. From the Data Apps list, click **Image Header**.
  - A Mozilla browser opens with the DICOM header information.
4. Use the scroll bar on the right side of the Mozilla browser to view all the DICOM header information.
5. To close Mozilla, click the X icon in the upper-right corner of the window.

- 
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## Tools

The ImageWorks desktop contains tools to set your preferences for the following features network configuration, application selection, series sorting, and MPPS<sup>1</sup>. It also provides options for detaching and labeling media.

Click the **ImageWorks** icon to open the ImageWorks desktop. Click Tools to view the Tools menu and select an ImageWorks tool.

Figure 17-64 ImageWorks Tools menu



See the following topics for more information on each tool.

[Network Configuration](#) [Application Reorder](#) [Detach media](#)

[Series Sort Configuration](#)

[MPPS](#)

---

1.Modality Performed Procedure Step

## TOOLS

### Reorder the Data Apps list

Use these steps to change the order of the applications on the Data Apps list so that the most frequently used applications are at the top of the list.

1. Click the **ImageWorks** icon.
2. From the **ImageWorks desktop**, click **Tools > Applications Reorder**.
3. On the Application Selection screen, click the item that you want to move in Data Apps list.

Figure 17-65 Application Selection screen



4. Click the **up/down** arrows to move the item to the new location.
5. Once the items in each list are in the desired order, click **OK**.
6. Click **OK** to the acknowledgement prompt.

# Chapter 18 : Protocols



**IMPORTANT:** Please refer to the [Safety](#) section for important safety information regarding the use of the equipment and software on this system.

## Protocols

- [Protocol Selection screen](#)
- [Build or edit a protocol](#)
- [Link a Protocol to Emergency Patient](#)
- [Set protocol as default](#)
- [Copy and paste a protocol](#)
- [Delete a protocol](#)
- [Delete a Protocol Link for Emergency Patient](#)

## Protocols Concept

A protocol must be selected in order to initiate the scanning sequence. Protocols are used as a basis for routine or established procedures. They save time by using preset established factors. Once chosen for use, any protocol may have any factor modified as needed for individual case purposes. The system comes with a set of protocols under the GE tab that cover common types of examinations. You can use these protocols or modify them to fit your department's particular clinical needs. Refer to known sources for techniques and dose information for viable parameters as proper techniques must be used to ensure image quality as well as patient safety.

### Build protocols

The protocols are built using the Protocol Management feature. There are four protocol selections:

- **User:** location where protocols can be built in either adult or pediatric models. These protocols are custom protocols that your radiologist or physician likes to use.
- **GE:** location for a set of predefined protocols that cannot be modified but can be copied and used. These protocols are factory installed. They have been developed in collaboration with clinical partners to provide users with a convenient and clinical relevant starting point for tailoring your departmental protocols.
- **Service:** location for protocols used by a service representative.
- **Most Recent:** location where a copy of the last 90 protocols reside exactly as they were used. These protocols can be copied and used but cannot be modified or deleted.

The protocols contain all of the scan parameters. There is space for 90 protocols in each of the 10 anatomical regions for adult protocols and 90 protocols for each color area of the pediatric protocols. There are nine different weight classifications in each of the seven color areas, plus three additional areas for you to build pediatric protocols. You have a total of 6,840 available spaces to build user selected protocols.

### Use protocols

After entering the patient information in the Exam Rx area, you choose a protocol from one of the four protocol locations (User, GE, Service, or Most Recent).

Once you choose the area you wish to get the protocol from, then you select an anatomical area and the protocol you wish to use. Once the protocol is chosen, the scanning sequence is activated. All parameters for scanning a patient can be set up in a protocol. This saves you time when prescribing scan parameters for each patient.

### Edit protocols

Once a protocol is chosen, any factor in the individual exam may be adjusted without affecting the established protocol. If an established protocol has a factor or factors you wish to permanently change, this can be done through the Protocol Management feature. If your system has been configured for EA3 Login, you must have permission to accept any changes in Protocol Management.

### View protocols

Protocols can be viewed with the Protocol Management feature. Each series can be viewed and scan values may be changed to see the effect on other values or other available options.

### Export protocols

See [Export protocols](#).

## System options

There are several option packages that may be purchased and installed on your system which include the setup of various protocols. You need to have some understanding of their functions if you are to use them in your protocols. These options include: Auto Applications.

## Pediatric protocols

For more information on protocols for pediatric imaging, see [Pediatric Protocols](#).

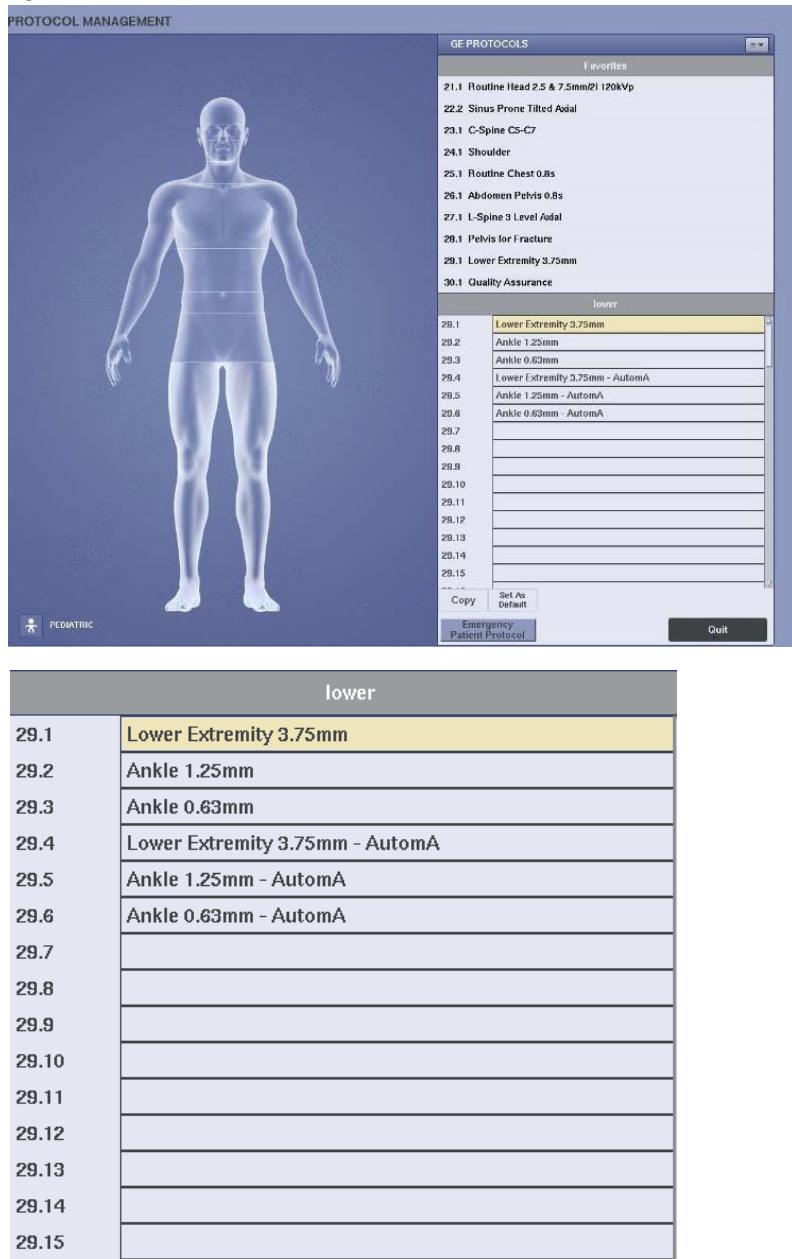
## PROTOCOLS

### Protocol Selection screen

Click **Protocol Management**, to view the Protocol Selection screen. See [Applications Configuration](#).

The protocol area has 10 adult and 10 pediatric protocol categories. Protocols 1 to 10 are adult protocol areas and 11 to 20 are pediatric protocol areas. Each protocol area allows up to 90 different protocols.

**Figure 18-1 Protocol Selection screen**



#### Protocol numbers

The protocol numbering systems enable you to easily enter a protocol number in the patient information screen when you are setting up a scan. The first number indicates the protocol area you are using. The second number indicates which protocol you selected out of that area.

- User area numbers: Adults = 1 to 10, Pediatrics = 11 to 20
- GE area numbers: Adults = 21 to 30, Pediatrics 31 to 40

*Anatomical Selector*

The Anatomical Selector area lets you decide if you want to use a GE defined, User defined, Service defined, or a Most Recent protocol.

## PROTOCOLS

### Build or edit a protocol

Use this procedure to complete a new protocol or change the established user protocols on the system.



If when you select a protocol, it displays the message, "Can't read selected protocol, please choose another protocol," then the protocol is corrupt. Delete the protocol and rebuild it.

#### Consideration

- Copy orientation and patient position is a feature that adjusts the patient orientation and position based on the prior series. For example, if the patient orientation and position is supine feet first, and the scout for the patient you are currently scanning, is prone, feet first, after the scout is acquired and next series is selected, the orientation and position values set in the protocol are automatically changed to the scout values.
- Copy forward is a feature that allows you to duplicate the following scan parameters to R2 to R10 or the next series:
  - Start/End
  - Interval
  - Tilt
  - DFOV
  - R/L and A/P centers

To activate copy forward, type "d" or "D" in the parameter text field.

1. Click **Protocol Management**.
2. On the Protocol Selection screen, click **User**.
  - If you wish to create or edit pediatric protocols, click **Pediatric**.
  - There is space for 90 protocols in each of the Adult anatomical areas.
  - For the color coded Pediatric anatomical areas, there is space for 90 protocols in each of the different weight classifications. The Head, Orbit, and Miscellaneous are not color coded.
  - There is a total of 6,840 available user selected protocols to build.
3. Select an anatomical region.
  - Click the arrow up or down to view a list of 15 protocols at a time.
  - Click and drag the scroll bar to move quickly through all 90 protocols.
4. Click **Edit** if you are making changes to an existing protocol.
5. Select a blank protocol space, click **New** type the name of protocol and press **Enter**.
  - Any name may be used. It is helpful if you choose a name that reflects what the protocol is meant to be used for (e.g., Routine Head, Trauma Spine, Chest/Abd/Pelvis).
  - The protocol name can be up to 60 characters.
  - The backslash (\) character should not be used.
6. The system defaults to Scout series the first time you are building/editing a protocol. For subsequent series, click **Create New Series** and select the type of series to be built.
  - In most cases, a scout series is built first because this allows for more precise scanning. A scout must be programmed first if it is to be displayed automatically with Show Localizer.
  - AutomA and SmartmA require a scout to be acquired in order to generate a mA table.
7. Click **OK**.

8. Set the patient position.
  - Click the direction of the arrow above the model will change top/bottom directions or rotate the model with a range of 90 degrees.
  - Click **Copy Patient Orientation, Patient Position, Anatomical Reference**, to copy the patient orientation from the previously scanned series, regardless of what is in the protocol.
9. Click **Anatomical Reference** and assign a two letter abbreviation for the zero point (landmark). Click **OK** to confirm your change or click **Cancel** to exit the Anatomical Reference screen with no change.
10. Select series parameters: archive, network, filming options, if desired.
  - Click **Auto Store** to automatically transfers the image at an exam level to a remote storage device such as PACS<sup>1</sup> when the exam ends.
  - Click **Auto Transfer** to automatically send images at an exam or image level to one of up to four destinations. Follow these steps for each host selection:
    - a. Select a host.
    - b. Select transfer by exam or image.
    - c. Click **OK**.
    - By Image: images are transferred in groups of 50. Only prospective images are transferred when using this mode.
    - By Series: each series is transferred after it is completed.
    - By Exam: the entire exam is transferred after it is completed with the End Exam operation. Any Screen Save, Reformat, 3D, Navigator, Dentascan, Retrospective, images created before the exam is ended are transferred. The Dose Report is automatically sent when Auto Transfer By Exam is selected.
  - Click **Dose Report Auto Transfer**. From the Dose Report Auto Transfer screen complete the following:
    - a. Select a host.
    - b. Click **OK**.
    - This automatically transfers the dose information for both the Dose Report and the DICOM<sup>2</sup> Structured Dose Report to up to four different locations. This is used to transfer the dose information when Auto Transfer By Image or By Series is selected on the Recon tab for Scouts and PMR R1 to R10.
11. Set the **Scout parameters**. Set the technique factors low.



Scout Parameters include Scout Image number, Start and End Locations to set the length of the scout, technique factors of kVp and mA, scout plane, Auto Voice and use of the Window Width/Level feature. Selecting an individual cell under a parameter column allows you to adjust only the factor in that group. Selecting the parameter column from the top row highlights all of the factors directly below the selected column and allows you to adjust that factor in all of the images.

- Define the Start/End locations.
- Select the kV.
- Select the mA.

---

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- The Scout Plane designates what type of scout is being acquired. Only 0, 90, 180, and 270 can be used with Show Localizer.
- Choose an Auto Voice message.
  - The language is set by the service engineer.
  - Multiple languages are available for Auto Voice messages 1, 2, or 3.
- Set the W/L.

12. Click **Create New Series**.

13. Click **Axial** and **Create After**.

14. Prescribe the parameters for the series.

#### *Set the scan parameters.*

- a. **Adjust the Graphic Rx.**
- b. **Set the timing parameters.**
  - If any of the values in Start/End Location, Number of Images, Slice Thickness, or Image Interval are changed from the original value, the system automatically adjusts any necessary values to maintain the signal to noise. For example, if the number of images is decreased, the system automatically adjusts the end location. The system highlights any adjusted value in orange and changes any necessary graphic representations on the scout.

#### *Set up Auto Voice.*

- c. **Set the recon parameters.**
- d. **Set the film parameters.**
- e. **Apply any additional scan features.**
  - The data acquired for all other series is different than data acquired for scout images. This means that features such as Patient Position and **Auto Voice** must be set or activated again for this series.
  - If the patient orientation does not match the scout for the current series, AutomA/SmartmA are not enabled.
  - Click **Copy Orientation, Patient Position, Anatomical Reference**, to copy the patient orientation from the previously scanned series, regardless of what is in the protocol.
  - If Auto Store/AutoTransfer were set for the exam scout image, they are automatically set for this series.



The **Tab** key should not be used when building protocols. If Tab and Cancel are selected while building protocols, the protocol below the one being built could be deleted.

## Link a Protocol to Emergency Patient

Use this procedure to link a protocol to Emergency Patient.

1. Click **Protocol Management**.
2. On the Protocol Selection screen, click **Emergency Patient Protocol**.
  - If you wish to build or edit adult or pediatric protocols, refer to Build or edit a protocol section.
3. On the Emergency Protocol screen, click one Protocol title button from the nine icon selections.
4. Click **Link**.
5. On the Protocol Selection screen, select an anatomical region.
  - Click the arrow up or down to view a list of 15 protocols at a time.
  - Click and drag the scroll bar to move quickly through all 90 protocols.
  - Only the protocols in User tab are available.
6. Select an existing protocol, then click **OK**.
  - Click **Cancel** to cancel the protocol link.
7. On the icon selection screen, select the desired icon.
  - Displays Adult icon selection popup when the linked protocol is in 1.x to 10.xx.
  - Displays Pediatric icon selection popup when the linked protocol is in 11.x to 20.xx.



Please select an appropriate icon according to the Protocol patient position and entry selection.

8. Click **Quit**.

***PROTOCOLS*****Set protocol as default**

Use this procedure to define a single, most commonly used protocol within a anatomical area as the default.

1. Click **Protocol Management**.
2. On the Protocol Selection screen, click **GE** or **User**.
3. Click the desired anatomical body part to view the protocols.
4. From the Anatomical Protocol list, click a protocol and then click **Set as Default**.
  - Only one protocol in each list can be set as the default.
  - Default protocols can not be set in the Pediatric color coded areas.
  - The default protocol is highlighted in yellow.

## Copy and paste a protocol

Use this procedure to copy protocols from the GE anatomical selector or Most Recent selector into the User anatomical selection area. You can also copy a protocol within the User anatomical selector. Copy protocol can be used as a template to create different protocols with minor adjustments.

1. Click **Protocol Management**.
2. From the Protocol Selection screen, click the anatomical selector you want to copy from (GE, User, or Most Recent).
3. Select the protocol you want to copy.
4. Click **Copy**.
5. Click the anatomical selector to where you want to paste the protocol.
6. Click on an empty protocol list number and then click **Paste**.
7. Rename the protocol, if necessary.
  - a. Click the protocol.
  - b. Highlight the text and type and Enter a new name.
8. Click **Done**.

**PROTOCOLS****Delete a protocol**

Use this procedure to delete a protocol from your user defined list. This allows you to keep your protocol list current by deleting any unnecessary protocols.

1. Click **Protocol Management**.
2. From the Protocol Selection screen, click the anatomical selector from where you want to delete a protocol.
  - You can only delete from the **User** or **Service** protocol selectors.
3. Select the protocol you want to delete.
4. Click **Delete**.
5. Click **OK** to the confirmation prompt.
6. Click **Done**.

### *Delete a Protocol Link for Emergency Patient*

Use this procedure to delete a Protocol link for Emergency Patient.

1. Click **Protocol Management**.
2. On the Protocol Selection screen, click **Emergency Patient Protocol**.
3. On the Emergency Protocol screen, click one Protocol title button of nine selections.
4. Click **Delete Link**.

# Chapter 19 : Data privacy

Today, most countries have enacted data privacy laws to protect against the unauthorized access to and use of health information. Examples of global privacy laws are:

- Health Insurance Portability and Accountability Act (HIPAA)
- Directive 95/46/EC on Data Protection (the Data Protection Directive)
- Personal Information Protection and Electronic Documents Act (PIPEDA)

[Data privacy concept](#)

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[Add a local group](#)

[Add an enterprise group](#)

[Add or remove a user from a group](#)

[Change a user's full name](#)

[Change a user's password](#)

[Force a user to change password on next login](#)

[Lock/unlock a user](#)

[Remove a user, group, or membership](#)

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[Configure the Enterprise tab](#)

[AutoConfiguration](#)

[Manual configuration](#)

**DATA PRIVACY****Data privacy concept****Overview**

GE Medical Systems has a longstanding reputation of providing customizable, clinical solution to protect the privacy and security of your organization's unique clinical workflow, as well as your patient's confidentiality. Our scanner, software and services already incorporate many of the core Data Privacy requirements. We are saved to working with you, our customer, to provide additional value to help you meet the continuing Data Privacy challenge.

Please recognize the intended use of the product when determining how critical any privacy risk is, relative to patient care and safety. GE is very concerned with providing the best care to the patients, and in some cases we have determined that patient care is more important than the risk to privacy. In these cases we take every precaution to minimize privacy risk.

Security and Privacy are maintained across a Healthcare system. Any product that is placed into an uncontrolled environment will not be secure and cannot protect privacy. As we design scanners, we design them to be implemented in a "Secure Environment". A secure environment is based on a multiple layers of security, a concept known as defense in depth. For example, a Best Practice that is gaining much attention places firewalls between departments, as well as at a DMZ, between all extranets, and the external Internet access point. In this example a radiology firewall may allow DICOM and HL7 traffic through, but no other protocols. These DICOM and HL7 protocols would be blocked at the DMZ and again at the Internet Firewall.

Data Privacy using EA3 requires you to log on to the scanner and log off when you are done scanning for a period of time. If you do not log off, the system will log you off and you will have to log back on. Data Privacy using EA3 contains the following permissions. You can have Administrative, GE Service, Standard User or Limited User. Standard User can perform scanning functions and modify protocols. Administrator can set up and delete users. Limited users can perform all scanning functions. You must have Administrative permission to add or delete users.

When you are adding users for local databases, certain rules apply. You must use the following guidelines:

- Users/Groups – Lower case letters and numbers only
- Users/ Groups – Can not start with a number
- Users/Groups – No limit on length
- Passwords – Must be at least one character long, no Null characters
- Passwords – Can contain uppercase letters, numbers and special characters

Administrator and Limited User permissions have different abilities when logging on. The Administrator permission can add users. The Standard User permission can scan and modify protocols in Protocol Management. The Limited User can only scan. Emergency User login has Limited User permission.

Data Privacy (HIPAA) is an option that can be enabled or disabled by your Field Engineer through reconfiguration of your system.

**Users and groups**

Every person who has permission to use the system is a user. Users are set up by system administrators. These administrators may be IT personnel in an enterprise environment, or a site manager or lead tech in stand-alone environments. The administrator adds new users and assigns the users to a group, which dictates the level of privileges a person will have.

For example, a person named Sue Smith could belong to a group called technologists, radiologists, administrators, or any combination.

**Groups and privileges**

The group to which a person belongs has privileges. If you do not have an enterprise system, the assignment of group privileges is probably limited to those who have administrator privileges and those who do not.

Additionally, permission for protocol edit may be assigned to groups. If your system is set up for enterprise login, your IT person or administrator use more of the features.

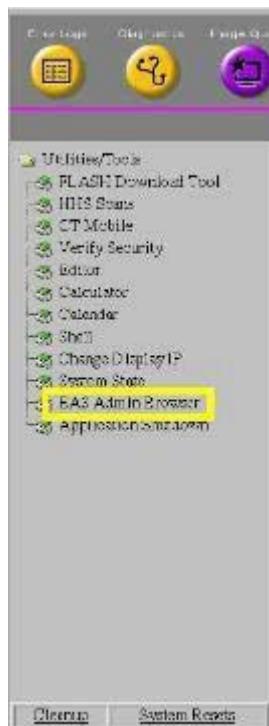
## DATA PRIVACY

### Open EA3

Use this procedure to open EA3 user interface.

1. Click the **Service** icon.
2. From the Service desktop, click **Utilities** icon.
3. From the Utilities screen, click EA3 Admin Browser.

Figure 19-1 Utilities menu

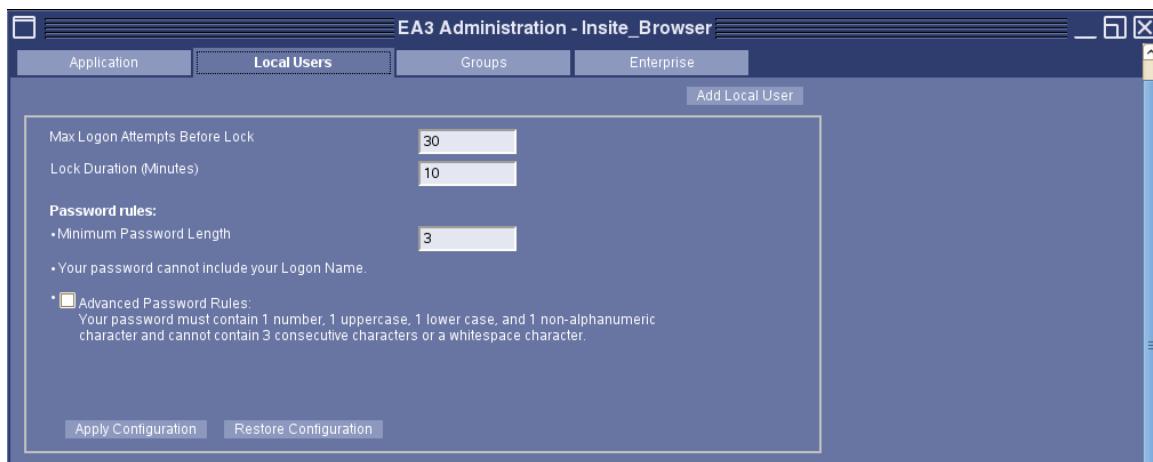


4. From the EA3 Administration screen, type your Username and Password.
  - Consult your service engineer or application representative for user name and login.

Figure 19-2 EA3 Administration screen



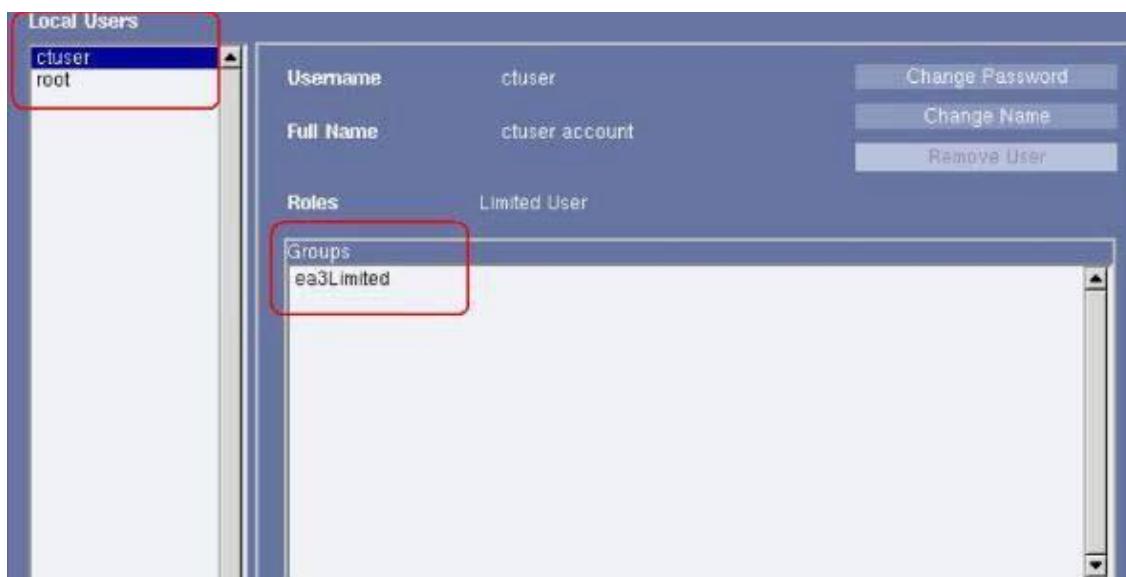
5. Click **Login**.



6. From the **Local Users** or **Group tab**, select a group or user.

- Only one group and user can be in context at a time. If you choose multiple users, the system selects the top user in your selected list. Once a user or group is in context, you can make any necessary modifications to that user or group.
- If there are no users or groups, then there are no items in context. All of the buttons in the center panel are disabled until a user or group is added.

Figure 19-3 Local User list and Group list



**DATA PRIVACY**

# Configure local users

Use this procedure to add or remove users, change user group memberships, change user names, change user passwords, lock / unlock users, force users to change their password on next login, etc.

*Open EA3.*

1. From **the Local Users tab**, enter desired selections.
  - **Max Logon Attempts Before Lock** - the number of failed login attempts you can make before your account is locked for a certain number of minutes. When your account is locked, you cannot login, even if you provide the correct username/password combination. Either the specified time must elapse before you login again, or a user with an ADMIN role must login to the EA3 Administration component to unlock you. Locking only applies to local users. Enterprise user locking is managed by the enterprise server.
    - If the administrator forcefully locks your account, the lock duration does not apply. You are locked until the administration unlocks you.
  - **Lock Duration (Minutes)** - the number of minutes you stay locked if you become locked due to failed login attempts.
  - You can become locked in one of two ways.
  - Password Rules
    - Minimum Password Length** - the minimum length of a new password. If a password is below the minimum length already, setting this value has no effect on the password. For example, if your password is 8 characters, and someone changes the minimum password length to 10 characters, the 8 character password is still okay. However, next time you change your password, you must choose a password that is 10 characters or greater. The minimum password length feature only applies to local users. Password length restrictions for enterprise users are managed by the enterprise server.
      - Your password cannot include your Logon Name.
    - Optional - Advanced Password Rules** – provides a more secure 14 character password format. If you select Advanced Password Rules, the system requires that your password must:
      - Include at least one uppercase alphabetic character,
      - Include one lowercase alphabetic character,
      - Include at least one numeric character,
      - Include one non-alphanumeric (special) character (any alpha-numeric character),
      - Cannot contain more than 3 consecutive characters or a Whitespace character.
2. Click **Apply Configuration** to accept your configuration changes. Alternatively, click **Restore Configuration** to undo any changes made that have not yet been saved.
  - If there was a problem with making the changes (such as an invalid value or a problem contacting the back-end Servlet) an error message box appears with a description of the error.
  - If the changes are successful, then a brief message appears indicating that the changes were applied in a green label.

## DATA PRIVACY

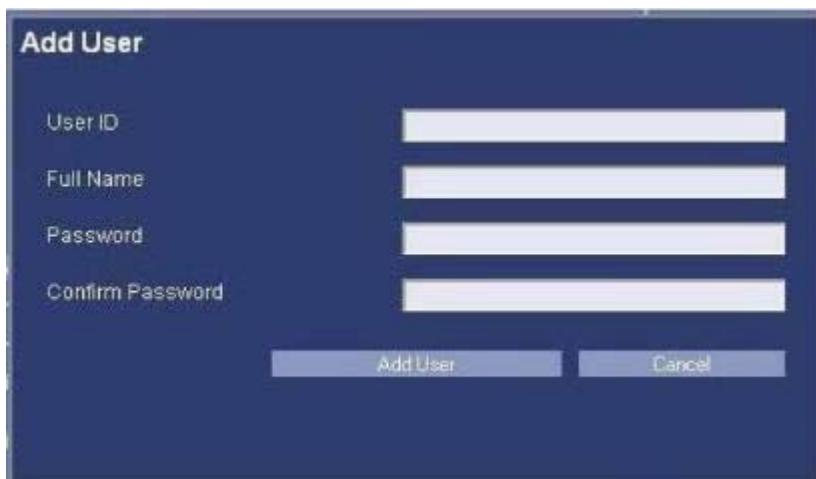
### Add a local user

Use this procedure to add a local user.

#### *Open EA3.*

1. From the Local Users tab, click **Add Local User**.
2. From the pop-up panel, type information for each of the following:
  - A unique user ID
  - Full Name
  - Password
  - Confirm Password
  - If an error occurs, a message box displays, and your changes are not committed to the database. Correct your errors and try again. Common errors include:
    - User name and password cannot be the same.
    - Password does not meet the minimum length requirements. Choose a longer password.
    - Password and Confirm Password box do not match. Make sure the passwords match.

Figure 19-4 Add User screen



3. Click **Add User**.

#### User restricted fields

Some fields and buttons on the Local User tab are not selectable under the following conditions. The following roles, users or groups have one or more of these criteria and they cannot be modified. Roles: limited user, standard user, GE service, administration. Users: root, ctuser, insite.

- **Permanent** - if a user is permanent, he can never be removed. When a permanent user is in context, the Remove User button is disabled.
- **Content Not Editable** - if a user is flagged as this, then their group memberships cannot be changed. When a 'content not editable' user is in context, the Add To Groups, and Remove From Groups' buttons are disabled.
- **Password not changeable** - if a user is flagged as this, then the password cannot be changed, and the Change Password button is disabled.

**DATA PRIVACY****Add a local group**

Use these procedures to add a group.

*Open EA3.*

1. From the Group tab, click **Add Local Group**.
2. From the Add Local Group window, type and Enter a unique group name.
  - If an error occurs, a message box displays, and your changes are not committed to the database. Correct your errors and try again. Common errors include:
    - Group name already exists in the database
    - Application session timeout

Figure 19-5 Add Local Group



3. Click **Add Group**.
  - The group is highlighted in the Local Groups list box. All information and buttons in the center panel refer to the highlighted group.
4. To change a group's roles, select the Roles option boxes and click **Apply Roles**.
  - A green label confirms the applied roles.
  - An error message box displays if it is unsuccessful.

**Add memberships***Open EA3.*

1. From the Groups tab, select a group in the Local Groups area.
2. In the Group Members area, click **Add Membership**.
  - A panel lists all the users that are eligible to be added to the selected group.
3. Select the users you want to add to the group.
  - If no users are eligible to be added to this group, an error message displays.
4. Click **Add To Group**.

**Group restricted fields**

Some fields and buttons on the Group tab are not selectable under the following conditions. The following roles, users or groups have one or more of these criteria and they cannot be modified. Roles: limited user,



- **Permanent** - if a group is permanent, it can never be removed. When a permanent group is in context, the Remove Group button is disabled.
- **Content Not Editable** - if a group is flagged as this, then its group memberships cannot be added or deleted. When a user belongs to a Content Not Editable group, the user cannot be removed or added from the group, therefore, the group name does not show up when you click Remove From Group or Add to Group.
- **Password not changeable** - if a group is flagged as this, then the roles associated with that group cannot be changed. This property does not have a direct impact on what you can do on the Local Users tab.

**DATA PRIVACY****Add an enterprise group**

Use this procedure to add an enterprise group.

***Open EA3.***

1. From the Group tab, click **Add Enterprise Group**.
2. From the Add Enterprise Group pop-up window, type and Enter a unique group name.
  - If an error occurs, a message box displays, and your changes are not committed to the database. Correct your errors and try again. Common errors include:
    - Group name already exists in the database
    - Application session timeout

Figure 19-6 Add Enterprise Group



3. Click **Add Group**.

- This action does not add an enterprise group, rather it provides EA3 the ability to manage roles for that group that already exist on the Enterprise directory server. For example, if you add a group All Employees as an Enterprise group to EA3, and assign that group with the STANDARD role, then any enterprise user that logs in through EA3 and belongs to the All Employees group has the STANDARD role.
- You cannot manage the group memberships for Enterprise groups. This is managed by the directory server, not EA3. Therefore, whenever an Enterprise group is in context, both the Add Membership and Remove Membership buttons are blocked. This does not mean that no one belongs to the Enterprise groups, but rather that this is managed by the directory server and not EA3.
- Once an enterprise group is added, it is automatically highlighted in the Enterprise Groups list box and it is in context<sup>1</sup>.

---

1.A HIPAA term meaning that all information and buttons in the center panel refer to the selected user or group.

## Add or remove a user from a group

Use this procedure to add or remove groups listed in the Groups list.

*Open EA3.*

1. Select the Local Users tab.
2. In the Local Users area, select the user you want to modify.
  - The groups that this user is currently a member are listed in the Groups area.
3. In the Groups area, click **Add To Groups** or **Remove From Groups**.

Figure 19-7 Groups

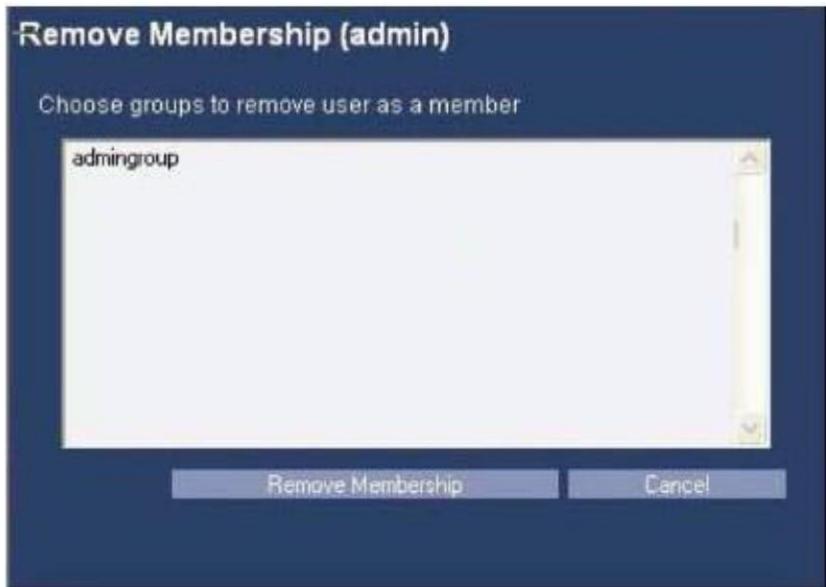


4. Select the group you wish to add or remove for this user.
5. Click **Add Membership** or **Remove Membership**.

Figure 19-8 Add membership list



Figure19Removemembershiplist



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### Change a user's full name

Use this procedure to change a user's name.

#### *Open EA3.*

1. From the Local Users tab, select a user.
2. Click **Change Name**.
3. From the Change Name window, type a new name.

Figure 19-10 Change Name



4. Click **Confirm Change**.

## DATA PRIVACY

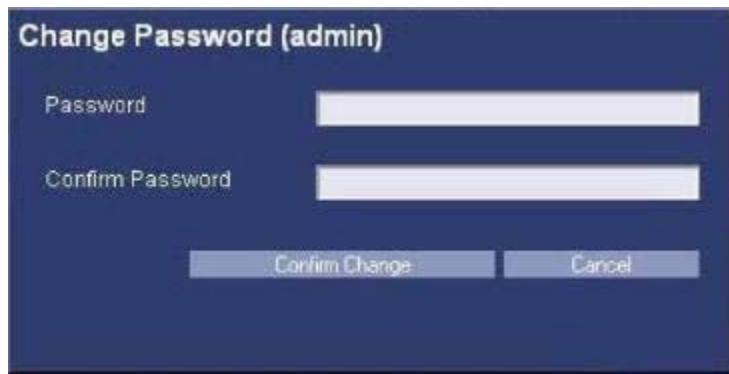
### Change a user's password

Use these procedures to change a user's password.

*Open EA3.*

1. From the Local Users tab, select a user.
2. Click **Change Password**.
3. From the Change Password window, enter a password and confirm the password.
  - A password can contain uppercase letters, numbers, and special characters.
  - An error message displays if the password does not meet the minimum length requirements. The minimum requirement are displayed in the Minimum Password Length field located in the top area of the Local Users tab. Change the password to an acceptable length.

Figure 19-11 Change Password window



4. Click **Confirm Change** to accept the new password or Cancel to exit without changing your password.

### *Force a user to change password on next login*

Use this procedure if you are an administrator to force a user to change his password.

1. From the Local Users tab, select a user.
2. From the bottom of the Local Users tab, select the **Change Password on Next Login** option.
3. Click **Apply Configuration**.
  - The next time the user logs in, he will be required to enter a new password.
  - Once the new password is entered, the **Change Password on Next Login** option is de-selected.

**DATA PRIVACY*****Lock/unlock a user***

Use this procedure to lock/unlock a user from login privileges.

***Open EA3.***

1. From the Local Users tab, select a user.
2. From the bottom of the Local Users tab, select the **Locked** toggle option.
  - When the Locked box is checked the user is locked from login even if he has a valid password.
  - If Emergency User is enabled on your system, the locked user can login as an Emergency User.
3. Click **Apply Configuration**.

### *Remove a user, group, or membership*

Use these procedures to remove items from the list.

#### *Remove a user*

##### *Open EA3.*

1. From the Local Users tab, select a user.
2. Click **Remove User**.
3. From the Confirm Removal window, click **Confirm Removal**.

Figure 19-12 Confirm Removal window



#### *Remove a group*

##### *Open EA3.*

1. From the Group tab, select a group.
2. Click **Remove Group**.
3. From the Confirm Removal window, click **Confirm Removal**.

Figure 19-13 Confirm Removal window



#### *Remove a membership*

##### *Open EA3.*

1. From the Group tab, select a group.

2. Click **Remove Membership**.

- A panel lists all users that are eligible to be removed from the highlighted group. Select users you want to remove from the group.
- If no users are eligible to be removed from this group, an error message box displays.

3. Click **Remove From Group**.

## DATA PRIVACY

### *Configure EA3 properties*

Use this procedure to configure EA3 application properties.

#### *Open EA3.*

1. From the Applications screen, enter the desired selections.
  - **Enable Authorization** - enable or disable authorization. If authorization is enabled, anyone logging in through EA3 (both local and enterprise users) must have a role. Anyone without a role is denied access, if authorization is turned on. The User role does not matter for logging into EA3, however, other EA3 client applications may restrict which roles can login.
  - **Emergency Logon Allowed** - enable or disable emergency access. If EA3 is used in GUI mode, this entry decides whether or not to display the Emergency login button. If this is disabled, emergency user access is prevented.
  - **Configurable delay after authentication failure (second)** – is delay defined by administrator for number of seconds delay after system failed to authenticate logon.
  - **Emergency Roles** - the roles assigned to the emergency user. The defaults allow an admin to assign a Standard user role, Limited User role, or both roles.
  - **Inactivity Timeout (minutes)** - The minutes that must elapse without any mouse/keyboard, etc. activity before a timeout is generated. When a timeout is generated, the EA3 logon screen is displayed. This value can be any positive integer, or it can be 0. If the value is 0, this indicates NO inactivity timeout; regardless of how much time has elapsed the system does not timeout.
  - **Display Last Logon Name** - enable or disable to display the username of the last user that has logged in on the EA3 logon screen.
  - **Administrator Message** - under certain circumstances / error conditions, the user of EA3 is asked to contact an administrator. This field allows the administrator to specify contact details for himself / herself and a custom message.
  - **Emergency Prompt** - the text that is displayed to any user logging in as emergency. The user is asked to enter information (usually their actual user name). This text appears in that prompt for information.
  - **Custom message to display on logon page** - the text that is displayed to any user logging. The user is asked to enter information (usually any message for logon user). This text appears on logon screen.
2. Click **Apply Configuration** to accept your configuration changes. Alternatively, click **Restore Configuration** to undo any changes made that have not yet been saved.
  - If there was a problem with making the changes (such as an invalid value or a problem contacting the back-end Servlet) an error message box appears with a description of the error.
  - If the changes are successful, then a brief message appears indicating that the changes were applied in a green label.

### Configure the Enterprise tab

Use this procedure to configure the properties necessary to make a connection to an Enterprise directory server (i.e., MSAD, Novell, etc.). The Enterprise tab is used by the site's IT<sup>1</sup> or GE Service personnel. It provides connectivity to the site's user database. If you do not have a network established in your hospital or clinic, this tab is not used.

#### [Open EA3.](#)

1. From the Enterprise tab, enter desired selections.
  - **Enable Enterprise Authentication** - login authorization. If it is unchecked, only local EA3 users can log in. If it is checked, both local users and enterprise EA3 users can log in and local EA3 user database is tried first.
  - **Cache Enterprise Users** - enables Enterprise users to be cached once they successfully login. If the Enterprise directory server is not available due to network or other issues the following scenarios occur:
    - If it is checked, a local record of an Enterprise user is kept and the you can login.
    - If it is unchecked, an Enterprise user is denied access.
    - Hashed passwords are cached, the actual password is not cached.
  - **Enterprise Authentication Latency (Seconds)** - the time the EA3 login process wait for a response from the Enterprise directory server. Often times, there is a network latency when connecting to servers, which is dependent on your network configuration. If the amount of time is reached without a response from the directory server, the EA3 login process returns a failed login. A value of 5 seconds is typically enough time to allow a properly configured directory server to respond, without causing undue user annoyance.
2. Modify properties in the lower two boxes of the Enterprise tab to make the Enterprise directory server connection.
3. Click **Apply Configuration** to accept your configuration changes. Alternatively, click **Restore Configuration** to undo any changes made that have not yet been saved.

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1.InformationTechnology

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## DATA PRIVACY

### *AutoConfiguration*

#### *Open EA3.*

1. From the Enterprise tab, click **Auto-detect Server Name**.
  - The system searches for the Server Name of the directory server.
  - If the DNS allows service lookups, EA3 executes an auto-detection with the Enterprise Directory Server. If it cannot find the server, it is not an error. Continue with these steps to configure the Server.
2. In the Server Configuration text field, type the Server Name or IP address of the Enterprise directory server that EA3 should connect to.
  - The system must either have DNS enabled or the system must have static information in a hosts file (i.e., /etc/hosts).
3. Select the Authentication type the directory server supports.
  - If it is a Microsoft Active Directory Server, typically select Kerberos. If it is a Novell eDirectory Server, typically select LDAP. If you do not know, check with the owner of the directory server for information.
  - If the enterprise server supports SSL connections, select the 'Use SSL' option.
  - If you use LDAP authentication without SSL, passwords are sent in the clear. This is not recommended. An alert is posted for this configuration. With kerberos and non-SSL, the authentication is encrypted, but the LDAP traffic is not.
4. Click **Test Connection** to test if the machine can connect to the directory server.
  - If the connection is successful, CONNECTION OK is displayed next to the Test Connection button.
  - If the connection is unsuccessful, CONNECTION BAD is displayed next to the Test Connection button.
  - If the connection is bad, then there is a problem connecting to the directory server. Check the following:
    - IP/servername
    - if system has DNS running
    - if the system can resolve the IP address / server name
  - Once the Test Connection procedure indicates that the connection is good.
5. Once the Test Connection is successful, select the type of directory server, either Microsoft Active Directory, Novell eDirectory, or another.
6. Click **Generate Defaults** to populate the Realm Name, Format, DN, Login Attribute, First Name Attribute, Last Name Attribute, and Group Attribute fields with default values for that directory server type.
  - If the directory type is MSAD, both the realm name and the DN are populated.
  - If the directory type is eDirectory, the realm name is left blank. If you are configuring a directory server that is not MSAD or Novell eDirectory, the configuration must be done manually. Get the correct LDAP property information from the owner of the directory server.
  - If this is a non-MSAD, non-eDirectory server, or is a server with a non-default configuration,

manually change some properties, as needed.

7. Enter a username and password of a user that resides on the directory server.
8. Click Login and view the result information to see if the login is successful.
  - The First Name, Last Name, and any group memberships for the user are printed. If First Name, Last Name, or Group Memberships are not found, a warning is posted, which indicates that:
    - the LDAP properties are mis-configured (i.e., First Name Attribute, Last Name Attribute, and/or Group Attribute).
    - the user does not have a First Name, Last Name, or any Group Memberships configured on the Enterprise directory server.
  - If you get these warnings, talk with the owner of the directory server to verify you have everything set up correctly.
  - If the test login succeeded and you are satisfied with the first name, last name, and group membership information, then your Enterprise directory server is properly configured.
9. Click **Apply Configuration** to accept your configuration changes. Alternatively, click **Restore Configuration** to undo any changes made that have not yet been saved.

## DATA PRIVACY

### *Manual configuration*

Use this information to connect to a directory server other than MSAD, Novell eDirectory, or any other system that has a custom configuration. The following LDAP definitions are for configuration properties that may need to be manually selected.

**Format** - set to domain or dn.

- domain is the 'MSAD' way of doing LDAP authentication (i.e <userId>@<realm name>).
- dn is the eDirectory, and most other directory servers use (i.e. loginAttribute=<userId>,<ldap base dn>) way of doing LDAP authentication. If you are connecting to a non-MSAD directory server, more than likely use dn.

**DN** - is the LDAP base DN of the LDAP server to which you are connecting. Typically this is the fully qualified domain name separated by a bunch of 'DC='. For example, if the fully qualified domain name of the directory server is 'example.com', it is likely that the DN is 'DC=example,DC=com'.

**Login Attribute** - is the LDAP attribute to be used for the unique user identifier, that is the user id to login. Set it to the unique identifier your server uses.

- On MSAD it is: sAMAccountName
- On eDirectory, it is typically: cn

**First Name Attribute** - is the LDAP attribute that is used for the user's first name.

**Last Name Attribute** - is the LDAP attribute that is used for the user's last name.

**Group Attribute** - is the LDAP attribute that is used to find group memberships for the user. On MSAD, it is 'memberOf'.



EA3 finds all instances of this attribute (not just the first, like it does for other attributes). If a user belongs to more than one group, EA3 finds all memberships.



Regarding LDAP parameter configurations, EA3 finds the first instance of the configured attribute for a user, except for Group Membership. If you configure the First Name attribute to be an attribute that is listed multiple times, EA3 assumes the first one found during an LDAP query is the correct First Name. For Group Membership, EA3 finds all instances of that attribute.

### Save changes

No changes are saved to EA3 on a tab unless you click **Apply Configuration** before you navigate to another tab or click **Confirmation** on a popup panel. If there is more than one Apply Configuration button on a tab, click the one associated with the data you changed (the buttons are grouped with the data they manage in a bordered panel).

Click **Apply Configuration** or **Restore Configuration** and in 5 seconds a label appears indicating that the changes have or have not been saved, respectively:

- EnableAuthorization
- Limited User
- InactivityTimeout(Minutes)
- EmergencyPrompt
- ApplyConfiguration

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# Chapter 20 : System management

Use these procedures for service management level functions. Most of the procedures are accessed from the Tool Chest.

## Tool Chest

- [Control the Auto Voice volume](#)
- [Open a Unix shell](#)
- [Turn on/off extended CT numbers](#)
- [Collect data with Quick Snap](#)
- [Collect data with IQ Snap](#)
- [Set the anonymize patient](#)
- [annotation level Export protocols](#)
- [Set the screensaver timeout](#)
- [Use iLinq](#)
- [Apply Product Network filters](#)
- [Download software](#)
- [Leave a memo for service engineer](#)

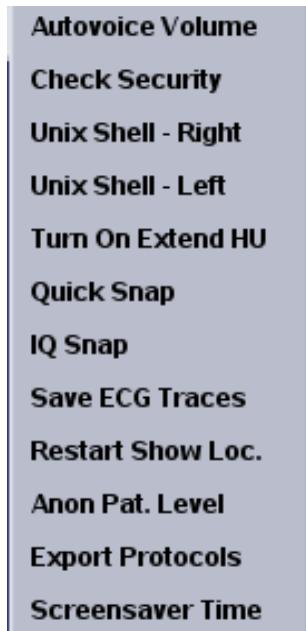
**SYSTEM MANAGEMENT**

# Tool Chest

## ImageWorks Tool Chest

The ImageWorks Tool Chest is located on the ImageWorks desktop.

Figure 20-1 ImageWorks Tool Chest



### **AutoVoiceVolume**

AutoVoice Volume displays a screen with volume sliders that allow you to adjust the left and right audio volume levels for AutoVoice in the scan room. See [Control the Auto Voice volume](#).

### **CheckSecurity**

Check Security is used by service personnel.

### **Unix Shell - Left**

Displays a Unix Shell on the monitor. This area is used by service personnel. See [Open a Unix shell](#).

### **Unix Shell - Right**

Displays a Unix Shell on the monitor. This area is used by service personnel. See [Open a Unix shell](#).

### **Turn On Extend HU**

Displays the extended Houndsfield Units. See [Turn on/off extended CT numbers](#).

### **Quick Snap**

Quick Snap takes a snapshot of all the parameters you have prescribed and information for processes touched by the prescription. This is useful when you are having system issues for service personnel to recall the system issues. See [Collect data with Quick Snap](#).

## **IQ Snap**

After a set of anonymous images have been selected, IQ Snap takes a snapshot of the images and reserves the scan data file related to the images and recon files for service personnel to review. For Helical, the scan data reserved is for the group or scan the group the images are related to. For Axial, the scan data reserved will be the axial rotation the images are related to. For the Axial mode, you may want to select a group of images on either side of the image where an IQ issue is seen to make sure enough scan data will be available later. See [Collect data with IQ Snap](#).

## **Anon Pat. Level**

The Anon Pat. Level function determines if the anonymized patient information is saved with full or partial annotation. This is a toggle button. A message indicates the current state and the state to transition to. See [Set the anonymize patient annotation level](#) procedure and [Patient Data](#) to view the differences between the full and partial annotation modes.

## **Export Protocols**

User protocols for adult and pediatric categories can be copied to CD-R in an Excel format with the Export Protocols feature. The file can be edited once it is saved to a PC with Excel software. See [Export protocols](#).

## **Screensaver Time**

The Screensaver Time function allows you to set the time period before the scan and display monitor screensaver displays. See [Set the screensaver timeout](#).

## **Service Tool Chest**

The Service Tool Chest is located on the Service browser. It contains several of the same features that are in the ImageWorks Tool Chest.

Figure 20-2 Service Tools Chest



## Product Network Filters

Product Network Filters provide the capability to place a personnel firewall in front of the CT scanner. Filters may be configured to restrict which system services are allowed to be controlled by other devices trying to access the operator console such as FTP<sup>1</sup>, telnet, and rlogin and which computers may access the system. This access is determined by configuring which IP<sup>2</sup> addresses are allowed to access the system. DICOM<sup>3</sup> access to the system can also be configured.

The system default is for no services enabled, no IP addresses authorized, and DICOM port 4006 enabled.

Your service personnel can assist you and your IT Department in configuring PNF<sup>4</sup>. See [Apply Product Network filters](#).

## Software Download

Software Download provides the capability for Broadband connected systems with a Service Contract to automatically download software updates to the scanner. These updates can be configured to Auto Install or Manual install. A message indicates that this capability is installed on the system displays for the first three weeks after a software load from cold at every reboot. As updates become available, a message will display to inform you of the update. See [Download software](#).

---

1.File Transfer Protocol

- 2. Internet Protocol
- 3. Digital Imaging and Communications in Medicine
- 4. Product Network Filter

## SYSTEM MANAGEMENT

### Control the Auto Voice volume

Use this procedure to adjust the volume level of Auto Voice heard in the scan room.

#### ImageWorks

1. Click the **ImageWorks** icon.
2. On the Tool Chest, click **Auto Voice Volume**.
3. Click and drag the right or left slider to adjust the Auto Voice volume levels in the scan room.
4. Make a selection:
  - a. Click **Accept** to accept the values but not save the values.
  - b. Click **Save** to save the values.
  - c. Click **Default** to reset the values to the system default values.
5. Click **Quit** to exit.



If Auto Voice cannot be heard, check the settings for the Auto Voice Volume listed in the Tool Chest on the Image Works desktop. Click **Auto Voice Volume** on ImageWorks desktop in the toolbar. Use the sliders to set the value between 50 to 85%, click **Save**, and then **Default** to set the new saved value as the new default. Click **Reset** to reset the system default values.



Auto Voice may fail to function, especially during system simultaneity. Make sure that you can hear the Auto Voice to recognize if Auto Voice has quit. Manually breathe the patient when this occurs.

**SYSTEM MANAGEMENT**

**Open a Unix shell**

Use the procedure to display a Unix shell on the monitor. This area is used by service personnel.

**ImageWorks**

1. Click the **ImageWorks** icon.
2. From the Tool Chest screen, click **Unix Shell - Left** or **Unix Shell-Right** to open a Command Line window on the monitor.
3. Click **File > Close Window** or type **exit** to close the Unix shell window.

## SYSTEM MANAGEMENT

### Turn on/off extended CT numbers

Use this procedure to enable or disable extended CT number range.



DentaScan and BMD<sup>1</sup> are not supported in Extended CT Number, therefore do not use Extended CT numbers with these applications.

1. Verify that the system is idle and that all reconstructions are complete.
2. Click the **ImageWorks** icon.
3. From the **Tool Chest**, click **Turn On Extend HU** or **Turn Off Extend HU**.
  - The action that occurs is described on the button and does not reflect the state of the system.
4. Click **OK** on the message prompt.
  - The system automatically shuts down and reboots as part of the extended CT numbers procedure.

**SYSTEM MANAGEMENT**

1.Bone Mineral Densitometry

## SYSTEM MANAGEMENT

### Collect data with Quick Snap

Use this procedure to collect necessary data for trouble shooting system issues.



Do not initiate a QuickSnap if the system is actively collecting data with X-ray on.

#### ImageWorks

1. Click the **ImageWorks** icon.
2. From the Tool Chest, click **Quick Snap**.
3. Click **OK** to the message prompt located on the left monitor. The pop-up screen closes when the snap is complete.
4. Record the time and date of the QuickSnap for debugging by the service engineer.

## SYSTEM MANAGEMENT

### Collect data with IQ Snap

Use this procedure to collect the necessary data for troubleshooting image quality issues.



Do not initiate an IQ Snap while the system is actively scanning or reconstructing data.

1. Click the **ImageWorks**  icon.
2. From the browser, select all the images for the investigation.
3. Click **Utilities**.

**Select** *Create anonymous patient by image, series, or exam.*

- Select up to 500 images in a single series.
4. Select the anonymous exam.
    - Maximum of 500 images.
  5. From the Tool Chest, click **IQ Snap**.
    - If you did not make the images anonymous or did not select the anonymous exam, a pop-up displays instructing you to make the images anonymous. You cannot proceed until the selected images are anonymous.
  6. Click **OK** to the warning and the message prompts located on the left monitor.
    - If you get a message at the end of IQ Snap that indicates it failed, contact service.
    - This message closes once the IQ Snap is complete.

### Set the anonymize patient annotation level

Patient de-identification or anonymizing an exam electronically removes certain exam information and replaces it with anonymous information. There are two levels to anonymizing patient information: Full and Partial. Use this procedure to set the annotation level for patient anonymize.

#### ImageWorks

1. Click the **ImageWorks** icon.
2. From the **Tool Chest**, click **Anon. Pat. Level**.
3. Respond to the message prompt that defines the currently active anonymous state.
  - Click **OK** to change the patient anonymous annotation level.
  - Click **Cancel** to keep the current patient anonymous annotation level.
4. Set the desired level: **Full** or **Partial**.
  - Full mode is the most HIPAA compliant mode.
  - ANON and the exam number are added to the Patient List.



See [Make a patient anonymous](#) to anonymize an exam, series, or image.

### Exportprotocols

Use this procedure to export user protocols to a CD so that you can load the CD on a PC and print. The format is excel.



The system must be idle when exporting protocols.

#### ImageWorks

1. Click the **ImageWorks** icon.
2. From the Tool Chest screen, click **Export Protocols**.
3. The CD/DVD tray opens and the system prompts you to place a blank CD media in the CD/DVD drive.
4. Place a CD inserted in the tray.
5. Click **OK** to close the drive and initiate the save process.
  - The User adult and pediatric protocols are saved.
6. The CD tray opens automatically when the save is complete. Remove the CD and click **OK** to the message prompt, which closes the tray.

## SYSTEM MANAGEMENT

### *Set the screensaver timeout*

Use this procedure to set the time period for the scan and display monitor screen saver to start.

1. Click **Service**.
2. From the Service browser, click the Service browser title bar to move it so you can see the service **Tool Chest**.
3. From the Tool Chest, click **Screensaver Time**.
4. From the Set Screensaver Timeout screen, click and drag the slider to adjust the time that the screensaver mode starts to between 5 to 60 minutes.
  - Click on either side of the slider grab bar to increment in steps of 1 minute.
  - The default is 30 minutes.
5. Click **Save**.

## *Use iLinq*

Use iLinq to access GE Online Center engineers and Answer line Applications Specialists.

The iLinq tools are designed so you can get information yourself, rather than having to always rely on a FE or an Online Center Engineer. The Applications Self Help feature provides automated expert advice from a database of application problems and solutions.

- Answer questions - Top 10 FAQs.
- Search the Knowledge Database.
- Share the knowledge with co-workers by saving the results.



If InSite is running the Remote Safety test, New Patient does not open. To access New Patient:

- call InSite and request they abort the test
- navigate to the Service Desktop and select CleanUp option to cancel the test in progress

## *Launch iLinq*

Click **iLinq** to open the iLinq desktop.

## *Terminate iLinq remote connection*

Use this procedure to terminate an iLinq connection when a GE representative initiated the connection.

1. Click **Exam Rx** .
  - A message is posted that the scan hardware resource is not available.
2. Wait three minutes and click **Exam Rx** again to begin scanning.

## SYSTEM MANAGEMENT

### *Apply Product Network filters*

Product Network filters allow you to place a site firewall in front of the CT scanner. Filters may be configured to restrict which computers may access the system and which system services are allowed to be controlled by other devices trying to access the operator console such as ftp, telnet and rlogin. This access is determined by configuring IP addresses allowed to access the system. DICOM<sup>1</sup> access to the system can also be configured. The system default is for no services enabled, no IP addresses authorized and DICOM port 4006 enabled.

Consult your Field Engineer and your IT Department in configuring PNF<sup>2</sup>.

- 
- 1.Digital Imaging and COmmunications in Medicine
  - 2.Product Network Filter

## Downloadsoftware

The Software Download feature allows systems that have a service contract with Broadband connected to automatically download software updates. These updates can be configured to Auto Install or Manual install. A pop up indicating that this capability is installed on the system is displayed at every reboot for the first 3 weeks after a software load from cold.

- From the Automatic Software Updates screen, click **Continue**.

Figure 20-3 Automatic Software Update screen



- As updates become available, from the Automatic Software Updates screen, click **Install Later** or **Install Now**.

Figure 20-4 Automatic Software Update download screen



- If **Install Now** is selected, view the progress bar, which indicates the install progress. If **Install Later** is chosen, you will be asked again on the next reboot to install the software update.

## SYSTEM MANAGEMENT

### *Leave a memo for service engineer*

1. From the Feature Status area, click message area.
2. From the message screen, click **Memo**.
3. Place the cursor in the menu area and type and Enter a message.
4. Click **Save**.
  - The message displays in the log file.

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# Appendix A: Operator messages

This appendix lists user messages that are posted to the user interface and have not been translated. These messages are displayed in one or more of the following areas.

Table A-1 Operator messages

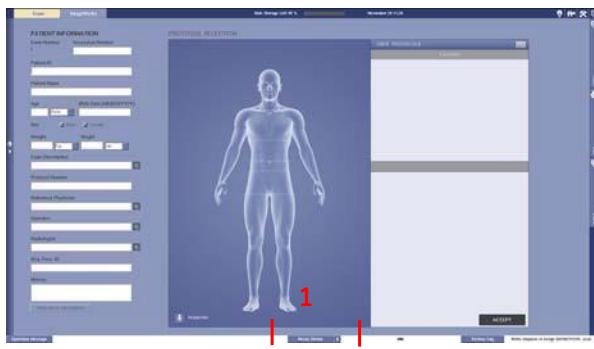
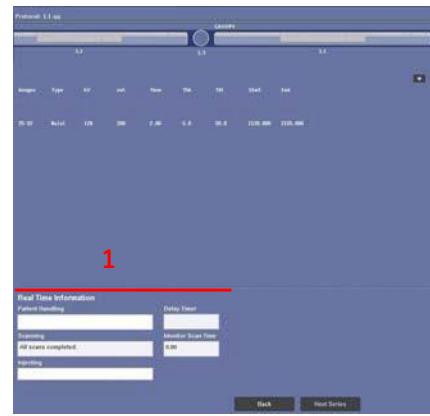
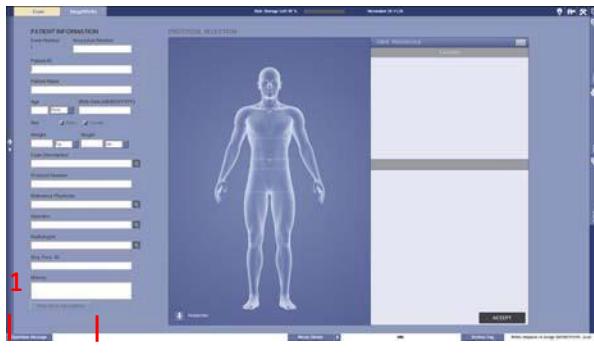
Areas where messages are posted to the user interface	
Attention pop up dialog.	Message area (1) of the Feature Status Area on the screen monitor.
	
Real Time information area (1) of the scan progress screen on the monitor	Operator console message bar (1) on the ViewEdit screen of the monitor.
	

Table A-2 Untranslated messages

No.	English operator message	Translated operator message
1.	Your patient orientation has changed from the previous series. Please verify or change the orientation if needed.	
2.	Table landmark has been changed. This changes the location of all scans you have prescribed. Double check all scans locations before you start scanning.	
3.	 <b>WARNING</b> This series contains one or more groups with multiple scans at the same tomographic plane, i.e. same location. Minimum diagnostic delay is seconds ± the time of a monitor scan. Do you wish to continue?	 <b>WARNING</b>

No.	English operator message	Translated operator message
4.	Biopsy has disabled automA. Please verify or change the mA as needed.	
5.	The dose for the new scan is greater than the maximal possible value. Do you wish to continue?	
6.	Unrecognized tube in use - Dose may vary. The reported dose information is calculated based on empirical observations of systems with GE Medical Systems tubes.  GE cannot assure the accuracy of reported dose information for any configurations that include tubes other than GE Medical Systems tubes.	
7.	The detector is not at the proper temperature please allow approximately    minutes for the detector to come to temperature. If you wish to proceed with this scan select the "OK" button, however IQ maybe degraded including image artifacts.	
8.	Auto mA has been disabled. It can be enabled again once patient orientation matches with that of the last scout series.	
9.	The prescribed mAs for Group % is greater than mAs limit for this tube, decrease mA to    mA.	
10.	The scan database is corrupted.	
11.	If you continue to use the system you might propagate the corruption. Please shutdown and restart the system in order to automatically recover the database.	
12.	Please confirm that there is no beam obstruction.	
13.	The Daily Image Quality Check Test has detected a condition that may result in an image with unacceptable image quality. Please call GE Service and request a more thorough evaluation of your system's condition.	
14.	Multiple patient entries are found. Please select the appropriate patient from the Select Schedule Patient screen.	
15.	Failed to Acquire Scan Hardware. This is probably because: <ul style="list-style-type: none"><li>• New Patient is started in the Exam Rx screen, or</li><li>• Some other tool is already scanning, or</li><li>• The application firmware is not downloaded to SBC, or</li><li>• Some other problem with the scan hardware.</li></ul> Please correct the problem and try again.	
16.	Firmware reset occurred. Please wait until reset is completed.  To continue, you may have to reset the landmark. However, the new landmark could be different from the previously set landmark.	

No.	English operator message	Translated operator message
17.	Firmware reset occurred during scanning. The current exam cannot be completed. You may obtain information on completed scans by returning to ViewEdit.  Please select  End Exam  when ready.  New Patient  button will be available when the firmware reset is complete.	
18.	Recon Self Test detected reconstruction errors.	
19.	You will not be able to scan because no calibration information is available. Try pressing  End Exam  followed by  New Patient . This will cause ScanRx to attempt to read the calibration database again.	
20.	 <b>WARNING</b>  Please remove any obstruction in the path of the beam.	 <b>WARNING</b>
21.	 <b>WARNING</b>  Converter boards have changed.  Please first run DAS Gain Cal before running Collimator Cal.	 <b>WARNING</b>
22.	 <b>WARNING</b>  Collimator Cal failed but scanning can be done with the pre-existing valid calibration.  If this error repeats over several days call service. Fast Cal continues.	 <b>WARNING</b>
23.	 <b>WARNING</b>  Fastcal may not have been performed within the last 24 hours.	 <b>WARNING</b>
24.	Image generation has been delayed! SmartPrep cannot continue. Monitor phase scanning has been paused. Please proceed to the scan phase by selecting the "Scan Phase" button at your discretion. The SmartPrep clock continues to show the elapsed time since the contrast injection began. Use this clock to determine when to proceed to the scan phase.	
25.	The Mylar Window check has detected that the window is not clean. A dirty mylar window may affect the calibration and cause Image Artifacts. Please clean the mylar window. Hit Continue to go on with FastCal without repeating the check or hit Retry to repeat the check and confirm that the mylar window is clean.	
26.	Please call the FE or GE Cares center for more information and help.	
27.	It has been over 96 hours since the fastcal was done.	
28.	Number of phase is over the allowable limit.	
29.	AutoStore to Archive Device Unavailable.	

No.	English operator message	Translated operator message
30.	 <b>WARNING</b> Scan Manager Configuration Has Non-Patient Scanning Options Enabled!	 <b>WARNING</b>
31.	 <b>WARNING</b> Scan Manager Configuration Has Beam Tracking Disabled! Scanner Is In High Dose Mode.	 <b>WARNING</b>
32.	Software has detected an invalid DAS configuration. Please reconfig to correct. If condition persists after Reconfig call GE Cares.	
33.	Reconstruction process has stopped. Scanning is possible but no images will be made. Restart the system. Please contact GE service.	
34.	Reconstruction times will be slower. Scanning can continue. Please contact GE service.	
35.	All of the images from a scan that is currently being reconstructed are suspended.	
36.	The Scanning Hardware is not available; please wait for the hardware reset successful status posted in the feature status area on the right monitor.  If the hardware reset fails, then reset the scan hardware from the Service Desktop System Resets button.	
37.	A scan disk array failure was detected. Please call GE Service to schedule repair of the scan disk array. To continue scanner operation now, you may rebuild the scan disk array with less storage capacity.  If you rebuild the scan disk array, all scan data on the current disk array will be lost. Are you sure you want to rebuild the scan disk array?	
38.	Unable to verify system functionality on startup. Please power cycle the console.  If the system fails to startup after the power cycle, then please call GE Service.	
39.	Protocol file is corrupted. Please correct using method below or contact your GE Service Representative. <ul style="list-style-type: none"> <li>• Restore protocols - this will replace all protocols in "User"</li> <li>• Using the most up to date copy of the Protocol DVD disk or System State disk</li> <li>• From Service Desktop select "Utilities" then "System State"</li> <li>• Now select "Protocols" and then "Restore".</li> </ul>	

No.	English operator message	Translated operator message
40.	An unrecognized X-ray tube has been installed on the system. <ul style="list-style-type: none"><li>• GE Medical Systems cannot assure that the system performance will conform to specifications.</li><li>• Advisory messages will be posted to the operator about an unrecognized tube during tube warm-up, during Fast Calibration, and in the dose report.</li></ul>	
41.	The system has been configured to recognize a GE Medical Systems Tube. A %s-day period from the date of tube installation has been granted to allow time to manually verify the tube identity. Please call GE Medical Systems to dispatch a Field Service Engineer (FSE) to verify the tube configuration. Please allow a minimum of 10 days for the FSE to schedule verification. Verification should take no more than 30 minutes. If a GE Medical Systems FSE does not verify the tube identity within xx days, the system will revert to an "unrecognized tube" status, resulting in the following: <ul style="list-style-type: none"><li>• GE Medical Systems cannot assure that the system performance will conform to specifications.</li><li>• Advisory messages will be posted to the operator about an unrecognized tube during system startup, during tube warm-up, during Fast Calibration, and in the dose report.</li></ul>	
42.	Scan disk array performance is degraded by one or more hard drive failures. Your scan data storage is reduced because of this. Please contact GE service to have the disk array repaired as soon as possible.	
43.	Automatic Software Download & Install Capability Exists for your scanner! This GE exclusive capability leverages the power of your Insite Broadband connection to deliver the latest software updates to your system as soon as they are released. The updates are downloaded automatically and the option to automatically install them is provided during system start-up. Only GEHC developed and validated updates are distributed via this tool. For an overview of this capability, Please review the Software Download Topic on iLinq.  Automatic Software Updates Continue (time out after 20 seconds)  Try Again Skip Install please wait ....	

No.	English operator message	Translated operator message
44.	<p>New software updates are available and ready to be installed on your scanner. These software updates provide system enhancements and corrections to ensure optimal system performance and security. All updates have been developed and validated specifically for your hardware and software configuration. By downloading these software updates, you agree to and are bound by the Terms and Conditions of Sale for GE Medical Systems Products. The updates are expected to take approximately to install. For additional information regarding the updates: Contact your Customer Service Center or choose "Install Later" (you will be prompted on subsequent re-boots with this dialog), go to iLinq, Under Software Updates review data for updates.</p> <p>If you have questions or concerns, please contact your local Service Engineer or Customer Service Center. Do you want to install software updates now?</p> <p>The following patch(es) require a system reboot after install. The reboot will occur in 10 seconds. 2005 General Electric Company:</p> <p>Installing Software Updates...</p> <p>Please wait while the system updates are installed... Estimated time required to install updates is approximately.</p> <p>The software update installation started at .</p> <p>Update Installation Failed!</p> <p>The following updates failed to install. Please restart your system and initiate software update again, or notify the GEHC On-Line Center that the install failed.</p> <p>Revert back to the original configuration, skip installation and notify GEHC On-Line Center that the install failed and create dispatch for FE follow-up.</p>	
45.	The detector is not at the proper temperature. If you wish to proceed with this scan select the "OK" button, however IQ may be degraded including image artifacts. Please contact GE Service.	
46.	<p>The detector is too hot.</p> <p>No scanning allowed.</p> <p>Please contact GE Service</p>	
47.	<p>A system communication failure has occurred which will prevent scanning.</p> <p>Please contact GE Service.</p>	
48.	System has detected that firmware is down. This will prevent scanning.	
49.	ScanRx could not be started because it could not communicate with scan database. The system has to be shut down and restarted. Please contact GE service.	
50.	Patient placements in series are different.	

51. The landmark is not set.

No.	English operator message	Translated operator message
52.	Patient orientation now differs from when last scanned.	
53.	A localizer(s) is invalid for this prescription.	
54.	Unable to locate existing Patient Information.	
55.	Exposure Time was changed to System Maximum Allowable value.	
56.	Exposure Time was changed to Tube Cooling Maximum Allowable value.	
57.	Tube has reached the highest allowable temperature, Tube Cooling Optimization is required.	
58.	Table height has changed - No timing graph will be displayed in SmartPrep.	
59.	The SmartPrep timing graph will not display due to a mismatch between the system and reconstruction engine clocks. After the exam is complete, contact service to synchronize the clocks.	
60.	System rounded Patient Weight in pounds to the closest value in kilograms.	
61.	System adjusted patient weight to be within allowable weight range.	
62.	Scan Request is not possible due to tube cooling. No up front delay is possible.	
63.	The system will apply an up front delay prior to scanning.	
64.	Scan Request is not possible due to tube cooling. Lower mA or kV to enable scan.	
65.	Start/End location(s) were changed due to landmark position.	
66.	More than 2 hours have elapsed since the last scan. Tube needs warming.	
67.	The Smart Prep Baseline image failed. Please try again.	
68.	Can not start Monitor Phase while interacting with the Baseline image.	
69.	Unable to set Alignment location. Landmark not set or table needs to be referenced.	
70.	Dose information database is uninitialized. Please see Error Log for Details.	
71.	Detector Temperature Is High. Image quality may be affected.	
72.	Detector Temperature Is Low. Image quality may be affected.	
73.	 <b>WARNING</b> Backup Timer stopped scan. X-ray stayed on longer than prescribed.	 <b>WARNING</b>
74.	kV out of range. Potential for degraded image quality.	
75.	Auto Voice Malfunction: Auto Voice is disabled until scanning is stopped.	
76.	Gantry Controls Horizontal In button is non-functional. Unlatch cradle to position patient.	

No.	English operator message	Translated operator message
77.	Gantry Controls Horizontal Out button is non-functional. Unlatch cradle to position patient.	
78.	Gantry Controls Landmark buttons are non-functional. Scanning cannot continue.	
79.	Auto Voice and Breathing lights are disabled due to operator intervention until scanning is stopped.	
80.	Cradle is released.	
81.	Gantry Controls Cradle Release button is non-functional.	
82.	Prep Delay: Seconds Remaining	
83.	Interscan Delay: Seconds Remaining	
84.	Tube Cooling Delay: Seconds Remaining	
85.	Operator Paused Scan.	
86.	Operator Stopped Scan.	
87.	Scanner Hardware Paused Scan.	
88.	Scanner Hardware Stopped Scan.	
89.	X-ray off scan is in progress. Press [Stop Scan] to stop scanning.	
90.	Prep Delay after [Start Scan] will be Seconds.	
91.	Cradle is released. Latch the cradle to scan.	
92.	Table lower than minimum position limit. Please raise the table to begin scanning.	
93.	Scan position prescribed is no longer valid. Please re-prescribe.	
94.	Cradle is released.	
95.	Cannot bring tube rotor up for seconds.	
96.	Application Startup stopped due to the failure of product name setting.	
97.	Software detected mismatched Table configuration. Please reconfigure to correct Table configuration.	
98.	The X-ray and Drive power is disabled. Please press E-Reset button on SCBSV.	
99.	Please ensure there are no objects in the gantry bore.	
100.	Neuro3D Already Running.	
101.	System turned off Neuro3D prescription in the current series.	
102.	Unable to mount the CD-ROM, ie: either no CD in the drive or the CD is not iso9660 format.  To start the Acrobat Reader without a CD, select the Continue button.  If you wish to correct the problem with the CD first, select the Cancel button.	
103.	Algorithm prescribed is not allowed. System will choose a default algorithm.	
104.	The system defaults Display Field to match scan field of view.	
105.	The system adjusted Image Interval to the closest possible value.	

106.	System changed keV value to be within allowable range.
------	--

No.	English operator message	Translated operator message
109.	Attention: When the system is turned on prior to the power saving preset wake up time, scanning is disabled until the detector has reached proper temperature.	
110.	 <b>WARNING</b> An unrecognized tube has been installed on the system. Tube Cooling algorithms are designed specifically for GE Medical Systems tubes and performance of the system cannot be guaranteed with unrecognized tubes. Because of the high energy input allowed for these tube units, failure to perform Tube Warmup can result in destructive component failure. Contact your service representative if you have questions about the tube compatibility of this CT system.	 <b>WARNING</b>
111.	Communication loss detected between scanner and injector. Please turn off the injector and re-connect the injector to scanner.	
112.	The parameters you prescribed on the scanner and on the injector monitor are different. Please re-send the parameters on the CT scanner to the injector by pressing the "Accept" button or press the "Get Current" button to get the parameters currently set on the injector.	
113.	Communication loss detected between scanner and injector. Please turn off the injector and re-connect the injector to the scanner.	
114.	No Emergency Patient protocol default has been set. Please use Emergency Patient Protocol in Protocol Management to set Emergency Patient protocol defaults.	
115.	Start/End location, Image thickness and interval are fixed with 0 degree because of Digital Tilt acquisition.	
116.	Over 120 seconds helical scan is not allowed with Digital Tilt acquisition.	
117.	Digital tilt cannot be applied in Axial scan.	
118.	Digital tilt cannot be applied in Cine scan.	
119.	Digital tilt cannot be applied in SmartPrep scan.	
120.	PMR can't be processed when digital tilt applied.	
121.	Priority recon is not available with Digital Tilt scan.	

No.	English operator message	Translated operator message
122.	Scan data will be increased if digital tilt angle is greater than 25 degrees. Please make sure the tilt angle is clinically relevant.	
123.	DFOVs larger than 20cm will increase scan range, resulting in an increase for the series total DLP. Please make sure DFOV is clinically relevant.	
124.	Time to 1 <sup>st</sup> image will be longer if digital tilt applied.	
125.	ODM has changed for the selected group.	
126.	ODM region is outside prescribed group location.	
127.	 <b>WARNING</b> One or more ODM regions will not be applied to prescribed scan groups. Check ODM prescriptions, ensure SmartMA is enabled and Scan Types are valid.	
128.	 <b>WARNING</b> Dynamic Transition in Smart Prep is ON. System will automatically transition to Scan Phase when enhancement level for Transition ROI reaches the HU value set for threshold.	
129.	Please confirm that the Transition ROI is set correctly.	
130.	ODM enabled, Diagnostic Delay may be increased up to 1.0 second"	

# Appendix B: Units of measure

These are the units of measure used in this manual.



Birthdate and age do not have SI units and will be translated.

Table B-1 New Patient / Patient Schedule

Data	Unit	Symbol
Weight	Kilogram	kg
Weight	Pounds	lb
Height	Centimeter	cm
Time	days	d

Table B-2 ScanRx Screen numeric indications

Data	Unit	Symbol
Height	centimeter	cm
Rotation time	second	s
Slice Thickness	millimeter	mm
Interval	millimeter	mm
kV (Tube Voltage)	kilovolt	kV
mA (Tube Current)	milliampere	mA
Gantry Tilt	degree	°
Total Exposure Time	second	s
Prep Group	second	s
ISD	second	s
Breath Hold	second	s
Breathe Time	second	s
Cine Duration	second	s
DFOV	centimeter	cm
R/L Center	millimeter	mm
A/P Center	millimeter	mm
CTDIvol	milligray	mGy
DLP	milligray centimeter	mGy cm
Phantom size	centimeter	cm
Beam Collimation	millimeter	mm
Helical Thickness	millimeter	mm
Axial Thickness	millimeter	mm
Retro Recon Thickness	millimeter	mm

Table B-3 Smart Prep Setting

Data	Unit	Symbol
Monitoring Delay	second	s
Monitoring ISD	second	s
Diagnostic Delay	second	s
mA (Tube Current)	milliampere	mA

Table B-4 Biopsy Rx Setting

Data	Unit	Symbol
Gantry Tilt	degree	°
Thickness	millimeter	mm
Image Interval	millimeter	mm

Table B-6 AutoVoice Selection

Data	Unit	Symbol
Preset Delay Time	second	s

Table B-7 Routine Display Tools - List>Select

Data	Unit	Symbol
Im Ctr S-I	millimeter	mm
Thick	millimeter	mm
Gantry	degree	°
Im Ctr R-L	millimeter	mm
Im Ctr A-P	millimeter	mm
SFOV	centimeter	cm
DFOV	centimeter	cm
Midscan	seconds	s

Table B-8 Exam Pg/Series Pg

Data	Unit	Symbol
Height	Centimeter	cm
Weight	Kilogram	kg

Table B-9 Display result on an image for the Image Measurements - Ellipse ROI/Box ROI/Trace ROI

Data	Unit	Symbol
a (area)	square meter	mm <sup>2</sup>

Table B-10 Measure Distance

Data	Unit	Symbol
distance	millimeter	mm
angle	degree	°

Table B-11 Measure Angle

Data	Unit	Symbol
angle	degree	°

Table B-12 MIROI

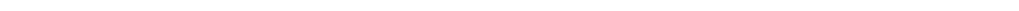
Data	Unit	Symbol
Elapsed Time	second	s

Table B-13 Dynaplan screen numeric indications

Data	Unit	Symbol
kV	kilovolt	kV
mA	milliampere	mA
Time	second	s
Thk	millimeter	mm
Tilt	degree	°

Table B-14 ImageWorks numeric indications - Image Works List

Data	Unit	Symbol
Im Ctr S-I	millimeter	mm
Thick	millimeter	mm
Gantry	degree	°
Im Ctr R-L	millimeter	mm
Im Ctr A-P	millimeter	mm
SFOV	centimeter	cm



DFOV	centimeter	cm
Midscan	seconds	s

---

Table B-15 Denta Scan Control Panel

Data	Unit	Symbol
Shift curve	millimeter	mm

Table B-16 Batch Control Panels for Reformat/3D

Data	Unit	Symbol
Spacing Between Images	millimeter	mm
Slice thickness	millimeter	mm
FOV	centimeter	cm
Angle Between Images	degree	°

Table B-17 Image Annotation numeric indications

Data	Unit	Symbol
DFOV	centimeter	cm
kV	kilovolt	kV
mA	milliampere	mA
Thickness	millimeter	mm
Rotation Speed	second	s
L/R/A/P/S/I indication	millimeter	mm

# Glossary

**2**

**2D**

two-dimensional

**3**

**3D**

three-dimensional

**A**

**A**

Anterior

**AAR**

Advanced Artifact Reduction

**ALARA**

As Low As Reasonably Achievable

**ANR**

Advanced Noise Reduction

**AP**

Anterior/Posterior

**ASiR**

Adaptive Statistical Iterative Reconstruction

**AVG**

Average

**AW**

Advantage Workstation

**axial**

divides anatomy into superior and inferior sections

**B**

**BMD**

Bone Mineral Densitometry

**C**

**CD**

Compact Disc

**CD-R**

Compact Disc-Recordable

**CFR**

Code of Federal Regulations

**CISPR**

International special committee on Radio Interference

**CNR**

Contrast-to-Noise Ratio

**coronal**

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5641787-1EN

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Page 18

divides anatomy into anterior and posterior sections

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**CSA**

Canadian Standards Association

<b>CT</b>	Computed Tomography
<b>CTA</b>	Computed Tomography Angiography
<b>CTDI</b>	Computed Tomography Dose Index

## D

<b>DAS</b>	Data Acquisition System
<b>DFOV</b>	Display Field Of View
<b>DICOM</b>	Digital Imaging and Communications in Medicine
<b>DLP</b>	Dose Length Product

<b>DVD</b>	Digital Versatile Disc
<b>DVD-R</b>	Digital Versatile Disc-Recordable

## E

<b>EFUP</b>	Environment-Friendly Use Period
-------------	---------------------------------

<b>F</b>	
<b>FOV</b>	Field Of View
<b>FTP</b>	File Transfer Protocol
<b>FWHM</b>	Full Width Half Maximum
<b>FWTM</b>	Full Width Tenth Maximum

## G

<b>GI</b>	Gastro-Intestinal
<b>GSE</b>	Gray Scale Enhancement
<b>GSI</b>	Gemstone Spectral Imaging
<b>GSPS</b>	Gray Scale Presentation State



## H

### **HIPAA**

Health Insurance Portability and Accountability Act

### **HIS/RIS**

Hospital Information System / Radiology Information System

### **HU**

Hounsfield Unit

### **HV**

High Voltage

## I

### **IICRP**

Inferior

### **ID**

International Commission on Radiation Protection

### **IE**

identification

### **IEC**

Internet Explorer

### **IGD**

International Electrotechnical Commission

Inter-group Delay

### **in context**

A HIPAA term meaning that all information and buttons in the center panel refer to the selected user or group.

### **IP IQ**

Internet Protocol

### **ISD**

Image Quality

### **IT IV**

Inter-scan Delay

Information Technology

intravenous

## K

### **keV**

kiloelectron Volt

### **kVp**

peak kilo Volt

## L

### **LLCD**

Left

### **LED**

Low Contrast Detectability or Liquid Crystal Display

L  
i  
g  
h  
t  
E  
m  
i  
t  
t  
i  
n  
g  
D  
i  
o  
d  
e

## M

### **mA**

milliampere

### **MHLW**

Ministry of Health, Labour and Welfare

### **MID**

Multiple Image Display

### **MINIP**

Minimum Intensity Projections

### **MIP**

Maximum Intensity Projections

### **MIROI**

Multi-Image Region of Interest

### **MOD**

Magnetic Optical Disk

### **MPVR**

Multi Projection Volume Reformation

### **MTF**

Modulation Transfer Function

## N

### **NCRP**

National Council on Radiation Protection

### **NI**

Noise Index

## O

### **OC**

OperatorConsole

## P

### **P**

### **PAA**

### **PACS**

### **PAI**

### **PC**

### **PDU**

### **PM**

### **PMR**

### **PMRs**

### **PNF**



ications System Patient Attenuation  
Posterior Indicator  
or

Patient Personal Computer  
Attenuation n  
Area

---

P  
i  
c  
t  
u  
r  
e

A  
r  
c  
h  
i  
v  
i  
n  
g

C  
o  
m  
m  
u

Pow struction Prospective Multiple  
er Reconstructions Product Network  
Distr on Unit Filter

Plan ned  
Mai nten anc e

P

r

o

s

p

e

c

t

i

v

e

M

u

l

t

i

p

l

e

R

e

c

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**PPS**

Performed Procedure Step

**Q****QA**

Quality Assurance

**QC**

Quality Check

**R****R RAM**

Right

**RAS**

Random Access Memory

**RF RL**

Right Anterior Superior

**ROI**

Radio Frequency

**ROIs**

Right Left

**ROM**

Region Of Interest

Region of Interest

Read Only Memory

**S****S**

Superior

**sagittal**

divides the anatomy into right and left sections

**SFOV**

Scan Field Of View

**SR**

Structured Report

**U****UID**

Unique Identifier

**UL**

Underwriters' Laboratories

**USB**

Universal Serial Bus

**V****VOI**

Vol  
um  
e of  
Int  
ere  
st

**W**

**W/L**

Window Width and Window Level

**WL**

Window Level

**WW**

WindowWidth

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