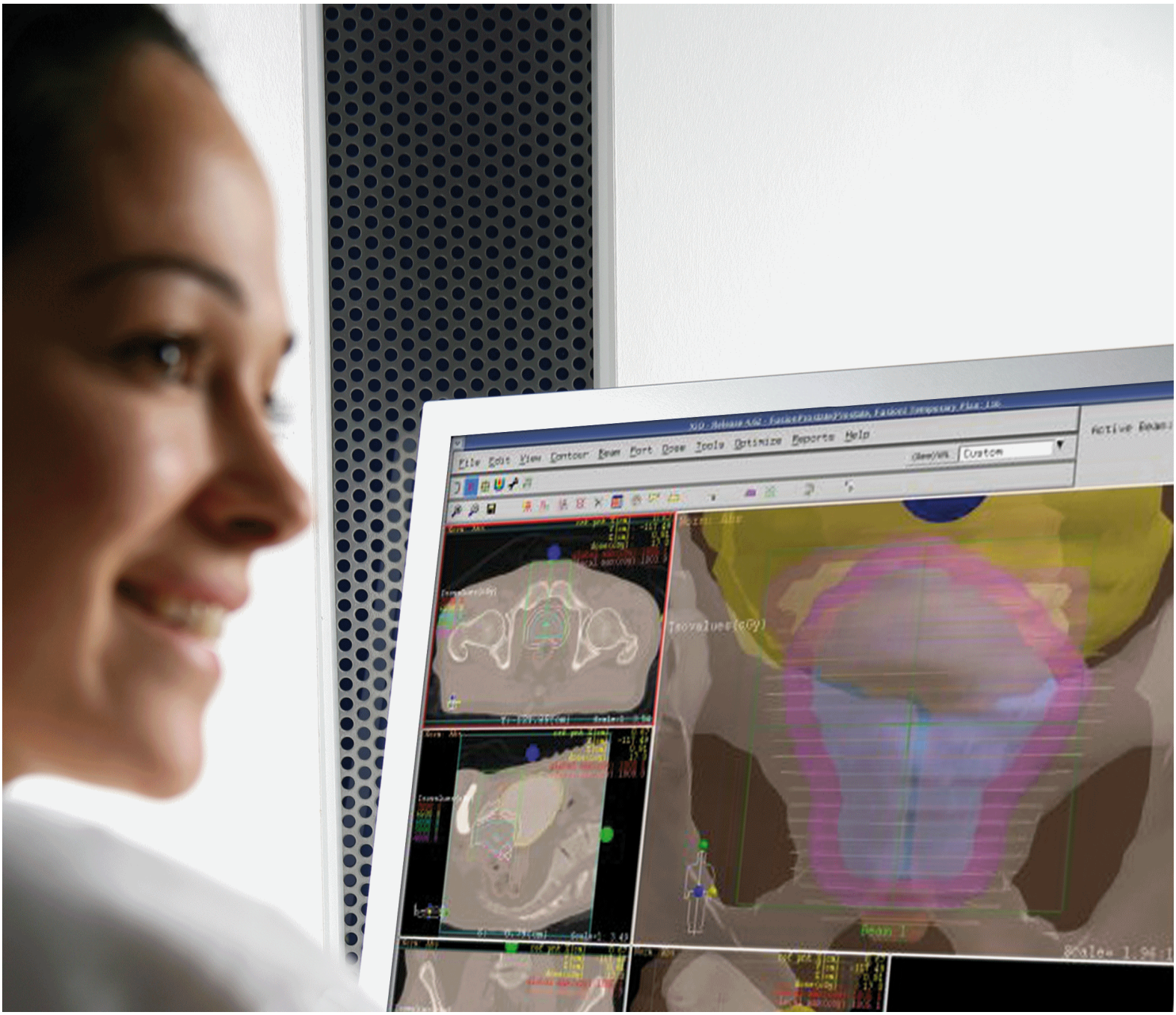
XiO® DICOM Conformance Statement

For Release 5.00



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Referenced documents

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Contact Software Support: http://www.elekta.com/healthcare-professionals/products/elekta-services/service-and-support/software-support.html

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Revision History

Revision	Date	Purpose
LEDDCMXIO0001(9.0)	May 2012	Updated legal entity information.

LEDDCMXIO0001(10.0)	September 2012	Updated for 4.80 changes: RT ION PLAN import details added Flattening Filter Free Support in Export (Fluence Mode Sequence)
LEDDCMXIO0001(11.0)	November 2013	Updated for 5.00 changes Default export in original image frame of reference Added RT Structure set details in new appendix
LEDDCMXIO0001(12.0)	October 2013	Wherever CMS Inc. is mentioned, add a sword (†) symbol and paragraph at the bottom of the table or page to indicate the IMPAC Medical Systems Inc. successorship.
LEDDCMXIO0001(13.0)	February 2014	Updated for 5.00.01 changes. Changes relate to: report FIXED_SSD at the appropriate time, and description of monitor units for Motorized Wedge DCAT beams.

Contents

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Tables

1. Overview

The following is the DICOM Conformance Statement for the XiO product as of release 5.00.

XiO is a 3-dimensional radiation treatment planning system that uses medical images to develop radiation treatment plans for cancer patients. XiO uses DICOM services to import images, structures and plan parameters and to export images, structures, plan parameters and dose to other vendors. XiO supports the network import of CT, MR and PET images, RT Structure Sets, RT Plans and RT Ion Plans and the network export of CT Images, RT Structure Sets, RT Plans, RT Ion Plans, RT Dose and export of DRRs and Intensity Maps as Secondary Capture or RT Image. XiO imports CT and MR images from DICOM media CD or DICOM Media magneto optical disks (MOD). XiO prints digital reconstructed radiographs (DRR's) to DICOM compatible printers.

XiO can define multiple export (SCP) locations to which the user can choose to export CT IMAGE, STRUCTURE SET, RTPLAN, RT ION PLAN, RT DOSE and RT IMAGE.

DRR Images exported from the Print, DRR option (as Secondary Capture or RT Image) can be exported to one, pre-defined network location and printed to one, pre-defined printer. Intensity Maps (as Secondary Capture or RT Image) can currently be exported to one, pre-defined network location and printed to one, pre-defined printer. The Intensity Map location and printer can be different than the one used for DRRs.

The user can edit the AE title for each XiO workstation's export of CT IMAGES, RT STRUCTURE SETS, RT PLANS, RT ION PLANS, RT DOSE and RT IMAGE. The AE title for stand-alone exporting of DRR (via the Print, DRR option) and Intensity Maps (Secondary Capture or RT Image) or for DICOM printing is not editable.

The tables below provide an overview of the network services supported by XiO.

Table 1-1: Network Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
CT Image Storage	Yes	Yes
MR Image Storage	No	Yes
PET Image Storage	No	Yes
SECONDARY CAPTURE Storage	Yes	No
STRUCTURE SET Storage	Yes	Yes
RT ION PLAN Storage	Yes	Yes
RT PLAN Storage	Yes	Yes
RT DOSE Storage	Yes	No
RT Image Storage	Yes	No
Print Management		
Basic Grayscale Print Management	Yes	No

Table 1-2: UID Values

UID Value	UID Name	Category
1.2.840.10008.1.1	Verification	Transfer
1.2.840.10008.5.1.4.1.1.2	CT Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.4	MR Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.128	Positron Emission Tomography (PET) Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage	Transfer
1.2.840.10008.5.1.4.1.1.481.3	RT Structure Set Storage	Transfer
1.2.840.10008.5.1.4.1.1.481.5	RT Plan Storage	Transfer
1.2.840.10008.5.1.4.1.1.481.8	RT Ion Plan Storage	Transfer
1.2.840.10008.5.1.4.1.1.481.2	RT Dose Storage	Transfer
1.2.840.10008.5.1.4.1.1.481.1	RT Image Storage	Transfer
1.2.840.10008.5.1.1.9	Basic Grayscale Print Management Meta SOP Class	Print Management

Table 1-3: Media Services

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk- Recordable		
General Purpose CD-R	No	Yes
Magneto-Optical Disk		
CT/MR MOD	No	Yes

2. Introduction

2.1 Audience

- DICOM interface implementers
- Radiation Therapy product support personnel
- Radiation Oncology Medical Physicists
- Radiation Oncology Marketing and Sales personnel

2.2 Remarks

XiO's role as a treatment planning system means that it both imports and exports DICOM data.

XiO's PFM (patient file maintenance) program initially creates the existence of a patient within XiO using images (CT, MR, PET) and contours (using RT STRUCTURE SET or the Curve module of a set of CT images) "pushed" to it from an imaging source or PACS system.

XiO's Teletherapy program is the place where users develop external beam treatment plans. They can import partially developed plans (using DICOM RT PLAN or RT ION PLAN import), edit and add to this plan or develop a new plan. XiO calculates dose and the user saves the proposed treatment plan. At the end of the planning process, options within Teletherapy allow the user to export combinations of CT Images, RT STRUCTURE set representations of contours, markers and reference points, RTPLAN, RT ION PLAN, 3D RTDOSE and DRR's as RT IMAGE. The user can also export DRRs by themselves through the File | Print | DRR option. If DRRs are sent from this menu or without the RTPLAN on the regular export menu, then these DRR's do NOT reference the RTPLAN to which the beams belong.

2.3 Definitions, Terms and Abbreviations

DRR- Digitally Reconstructed Radiograph

PFM- Patient File Maintenance- XiO's contouring application

Teletherapy- XiO's main external beam treatment planning and dose calculation application

2.4 References

Digital Imaging and Communications in Medicine (DICOM), Parts 1-20 (2011) NEMA, Rosslyn, VA

IEC Standard 61217, Radiotherapy Equipment - Coordinates, Movements and Scales (Reference CEI/IEC 61217: 2001)

3. Networking

3.1 Implementation Model

3.1.1 Application Data Flow Diagram

The diagrams below illustrate the interactions that XiO makes with the DICOM world.

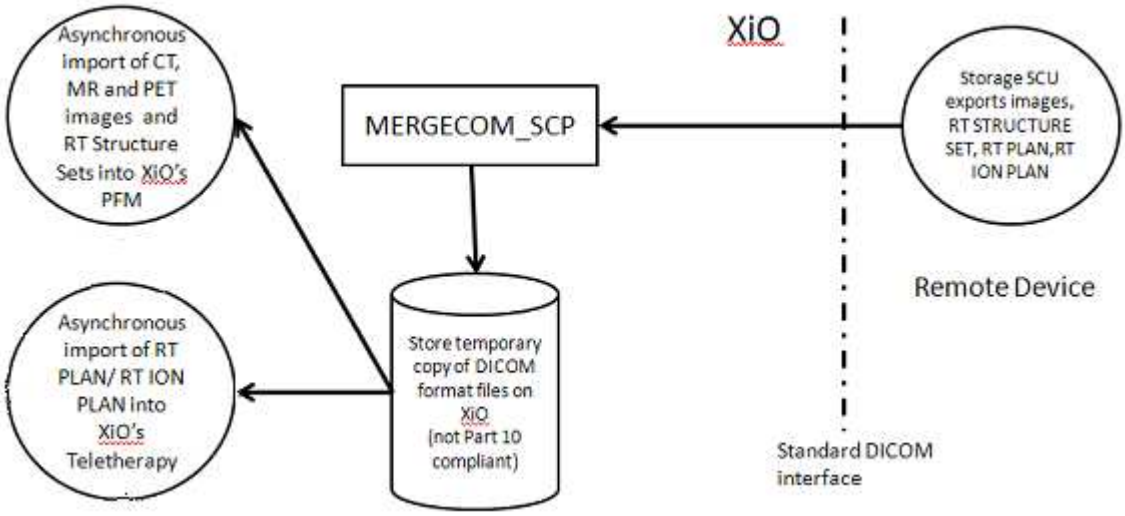

Figure 3-1 - Application Data Flow Diagram:
Image, Structure Set and RT Plan Transfer to XiO diagram

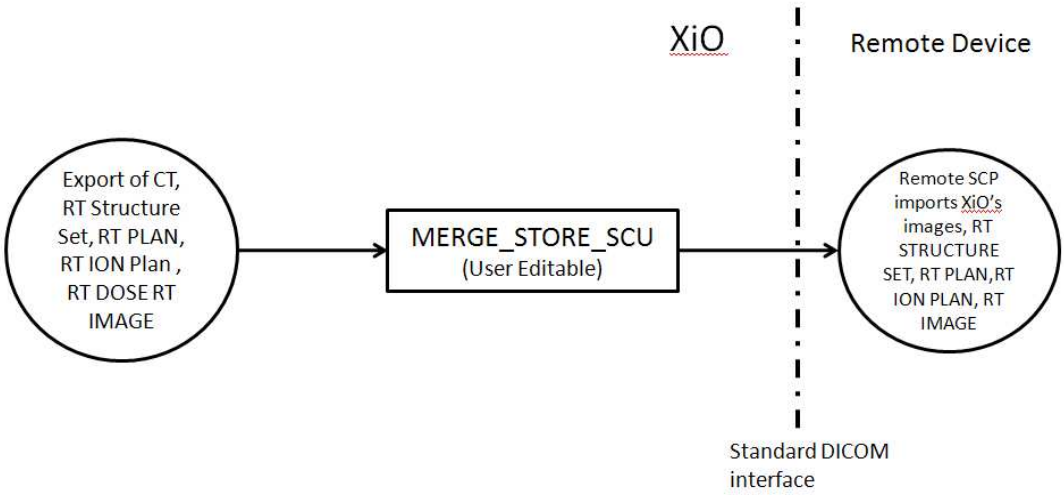

Figure 3-2 - Application Data Flow Diagram:
CT IMAGE, RT Structure Set, RT (Ion) Plan, RT Dose and RT Image Export from XiO

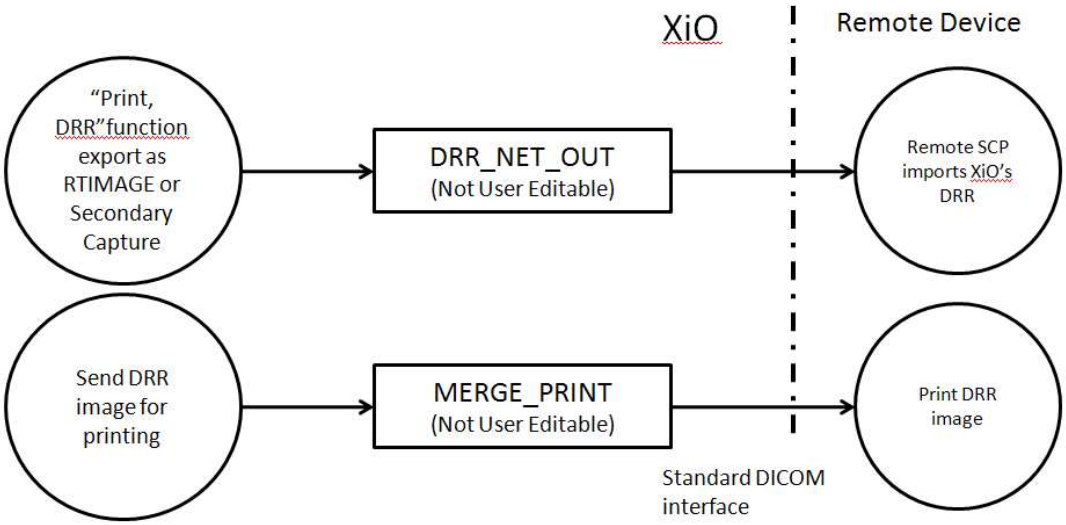

Figure 3-3 - Application Data Flow Diagram: DRR Image Export and DRR Print

3.1.2 Functional Definition of AE Titles

3.1.2.1 Functional Definition of MERGECOM_SCP

CT, MR, PET, STRUCTURE SET, RTPLAN and RT ION PLAN Import into XiO.

The exporting system initiates the negotiation of an association with the merge3srv application running on XiO over the network. The merge3srv application will negotiate with the client and accept the association if it can perform the requested service. If the association is accepted by the server, any DICOM objects are transferred from the client to merge3srv over the association and stored in a temporary directory on the XiO system. When the transfer is complete the client application closes the association. Later, the XiO user imports acceptable DICOM data into the XiO application at which point it is converted to the internal XiO format.

3.1.2.1.1 CT/MR/PET Image Import

If the DICOM header for a 16-bit CT image file defines a pixel padding value, XiO will convert all pixels equal to that padding value to the minimum pixel value that can be represented by the data type of that image. It is assumed that the CT manufacturer has selected a padding pixel value that is outside the range of the pixel values that make up the image. Pixel Padding values are ignored for MR and PET.

XiO will apply the slope and intercept to the pixel values for CT and PET images before saving them in XiO's internal format. XiO will not apply any slope and intercept for MR images.

3.1.2.1.2 RT Structure Set Import

The XiO application imports structure sets which have associated images present. It cannot import structure sets by themselves. XiO will move POINTS to the nearest image location (after warning the user).

3.1.2.1.3 RT Plan Import

The XiO application can import plans without referenced images or structure sets. Restrictions on the acceptable data are given in the appendices.

3.1.2.2 Functional Definition of MERGE_STORE_SCU

CT Image, RT Structure Set, RT Plan, RT Ion Plan, RT Dose Export and RT Image from XiO's Teletherapy DICOM Export page

The XiO client application requests Storage Services of a user-selected (one of five) DICOM server over an association. If the association is accepted by the server, the user-selected DICOM object combination is transferred from the XiO client to the selected server. When the transfer is completed, the client application closes the association.

MERGE_STORE_SCU is the default name for the XiO workstation's AE-Title. It can be edited to be unique for each workstation through XiO's Settings application.

3.1.2.3 Functional Definition of DRR_NET_OUT/DRR_PR_OUT

DRR and Intensity Map filming and digital image export via Secondary Capture, RT Image and DICOM print export to SCP.

When output to "Film" is selected, the XiO client application requests Print Services of one, pre-defined DICOM server over an association. If the association is accepted by the server, secondary capture images are then transferred from the XiO client to the print server. When the transfer is completed, the client application closes the association.

When output to "Network" is selected, the XiO client application requests Image Storage Services of one, pre-defined DICOM server over an association. If XiO is licensed for RT Image export, the association is requested for RT Image storage. If not, the association is requested for Secondary Capture storage. If the association is accepted by the server, the images are transferred from the XiO client to the storage server. When the transfer is completed, the client application closes the association.

3.1.3 Sequencing of Real World Activities

3.1.3.1 CT/MR/PET/SC Image; RT Structure Set; RT Plan; RT Ion Plan Import

An operator initiates the transfer of data from a system that wants to send data to XiO (CT, MR, PET machine or CT Simulator). The client application initiates the storage command for CT, MR, PET, RT Structure Set and/or RTPlan or RT Ion Plan. The XiO server receives the data and places it in a temporary disk directory on XiO.

Asynchronous to the DICOM transfer of this data, the user can import the images and structure set to create a new patient image set using XiO's PFM program or create an initial external beam plan for an existing patient by importing RTPlan in XiO's Teletherapy program.

Structure Sets can only be imported if the corresponding images are present at the same time the CT images are used to create a new XiO image set.

RTPLAN and RT ION PLAN import in Teletherapy will check for the patient ID and warn if the patient ID is different but the user can still proceed.

RT Ion Plan Import for IBA machines is not currently supported.

3.1.3.2 DRR or Intensity Map Export

Stand alone DRR image transfer is initiated by selecting the File menu in XiO's Teletherapy application then selecting Print, DRR. The user can select output to "Film" for printing or "Network" for a digital image transfer. The DRR calculation and output are performed in the background.

The host name, AE-Title and port number of one "Network" location and one "Film" location per XiO workstation must be specified in XiO's Settings, Workstation DRR output application, ahead of time.

Intensity Map transfer is initiated by selecting the File menu in XiO's Teletherapy application then selecting Print, Intensity Map. The user can select output to "Film" for printing or "Network" for a digital image transfer.

The host name, AE-Title and port number of one "Network" location and one "Film" location per workstation for the intensity map must be specified in XiO's Settings, Workstation, Intensity Map output application ahead of time.

3.1.3.3 CT IMAGE, STRUCTURE SET, RTPLAN, RT ION PLAN, RT DOSE and RT IMAGE Export

From the XiO DICOM export page in Teletherapy, the user selects which combination of DICOM objects to export (CT, STRUCTURE SET, RT PLAN, RT ION PLAN, RT DOSE, RT IMAGE) and to which DICOM location. If dose calculation is finished, all four objects will be available to export. RT Dose cannot be exported without a corresponding RT Plan; RTPlan can be exported with or without RT Structure Set. RT Structure Set can be sent with or without CT images. If no RT Structure Set is selected, the RTPlan will have RT Plan Geometry (300A,000C) set to the value of TREATMENT_DEVICE and no Structure Set will be referenced.

The user can export to multiple DICOM SCPs with host data, AE-Title and port number pre-defined in XiO's Settings | DICOM settings dialog.

3.2 AE Specifications

3.2.1 AE Specification for MERGECOM_SCP

3.2.1.1 SOP Classes

This Application Entity provides Standard Conformance to all Storage SOP Classes but only the following SOP classes are of current interest to XiO users:

Table 3.2-1: SOP Classes for MERGECOM_SCP

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	No	Yes

SOP Class Name	SOP Class UID	SCU	SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Positron Emission Tomography (PET) Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	No	Yes
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	No	Yes
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	No	Yes

3.2.1.2 Association Policies for MERGECOM_SCP

3.2.1.2.1 General

The (PDU) size proposed in an association request will default to 16K bytes and is configurable in the [ASSOC_PARMS] section of the mergecom-Linux.pro file to be anything from 2K bytes to 512K bytes using the parameter PDU_MAXIMUM_LENGTH.

3.2.1.2.2 Number of Associations

Table 3.2-2: Number of Associations as an Association Acceptor for MERGECOM_SCP

Maximum number of simultaneous associations	5

3.2.2 Association Acceptance Policies for MERGECOM_SCP

MERGECOM_SCP runs as a server in the background of the XiO main workstation (usually rtp1) listening for association requests from DICOM sources wishing to send to XiO. Associations will only be accepted from recognized IP address already entered in the /etc/hosts or Domain Name Server (DNS) file of the main XiO workstation.

3.2.2.1 MERGECOM_SCP SOP Specific Conformance for SOP Classes

All DICOM objects are accepted by MERGECOM_SCP and written to a local disk for later, asynchronous selection. XiO users are then able to import the XiO compatible objects into the treatment planning application. Errors or inconsistencies in DICOM object content will not be detected until XiO goes through its import.

See Appendices on page 20 or specific tag-by-tag data used by XiO.

3.2.3 AE Specification for MERGE_STORE_SCU

3.2.3.1 SOP Classes

This Application Entity provides Standard Conformance to the following SOP classes:

Table 3.2-3: SOP Classes for MERGE_STORE_SCU

SOP Class Name	SOP Class UID	SCU	SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Yes	No
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	No
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	Yes	No
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	Yes	No
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	Yes	No
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	Yes	No

3.2.3.2 Association Policies for MERGE_STORE_SCU

3.2.3.2.1 General

The (PDU) size proposed in an association request will default to 16K bytes and is configurable in the [ASSOC_PARMS] section of the mergecom-Linux.pro to be anything from 2K bytes to 512K bytes using the parameter PDU_MAXIMUM_LENGTH.

3.2.3.2.2 Number of Associations

Table 3.2-4: Number of Associations as an Association Initiator for MERGE_STORE_SCU

Maximum number of simultaneous associations	1

3.2.3.3 Association Initiation Policy for MERGE_STORE_SCU

3.2.3.3.1 Store CT Image, RT Structure Set, RT Plan, RT Dose or RT Image

The XiO client application requests Storage Services of a user-selected (one of five) DICOM server over an association. If the association is accepted by the server, the user-selected DICOM object combination is transferred from the XiO client to the selected server over the association. When the transfer is completed, the client application closes the association.

MERGE_STORE_SCU is the default name for the XiO workstation's AE-Title. It can be edited to be unique for each workstation in XiO's Settings menu.

Table 3.2-5: Proposed Presentation Contexts for MERGE_STORE_SCU

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
RT Ion Plan Storage	1.2.840.10008.5.1.4.1.1.481.8	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		DICOM Explicit VR Little Endian (for any private element content)	1.2.840.10008.1.2.1	SCU	None
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.3.3.2 SOP Specific Conformance for all storage SOP classes with MERGE_STORE_SCU

Except for the Study Instance and Frame of Reference UID, XiO always generates new UIDs with each new export. The Patient Name (0010,0010), Patient ID (0010,0020), Patient's Birth Date (0010,0030), Patient Sex (0010,0040), Study ID (0020,0010), Study Instance UID (0020,000D) and Frame of Reference UID (0020, 0052) will be the same for all objects exported at the same time. Specific Character Set (0008,0005) will be ISO_IR 100 for all objects.

See Appendix 2 for tag-by-tag conversion from XiO data of the DICOM modules common to all exported objects.

3.2.3.3.2.1 SOP Specific Conformance for CT Image Storage SOP Class with MERGE_STORE_SCU

The Manufacturer (0008,0070) is reported as CMS, Inc.† . The CT images are derived from incoming original images and are not original copies; the Image Type (0008,0008) will be reported as ORIGINAL\SECONDARY\AXIAL.

As of the XiO 5.00 release, the default export behavior for XiO is to export DICOM data in the original CT images frame of reference ("Original DICOM" coordinate).

If necessary, a user with administrator rights can set the export frame of reference back to the pre-XiO 5.00 type where the CT data is in a patient relative coordinate system but may not have the same origin as the original images. In this "XiO Generated" coordinate mode, the images will always be set to Head First (even if the plan is Feet First) and this "XiO Generated" coordinate will have a new frame-of-reference UID.

The CT Pixel data will have had the slope and intercept applied and therefore, at export, the images will always be 16-bit signed.

RT Structure Sets and RT Dose exported from XiO will be in the frame of reference established by the CT images- "Original DICOM" or "XiO Generated".

† CMS Inc. has been succeeded as a corporation by IMPAC Medical Systems Inc.; for sustained data compatibility with DICOM receivers that might use this name for specific import filtering or processing, we have refrained from changing the Manufacturer name in the DICOM export objects.

3.2.3.3.2.2 SOP Specific Conformance for RT Structure Set Storage SOP Class with MERGE_STORE_SCU

Original DICOM export frame of reference mode:

If the RT Structure Set is exported without the CT Images, the RT STRUCT object will reference the original UIDs for the original CT images

XiO Generated export frame of reference mode:

If the RT Structure Set is exported without the CT Images, the RT STRUCT object will reference UIDs for CT images as if XiO was exporting new CT images.

3.2.3.3.2.3 SOP Specific Conformance for RT Plan Storage SOP Class with MERGE_STORE_SCU

If RT Plan is sent without an RT Structure Set, RT Plan Geometry (300A, 000C) will be set to TREATMENT_DEVICE, otherwise the value will be PATIENT and the RT Plan will reference the RT Structure Set exported at the same time.

See Appendix 4 on page 46 for tag-by-tag conversion from XiO data for the RTPLAN IOD.

3.2.3.3.2.4 SOP Specific Conformance for RT Dose Storage with MERGE_STORE_SCU

XiO exports Dose Type tag (300A,0004) equal to PHYSICAL and Dose Summation tag (300A,000A) equal to PLAN.

RT Dose will not export without its corresponding, referenced DICOM RTPLAN. XiO will force this through the export user interface.

With this release, RT Dose is exported with Bits Allocated (0028,0100) = 16, Bits Stored (002, 0101) = 16 and High Bit (0026,0102) = 15.

XiO uses the Grid Frame Offset Vector (3004, 000C) to indicate the DICOM z value for the 3D doses. XiO supports only monotonically increasing offsets in the z direction and the values in the vector are considered relative to the Image Position Patient (0020,0032) z value.

See Appendix 5 on page 48for tag-by-tag conversion from XiO data for the RT DOSE IOD.

3.2.3.3.2.5 SOP Specific Conformance for RT Ion Plan Storage with MERGE_STORE_SCU

If any of the plan data conditions are met such that private tags are added to the RT Ion Plan object, the system will first negotiate to use the Explicit VR Little Endian transfer syntax. If the receiving device is acting as a “full fidelity storage device”, it should utilize this syntax, such that it can retain and re-transmit all the private data elements.

See Appendix 8 on page 54 for tag-by-tag conversion from XiO data for the RT ION PLAN IOD.

3.2.3.3.2.6 SOP Specific Conformance for RT Image with MERGE_STORE_SCU

If RT IMAGE is exported without the RTPLAN, then the DRR does not contain a reference to the RTPLAN and therefore the beam for which it was generated.

3.2.4 AE Specification: DRR_NET_OUT/DRR_PR_OUT

3.2.4.1 SOP Classes

This Application Entity provides Standard Conformance to the following SOP classes:

Table 3.2-6: SOP Classes for DRR_NET_OUT

SOP Class Name	SOP Class UID	SCU	SCP
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1 (DRR_NET_OUT)	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7 (DRR_NET_OUT)	Yes	No
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9 (DRR_PR_OUT)	Yes	No

3.2.4.2 Association Policies

3.2.4.2.1 General

The (PDU) size proposed in an association request will default to 16K bytes and is configurable in the [ASSOC_PARMS] section of the mergecom profile to be anything from 2K bytes to 512K bytes using the parameter PDU_MAXIMUM_LENGTH.

3.2.4.2.2 Number of Associations

Table 3.2-7: Number of Associations as an Association Acceptor for DRR_NET_OUT/DRR_PR_OUT

Maximum number of simultaneous associations	1

3.2.4.3 Association Initiation Policy for DRR_NET_OUT/ DRR_NET_OUT

3.2.4.3.1 Export DRR to film and network

When output to "Film" is selected, the XiO client application requests Print Services of one pre-defined DICOM server over an association. If the association is accepted by the server, the images are then transferred from the XiO client to the print server over the association. When the transfer is completed the client application closes the association.

When output to "Network" is selected, the XiO client application requests Image Storage Services of one pre-defined DICOM server over an association. If XiO is licensed for RT Image export, the association is requested for RT Image storage. If not, the association is requested for Secondary Capture storage. If the association is accepted by the server, the images are then transferred from the XiO client to the storage server over the association. When the transfer is completed, the client application closes the association.

Table 3.2-8: Proposed Presentation Contexts for DRR_NET_OUT

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.2.4.3.1.1 SOP Specific Conformance for SOP Classes with DRR_NET_OUT (film and network export)

3.2.4.3.1.1.1 Stand alone DRR Export as RT IMAGE or Secondary Capture (File | Print | DRR option)

Each time an image is exported, a new UID is created. Image UIDs are not persistent.

See Appendix 6 on page 52 and Appendix 7 on page 52 for tag-by-tag content of DRR and Intensity Maps as RT Image and Secondary Capture.

3.3 Network Interfaces

The merge3srv and XiO applications run over the TCP/IP protocol stack on any physical interconnection media supporting the TCP/IP stack.

3.3.1 Supported Communication Stacks

3.3.1.1 TCP/IP stack

Merge3srv is implemented (via MergeCOM-3 basic library) using the "Berkeley Sockets" interface to TCP/IP services.

The XiO client software is implemented (via MergeCOM-3 advanced library) using the "Berkeley Sockets" interface to TCP/IP services.

3.3.1.2 Physical Media Support

Any physical media supported by the TCP/IP stack being run on the host machine is supported.

4. Media Interchange

4.1 Application Data Flow Diagram

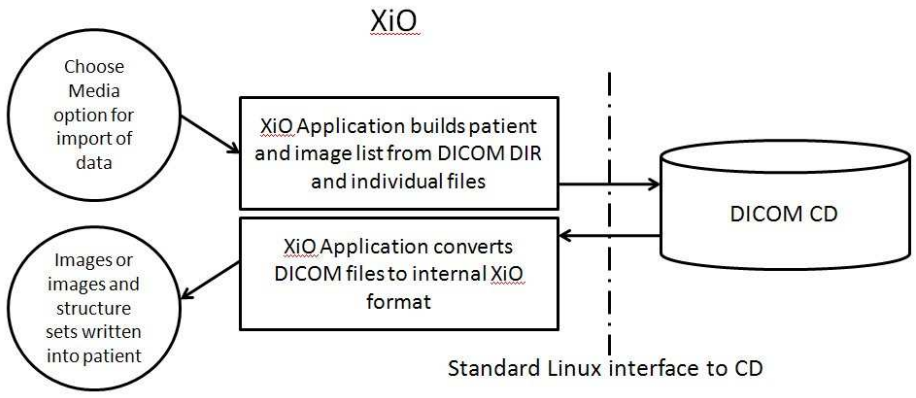

Figure 4-4 - Application Data flow diagram for Interface with a DICOM CD.

4.2 Functional Definition of MERGECOM_SCP with a DICOM media

4.2.1 CT and MR Import into XiO

The XiO system initiates the reading of the DICOM media application running on XiO. If the DICOMDIR is found, the listing of CT or MR studies is presented. The user then chooses one study to import from the media. When the transfer is complete the application closes the media. A follow-on menu then lets the XiO user import the images into the XiO application at which point they are converted to the internal XiO format.

4.2.2 CT/MR Image Import

If the DICOM header for a 16 bit CT image file defines a pixel padding value, XiO will convert all pixels equal to that padding value to the minimum pixel value that can be represented by the data type of that image. It is assumed that the CT manufacturer has selected a padding pixel value that is outside the range of the pixel values that make up the image. Pixel Padding values are ignored for MR and PET.

XiO will apply the slope and intercept to the pixel values for CT images before saving them in XiO's internal format. XiO will not apply any slope and intercept for MR images.

For PET images, the average of slope is found and applied to the entire set of images. XiO will not apply intercept for PET images.

5. Support of Extended Character Sets

As an SCU, XiO exports the extended Character Set value of ISO-IR 100 for the IMAGE, STRUCTURE SET, RTPLAN, RT IMAGE and Secondary Capture objects.

As an SCP, XiO accepts the basic and extended character set of ISO-IR 100. XiO does not validate that characters received conform to these character sets.

6. Appendices

Appendix 1 Import Processing

A1.1 Import Processing for DICOM CT, MR and PET images

The following modules, which make up the CT and MR image IOD, are read. The elements used by XiO are listed. Since XiO has no use for the unlisted elements, they are not read.

Patient Module (C.7.1.1)		
Group	**Element**	**Description**
0010	0010	**Patient Name**
0010	0020	**Patient ID**
0010	0030	**Patient's Birth Date**
0010	0040	**Patient's Sex**
0010	1000	**Other Patient ID's** If exists, imported from CT for re-export
0010	1001	**Other Patient Names** If exists, imported from CT for re-export

General Study Module (C.7.2.1)		
Group	**Element**	**Description**
0008	000D	**Study Instance UID**
0008	0020	**Study Date**
0008	0030	**Study Time**
0008	0090	**Referring Physician's Name**
0020	0010	**Study ID**
0008	0050	**Accession Number**

General Series Module (C.7.3.1)		
Group	**Element**	**Description**
0008	0060	**Modality**
0018	5100	**Patient Position** Read from CT images to establish default orientation of patient images and to establish the export frame of reference when 'Original DICOM ' frame of reference is used. During import, the system accepts only HFS, HFP,FFS or FFP; system will prompt for user to edit from any other value.

Frame of Reference Module (C.7.4.1)		
Group	**Element**	**Description**
0020	0052	**Frame of Reference UID**
0020	1040	**Position Reference Indicator**

General Equipment Module (C.7.5.1)		
Group	**Element**	**Description**
0008	0070	**Manufacturer** (used to create an initial storage location)
0008	1090	**Manufacturer's Model** (used to create an initial storage location)
0028	0120	**Pixel Padding Value**

General Image Module (C.7.6.1)		
Group	**Element**	**Description**
0020	0013	**Image Number**

Image Plane Module (C.7.6.2)		
Group	**Element**	**Description**
0028	0030	**Pixel Spacing**
0020	0032	**Image Position (Patient)**
0020	0037	**Image Orientation (Patient)**
0020	0030	**Image Position** (Retired element which is used only if Image Position (Patient) is not available)
0018	0050	**Slice Thickness**
0020	1041	**Slice Location**

Image Pixel Module (C.7.6.3)		
Group	**Element**	**Description**
0028	0010	**Rows**
0028	0011	**Columns**
0028	0100	**Bits Allocated**
0028	0101	**Bits Stored**
0028	0103	**Pixel Representation**
7FE0	0010	**Pixel Data**
0028	0106	**Smallest Image Pixel Value**

CT Image Module (C.8.2.1)		
Group	**Element**	**Description**
0008	0008	**Image Type**
0028	1052	**Rescale Intercept** This is applied to the pixel data before it is stored in XiO.
0028	1053	**Rescale Slope** This is applied to the pixel data before it is stored in XiO.

MR Image Module (C.8.3.1)		
Group	**Element**	**Description**
0008	0008	**Image Type**

PET Image Module (C.8.9.4)		
Group	**Element**	**Description**
0008	0008	**Image Type**
0028	1052	**Rescale Intercept** This is applied to the pixel data before it is stored in XiO
0028	1053	**Rescale Slope** This is applied to the pixel data before it is stored in XiO

Curve Module (C.10.2) Used to read patient contours by systems licensed for PICKER PT_XFER only		
Group	**Element**	**Description**
5000	0010	**Number of Points**
5000	0022	**Curve Description**
5000	3000	**Curve Data**

A1.2 Import Processing for DICOM RT Structure Set

The following modules, which make up the RT Structure Set IOD, are read. The elements used by XiO are listed. Since XiO has no use for the unlisted elements, they are not read.

Patient Module (C.7.1.1)		
Group	**Element**	**Description**
0010	0010	**Patient Name**
0010	0020	**Patient ID**

General Equipment Module (C.7.5.1)		
Group	**Element**	**Description**
0008	0070	**Manufacturer**
0008	1090	**Manufacturer's Model**

Structure Set Module (C.8.8.5)		
Group	**Element**	**Description**
3006	0002	**Structure Set Label** Uses to create name of temporary ***storage*** file
3006	0026	**ROI Name** Imports and uses first 25 characters of ROI Name

ROI Contour Module (C.8.8.6)		
Group	**Element**	**Description**
>3006	002A	**ROI Display Color**
>>3006	0042	**Contour Geometric Type**
>>3006	0046	**Number of Contour Points**
>>3006	0050	**Contour Data**

RT ROI Observations Module (C.8.8.8)		
Group	**Element**	**Description**
3006	00A4	**RT ROI Interpreted Type**

A1.3 Import Processing for DICOM RTPLAN

The following modules, which make up the RT Plan IOD, are read. The elements used by XiO are listed. Since XiO has no use for the unlisted elements, they are not read.

Patient Module (C.7.1.1)		
Group	**Element**	**Description**
0010	0010	**Patient's Name** Patient’s full legal name Presented as information during import. Warning issued if not the same as the patient in memory; user can override and continue.

Patient Module (C.7.1.1)		
Group	**Element**	**Description**
0010	0020	**Patient ID.** Presented as information during import. Warning issued if not the same as the patient in memory; user can override and continue.

General Study Module (C.7.2.1)		
Group	**Element**	**Description**
0008	0020	**Study Date** Presented as information during import

General Equipment Module (C.7.5.1)		
Group	**Element**	**Description**
0008	0070	**Manufacturer** Import: This data is used to pick a location for rtp1 temporary local disk storage on XiO. It has no current user interface or planning use.

RT Series Module (C.8.8.1)		
Group	**Element**	**Description**
0008	0060	**Modality** Import: must be RTPLAN.

RT General Plan Module (C.8.8.9)		
Group	**Element**	**Description**
300A	0002	**RT Plan Label** Import: This data will be presented in the plan index as a help to the user, and will be used to create the XiO filename.
300A	0006	**RT Plan Date** Import: This data will be presented in the plan index as a help to the user, but will not be stored as a studyset will already exist.
300A	0007	**RT Plan Time** Import: This data will be presented in the plan index as a help to the user, but will not be stored as a studyset will already exist.
300A	000C	**RT Plan Geometry** Import: Both PATIENT and TREATMENT_ DEVICE (e.g. X-ray simulator) will be accepted.

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	00C0	**Beam Number** Import: This will be mapped to an XiO beam number (an integer between 1 and 99).
300A	00C2	**Beam Name** Import: This will be used as the XiO beam description unless Beam Description (300A,00C3) exists.
300A	00C3	**Beam Description** Import: The first 24 characters will be used as the XiO beam description.
300A	00C4	**Motion Characteristic of Beam** If DYNAMIC, the 'Gantry Rotation Direction' will be checked that it is set to either 'CW' or 'CCW' and the beam will be marked as a rotational beam. If all necessary gantry rotation data is not present the plan import will be aborted with the error message "DICOM Plan Import was not successful. The following tags are invalid: (300A,00C4)".
300A	00C6	**Radiation Type** Only ELECTRON and PHOTON are accepted for RTPLAN modality.
300A	00B2	**Treatment Machine Name** User defined name identifying treatment machine used in beam delivery. XiO will use its DICOM import machine name mapping table to try to uniquely identify a corresponding XiO treatment machine name to use for dose calculation. If this mapping is not unique, XiO will prompt the user to pick an XiO treatment machine. If the DICOM import machine mapping is not defined in XiO, XiO will use the first 14 characters to match the imported treatment machine with an XiO treatment machine. If no machine match is found, XiO will prompt the user to pick an XiO treatment machine. If the XiO treatment machine is not of the same type as the imported machine (300A, 00C6), the user will prompted to pick an XiO treatment machine.
300A	00B3	**Primary Dosimeter Unit** Import: Not used; This is set by the XiO treatment machine.
300A	00B4	**Source-Axis Distance** Import: Not Used; This is set by the XiO treatment machine.
300A	00B8	**RT Beam Limiting Device Type** Import: This is saved as a check against the data in the Control Point Sequence (300A,0111).
300A	00BA	**Source to Beam Limiting Device Distance** Import: Not Used; This is set by the XiO treatment machine.

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	00BC	**Number of Leaf/Jaw Pairs** Import: If MLC, the value is checked that it matches the XiO treatment machine parameters; if not the import is aborted with the error message "DICOM Plan Import was not successful. The following tags are invalid: (300A,00BC)".
300A	00BE	**Leaf Position Boundaries** Import: Not Used; This is set by the XiO treatment machine.
300A	006A	**Referenced Patient Setup Number** Import: Not Used. System assumes ISOCENTRIC.
300A	00D0	**Number of Wedges** Import: Only 0 is allowed.
300A	00F0	**Number of Blocks** XiO accepts 1 APERTURE (i.e. PORT) and up to 19 SHIELDING entries or 20 *SHIELDING (i.e. B*LOCK) type blocks.
300A	00F2	**Total Block Tray Factor** Import: This is mapped to the XiO beam's tray factor. If no value supplied, XiO will use the default XiO block tray value. If no default block tray is defined, XiO will not import the plan and exit with an error message that the following tag (300A,00F2) is invalid.
300A	00F8	**Block Type** This is mapped to an XiO flag identifying XiO's polygon type where SHIELDING =BLOCK and APERTURE= PORT. XiO allows only one APERTURE per beam. If more than one APERTURE is sent then the import will be aborted with the error message "DICOM Plan Import was not successful. The following tags are invalid: (300A,00F8)".
300A	00FA	**Block Divergence** All blocks in XiO are divergent (PRESENT). If ABSENT or null value is received the user will be forced to acknowledge the message that the 'Block for beam n will be imported as a divergent block".
300A	00FC	**Block Number** This will be mapped to XiO's first available polygon number for this beam. If this will create more than 20 polygons for this beam, the import will be aborted with the error message "DICOM Plan Import was not successful. The following tags are invalid: (300A,00FC)".
300A	00FE	**Block Name** Import: If there is a Port ID this information is imported otherwise it is blank.
300A	00E1	**Material ID** Import: See note for Block Transmission.
300A	0100	**Block Thickness** Import: See note for Block Transmission.

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	0102	**Block Transmission** Import: The material ID, Block Thickness and Block Transmission are all checked to verify that valid values were sent. If any of these three tags are not valid, then SFM defaults are used for all of them, and a warning message is displayed. If any of these defaults have not been setup in SFM then the import will fail with the error message "DICOM Plan Import was not successful. The following tags are invalid: (300A,0102)".
300A	0104	**Block Number of Points** Import: This is stored as a check against the Block Data (300A,0106).
300A	0106	**Block Data** Import: This data is mapped to an XiO polygon.
300A	0108	**Applicator ID** Import: If the XiO machine does not have a matching cone ID the import is aborted with the error message "DICOM Plan Import was not successful. The following tags are invalid: (300A,0108)".
300A	0109	**Applicator Type** Import: Not Used
300A	010A	**Applicator Description** Import: Not Used
300A	0110	**Number of Control Points** Import: If more than two control points are present then the import will be aborted with the error message "DICOM Plan Import was not successful. The following tags are invalid: (300A,0110)".
300A	0114	**Nominal Beam Energy** Import: Not Used; This is set by the XiO treatment machine.
300A	00B8	**RT Beam Limiting Device Type** Import: This is checked against the value sent and stored previously. If it is different, or if it doesn't match the XiO treatment machine parameters, the import is aborted with the error message "DICOM Plan Import was not successful. The following tags are invalid: (300A,00B8)".
300A	011C	**Leaf/Jaw Positions** Import: The XiO machine’s leaves / jaw positions are mapped to these values.
300A	011E	**Gantry Angle** XiO beam's gantry angle is mapped to this value.
300A	011F	**Gantry Rotation Direction** Import: This is saved temporarily for determining the degrees of rotation for this arc beam

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	0120	**Beam Limiting Device Angle** Import: Beam's collimator angle is mapped from this value.
300A	0121	**Beam Limiting Device Rotation Direction** Import: Only NONE is accepted.
300A	0122	**Patient Support Angle** Import: The XiO beam's couch angle is mapped to this value.
300A	0123	**Patient Support Rotation Direction** Import: Only NONE is accepted.
300A	012C	**Isocenter Position** Import: This is mapped to the XiO beam isocenter; if NULL, not sent, or will end up outside the patient extent the user is prompted to enter an isocenter.

Appendix 2 Export of CT Images, RT Structure Set, RT Plan RT Dose and RT Image from XiO (common module content except RT Ion)

Patient Module (C.7.1.1)		
Group	**Element**	**Description**
0010	0010	**Patient's Name** Export XiO's DICOM Patient Name; if not available, export XiO's patient name
0010	0020	**Patient ID** Export XiO's DICOM Patient's ID, if not available, export XiO patient ID
0010	1000	**Other Patient IDs** If stored from CT, export those values, else export XiO's patient ID.
0010	1001	**Other Patient Names** If stored from CT, export those values, else export XiO's patient name.
0010	0030	Patient Birth Date **Export XiO's birth date**
0010	0040	**Patient Sex** Export **M** for male **F** for female **O** for unknown

General Study Module (C.7.2.1)		
Group	**Element**	**Description**
0020	000D	**Study Instance UID**
0020	0010	**Study ID** Export CT's value. If not available, export XiO studyset ID.
0008	0020	**Study Date** Export CT Study's creation date If not available in XiO studyset, export null.
0008	0030	**Study Time** Export CT Study's creation time If not available in XiO studyset, export null.
0008	0050	**Accession Number** Export original image's valuable if available, otherwise 1

General Study Module (C.7.2.1)		
Group	**Element**	**Description**
0008	0090	**Referring Physician's Name** Export value from CT images

RT Series Module (C.8.8.1)		
Group	**Element**	**Description**
0008	0060	**Modality** Export CT, RTSTRUCT, RTPLAN RT DOSE or RTIMAGE depending on modality being sent.
0020	000E	**Series Instance UID**
0020	0011	Series Number Export 1

General Equipment Module (C.7.5.1)		
Group	**Element**	**Description**
0008	0070	**Manufacturer** Export CMS, Inc. †
0008	1090	**Manufacturer's Model Name** Export XiO
0018	1020	**Software Versions** Export XiO's Software Version Number (X.XX.XX format)

† CMS Inc. has been succeeded as a corporation by IMPAC Medical Systems Inc.; for sustained data compatibility with DICOM receivers that might use the name for specific import filtering or processing, we have refrained from changing the Manufacturer name in the DICOM export objects.

SOP Common Module (C.12.1)		
Group	**Element**	**Description**
0008	0018	**SOP Instance UID**
0008	0005	**Specific Character Set** Export ISO_IR 100
0008	0012	**Instance Creation Date** Export: Instance Date
0008	0013	**Instance Creation Time** Export: Instance Time

Appendix 3 Export of RT Structure Set

Structure Set Module (C.8.8.5)		
Group	**Element**	**Description**
3006	0002	**Structure Set Label** Export Structure Set label
3006	0004	**Structure Set Name** Export XiO studyset name
3006	0008	**StructureSetDate**
3006	0009	**StructureSetTime**
3006	0010	**ReferencedFrameOfReferenceSequence**
>0020	0052	**Frame of Reference UID**
3006	0020	**StructureSetROISequence**
>3006	0022	**ROI Number**
>3006	0022	**Referenced Frame of Reference UID**
>3006	0026	**ROI Name**
>3006	0036	**ROI Generation Algorithm**

ROI Contour Module (C.8.8.6)		
Group	**Element**	**Description**
3006	0039	**ROI Contour Sequence**
>3006	0084	**Referenced ROI Number**
>3006	002A	**ROI Display Color**
>3006	0040	**Contour Sequence**
>>3006	0016	**Contour Image Sequence**
>>3006	0042	**Contour Geometric Type**
>>3006	0046	**Number of Contour Points**
>>3006	0050	**Contour Data**

RT ROI Observations Module (C.8.8.8)		
Group	**Element**	**Description**
3006	0080	**RT ROI Observation Sequence**
>3006	0080	**Observation Number**
>3006	0084	**Referenced ROI Number**
>3006	0085	**ROI Observation Label** Export XiO's contour name
>3006	0088	**ROI Observation Description** Export XiO's contour name
>3006	00A4	**RT ROI Interpreted Type** EXTERNAL ORGAN MARKER ISOCENTER
>3006	00A6	**ROI Interpreter** Export Null
>300C	300C	**ROI Physical Properties Sequence**
>>3006	00B2	**ROI Physical Property** Export REL_ELEC_DENSITY
>>3006	00B4	**ROI Physical Property Value** Export Electron Density value.

Appendix 4 Export of RT PLAN

The following modules, which make up the DICOM RT Plan IOD, are sent. Elements that are not supported for export from an XiO teletherapy plan are not listed. For several elements, the SFM DICOM export data function or page is mentioned. For each XiO treatment machine, the user should tailor the convention of XiO plan data to fit the receiving system's requirements by using these menus. The user can set a different machine name, define a "no wedge" ID, a constant block ID (*e.g.,* custom), a default tolerance table value, what to call IMRT beams ("static" or dynamic"), and set up a mapping of exported wedge IDs based on the wedge angle and toe direction.

RT General Plan Module (C.8.8.9)		
Group	**Element**	**Description**
300A	0002	**RT Plan Label** Export Plan ID based on combination of Course ID (if present) plus saved plan ID. If plan was in temporary status when exported, the label will be preceded by Temp.
300A	0003	**RT Plan Name** Export: If this is a permanent plan send plan ID or if it is a temporary plan with no permanent plan reference send Temporary plan number Temporary_<Temporary Plan #>. If it is a temporary plan with a permanent plan reference, send Temporary_ <Temporary Plan #>_<Plan Id>.
300A	0004	**RT Plan Description** Export Plan Description
300A	0006	**RT Plan Date** Export Plan saved on date
300A	0007	**RT Plan Time** Export Plan saved on time
300A	000A	**RT Plan Intent** Export Plan intent field from XiO if there, otherwise not exported.
300A	000C	**RT Plan Geometry** Export PATIENT unless no RT SRUCTURE SET is being exported at the same time; for that case, export TREATMENT_DEVICE

RT Prescription Module (C.8.8.10)		
Group	**Element**	**Description**
300A	0010	**Dose Reference Sequence** Only export if Prescription Site and Prescription Dose are defined for at least one fraction group. Only groups that contain both pieces of information are exported.
300A	0012	**Dose Reference Number** The number of fractions planned sets this value (the number of fractions for each fraction group is unique and therefore used here and as the Tolerance Table Number).
300A	0014	**Dose Reference Structure Type** Export "SITE"
300A	0016	**Dose Reference Description** Export XiO's Rx (prescription) Site name for the fraction group.
300A	0020	**Dose Reference Type** Export "TARGET"
300A	0026	**Target Prescription Dose** Export XiO's Rx (prescription) Total Dose

RT Tolerance Tables Module (C.8.8.11)		
Group	**Element**	**Description**
300A	0040	**Tolerance Table Sequence** Only export if Tolerance table name is defined for at least one fraction group.
300A	0042	**Tolerance Table Number** Export number of fractions for the group.
300A	0043	**Tolerance Table Label** Export XiO's Tolerance Table Name.

RT Fraction Scheme Module (C.8.8.13)		
Group	**Element**	**Description**
300A	0070	**Fraction Group Sequence** Any beams with the same number of fractions in an XiO plan will be exported as part of the same fraction group.
300A	0071	**Fraction Group Number** Export number of the Fraction Group
300A	0078	**Number of Fractions Planned** Export number of fractions for these beams.
300A	0080	**Number of Beams** Export number of beams that are part of this fraction group.
300A	00A0	**Number of Brachy Application Setups** Export 0
300C	0004	**Referenced Beam Sequence**
300A	0082	**Beam Dose Specification Point** Export Weight Point Coordinates in millimeter coordinates to first decimal place.
300A	0084	**Beam Dose** Export: If plan dose is calculated, export dose per fraction in Gy at the weight point (to the third decimal place).
300A	0086	**Beam Meterset** Export total meter set value for this beam (MU or time)
300C	0006	**Referenced Beam Number** Export XiO Beam number (an integer value between 1 and 99).
300C	0050	**Referenced Dose Reference Sequence** Exported only if Rx Site and Rx Total Dose are present in XiO for the beam's fraction group.
300C	0051	**Referenced Dose Reference Number** Export the number of fractions for this group

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	00B0	**Beam Sequence**
300A	00C0	**Beam Number** Export XiO Beam number (an integer between 1 and 99)
300A	00C2	**Beam Name** Export Field ID if present in the beam, otherwise export XiO's beam description (up to 24 characters)
300A	00C3	**Beam Description** Export XiO beam description unless treatment beam is Dynamic Conformal Arc for a Varian machine – in this case set automatically to "DMLC_ARC"
300A	00C4	**Beam Type** Export: If beam is rotational arc beam or dynamic conformal beam, put DYNAMIC. If SegMLC (i.e. IMRT beam) beam, export DYNAMIC or STATIC depending on value chosen for step-and-shoot on the DICOM Export Data page in SFM.
300A	00C6	**Radiation Type** Export: ELECTRON or PHOTON
300A	00B2	**Treatment Machine Name** Export machine ID from XiO's SFM Export customization page. This may be a different machine name than is used on XiO.
0008	1040	**Institutional Department Name** Export XiO Clinic Name
300A	00B3	**Primary Dosimeter Unit** Export units identified in XiO for this machine.
300C	00A0	**Reference Tolerance Table Number** Export Tolerance table number which will equal the number of fractions for the beam.
300A	00B4	**Source-Axis Distance** Export machine reference distance defined in XiO for this machine.
300A	00B6	**Beam Limiting Device Sequence** Export: a minimum of two and up to three collimator sequences will be sent for each beam- an X jaw pair, a Y jaw pair and MLC, if one exists. MLCX is only MLC type currently available in XiO. For an electron beam, create the X,Y jaw values from the XiO cone ID. That is, for a 6x10 cone, report a symmetric jaw value as 60 (mm) and a symmetric Y jaw value as 100 (mm).

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	00B8	**RT Beam Limiting Device Type** Export: Start with the X jaw and export settings according to plan (asymmetric versus symmetric). Create a second sequence with the Y jaw and finish with the MLCX if one is in the beam. XiO will export 3 devices when there is an MLC, even for jaw replacement MLCs.
300A	00BA	**Source to Beam Limiting Device Distance** Export beam's source to collimator distance for the X, Y or MLC collimator as appropriate.
300A	00BC	**Number of Leaf/Jaw Pairs** Export 1 if not MLC, if MLC, export value from XiO's MLC configuration file.
300A	00BE	**Leaf Position Boundaries** Export values from XiO's MLC configuration file.
300A	006A	**Referenced Patient Setup number** Will be 1 unless an SSD or Extended SSD beam is used in the plan. In this case, it will be 1 or 2 depending on the Patient Setup Sequence order for ISOCENTRIC or FIXED_SSD.
300A	00CE	**Treatment Delivery Type** Export TREATMENT
>3002	0050	**Primary Fluence Mode Sequence** Sequence only sent if the energy in the machine model has been explicitly updated to indicate that its fluence is STANDARD or NON_STANDARD. Otherwise, sequence is not exported.
>>3002	0051	**Fluence Mode** If sequence is sent, export STANDARD or NON_STANDARD as stored in the XiO machine model for this energy.
>>3002	0052	**Fluence Mode ID** If Fluence Mode is NON_STANDARD, export value stored in Fluence Mode ID for this machine for this energy.
300A	00D0	**Number of Wedges** Export 1 if wedge exists; if wedge ID exists in SFM, export 1 if there are parameters for "no wedge." Otherwise export 0. Export 0 for an electron beam Note: Although there may be no physical wedge in the beam, an entry for no wedge in XiO's export wedge mapping table means that the user wishes to report a wedge ID anyway.
300A	00D1	**Wedge Sequence**
300A	00D2	**Wedge Number** Export 1 if a wedge exists or if the user has entered a "NONE" to map to no wedge; otherwise 0.

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	00D3	**Wedge Type** The following XiO wedge terms are exported as the following DICOM terms: XiO MOTORIZED= MOTORIZED XiO FIXED=STANDARD XiO DYNAMIC= DYNAMIC XiO VIRTUAL= DYNAMIC For NONE = STANDARD
300A	00D4	**Wedge ID** Export wedge ID from SFM Wedge Mapping table if it exists; otherwise export XiO wedge ID.
300A	00D5	**Wedge Angle** Export wedge angle from SFM Wedge mapping table if one exists; otherwise, export null for no wedge or STANDARD wedge, and wedge angle for motorized, virtual or dynamic wedge.
300A	00D6	**Wedge Factor** Export XiO wedge correction factor as reported at the weight point on the source index For NONE export 1.0
300A	00D8	**Wedge Orientation** For Fixed, Virtual and EDW wedges export offset of wedge heel with respect to IEC BEAM LIMITING DEVICE coordinate system as follows XiO Heel In= 180 XiO Heel out= 0 XiO Heel Left= 270 XiO Heel Right= 90 For NONE wedge export 0 For MOTORIZED, export 0
300A	00DA	**Source to Wedge Tray Distance** Export wedge tray distance parameter from SFM machine file. For NONE do not export.
300A	00E0	**Number of Compensators** Export 1 if compensator exits otherwise 0 For XiO's Ellis and Lucite types, export 0.
300A	00E2	**Total Compensator Tray Factor** Export Compensator Tray Factor Used in beam.
300A	00E3	**Compensator Sequence**
300A	00E4	**Compensator Number** Export 1
300A	00E1	**Material ID** Export compensator material from XiO's treatment machine parameters for compensators

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	00E5	**Compensator ID** Export compensator type: Huestis, Par Scientific, decimal, from XiO's treatment machine parameters for compensators
300A	00E6	**Source to Compensator Tray Distance** Export beam's Source to compensator filter tray value from XiO's treatment machine parameters
300A	00E7	**Compensator Rows** Export number of compensator data points in the X jaw dimension
300A	00E8	**Compensator Columns** Export number of compensator data points in the Y jaw dimension
300A	00E9	**Compensator Pixel Spacing** Export: Calculate from Points Per/cm in Compensator data and project to the isocenter plane
300A	00EA	**Compensator Position** For symmetric beam export (-W/2, +L/2) For Asymmetric export (–LW, +UL) where W(width) , L(length), LW(left width) and UL(upper length) are the XiO names for the X and Y jaws of the machine
300A	00EC	**Compensator Thickness Data** XiO exports once-smeared compensator physical thicknesses at each grid location.
300A	02E1	**Compensator Mounting Position** Export PATIENT_SIDE or SOURCE_SIDE as set by the compensator details in Source File Maintenance.
300A	00ED	**Number of Boli** Export number of boli used in this beam Note: If beam is not 100% bolused or 100% unbolused, error message will be issued and the non-bolused beam only will be exported. The user must create a second beam with the desired bolused plan contribution for DICOM to recognize it
300A	00B0	**Referenced Bolus Sequence** Export all plan bolus numbers turned on for this beam as a sequence
3006	0084	**Referenced ROI Number** Export XiO's plan Bolus Number
300A	00F0	**Number of Blocks** Export total number of ports and blocks in the beam (XiO maximum is 20)
300A	00F2	**Total Block Tray Factor** Export Tray factor for beam shown in the XiO's source index
300A	00F4	**Block Sequence**

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	00F5	Block Tray ID Export tray description if defined in XiO, otherwise null
300A	00F6	**Source to Block Tray Distance** Export source to block tray distance from XiO's treatment machine parameters
300A	00F8	**Block Type** If XiO polygon flag says port, then export APERTURE otherwise SHIELDING
300A	00FA	**Block Divergence** PRESENT is currently the only supported type on XiO for photon and electron
300A	00FC	**Block Number** Export polygon number (1-20)
300A	00FE	**Block Name** Export universal Block ID from XiO SFM DICOM data export parameters page if a value has been defined; otherwise there is no export of this tag
300A	00E1	**Material ID** Export map Block material for this block if it has been defined for the aperture or block, otherwise value is null
300A	0100	**Block Thickness** Export FFT block thickness value if available, otherwise null
300A	0102	**Block Transmission** Export Block transmission as given by HVL value in a Clarkson calculated beam, otherwise null
300A	0104	**Block Number of Points** Export total polygon coordinates count
300A	0106	**Block Data** Export data stream of polygon coordinates
300A	0107	**Applicator Sequence**
300A	0108	**Applicator ID** Export the XiO cone description (a cone size in centimeters)
300A	0109	**Applicator Type** Export: ELECTRON_OPEN
300A	010A	**Applicator Description** Export XiO Cone description
300A	010E	**Final Cumulative Meterset Weight** Export: 1.0

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	0110	**Number of Control Points** Export number of control points. XiO Fixed and rotation beams with no MOTORIZED wedge or Segmented MLC (IMRT) will have 2 control points; A rotational beam has only the MU/minutes and gantry angle changing in value; a rotational beam is differentiated by the designation of beam type DYNAMIC A MOTORIZED WEDGE beam will have 4 control points: CP 0 to CP1 increment the cumulative meterset weight to the amount needed for the wedged beam; set wedge position as IN. CP1 to CP2, change wedge position from IN to OUT with no increment in cumulative meterset weight. Report the cumulative meterset weight value again at CP2. CP2 to CP 3 increment cumulative meterset weight for open part of the beam. For an arc with motorized wedge, also use 4 control points: 0 - 1: define a radiating arc with wedge IN 1 - 2: define a non-radiating segment where only the wedge moved IN to OUT 2-3 define a (reverse) radiating arc with wedge OUT. A DYNAMIC CONFORMAL beam with no wedge or a 60-degree wedge will have a control point at every export angle increment (selected in SFM) plus control point 0. For example, a 120° arc will have 121 control points. For a DYNAMIC CONFORMAL beam with a motorized wedge (that is not set for 60 degrees), there will be twice as many control points. The first half of the control points will report the arc with the WEDGE set to OUT, the second with the WEDGE set to IN.
300A	0111	**Control Point Sequence**
300A	0112	**Control Point Index**
300A	0134	**Cumulative Meterset Weight** Export Cumulative Meterset Weight (CMW) For a fixed beam MOTORIZED WEDGE, CMW at CP1 will be (MU wedged/total MU)/ Final Cumulative Meterset Weight For a Dynamic Conformal Arc beam with a motorized wedge that is not set to 60 degrees, XiO will export the treatment as a single beam describing two arcs. The value of **Final Cumulative Meterset Weight** value is reached at the end of these two arcs**.** The two arcs are described by the same number of control points. The first half of the control points reports the cumulative meterset weight to reach the OPEN field MU, the second half accumulates the meterset weights needed to add the WEDGE field MU. For a Dynamic Conformal Arc with a 60 degree motorized wedge angle, there will be one arc that accumulates the WEDGE field MU.

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	0114	**Nominal Beam Energy** Export: machine energy at Control Point 0
300C	0050	**Referenced Dose Reference Sequence** Exported only if Dose Reference Sequence (300A, 0010) is exported for the fraction group.
300C	0051	**Referenced Dose Reference Number** Export number of fractions for the beam
300A	0115	**Dose Rate Set** Only exported for non dynamic IMRT beams if Dose Rate is defined for the fraction group. For dynamic IMRT beams, the dose rate used for segmentation is exported. In all cases, only encoded for control point 0.
300A	0116	**Wedge Position Sequence** Export: used if wedge is in the beam
300C	00C0	**Referenced Wedge Number** Export: 1 if wedge in beam
300A	0118	**Wedge Position** For FIXED, NONE, EDW and VW, put IN For Motorized WEDGE, at Control Point 0 and 1, set Wedge Position to IN. At control point 2 and 3 set the wedge Position to OUT
300A	011A	**Beam Limiting Device Position Sequence**
300A	00B8	**RT Beam Limiting Device Type** Export collimator tag appropriately. A minimum of two and up to three collimator sequences will be sent for each beam- an X jaw pair, a Y jaw pair and MLC, if one exists. MLCX is only currently available MLC in XiO
300A	011C	**Leaf/Jaw Positions** Export X, Y and MLC jaw positions in IEC 1217 coordinate system
300A	011E	**Gantry Angle** Export IEC gantry angle value
300A	011F	**Gantry Rotation Direction** For rotation (arc) beam, export gantry increasing direction value from SFM beam file. For DYNAMIC CONFORMAL beam, export current value based on next gantry position. For last control point, enter "none."
300A	0120	**Beam Limiting Device Angle** Export XiO collimator value
300A	0121	**Beam Limiting Device Rotation Direction** Export: NONE

RT Beams Module (C.8.8.14)		
Group	**Element**	**Description**
300A	0122	**Patient Support Angle** Export XiO table angle
300A	0123	**Patient Support Rotation Direction** Export: NONE
300A	0125	**Table Top Eccentric Angle** Export 0
300A	0126	**Table Top Eccentric Rotation Direction** Export NONE
300A	012C	**Isocenter Position** Export: map XiO beam isocenter value in DICOM coordinate system
300A	012E	**Surface Entry Point** Export XiO beam entry point in DICOM coordinate For rotational or dynamic conformal beam, do not export
300A	0130	**Source to Surface Distance** Export SSD of the beam in DICOM coordinate system. For Rotational and dynamic conformal beams, do not export

RT Patient Setup Module (Part 3 C8.8.12)		
Group	**Element**	**Description**
300A	0180	**Patient Setup Sequence** Export: Two sequence entries if the plan uses an SSD or extended SSD beam in the plan. Otherwise one sequence.
300A	0182	**Patient Setup Number** Export 1 or 2
300A	01B0	**Setup Technique** Export: ISOCENTRIC or FIXED_SSD depending on the beams used in the plan.
0018	5100	**Patient Position** If no record of original CT Image Patient Position and patient planning position is eFOOTIN, Send FFS. Else if there is no record of original CT Image Patient Position and patient planning position is eHEADIN, Send HFS. Else if patient planning position is eFOOTIN, send original CT Image Patient Position except the first character is replaced with "F". Else if plan is head-in eHEADIN, send original CT Image Patient Position except the first character is replaced with "H".

Approval Module (C.8.8.16)

Group	Element	Description
300E	0002	**Approval Status** Export: Send APPROVED (if plan is approved); otherwise send UNAPPROVED.
300E	0004	**Review Date** Export: If Approval Status (300E,0002) is APPROVED, send the plan's last modification date.
300E	0005	**Review Time** Export: If Approval Status (300E,0002) is APPROVED, send the plan's last review time of day.
300E	0008	**Reviewer Name** Export: If Approval Status (300E,0002) is APPROVED, send physician's name.

Appendix 5 Export of RT DOSE

The following modules, which make up the DICOM RT DOSE IOD, are sent. Elements that are not supported for export from an XiO teletherapy plan are not listed.

RT Dose Module		
Group	**Element**	**Description**
0028	0002	**Number of Samples** Export 1
0020	0013	**Instance Number** Export 1
0028	0004	**Photometric Representation** Export MONOCHROME2
0028	0100	**Bits Allocated** Export 16
0028	0101	**Bits Stored** Export 16
0028	0102	**High Bit** Export 15
0028	0103	**Pixel Representation** Export 0
3004	0002	**Dose Units** Export GY
3004	0004	**Dose Type** Export PHYSICAL
3004	000A	**Dose Summation Type** Export PLAN
300C	0002	**Referenced RT Plan Sequence**
0008	1150	**Referenced SOP Class UID** Export 1.2.840.10008.5.1.4.1.1.481.2
0008	1155	**Referenced SOP Instance UID** Export the SOP Instance UID for the RTPLAN object that was exported at the same time as this dose object
3004	000C	**Grid Frame Offset Vector** First value is zero and monotonically increasing in the DICOM patient Z direction. The values in the vector are relative to the z-value of “Image Position (Patient)” (0020,0032)
3004	000E	**Dose Grid Scaling**

Appendix 6 Secondary Capture and RT IMAGE Export of DRR and Intensity Map

The following elements, which make up the DICOM Secondary Capture IOD, are sent for a DRR. Elements that are not supported for export from an XiO teletherapy plan are not listed.

Secondary Capture (DRR and Intensity Map Fluence)		
Group	**Element**	**Description**
0008	0005	**Specific Character Set** Export ISO_IR 100
0008	0008	**Image Type** DERIVED\SECONDARY
0008	0016	**SOP Class UID** 1.2.840.10008.5.1.4.1.1.7
0008	0018	**SOP Instance UID**
0008	0020	**Study Date** Export CT creation date if available; if not available, export null.
0008	0030	**Study Time** Export CT creation time if available; if not available, export null.
0008	0050	**Accession Number** Export null
0008	0060	**Modality** CT
0008	0064	**Conversion Type** WSD
0008	0070	**Manufacturer** CMS, Inc.†
0008	0090	**Referring Physicians Name** Export value stored in CT images.
0008	1090	**Manufacturer Model Name** XiO
0008	2111	**Derivation Description** Export: “XiO\<patientID\<saved plan ID>\beam number\BEV”
0020	000D	**Study Instance UID**
0020	000E	**Series Instance UID**
0020	0010	**Study ID** Export XiO’s studyset ID
0020	0011	**Series Number** Export 0
0020	0013	**Instance Number** Export 1

Secondary Capture (DRR and Intensity Map Fluence)		
Group	**Element**	**Description**
0020	0020	**Patient Orientation** See Appendix 6 for reported values algorithm
0028	0002	**Samples Per Pixel** 1
0028	0004	**Photometric Interpretation** MONOCHROME 2
0028	0010	**Rows**
0028	0011	**Columns**
0028	0100	**Bits Allocated**
0028	0101	**Bits Stored**
0028	0102	**High Bit**
0028	0103	**Pixel Representation** 0
0028	0106	**Smallest Image Pixel Value**
0028	0107	**Largest Image Pixel Value**
0028	1050	**Window Center**
0028	1051	**Window Width**
7FE0	0010	**Pixel Data**

† CMS Inc. has been succeeded as a corporation by IMPAC Medical Systems Inc.; for sustained data compatibility with DICOM receivers that might use the name for specific import filtering or processing, we have refrained from changing the Manufacturer name in the DICOM export objects.

The following elements, which make up the DICOM RT IMAGE IOD, are sent for a DRR image; exported tag values will be the same as those exported for Secondary Capture DRR except where noted below.

RT IMAGE (DRR)		
Group	**Element**	**Description**
0008	0008	**Image Type** DERIVED\SECONDARY\DRR
0008	0060	**Modality** RTIMAGE
0028	0004	**Photometric Interpretation** MONOCHROME2
3002	0002	**RT Image Label** Export the Beam Description if available otherwise, export BeamN (where N is the beam number from XiO's current plan)
3002	000C	**RT Image Plane** NORMAL

RT IMAGE (DRR)		
Group	**Element**	**Description**
3002	000D	**X-ray Image Receptor Translation** Export X, Y shift of the center of the DRR from the beam isocenter. Value of Z will be zero (i.e. at the isocenter plane)
3002	000E	**X-ray Image Receptor Angle** Export 0.0
3002	0011	**Image Plane Pixel Spacing** Export pair of values that are the same (square pixels) . Calculated as image width at isocenter divided by the number of columns
3002	0012	**RT Image Position** Export the top left corner of the image where the center of the image is 0,0
3002	0020	**Radiation Machine Name** Export XiO's DICOM export treatment machine name (use the same mapping code as RTPLAN export); if not present, export XiO's treatment machine name
300A	00B3	**Primary Dosimeter Unit** If Cobalt unit, export MINUTE, otherwise export MU. If nothing can be found, export null
3002	0022	**Radiation Machine SAD** Export SAD of the treatment machine being used for this beam (use the same mapping code as RTPLAN export)
3002	0026	**RT Image SID** Export SAD value of the treatment machine for this beam
300A	011E	**Gantry Angle** Export beam's gantry angle
300A	0120	**Beam Limiting Device Angle** Export beam's collimator angle
300A	0122	**Patient Support Angle** Export beam's couch angle
300A	0125	**Table Top Eccentric Angle** Export 0 (not used in XiO)
300A	0012C	**Isocenter Position**

RT IMAGE (DRR)		
Group	**Element**	**Description**
0018	5100	**Patient Position** If plan is Feet First read the CT patient position value, convert and export the value as follows: HFS→FFS HFP→FFP FFS→FFS FFP→FFP If plan is Head First, read the CT patient position value, convert and export the value as follows: FFS→HFS FFP→HFP HFS→HFS HFP→HFP
300C	0002	**Referenced RT Plan Sequence** Only exported if RTPLAN or RTIONPLAN is being exported with the RT IMAGE.
>0008	1150	**Referenced SOP Class UID** If beam is Proton beam, export 1.2.840.10008.5.1.4.1.1.481.8.(RT ION PLAN) Else export 1.2.840.10008.5.1.4.1.1.481.5 (RT PLAN).
>0008	1155	**Referenced SOP Instance UID** Export instance of Plan object (RT or RT ION)
300C	0006	**Referenced Beam Number** Export the beam number

The following elements, which make up the DICOM RT IMAGE IOD, are sent for an Intensity Map image; exported tag values will be the same as those exported for RT IMAGE (DRR) except where noted below:

RT IMAGE (Intensity Map Fluence)		
Group	**Element**	**Description**
0008	0008	**ImageType** DERIVED\SECONDARY\FLUENCE
3002	0040	**Fluence Map Sequence**
3002	0041	**Fluence Data Source** Export CALCULATED
3002	0042	**Fluence Data Scale** Export MU from the beam

Appendix 7 DRR and Intensity Map Patient Orientation tag (0020,0020) Reported Values

Head First plan, patient is supine
Beam at IEC 0 = L\F
Beam angle 0 < angle < 45 (beam gantry angle between zero and forty five degrees) = LP\F
Beam angle 45 <= angle < 90 (beam gantry angle from 45 degrees up to ninety degrees) = PL\F
Beam at IEC 90 = P\F
Beam angle 90 < angle < 135 (beam gantry angle between 90 and 135 degrees) = PR\F
Beam angle 135 <= angle < 180 (beam gantry angle from 136 degrees up to 180 degrees) = RP\F
Beam at IEC 180 = R\F
Beam angle 180 < angle < 225 (beam gantry angle between 180 and 225 degrees) = RA\F
Beam angle 225 <= angle < 270 (beam gantry angle from 226 degrees up to 270 degrees) = AR\F
Beam at IEC 270 = A\F
Beam angle 270 < angle < 315 (beam gantry angle between 270 and 315 degrees) = AL\F
Beam angle 315 <= angle < 360 (beam gantry angle from 316 degrees up to 360 degrees) = LA\F

Feet First plan, patient is supine
Beam at IEC 0 = R\H
Beam angle 0 < angle < 45 (beam gantry angle between zero and forty five degrees) = RP\H
Beam angle 45 <= angle < 90 (beam gantry angle from 45 degrees up to ninety degrees) = PR\H
Beam at IEC 90 = P\H
Beam angle 90 < angle < 135 (beam gantry angle between 90 and 135 degrees) = PL\H
Beam angle 135 <= angle < 180 (beam gantry angle from 136 degrees up to 180 degrees) = LP\H
Beam at IEC 180 = L\H
Beam angle 180 < angle < 225 (beam gantry angle between 180 and 225 degrees) = LA\H
Beam angle 225 <= angle < 270 (beam gantry angle from 226 degrees up to 270 degrees) = AL\H
Beam at IEC 270 = A\H
Beam angle 270 < angle < 315 (beam gantry angle between 270 and 315 degrees) = AR\H
Beam angle 315 <= angle < 360 (beam gantry angle from 316 degrees up to 360 degrees) = RA\H

Head First plan, patient is prone
Beam at IEC 0 = R\F
Beam angle 0 < angle < 45 (beam gantry angle between zero and forty five degrees) = RA\F
Beam angle 45 <= angle < 90 (beam gantry angle from 45 degrees up to ninety degrees) = AR\F
Beam at IEC 90 = A\F
Beam angle 90 < angle < 135 (beam gantry angle between 90 and 135 degrees) = AL\F
Beam angle 135 <= angle < 180 (beam gantry angle from 136 degrees up to 180 degrees) = LA\F
Beam at IEC 180 = L\F
Beam angle 180 < angle < 225 (beam gantry angle between 180 and 225 degrees) = LP\F
Beam angle 225 <= angle < 270 (beam gantry angle from 226 degrees up to 270 degrees) = PL\F
Beam at IEC 270 = P\F
Beam angle 270 < angle < 315 (beam gantry angle between 270 and 315 degrees) = PR\F
Beam angle 315 <= angle < 360 (beam gantry angle from 316 degrees up to 360 degrees) = RP\F

Feet first plan, patient is prone
Beam at IEC 0 = L\H
Beam angle 0 < angle < 45 (beam gantry angle between zero and forty five degrees) = LA\H
Beam angle 45 <= angle < 90 (beam gantry angle from 45 degrees up to ninety degrees) = AL\H
Beam at IEC 90 = A\H
Beam angle 90 < angle < 135 (beam gantry angle between 90 and 135 degrees) = AR\H
Beam angle 135 <= angle < 180 (beam gantry angle from 136 degrees up to 180 degrees) = RA\H
Beam at IEC 180 = R\H
Beam angle 180 angle < 225 (beam gantry angle between 180 and 225 degrees) = RP\H
Beam angle 225 <= angle < 270 (beam gantry angle from 226 degrees up to 270 degrees) = PR\H
Beam at IEC 270 = P\H
Beam angle 270 < angle < 315 (beam gantry angle between 270 and 315 degrees) = PL\H
Beam angle 315 <= angle < 360 (beam gantry angle from 316 degrees up to 360 degrees) = LP\H

Appendix 8 DICOM RT Ion Plan Export/Import (available only with PROTON planning license)

An RT Ion Plan object will contain the elements listed below. The import mapping is IGNORE unless otherwise specified. Data items described as NULL are zero-length items.

SOP Common Module (Part 3 C12.1) (See also Part 3 C12.1.1.2)		
Group	**Element**	**Description**
0008	0005	**Specific Character Set** Export: ISO_IR 100
0008	0012	**Instance Creation Date** Export: Instance Date
0008	0013	**Instance Creation Time** Export: Instance Time
0008	0014	**Instance Creator UID** Export: 2.16.840.1.114337
0008	0016	**SOP Class UID** Export: RT Ion Plan Storage Import: Process only if RT Ion Plan Storage or else pass to RT Plan import
0008	0018	**SOP Instance UID** Export: Plan Instance UID Referenced below <SOP Instance UID>

Patient Module (Part 3 C7.1.1)		
Group	**Element**	**Description**
0010	0010	**Patient's Name** Export: Name Import: Presented as information during import. Warning issued if not the same as the patient in memory; user can override and continue.
0010	0020	**Patient's ID** Export: Send DICOM patient ID if one exists; otherwise, send the patient ID associated with the plan. Import: Presented as information during import. Warning issued if not the same as the patient in memory; user can override and continue.
0010	0030	**Patient's Birth Date** Export: Date of birth.

Patient Module (Part 3 C7.1.1)		
0010	0040	**Patient's Sex** Export: Send M, F, or O gender mapped to M/F/O
0010	1000	**Other Patient's IDs** Export: Patient ID.

General Study Module (Part 3 C7.2.1)		
Group	**Element**	**Description**
0008	0020	**Study Date** Export: Original Study date Import: only presented as information during import
0008	0030	**Study Time** Export: Original Study time Import: only presented as information during import
0008	0050	**Accession Number** Export: Original DICOM accession number
0008	1030	**Study Description** Export: Study Description
0020	000D	**Study Instance UID** Regardless of value exported, a unique UID shared across all IODs exported simultaneously is generated and referenced below as <SU>. Export: Original Study Instance UID if one exists, otherwise send <SU>
0020	0010	**Study ID** Export: Original study ID if it exists, otherwise export studyset ID.

RT Series Module General Series Module (Defined: Part 3 C7.3.1 Defined: Part 3 C8.8		
Group	**Element**	**Description**
0020	000E	**Series Instance UID** Export Series instance UID = <Study Instance UID>.1.1
0020	0011	**Series Number** Export: NULL

RT Series Module General Series Module (Defined: Part 3 C7.3.1 Defined: Part 3 C8.8 See also: Part 3 C7.3.1.1)

RT Series Module General Series Module (Defined: Part 3 C7.3.1 Defined: Part 3 C8.8 See also: Part 3 C7.3.1.1)		
Group	**Element**	**Description**
0008	0060	**Modality** Export: RTPLAN
0020	000E	**Series Instance UID** Export Series instance UID = <Study Instance UID>.1.1
0020	0011	**Series Number** Export: NULL

Frame of Reference Module (Part 3 C7.4.1 See also Part 3 C7.4.1.1.1)		
Group	**Element**	**Description**
0020	0052	**Frame of Reference UID** Export: CT's original frame of reference UID if available; else generate a unique UID.

Frame of Reference Module (Part 3 C7.4.1 See also Part 3 C7.4.1.1.2)		
Group	**Element**	**Description**
0020	1040	**Position Reference Indicator** Export: Send original position of reference.

General Equipment Module (Part 3 C7.5.1)		
Group	**Element**	**Description**
0008	0070	**Manufacturer** Export: "CMS, Inc."† Import: If Varian, continue import, otherwise stop.
0008	1010	**Station Name** XiO workstation hostname at the time of SOP Instance UID generation. Export: Station Name
0008	1090	**Manufacturer's Model Name** Export: "XiO"
0018	1020	**Software Version(s)** Export: XiO's Software Version Number (x.xx.xx format).

† CMS Inc. has been succeeded as a corporation by IMPAC Medical Systems Inc.; for sustained data compatibility with DICOM receivers that might use the name for specific import filtering or processing, we have refrained from changing the Manufacturer name in the DICOM export objects.

RT Series (Part 3 C8.8)		
Group	**Element**	**Description**
0008	0060	**Modality** Export: RTPLAN
0008	1070	**Operator's Name** Export: Login user name
0020	000E	**Series Instance UID** Export: <Study Instance UID>.1.1
0020	0011	**Series Number** Export: NULL

RT General Plan (Part 3 C8.8.9)		
Group	**Element**	**Description**
0008	1070	**Operator's Name** Export: Login user name
0008	1150	**Referenced SOP Class UID** Export: RT Structure Set Storage
0008	1155	**Referenced SOP Instance UID** Export: SOP Instance UID of exported Structure Set
300A	0002	**RT Plan Label** Export Plan ID based on combination of Course ID (if present) plus saved plan ID. If plan was in temporary status when exported, the label will be preceded by Temp. Import : This data will be presented in the plan index as a help to the user, and will be used to create the temporary XiO filename.
300A	0003	**RT Plan Name** Export: If this is a permanent plan send plan ID or if it is a temporary plan with no permanent plan reference send Temporary plan number Temporary_<Temporary Plan #>. If it is a temporary plan with a permanent plan reference, send Temporary_ <Temporary Plan #>_<Plan Id>.
300A	0004	**RT Plan Description** Export: Plan description
300A	0006	**RT Plan Date** Export: Plan Modification Date Import: This data will be presented in the plan index as a help to the user.
300A	0007	**RT Plan Time** Export: Plan Modification Time Import: This data will be presented in the plan index as a help to the user.

RT General Plan (Part 3 C8.8.9)		
Group	**Element**	**Description**
300A	000A	**Plan Intent** Export Plan intent field from XiO if there is one, otherwise not exported.
300A	000C	**RT Plan Geometry** Export: If Structure Set was sent, send "PATIENT" or else send the "TREATMENT_DEVICE".
300C	0060	**Referenced Structure Set Sequence** Export: Send if Structure Set was sent with the RT Ion Plan.

RT Prescription Module (C.8.8.10)		
Group	**Element**	**Description**
300A	0010	**Dose Reference Sequence** Export: Only export if Prescription Site and Prescription Dose are defined for at least one fraction group. Only groups that contain both pieces of information are exported.
300A	0012	**Dose Reference Number** Export: The number of fractions planned sets this value (the number of fractions for each fraction group is unique and therefore used here and as the Tolerance Table Number). Import: not used
300A	0014	**Dose Reference Structure Type** Export "SITE"
300A	0016	**Dose Reference Description** Export XiO's Rx (prescription) Site name for the fraction group. Import: system imports the first Dose Reference Description as a prescription (Rx) site
300A	0020	**Dose Reference Type** Export "TARGET"
300A	0026	**Target Prescription Dose** Export XiO's Rx (prescription) Total Dose Import: not imported

RT Patient Setup (Part 3 C8.8.12)		
Group	**Element**	**Description**
300A	0180	**Patient Setup Sequence** Export: Always
0018	5100	**Patient Position** Export: If plan has an IBA beam and its Patient Support Type (300A,0350) is “CHAIR”, then export SITTING: Else if there is no record of original CT Image Patient Position and patient planning position is eFOOTIN, Send FFS. Else if there is no record of original CT Image Patient Position and patient planning position is eHEADIN, Send HFS. Else if patient planning position is eFOOTIN, send original CT Image Patient Position except the first character is replaced with "F". Else if plan is head-in eHEADIN, send original CT Image Patient Position except the first character is replaced with "H".
300A	0182	**Patient Setup Number** Export: 1
300A	01B0	**Setup Technique** Export: ISOCENTRIC Import: assumes ISOCENTRIC

RT Fraction Scheme (Part 3 C8.8.13)		
Group	**Element**	**Description**
300A	0070	**Fraction Group Sequence** Export: Always
300A	0071	**Fraction Group Number** Export: fraction group number. Groups are created based on common number of fractions for each beam and group numbers are assigned sequentially.
300A	0078	**Number of Fractions Planned** Export: Number of fractions from any beam in group because they are all equal.
300A	0080	**Number of Beams** Export: Number of beams in current group.
300A	00A0	**Number of Brachy Application Setups** Export: 0
300C	0004	**Referenced Beam Sequence** Export: Always
300A	0082	**Beam Dose Specification Point** Export Dose Specification Point Coordinates in millimeter coordinates to first decimal place.

RT Fraction Scheme (Part 3 C8.8.13)		
Group	**Element**	**Description**
300A	0084	**Beam Dose** Export: If plan dose is calculated, export dose per fraction in Gy at the dose specification point.
300A	0086	**Beam Meterset** Export: Number of monitor units per fraction, if they are available. Import: tag value is ignored. Spot beam monitor unit is set by the Final Cumulative Meterset Weight tag (300A,010E).
300C	0006	**Referenced Beam Number** Export: Beam number
300C	0050	**Referenced Dose Reference Sequence** Exported only if Rx Site and Rx Total Dose are present in XiO for the beam's fraction group.
300C	0051	**Referenced Dose Reference Number** Export the number of fractions for this group

Approval Module (Part 3 C.8.8.16)		
Group	**Element**	**Description**
300E	0002	**Approval Status** Export: Send APPROVED (if plan is approved); otherwise send UNAPPROVED. Import: plan will be set to UNAPPROVED
300E	0004	**Review Date** Export: If Approval Status (300E,0002) is APPROVED, send the plan's last modification date.
300E	0005	**Review Time** Export: If Approval Status (300E,0002) is APPROVED, send the plan's last review time of day.
300E	0008	**Reviewer Name** Export: If Approval Status (300E,0002) is APPROVED, send physician's name.

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
300A	03A2	**Ion Beam Sequence** Export: Send for each proton beam that is active and calculable. Import: Read all
0008	1040	**Institutional Department Name** Export: XiO Clinic Name
300A	00B2	**Treatment Machine Name** Export: Send the DICOM machine ID if one is assigned; otherwise send the XiO-assigned machine ID. Import: XiO machine ID
300A	00B3	**Primary Dosimeter Unit** Export: MU
300A	00C0	**Beam Number** Export: Beam number Import: This will be mapped to an XiO beam number (an integer between 1 and 99).
300A	00C2	**Beam Name** Export Field ID if present in the beam, otherwise export XiO's beam description (up to 24 characters) Import: This will be used as the XiO field ID and beam description unless Beam Description (300A,00C3) exists.
300A	00C3	**Beam Description** Export: Beam description (up to 24 characters) Import: The first 24 characters will be used as the XiO beam description.
300A	00C4	**Beam Type** Export: If Beam Spreading type is "spot Scanning" and Manufacturer is "IBA", send STATIC. Else, if Beam Spreading type is "spot scanning" and Manufacturer is "Varian", send DYNAMIC. Else send STATIC.
300A	00C6	**Radiation Type** Export: PROTON Import: Skip beam if not PROTON.
300A	00CE	**Treatment Delivery Type** Export: TREATMENT
300A	00D0	**Number of Wedges** Export: If beam has a wedged compensator, send 1; otherwise send 0.
300A	00E0	**Number of Compensators** Export: 0
300A	00ED	**Number of Boli** Export: 0

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
300A	00F0	**Number of Blocks** Export: If beam has a port, send 1; otherwise send 0. Import: Read
300A	010E	**Final Cumulative Meterset Weight** Export: Time/MU results. Import: import as final MU for beam
300A	0110	**Number of Control Points** Export: See Ion Control Point Sequence (300A,03A8).
300A	02EA	**Ion Range Compensator Sequence** Export: If there is a range compensator on the beam. Import: not read.
300A	02E0	**Compensator Divergence** Export: "ABSENT"
300A	02E1	**Compensator Mounting Position** Export: "SOURCE_SIDE"
300A	02E4	**Isocenter to Compensator Tray Distance** Export: The distance from the Compensator to the Isocenter.
300A	02E5	**Compensator Column Offset** Export: The column offset is sent if it is not set to zero.
300A	02E8	**Compensator Milling Tool Diameter** Export: Compensator Milling Tool Diameter
300A	02EB	**Compensator Description** Export: The Range compensator description if it is defined.
300A	0308	**Scan Mode** Export: If the beam is spot scanning, send MODULATED. If the Scan Mode (SFM) is specified as Uniform, send UNIFORM. Otherwise, send NONE. Import: skip beam if not MODULATED.
300A	030A	**Virtual Source-Axis Distances** Export: If the beam is spot scanning, send the vertical and horizontal scan reference distances; otherwise, send machine reference distance.
300A	030C	**Snout Sequence**
300A	030F	**Snout ID** Export: Snout ID. Import: read snout ID; skip beam if not valid.
300A	0312	**Number of Range Shifters** Export: If a proton beam degrader exists, send 1; otherwise send 0.
300A	0314	**Range Shifter Sequence** Export: Send if Number of Range Shifters (300A,0312) > 0. Import: Read if Number of Range Shifters (300A,0312) > 0.

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
300A	0316	**Range Shifter Number** Export: 1
300A	0318	**Range Shifter ID** Export: Send proton beam degrader ID. Import: read proton beam degrader ID; skip beam if not valid.
300A	0320	**Range Shifter Type** Export: If the proton beam is spot scanning, send BINARY; otherwise send ANALOG.
300A	0330	**Number of Lateral Spreading Devices** Export: 0
300A	0340	**Number of Range Modulators** Export: If beam is spot scanning and a ripple filter exists, send 1. If the beam is not spot scanning, send 1. Otherwise, send 0.
300A	0342	**Range Modulator Sequence** Export: send if Number of Range Modulators (300A,0340) > 0. Import: read if Number of Range Modulators (300A,0340) > 0.
300A	0344	**Range Modulator Number** Export: 1
300A	0346	**Range Modulator ID** Export: For Manufacturer “IBA” If Scan Mode (300A,0308) is NONE, send RF_Undefined. If Scan Mode is UNIFORM, send Modulator ID or Prescribed Modulation. If Scan Mode is MODULATED, send user selected Ripple Filter ID For Manufacturer not equal to IBA If Scan Mode is NONE or UNIFORM, send Modulator ID or Prescribed Modulation If Scan Mode is MODULATED, send the ripple filter ID. Import: read Ripple Filter if scan mode is MODUALTED.
300A	0348	**Range Modulator Type** Export: If beam is spot scanning, send FIXED; otherwise, send WHL_FIXEDWEIGHTS.
300A	0350	**Patient Support Type** Export: If the couch definition is chair, send CHAIR; otherwise send TABLE. Import: Use if value is sent, otherwise default to TABLE.
300A	0352	**Patient Support ID** Export: Send the couch ID if one exists, otherwise, do not send. Import: import as beam’s couch ID; skip beam if not valid.
300A	0356	**Fixation Light Azimuthal Angle** Export: If gaze data exists for an OcuPro plan, send the azimuthal angle.

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
300A	0358	**Fixation Light Polar Angle** Export: If gaze data exists for an OcuPro plan, send the polar angle.
300A	03A6	**Ion Block Sequence** Export: Send if Number of Blocks (300A, 00F0) is > 0. Import: Read if Number of Blocks (300A, 00F0) is > 0. If more than 1 block is defined, only the first block with a Block Type (300A,00F8) of Aperture will be processed. If any blocks/apertures are not processed, a warning will be displayed.
300A	00E1	**Material ID** Export: Export customized port material. Import: Same
300A	00F7	**Isocenter to Block Tray Distance** Export: Send isocenter to aperture distance plus port thickness. Import: Ignore
300A	00F8	**Block Type** Export: Aperture Import: Ignore blocks that are not APERTURES.
300A	00FA	**Block Divergence** Export: Absent Import: Ignore
300A	00FB	**Block Mounting Position** Export: PATIENT_SIDE Import: Ignore
300A	00FC	**Block Number** Export: 1 Import: Ignore
300A	00FE	**Block Name** Export: If this is defined export, otherwise do not export. ***Import: If this field is defined then import.***
300A	0100	**Block Thickness** Export: Export port thickness. Import: import block thickness
300A	0104	**Block Number of Points** Export: Export number of coordinates. Import: import number of points
300A	0106	**Block Data** Export: Export coordinates. Import: import coordinates

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
300A	03A8	**Ion Control Point Sequence** Export: If Beam Spreading type is “spot scanning” and Manufacturer is “IBA”, send two separate control points. (Specify beginning and end of each layer. Layers that have no dose contribution are not sent.) Else, if the beam is spot scanning, send all layers that are ON plus one Control Point after the last layer. For example, for N layers: NOTE: "sum" means Cumulative Meterset Weight (300A,0134) CP#0) sum=0; containing 1st layer CP#1) sum=after 1st layer; containing 2nd layer CP#2) sum=after 2nd layer; containing 3rd layer CP#N-1) sum=after (N-1)th layer; containing Nth layer CP#N) sum=after Nth layer; containing no layer Else send two items: i.e. CP#0) sum=0; containing delivery settings CP#1) sum=1.0; containing no settings Import: Read all
300A	0015	**Nominal Beam Energy Unit** Export: MEV
300A	0112	**Control Point Index** Export: Start at 0 and increment by 1 for each subsequent control point.
300A	0114	**Nominal Beam Energy** Export: If beam is spot scanning, send the Energy value converted from the prescribed range. E (MeV) = (prescribed range / 0.022)^(1.0 / 1.77) Import: Skip beam if not valid. Otherwise convert incoming Energy to prescribed range using the inverse of the formula above.
300A	011E	**Gantry Angle** Export: In first control point send the gantry angle converted from XiO to IEC coordinate system. Import: Same, converted from IEC to XiO coordinate system.
300A	011F	**Gantry Rotation Direction** Export: In first control point, send NONE.
300A	0120	**Beam Limiting Device Angle** Export: In first control point, send 0.
300A	0121	**Beam Limiting Device Rotation Direction** Export: In first control point, send NONE.
300A	0122	**Patient Support Angle** Export: In first control point, send the couch angle converted from XiO to IEC coordinate system. If a chair is used, this angle will include the addition of the chair mount angle. Import: Same converted from IEC to XiO coordinate system.

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
300A	0123	**Patient Support Rotation Direction** Export: In first control point, send NONE.
300A	0128	**Table Top Vertical Position** Export: In first control point, if set send the couch position z-coordinate transformed to the original Frame of Reference; otherwise send NULL. Import: In first control point, transform to XiO patient coordinates and use as the couch position z-coordinate.
300A	0129	**Table Top Longitudinal Position** Export: In first control point, send NULL.
300A	012A	**Table Top Lateral Position** Export: In first control point, if set, send the couch position x-coordinate transformed to original Frame of Reference; otherwise send NULL. Import: In first control point, transform to XiO patient coordinates and use as the couch position x-coordinate.
300A	012C	**Isocenter Position** Export: In first control point, send the beam isocenter transformed to original Frame of Reference. Import: Same with reverse transform if within patient volume extents; otherwise, mark for user override.
300A	0134	**Cumulative Meterset Weight** Export: If beam is spot scanning, send sum of all spot weights (Scan Spot Meterset Weights (300A,0396)) sent thus far (before current control point). For example: CP#0) 0 CP#1) sum of 1st layer CP#2) sum of 1st and 2nd layers CP#3) sum of 1st, 2nd and 3rd layers CP#N) sum of all (1st through Nth) layers Otherwise, send 0 for first control point and 1.0 for the second control point.
300A	0140	**Table Top Pitch Angle** Export: Only for the first control point. Send 0 if it is a spot-scan beam. Else, if beam Patient Support Type (300A,0014) is “CHAIR” and its Manufacturer is “IBA”, send 0. Else send the pitch angle converted to IEC. The XiO positive pitch angle is the same as IEC. Import: for the first control point, if sent, convert to XiO angle and store as the beam’s Pitch Angle. If not sent, set to the nominal Pitch Angle for the machine.
300A	0142	**Table Top Pitch Rotation Direction** Export: In first control point, send NONE. Import: not used

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
300A	0144	**Table Top Roll Angle** Export: In first control point, send table top roll angle converted to IEC . Note: For head-first plans, XiO Positive Roll Angle is in the opposite direction as the IEC. For feet-first plans, the XiO positive roll angle is in the same direction as the IEC. Import: for the first control point, if sent, convert to XiO angle and store as the beam's Roll Angle. If not sent, set to the nominal Roll Angle for the machine.
300A	0146	**Table Top Roll Rotation Direction** Export: In first control point, send NONE. Import: not used
300A	014A	**Gantry Pitch Angle** Export: In first control point, send 0.
300A	014C	**Gantry Pitch Rotation Direction** Export: In first control point, send NONE.
300A	030D	**Snout Position** Export: In first control point, send the nozzle to isocenter distance. Import: In the first control point, set the air gap to this value minus the difference between the machine reference distance and the source-to-skin distance and then added to the thicknesses of the range shifter, ripple filter, and aperture (all that applies). If any of these thicknesses is applicable, the device is attached to the snout.
300A	0360	**Range Shifter Setting Sequence** Export: Send in first control point if Number of Range Shifters (300A,0312) > 0.
300A	0362	**Range Shifter Setting** Export: If Beam Spreading type is "spot scanning" and Manufacturer is "IBA", Send 1. Else, same as Range Shifter Water Equivalent Thickness (300A,0366).
300A	0364	**Isocenter to Range Shifter Distance** Export: Send the isocenter to degrader distance.
300A	0366	**Range Shifter Water Equivalent Thickness** Export: If beam is spot scanning, send the degrader water equivalent thickness. For non-spot scanning beams, export the maximum range minus the prescribed range.
300C	0100	**Referenced Range Shifter Number** Export: 1
300A	0380	**Range Modulator Settings Sequence** Export: Send in first control point if Number of Range Modulators (300A,0340) > 0.

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
300A	0386	**Range Modulator Gating Start Water Equivalent Thickness** Export: Send water equivalent thickness (range modulator offset is 0).
300A	0388	**Range Modulator Gating Stop Water Equivalent Thickness** Export: Send water equivalent thickness (range modulator offset is the number of elements –1).
300A	038A	**Isocenter to Range Modulator Distance** Export: Send the isocenter to modulator distance.
300C	0104	**Referenced Range Modulator Number** Export: 1
300A	0390	**Scan Spot Tune ID** Export: If the beam is spot scanning, send the tune ID (sigma value). Import: Same; Skip beam if not valid.
300A	0392	**Number of Scan Spot Positions** Export: If beam is spot scanning, send number of spots with non-zero weight. Import: Determines number of spot positions and weights to read.
300A	0394	**Scan Spot Position Map** Export: If beam is spot scanning, send the x/y position in beam coordinates of each spot with non-zero weight. Import: Spot positions are read and used if within scan/field extents (width and length) specified in SFM (Skip beam if not valid.). They are not fit to a rectilinear grid. Dose will calculate but the spot weights will not be individually editable.
300A	0396	**Scan Spot Meterset Weights** Export: If beam is spot scanning and manufacturer is Varian, send spot weights corresponding to the spots in Scan Spot Position Map (300A,0394). If beam is spot scanning and the manufacturer is “IBA”, For the control point that specifies the beginning of an energy layer, send the spot weights that correspond to the spots in Scan Spot Position Map (300A,0394). For the control point that specifies the end of an energy layer, send spot weights of “0” for each spot on Scan Spot Position Map (300A,0394). Import: Same; Skip beam if not valid.
300A	0398	**Scanning Spot Size** Export: If beam is spot scanning, send spot size.
300A	039A	**Number of Paintings** Export: If beam is spot scanning, send number of paintings. Import: Same.
300A	03AC	**Ion Wedge Position Sequence** Export: Send in first control point if Number of Wedges (300A,00D0) > 0.

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
300A	00DB	**Wedge Thin Edge Position** Export: Send insertion distance for wedge.
300A	0118	**Wedge Position** Export: IN.
300C	00C0	**Referenced Wedge Number** Export: 1
300A	03AA	**Ion Wedge Sequence** Export: Send if Number of Wedges (300A,00D0) > 0.
300A	00D2	**Wedge Number** Export: 1.
300A	00D3	**Wedge Type** Export: PARTIAL_STANDARD
300A	00D4	**Wedge ID** Export: Send Wedge_XX where XX is the wedge angle in value stated in (300A,00D5) field.
300A	00D5	**Wedge Angle** Export: Send wedge angle.
300A	00D8	**Wedge Orientation** Export: Send wedge orientation angle.
300A	00D9	**Isocenter to Wedge Tray Distance** Export: Send isocenter to wedge tray distance.
300B	0010	**MOSAIQ Private Creator** Export: "IMPAC" if it is not a spot-scan beam.
300B	1002	**Maximum Collimated Field Diameter** Export: If it is not a spot-scan beam, or if it is Spot Scanning and manufacturer is “IBA” then send the maximum field diameter.
300B	1004	**Planned Distal Target Distance** Export: If Beam Spreading type is “Spot Scanning” and manufacturer is IBA, send distal layer prescribed range. Else, if it is not a spot-scan beam, send prescribed range.
300B	100E	**Nominal SOBP Width** Export: If Beam Spreading type is “Spot Scanning” and manufacturer is IBA, send difference between the prescribed ranges for the first and last layers. Else, if it is not a spot-scan beam, send the prescribed modulation.
300C	006A	**Referenced Patient Setup Number** Export: 1
4429	0011	**ACCEL Private Creator** Export: If OcuPro gaze data or seated treatment data exists, send ION_PRIVATE11.

RT Ion Beams Module (Part 3 C.8.8.25)		
Group	**Element**	**Description**
4429	110C	**Fixation Light Position** Export: If eye planning gaze data exists send the x, y, and z coordinates of the fixation position.
4429	110D	**Reference Fixation Light Azimuthal Angle** Export: if eye planning gaze data exists, export the Reference azimuthal angle received from Focal.
4429	110E	**Reference Fixation Light Polar Angle** Export: if eye planning gaze data exists, export the Reference polar angle received from Focal.
4429	110F	**Chair Back Angle** Export: send chair back angle
4429	1110	**Chair Mount Offset Angle** Export: send chair mount angle
300D	0010	**IBA Private Creator** Export: if scan mode is NONE, send value of IBA; otherwise do not export tag.
300D	1002	**Scattered Mode** Export: if scan mode is NONE, export SINGLE or DOUBLE depending on the value set in the treatment machine; otherwise do not export tag.

Appendix 9 Private Data Elements

Below is a listing of the ValueRepresentation and ValueMultiplicity for the private tags mentioned in Appendix 7 for RTIONPLAN.

Table 9.1 Private Creator Identification (IMPAC)

Tag		Attribute Name	VR	VM
300B	0010	MOSAIQ Private creator	LO	1
300B	1002	Maximum Collimated Field Diameter	FL	1
300B	1004	Planned Distal Target Distance	FL	1
300B	100E	Nominal SOBP Width	FL	1

Table 9.2 Private Creator Identification (ION_PRIVATE11)

Tag		Attribute Name	VR	VM
4429	0011	ACCEL Private Creator	LO	1
4429	110C	Fixation Light Position	FL	3
4429	110D	Reference Fixation Light Azimuthal Angle	FL	1
4429	110E	Reference Fixation Light Polar Angle	FL	1
4429	110F	Chair Back Angle	FL	1
4429	1110	Chair Mount Offset Angle	FL	1

Table 9.3 Private Creator Identification (IBA)

Tag		Attribute Name	VR	VM
300D	0010	IBA Private Creator	LO	1
300D	1002	Scattered Mode	SH	1

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