JiveX

DICOM Viewer incl. CD Viewer and Mail Viewer

User Manual

Version: 5.1

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Creation date: 15.11.2018

Regulatory:

CE 0482

JiveX is a class IIa medical device within the scope of directive 93/42/EEC.

FDA

JiveX has Section 510(k) clearance under the following number: K181964.

Prescription statement for users in the United States of America:
Caution: Federal law restricts this device to sale by or on the order of a physician.

Used symbols:

Note:
This symbol indicates special information for easier product operation or it provides other important information.

Warning:
This warning symbol indicates important safety-related information, like warnings and precautions which cannot be placed on the medical device itself.

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1 Introduction

The **JiveX DICOM Viewer** displays medical images in DICOM format according to the DICOM standard and allows for basic image manipulation. It loads data from the file system e.g. from the hard disk drive, form a network share, or from portable medial like an USB stick.

Two flavors of the JiveX DICOM Viewer support additional use cases:

JiveX DICOM CD Viewer
The JiveX DICOM CD Viewer is burned together with DICOM data on portable media like CD or DVD. It can be started from the medium without installation and thus the DICOM data can be readily viewed.

JiveX DICOM Mail Viewer
The JiveX DICOM Mail Viewer includes an e-mail client that is capable of receiving DICOM Mail messages. The contained DICOM data can be locally saved and can be viewed.

The three flavors of the DICOM viewer use the same image viewer. This is the user manual for all three flavors.

The JiveX DICOM viewer is a part of the medical device "JiveX". The intended use or indications for use respectively for JiveX are given in the next paragraph.

1.1 Intended use / Indication for use

JiveX is a software only Picture Archiving and Communication System intended to display, process, read, report, communicate, distribute, store, and archive medical data which is available as DICOM or HL7 data, including mammographic images, and bio signals. JiveX also converts case related non-image documents, archives them as DICOM data and serves as a vendor neutral archive.
It supports the physician in diagnosis.
For primary image diagnosis in Mammography only uncompressed or non-lossy compressed images must be used. Also monitors (displays) and printers which received FDA clearance for Mammography must be used.
Typical users of this system are trained professionals, including but not limited to physicians, radiologists, nurses, medical technicians, and assistants.
Note: Web-based image distribution and mobile device display of mammographic images are not intended for diagnostic purposes.
For users in the United States of America: Mobile device display is not intended for diagnostic purposes.

2 Safety Instructions

This application may not be used for reading or for therapy planning.

3 System Prerequisites

The JiveX DICOM Viewer can be used on standard desktop hardware with an up-to-date CPU equipped with a monitor with minimum screen resolution of 1280x1024 pixels. It runs on the operating systems Windows 7, Windows 8.1 and Windows 10.

4 Installation

The same installation package installs as well the JiveX DICOM Viewer and the JiveX DICOM E-mail Viewer. You may download the installation package from the VISUS web site (http://www.visus.com/de/download/free-dicom-viewer.html).

Installation procedure
Start the set-up routine with a double click
Accept the license conditions
Follow the steps in the installation assistant

Please note that you will need to switch off the UAC (User Account Control). The configuration is found in the system configuration on the "tools" tab. Slide the slider of the UAC settings all the way down.

Depending on the license key available (see chapter Licenses) different user interfaces will be available (see chapter User Interfaces)

The JiveX DICOM CD Viewer starts from the medium without installation. To speed up the application start-up the application creates files in a temp folder. If this is not possible the application start-up will take longer.

5 Starting the Application

After successful installation, you can access the JiveX DICOM Viewer from the Windows start menu. You can call up the JiveX DICOM Mail Viewer in a similar manner. After starting the application, you must first confirm a dialog with legal notes for using the viewer and the license notices.

Under MS Windows, system variables are additionally set which associate the JiveX DICOM Viewer with the MIME type "application/dicom". This means that files with the extension ".dcm", ".dc", ".dicom", ".jil" and ".dicomzip" can be opened directly with the JiveX DICOM Viewer if you double click on these in a folder in your Windows interface.

The JiveX DICOM CD Viewer starts directly from a medium (CD/DVD). Provided that your Windows allows the automatic running of CDs, it will automatically open a dialog for the license agreement. Otherwise, please start the program "Start.exe" from the root directory of the CD. After confirming the dialog for license agreement, go to the start dialog of the CD. Here, please choose the "image viewer" button. Depending on the active virus scanner/firewall, instructions for their settings are shown in addition, which must be observed in order for the JiveX DICOM CD Viewer to be started without problems.

6 Licenses

Without an imported license key, the JiveX DICOM Viewer starts as "Personal Edition", which is available for non-commercial purposes free of charge. It is, however, limited in functions and can only be used up to a time limit.

You can import a license key via the "Help" ▸ "Registry key import". Depending on the key, this enables the full extent of function of the JiveX DICOM Viewer or additionally the DICOM mail functionalities.
This procedure must be carried out only once. You can view the details of the imported license by selecting the "License" tab of the info dialog of the application, which you can call up using the "Help" menu ▸ "About ...".

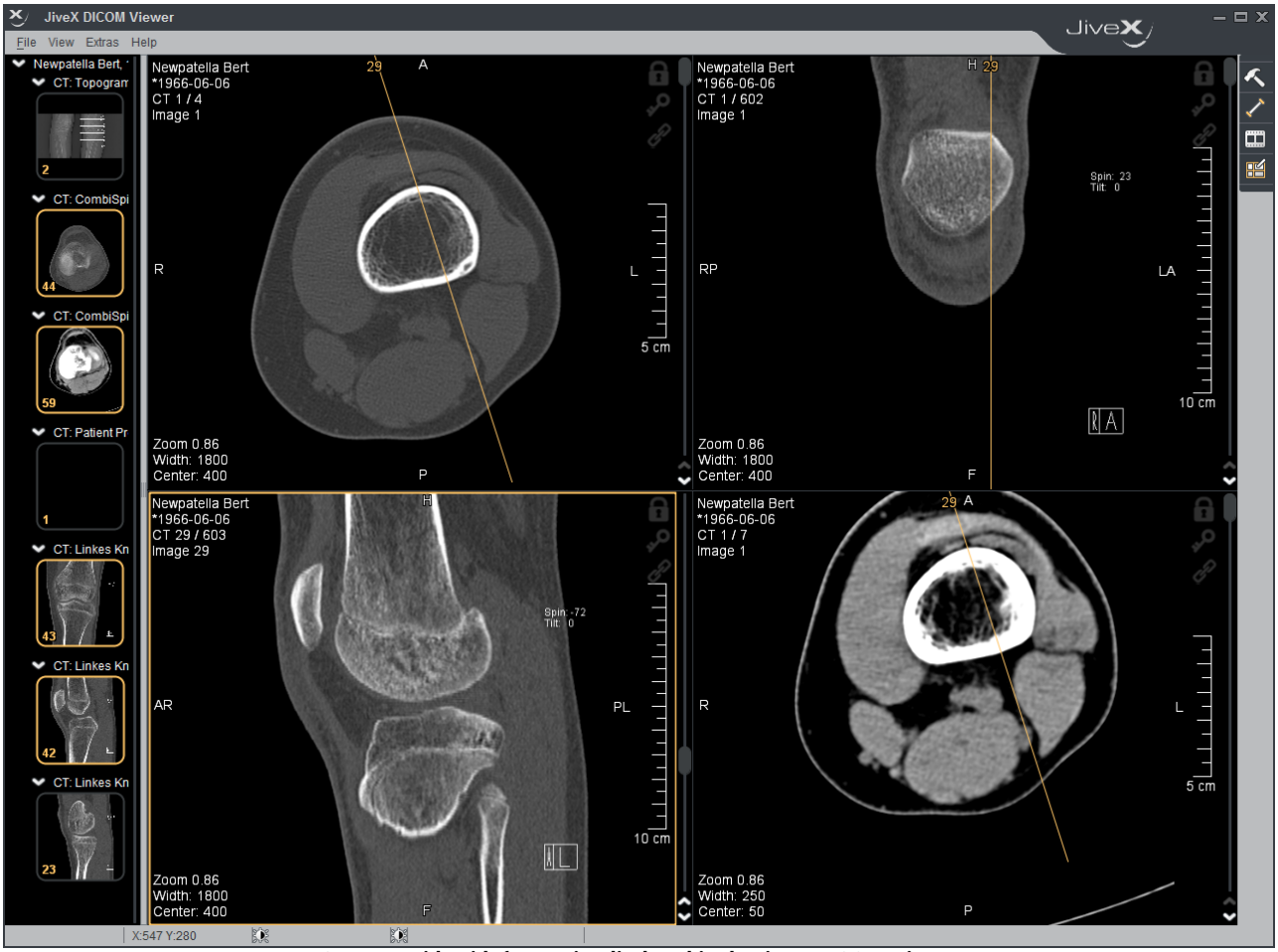
License keys can be purchased via VISUS Sales (sales@visus.com)

The JiveX DICOM CD Viewer already has an integrated license key and therefore does not require any further import of a key.

7 User Interfaces

The user interface of the JiveX DICOM Viewer consists of the menu bar on top, the preview panel at the left hand side and the function panel at the right hand side which gives access to image manipulation functions. The large central area displays DICOM images. The status bar at the bottom of the application window gives status information.

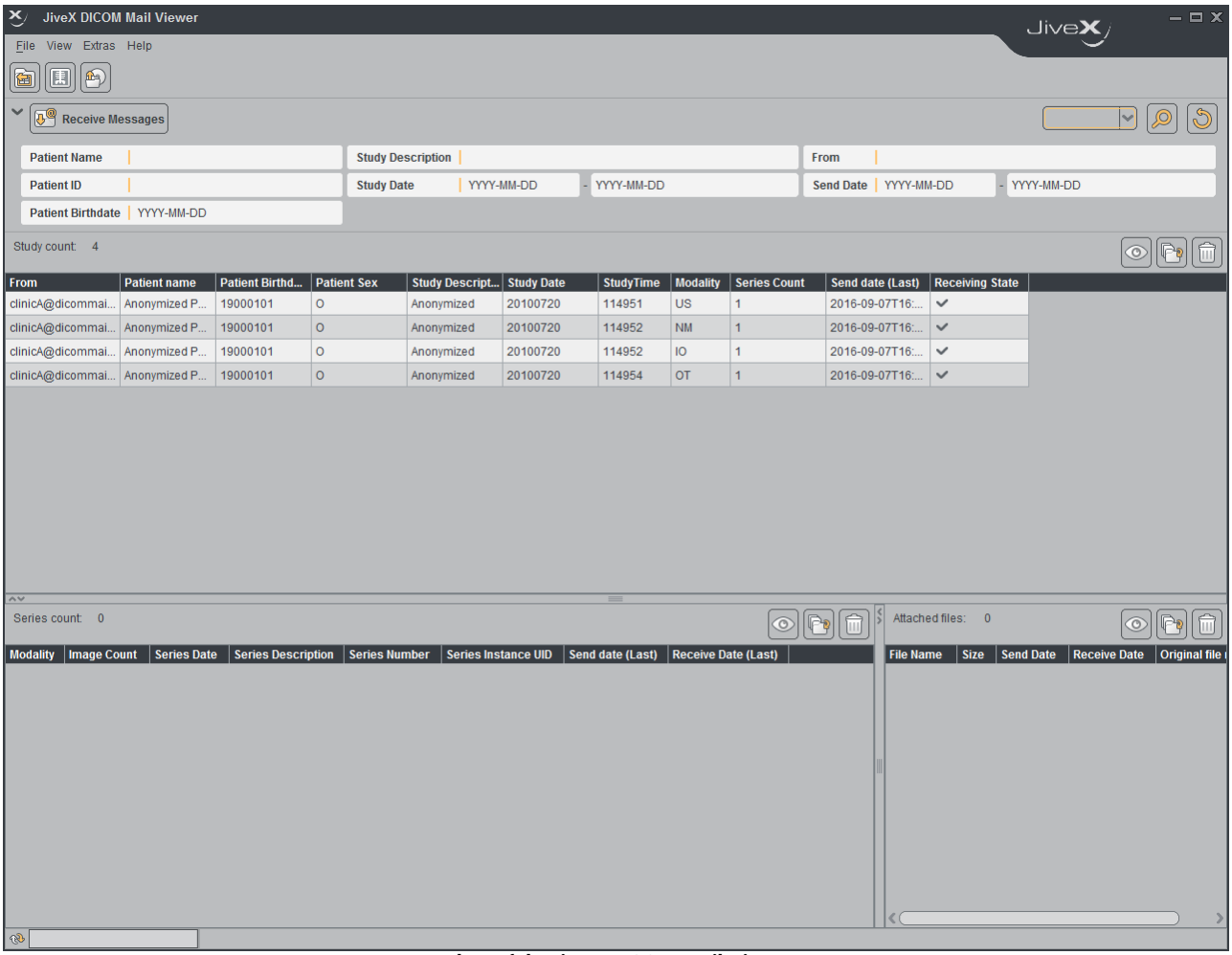
The following screen shot shows the JiveX DICOM Viewer with a CT-exam loaded.



CT exam with with four series displayed in the JiveX DICOM Viewer

JiveX DICOM CD Viewer
The JiveX DICOM CD Viewer shows a textual list of the DICOM data on the medium instead of the preview panel (see "Loading images into the DICOM CD Viewer").

JiveX DICOM Mail Viewer
In addition to the image viewer the JiveX DICOM Mail Viewer displays incoming mail in the inbox (see the following screen shot). You can switch to the inbox via the button  and return the image viewer with the button  .



Inbox of the JiveX DICOM Mail Viewer

7.1 Preview Panel

The **Preview Panel** displays a thumbnail of every image loaded in the viewer. These thumbnails are ordered by image number derived from their DICOM information. The studies of a patient are sorted by study date with the most recent study on top. When loading studies of more than one patient, the patients are separated.
Clicking a thumbnail with the left mouse button displays the image in the selected viewing section.
Thumbnails of all images currently visible in the viewing sections are displayed with an orange frame. The image over which the mouse pointer is positioned is also highlighted.
Some exams typically have many images per series (e.g. CT or MRI). For these series the preview panel shows only the thumbnail of one image in the middle of the stack. The number of images within the series is overlaid on the thumbnail.

Preview Panel

You may drag&drop images from the preview panel into viewing sections for display.

A right mouse button click will open the context menu of the preview panel. It allows to reverse the sort order of series and to remove series or studies from the image viewer.

7.2 Sichtbereich

In the upper right corner of the viewing sections, you can use the "lock" icon to fix an image and thus exclude it from processing.
You can select individual images as key images using the "key" icon. However, the marking cannot be stored in the JiveX DICOM viewers.
If you show two different series at the same time, you can link the viewing sections using the "chain" icon, see also " Synchronize image manipulations".

In the upper left corner of the viewing section, information about the patient and the series of the displayed image as well as the image number within the series can be displayed. To the right of the viewing section, a ruler can be displayed. Likewise, letters for image orientation (e.g. R = Right, A = anterior) are displayed centrally on each of the four sides.

If you press the right mouse button in the viewing section, a context menu appears. This menu offers the following options, among others:

- Selecting an already loaded series for display in the viewing section. Where several studies are loaded, the

series are displayed in a sub-menu.

- Mouse action:
  Specifying the action of the left mouse button (panning, windowing, image navigation and zoom).
- Image information:
  Image information on/off (patient information, ruler, orientation, image numbers, window level and zoom).
  Turning on/off the marking of older studies of a patient with the same modality using italics in the viewing area and in the preview panel.
- Insert/Insert in all pictures:
  If an annotation or a measurement has been copied, it can be inserted in the current image or in all images in the series.
- Topogram:
  Specifying the topogram settings (overview image, cutlines and topogram icon).
- Copy to clipboard (image, view)
- Export:
  Exporting image to JPEG, BMP, TIFF or PNG; export of matrix, series or study.
- Print:
  Print function for single images, visible matrix or series, view.
- View ▸ Series matrix:
  Choice of series matrix (comparison mode = 2x1 or single series mode = 1x1 or other matrix settings).
- Original size/Resize:
  Zoom adjustments for original size; maximize the size in the viewing section.
- Sort in ascending/descending order:
  Reverse series sorting.
- Synchronous scrolling according to orientation/image position.
- Separate series (only CT and MR).
- Window function:
  Choice of window presets (in case of more than ten window presets, the presets appear as a sub-menu)

8 Languages

The interface of the JiveX DICOM Viewer, JiveX DICOM Mail Viewer and JiveX DICOM CD Viewer respectively is available in German, English, French and Spanish. The system language of the Windows operating system is adopted at startup. The viewers always start with the English user interface on Windows systems with other language settings.

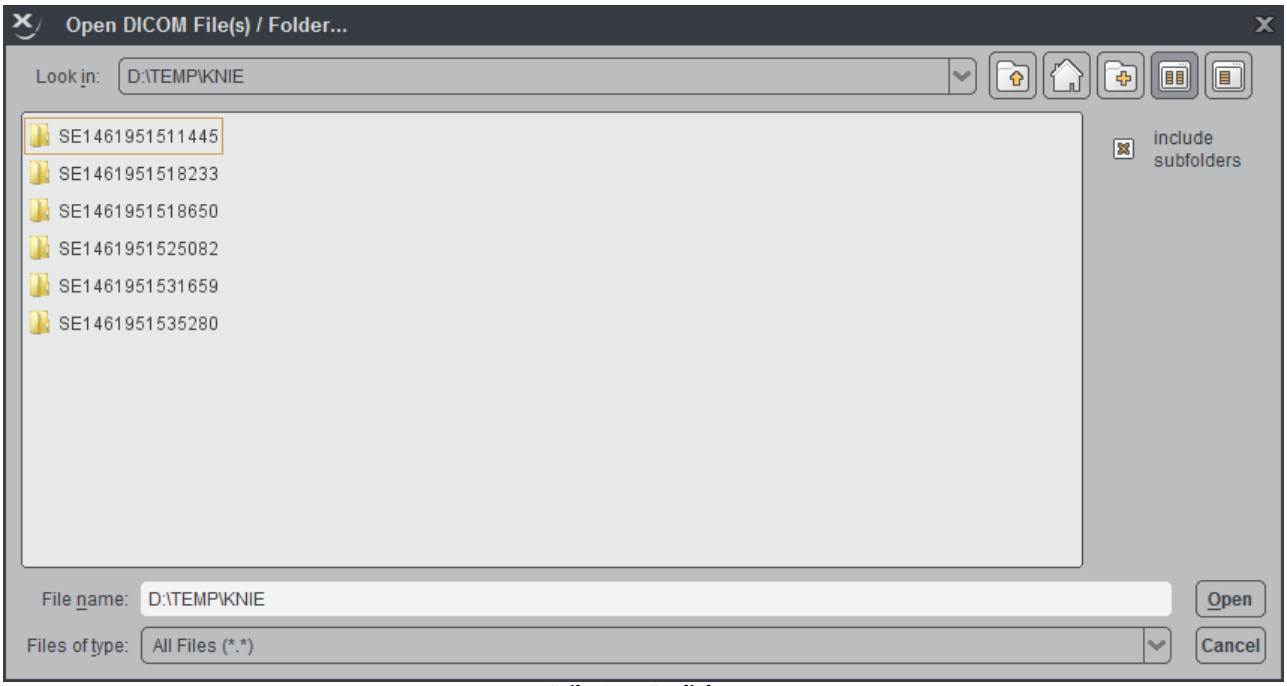
You can change the language of the user interface in the JiveX DICOM Viewer and JiveX DICOM Mail Viewer directly at startup in the dialog for legal notices or via the menu item "View" ▸ "Language". Please note that you must restart the viewer in order for the change to be implemented in all parts of the user interface. Once you have changed the language, the viewer uses your personal setting and ignores the language set by the operating system.

The JiveX DICOM CD Viewer provides no option for a permanent change of language.

VISUS partner companies can make the interface available in other languages for their customers.

9 Loading and Displaying Images

Please select the menu item "File" and "Open" in order to load DICOM images from the file system. This opens a dialog in which you can select individual images, multiple images or folders for loading.
When you select a directory, all the images within that directory are loaded and displayed. Images within the subdirectories are also loaded if the "Include sub-folders" option is selected.



"File Open" - dialog

The progress of loading is displayed in the status bar of the viewer. Displayed images can be edited even while further images are still loaded.

Loading images via "drag&drop"
You can also upload images using drag&drop from the file system. For this, drag a Windows folder with DICOM images from the operating system user interface directly into the image area of the viewer. These images are loaded in addition to already-loaded images.

An additional function for displaying images of a patient CD is available in the JiveX DICOM Mail Viewer.

When you click the  button, the JiveX DICOM Mail Viewer automatically searches the drives of your computer for loaded media and loads the DICOM images contained on them.

9.1 Loading images into the DICOM CD Viewer

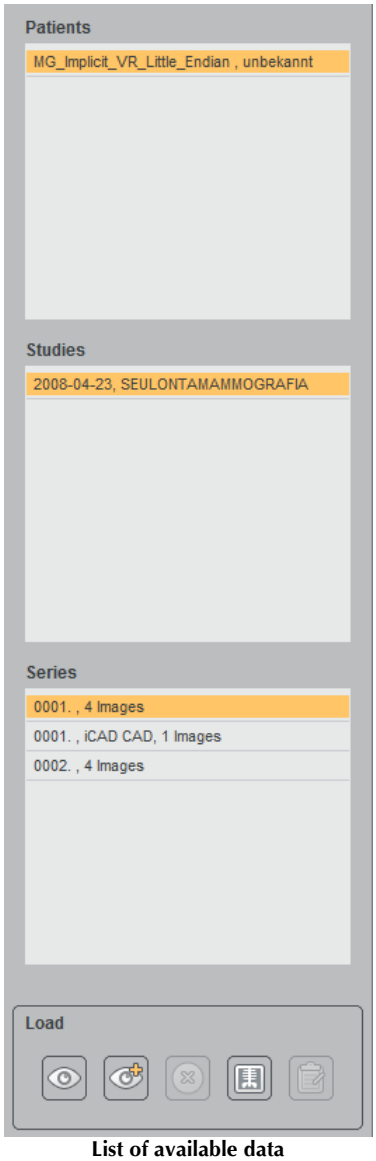
Instead of the preview bar, the JiveX DICOM CD Viewer displays a list of the content of the medium. It allows you to navigate on three levels (patients, studies, series):
At the topmost level, you can select the patients. The studies of this patient are displayed in the "studies" area of the list of contents.
If you choose a particular study in the "studies" area, the series will be shown in the "series" area.
The first study or series is selected automatically.

The JiveX DICOM CD Viewer already has an integrated license key and therefore does not require any further key import.

If image data is present in the selected study that has been marked as "key images" (i.e. images that are relevant for the diagnosis), the additional series "diagnosis relevant images" is displayed in the lowest level.

Press the button to load the selected series, replacing all data that had been loaded before. The button will load your selection in addition to data that had been loaded before.

After starting the JiveX DICOM CD Viewer, the first two series of the first study are automatically loaded in a comparison view if the CD contains more than two series.



List of available data

9.2 Receiving and Displaying DICOM Mails

The JiveX DICOM Mail Viewer combines the functionality of a (DICOM) Mail client with an image viewer.

The inbox displays a list of all incoming DICOM Mail messages. Here, not all messages are listed individually, but the data included is summarized at study level.
By clicking on the buttons and , you can change the view between the image viewer and the inbox.

Depending on the settings, messages are retrieved automatically at defined time intervals or manually by pressing the "Retrieve messages" button.
The messages are always downloaded in blocks. Only after a block has been fully downloaded and decrypted, the tables in the interface are updated. The status bar shows the process using a progress bar.

In the view of the inbox (see "User interfaces") shows three tables. The top table lists the available studies. The table in the lower-left area lists all series of the selected study. Non-DICOM files from the selected study are shown in the table at the bottom right.

For the three tables, the following functions are available:

Button	Action
	This button displays the selected studies / series in the image viewer. For non-DICOM files, this button opens the viewer linked in the system for the selected file.
	With the "Export" button, selected studies/series as well as files not based on the DICOM standard can be exported to any directory. The DICOM objects remain unchanged. This function is independent of export via the menu "File" menu ▸ "Export", which exclusively works on the images currently displayed in the image viewer.
	The selected files are deleted from the file system; the deletion cannot be undone.

9.2.1 Search DICOM Mail

The entries in the study table can be filtered by search criteria. You can show or hide the pre-defined settings using the button.

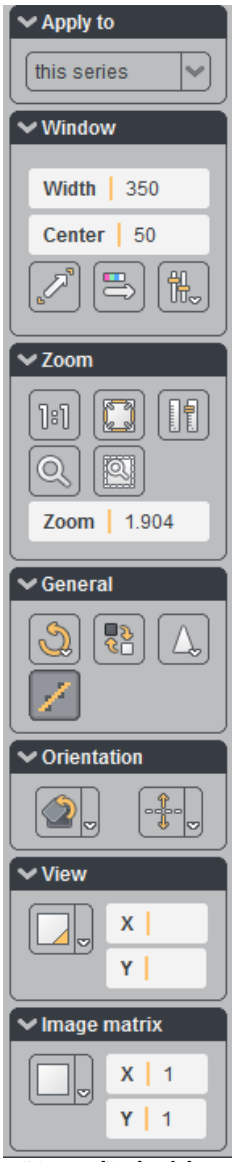
Filtering the inbox

The desired search parameters are entered in the search screen. Empty fields are ignored in the search. You can run the search using the button or by pressing the "Return" key. Use the button or the "ESC" key to reset the search mask.

10 Manipulating Images

Changing the window leveling, positioning and size of images or complete image series is possible as described in the following:

- The function panel offers respective options on the "General" tab (see Figure). Alternatively, you can manipulate the images using the mouse (see section "Setting the Mouse Action"). In the top function block named "Apply to", a selection list allows defining whether to apply the changes to "this series" or "this image".



"General" tab of the function panel

- For manipulating multiple series at the same time, you can link the respective viewing sections (see section "Synchronize image manipulations").

10.1 Windowing

Via mouse you can adjust the window level values of an image or a series. Select "Windowing" as mouse action (see section "Setting the Mouse Action"). Now click on the image or series to be manipulated. Hold down the left mouse key and pull it upwards or downwards or to the left or right side to set the desired window leveling value.

If the left mouse key is currently used for another function (e.g., "zoom") and this setting should remain unchanged, you can still change the window leveling values via mouse. For this, hold the keyboard key "W" (for "Window") pressed while moving the mouse over the image or series you want to change the window level values for.

In the function panel, the "General Settings" tab  provides multiple function blocks. From the second function block called "Window", select the window leveling options (see Figure in chapter "Manipulating Images"). Here, you can directly enter your desired numeric window level values or you can adjust them via slide bar. Furthermore, assigning grey values to "pseudo colours" is possible. Via the button  a menu is opened, providing window level presets and options to make changes to the "Window Method" and "Window Shape".

As an alternative to the typical "absolute windowing" function, use the "**Window Method**" option to perform one of the following windowing options:

- Relative offset windowing
  Using this setting, a proportional change of the window values is calculated relatively to the total grey value extent and is applied to all images of the series. This is helpful, if MRT images within a series have been acquired with different window values. For CT studies, this function is not available (the selection option is greyed out or deactivated).

- Percental windowing
  This kind of windowing method is the default setting for nuclear medicine image data (NM, PT and ST modalities) and is exclusively available for these modalities. Window level changes made to a single image will be applied to other images of the series by setting the current percentage values of the upper and lower window value for all images of the series.

Using the "**Window Shape**" option, you can select the linear, sigmoid, logarithmic or inverse-logarithmic windowing shape. Thus, you can enhance the contrast (compared with the linear windowing) either in the middle, the darker or in the brighter area of a window.

Also in the menu of the button  (in the middle area) you can select the window values predefined by modality (this is used, for example, in the mammography). The given window values are depending on the images indicated in each case and can be selected by shortly pressing key "B"; any further keystroke indicates the next proposed window preset.

In the lower area of the menu of the button  you can directly select preset window values. These are already predefined by the administrator for the concerning modality and can directly be taken over in your context menu via right mouse click in an image.

10.2 Zooming

Using the mouse you can zoom in or out of an image or series. Select the "Zoom" option as the mouse action (see section "Setting the Mouse Action"). Now click on the image or series to be manipulated. Keep the left mouse button pressed and move the mouse upwards or below for continuously zooming in or out of the image.

For an enlargement, the current mouse position is taken as center.

If the left mouse key is currently used for another function, e.g. "Windowing", and this setting should remain unchanged, zooming is still possible via mouse. For this, hold the keyboard key "Z" (for "Zoom") while moving the mouse over the image or series you want to zoom in or out.

In the function panel, the "General Settings" tab provides multiple function blocks. The third function block called "Zoom" provides multiple zoom functions (see Figure in chapter "Manipulating Images") for changing the displayed image size.

The following zoom options are provided:

Button	Description	Function of the button
	Original size	Via this button, the selected image is displayed in original size (an image pixel is presented by exactly one display pixel). For this, you can also use the key combination [ALT+1].
	Fit to draw area	Via this button, the image will be adjusted to window size. For this, you can also use the key combination [ALT+2].
	Same scale	via this button, the image will be adjusted to window size. For this, you can also use the key combination [ALT+2].
	Magnifying glass	Via this button, a magnifying glass is used in the selected image or series to magnify details. For this, you can also press key [M].
	Start ROI zoom	Via this button, a ROI (Region of Interest) is defined to view this region in the total size of the window. For this, you can also use the key combination [ALT+R].

The "Zoom" input field allows you to manually enter a zoom factor. A value of "1" reflects the original size.

10.3 Panning

Via mouse you can move an image or a series. Select "Panning" as mouse action (see section "Setting the Mouse Action"). Now click on the image or series to be manipulated. Hold down the left mouse key and pull it upwards or downwards or to the left or right side to change the image position within a viewing area.

If the left mouse key is currently used for another function (e.g. "zoom") and this setting should remain unchanged, you can still change the window leveling values via mouse. For this, hold the keyboard key "P" (for "Panning") pressed while moving the mouse over the image or series you want to move.

10.4 Reset Image Manipulations

You can reset the image manipulations of the same session by pressing the "Reset" button . The reset button is found on the "General" tab of the function panel.

To configure the reset function, press and hold the left mouse button on the "Reset" button until a configuration menu is displayed. Here the manipulations to be reset, are listed. Check the check boxes to select the manipulations to be reset when using the reset function.

10.5 Setting the Mouse Action

After an image load procedure, the left mouse button action is set to "Window Leveling" by default. You can customize the action according to your needs. Right mouse click on a Viewport. Select the required mouse action from the context menu.

The following mouse actions are available:

- Panning
- Windowing
- Image Navigation (scrolling through an image stack)
- Zooming

Holding the left mouse button down and briefly pressing the right mouse button will switch to the next mouse action, in the order shown in the context menu.
The currently activated mouse action is indicated by a little icon in the status bar at the bottom of the application window.

10.6 Application of VOI LUT

Different representation options (VOI LUTs) may be available in the images. To select one of these options, use the [v] key to successively call the VOI LUTs and to display the image accordingly.

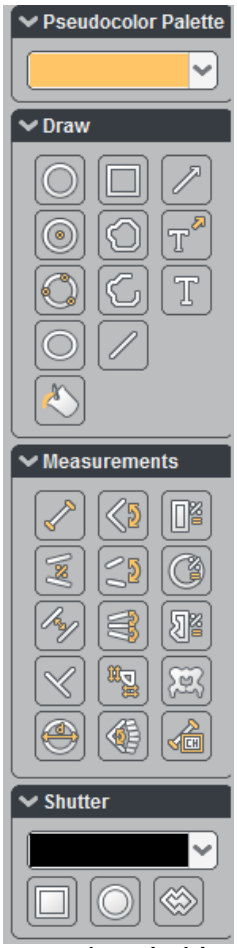
10.7 Image Sharpening

To sharpen an image you can use image filters. Open the "General functions" tab of the function panel (if necessary, this needs to be activated via the menu item "View" or the key combination [Strg]+[Shift]+[F]).
The middle section of this tab provides the "General" function group. In the top right area you find the function "Use sharpening for image display"  . A single click on the button will enable or disable the filter.

For changing the effectiveness of filters, press and hold the left mouse button on the filter button until the controls window opens.

11 Measurements and Annotations

The measurement tools and the annotation tools are provided in the "Annotations" tab of the function panel  .



Annotations tab of the function bar

For all measurements and annotations, the following applies:

- The marking color can be selected in the toolbar at the top.
- By clicking on an already drawn measurement/annotation, you can still change it.
- By selecting an already drawn measurement/annotation with the right mouse button, a menu offers further functions, e.g. for subsequently changing the color, deleting, copying. Here, deleting all annotations of an image at once is also possible.
  Furthermore, the creator of an annotation or measurement is shown. If several users have drawn measurements or annotations, you can filter per study for annotations made by a specific user.
- In order to draw exactly horizontal or vertical lines or lines at an 45 degree angle you can draw the line while holding the [SHIFT] key.

11.1 Making Measurements

Within an image, you can make measurements, e.g. measuring the distance or an angle is possible. First, select the desired measurement tool from one of the three categories (distance measurements, angle measurements and statistical measurements, see Figure in chapter "Measurements and Annotations").
This tool is, initially, used for a single measurement. For successive measurements of the same type, select the desired measurement via right mouse click. Thus, it remains permanently selected, so that you can draw any number of measurements. This selection is kept as long as the patient study is opened, until you manually choose another tool or until you manually deselect it by left click or "Esc".

11.1.1 Measuring the Distance

The length of distances is displayed in mm or in µm for microscopic images respectively. In case no size information is available in the image, the length is displayed in pixels. In such a case, you can calibrate as follows:

- Measure the length of an object of known size, e.g. a scale or catheter displayed in the image.
- Right mouse click on the created distance measurement. This will open a menu.
- Select the menu item "Calibrate pixel size" and enter the length of the object.

JiveX calculates distances mathematically exact. The display is with one decimal place. Hence the accuracy of the read out is +/- 0.05 mm or +/- 0.05 µm respectively. You can improve the accuracy of positioning the starting point or end point by zooming in. In principle, you can measure distances that are much smaller than the size of a pixel.
The accuracy of the measurement in total is dominated by the accuracy of the imaging modality, which typically is lower than the actual image resolution. While it is possible to perform sub-pixel distance measurements as stated above, it is rarely meaningful.

The following distance measurements are available:

Icon	Measurement	Performing the Measurement
	Distance Measurement	Mark the start and end point of the distance to be measured. After completion, the distance is displayed. For selecting the distance measurement tool to be active, you can also press key [D] and then perform the measurement.
	Line Relation Measurement	Draw two lines with four clicks. Now, the distances of the lines are displayed as well as the ratio of the shorter to the longer distance. This measurement is, e.g., suitable for stenosis measurement and is display as "CT Ratio" (Cardio Thoracic Ratio), whereby the degree of narrowing is given in percent.
	Parallel Lines Measurement	Draw two lines with three clicks (start and end point of the first line and start point of the second line - the rest will be automatically completed). The distance between the two lines is displayed.
	Plumb Line	Mark the start and end point of a distance. Now, a third plumb line is automatically drawn. You can determine the position and length of this distance by clicking again. The length of the plumb line is displayed.
	Chiropractic Pelvic Bone Measurement	This measurement is used for diagnostic investigation of pelvic misalignment using X-rays. Draw a line between both of the femoral heads. Now, a plumb line is displayed which you can fix via click on the center of the sacrum. After this, parallel lines are displayed. When selecting the lines, you can freely move them around, according to the anatomy. The distances between these lines are displayed. Following this, a point is marked. Move this point on the pubic symphysis. Here, the distance to the center of the sacrum is displayed.

	Diameter Measurement	First, determine the center of the circle to be drawn via mouse click. Then, click on another point that is to position on the circumference. The circle is drawn now and the diameter is shown.
	Charrière Distance Measurement	The diameter of a cannula or of a catheter is often expressed in the "Charrière" unit. In contrast to the usual circle measurement, here the measured value is given in Charrière (1mm corresponds to 3 Charrière).

11.1.2 Measuring an Angle

Angles are displayed in degree with one decimal place. JiveX calculates distances mathematically exact. The accuracy of the read out is +/- 0.05 degree.

The following angle measurements are available:

Icon	Measurement	Performing the Measurement
	Angle Measurement	Mark the vertex and the corner points of the two arms of the angle. The smaller angle between the two arms will be displayed.
	Open Angle Measurement	For this angle measurement, the two arms do not have to meet at the vertex point. The angle between any successively drawn straight lines will be measured.
	Open Three-Way Angle Measurement	Draw three straight lines one after the other by marking the start and end point of each line. Now, the angles between line one and two and between two and three are displayed.
	4-Point Angle Measurement	First, draw two lines. Now, their midpoints are automatically connected (straight line 1). Repeat this procedure with two further lines whose midpoints will also be automatically connected (straight line 2). The angle between the two straight lines drawn by JiveX is displayed.
	Cobb Angle Measurement	The Cobb Angle Measurement is used for spinal curvature measurements and is comparable to the Open Angle Measurement. The angle between two vertebrae with the strongest tilt within the spinal curvature is measured. Draw two straight lines along these vertebrae; these are the vertices. Due to the spinal curvature, these two vertices would meet, usually outside of the image. The intersecting point corresponds to the angle of the two plumb lines deriving from the vertices. The angle between these plumb lines is displayed.

11.1.3 Statistical Measurements and Measurments of Area

For statistical measurements you can define a region for collecting statistical data on the signal intensity of individual pixels. The following values are displayed:

- Avg = Average Value
- Min = Minimum Value
- Max = Maximum Value
- Std. Dev = Standard Deviation
- Median = Median Value

On CT images values are given in Hounsfield units (HU), on all other images without unit. Avg and Std.Dev are displayed with two decimal points, all other quantities as whole number.

The area of the drawn contour is displayed in mm^2 with two decimal points or in μm^2 for microscopic images respectively. In case no size information is available in the image, the area is displayed as the number of pixels in the contour.

The polygon statistic measurement calculates the area and the signal intensities based on the pixels within the contour. A pixel is considered within the contour if the center of the pixel is within the contour. The area is calculated as the total area of all pixels within the contour.
With contours that include only few pixels, e.g. 3x3 mm on a CT image, the measurement results seem to change erratically with small changes of the contour. This happens if one or more center points of pixels enter or leave the contour due to small changes in the contour itself or in its position. As a result two contours that look very similar can have very different evaluation results.
Also the accuracy of drawing small contours is low. As a result the reproducibility and the significance of statistic measurements is low when measuring close to the resolution limit of the imaging modality.

Three different measurement tools are available:

Icon	Measurement	Performing the Measurement
	Statistic Measurement	Using this tool, you can draw a rectangle. The first click defines the upper left-hand corner, the second click defines the lower right-hand corner.
	Circle Statistic Measurement	Using this tool, a circle is drawn. The first click defines the center of the circle, with the second click the radius is defined. For selecting the circle statistic measurement for being the active measurement tool, you can first of all press the [R] key.
	Polygon Statistic Measurement	Using this tool, you can draw any polygon. With each click you define a corner point. Via double-click, the drawn contour will be continued to the start point and will thus be finished.

11.2 Annotating an Image

For drawing an annotation, e.g. a circle annotation, in an image, select the "Annotations" tab on the function panel and click on the desired annotation. The selection generally applies to a single annotation only. For drawing multiple similar annotations one after another, select the desired type of annotation by right mouse clicking it. Thus, this annotation type is permanently selected and drawing as many annotations of the same type as desired is possible, as long as the patient study is opened and another tool will not been selected manually.

The following annotation types are available:

Icon	Annotation	Drawing an annotation
	Circle annotation	First, via mouse click, define the center of the circle to draw. Then, specify another point on the circumference of the circle by mouse clicking it. This will draw the circle. For selecting the circle annotation for being the active annotation type, you can also use the key combination [Alt]+[W].
	Rectangle annotation	Click in the left upper corner to mark it. Then, define the right lower corner with another click.
	Arrow annotation	First, mark the arrow's start point with a click, then set the arrowhead with a second click. For selecting the arrow annotation for being the active annotation type, you can also use the [F] key.
	Circle annotation with center point	This drawing compares with the "Circle annotation" (see above). In addition, the circle center is displayed.
	Closed freehand annotation	This function allows you to draw any polygon. With every click you define a corner point. Once you double-click, the contour drawn will be continued up to the start point, so that the contour is completed.
	Text annotation with	In the just opening text field, you can enter the desired text. Then, confirm the

	anchor point	dialog and mark the point where the text is to appear. From the text, an arrow starts. The arrowhead is set by another click. For selecting the text annotation with anchor point for being the active annotation type, you can also use the key combination [Alt]+[F].
	Circle annotation from three given points	For drawing a circle, mark any three points on the desired circle line, e.g. on a femoral head. In contrast to the circle annotation, searching for a center is not necessary.
	Open freehand annotation	Use this annotation to draw a line through multiple corner points. Via a simple click, you can set a corner point; a double-click will complete the line. The finishing point is not linked to the starting point.
	Text annotation without anchor point	In the text field that opens, enter the desired text. Then, confirm the dialog and mark the point where the text is to appear. For selecting the text annotation for being the active annotation type, you can also use the key combination [Alt] +[T].
	Ellipse annotation	Making two clicks, you can draw an ellipse in vertical or horizontal orientation.
	Line annotation	This annotation allows you to draw a line.

12 Reading MR and CT Studies

CT and MR image series usually consist of many images. The number of slices contained in a series is displayed in the preview bar.

Navigating Images

- **Fast image navigation:** In order to quickly navigate to another region within the stack of slices press and hold the right mouse button and move the mouse upwards or downwards. In the interest of high navigational speed individual images may be skipped from display. Alternatively, you can use the scroll bar provided next to a series area.
- **Mouse wheel:** you can navigate from one image to the next by scrolling the mouse wheel. The system will not make sure that all individual images are displayed when scrolling the mouse wheel very fast.
- **Cursor keys (arrow keys):** [Cursor up] displays the previous image of the series; [Cursor down] displays the next image. Scrolling with arrow keys makes sure each individual image is displayed.

When scrolling with the mouse wheel it is possible to reach the performance limit of the client hardware. In this case JiveX does not display all images that have been scrolled. Depending on the size of the display (e.g. 1x1 layout on a 5 mega-pixel monitor) and depending on the performance of the hardware and its workload individual images may be dropped from display also with a scrolling speed well below 30 frames per second. Dropping one image from display could remain unnoticed in case that successive images are very similar (e.g. CT thin slices). As a consequence a finding, relevant for reporting, may be missed. When scrolling through a stack of images using the mouse wheel with high speed the reading physician needs to make sure that he saw all images. Preferably the performance of the client hardware should be scaled to support the size of the monitor. Whether hardware and display match should be tested thoroughly by checking whether all images are displayed when operating in demanding reading scenarios. As an alternative the arrow keys of the keyboard can be used for scrolling. For these JiveX makes sure that all scrolled images are displayed.

Navigating series

- **Mouse wheel:** Navigation across series is possible by pressing the right mouse button while scrolling the mouse wheel. This will display each loaded series in the order shown in the preview bar.
- **Cursor keys (arrow keys):** [Cursor left] jumps to the previous series; [Cursor right] jumps to the next series.

12.1 Image Orientation

If the displayed image contains orientation information, this information is displayed at the edges and in the middle, using a capital letter; it adapts to rotation and flip operations. The following letters are used:

A - Anterior
P - Posterior
L - Left
R - Right
H - Head
F - Foot

The entry "Annotations" ▸ "Image Orientation" of the context menu shows or hides the orientation letters.

12.2 Displaying Cutlines

When displaying multiple section image series with different orientations in the Image Viewer, displaying Cutlines is helpful. If you navigate within a viewport and look at individual slices, then, in the other viewports, the slice you just look at will be symbolized by a line, making spacial orientation easier.

For showing or hiding Cutlines, use the shortcut [Alt]+[C]. Alternatively, use the option "Show Cutlines" provided by the context menu item "Cutlines".

12.3 Using the Position Synchronization Function

To quickly find a certain image area again in other series of the same study, for example, a discovered lesion, use the position synchronization function ("3D cursor"). The area at which the cursor points in the just focused series is indicated and marked in all other series. If necessary, it is automatically navigated to the slice concerned.

To automatically synchronize the position of the mouse cursor, press key [3] of the keyboard. While holding this key, you can further move the mouse or navigate through the series. The display of the other series will automatically be adapted.

12.4 Synchronize image manipulations

In order to perform manipulations in multiple viewing sections synchronously, link the respective series sections.

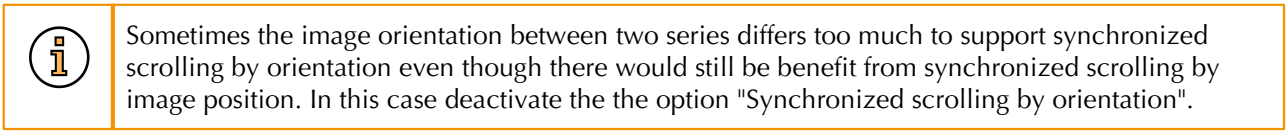
Within linked viewing sections all manipulations (navigation, zooming, panning, rotation, mirroring and inversion) done in one viewing section will automatically be applied to all other linked viewing sections.

- Within viewing sections there are three water marks in the upper right corner. The bottom most water mark shows a chain symbol. Click the chain symbol of the viewing sections to be linked with the left mouse button. The water mark is highlighted in the respective viewing section to show the linking. To remove one viewing section from the group of linked viewing sections click the chain symbol again.
- All displayed series can be linked by pressing the [T] key on the keyboard. Press this key again to unlink.

Additional options
There are additional options with regards to synchronizing manipulations available. These options can be activated in the context menu opened with a right mouse button click on any viewing section. To activate one or several of the options "Synchronized scrolling by image position", "Synchronized scrolling by orientation", and "Synchronized windowing" check the check boxes at the menu entry.

- **Synchronized scrolling by image position**
  With the option "Synchronized scrolling by image position" checked all viewing section will be scrolled to show images with the same image position. This option does only work on series within one study.

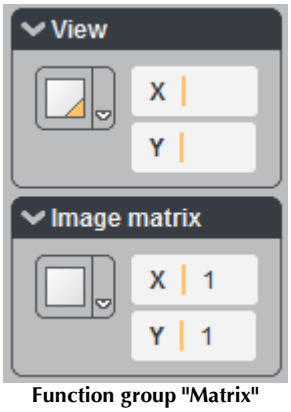
- **Synchronized scrolling by orientation**
  The option "Synchronized scrolling by orientation" restricts the synchronized scrolling to the series that have a similar orientation as the focused series (i.e. the series that is actively scrolled). As a standard the options "Synchronized scrolling by image position" and "Synchronized scrolling by orientation" are used together.



- **Synchronized windowing**
  If, for linked series, you want to apply the absolute window values of the focused image to all linked series, check the option "Synchronized windowing".

13 Changing the viewing matrix

In the toolbar, a function group is available for changing the display matrix (see figure below). This allows you to set the series matrix and the image matrix.
In the two input fields for the respective areas, you can enter the number of rows and columns. These are applied by confirming with the "Enter" key. By clicking on the "Image matrix" or "View" button, you can select a set of predefined views (e.g. 1x1, 2x1, 1x2, 2x2, 2x3, 3x3, ...). The predefined views can define both uniform and non-uniform divisions of the image viewer.



Function group "Matrix"

14 Full screen

If you double click on an image displayed within the viewing area of the JiveX DICOM Viewer, the viewer switches to a full screen display. In full-screen mode, only one image stack is displayed, in a 1x1 view (see "Changing the viewing matrix").
By double-clicking again, you can switch the viewer back to normal display mode.

15 Cine

The "Cine" tab in the function panel offers you functions with to play back images in the image viewer like films. You can adjust the playback speed using sliders. It can be played back optionally both forward and backward. Upon reaching the last (first) image, the playback can be repeated.

Cine tab of the function panel

Pressing the "Start" button starts the playback. Clicking on the "Stop" button stops the playback.

The slider allows you to vary the playback speed. If a playback speed is specified in the image data, it is set as the default value for the slider. You can restore this default playback speed by pressing the button.
The actual playback speed will be displayed above the slider while playing. Using the slider, you can specify the desired value. The playback speed actually achieved may be lower in slower hardware. In this case, the playback speed actually achieved is displayed in red.

Using the "Multi-frame Autoplay" button, you can control whether multi-frames should be played back

automatically when selecting via the navigation buttons on the Cine tab (or in the optionally visible toolbar in full-screen mode).

Using the  "multi-frame cycle" button, several multi-frames can be played within a series as a sequence. You no longer need to select the individual multi-frames in order to start its playback individually. In this mode single frame DICOM images (non-multi-frames) within the series are skipped.
The "multi-frame cycle" button will only be enabled and can only be selected if a multi-frame image is focused.

If the  "Same speed" button is selected, all multi-frames are played at the same speed.
Otherwise, the playback speed for each multi-frame can be set separately.

By using the "Show ECG" button, an ECG graph additionally contained in the image data can be displayed, which is played in sync with the images. The "Show ECG" button is enabled only if the image data contain ECG data (e.g. XA images).

Several image stacks can be played simultaneously. To do this, you have three setting options:

Graphic symbol	Meaning	Explanation
	Focused play	The focused image is played
	Linked play	All images are played, that are linked
	Visible play	All images are played, that are on display

16 Printing

The JiveX DICOM Viewer allows printing on paper printers. It is possible to print single images, the currently displayed image, the image matrix or an entire series.

Print outs on paper may not be used for diagnosis.

To start a print job, click on the desired image. The print menu  can be opened via the print option provided by the main menu or the context menu. Select the object you want to print (image, matrix, view or series) and the print preview will open.
For printing a single image, the print menu can be opened via the keyboard shortcut [CRTL]-[P].

The print preview offers the following options:

- Define general print settings (printer selection, page format, dpi resolution)
- Set the print space for images and the background color
- Adjust image matrix
- Window leveling, zooming, and panning
- Dispatch the print job and and closing the application

17 Copying to the Clipboard

Image data (JPEG) can quickly be exported via the clipboard. Drawn annotations and patient and study information is also copied.

To **copy a view or an image to the clipboard**, the following options are provided:
- Use the context menu (right mouse click on the image). Select the "Copy to clipboard" option first, then select the object to copy (image/view).
- For copying an image to the clipboard use the key combination [Ctrl]+[C].
- For copying a view to the clipboard use the key combination [Ctrl]+[Alt]+[C].

To insert the copied object (image, view) into a document, the following options are provided:
- Use the key combination [Ctrl]+[V].
- Press the "Insert" button.

18 DICOM Mail

The DICOM Mail functionalities described below require a "JiveX DICOM Mail Viewer" license. By acquiring and importing a corresponding license, a JiveX DICOM Viewer is expanded by the DICOM Mail functionalities in additional user interfaces. A "JiveX DICOM Mail Viewer" license cannot be imported into a "JiveX DICOM CD Viewer".

DICOM Mail is the exchange of DICOM objects using standard email protocols. This is based on the recommendation of a working group of the German Radiological Society (DRG). It describes the use of the DICOM MIME type (Suppl. 54 of the DICOM standard in release 3.0) enhanced with encryption and the confirmation of receipt. The encryption uses the OpenPGP standard.

The JiveX DICOM Mail Viewer can receive DICOM Mail messages, store them locally and view them and send acknowledgments. Sending DICOM objects is not intended. Export in DICOM format is possible. In this way, the image data received is also available to other applications.

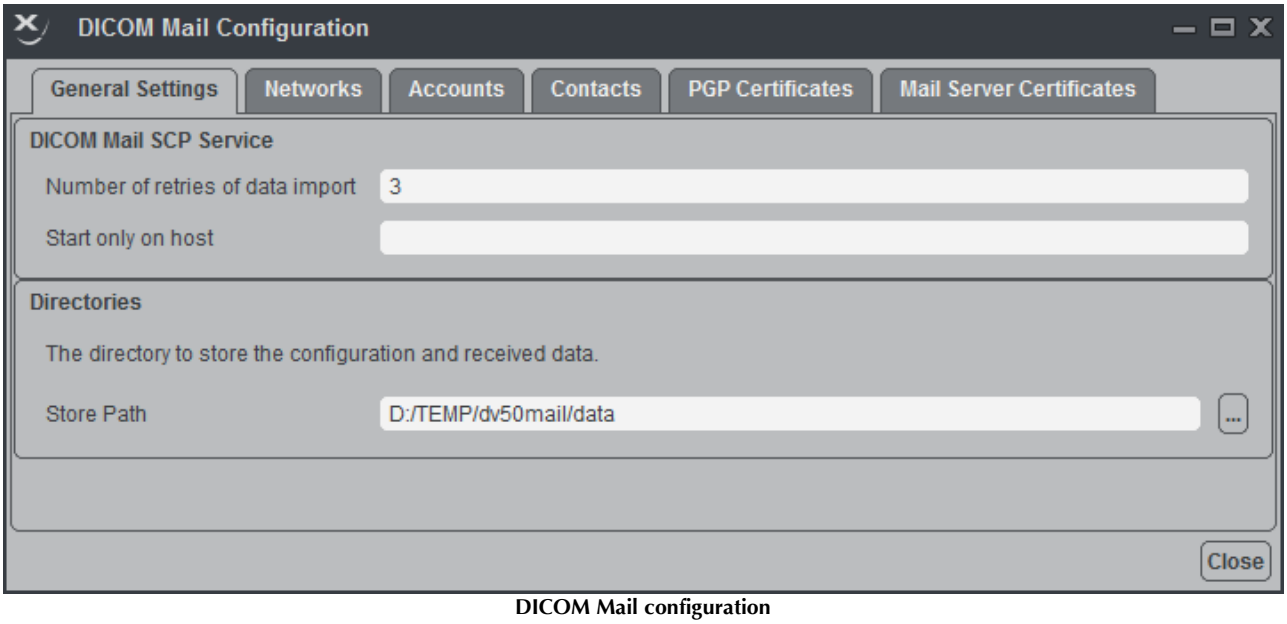
18.1 Configuration

The configuration of the JiveX DICOM Mail Viewer is similar to the configuration of a conventional e-mail client. In addition, some specific settings are required. The configuration is performed via the "Extras" menu ▸ "DICOM Mail settings...".
First, the directory, in which the incoming messages should be stored, is set during the configuration. As default, the installation directory sub-folder "data" is suggested. Depending on the operating system and user rights, this may need to be adjusted, since the user of the DICOM Mail Viewer requires read and write permissions for this directory.

A DICOM Mail account is configured to access the mail server of the DICOM Mail network with:
- exactly one e-mail address
- a private PGP certificate
- exactly one DICOM Mail network
- access data for the e-mail account (name and password)

The configuration of the members directory with the associated PGP certificates can be performed manually or via remote configuration, in case this service is available in the DICOM Mail network. In this case configuration e-mails can be retrieved and processed from DICOM Mail networks e-mail servers using the DICOM Mail account.
Manual configuration always includes the set-up of an encrypted connection and a DICOM Mail network. The individual configuration steps can be found in the DICOM e-mail service manual.

18.1.1 General Settings



DICOM Mail configuration

The basic configuration for the function of the DICOM Mail Viewer is carried out under the "General Settings" tab.

The following values can be configured:

- **Import repetitions**
  Specifies the number of repeat attempts to process a message in case of an error before it is deleted. This should rule out the possibility of the timing and also insufficient memory causing problems in the message processing.
- **Memory location**
  Here, the directory in which the DICOM Mail Viewer saves the configuration and all incoming data is specified. User of the DICOM Mail Viewer requires read and write access to this directory.

19 Keyboard Shortcuts

For frequently used viewer functions, the following keyboard shortcuts are provided:

Keyboard Shortcut	Function
[Ctrl] + 1	Switches to a 1x1 Image Matrix
[Ctrl] + 2	Switches to a 2x1 Image Matrix
[Ctrl] + 3	Switches to a 1x2 Image Matrix
[Ctrl] + 4	Switches to a 2x2 Image Matrix
[Ctrl] + 5	Switches to a 5x5 Image Matrix
[Ctrl] + 6	Switches to a 2x3 Image Matrix
[Ctrl] + 7	Switches to a 3x2 Image Matrix
[Ctrl] + 9	Switches to a 3x3 Image Matrix
[Ctrl] + [Shift] + 1	Switches to a 1x1 Series Matrix
[Ctrl] + [Shift] + 2	Switches to a 2x1 Series Matrix
[Ctrl] + [Shift] + 3	Switches to a 1x2 Series Matrix
[Ctrl] + [Shift] + 4	Switches to a 2x2 Series Matrix
[Ctrl] + [Shift] + 6	Switches to a 2x3 Series Matrix
[Ctrl] + [Shift] + 7	Switches to a 3x2 Series Matrix
[Ctrl] + [Shift] + 9	Switches to a 3x3 Series Matrix
[Ctrl] + P	Paper print (matrix)
[Ctrl] + L	Turn image(s) left
[Ctrl] + R	Turn image(s) right
[Ctrl] + [Shift] + F	Show / hide function bar
[Ctrl] + [Shift] + T	Show / hide preview tree
[Alt] + [Cursor ↑]	Zoom in (image)
[Alt] + [Cursor ↓]	Zoom out (image)
[Alt] + 1	Original size
[Alt] + 2	Fit image to view panel size
[Cursor ↑]	Jump to the previous image of the series or the previous frame with multiframe series
[Cursor ↓]	Jump to the next image of the series or the next frame with multiframe series

[Cursor ←]	Jump to the previous series or the previous image for multiframe series
[Cursor →]	Jump to the next series or the next image with multiframe series
[F2]	Slows down Cine mode
[F3]	Speeds up Cine mode
[F4]	Starts and stops Cine mode
[F5]	Displays the first frame of a multiframe image
[F6]	Displays the previous frame of a multiframe image
[F7]	Displays the next frame of a multiframe image
[F8]	Displays the last frame of a multiframe image
[Del]	Deletes a selected annotation
[Alt] + [Del]	Empties the focused image viewport
[Crtl] + [Del]	Empties the focused viewing section
[Ctrl] + [Shift] + [Del]	Empties all viewing sections
I	Invert image(s)
G	Show / hide image information
H	Show / hide painted annotations
C	During the creation of annotations: hide the mouse cursor
[Ctrl] + C	1. With a selected text or measurement annotation: Copies the text of the annotation into the system clipboard 2. Else: Copies the selected image to the system clipboard to use it in e.g. a word processing application
[Ctrl] + [Alt] + C	Copies the image matrix to the system clipboard
L	Show / hide image locator
Q	For series with similar orientation, the slice position is aligned to the focused series (plane alignment). For Oblique MPR and VRT with similar orientation, also the orientation is aligned.
3	Equalizes all image planes of a study of all three directions. The mouse position will be used.
T	Enables / disables linking of all series
0 (number pad)	Re-select the annotation last used
[ESC]	Cancel drawing of an annotation
[Alt] + W	Draw a circle annotation
R	Draw a circle statistic measurement

[Alt] + F	Draw a text annotation with anchor point
[Alt] + T	Draw a text annotation without anchor point
9 (number pad)	Draw a diameter measurement
[Alt] + C	Show cutlines
[Pause]	View all images of the current series in an optimal matrix
V	Iteration through available VOILUT's
B	Iteration through available Window presets
[*] (number pad)	Reset images
[Ctrl] + [*] (number pad)	Reset only window settings on images
[Shift]+[*] (number pad)	Removes all images from the viewer

Please use the following keyboard shortcuts to override currently selected, default left mouse button actions within the image viewer:

Keyboard Shortcut	**Function**
W	Windowing
[Alt] + R	ROI-Zooming
Z	Zooming
P	Panning
F	Draw an arrow.
D	Distance measurement
N	Navigate through series
S (or N+S)	Synchronous navigation (index-based)
E (or N+E)	Synchronous navigation (distance-based)
M	Magnify
[Shift] + le. mouse btn.	Change image positions manually (drag'n'drop')
[Ctrl] + le. mouse btn.	Move parts of annotations (like measurements)
[Shift] + ri. mouse btn.	On crossing a viewing section border: Equalize image plane (see menu item in context menu)

The mouse buttons can be used for multiple actions:

Keyboard / Mouse Shortcut	**Function**

Le. mouse btn.	As configured: pan, window, zoom, navigate
Le. Mouse btn. (double click)	Toggle full screen mode
Ri. mouse btn. + mouse move	Image navigation, with multiframed images: frame navigation
Ri. mouse btn. (click)	Show context menu
Mouse wheel rotation	Image navigation, with multiframed images: image navigation
[Ctrl] + Mouse wheel rotation	Row by row image navigation according to current matrix/layout
S + mouse wheel rotation	synchronized scrolling of all series by the same number of images
E + mouse wheel rotation	synchronized scrolling of all series by the same millimeter distance.
Pressed mouse wheel + mouse move	Pan
Pressed mouse wheel + mouse wheel rotation	Zoom
Double click on mouse wheel	Adjust the image size to the size of the view port (Fit-To-Viewport)
Ri. mouse btn. + mouse wheel rotation	Series navigation
Pressed le. mouse btn. + short ri. mouse btn. click	Toggle left mouse button action
[Ctrl] + C + mouse dragging	Drag'n'Drop of the selected image into external applications like Word or PowerPoint
[Ctrl] + [Alt] + C + mouse dragging	Drag'n'Drop of the image matrix into external applications like Word / PowerPoint