JiveX

User Manual
Version 5.8

# DICOM Viewer incl. CD Viewer

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**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 product itself.

**Regulatory:**

CE 0482 JiveX is a class IIa medical device in accordance with regulation (EU) 2017/745.

FDA JiveX has Section 510(k) clearance. The Unique Device Identifier of this product is: 4260632470084.

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.**

**Notice to users in the European Union:** Any serious incident that has occurred in relation to the medical device should be reported to the manufacturer and the competent authority.

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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.

The JiveX DICOM Viewer supports an additional use case:

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.

All flavors of the DICOM viewer use the same image viewer. This is the user manual for all these flavors.

## 1.1 Intended 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.

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 10 and Windows 11.

# 4 Installation

The installation package installs the JiveX DICOM Viewer. You may download the installation package from the VISUS web site (https://www.visus.com/downloads/jivex-dicom-viewer.html).

Start the set-up routine with a double click, accept the license conditions and 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. 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. This enables the full extent of function of the JiveX DICOM Viewer.

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 menu Help > "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.

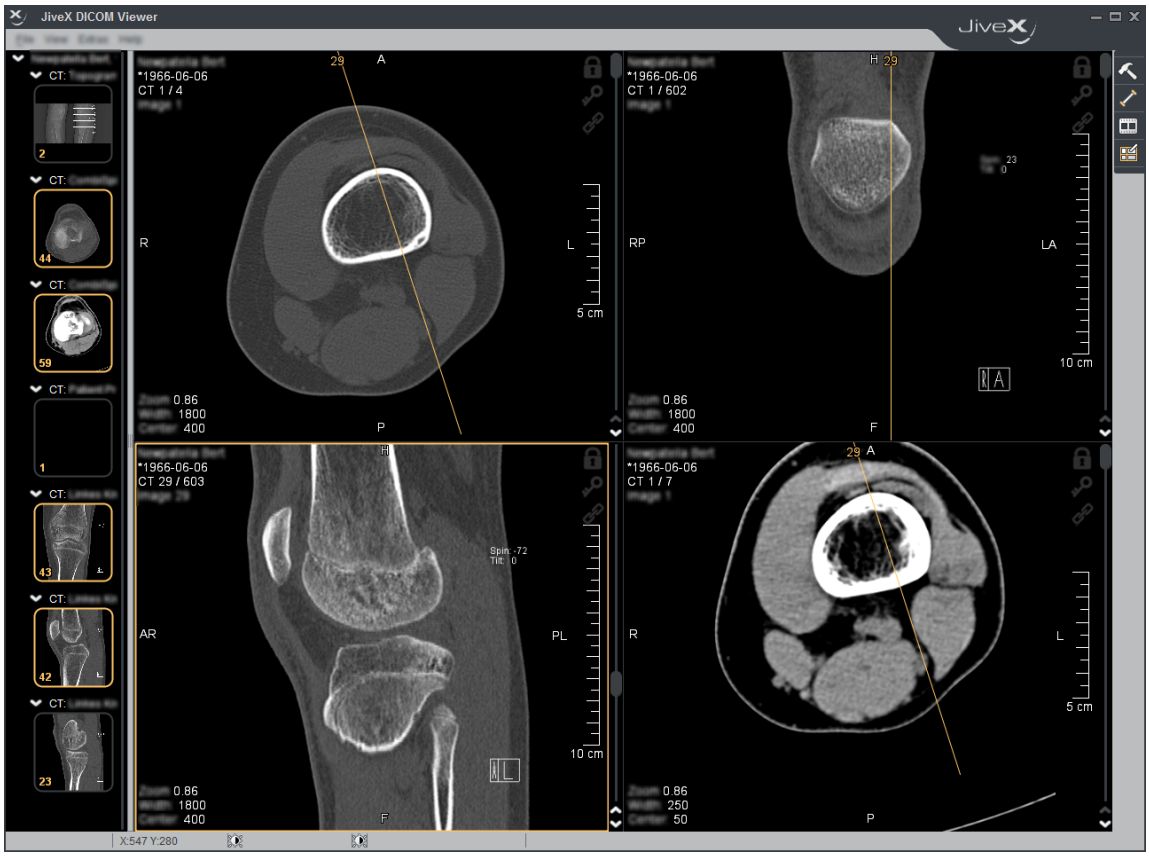


Fig. 7.1: CT exam with four series displayed in the JiveX DICOM Viewer

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"*↙).

## 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.


Fig. 7.2: 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 Viewing area

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 4 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 and the JiveX DICOM CD Viewer respectively is available in German, English and French. 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 directly at startup in the dialog for legal notices or via the menu item “View” 4 “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.

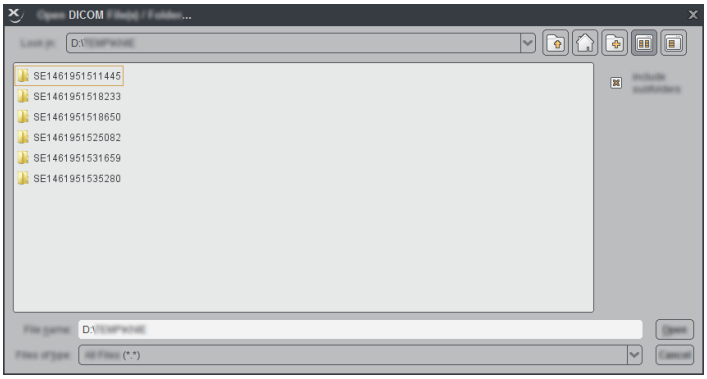


Fig. 9.1: “File Open” - Dialog

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.

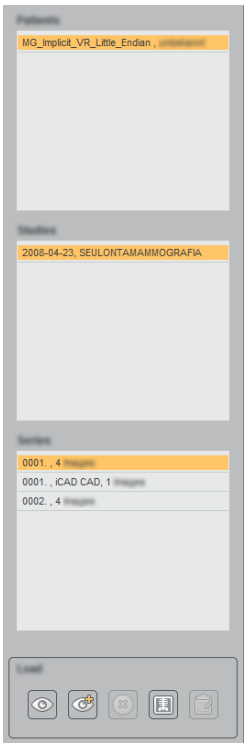


Fig. 9.2: List of available data

# 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”.


Fig. 10.1: “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.

You can also select predefined window values in the menu of the button (in the middle area). The preset window values are either dependent on the displayed images (preset by the modality) or individually stored in JiveX (see chapter *"Custom Window Setting"*↙). By repeatedly pressing the B key, you can select all window values one after the other.

You can select preset window values directly in the lower area of the button menu. These values have already been defined for the relevant modality by the administrator and can be added directly to your context menu by right-clicking on an image.

## 10.2 Custom Window Settings

To adjust or manage custom window settings, go to “General Functions” on the function panel. In the “Window” area, click on “Standard Window Presets” and then on “Manage Window Presets”.

For each modality you can define five individual window values (these may already be predefined) which can then be selected using the 5–9 keys on your keyboard.

### Creating Window Presets

Click on the plus button in the **Manage Window Presets** dialog .

The modality and the window setting are automatically adopted from the focused image.

- If you create more than 5 window presets per modality, they will no longer receive a keyboard shortcut.
- The order of the entries can be changed by dragging and dropping. The new position of the entry is automatically assigned the shortcut of the respective position (all others are updated correspondingly).

### Changing Window Presets

If you want to change an existing window preset, double-click on this value.

### Deleting Window Presets

If you want to delete window presets, select them and click on the minus button .

### Navigation through the individually created window values

In the “General” tab of the function bar in the “Window” section, you can activate the “Cycle only on own presets” entry via “Standard window presets”. The individually created window values are cycled through by pressing B, depending on the type of modality. The window values supplied by the modality are ignored.

## 10.3 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 seriesyou 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, all displayed series are displyed in the same scale (2cm in one image then corresponds to 2cm in another image). |
|  | 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.

## 10.4 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.

## 10.5 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.

## 10.6 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.

## 10.7 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.

## 10.8 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 Ctrl ⇧ 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 toolbar at the top of the application screen and by the function panel provided by the “Annotations” tab .

Frequently used tools can be configured into the right mouse button context menu (see section “Using the Context Menu” in the “User Manual for the Clinical User”).

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 is opened providing 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 ⇧ key.

- If you want to create a circular annotation / measurement / shutter, there is the possibility to configure this in the “Annotations” tab of the toolbar via the gear icon at the bottom. Depending on the structure, you can either draw the circle from the center or from the outline.

## 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

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 displayed as “CT Ratio” (Cardio Thoracic Ratio), whereby the degree of narrowing is given in percent. By double-clicking on the measurement you are able to switch to the ratio of the longer to the shorter distance. |
|  | 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. |

| Icon | Measurement | Performing the Measurement |
|---|---|---|
|  | 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). |
|  | Polyline Distance Annotation | Measurement of the length of a curved structure |
|  | Goniometry - Mechanical leg axis measurement | This measurement is used to measure the mechanical leg axis on the basis of X-ray images. Draw two circles to determine the femoral heads, a tangent to the femoral condyles, a line along outer limits of the eminentia intercondylaris and a line on the upper plateau of the talus. Then draw two lines to determine the tibio-femoral angle and leg length. |
|  | Measurement of a pelvic misalignment | Mark the highest points of the femoral heads one after the other. The measured height difference between the two points is then displayed. |

## 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. |

| Icon | Measurement | Performing the Measurement |
|---|---|---|
|  | 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

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 $\mu m^2$ 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. |

| Icon | Measurement | Performing the Measurement |
|---|---|---|
|  | 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

Annotating an Image

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 anchor point | In the just opening text field, you can enter the desired text. After entering the text, you can determine the position of the arrow with a left click. You can activate subsequent editing of the text by double-clicking on it. |
|  | 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, click into the image or press the ↵ key (if configured). |
|  | Ellipse annotation | Making two clicks, you can draw an ellipse in vertical or horizontal orientation. |

| Icon | Annotation | Drawing an annotation |
|---|---|---|
|  | 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):** ↑ displays the previous image of the series; ↓ 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.

## Series navigation

- **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):** ← jumps to the previous series; → 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. You can also lock the key 3 by selecting the corresponding function in the context menu or by using a modified keyboard shortcut (default: ⇧ 3).

## 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.

Sometimes the image orientation between two series differs too much to support synchronized scrolling by orientation even though there would still be benefit from synchronized scrolling by image position. In this case deactivate the the option “Synchronized scrolling by orientation”.

***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.

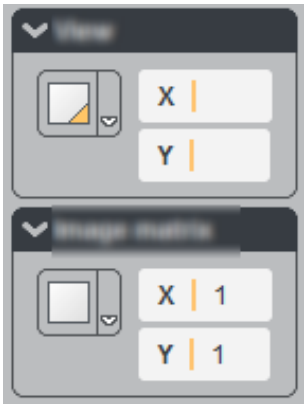


Fig. 13.1: Function group “Matrix”

# 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.


Fig. 15.1: 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 Ctrl 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 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 ⇧ 1 | Switches to a 1x1 Series Matrix |
| Ctrl ⇧ 2 | Switches to a 2x1 Series Matrix |
| Ctrl ⇧ 3 | Switches to a 1x2 Series Matrix |
| Ctrl ⇧ 4 | Switches to a 2x2 Series Matrix |
| Ctrl ⇧ 6 | Switches to a 2x3 Series Matrix |
| Ctrl ⇧ 7 | Switches to a 3x2 Series Matrix |
| Ctrl ⇧ 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 ⇧ F | Show / hide function bar |
| Ctrl ⇧ T | Show / hide preview tree |
| Alt ↑ | Zoom in (image) |
| Alt ↓ | Zoom out (image) |
| Alt 1 | Original size |
| Alt 2 | Fit image to view panel size |
| ↑ | Jump to the previous image of the series or the previous frame with multiframe series |
| ↓ | Jump to the next image of the series or the next frame with multiframe series |
| ← | Jump to the previous series or the previous image for multiframe series |
| → | 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 |

| Keyboard Shortcut | Function |
|---|---|
| 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 |
| Ctrl Del | Empties the focused viewing section |
| Ctrl ⇧ 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 | • With a selected text or measurement annotation: Copies the text of the annotation into the system clipboard<br>• 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 |
| Pad 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 |
| Pad 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 |
| Pad × (number pad) | Reset images |

| Keyboard Shortcut | Function |
|---|---|
| Ctrl Pad× (number pad) | Reset only window settings on images |
| ⇧ Pad× (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 |
| ⇧ + le. mouse btn. | Change image positions manually (drag'n'drop') |
| Ctrl + le. mouse btn. | Move parts of annotations (like measurements) |
| ⇧ + 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) |

| Keyboard / Mouse Shortcut | Function |
|---|---|
| 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 |