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CODONICS®
We bring the future into focus

Clarity™ Viewer

User's Manual

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A general working knowledge of MIP/MPR and Fusion protocols is assumed when using this manual.

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Overview

The Codonics® Clarity™ Viewer is a standalone application used for viewing and manipulating digital medical images from various sources (CT, MR, US, PET, etc.). The Viewer image manipulation tools include windowing, leveling, magnification, and various measurement tools. The Viewer application is included as part of the Codonics Virtua™ Operating Software.

System Requirements

The Clarity Viewer runs on Windows®-based PC computers. It has been validated under Windows 98, Windows Millennium, Windows NT 4.0, Windows 2000, Windows XP and Windows Vista.

Recommended minimum configuration:

- Pentium III processor
- 512-MB RAM
- 40-GB hard drive
- 32-bit graphics board
- 19-in. display
- Windows 2000 or XP

Required Software

The Clarity Viewer does not require any additional software to be installed on the PC. However, a PDF viewer, such as the Adobe® Reader, is required in order to open the Help documentation. The Adobe Reader is available free at http://www.adobe.com.

Quick Start

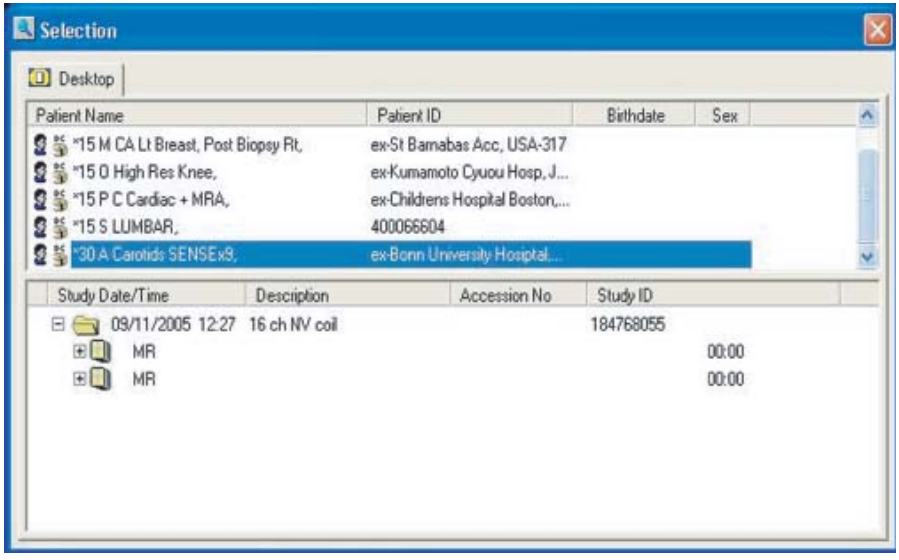
Starting the Viewer

If the CD or DVD was burned with the Virtua's Auto Run option turned on, the Viewer program will launch when the disc is inserted into a PC's CD/DVD drive. If this option was not enabled when the disc was burned, the Viewer must be started manually. If LaunchPad is being used, then LaunchPad will be seen before being able to navigate to the Clarity Viewer.

To start the Viewer manually, select **My Computer** in the Windows **Start** menu. Double-click the drive labeled **CODONICS** to display the contents of the CD/DVD. Double-click **RunViewer.bat** to launch the Viewer.

Opening a Series of Images

When the Viewer launches, the **Selection** window displays.



The **Selection** window is split into two sections:

- Patient information: Displays patient information such as the patient name, patient ID, birth date and sex.
- Study information: Lists the study folders, series folders, and patient images.

Table 1. Selection Window Icons

Icon		Description
Patient		Last name, first name, date of birth, patient ID
Study		Creation date and time, study ID, procedure description
Series		Modality, series description, number of frames, creation date, creation time
Image		Image number, number of frames, DICOM instance UID

To list the sub-levels on the selection window (for example, images of a series), click the **+** button to show more and the **-** button to show less.

To access the image contained within that series, double-click the series icon.

Basic Toolbar Commands

Table 2. Basic Toolbar Commands

Icon	Description
New/Clear Selection	Close all open series and return to the selection window.
Select/Browse	Go back to the selection window to select an additional series or patient. The current series remains open.
Print	Send the current image window to a Windows printer. The Codonics Horizon™ Imager configured with the PostScript option can be used to create high quality color and grayscale prints.
Tile Mode	Display multiple images from the same series.
Magnifying Glass	Magnify a portion of the active image. Select zoom factor by right-clicking in the magnified area (from x2 to x8).
Reset Window Level	Resets window levels to the original values.
Polarity	Changes the polarity of the active series; black becomes white, white becomes black.
Synchronize Slices	In this mode, the frames displayed that are in the same orientation will be synchronized.
Hide/Display Graphics	Toggle the display of graphics (drawing and measurement tools).
Distance Measurement	Determine the distance between two points in the active image.
Angle Measurement	Determine an angle within the active image.
Pixel Measurement	Display the pixel value of a point within the active image.

Table 2. Basic Toolbar Commands (Continued)

Icon	Description
Calibration	Calibrate the active image pixel size. Allows for measurement of a known size element within an image and allows for input of the known size.
Multi-Angle Measurement (Cobb)	Determine the angle between two separate lines within the active image.
Mosaic Mode	Split the current display window so that multiple series may be displayed.
Cine Loop	Allows display of multiple images from a series, one after the other. Clicking on the forward or reverse buttons allows the increase or decrease of the display rate.
Left Mouse controls Window Level	The default action for the left mouse button; adjusts the window level of the active image.
Left Mouse controls Image Position	Allows movement of the active image within the display window.
Left Mouse controls Zoom Level	Allows for zooming in and out.
Left Mouse controls Stack Navigation	Move through the images of the selected series.
Left Mouse controls Drag and Drop	Move the series to another display section (used in Mosaic Mode).

MPR Mode

NOTE: *This feature is available only on the 3D/Fusion Clarity Viewer.*

Overview

To enable MPR/MIP viewing mode, click the

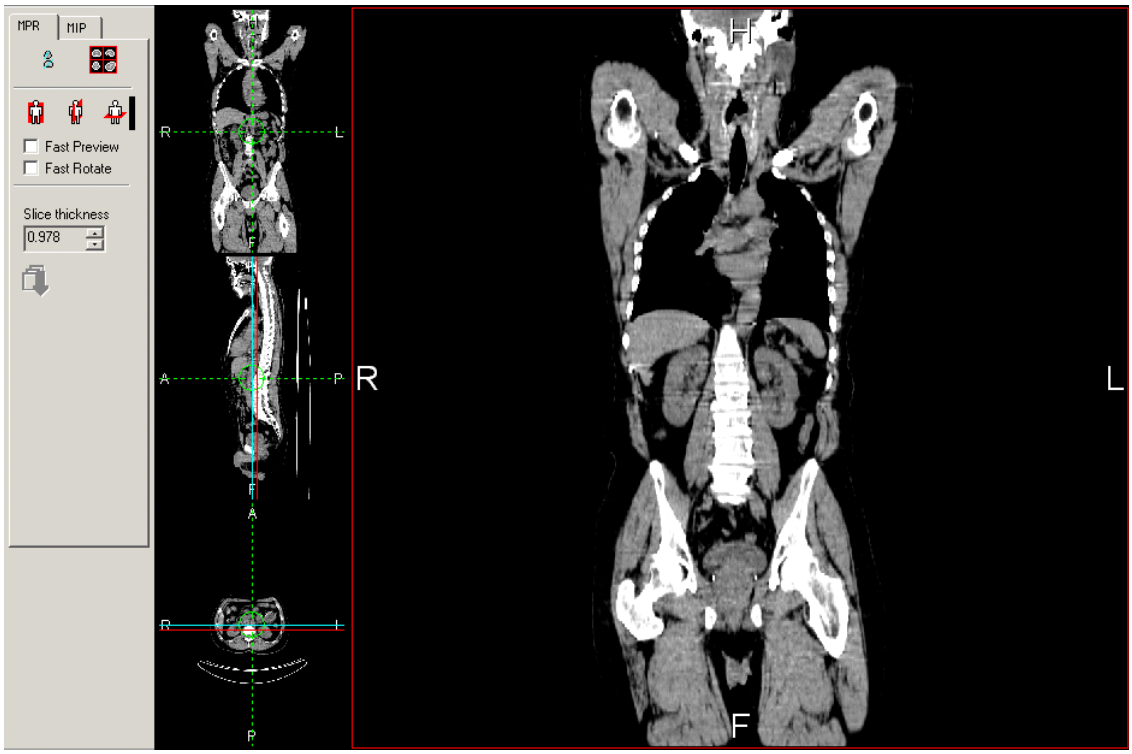
button.

Click on the **MPR** tab to activate the MPR mode.

The MPR screen features a dockable toolbar, an orthogonal viewer, and a reconstructed series display.

The orthogonal viewer shows the input image along three orthogonal views. In addition, it also shows the MPR cut-plane intersection (blue line), the current frame displayed on the reconstructed series (solid red line), and the reconstructed volume limits (red dotted lines).

The reconstructed series view behaves like the regular mosaic views in the general display. It shows the reconstructed series along the direction of the blue line.



Dockable Toolbar Options

Reslice Mode

To toggle the reslice mode, click the button.

- **Single oblique (button not pressed):** reslice the volume in a single oblique orientation:
  - Click on one of the blue lines and wait until the cursor turns into a rotation arrow.
  - Drag the line to the desired angle.

  The intersection of the new slices with the two other views will automatically be updated and reset to an orthogonal angle. The reconstructed series will display the center slice of the new series.

- **Double oblique (button pressed):** reslice the volume into any oblique orientation:
  - Click on one of the blue lines and wait until the cursor turns into a rotation arrow.
  - Drag the line to the desired angle.

  The intersection of the new slices with the two other views will automatically be updated.
  - Set the orientation on the other views (by rotating the blue line).

  The reconstructed series will display the center slice of the new series.

Layouts

To toggle between a 2x2 layout or a 3x1 + 1 layout, click the or button, respectively.

In the 2x2 layout, the orthogonal views are arranged in a 2x2 mosaic, and the reconstructed series is displayed in the lower right image box.

In the 3x1 + 1 layout, the orthogonal views are arranged in a 3x1 column, and the reconstructed view is displayed to the right of that column.

Default Orientation

By selecting a default orientation (coronal, sagittal, or transaxial), the resliced series is reset to one of the three basic orientations.

Fast Preview Option

When the **Fast Preview** option is checked, the resliced series is displayed without interpolation, and only one pixel out of two is computed. However, the full quality is always applied when saving the new series. Uncheck this option for a view of the actual reconstructed series.

Fast Rotate Option

When the **Fast Rotate** option is checked, the MPR display is not updated while rotating or dragging the reference cross lines. The MPR display is updated upon release of the left mouse button.

When this option is unchecked, the MPR display is updated in real time while rotating or dragging the reference cross. However, for performance reasons, the reconstructed series is always displayed in fast preview mode, regardless of the status of the **Fast Preview** check box.

Slice Thickness

Select the number of slices used to construct the 3D model. A higher number here can improve response time but may reduce the detail of the reconstruction.

To view the result in the reconstructed volume frame, click the button.

NOTE: *Slice thickness is always an integer multiple of the pixel size.*

MIP Mode

NOTE: *This feature is available only on the 3D/Fusion Clarity Viewer.*

Overview

To enable MPR/MIP viewing mode, click the 3D MPR MIP button.

Click on the **MIP** tab to activate the MIP mode.

The MIP is a 3D post-process that features three orthogonal views—coronal, sagittal, and transaxial. It also features a free angle view and a clipping box to isolate the organs you want to display. Every image is visualized with a Maximum Intensity Projection.

Dockable Toolbar Options

Reinitializing the Volume

To reinitialize the volume as it appeared at the first launch, click the button.

Be aware that the window level is not reinitialized.

Enabling Volume Rotation

To enable the volume rotation, click the button, then press the left mouse button while dragging the mouse. The button is enabled only on the fourth view (free angle view). The cube moves like the volume and on each face gives the orientation of the volume:

- A: anterior
- P: posterior
- L: left
- R: right
- H: head
- F: feet

Alternatively, you can also press ALT+ left button while dragging the mouse to rotate the image.

Switching Views

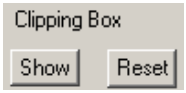
To switch the free angle view from mosaic view (four views) to full screen view, click the button.

Refer to “Cine Control” on page 13 for an example of the full screen view.

Displaying Orthogonal Views

To display on the free angle view, click one of the three orthogonal view buttons.

Displaying the Clipping Box



To display the clipping box, click the **Show** button.

The clipping box is displayed only on the orthogonal views. Use these three views to isolate the region to view; the result is displayed on the free angle view.

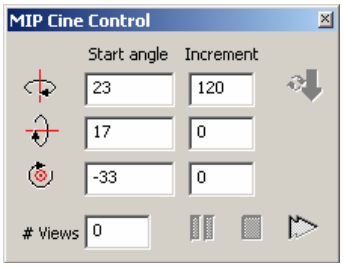
To clear the clipping, click the **Reset** button.

Below is an example of clipping.

Cine Control

To access cine control, click the button.

The **MIP Cine Control** window displays.



The cine control has to be used like a table. For the three axes of rotation, specify a start angle. The button applies the angles specified.

With a **# Views** value and **Increment** angles entered, click the button to start a cine with **# Views** frames, each one separated by **Increment** angles.

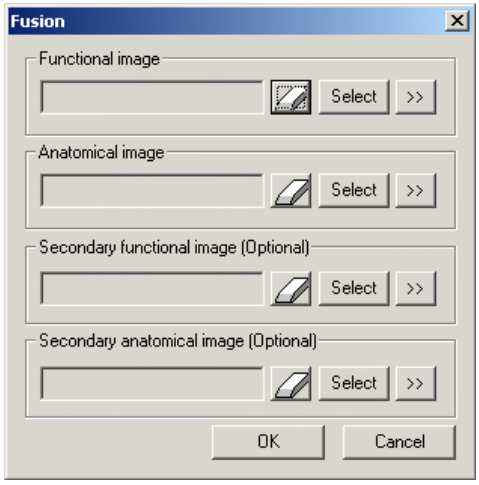
The cine can be controlled with the **Pause** button, **Stop** button, or **Start/Increase Cine Speed** button. There is also a **Stop** button in the MIP toolbar.

Fusion Mode

NOTE: *This feature is available only on the 3D/Fusion Clarity Viewer.*

Overview

When selecting the **Fusion** icon in the main application, the Viewer application automatically browses the loaded series. If it does not find suitable series, the **Series Selection** dialog box displays. Otherwise, the Fusion protocol starts with the loaded series.



In the **Series Selection** dialog box, there are two ways of selecting the input images for Fusion:

- By activating the requested image in the general display, then pressing the corresponding **Select** button on the selection dialog box.
- By navigating through the patient/study/series in the menu tree that pops up by clicking the corresponding >> button.

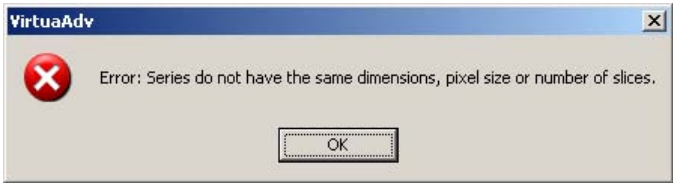
Using one of those methods, select a functional image and repeat the operation for the anatomical image, if needed.

A second functional image can be selected for use in the dual-orthogonal mode (it can be selected later when switching to dual-ortho mode).

To clear the selection, click the corresponding button.

Notes About the Fusion Module

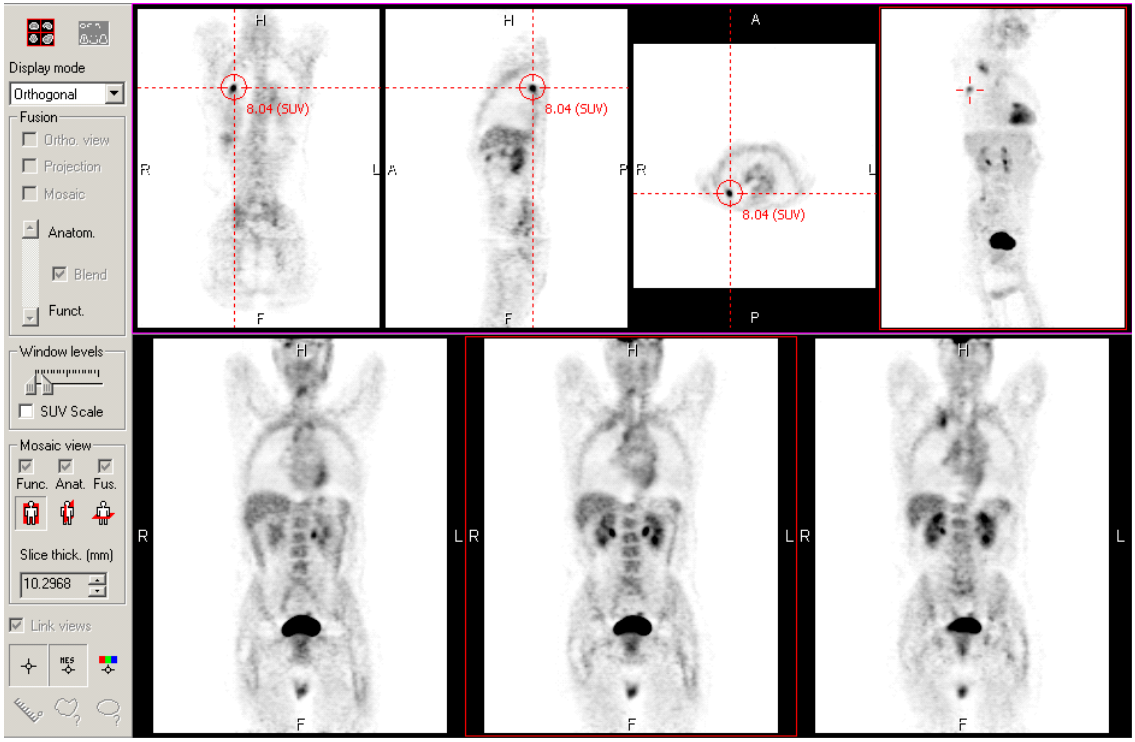
- The Fusion module works only with images for which the image orientation and image position data has been coded by the modality.
- All the images of the input series must have the same slice thickness and regular spacing between slices. If this is not the case, an error message displays and the module aborts.



Display Modes

Five display modes are available: Orthogonal, Dual-orthogonal, Triple-orthogonal, Horizontal mosaic, and Vertical mosaic. Switch between those modes using the **Display Mode** list box.

Orthogonal Mode



Fusion shows a transparency fusion of both image volumes along the three basic orthogonal directions, an MIP of the functional or fusion image, and a reconstructed series displayed in mosaic mode.

Orthogonal Display

To toggle the display of the cross target and reference lines, click the button.

To toggle the display of the pixel value, click the button.

To change the color of the cross-target and reference lines, click the button.

To use the orthogonal view full screen to hide the reconstructed slices, click the button.

MIP Display

An MIP is automatically computed from the transverse slices of the functional image. Thirty-two projections are computed with an angular shift of 22.5 degrees.

The MIP is computed in the background. A green progress bar shows the computation status upon program startup and after activating the fusion option for the Projection.

The MIP runs in cine-loop mode. It can be stopped and restarted using the regular cine-loop buttons in the general display of the application. A small cross on the MIP display materializes the cross-target center on the fusion display.

Reconstructed Slices

Reconstructed slices can be computed from either the functional image or the fusion image. These slices are displayed in the lower pane of the Fusion window.

- Select the orientation of the slices (coronal, sagittal, transverse) to recompute the slices in the requested orientation.
- Change the slice thickness using the corresponding control. Slice thickness is always an integer multiple of the original slice thickness.

Fusion Options

Use the dialog bar to choose which views are to be displayed in transparency fusion mode. Check the following boxes accordingly:

- Ortho view: the fusion is activated on the three orthogonal planes.
- Projection: the fusion is activated on the MIP display. Selecting this option automatically activates the fusion on the ortho view.

- Mosaic: the fusion is activated on the reconstructed images (bottom view).

Select the transparency level using the vertical slider in the dialog bar. This slider goes from fully anatomical to fully functional. Depending on the **Blend** check box status, the transparency is computed as follows:

- **Blend** check box not selected: the anatomical image is always displayed. The functional image is displayed as a transparency overlay [intensity varying from 0% to 100% depending on the position of the slider (anatomical to functional)].
- **Blend** check box selected: the anatomical image is displayed with an intensity varying from 100% to 0%, depending on the position of the slider (anatomical to functional). The functional image is displayed with an intensity varying from 0% to 100%, depending on the same slider setting.

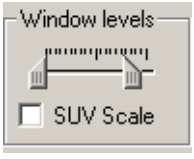
These settings are common to all views displayed in Fusion mode. Note that the following actions are not allowed in fusion mode:

- Inverse video
- B&W color palette

NOTE: *When the orthogonal and mosaic views are both in the same mode (fusion or not), the window levels and color palette are set to be the same on both views. The Projection view remains independent.*

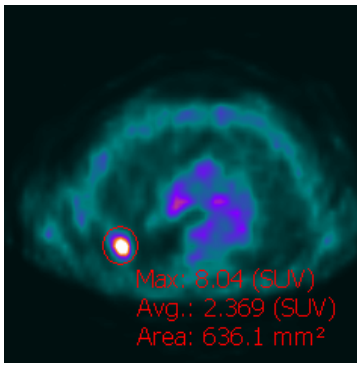
NOTE: *When changing the window levels on a fusion view, only the functional image is updated. To change the window levels on the anatomical image, use the same mouse key combination and hold the ALT key down while moving the mouse.*

Window Levels Options



- Use the sliders to set the activity window min and max on the active view.
- Select the **SUV Scale** option to display a color bar coded in SUV values on each functional view.

Measurements



The following measurement buttons are at the bottom of the toolbar:

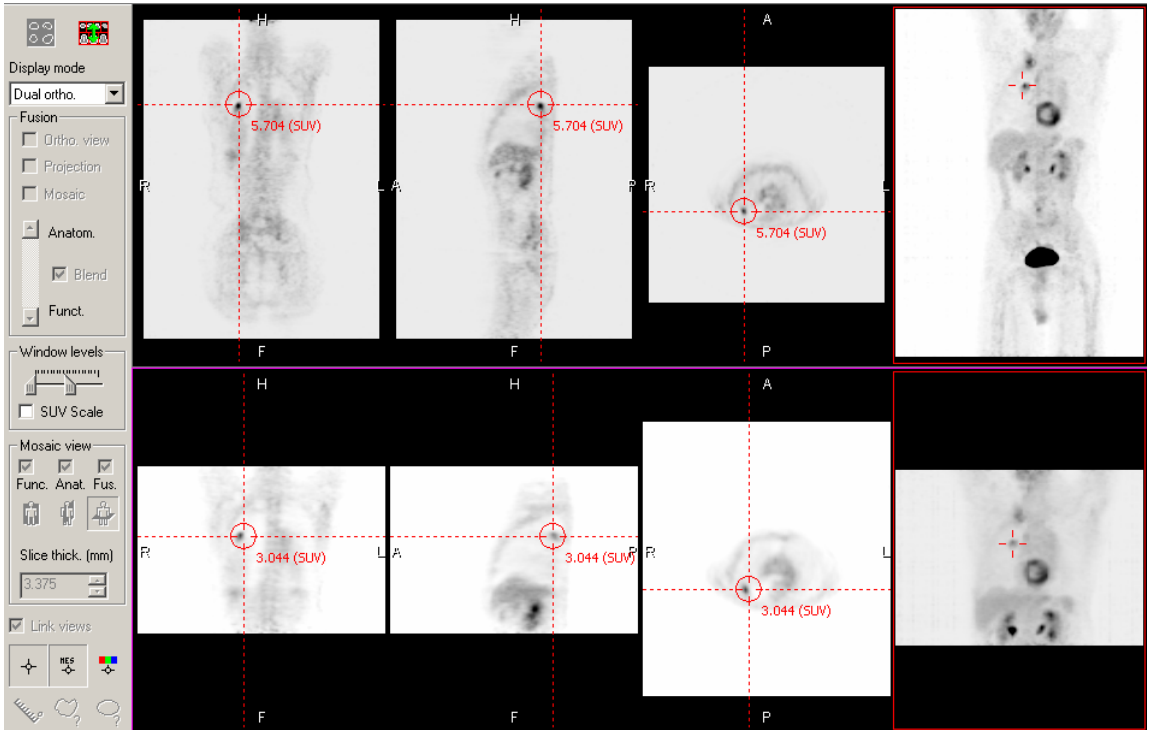
- Distance: measure the distance on a straight line.

- Free-hand: compute statistics on a free-form region of interest (after drawing the region, double-click to close the region and display the statistics).

- Ellipse: compute statistics on an elliptical region of interest.

These features are available only on mosaic views, not on orthogonal or MIP views.

Dual-Orthogonal Mode

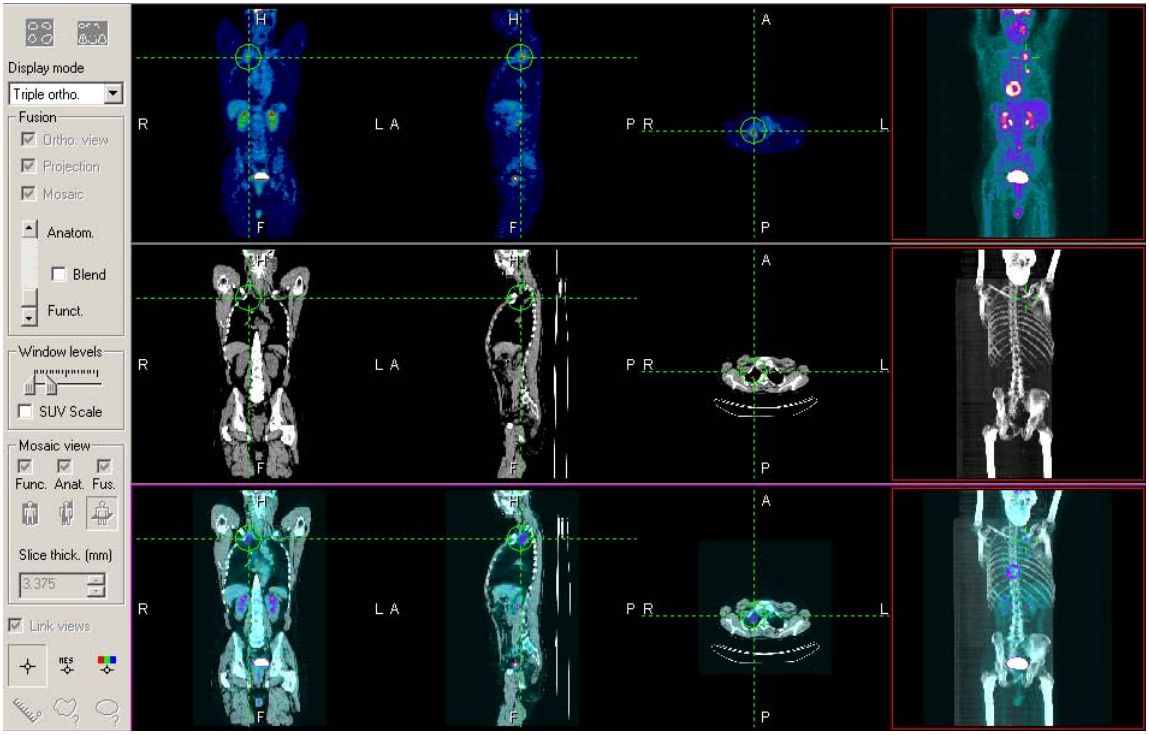


The Dual-Orthogonal mode features two orthogonal views for synchronized display of two functional images registered over the same anatomical image, or two sets of functional and anatomical images.

The cross target position is not synchronized on both views; they both work independently.

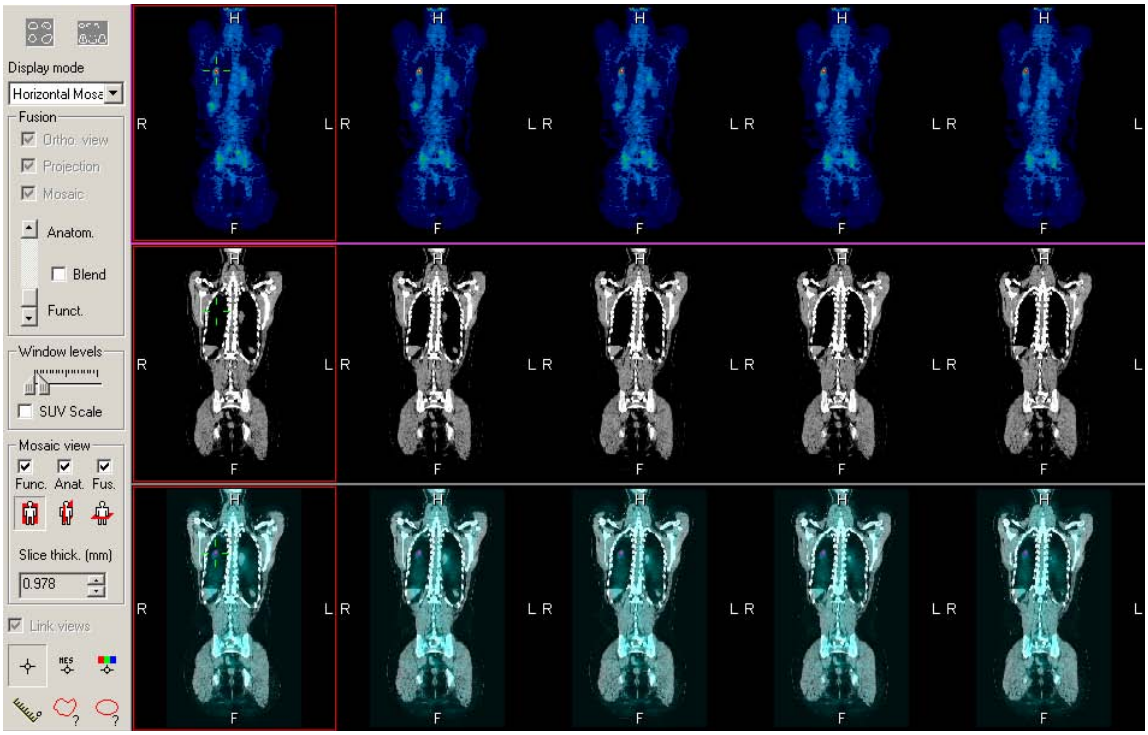
The two studies can be switched by pressing the button. This is especially useful since only the top study can be displayed in other modes, such as mosaic or triple orthogonal.

Triple-Orthogonal Mode



The Triple-Orthogonal mode features three orthogonal views for synchronized display of the anatomical, functional, and fusion images. The cross target position and the projection cine are synchronized on all views.

Mosaic-Only Mode

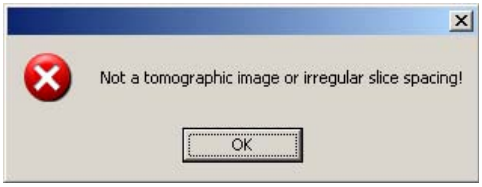


The Mosaic-Only mode features three views in a synchronized mosaic display: Functional, Anatomical, and Transparency fusion.

A synchronized cross-target is displayed over the views to help localize the same anatomical point on the three views.

Advanced Viewing Considerations

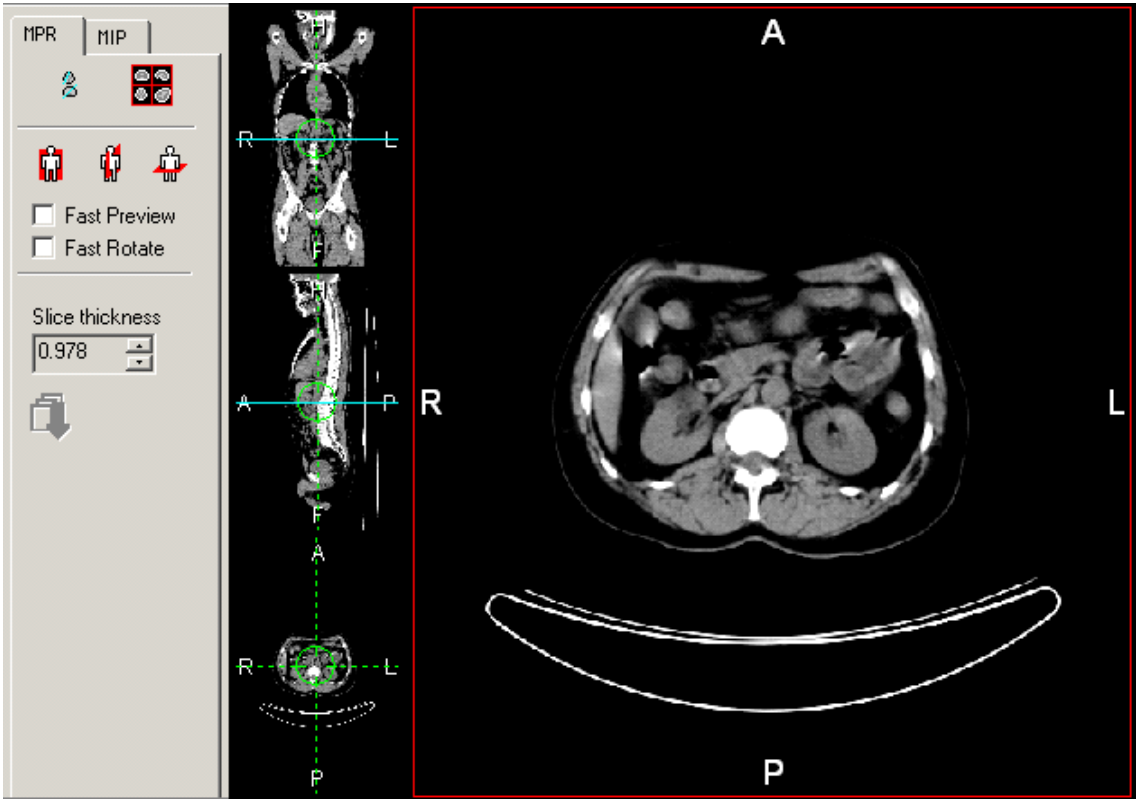
Advanced viewing modules work only on images for which orientation and image position data has been coded by the modality. Also, all the images of the input series must have the same slice thickness and regular spacing between slices. If this is not the case, the following error message displays.



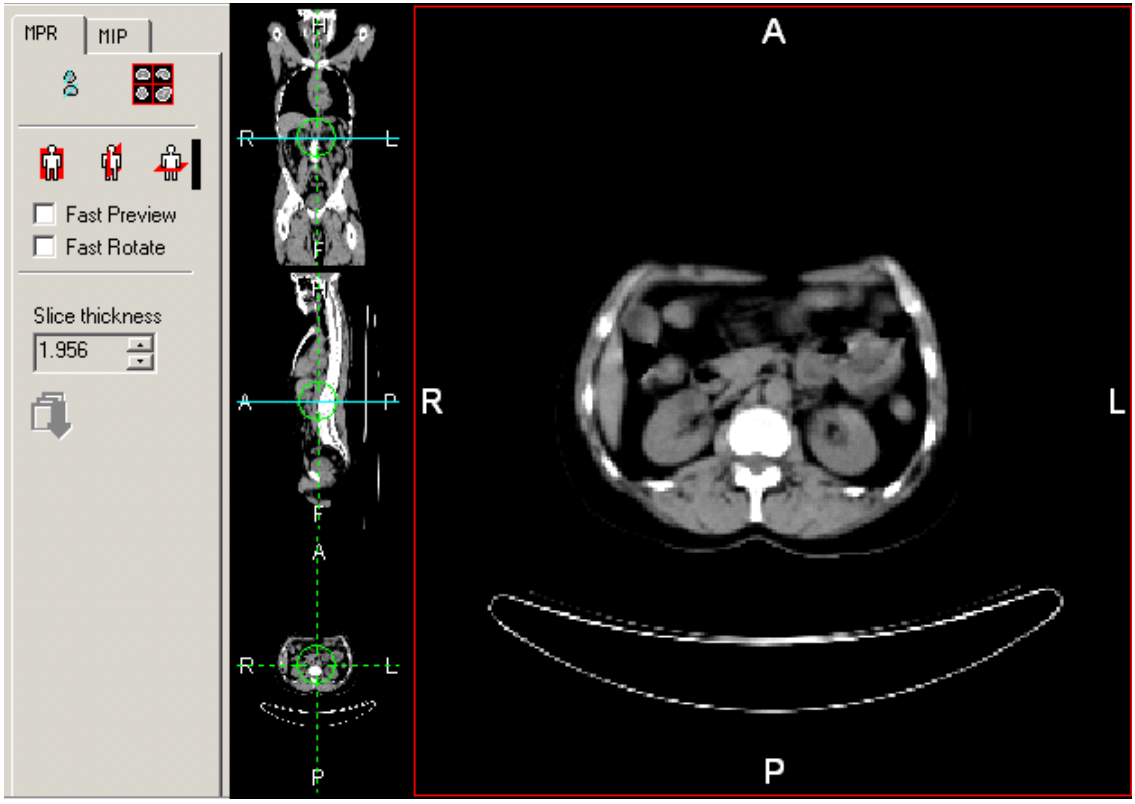
Note that when Orthogonal View or MPR/MIP protocols are launched, if the application detects that there is not enough memory on the PC to run such protocols with full performance, the user is prompted with the following message asking if a resampling is permitted.

If the user accepts to resample, the image quality will be altered by displaying only one pixel out of two on the X, Y, and Z axis. The user may nevertheless decide to continue without resampling the image size, but this will affect the performance of the protocol.

Refer to the following examples to see how rescaling affects the image.



Original Image Size



Resampled Image Size

SUV Calculations

With the Clarity Viewer, SUV Body Weight is computed using the following values:

- D, injected dose (Becquerels)
- t1, time span between injection and acquisition (seconds)
- T, half life period of the radio isotope used (seconds)
- W, weight of the patient (kilograms)

All these values ought to be imported from the original CTI and the pixel data (counts) have to be in Bq/ml. If one is missing, the SUV will not be proposed to the user.

The injected dose is decay-corrected to correspond to the existing dose at the time the image is acquired:

$$D1 = D \bullet e^{-\left(\ln 2 \bullet \frac{t1}{T}\right)}$$

Then SUV values are obtained using the formula:

$$SUV = counts \bullet W \bullet \frac{1000}{D1}$$