5 CT Common Tools

The CT Common Tools are distributed in two areas of the Tool Panel, as shown in the illustration. CT Common Tools provide many basic functions when you are working in the IntelliSpace Portal, including image manipulation, measuring image features, saving images and data, and filming images.

NOTICE

The tools in this section are common to CT viewers and applications. Not all tools are relevant to NM, MR and/or MMV applications.

Most of the CT Common Tools are available in every image display. Some tools are not available in every display.

Some tool buttons have a single function. When you click on the displayed icon, its function is made active - and its icon is highlighted (as in the example below, the “Scroll/Select” button). If you click on another button in that row, that other function will be made the active tool.

Other tools have down-arrows next to them, such as the “Save As...” tool, which represent a group of tools with related functions. If you want a different function than the one that is shown, click the down arrow to select another function from a drop-down menu. The last tool you used will become the displayed icon.

Auto-hide Tool Panel

The Auto-hide function (for CT applications) allows you to increase the viewport area by collapsing the toolbox. This is useful in applications and work stages that have many small viewports.

The Auto-hide button is at the upper left corner of the tool panel.

When the button appears depressed, the tool panel is fixed in its normal location.

When the button appears un-pressed, the tool panel is represented by a gray vertical stripe. Hovering over the gray stripe makes the panel temporarily appear.

NOTICE

Auto-hide can also be activated with the "H" keyboard shortcut.

3000067186691_A/881 * 2021-06-30

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Findings Navigator and Findings Repository

Use the **Findings Navigator** (also called **Findings Repository**) to gather and store images from the different stages of CT applications that support the functionality.

By default, **Findings** appear in a tray across the bottom of the viewports. To view **Findings**, hover over the collapsed **Findings** tray. To lock or unlock the tray in the open position, use the **Keep visible/Hide** toggle button (on the right side of the tray).

NOTICE

Some CT applications include customized **Findings** with pre-defined menu options. However, creating, annotating, saving, and reporting **Findings** is similar in all supported applications. See the **Findings** section in the individual applications for information.

Add Findings

Use the right mouse-button and drag an image to the **Findings** tray to add a new **Finding**.

Right-click and drag an image on top of an existing **Finding**.

Use the **Add** buttons in the **Findings** tray:

- The **Add Selected Image** button  adds the active image to a new **Finding**.
- The **Add Display** button  creates a new **Finding** that includes all images on the screen.

NOTICE

Use keyboard shortcuts to quickly add new **Findings**: Use the space bar to the **Add Selected Image**. Use **Shift+Space** as a shortcut to **Add Display**.

Or, use the context menu:

Right-click on a viewport and select **Findings** > **Add Selected Image** or **Add Display** from the context menu.

Merge Two Findings

To merge two **Findings**, drag an image from one **Finding** to another using the right mouse button.

3000067186691_A/881 * 2021-06-30

Add Additional Images to a Finding

It is possible to add reference/CS/longitudinal/volume images to an existing finding (default is axial image). Right-click and drag the desired image to the relevant finding on the **Findings Navigator**. Approve the adding by clicking **Add to existing**.

Preview and Edit Findings

The **Preview** button  appears on the **Finding** window and in the **Finding** tray. Use the button to open the summary window for all **Findings** and edit the **Findings**.

To switch between the images in the **Preview**, click on the arrows that appear on the left/right of the window.

To delete an image from a **Finding**, select the **Delete Image** button from the preview.

To delete the entire **Finding**, right click on it and select **Delete Finding**.

Use the **Sort Finding by** drop-down to order the findings by creation order or type.

Finding Options

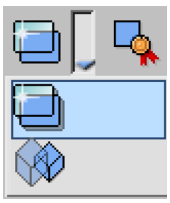
Report. Report allows quickly saving the findings in a report format.

Save all. Saves all **Findings** in one series in **Patient Directory**. When using this option, the images are saved without their comments, name, and other application-specific information.

Film. Sends all **Findings** to **Film**. When using this option, the images are saved without their comments, name, and other application-specific information.

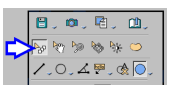
Send findings to report. Available from the toolbox. Sends all of the **Findings** to the **Report**.

Glass View and Show Transparent



Glass View and Show Transparent allow you to view, in a semi-transparent mode, all tissue and bone that have been removed from patient images. Removal includes bone removal, clipping, sculpting, and other functions. See section “CT Common Processes” on page 179.

Image Display Tools



This group of Common Tools is used to control the display of images in the viewports. The tools work on the currently selected image(s).

Scrolling

Perform scrolling using either the **Scroll** or **Continuous Scroll** tool for viewing original and MPR images.

Scroll

Select the **Scroll** tool (default) from the **Scroll** drop-down menu or from the right-click menu on any viewport.

WARNING

When scrolling using Scroll (the left mouse button or Ctrl + left mouse button), some slices may be skipped. The extent of skipping depends on the quality of the network connection. For continuous scrolling use the scroll wheel. See also section “Continuous Scroll” on page 144.

1. Select **Scroll** form the drop-down menu or select it from the right-click menu on any of the viewports.
2. Hover over the view you want to scroll and then do one of the following:
   – Drag up while pressing the left mouse button to scroll to the image behind the currently displayed image in the slice order.

     Or:

   – Drag down while pressing the left mouse button to scroll to the image before the currently displayed image in the slice order.
3. Release the left mouse button or stopping the dragging. Scrolling stops at the first or last image of the series.

To scroll while another interaction tool is selected:

- Hold the **Ctrl** button while dragging the left mouse button over the view.

  Or:

- Use the scroll wheel.

Continuous Scroll

Use **Continuous Scroll** to continually scroll through the images without skipping any images. To activate Continuous Control, select it from the drop-down menu or from the right-click menu on any viewport.

To toggle between the **Scroll** and **Continuous Scroll** mode, use **<Ctrl>**+ **<T>**.

3000067186691_A/881 * 2021-06-30

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NOTICE

Continuous Scroll is not available in all CT Applications.

1. Click on the viewport for which you intend to activate **Continuous Scrolling**.
2. Hover over the view you want to scroll and then do one of the following:
   - Drag up and continue pressing down on the left mouse button. This will scroll to the image behind the currently displayed image in the slice order.

     Or:

   - Drag down and continue pressing down on the left mouse button- to scroll to the image before the currently displayed image in the slice order.

   Scrolling stops at the first or last image of the series.

   In both cases, as long as you continue pressing down the left mouse button, **Continuous Scroll** continues to display slice-by-slice images.

NOTICE

This operation differs from the default scroll operation: you do not need to repeat the mouse dragging in order to keep scrolling. Rather, holding down the left mouse button automatically scrolls through the images.

3. The speed of the scrolling is, by default, the highest possible speed that the current network allows without skipping slices.

   (You can also use the keyboard shortcuts to adjust speed: **F10** decreases speed and **F11** increase scrolling speed.)

NOTICE

Because no slices are skipped when using Continuous Scroll, maximal speed is determined by the network speed and connection quality.

4. To change scroll direction while **Continuous Scroll** is activate: continue to hold the left mouse button and more the mouse in the opposite direction. The scroll speed and direction will match the movement.

Pan

This function is used for moving (dragging) an image within a viewport. It allows you to center the feature of interest in the viewport by dragging the image in the window.

3000067186 91_A/881 * 2021-06-30

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Zoom

Used to magnify or reduce the size of the image in the display. To magnify an image, drag the mouse upwards. To reduce an image, drag the mouse downwards. The mouse pointer appears as a magnifying glass.

The maximum zoom factor in all applications is 15 on all images, including cross-sectional images.

Zoom to Point

Use to zoom to the point from which the zoom operation begins. In applications where **Rotation Center** is shown (for example, **CT Viewer**, **Cardiac Viewer**, **CCA**, **TAVI**), the rotation center jumps to the point of zooming when this option is used.

NOTICE

Zoom to Point may be accessed by the right-click menu. If the Zoom tool is active, hold down the mouse center wheel and right button and then press Alt on the keyboard.

Roll/Rotate

Roll / Rotate is used to manipulate the rotation of a volume or slab image. The Roll / Rotate function allows you to follow an anatomy which cannot be seen in its entirety in one orientation.

Roll / Rotate is not active in the 2D mode.

1. Position the rotation center near the middle of the anatomy.
2. Click the **Roll / Rotate** button to enable the rotating function.
3. Using the left mouse button, rotate the image until the desired image is achieved.

Change Window Level

Click the **Change window level** button and drag the mouse in the active viewport up and down, and left and right, to change window level.

3000067186691_A/881 * 2021-06-30

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Enhance

The Enhance function allows you to sharpen or smooth the image by changing the enhancement value.

Click the **Enhance** button and drag the left mouse up or down to change the enhancement value.

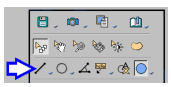
Or:

You can type in an enhancement value by selecting **Enhancement** from the right click menu, then select **Type in**. This allows you to type in an enhancement value in a range from -0.01 (smooth) to 5.0 (sharp). The value can include up to 2 places after the decimal point.

To exit Enhance, select another tool such as scroll or pan.

To turn enhancement off select the Type in feature and type in 0 (zero).

Image Mark-up and Annotation (Graphic) Tools



The third row of Common Tools supplies the Graphics tools, which are used during image analysis to measure anatomical features and to add text comments about features of interest. Also included is the function to set the data compression factor.

WARNING

When performing distance or angle measurements on a volume rendered perspective image, the depth of the position pointed to must be well defined in the image.

Measurements on a volume rendered perspective image should be carried out very carefully and it is the user's responsibility to verify each point of reference. When measuring distances or angles each point that is clicked on the volume-rendered image is related to a slice and an oblique plane. The depth of each point should be verified individually on the correspondent planes.

NOTICE

The end-points of your measurement line must lie on data points that are sufficiently opaque so that no ambiguity exists regarding the depth of these points within the volume. Otherwise, the distance or angle will not display.

Measurement Accuracy

To ensure accurate and repeatable Line length and Region of Interest (ROI) measurements, use these standards:

- Use a normal full-screen viewing window with a single, dual or quad (1, 2, or 4) image format. Do not exceed a four-window layout for any measurement.

3000067186691_A/881 * 2021-06-30

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- If films and measured data are desired for your records, you should film in a similar large format. This maximizes the accuracy of the film result and minimizes discrepancies between monitor and film results.
- When measuring Average CT values, do not draw a ROI that includes or touches a high contrast boundary. For example, keep the border of the ROI well inside the organ or tissue, and away from neighboring higher or lower density structures.

For increased accuracy, use an image zoom factor (magnification) greater than one (maximum zoom factor is 15 on all images).

Length Accuracy

The maximum estimated error of the length measurement is defined as follows:

```
Length Error (mm)
equals
2 x Recon FOV (mm) / (zoom x display matrix) + 0.1 (mm)
```

where display matrix = 1024 x image height/screen height.

These are some typical values of display matrices:

- Four images on full screens = 450.
- Four images in a window on a half screen = 170.
- Sixteen images on a full screen = 225.

Area Accuracy

The maximum estimated error of the area measurement is defined as follows:

```
Estimated maximum area error (mm²)
equals
(maximum length dimension (mm) in ROI) x length error (mm)
```

and

```
Estimated maximum % area error
equals
2 x length error (mm) / (maximum length dimension (mm) within ROI) x
100
```

Graphic Tools

You can control the way some measurement graphics are displayed on the image. Refer to the “Measurements” page in the Preferences utility.

3000067186691_A/881 * 2021-06-30

Select a Graphic Tool

After you click on a graphic tool button to select it for use, the mouse pointer changes to a pencil when you point into a viewport, indicating that you can now draw a graphic object.

Single clicking on a graphic tool activates it for a single use - then the application will return to its previous function.

Double click or right click on the graphic tool to display the Annotation Format. Choose the relevant editing tools from the Annotation Format and manually close the Annotation Format.

To use the same tool multiple times in succession (for example, if you want to annotate various locations with text), double click the tool's icon.

Edit Existing Graphic

After drawing a graphic, you can change its shape if necessary. By pointing onto an existing graphic, the graphic will enter an edit mode, and you can change its appearance by dragging "control boxes" to new locations. Details about editing graphics are provided later in this section.

Graphic Tool Right-click/Double-click Menu

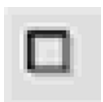
After drawing a graphic within a CT application, you can activate a right mouse menu (or double-click on a graphic) that allows you to change the appearance of the graphic or to display additional information.

Open Menu

1. After drawing the graphic, place the mouse cursor on it. The graphic changes color to yellow.
2. Double-click or click with the right mouse. A graphics operation menu in an Annotation Format will open.
3. Select from the desired options to apply it to the graphic.

The Double-click or right-click menu typically includes the following options:

Show Ticks	Add measuring scale on drawn lines.	
Graphic Properties	Graphic Property Options in Annotation Format Window:	

	• Text size (#1) 	Using the Annotation Format, the user can use the slider to set the desired Text font size (#1 above). To make the selected Text size the default for the current session , select the **Set Text size as default** button (#5 in image). The Text size for new sessions are defined from the Preferences settings.
	• Line width 	#2 above
	• Line color 	#3 above
	• Fill color 	#4 above
Cut, Copy, Delete	These functions are common to most graphic tools.	

Line

Lines are used to measure distances on images in millimeters. After you draw the line, its length is calculated and displayed.

WARNING

When you perform distance measurements on a volume rendered perspective image, the depth of the position pointed to must be well defined in the image.

3000067186691_A/881 * 2021-06-30

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Draw Line

Select the line type (straight, freehand or double). Place the cursor at the first point.

Hold down the left mouse button and drag the cursor to the end location and release the button.

Draw Spline or Polyline

Select the line type (spline or polyline).

Left mouse click at each point along the line you are drawing.

Change Appearance of a Line

After you have drawn a line, you may change the way it looks. Point to it with the mouse until the line turns yellow. Double-click or right mouse click on the line and a submenu appears.

Straight-line Options (CT Applications)

Show Ticks	Add measuring scale on drawn lines.
Profile	
Properties	Access menu to show/hide length.
Graphic Properties	Access menu/Annotation Format to modify line width, text size and color.
Cut, Copy, Delete	These functions are common to most graphic tools.

3000067186 91_A/881 * 2021-06-30

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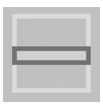
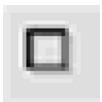
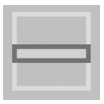
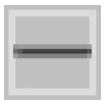
Graphic Properties Options (CT Applications)

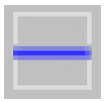
Graphic Properties	Graphic Property Options in Annotation Format Window:	
	• Text size (#1) 	Using the Annotation Format, the user can use the slider to set the desired Text font size (#1 above). To make the selected Text size the default for the current session , select the **Set Text size as default** button (#5 in image). The Text size for new sessions are defined from the Preferences settings.
	• Line width 	#2 above
	• Line color 	#3 above
	• Fill color 	#4 above

300006718691_A/881 * 2021-06-30

Line-width Options (CT Applications)

Line width 	Thin 
	Medium 
	Thick 

Color Options (CT Applications)

Color 	White 
	Yellow 
	Red 
	Green 
	Blue 

300006718691_A/881 * 2021-06-30

Freehand-line Options (CT Applications)

Show Ticks	Add measuring scale on drawn lines.
Properties	Access menu to show/hide length.
Graphic Properties	Access menu/Annotation Format to modify line width, text size and color.
Cut, Copy, Delete	These functions are common to most graphic tools.

Spline and PolyLine Options (CT Applications)

Show Ticks	Add measuring scale on drawn lines.
Add points	Add control boxes.
Properties	Access menu to show/hide length.
Graphic Properties	Access menu/Annotation Format to modify line width, text size and color.
Cut, Copy, Delete	These functions are common to most graphic tools.

Double-line Options (CT Applications)

Show Ticks	Add measuring scale on drawn lines.
Move double line	Moves both lines together.
Always 90 Degrees	Displays the lines 90 degrees from each other.
Profile	
Properties	Access menu to show/hide length.
Graphic Properties	Access menu/Annotation Format to modify line width, text size and color.
Cut, Copy, Delete	These functions are common to most graphic tools.

Delete Graphic

Place the mouse on the graphic - it turns yellow.

Right mouse click and select **Delete** from the menu that pops up.

Or:

Use the <Delete> button on the keyboard.

Move Graphic

1. Place the mouse on the graphic to make it active. It turns yellow.

3000067186691_A/881 * 2021-06-30

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2. Move the mouse along the graphic until the cursor changes to the Move symbol.
3. Click and drag the graphic to the desired location.

Change Shape of Graphic

1. Place the mouse on the graphic to make it active. It turns yellow.
2. Place the mouse on the control box you want to use to change the shape. The cursor becomes an arrow head with a white square.
3. Drag the control box to the desired location and release the mouse.
4. Move additional control boxes as needed.

Add Additional Graphic Control Boxes

1. Place the mouse on the graphic to make it active; it turns yellow.
2. Move the mouse on the graphic where you want to add a control box. The cursor changes to an arrow with a white square and a plus sign (+).
3. Left click to add a new control box.

Delete Graphic Control Box

1. Place the mouse on the graphic to make it active; it turns yellow.
2. Move the mouse over the existing control box that you want to remove.
3. Hold down the <Ctrl> key. The cursor changes to an arrow and a white square with an X over it.
4. Click on the box and the box is deleted.

NOTICE

If a line or similar graphic is not exact enough, you should delete it and start again.

Region of Interest (ROI)

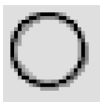
The ROI is a graphic tool used to enclose a region of interest on the image. Use an ROI to view data about the enclosed area.

Four ROI measurement parameters are automatically calculated by the Graphics application after you create an ROI. They are:

- AR (area);
- AV (average);
- SD (standard deviation); and
- ED (effective diameter) - Default OFF.

ROI measurement parameters display automatically if you activate them in Preferences. Alternately, you can activate the desired parameters to display from the ROI right mouse menu, described later. Also from the right mouse menu, after drawing overlapping ROIs, you can calculate the Sum, Subtraction, and Occlusion parameters, and display a histogram.

Circle ROI

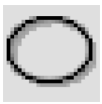


The Circle ROI is used to create a circular graphic around a region of interest. Drag the mouse to enclose the desired region. Release the mouse button to end the drawing.

Freehand ROI

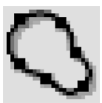
The Freehand ROI is used to draw an area of any arbitrary shape surrounding the region of interest. Drag the mouse around the region and release the mouse button when the entire region is enclosed.

Ellipse ROI



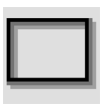
The Ellipse ROI is used to draw an area oval in shape around the region of interest. To start the ellipse, click the mouse at the center point of the region and drag to the desired size. Release the mouse button to end the drawing.

Spline ROI



The Spline ROI is used to create a region of any user-defined shape. A Spline ROI has rounded “corners.” While drawing the Spline ROI, wherever you click is where a vertex is set. Double-click on the last point to end the drawing.

Rectangle ROI



The Rectangle ROI is used to draw an ROI with a rectangular shape. Drag the mouse to enclose the desired region. Release the mouse button to end the drawing. (To make a square ROI, hold <shift> while drawing.)

3000067186691_A/881 * 2021-06-30

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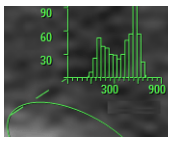
FWHM Function (Rectangle ROI Option)



By placing a thin rectangular ROI across a vessel, you may have the average profile calculated using the FWHM function. FWHM calculates and displays the distance between the points of half contrast around the global maximum and the global minimum. The values displayed are in mm^2.

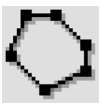
The global maximum and global minimum are found and two pairs of half-density are calculated around them. Two connecting lines (global maximum and global minimum) with their lengths are calculated and displayed.

The thickness of the rectangle defines the number of points that are considered in the calculation of each profile point. (The profile point is an average of pixels along the side parallel to the shortest side).

To use the FWHM function:

- Place the rectangular ROI across the desired area.
- Select the FWHM option (from the right mouse menu). The profile is calculated.

Polygon ROI



Polygon ROI is used to create a region of any user-defined shape. A Polygon ROI has angular “corners.” While drawing the Polygon ROI, wherever you click is where a vertex is set. Double-click on the last point to end the drawing.

Pixel Value ROI

The Pixel value tool is used to measure the CT value of the pixel on which you place the cursor. On 2D images, the XY coordinates of the point are also shown if turned on in Preferences or the submenu. The XY coordinates are displayed in all 2D images. Partial display of the cursor data may be set in the Preferences utility.

To use the Pixel Value tool, place the mouse pointer on the image and click on the point to be measured. The pixel value displays.

NOTICE

On Surview images, the X and Y coordinates are inaccurate and are to be used for reference only. The Surview is a planar projection and the magnification factor of each object varies with its distance from the focal spot, similar to conventional X-ray radiography.

- On a Lateral Surview the height (Y) and table position (Z) are displayed.
- On AP or PA Surviews, the lateral distance (X) and table position (Z) are displayed.

Auto Contour ROI

Auto Contour calculates the contour of a vessel along the line of equal density. Position the cursor on the edge of a vessel and click. The line of equal density is drawn and the Area, Average Density, SD, and Effective Diameter can be displayed.

If no contour is found the algorithm will try a new starting point. The new point is an adjacent point where the relative change in the CT value from the original point is the greatest.

If a contour is still not found, move the cursor slightly to change the start position of the contour search.

The CT value in each pixel is calculated with smoothing to an average of a 3x3 mask.

Flexi Contour ROI

Flexi Contour calculates the contour of a vessel where a contour value is interpolated according to its relative location between the rays drawn through outside selected points.

1. Move the cursor to the center of the vessel and click.
2. Move the cursor to a few points outside the vessel and click.
3. Double-click the mouse to conclude point selection.

The contour is drawn on the line of average density between the selected point in the center of the vessel and the point outside the vessel. The continuation of the contour is interpolated according to its relative location to the succeeding selected points.

NOTICE

It is not required to have a minimal difference in CT values between the point inside the vessel and each of the points chosen outside the vessel.

3000067186 91_A/881 * 2021-06-30

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Edge Finder ROI

Edge Finder calculates average density difference between points outside the vessel and a point in the center of the vessel. A contour is then drawn along the equal density line at half the density difference.

1. Find the center of the vessel. The first point selected must be at the center of the vessel.
2. Move the cursor to the center of the vessel and click.
3. Adding additional points outside the vessel will recalculate and redraw the line of equal density.
4. Double-click the mouse to conclude point selection. The line of equal density with appropriate parameters is calculated and displayed.

If the difference in CT values between the point inside the vessel and those outside are less than 20, no contour will be calculated.

Edge Finder uses an average of CT values in the selected points as a contour value and bases its calculation on eight base points in eight constant directions. The examination of the line of equal density is done by moving from one base point to another.

After the contour is found, refinement of the results to the desired form can be achieved by changing the position of the chosen points. This feature is a significant advancement in the solution of difficult cases.

The CT value in each pixel is calculated with smoothing to an average of a 3x3 mask.

Change ROI Shape

After drawing a graphic, you can change its shape if necessary. By pointing onto an existing graphic, the graphic will enter an edit mode, and you can change its appearance by dragging “control boxes” to new locations. Details about editing graphics are provided later in this section.

Sum (Add), Subtract Operations on ROIs

When one region of interest overlaps another, or is completely enclosed within another, the sum, difference, and percent occlusion of the ROIs may be calculated. These functions work with all ROI graphic options.

1. Draw the first ROI.
2. Right mouse click on the first ROI. The ROI right mouse menu displays. (The menu is shown on a later page.)
3. From the menu, select **Sum**.

   The first ROI graphic drawn must start with the Sum function. If you use Subtract on the first graphic you draw, you will not get an accurate calculation.

   Each time you draw an ROI you must select either Sum or Subtract after you draw the ROI graphic.
4. Draw the second ROI.

3000067186 91_A/881 * 2021-06-30

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5. From the ROI right mouse menu, select either **Sum** or **Subtract**.

   When subtracting, only the total AR is displayed.

For each ROI drawn, the AR (area), AV (average), SD (standard deviation), ED (estimated diameter) measurement information is given.

At the bottom of the image a mathematical equation with the following values appears, in green:

- ROI: (A+B, for example);
- Tot AR: (total area, mm^2);
- Tot Av: (total average); and
- Tot Sd: (total standard deviation).

Calculate Vessel Occlusion on ROI

1. Draw the ROI around the entire vessel.
2. Place the cursor over the ROI to make it active.; it turns yellow.
3. Right click to open up the submenu.
4. Select Occlusion.
5. Draw an ROI around the contrasted filled portion of the vessel.
6. Repeat steps 2 - 4.

The Occlusion calculations are displayed.

ROI Submenus

After an ROI graphic has been completed, point to it with the mouse until the graphic turns yellow. Right mouse click to view an applicable submenu.

ROI Options

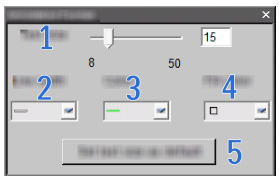
Sum	Calculate the sum of overlapping ROI areas.
Subtract	Calculate the overlap area of ROIs.
Occlusion	Calculates the vessel occlusion.
Histogram	Display the histogram of an ROI. (An example histogram is shown on a later page.)
Export Values	Saves the pixel values as a csv file that can be exported into an excel document.
Properties	Select which ROI measurements to display.
Graphic properties	Modify line width, text size and color.
Cut, Copy, Delete	These functions are common to most graphic tools.

3000067186691_A/881 * 2021-06-30

ROI Measurement Annotations

Properties	Area
	Average
	SDev
	EDiam

ROI Graphic Properties Options (CT Applications)

Graphic Properties	Graphic Property Options in Annotation Format Window:	
	• Text size (#1) 	Using the Annotation Format, the user can use the slider to set the desired Text font size (#1 above). To make the selected Text size the default for the current session , select the **Set Text size as default** button (#5 in image). The Text size for new sessions are defined from the Preferences settings.
	• Line width 	#2 above
	• Line color 	#3 above
	• Fill color 	#4 above

Rectangle ROI Options

Rotate	Rotate the rectangular ROI.
Sum	Calculate the sum of overlapping ROI areas.
Subtract	Calculate the overlap area of ROIs.
Occlusion	Calculates the vessel occlusion.
FWHM	Calculate the Full width, Half max value. See section “FWHM Function (Rectangle ROI Option)” on page 157.
Histogram	Display the histogram of an ROI.
Export Values	Saves the pixel values as a csv file that can be exported into an excel document.
Properties	Select which ROI measurements to display.
Graphic properties	Modify line width, text size and color.
Cut, Copy, Delete	These functions are common to most graphic tools.

Ellipse ROI Options

Rotate	Rotate the rectangular ROI.
Sum	Calculate the sum of overlapping ROI areas.
Subtract	Calculate the overlap area of ROIs.
Occlusion	Calculates the vessel occlusion.
Histogram	Display the histogram of an ROI.
Export Values	Saves the pixel values as a csv file that can be exported into an excel document.
Properties	Select which ROI measurements to display.
Graphic properties	Modify line width, text size and color using the Annotation Format.
Cut, Copy, Delete	These functions are common to most graphic tools.

Angle

The Angle tool draws two lines, joined at a vertex, which may be placed along two image features to measure the angle between them.

WARNING

When performing angle measurements on a volume rendered perspective image, the depth of the position pointed to must be well defined in the image. Refer to the measurements Warning earlier in this section for more information.

3000067186691_A/881 * 2021-06-30

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Draw Angle

1. Single or double click the **Angle graphic** tool.
2. Move the cursor to the first point on the image and click.
3. With the left mouse button drag the pointer in the desired direction to draw the first line of the angle and release the mouse button.
4. Drag the mouse to draw the second line of the angle.
5. Click to end drawing.

   The angle value, in degrees displays near the angle vertex.

   Length measurement and ticks can also be displayed, if they are activated.
6. Repeat steps as necessary.

Angle Graphic Options

Show Ticks	Add measuring scale on angle.
Properties	Select length.
Graphic properties	Modify line width, text size and color using the Annotation Format.
Cut, Copy, Delete	These functions are common to most graphic tools.

Arrow/Text Tool

Arrows are used to point to features of interest on the image and, if you desire, type in corresponding text. Text allows you to place information anywhere on the image, without a corresponding arrow.

Create Arrow and Add Text

1. Click the **Arrow + Text** tool.
2. Move the cursor near the feature you are marking.
3. Click to place the arrow and drag the mouse to a location where you want the text to appear.
4. Release the mouse. An empty text box opens.
5. If you do not want any text in the box, click outside the box to close it (or hit <Escape> on the keyboard).

   Or:

   If you want to enter text in the box, type the desired text in the box. When finished, click outside the text box to end typing or click the desired text in the predefined list, defined in **Preferences**.
6. Repeat steps as necessary.

3000067186 91_A/881 * 2021-06-30

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Add Text without Arrow

1. Click the **Text** tool.
2. Move the cursor to the location on the image where text is to begin and click. An empty text box opens.
3. Type desired text or select from the predefined list.
4. When finished typing, click outside the text box to close it.

Use Predefined Text

There is an option in the Viewing Applications section of Preferences called “Predefined ‘Text’ for applications,” where you can enter your own text annotation, which then becomes available for selection from the predefined text list specific to each application.

Arrow/Text Tool Options (CT Applications)

To access the Arrow and/or Text right mouse menu, point to the arrow or text until the graphic turns yellow. Right mouse click and this menu appears:

Set As Title	Fixes the text to the image for filming.
Edit text	Allows editing of the text.
Properties	Select length.
Graphic properties	Modify line width, text size and color using the Annotation Format.
Cut, Copy, Delete	These functions are common to most graphic tools.

Move Text - Arrow/Text Tool

Point to the text with the mouse until the graphic turns yellow and a cross appears.

Click and drag it to another location.

Line/Text Tool

1. Click the **Line + Text** tool.
2. Move the cursor near the feature you are marking.
3. Click to place the line and drag the mouse to a location where you want the complete distance measurement text to appear.
4. Release the mouse. An empty text box opens.
5. If you do not want any text in the box, click outside the box to close it (or hit <Escape> on the keyboard).

   Or:

300006718691_A/881 * 2021-06-30

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If you want to enter text in the box, type the desired text in the box. When finished, click outside the text box to end typing or click the desired text in the predefined list, defined in **Preferences**.

6. Repeat steps as necessary.

Remove All Graphics (CT Applications)

To remove all graphics click on the Remove all graphics icon. Graphics are removed from images you have selected.

Compression

Use compression to help the performance of the system by allowing faster image manipulations. Compression allows data to be stored or transmitted using a reduced amount of digital data. Compression affects only the viewing of the images. When images are exported - saved, sent to film, and reported - compression is lossless (100%).

WARNING

When you select one of the options which include resolution reduction - the image resolution and quality will be reduced during interaction.

When loading images into IntelliSpace Portal applications, all images which contain 16 bit data are converted into 12 bit images. This means that for rescale intercept equal to -1000, HU values above 3095 are displayed as 3095. For rescale intercept equal to -1024, HU values above 3071 are displayed as 3071.

When selecting one of the lossy compression options, the performance (user interaction) during image manipulations is improved due to reduced image resolution.

Lossless [100%]	No data compression
Quality level 80%	Lossy compression which may reduce the quality level of the images down to 80%
Quality level 60%	Lossy compression which may reduce the quality level of the images down to 60%
Quality level 40%	Lossy compression which may reduce the quality level of the images down to 40%
Quality level 40%	Lossy compression which may reduce the quality level of the images down to 40%
Quality level 80% & Resolution reduction	In addition to the Lossy compression, there is a resolution reduction while manipulating the images (zoom, scroll, pan, swivel, rotate, ...)

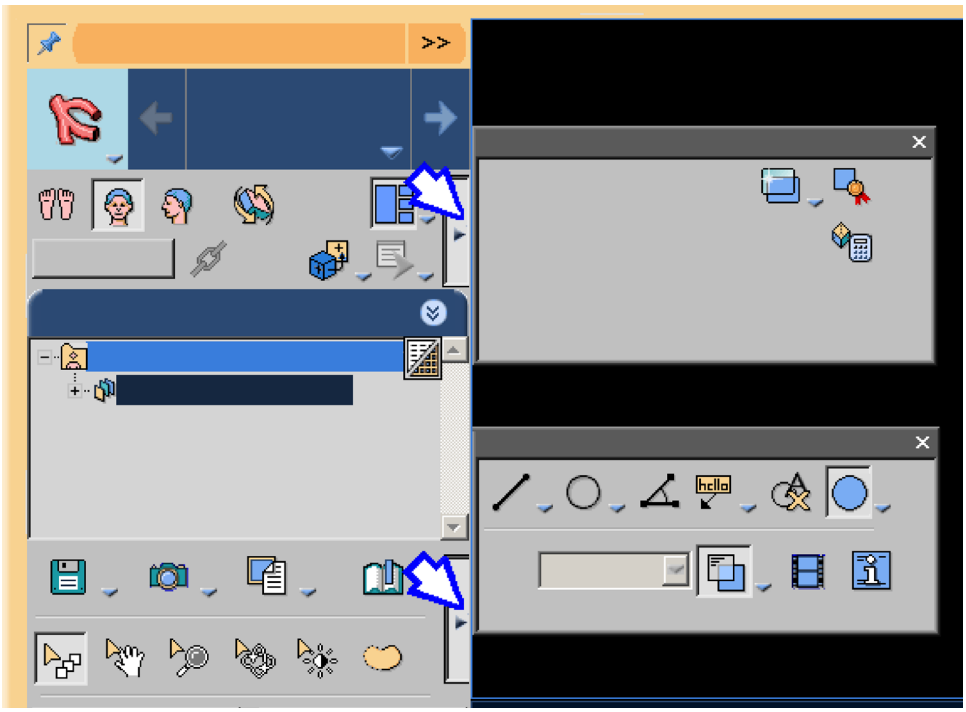
3000067186 91_A/881 * 2021-06-30

Philips

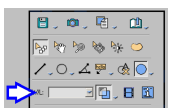
Quality level 60% & Resolution reduction	In addition to the Lossy compression, there is a resolution reduction while manipulating the images (zoom, scroll, pan, swivel, rotate, ...)
Quality level 40% & Resolution reduction	In addition to the Lossy compression, there is a resolution reduction while manipulating the images (zoom, scroll, pan, swivel, rotate, ...)

Low Resolution Tool Panel

In the Low Resolution display the height of the panel is shortened - some tools are not displayed, but can be accessed. To access the additional tools, click the More arrow. The window with additional tools can be dragged anywhere on the screen.



Miscellaneous Functions



use the Miscellaneous functions to translate the values of displayed images; turn on and off titles and grids; toggle to black-and-white; show Cine; and more.

Windowing Function

The Windowing function is used to translate the values of the displayed image into a range of gray levels suitable for optimal viewing and filming.

The system is supplied from the factory with 9 windowing presets (whose values you can modify, if desired).

3000067186691_A/881 * 2021-06-30

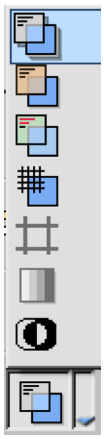
There are many ways to work with windowing:

- You can select one of the windowing presets from the drop-down menu.
- You can activate a windowing preset with the keyboard shortcuts. Press a number key between 0 and 9.
- You can modify the factory presets in the **Preferences** utility.
- You can type in your own windowing Center and Width values. Select Type in from the drop-down and enter the desired values.
- You can drag the mouse in the active viewport to make adjustments to the image's windowing values. To adjust the window Center, drag the mouse up or down with the middle mouse button pressed. To adjust the window Width, drag the mouse right or left.

The Default value in the drop-down menu is the window center and width that comes from the scanner.

Automatic is used to allow the system to select a windowing center and width based on the anatomy being displayed. "Modified" becomes the label any time you change the window with the middle mouse or Type-in feature.

Titles, Grid, and Other Display Controls (CT Applications)



The Titles On\Off button turns on and off all text displayed on all images. The Functional Titles On\Off button turns off and on only the patient and scan information, and leaves on the viewport control display text. Turning off titles display has no affect when saving, filming or reporting images. All data still appears on those images.

Grid Display and Spacing

This function displays a grid pattern on the active image. The default grid spacing is10mm. Click the drop-down arrow to open the Grid Spacing dialog box. The range of grid spacing is from 1 mm to 50 mm.

Viewport Center Option

By default, the center of the grid is located at the **Viewport Center** (shown at the lower left corner of the grid). When panning the image, the grid does not move.

3000067186691_A/881 * 2021-06-30

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Image Center Option

To activate, right click on the text (Viewport Center) in the lower left hand corner of the grid and select **Image Center** from the menu. This option keeps the grid center connected to the image center. When panning, the grid moves in conjunction with the image.

Color to Black-and-white

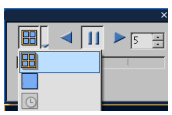
When the active viewport is displaying a color-rendered volume image, click this button to convert it to a black and white (monochrome) image.

Invert

When the active viewport is displaying a color-rendered volume image, click this button to convert it to a black and white (monochrome) image.

Show Cine (CT Applications)

The Cine function allows you to view (“play”) the study in the Cine (animated) mode. To activate Cine, click the **Cine** button. A semi-transparent control box is displayed over the image viewport.



To view the selected images in the Cine mode, click the down arrow:

All. Play all the images in the study. The entire selection in the series tree is played regardless of the selection mode, and in their displayed order (including combine and sort).

Batch. Play a batch, if one has been defined. (The selection is grayed out if there is no currently defined batch.)

Time. Play the Time Batch. (This selection is available only for some applications.)

NOTICE

If you are in the Compare mode, the selected viewports will play.

You can play the cine forward or backward, and can pause the display. Cine speed is measured in frames per second and can be changed before or during play. Speed range is from 0.1 to 25 frames per second.

Image Scan Parameters

This button opens a window that displays all the image scan parameters that are available for the current image.

In the 2D view mode of the CT Viewer, the image parameters window contains more information than in other viewing modes and applications.

3000067186 91_A/881 * 2021-06-30

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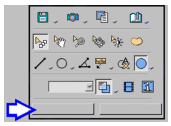
Reset All and Exit (CT Applications)



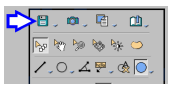
If changes have been made to the image, The Reset All function resets the current scene to its original state when it was loaded into the application.

The Exit function closes the application. If there are unsaved objects in the series tree, a message asks you if you want to save those items before you exit. If you click OK, the Save dialog opens for the first unsaved object. If there are other unsaved objects, you are prompted to save each one. If you click No, unsaved objects are not saved, and the viewer closes. If you click Cancel, the application does not close. The Directory opens after the application is closed.

NOTICE

In **Preferences**, you can select to automatically save a bookmark when exiting.

Save, Film, and Report Tools



These tools are used for saving, filming, reporting, and for saving bookmarks (saving your work during your work sessions).

NOTICE

For applications where enabled, you can save **Findings** and send them to **Report** or **Film**. See section “Findings Navigator and Findings Repository” on page 142.

Save Functions

The **Save** functions are selectable from a drop-down menu. Click the down-arrow next to the icon to view all **Save As** functions. Clicking a **Save As** function opens a dialog box (**<Shift> + S** may also be used).

NOTICE

Some CT applications have more **Save As** selections than shown above. They are described in the relevant sections.

1. Select the appropriate option from the **Save As ...** drop-down menu.
2. Give a file name (description).
3. Select either the **DICOM** or **Non-DICOM** radio button and choose the file type from the menu. Depending on the file type selected, additional options are available.

3000067186 91_A/881 * 2021-06-30

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Images are saved according to the selection mode in the default format. For example:

- Original images are saved as (DICOM) ORIGINAL.
- Images combined by the user are saved as (DICOM) DERIVED.
- Others are saved as (DICOM) SC (secondary capture). SC represents most generic kind of image. While there is sufficient information to identify the patient and (with some limitations) the study, other details (like image orientation, pixel spacing, etc.) may be missing.

The JPEG, BMP, TIFF, Movie (WMV) and AVI formats are used to save images or movies in common graphical file formats recognized by many Personal Computer (PC) applications. The quality may be adjusted.

4. Save the images to the local server (default) or a remote device. If you need to save the images to multiple local devices, select them from the available options. To export NON-DICOM images, select **Browse**.

   You may also save to the CDR folder or directly to a storage device.

5. To remove existing patient information and create a new **Study**, click the **De-identify** button, give the required information, and click **Apply**.
6. Click **OK**.

NOTICE

If you do not exit the application after changing the **Save As** functions, the last device you selected, along with the local device, is selected when you open the next **Save As** function. If you have previously saved DICOM data during the current session, a **Same Series** check box also appears. This allows you to save images to the same series that you are working on. After you exit the application, the **Save As** device is automatically reset to the device defined in **Preferences**.

Option	Description
Save Selected Image(s) as... 	Use to save currently selected viewports as different file formats.
Save Screen Snapshot As... 	A display (screen snapshot) is the current visual contents of the monitor. You may save the display as a Secondary Capture, or as a file in a standard graphic format (JPEG, BMP, or TIFF) or DICOM.

3000067186 91_A/881 * 2021-06-30

Option	Description
Save Created Series/Movie As... 	A **Batch** is group of images from the study that you want to handle as a single entity. The **Save Save Created Series/Movie As** function is available when a batch or movie has been created. The batch or movie is saved in the default format of the image(s) it contains. When you choose to save a batch as a movie, the dialog box allows you to select the image quality of the movie, by means of a quality scroll bar. The movie quality is selectable from lowest to highest.
Save Results As... 	The results include centerlines, tissues, curves, contours, and other information, all in one **Series**. When you are saving the results of an operation from the current application, the results are saved in DICOM format, with an identifying description. To restore all the work that was done within the application, select the saved results **Series** together with the original **Series** and open the relevant application.

Film Functions

The Film functions allow you to send selected patient images to the FilmView application. The Film functions are selectable from a drop-down menu. Click the down-arrow near the icon to view all Film functions.

Images sent from 2D mode to Filming are in their original matrix size.

Film Images

Your selection of patient images is sent to the FilmView application.

Film Display

The content of the display is sent to the FilmView application.

Film Batch

This is enabled when a batch is created. Use to send the active batch to film.

Report Functions

The Report functions allows you to send patient images and patient data to the Report application. The Report functions are selectable from a drop-down menu.

Advanced applications may also have a selection for sending results and clearing results from the report.

The Report buttons are grayed out if the optional Report Editor is not installed.

Add Comments to Report

There is a check box in the Reporting page of Preferences called “Open comments dialog when sending images to report.” If you activate this, a comments text box opens each time you send images to the Report application.

Send Selected Image(s) to Report

Your selection of patient images is sent to the Report application.

Report Display

The content of the display is sent to the Report application.

Send Batch to Report

This option is available when a batch is created.

Bookmark Functions

Click **Save bookmark** during a work session to save the current status of an application. When you save a bookmark, IntelliSpace Portal saves numerous existing parameters and data about your current work session. At any time subsequently, you can “open” a saved bookmark. In effect you "step into" the application as it existed at the moment you saved the bookmark, and can continue working from that point on.

As you work, you can continue saving bookmarks. The bookmarks can be saved even if you end your work session. See section “CT Common Processes” on page 179.

3000067186691_A/881 * 2021-06-30

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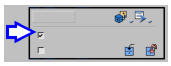
Viewport Tools



Use the viewport tools, in the upper tool panel, to relate views; show and hide crosshairs and rotation center; move to next series; and perform other view functions.

Relate

The **Relate** functions allow you to relate a location on one image of the patient to that location as viewed on other image(s) of the patient.

1. Click the **Relate** down arrow and select either **Relate Scenes**  or **Relate Viewports**  from the menu.
2. With the **Relate** button active, click on the desired location using the left mouse button to place the relate cursor at that location. The Relate mode allows you to scroll and also locate the relate cursor without the need to toggle between the **Relate** and the **Scroll** functions.
3. With the **Relate** button active, hold down the left mouse button and move the cursor up or down to navigate (scroll) through images.

NOTICE

Use **Compare** to relate different reconstructions from the same acquisition. When active, the **Series** are linked: placing the relate crosshair on one **Series** will place it on the linked **Series**.

WARNING

When reviewing the Relate cursor on various compared series that were registered via Automatic Registration, always verify anatomical locations. Automatic registration may provide inaccurate alignment between compared series.

Relate Scenes

The **Relate Scenes** function allows you to mark a specific location of interest in one viewport, then access other CT viewing modes (Slab, Volume, and Endo viewers) and see the related point identified with cross marks.

When **Relate Scenes** is selected, clicking on an image locates the relate point at that location. When selected, clicking and dragging the left mouse on an image scrolls through the images on 2D/MPR images and rotates the image in case of a volume image. This enables selecting the **Relate Scenes** option and scrolling through the images without the need to switch between buttons.

3000067186 91_A/881 * 2021-06-30

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If **Compare** mode is active (i.e. several series are displayed side by side on the screen), when placing a relate point on one series, it is also shown on the other series if:

- The series come from the same acquisition (different reconstructions coming from the same scan).
- Automatic Registration was applied between the displayed series.

Relate Viewports

The **Relate Viewports** function allows you to mark a specific location of interest in one viewport and see it on other images in the display (relate works only when you have the reference image viewports open, along the right side of the window).

When **Relate Viewports** is selected, clicking on an image locates the relate point at that location. When selected, clicking and dragging the left mouse on an image scrolls through the images on 2D/MPR images and rotates the image in case of a volume image. This enables selecting the **Relate Viewports** option and scrolling through the images without the need to switch between buttons.

If **Compare** mode is active (i.e. several series are displayed side by side on the screen), when placing a relate point on one series, it is also shown on the other series if:

- The series come from the same acquisition.
- Automatic Registration was applied between the displayed series.

Move to Next Series

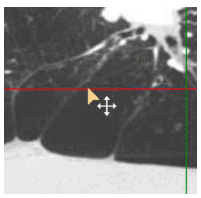
Use this button to move to the next series. The button is enabled when more than one series has been loaded to the current application.

Using Crosshairs

Most CT applications support crosshair rotation, enlargement, and repositioning. To toggle the display crosshairs, use the **Show Crosshair** checkbox in the upper toolbox.

For viewports with crosshairs, perform one or more of the following to adjust:

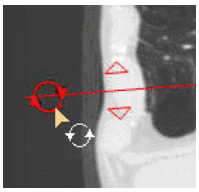
- Grab the crosshair and drag it to the correct position.



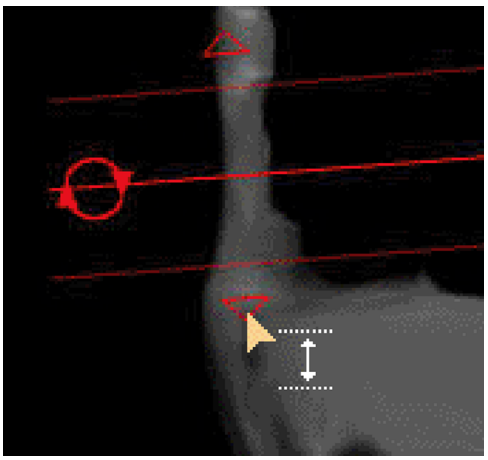
- To rotate, grab near the end of the crosshair and drag in the appropriate direction.

3000067186691_A/881 * 2021-06-30

Philips



- To change thickness of the images represented by the crosshair, grab the triangle and drag it.

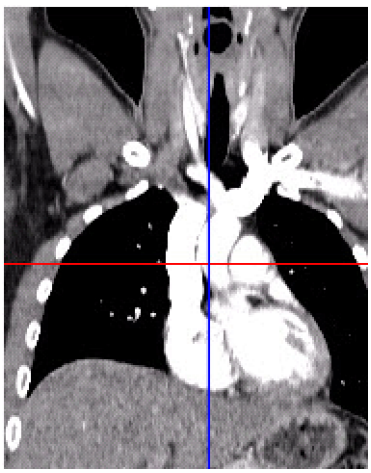


Some applications display a hole in the center of a crosshair by default. A hole in the crosshair prevents hiding important anatomical structures.

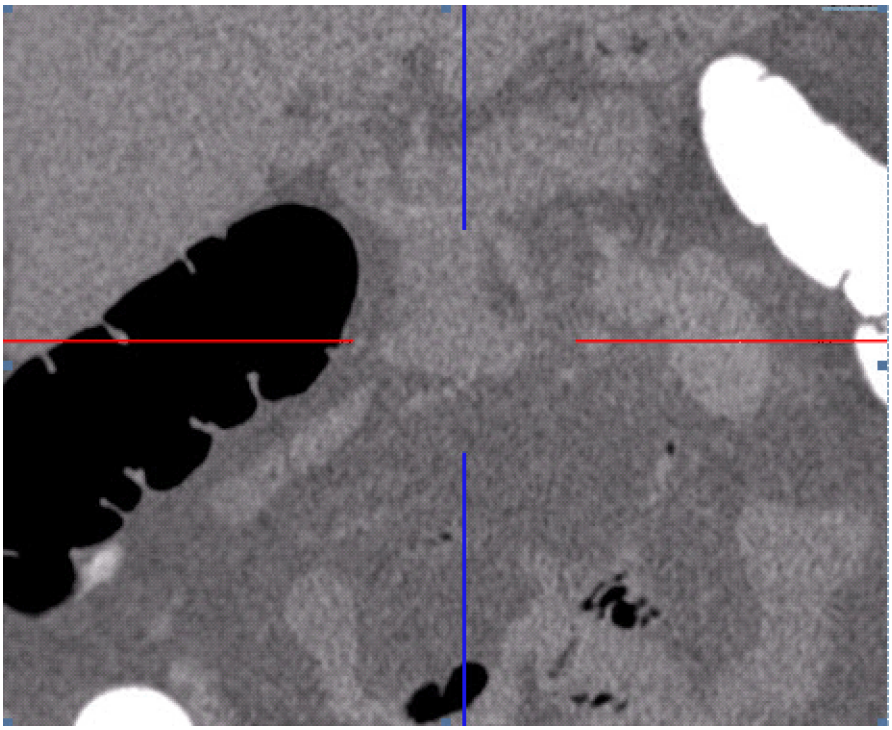
The right click menu on the crosshair allows switching between modes where the hole in the crosshair is displayed/not displayed.

Once crosshair settings are selected, (Show short crosshair, Hide crosshairs center, Show short/long crosshairs), these settings are remembered the next time the application is opened by the same user.

The **Show Crosshair Center** option shows a continuous crosshair without a hole.



The **Hide Crosshair Center** option shows a crosshair with a hole



Shortened Crosshairs

In order to minimize the possibility of crosshairs hiding anatomical structures, it is possible to display shortened crosshairs and to only show the crosshairs where relevant.

- To switch to a shortened crosshair mode, right click on the crosshair and select **Show short crosshairs**.
- To switch to the default (long) crosshair, right click on the crosshair and select **Show long crosshairs**.

Rotation Center

Use to show the center point (the X) around which the volume can be rotated.

NOTICE

Rotation Center may also be activated by holding down the `Alt` key and clicking on one of the images. To reposition, continue to hold down the key and drag the pointer to the desired location.

Center Cursor

This function moves the middle of the image to the rotation center, centering the image around the rotation center. Change the rotation center as follows:

3000067186 91_A/881 * 2021-06-30

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1. Move mouse over the current rotation center (the X) in the slab view. The mouse pointer turns into an arrow cross symbol.
2. Drag the rotation center to the desired region of interest.
3. Click **Center Cursor** and the slab view centers around the new rotation center location.

The image now rotates around this new rotation center when you use the swivel or paddlewheel mode.

Reset Center and Axis - CT Cardiac Viewer

Clicking this button influences the rotation center and axis as follows:

- **Rotation Center.** The center of rotation is reset to its original location upon loading the phases to the application.
- **Orientation.** The orientation of the main image is changed to axial.
- **Cardiac Orientation.** The orientation of the main image is changed to short axis view.

3000067186691_A/881 * 2021-06-30

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