

Figure 5.2. The Protocols preferences window options showing the modality drop-down list.

For example, suppose you wanted to add a new protocol for an abdominal CT study with six series. You might set the layout to Window Tiling 2x3 and Image tiling to 1x2. Doing so would result in a layout similar to that shown in Figure 5.3.

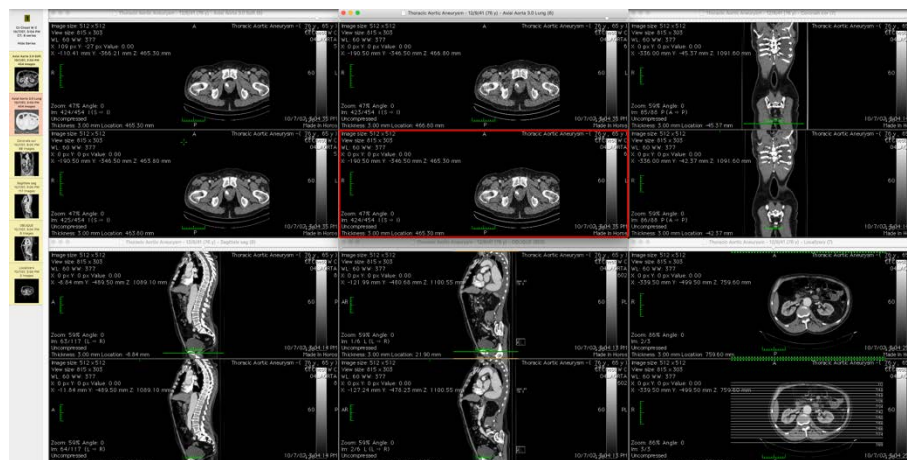


Figure 5.3. Multiple views layout for a study with six series.

## Viewers

The Viewers preferences (Figure 5.4) allows you to customize a wide range of behaviors for the 2D Viewers (Figure 5.5). These settings modify the display parameters of the 2D views, including mouse behavior, ROIs display, etc. You can also modify the behavior of multiple 2D Viewers using settings for magnetic windows, widow tiling, etc.

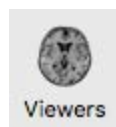


Figure 5.4. The Viewers icon in the Horos Preferences panel.

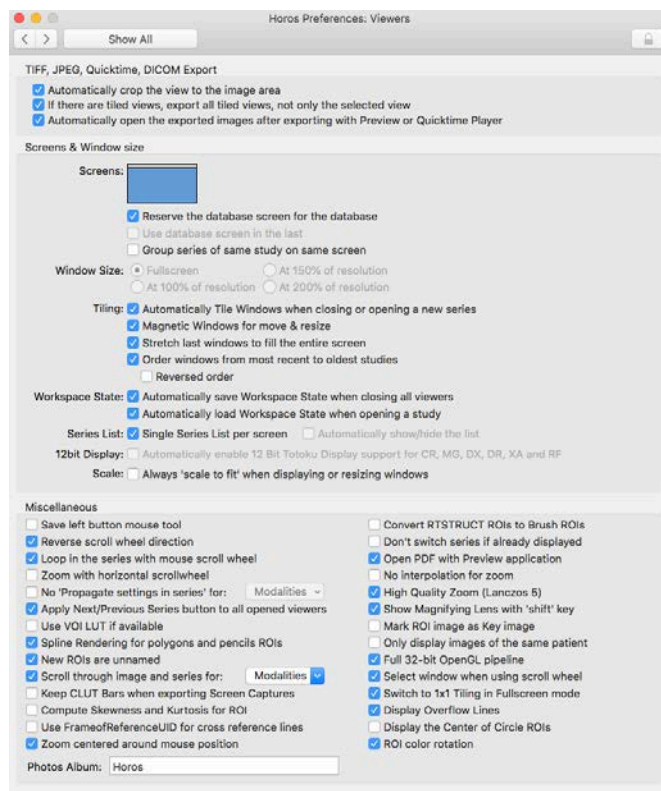


Figure 5.5.

The Viewers Preferences options from the Horos Preferences panel.

At the top are settings for exporting **TIFF**, **JPEG**, **QuickTime**, and **DICOM** images from any Viewer. You can automatically crop images to remove black regions surrounding images. You can choose to export an image that consists of all tiled views (if multiple tiled views are open). Finally, you can automatically open and preview images exported as TIFF, JPEG, or QuickTime sequences.

The middle section allows you to set parameters for **Screens and Window size**. For example, if you have multiple computer screens, you can open 2D Viewers on all available screens or a subset of available screens. The Screens parameters are activated by clicking on the screens icon to bring up a list of available screens.

The top checkbox is an option to always reserve a screen for the database window. When checked, no 2D Viewers windows are displayed on the database screen. Unchecking the top checkbox allows you to use the database window in the last screen (if all others screens are

already used). Finally, you have the option to keep Series from the same Study on the same screen.

The Window Size options allows you to open series at 100%, 150% or 200% of their resolution in a window of the same size, or in a window that fills the whole screen (Fullscreen). By default, these options may be grayed out because the Automatic Tiling option is turned on (see below). To change Window sizes, simply uncheck the Automatic Tiling options. With Automatic Tiling option on, windows are automatically resized and rearranged so that all windows fill the available screen space. Turning on the Magnetic Windows option causes windows to automatically stick to the screen edges and to each other. Tiling and Magnetic Windows features are also described in Chapter 6.

The Workspace State allows you to automatically save the state of the workspace displayed on the screen. Parameters that will be saved include WL/WW, pan, zoom, rotation and other settings. You can also choose to automatically load the workspace state if one have been saved. The 12bit Display will only be available if a 12bit Totoku display is available. When turned on, the scale to fit option will ensure that the whole image is always visible when resizing the window.

The remaining options are found under the Miscellaneous parameters options at the bottom. These options are described in Chapter 2.

## Chapter 6

### 2-D Viewer

In this chapter we describe how 2D images are displayed and manipulated in Horos. Typically, the 2D Viewer window is the first place to start. Open a study and click on the 2D Viewer button on the top Horos menu bar. This displays the DICOM stack in the 2D Viewer window (Figure 6.1). There are three parts to the Viewer window; the Toolbar across the top, the Series List on the left side, and the Image View displaying one slice from the DICOM stack.

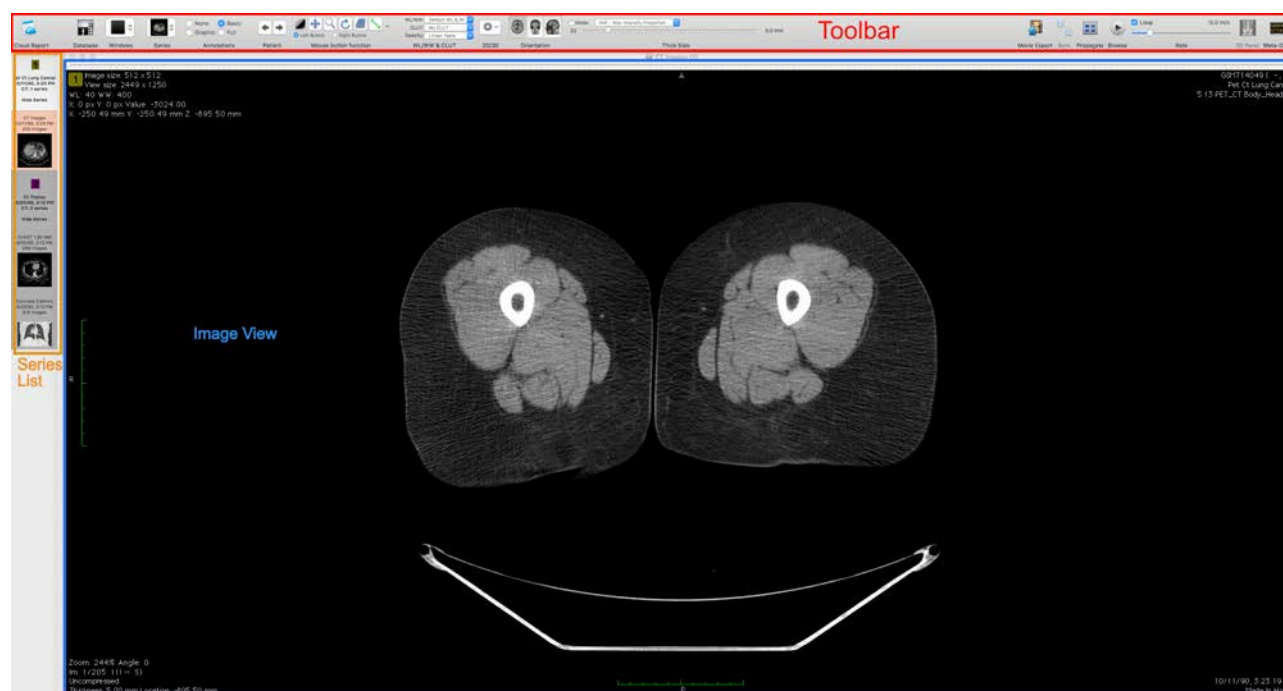


Figure 6.1. The 2D Viewer window

Across the top is the 2D Viewer Toolbar containing buttons for the most commonly used functions in the 2D Viewer. The Toolbar can be customized by clicking on Formal > Customized Toolbar from the main Horos menu bar (Figure 6.2)



Figure 6.2. The options for customizing the 2D Viewer toolbar.

The Series List along the left margin displays the open series or studies. The largest window is the Image View which displays a single slice from the DICOM stack. You can move through the stack by moving the small triangular marker at the top of the image view to the right or left.

## The Toolbar

The 2D Viewer Toolbar provides a subset of the tools and functions for working with patient DICOM images. Recall that you can add additional tools or remove unwanted tools from the toolbar using the Format > Customize Toolbar command. The default toolbar (Figure 6.3) is described below in order from left to right.



Figure 6.3. The 2D Viewer Window Toolbar

### Cloud Report

This button allows registered users to access the Horos Cloud and create detailed reports and manage signatures using simple templates.

### Database

Clicking on the Database button closes the 2D Viewer windows and takes you back to the main database window.

### Windows

The Windows button displays a dropdown list of options for tiling multiple windows on the screen. You can choose how many windows to display and their orientation on the screen (Figure 6.4).

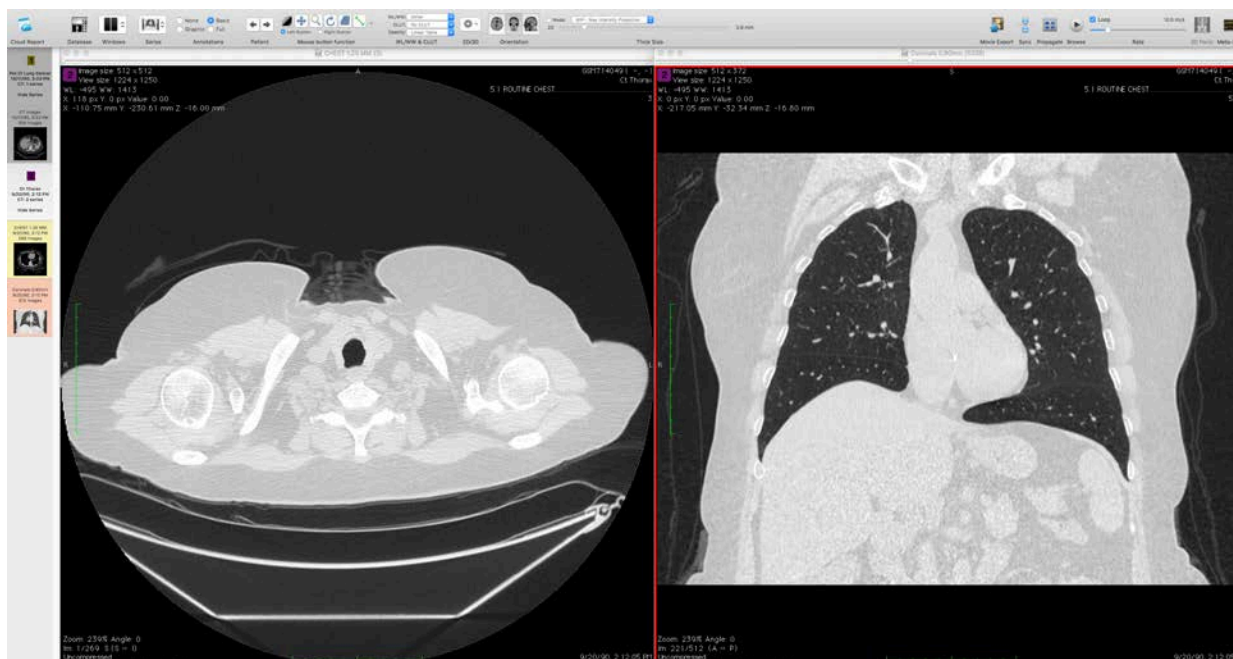


Figure 6.4. The 2D Viewer window with the Windows button set to 2 vertical images

### *Series*

Clicking the Series button brings up a list of series. Clicking on a new series bring up that series in the Image Window. You can also access these options from the main Horos menu by clicking 2D Viewer.

### *Annotations*

The Annotations button gives you four choices for how annotations are displayed on the Image Window. Clicking the None option removes all text annotations. The Basic option is the default and displays information about the image size, slice thickness, and other attributes about that series, except the patient name. The Graphics option removes text from the image and the Full options displays all annotations including the patient's name (if available).

### *Patient*

You can display the next or previous patient by clicking on the forward or back arrows.

### *Mouse button function*

There are twenty-one function buttons (only a subset maybe visible) that can be assigned to you mouse's right or left button (Figure 6.5)



Figure 6.5. The visible list of mouse buttons for image manipulation.

These five buttons manipulate the image, while the remaining buttons (Length through Selector) are used with regions of interest (ROIs). From left to right are:

- *Window Level & Width Tool* – Click on this tool and then click and dragging anywhere on the image and the Window Level changes (level refers to contrast/brightness).
- *Pan* – You can reposition the image within the Image Window by clicking and dragging on the Pan button
- *Zoom* – The Zoom tool (magnifying glass) changes the magnification of the image. Clicking on the Zoom button and click and drag up on the image increases the magnification. Dragging down decreases the zoom level.
- *Rotate* – You can rotate the image within the Image Window by holding down the mouse button and moving the mouse
- *Scroll* – The scroll button looks like a stack of cards. Clicking on it and then clicking and dragging up or down anywhere in the Image Window allows you to scroll through the DICOM stack in ascending or descending order.

In addition to the first five buttons described above, there are 16 additional mouse buttons that are used to manipulate ROIs (Figure 6.6). These are described briefly below and discussed in more detail in the Quantification Tools section.

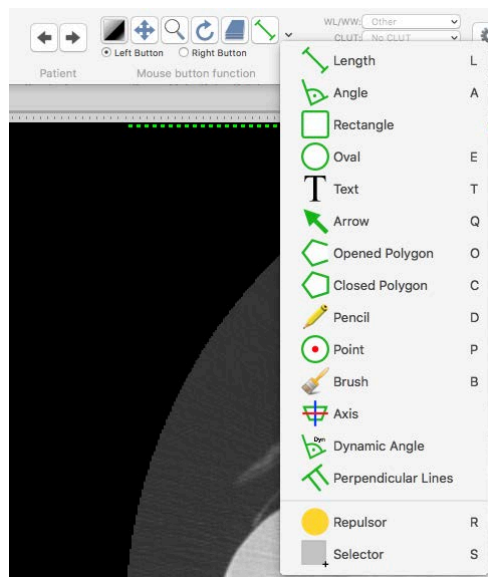


Figure 6.6. The dropdown list of additional mouse buttons for use with ROIs.



*ROI tools include:*

- *Length* – Click on the Length tool and click and drag on the image to create a straight line with it's distance units displayed.
- *Angle* – Click on the Angle tool and then click three places with the image to display angle lines with both inside and outside angles given in degrees.
- *Rectangle* – This tool allows you place a rectangle on the image. It also displays the rectangle's area, width, height, and the mean, max and min pixel values within the rectangle.
- *Oval* – The Oval tool allows you to place an ellipse on the image. It displays the ellipse's area, width, height, and the mean, max and min pixel values within the ellipse.
- *Text* - Clicking on the Text tool allows you to enter comments or other text at the location you clicked on in the Image Window.
- *Arrow* – You can add an arrow anywhere on the image by choosing the Arrow tool and clicking at the location on the image where you want the tip of the arrow to begin.
- *Closed Polygon* – You can create a polygon with as many corners as needed by clicking at various places on the image and closing the polygon by double-clicking. Double-clicking connects the first and last corners of the polygon. The polygon's area and other attributes are displayed when the polygon is closed.
- *Opened Polygon* – Open polygons are similar to closed polygons except that the first and last corners are not connected.
- *Pencil* – The pencil tool creates a closed polygon by clicking and dragging the mouse around the object of interest.
- *Point* – Click on the image with the Point tool and you will see information displayed about that point including pixel value and its 2D and 3D position.
- *Brush* – Click on the image with the Brush tool and you will see a pop-up screen with brush attributes. Select brush and begin painting on the image to create a region of interest (ROI). Choosing erase from the brush attributes allows you to erase parts of the previous brush ROI.
- *Axis* – Creating four points on the image with the Axis tool displays the mean axis based on those four points.
- *Dynamic Angle* – This tool displays the angle between two lines (between the first two points and the last two points). The sum of these two angles is equal to 360 degrees.
- *Repulsor* - The Repulsor is used to modify existing ROI shapes created with the Length, Opened Polygon, Closed Polygon and Pencil tools. Select the repulsor tool, click and drag toward an existing ROI line, and the repulsor's yellow ball will push the contour of that ROI line to reshape the line (Figure 6.7).
- *Selector* - The Selector tool allows you to select ROIs currently displayed in the Image Window.



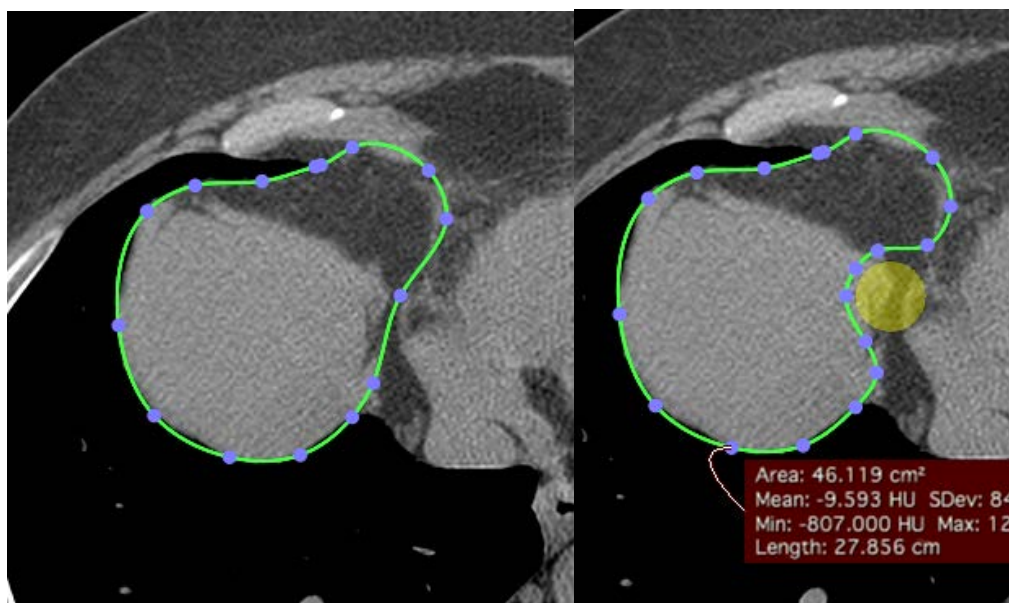


Figure 6.7. The Closed Polygon tool was used to create the ROI on the left. The Repulsor tool (yellow circle) is pushed into the ROI to create an adjusted boundary

### *WL/WW & CLUT Tools*

The next set of tools are a set of three dropdown menu items; WL/WW, CLUT, and Opacity. The top item is the WL/WW, which translates to window level and window width. Clicking on the dropdown gives you several choices (Figure 6.8).

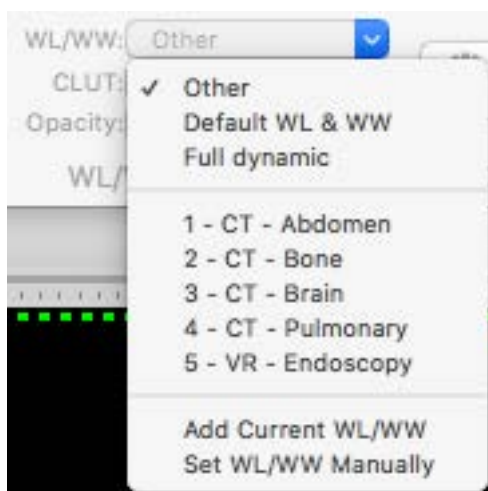


Figure 6.8. The dropdown menu for WL/WW options

Recall from the above description that WL and WW refer to brightness and contrast. In Figure 6.8 you can see the default option and the full dynamic option. Below those options are a set of predefined options that allow you to quickly move from one option to another. For example, Figure 6.9 shows three of the predefined options.



Figure 6.9. The left image shows the Abdomen pre-set, the middle images shows the Bone pre-set option, and the right images uses the Pulmonary pre-set option. You can use Add Current WL/WW to create a new pre-set using the current image settings.

The second dropdown list is the ***Color Look Up Table (CLUT)***. It provides a large series of options. The default is not to add a CLUT and just allow each pixel to retain a gray-scale value from 0 to 255, but if you want to visualize the image in a different way, you can use a predefined CLUT. For example, selecting the CLUT called VR Muscles-Bones displays an image with 0 pixel values as black, intermediate pixels as red, and pixel values of 255 as bright yellow to white (Figure 6.10). Try selecting a few CLUT choice to see how they display the image data.

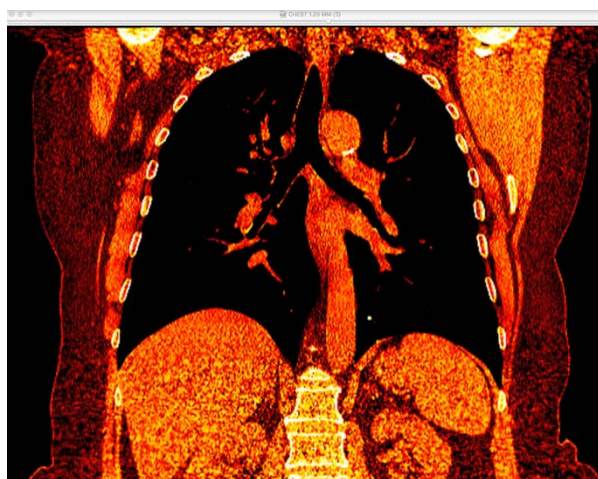


Figure 6.10. The VR Muscle-Bones CLUT

The bottom dropdown in the WL/WW & CLUT list is Opacity. Opacity options work like CLUT options in assigning each pixel an opacity value. The default opacity is linear. That is to say the input assigned opacity is the same as the output assigned opacity.

### *2D/3D Button*

Clicking on this button displays a list of different 2 and 3 dimensional rendering options (Figure 6.11).