

the image will be correctly modified:. This function is also available in the 2D Viewer Menu under Orientation.

### *Fusion*

When two datasets are fused together (i.e. PET-CT studies), you can change fusion parameters such as fusion mode (linear, log, inverse, etc.) and the fusion percentage from 0% to 100%.

### *Growing*

The Growing tool displays the Region Growing panel (Figure 6.28). Details of Region Growing algorithms and use of the Region Growing Panel are described below. This function is also available in the ROI menu: Growing Region (2D/3D Segmentation).

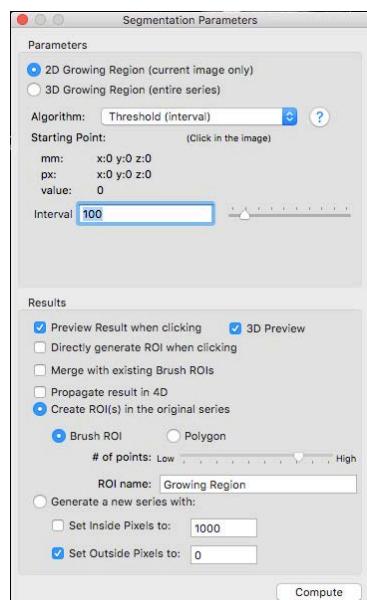


Figure 6.28. The Region Growing Panel.

### *Key Images*

If you are working with a lot of images or want to create an illustrated report, you may want to tag important images (key images). Clicking the box next to Key Image selects the current image as a key image. You can switch from viewing only key images to viewing all images. This tool is also available from the 2D Viewer menu.

### *Navigator*

You can display the Navigator Panel (figure 6.29) below the current image by clicking the Navigator tool. The Navigator panel displays all the images in the current series, in a row of thumbnail images. This panel allows you to quickly and easily see the entire series. This function is also available in the 2D Viewer menu under Navigator Panel.



Figure 6.29. A sagittal section through the head with the Navigator Panel displayed at the bottom of the screen.

### *Photo*

You can create a screen capture of the current image and add it to your Photos library by clicking the Photo tool. This will bring up the popup window shown in Figure 6.27 except the Photos icon will be highlighted.

### *Print*

You can print the entire series or a subset of the series to a DICOM Printer if that printer has been defined in Preferences. This function is also available in the File menu: DICOM Print.

### *Report*

You can begin writing a report for the current study by launching the report software via the Report tool. Horos supports several file formats including Pages, LibreOffice, Rich Text, and MS Word. The default format is set in the Database Preferences. This function is also found in the File menu > Report > Open Report.

### *Reset*

If you have moved or changes the current image's settings, you can reset all display settings, including the image position in the window, the image size, the rotation, and the default window level and width. This function is also available from the 2D Viewer menu > Reset Image View.

### *Revert*

If you have applied a convolution filter or other effect to the image, you can use the Revert tool to reload the pixel data from the files. This function is also available from the 2D Viewer menu > Revert Series.

### *RGB Factors*

You can modify the balance of each RGB channel for both color and black and white images using the sliders provided with the RGB Factors tool. The raw data is not modified.

### *ROI Manager*

The ROI Manager tool bring up a window that allows you to edit the list of existing ROIs and their areas and volumes (Figure 6.30). This function is also available from the ROI Menu > ROI Manager.

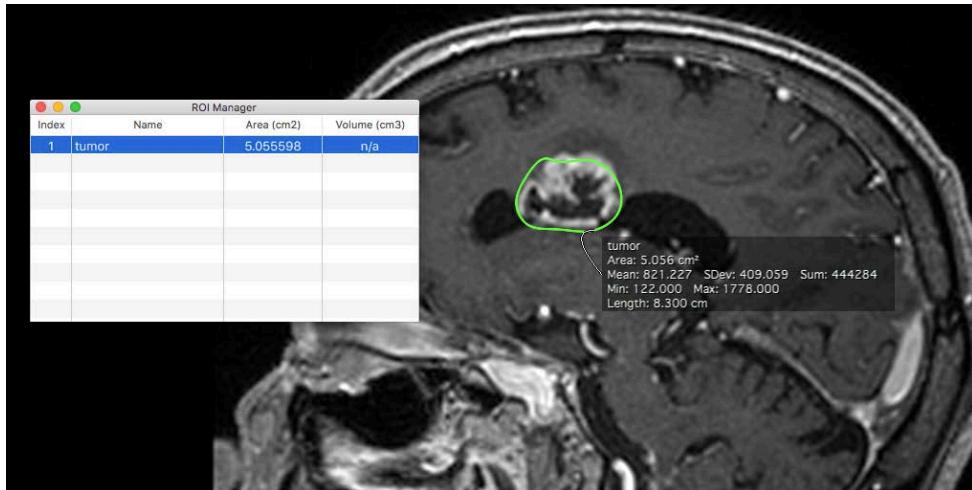


Figure 6.30. The ROI Manager dialog box for the tumor ROI shown on the image slice.

### *Send*

You can send an entire series or a subset of the series to a DICOM node, with the DICOM C-STORE SCU protocol. This function is also available in the File menu > Export > Export to DICOM Network Node.

### *Set Pixels*

You can modify the pixels values (intensity) by applying this algorithm to all pixels in the series, all pixels within ROIs with the same name as the selected ROI, or to all ROIs in the series (Figure 6.31). You can modify pixels that are contained in the ROIs or that are outside the ROIs. You can also set an lower and upper threshold value, to filter the pixels' intensity. This function is also available in the ROI menu > Set Pixel Values to.

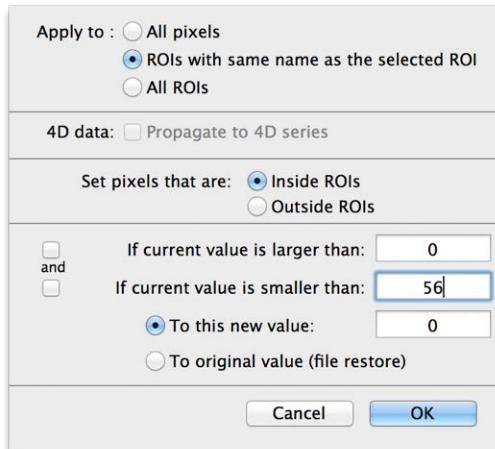


Figure 6.31. The Set Pixels popup panel

### *Shutter*

If you have a rectangle ROI selected on an image, you can add or remove a mask to the entire series. This mask can be toggled on and off by clicking the shutter button.

### *Status & Comments*

You can change the status of the series from empty to unread, reviewed, dictated, or validated. You can also add a comment for each series as described in the Database Chapter.

### *Subtraction*

Sometimes you may need to remove parts of an image that are stationary over time to reveal those parts of the image that do change over time. This is commonly used in Digital Subtraction Angiography (DSA). The subtraction tool available in Horos allows you to adjust the subtraction function (Figure 6.32). The details of the Subtraction tool are described below. This function is also available in the 2D Viewer menu > Subtraction.

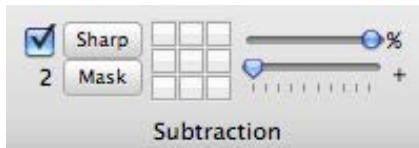


Figure 6.32. The Subtraction tool

### SUV

The SUV, or Standardized Uptake Value (aka dose uptake ratio) is used with PET series. It is the ratio of activity per unit volume of a region of interest (ROI) to the activity per unit whole body volume. It is often used to distinguish between “normal” and “abnormal” levels of uptake. The SUV button displays the parameters used to compute the SUV values.

### Tile

You can tile the opened windows by clicking on this button.

## Displaying Images

### Displaying a series

Horos provides several options for displaying a study or a series of DICOM images. The default display is a single series for one individual (a stack) presented in a single image view window (Figure 6.1). However, you can open multiple series (discussed below). To open a series, select the series in the database window and either double click on it or hit the return key.

Simultaneously clicking on the option key on your keyboard and on the 2D Viewer icon (Figure 6.33) in the top menu of the database screen brings up a dialog box (Figure 6.34) that allows you to select a subset of images in the stack.

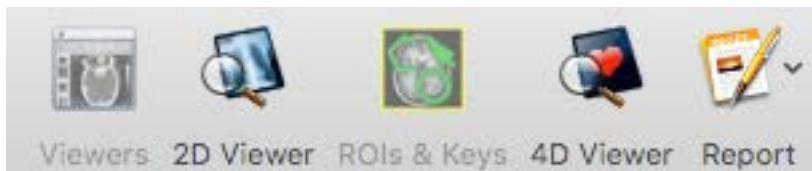


Figure 6.33. The 2D Viewer icon in the database toolbar.

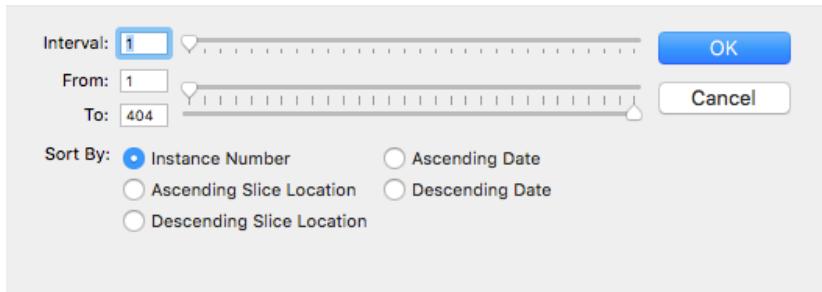


Figure 6.34. The dialog box for selecting a subset of images in a series.

Alternatively, you can open a study or series by selecting the study or series of interest and:

- *clicking on the 2D/3D viewer icon in the toolbar.*
- *Selecting the series in the lower left part of the window – the Series List – and double clicking or hitting the return key.*
- *Selecting the series in the lower left Series List and double clicking on the 2D/3D viewer icon in the toolbar.*
- *Selecting the series in the lower left Series List and double clicking on the preview pane.*

You can also open a merged selection by selecting the thumbnails in the lower part of the window and choosing Open Merged Selection from the contextual menu.

### Displaying Multiple Series

Recall that a patient may undergo multiple MRIs or CT scans. Each generates a series of images, a DICOM stack. For example, a physician may require a patient to undergo MRIs before and after a treatment – generating a before and after series. Or a patient will have a CT and PET done. Sometimes it is useful to display several series from that patient simultaneously (Figure 6.35).

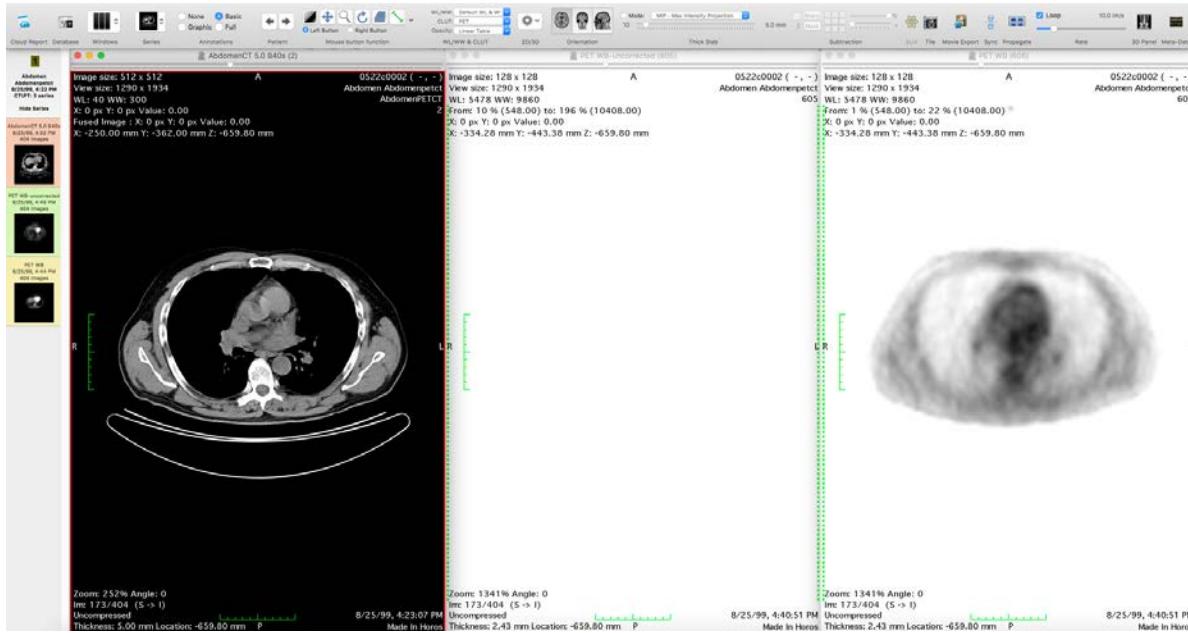


Figure 6.35. A view of an abdominal CT (left), uncorrected PET (center) and PET (right) for one patient.

For example, you can select all three series in a study by holding down the shift key (or command key) as you click on the thumbnail icon for each series. Once selected, click on the 2D Viewer icon in the database toolbar. This displays the three series simultaneously in side-by-side tiled windows as shown in Figure 6.36. Horos will adjust the window sizes to fit the screen but you can manually change each window size and reposition its location on the screen(s) at will. Once the series are displayed in the 2D Viewer, you can choose a different window tiling option from the 2D Viewer menu at the top by clicking on Image Tiling in the dropdown list and selecting the tiling arrangement form the list of choices.

## Tiling & Magnetic Windows

As described above, tiling will reorganize the opened windows to fill the screen. The Magnetic windows feature allows you to quickly reorganize the open windows. Grab an open window along the top gray bar with your cursor and drag it to a new location on the screen. When the dragged window approaches a screen border or another window edge, the window being moved will stick to it. When you move a window onto another one, the second window is automatically moved to the window's previous position and both windows are resized to fit their new position. To correctly use this feature, you must drag the upper left-hand corner of your window on top of the corresponding corner of the second window. Holding down the option key while moving windows turns off the magnetic window feature. These features can also be modified in the Viewers Preferences panel.

## Propagate Settings

You can synchronize the viewing settings (WL/WW, rotation, etc.) when multiple 2D Viewers are open using the Propagate Settings feature in Horos. When propagation is turned on, WL/WW, pan, zoom, and rotation are effected. That is, if you modify the WL/WW in one window viewer, it will be similarly applied to the other open window viewers. There are four exceptions:

1. WL/WW will be propagated only if the modality and acquisition parameters are identical. Thus, WL/WW will not be propagated between CT and CR images.
2. Setting will never be propagated between CR and NM modalities.
3. In PT modality, WL/WW will not be propagated between a SUV converted series and a non-SUV corrected series.
4. Pan, rotation and zoom settings are not propagated if the viewers have different planes. For example, a sagittal series will never propagate pan and zoom settings to a coronal series.

Often you will make changes to the CLUT or WW/WL settings on one image in a series. In the 2D Viewer you can propagate those settings to all the images in the series by selecting the Propagate Settings in Current Series from the dropdown list in the 2D Viewer menu (Figure 6.36).

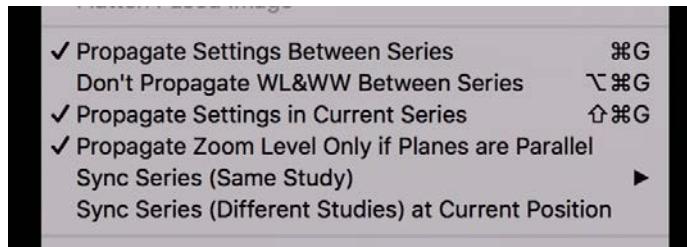


Figure 6.36. The choices for settings propagation from the 2D Viewer menu.

You can also choose to propagate those settings between series in a study or not to propagate the WL&WW settings between series. For CR, DX and DR modes, you can block this function by selecting No Propagate settings in series for CR, DX, DR, in the Viewers Preferences.

## Synchronization

Horos allows you to synchronize the slice position across several open 2D Viewers (figure 6.37). When Synchronization is turned on, all open viewers display the same stack z level. Synchronization works automatically if the open series belong to the same study. For example, the three abdominal acquisitions of the same CT/PET study shown in Figure 6.37. This is accomplished using the Image Position Patient DICOM field (0x0020,0x0032) to locate the nearest corresponding slice. Note, that if this DICOM field is not available, no synchronization is

possible. Additionally, synchronization works only if the open 2D Viewers display series with the same orientation plane.

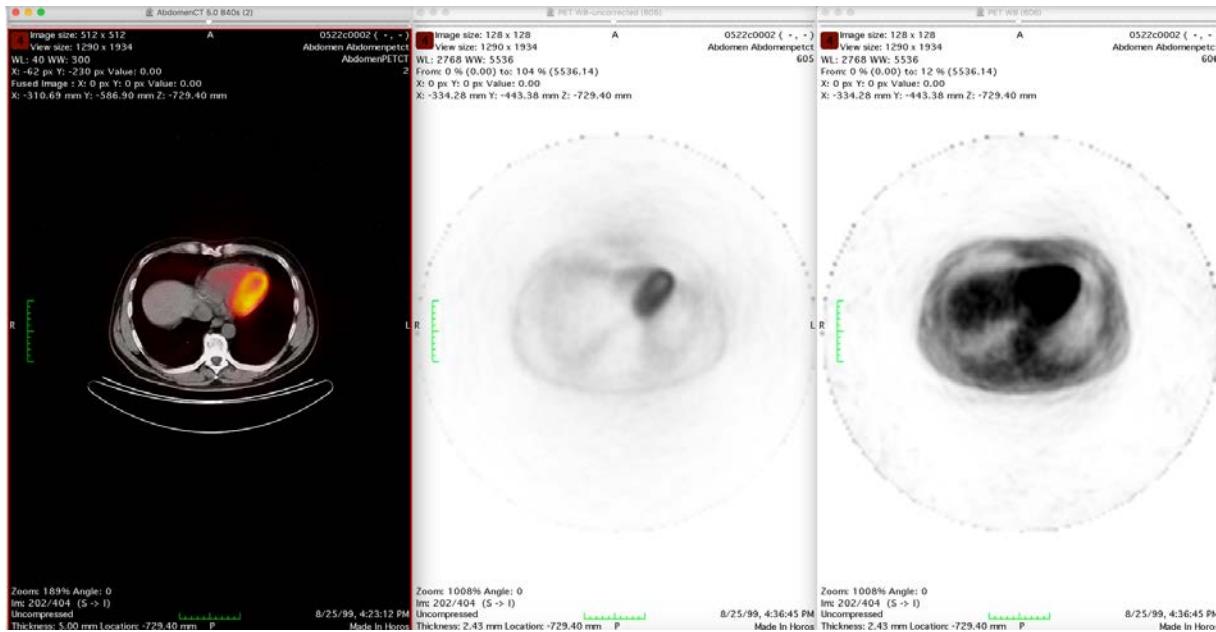


Figure 6.37. The Synchronization feature illustrated in three viewer windows for abdominal transverse sections.

The Synchronization function can be activated manually from the 2D Viewer dropdown list (Figure 6.36). Alternatively, if you have placed the Sync button in your toolbar, you can just click on that button. Thus, you can compare a CT study acquired in June and another CT study acquired in September. Horos notes the current position in the stack of the viewers and attempts to keep them synchronized even if acquisition parameters such as slice interval or slice thickness are not identical.

### Reference Lines

If you display several series of the same study showing different orientation planes, Horos adds reference lines on the non-active viewers (Figure 6.38) allowing you to easily locate the current slice on the other series. A central thicker green line shows the location of the current slice, while the two thin green lines depict the slice thickness. Orange lines reveal the bounds of the selected volume on the other viewers.

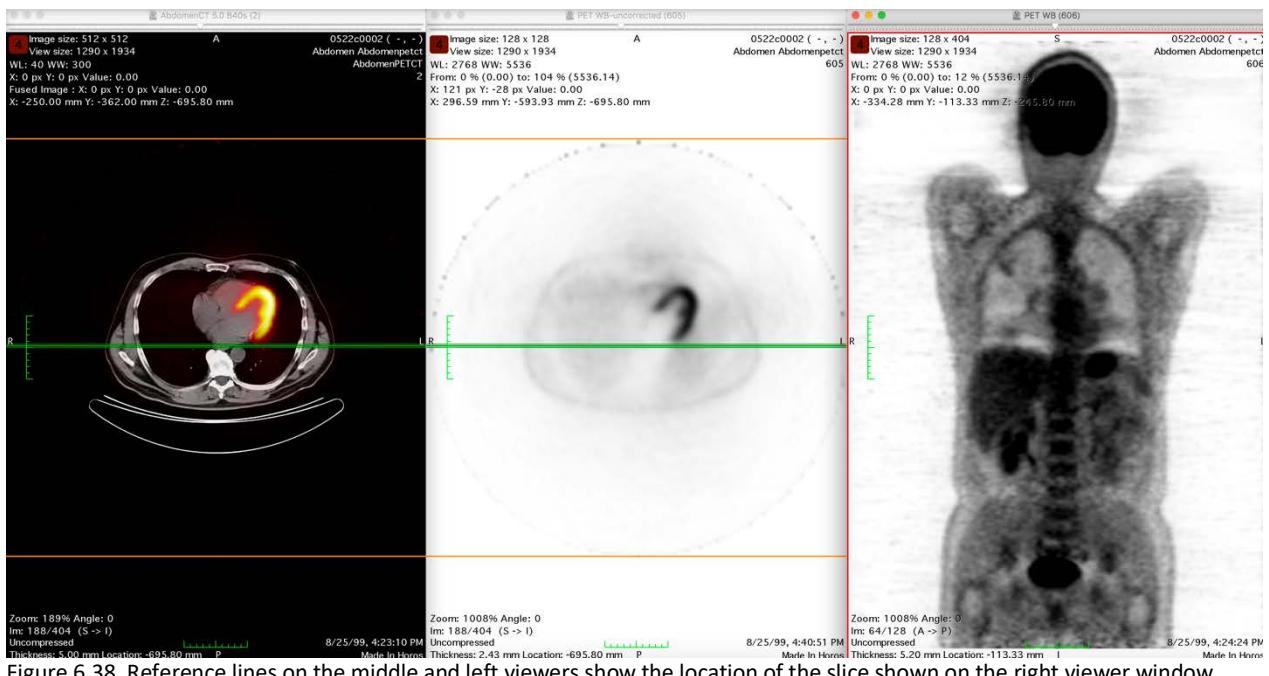


Figure 6.38. Reference lines on the middle and left viewers show the location of the slice shown on the right viewer window.

Scrolling across the active stack causes the green line to move as Horos locates the same position on the other planes/windows. Reference lines can be hidden/shown by clicking on the Annotations > Display Cross Reference Lines item from the 2D Viewer menu.

## Navigating Between Studies And Series

Suppose you have CT data from three patients in your database and you want to rapidly switch back and forth from one patient to another. One option is to simultaneously display the three patients in three side-by-side window viewers (as described section 6.3). However, you can also rapidly navigate from one patient to another or from one series to another from the same patient. Horo uses a very fast dynamic mode to let you view one set of images, then load and display a new set of images with almost no delay even for large sets of images. There are several ways to quickly switch series, studies, or patients.

### Switching image series

In the 2D Viewer menu's dropdown list, you can use Next Series and Previous Series to replace the current image series with either the next or previous series in the same study. The keyboard shortcuts ( $\mathbf{\text{⌘}\rightarrow}$  and  $\mathbf{\text{⌘}\leftarrow}$ ) perform the same functions. Alternatively, you can use the Series list on the left-hand side of the viewer. Clicking on a thumbnail in this list will load the corresponding series, replacing the current one. Finally, if you have added the Series icon to your toolbar, you can simply click on the icon's up and down arrows to display the full list of open series (Figure 6.39).