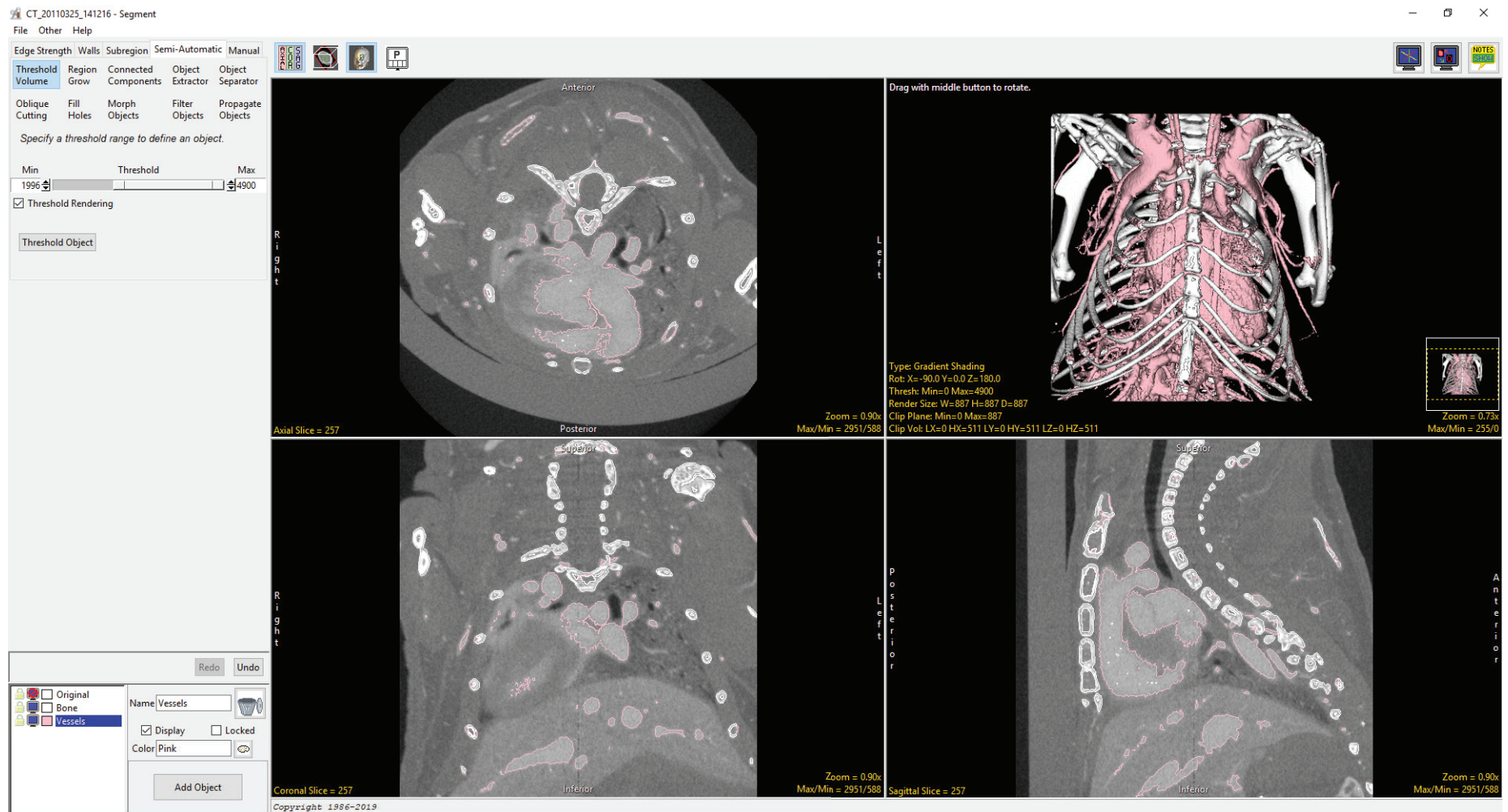


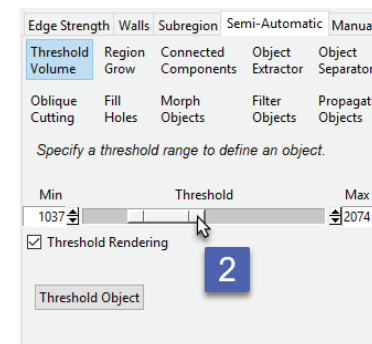
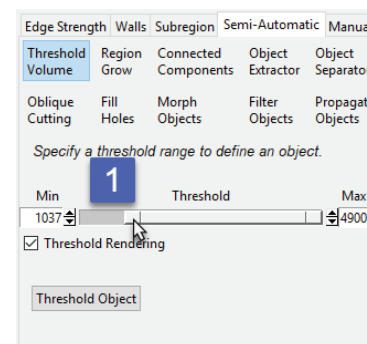
Threshold Volume

Threshold segmentation allows a range of voxels from the input volume to be assigned to an object. All voxels greater than or equal to the threshold minimum and less than or equal to the threshold maximum are assigned to the object.

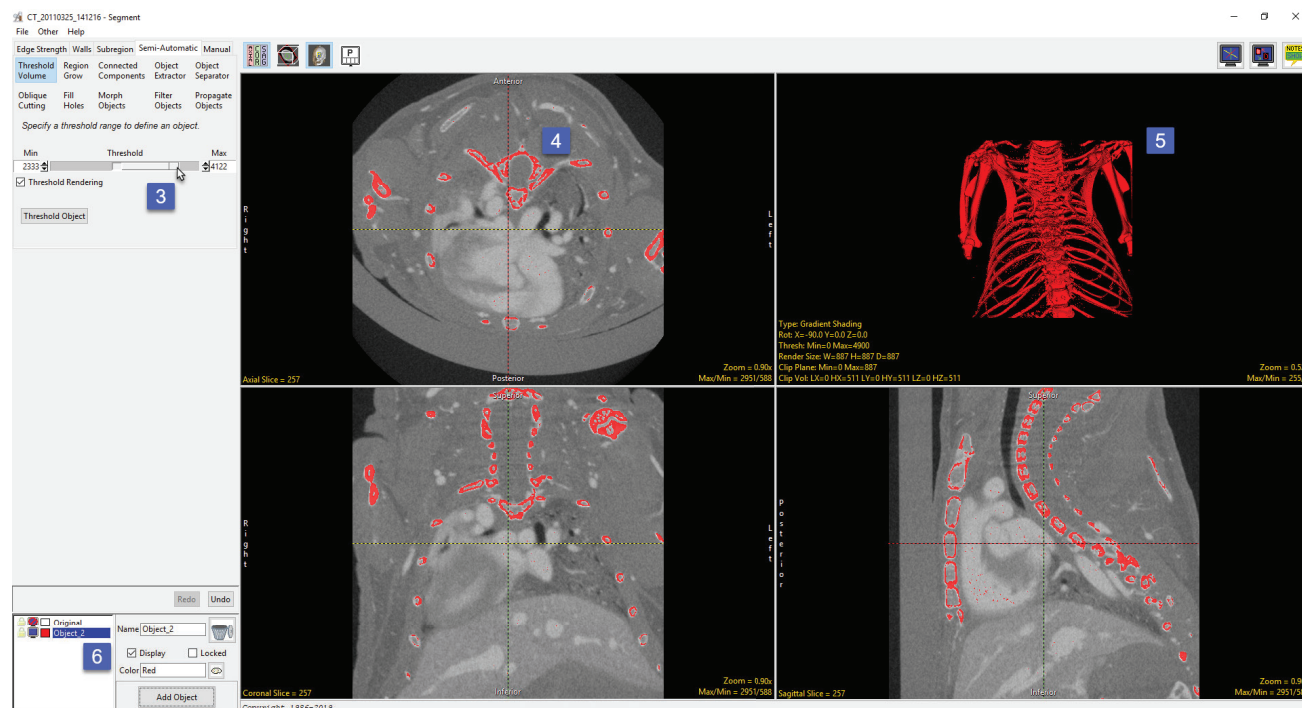


Threshold Volume Options

Threshold Slider: The Threshold double-ended slider bar allows users to specify a range of threshold values using the minimum and maximum ends of the threshold slider. Selecting the minimum end of the slider [1] and moving it to the right will increase the minimum threshold value, moving it to the left will decrease the minimum value. Selecting the maximum side of the slider [2] and moving it to the left will decrease the maximum threshold value, moving the slider to the right will increase the maximum value. Voxel with values outside the range are ignored and not include as part of the current object.



When adjusting the minimum or maximum threshold range [3] an interactive preview showing the range of selected voxels will be displayed overlaid on the grayscale data [4], a 3D display of the voxels will also be displayed in the render window. [5] The color of the previewed voxels will match the color of the object you currently have selected. [6]





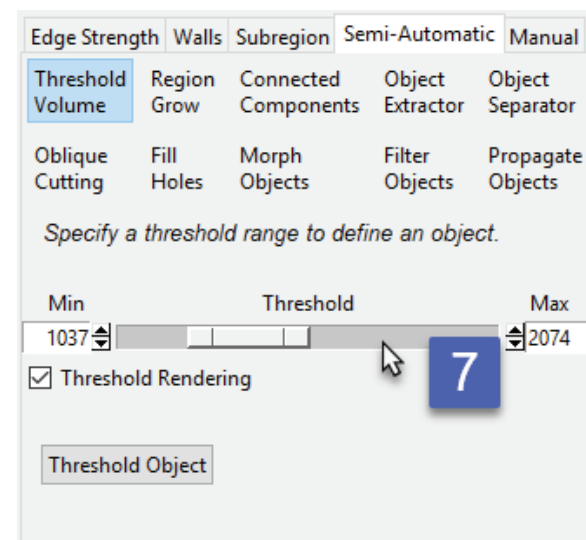
Threshold Volume Options (continued)

Holding the Alt key while dragging either the minimum or maximum end of the slider allows for smaller adjustment of the value allowing users to fine tune selections. Clicking in the trough to either side of the minimum or maximum end of the slider [7] will advance the value by 1. Shift-click will decrease the value by 1.

Min and Max: The minimum and maximum input field allows users to manually enter the minimum or maximum threshold value. There are also arrow up and down buttons the right of the input field to increase or decrease the currently value by 1.

Threshold Rendering: This option allows users to disable and enable to 3D preview of the selected voxel range. It is recommended to disable this option by unchecking the checkbox when working with large data sets.

Threshold Object: Assigns the voxels in the selected range to the current object.



Right click options: Right clicking on the Threshold slider provides users with access to the following options:

Presets: The Presets option allows users to define threshold values for specific structures or objects of interest. This is particularly useful for those users who routinely segment the same structures from their image data.

Edit Preset Thesholds						
Name	Min	Max	Depend Type	Dependencies	Action	Order
Dentin	750	1649	Any		Delete	Up Down
Enamel	1650	3000	Any		Delete	Up Down
Alveolar Bon	1000	10000	Any		Delete	Up Down
			Any		Add	
Save						



Threshold Volume Options (continued)

Right click options (continued)

Presets (continued): When the Edit Presets Thresholds window opens, the following options are available:

- **Name:** Allows users to enter the name for preset
- **Min:** Enter the minimum threshold value for the preset
- **Max:** Enter the maximum threshold value for the preset
- **Depend Type:** Allows users to set dependencies for presets. This option allows users to set multiple presets but only the presets that meet the dependencies requirements are displayed for the current data. In the example screenshot two sets of segmentation presets have been defined. The first three presets are for a dental segmentation application. The second three presets are for a muscle segmentation application. As the first three presets Depend Type is set to Any these presets will be available for any data set loaded into the Segment module. However, the latter three presets have a depend type set to Volume Dimension and the Dependency set to a volume size of 450 by 450 by 224, these presets will only be available for data sets loaded into Segment of this size. The following Depend Types are available:

Module: Defaults can be set for specific modules, for example presents to segment image data can be set to only appear when the data is opened with Segment, presents for rendering set to appear only when data is opened with Display.

Volume Name: The preset will only display if the volume name meets dependency criteria.

Volume Data Type: The preset will only display if the volume data type meets the dependency criteria.

Volume Dimensions: The preset will only display if the volume data type meets the dependency criteria.

Any: Default option. The preset will be displayed.

Name	Min	Max	Depend Type	Dependencies	Action	Order
Dentin	750	1649	Any		Delete	^ v
Enamel	1650	3000	Any		Delete	^ v
Bone	1000	10000	Any		Delete	^ v
Ortho_ST	85	1000	Volume Dimensions	450 x 450 x 224	Delete	^ v
Ortho_Musc	95	230	Volume Dimensions	450 x 450 x 224	Delete	^ v
Ortho_Bone	-43	96	Volume Dimensions	450 x 450 x 224	Delete	^ v
			Any		Add	

Save



Threshold Volume Options (continued)

Right click options (continued)

Presets (continued):

- Dependencies: Allows users to specify the dependency criteria for the selected depend type.
- Action: Allows users to Add or Remove presets.
- Order: Allows users to change the order of hold the presets are listed. As a general rule of thumb presets should be listed in the order they are used for segmentation.

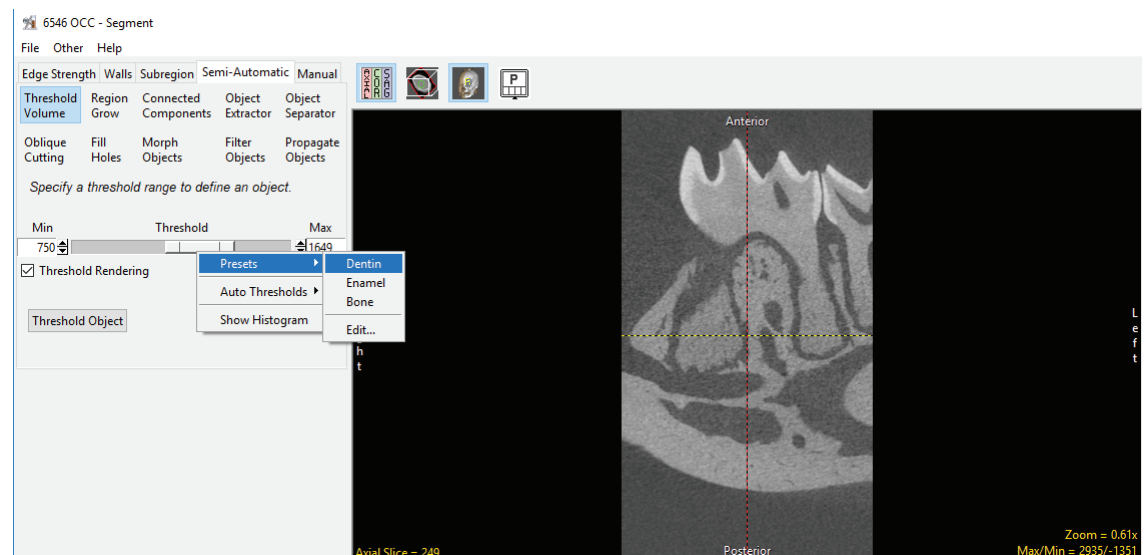
Edit Preset Thresholds						
Name	Min	Max	Depend Type	Dependencies	Action	Order
Dentin	750	1649	Any		Delete	▲ ▼
Enamel	1650	3000	Any		Delete	▲ ▼
Bone	1000	10000	Any		Delete	▲ ▼
Ortho_ST	85	1000	Volume Dimensions	450 x 450 x 224	Delete	▲ ▼
Ortho_Musc	95	230	Volume Dimensions	450 x 450 x 224	Delete	▲ ▼
Ortho_Bone	-43	96	Volume Dimensions	450 x 450 x 224	Delete	▲ ▼
			Any		Add	
Save						

To define a set of presets do the following:

Right-click on the Threshold slider and choose Presets.

In the Presets window set the preset name, next enter the min and max threshold values, finally set a Depend Type and Dependency if desired. Click Add and either enter the next Preset or choose Save.

Once Presets are established, they can be accessed by simply right-clicking on the Threshold slider and choosing Presets and then the Present name.





Threshold Volume Options (continued)

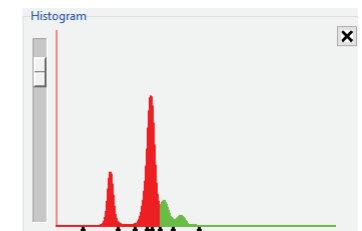
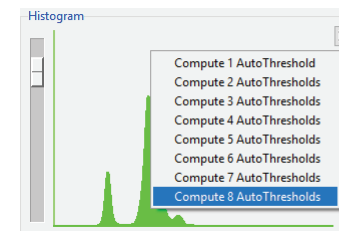
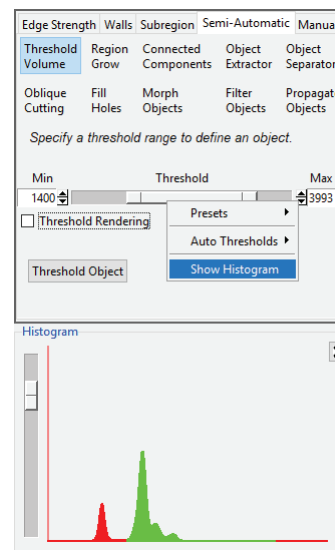
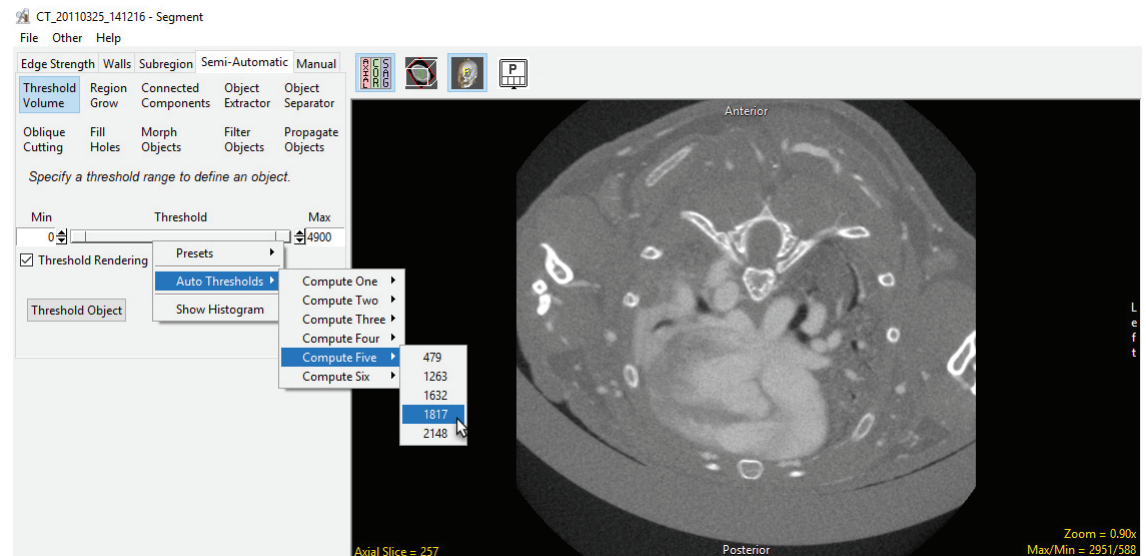
Right click options (continued)

Auto Thresholds: The auto thresholds option allows users to compute up to 6 automatically computed threshold to specify the number of automatic thresholds computed. Selecting a threshold value will set the minimum threshold to that value.

Show/Hide Histogram: When selected, calculates and displays the volume histogram below the Threshold Volume options.

When the threshold minimum and maximum values are adjusted the voxels within the selected range display as green on the histogram while the voxels out of range are displayed in red. Adjusting the scale bar to the left side of the histogram display will increase or decrease the scale the histogram.

Right clicking on the histogram allows users to auto compute up to 8 threshold values for the image data. The thresholds are displayed as triangular buttons at the bottom of the histogram display, selecting a triangle will set the minimum threshold value.

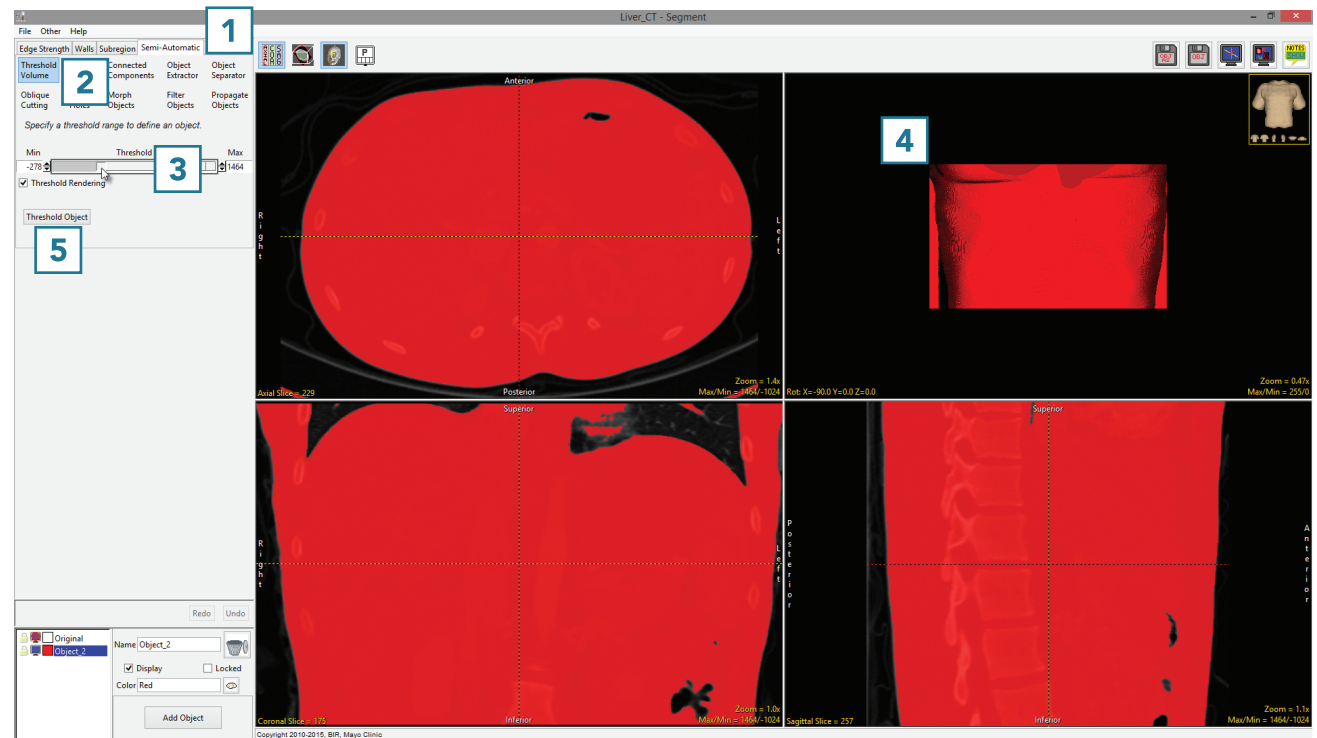


Threshold Volume Segmentation

Here we will use Threshold Volume
to create a new object in a dataset.

To follow along, download the data set CT_Liver from analyzedirect.com/data and load into Analyze using Input/Output.

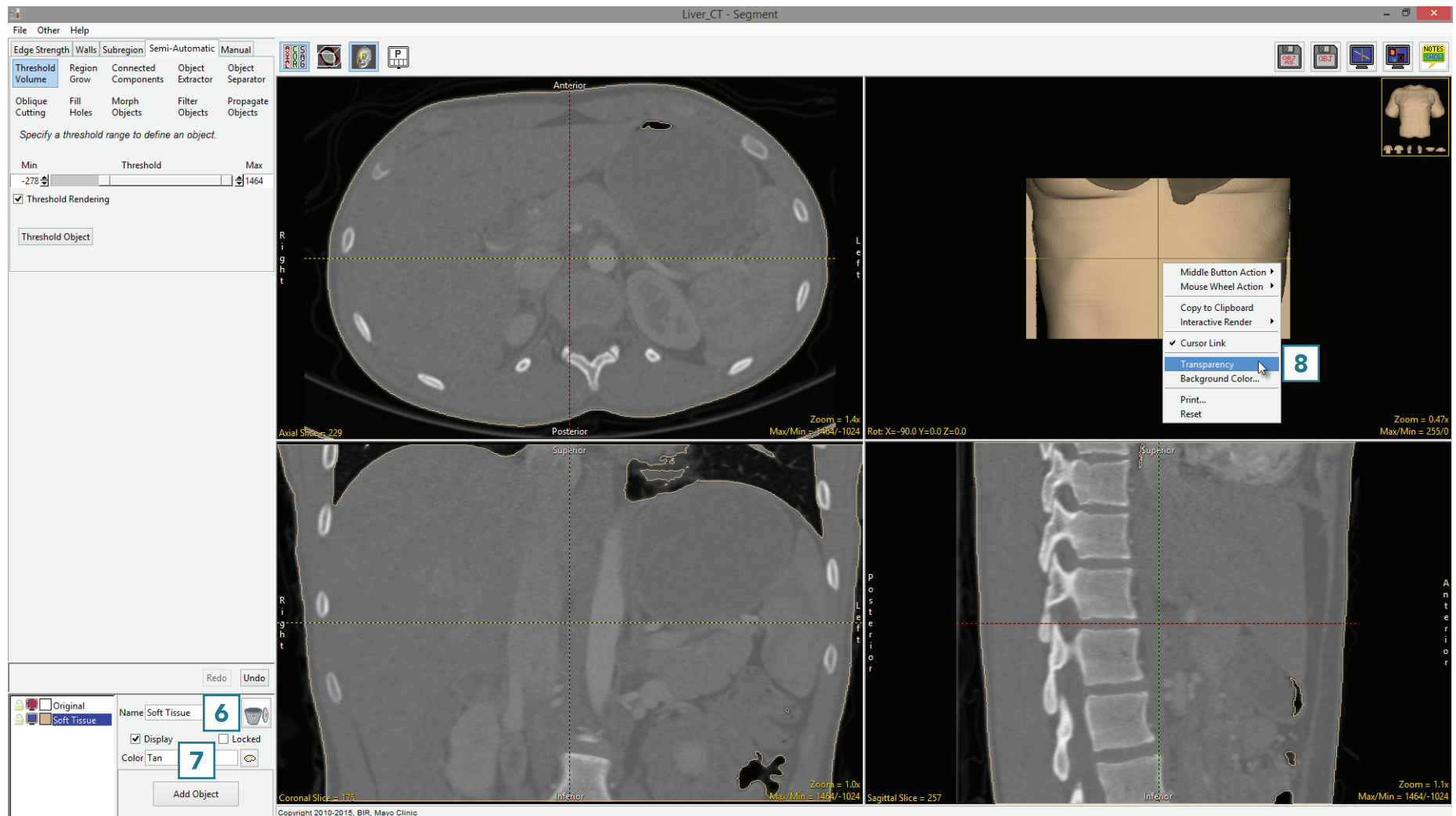
- Select the data set and open Segment.
- Select Semi-Automatic [1] and choose Threshold Volume. [2].
- Use the Threshold slider [3] to adjust the voxel intensity range, so that the soft tissue is displayed in the binary mask preview. This data set is scaled to Hounsfield Units (HU), so the grayscale intensities represent HU. This may be used to isolate tissue with a known HU range [4].
- Click Threshold Object [5] to assign all selected voxels to the current object.





Threshold Volume Segmentation (continued)

- Rename the object, [6] then change the color [7].
- Right-click on the rendering and select Transparency [8].





Threshold Volume Segmentation (continued)

- Add a new object [9].
- Update the name [10] and color [11].
- Adjust the threshold range [12] so that the bone is displayed in the binary preview, then click Threshold Object [13].
- Note that the rendering [14] will update to display both objects. The bone is now fixed to visible, as the rendering transparency is enabled [8].
- Select File > Save Object Map to save your work.

