CT Spectral Analysis: Cardiac Workflow

VPMC-17001 B

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Spectral Analysis - Cardiac

Overview:

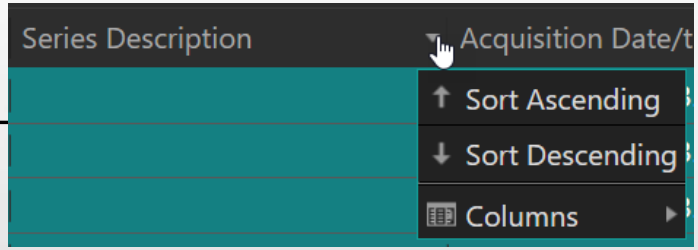
- This application facilitates the detailed analysis of spectral imaging data from the Aquilion ONE PRISM Edition. The Spectral Analysis application uses material decomposition methods embedded within the application to generate new spectral imaging data. When a snapshot from the Cardiac Analysis, and/or the Myocardial Perfusion application is restored, two additional layouts become available for a detailed analysis of the coronary arteries and the myocardium.

  - Load the study
  - Customize the layout if necessary
  - Change the keV value
  - Perform the analysis
  - Generate batches and snapshots
  - Distribute the findings

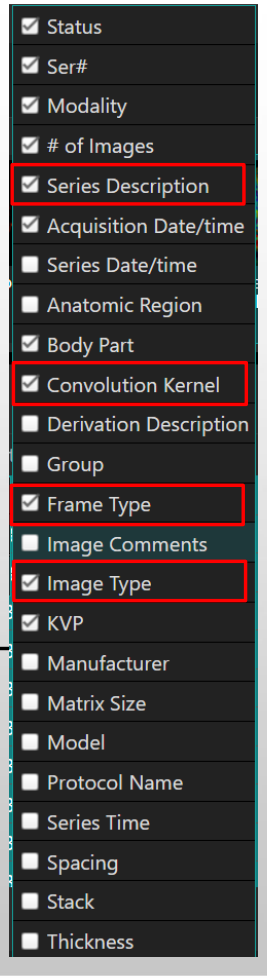
Spectral Cardiac – Enable Image Type & Convolution Kernel

Display the Series column in a list format by selecting the list tab.

Hover the mouse in the top right corner of any column header. Click on the dropdown arrow that appears.



Hover the mouse over the Columns tab and check the box in front of Series Description, Image type, Frame Type and Convolution kernel.



Note: The user only needs to activate the filters once.

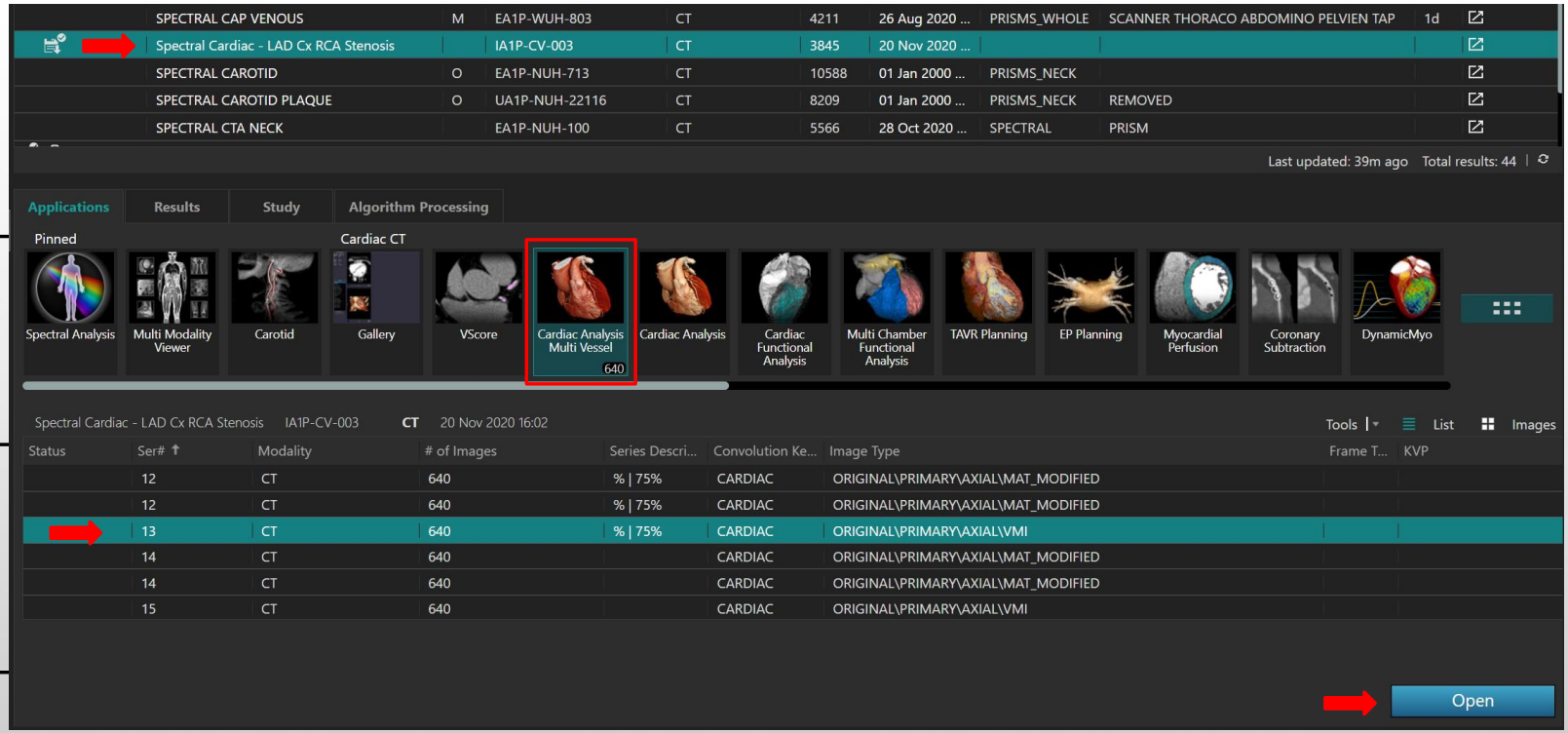
Spectral Cardiac – Load the Study

Select the Patient.

Select the Cardiac Analysis application.

Left click and select the **VMI** images from the list.

Click on **Open** to launch the study, OR double click on the Cardiac Analysis application to launch the study.



Spectral Cardiac – Generate the vessel mask

Use the Vessel Analysis tools to probe additional vessels where necessary.

Evaluate the centrelines and contours of the probed vessels.

Take a snapshot.

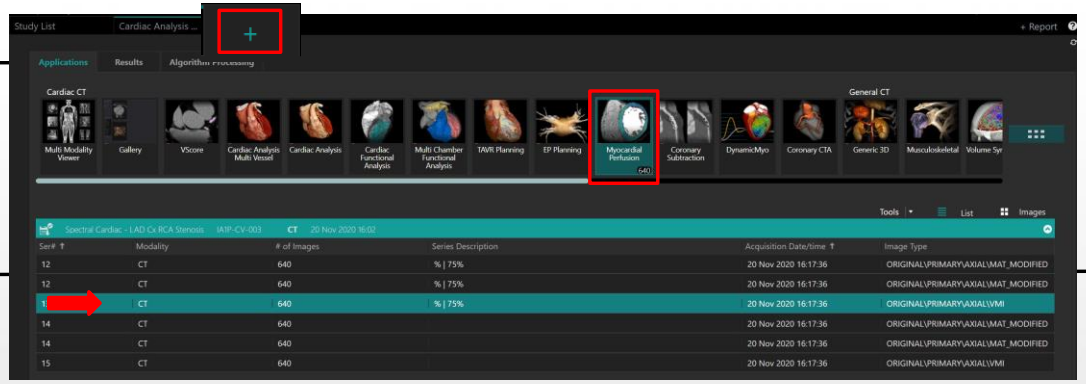
Spectral Cardiac – Generate Myocardium mask

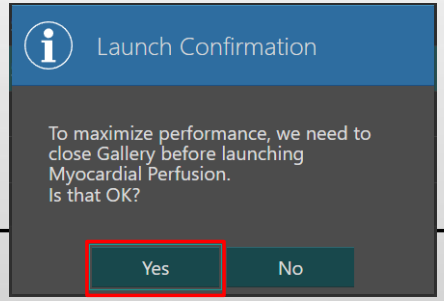
Click on the +Tab

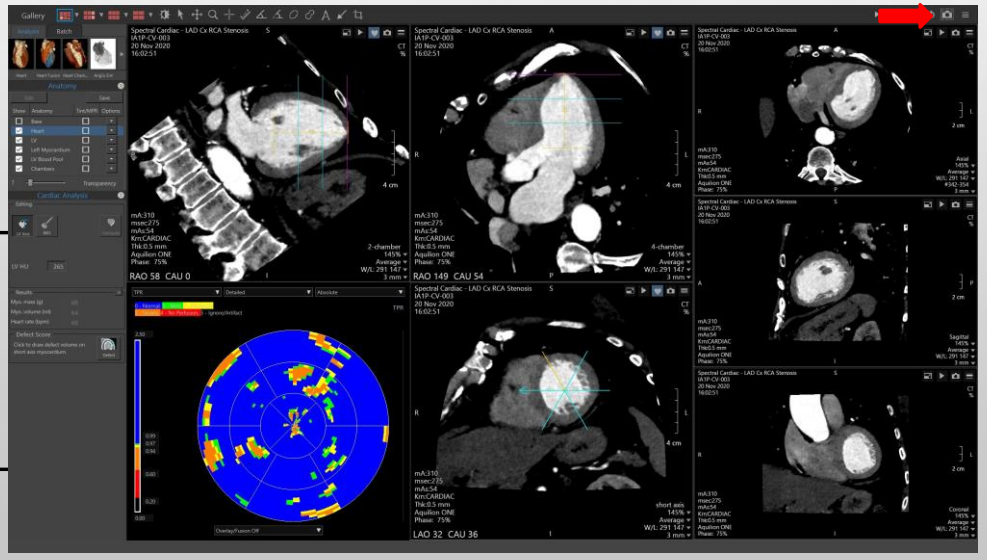
Select the Myocardial Perfusion application. When the warning message displays click on Yes.

Use the tools in the application to modify the myocardial contours where necessary.

Take a snapshot.







Spectral Cardiac – Load into Spectral Analysis

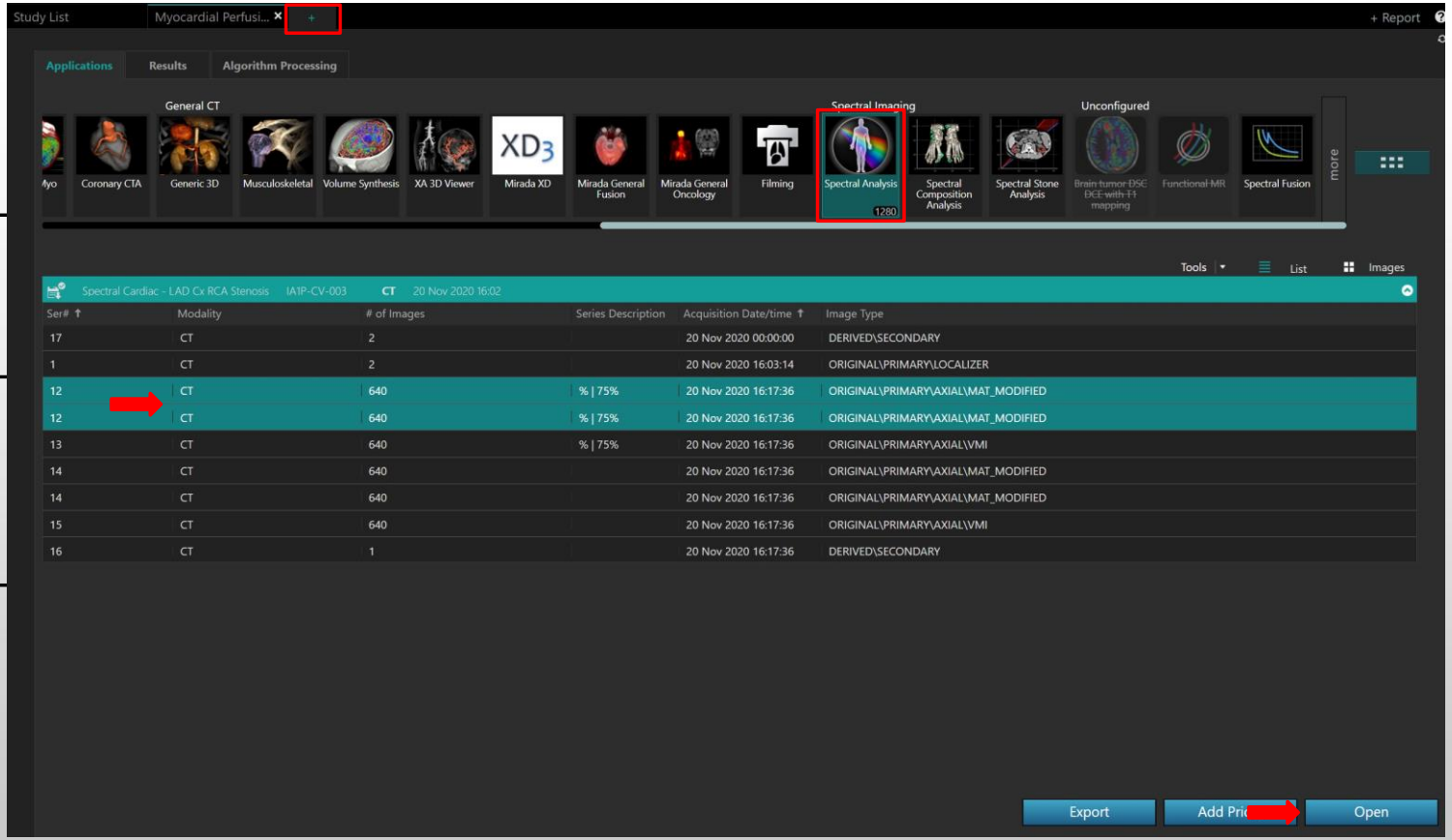
Click on the + Tab again.

Select the Spectral Analysis application.

Left click to select the **MAT_MODIFIED** series from the list.

Click on **Open** to launch the study, OR double click on the Spectral Analysis application to launch the study.

Note: Select the series that was reconstructed with the Cardiac reconstruction kernel.



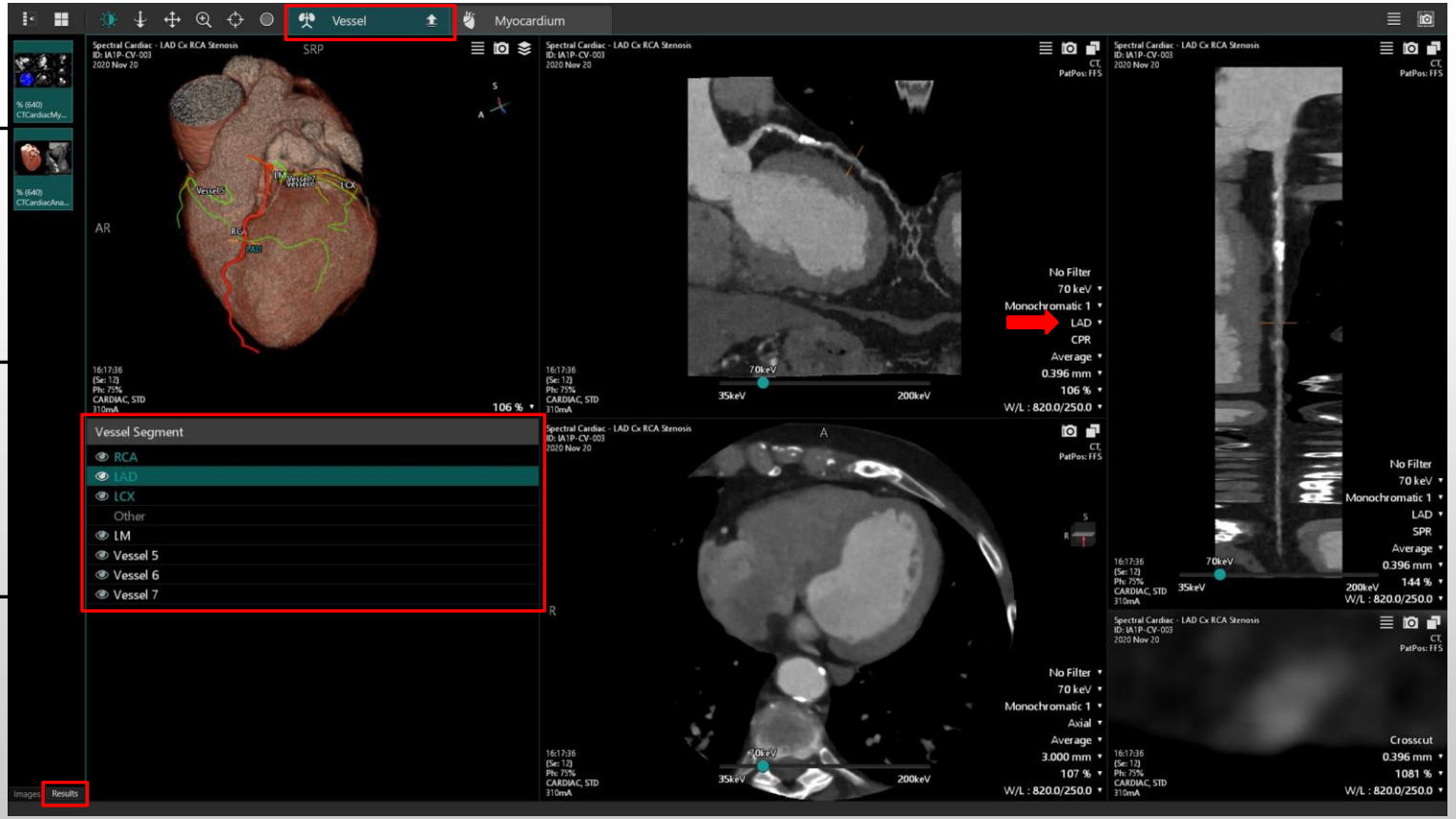
Spectral Cardiac – Vessel Window layout

When a study with snapshots, is selected, the default layout updates automatically. Snapshot are listed under results in the image carousal.

A snapshot from the Cardiac Analysis application will automatically trigger the Vessel layout.

The vessel label, centerline and contours of each probed vessel will be restored. Simply select the vessel to analyse from the list.

Tip: The label of the selected vessel is listed in the bottom right corner of the 2D images. The user can also select a different vessel from here.

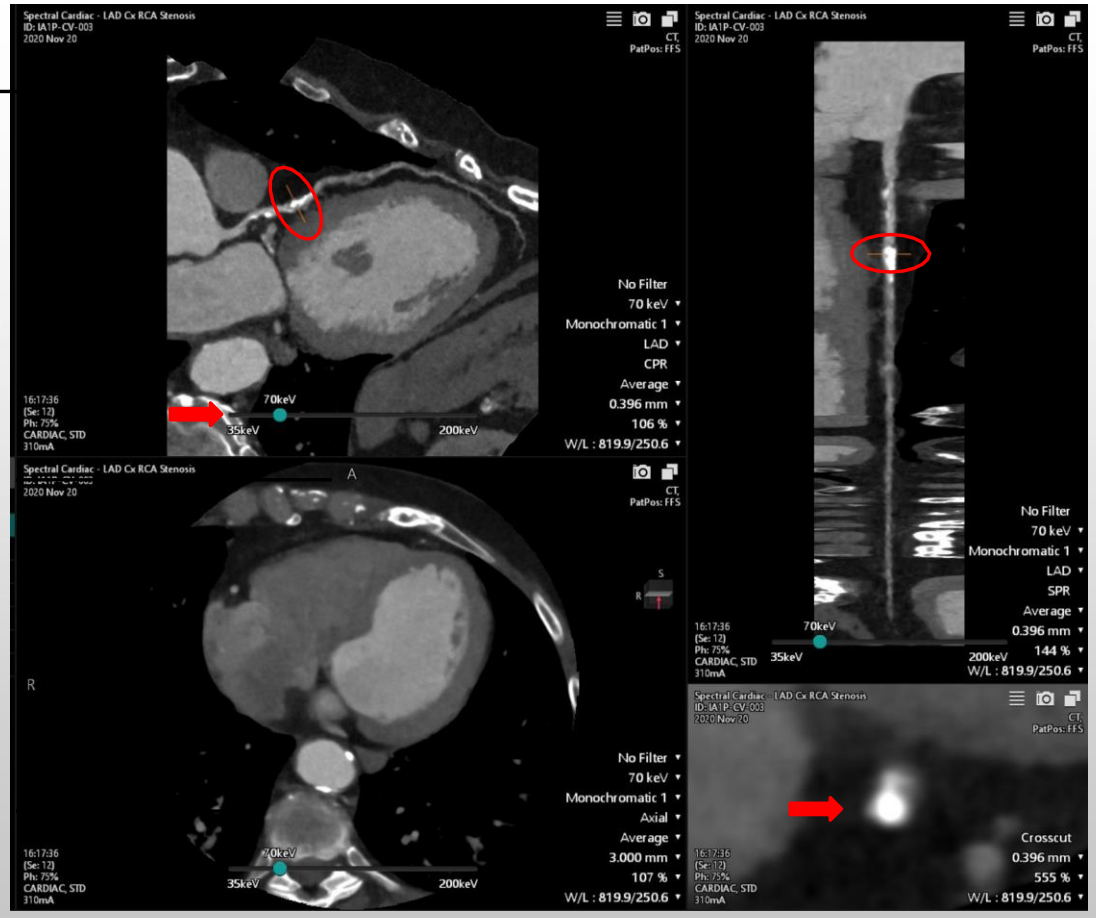


Spectral Cardiac – Evaluate the vessels

Use the slider bar to change the monochromatic keV.

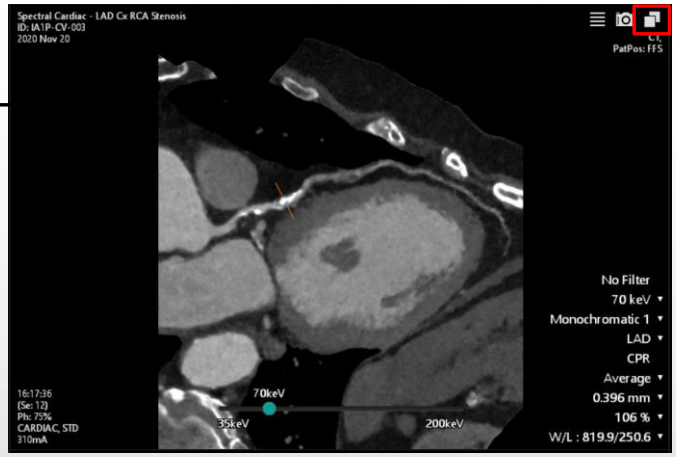
Use the right mouse to scroll through the images.

Tip: The orange line on the CPR and SPR images, indicated the position of the cross-cut image.

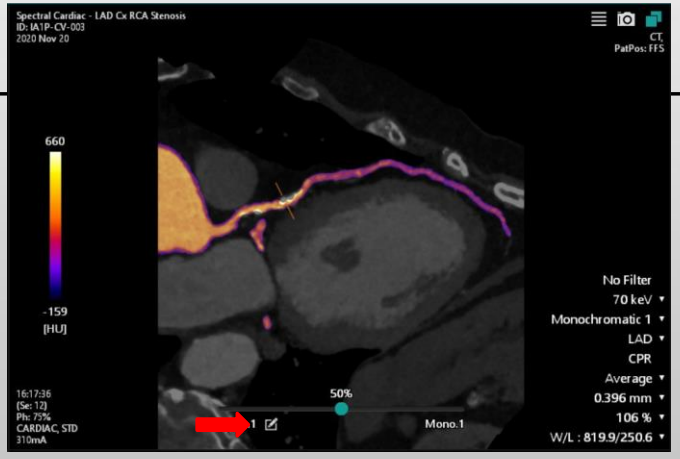


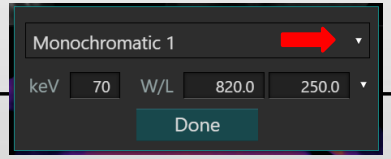
Spectral Cardiac – Fuse Images

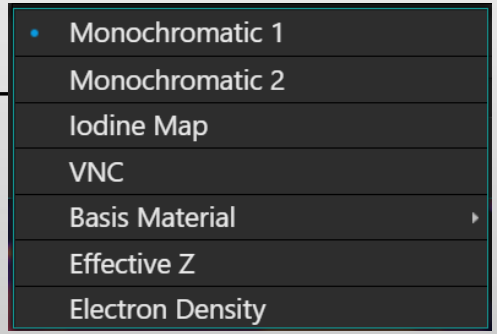
Click on the Fusion icon in the top right corner.



To select the image you want to fuse with the monochromatic image, click on the edit icon, next to Mono.1 below the slider bar.





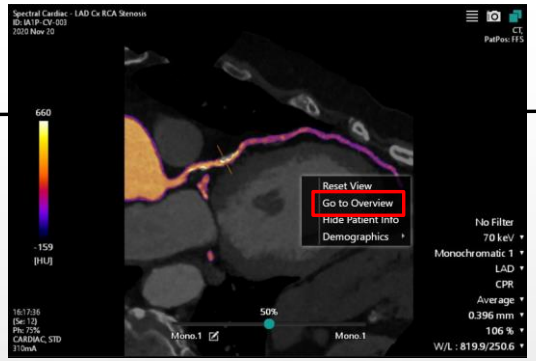


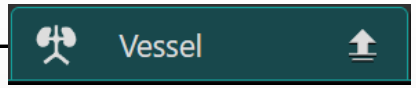
Take a snapshot.

Tip: Use the slider bar to determine the percentage of blending displayed.

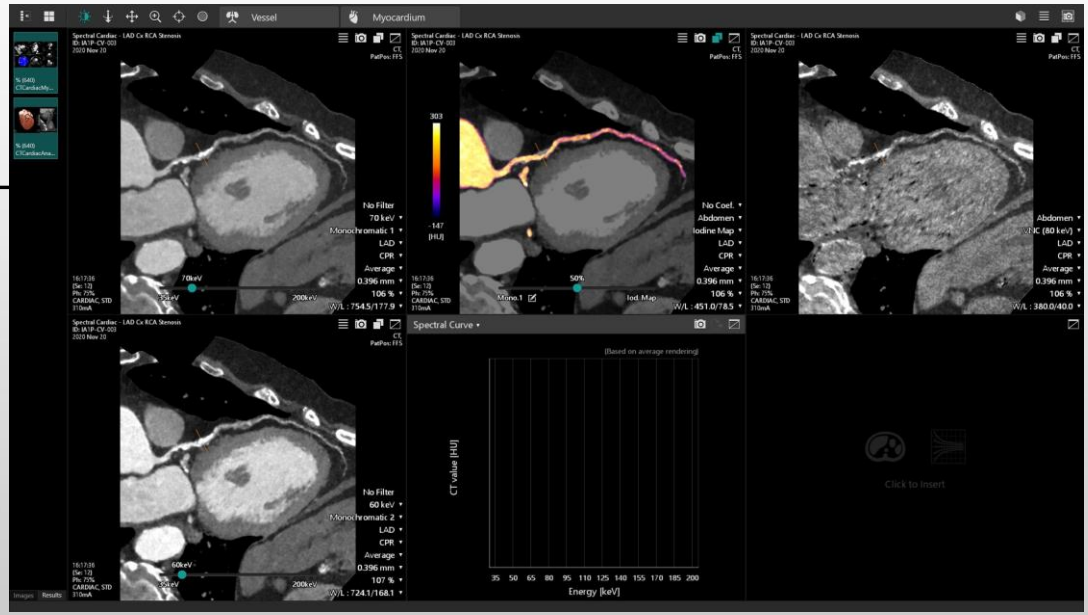
Spectral Cardiac – Vessel analysis in spectral analysis layout

Right click in one of the MPR images. Select Go to Overview. Or click on the arrow next to Vessel.

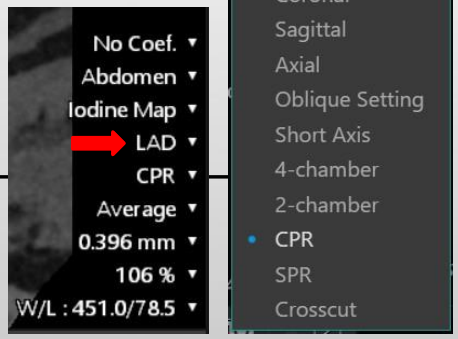




This allows the user to toggle to the standard spectral layout for access to other analysis tools.



Click on the arrow next to the listed view and select a different view from the list.



Click on the greyed-out vessel tab to return to the vessel layout.

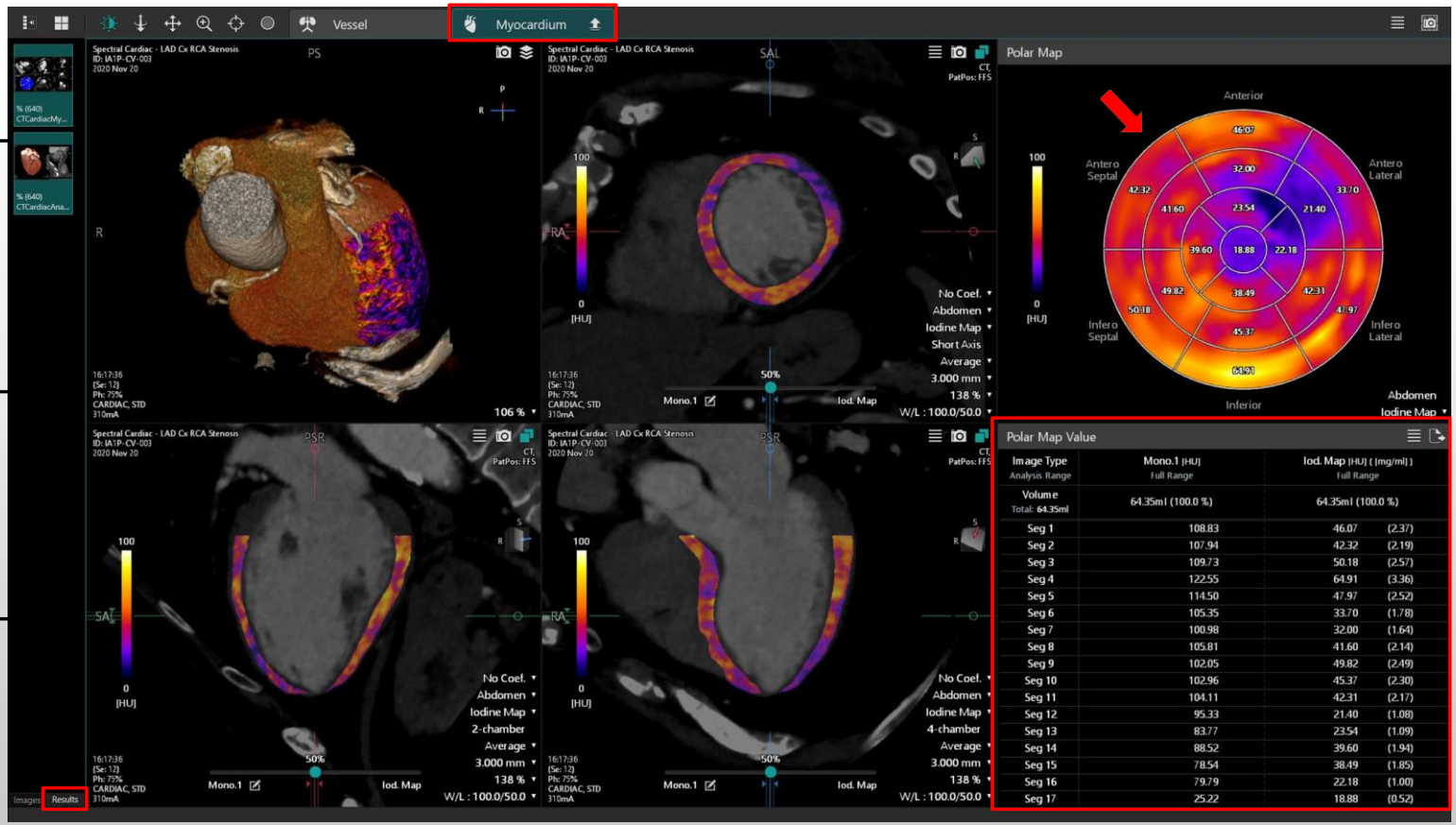
Spectral Cardiac – Myocardium Window layout

A snapshot from the Myocardial perfusion application will automatically trigger the Myocardium layout.

The heart axis, and the myocardium contours are restored from the snapshot. A polar plot of the left ventricular myocardium is displayed.

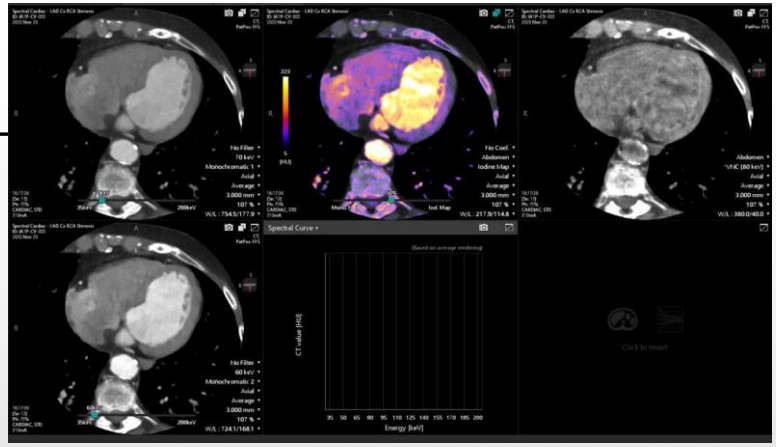
Click on the arrow next to Myocardium to return to the standard analysis spectral layout.

Tip: The value for each segment of the 17 segments in the polar map is displayed.



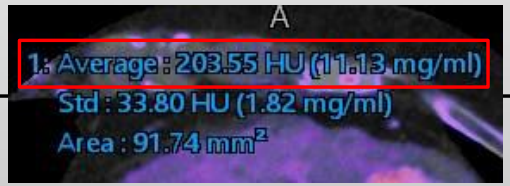
Spectral Cardiac – Quantitative Analysis

If no snapshots are made, and only the **MAT_MODIFIED** images are selected, the study will launch into the default Abdominal layout.



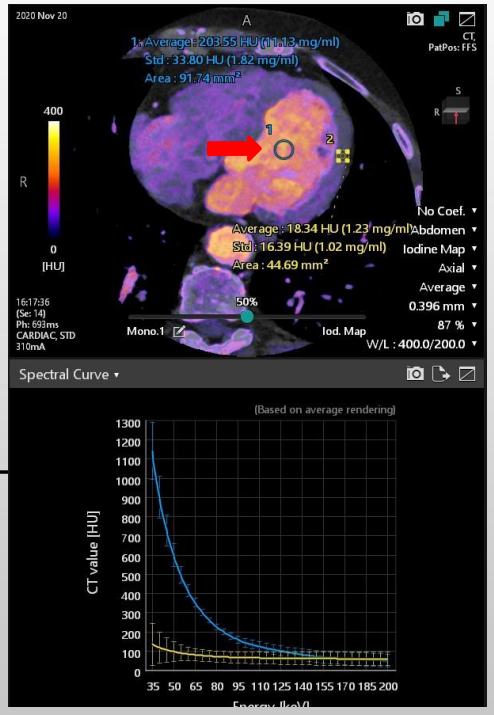
Select the ellipse tool from the common toolbar and draw an ROI in an area of interest.

True iodine values are displayed in mg/ml. The spectral curve will display the HU values measured at the different energy levels, within the ROI.



Note: The Abdominal Iodine map preset is used for Cardiac analysis.

Tip: The Spectral curve and Effective Z can also be used to do a quantitative analysis.



Spectral Cardiac – Change the Monochromatic keV

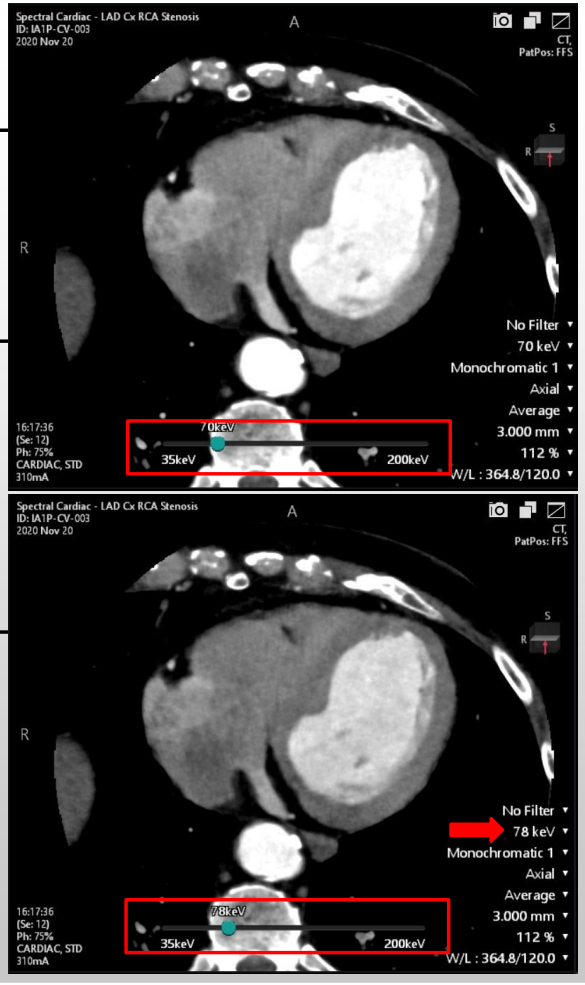
To change the keV, hover the mouse cursor over the slider bar. Drag the bar right or left until the desired value is displayed.

Single left click on the bar and the monochromatic images will reprocess with the new value.

OR

Interactively change the keV value. Left click and drag the teal dot on the slider bar. The image slice will process the keV change in real time and the user will see the effect of the change in real time.

When the user lets go, the image will reprocess with the current keV value.



Tip: Reducing the keV will enhance the brightness of the contrast and increase conspicuity of the iodine in the image. Increasing the keV could reduce the brightness of contrast and beam hardening artifacts.

Tip: The "new" keV value will be displayed in the bottom right corner of the viewport.

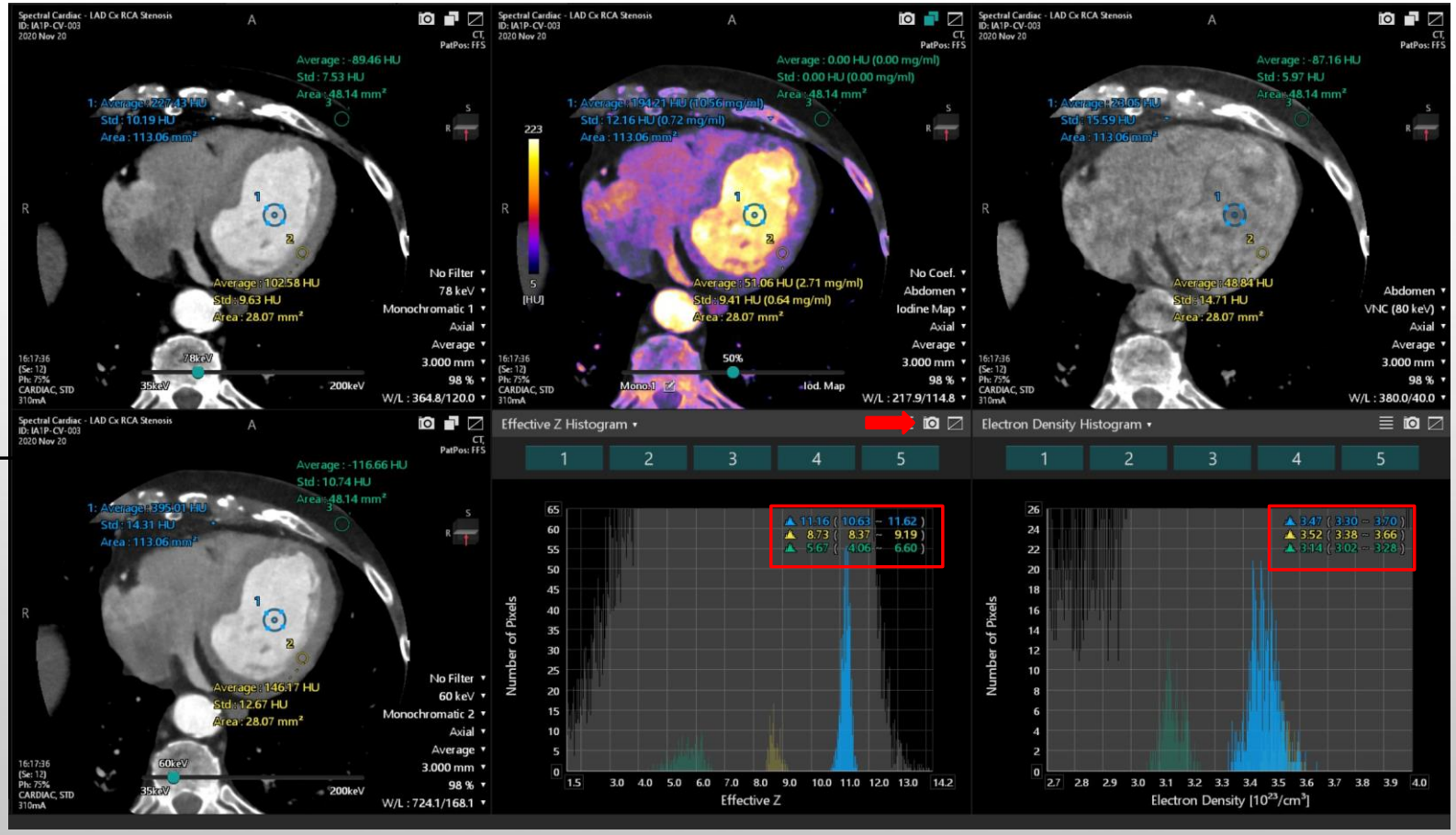
Spectral Cardiac – ROI Condition

When a ROI is drawn on an image, corresponding graphs will display the range of values in the ROI.

The graph will show both the average value within the ROI and the range of values within the ROI.

Tip: Use the tab key to toggle between ROI's if multiple ROI's were placed.

Tip: Use the camera icon to create a snapshot of a graph.



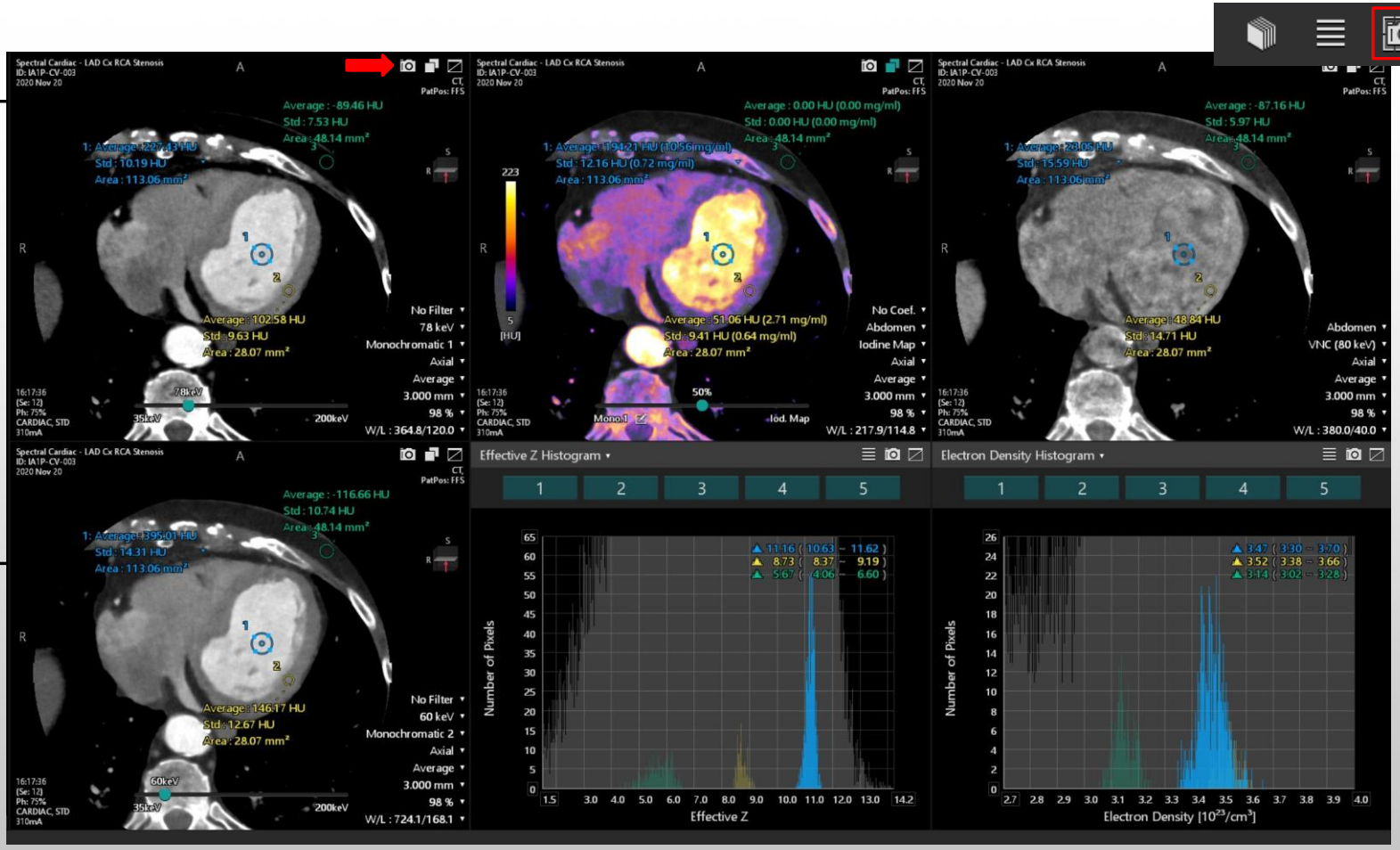
Spectral Cardiac – Take snapshots

Click on the snapshot icon on the common toolbar to generate a global snapshot.

Click on the snapshot icon in the viewport to create a snapshot of the image/graph.

Snapshots are listed under the results tab in the study list and can be exported from here.

Note: The snapshots are only a screen capture and cannot be restored.



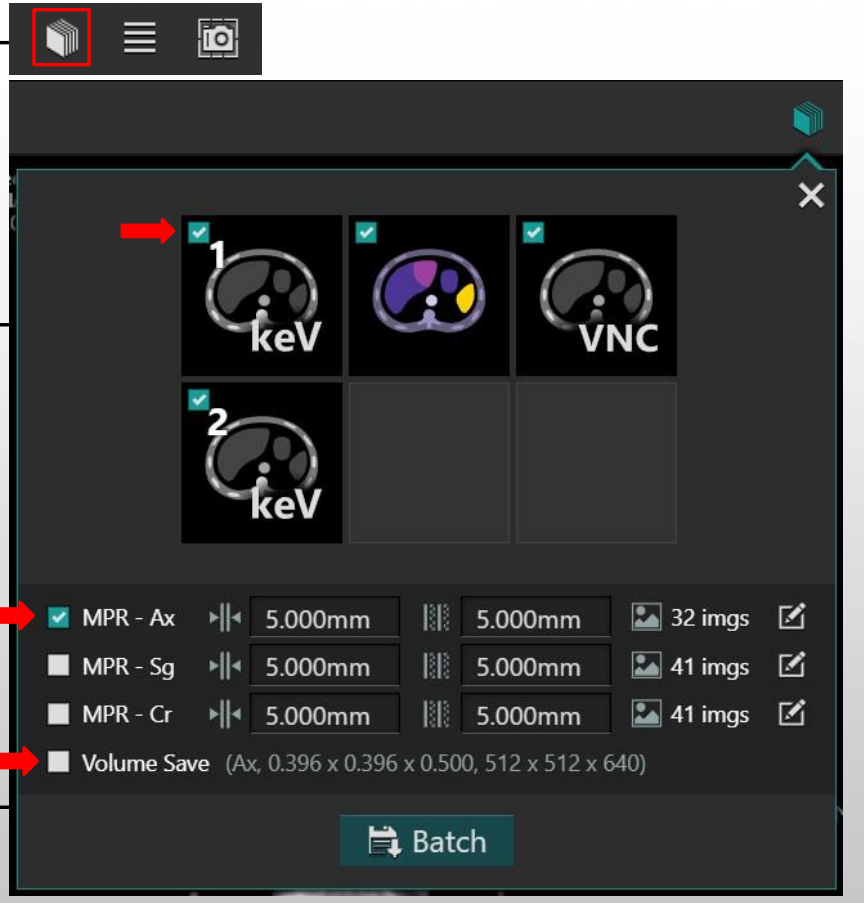
Spectral Cardiac – Generate MPR Batches

Locate the batch tool in the top right corner on the common toolbar.

Select the images and MPR planes to batch, by checking the teal boxes.

All 3 orthogonal planes can be batched.

A new volume can also be generated and saved. This batch can then be loaded into other post processing applications.

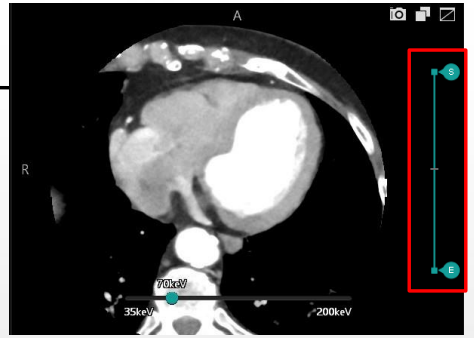


Note: Only images displayed in the viewports can be batched.

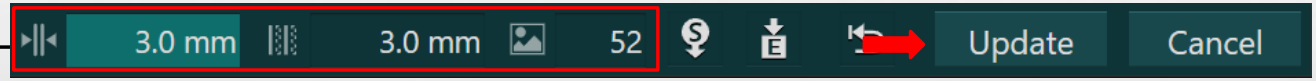
Note: The default thickness and spacing is set to 5mm.

Spectral Cardiac – Generate MPR Batches

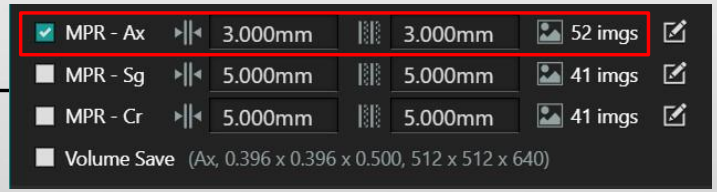
To change the start and end positions, click on the Edit icon.



Change the parameters as necessary and click **Update,** on the right side of image to activate the changes.



The updated parameters will display in the batch settings menu.



Note: The slice thickness and interval can be changed in the dialog box without selecting the edit option.

Note: if the user changes the batch thickness and spacing and then defines a new layout the changes in the batch setting are then saved in that layout.

Click on Batch to generate the batches. The progress of the batch is displayed in the bottom left corner.

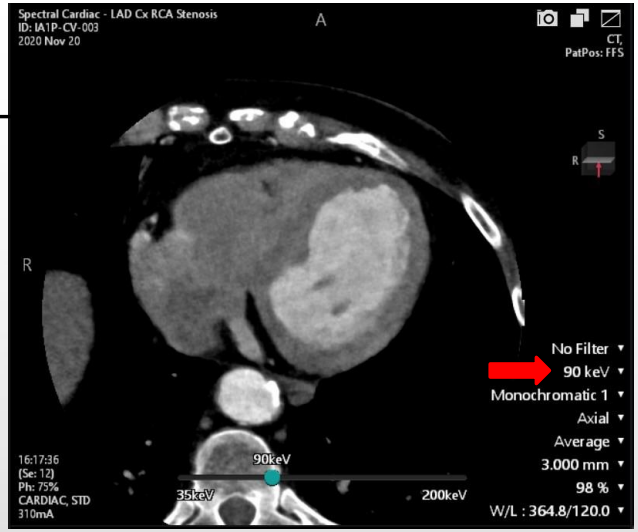
Note: Batches are stored under Applications/Study in the Study list.

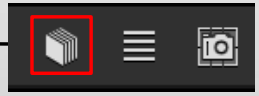
Spectral Cardiac – Generate volume of various keV's

Change the keV value of the monochromatic image to the keV of choice.

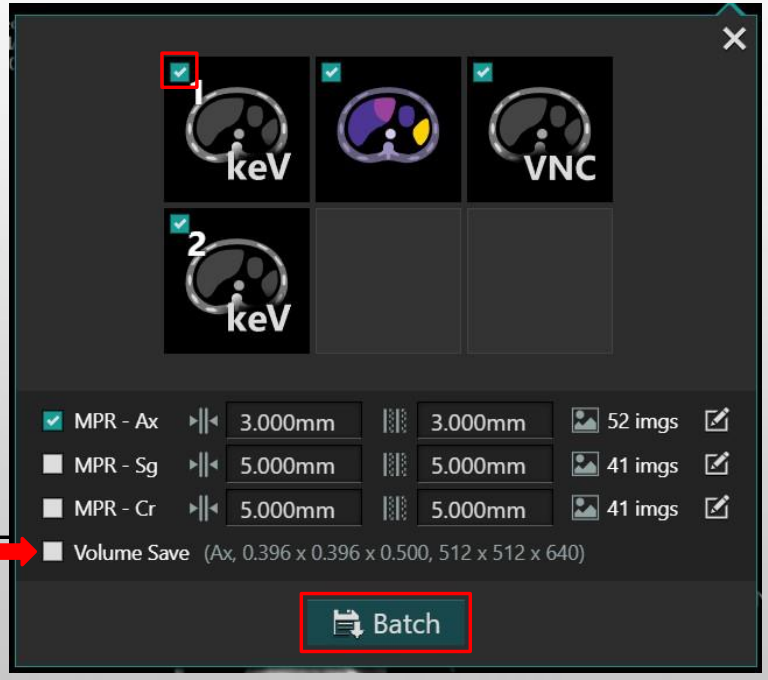
Click on the Batching icon and select the Monochromatic image that was changed.

Select volume save and click on Batch.





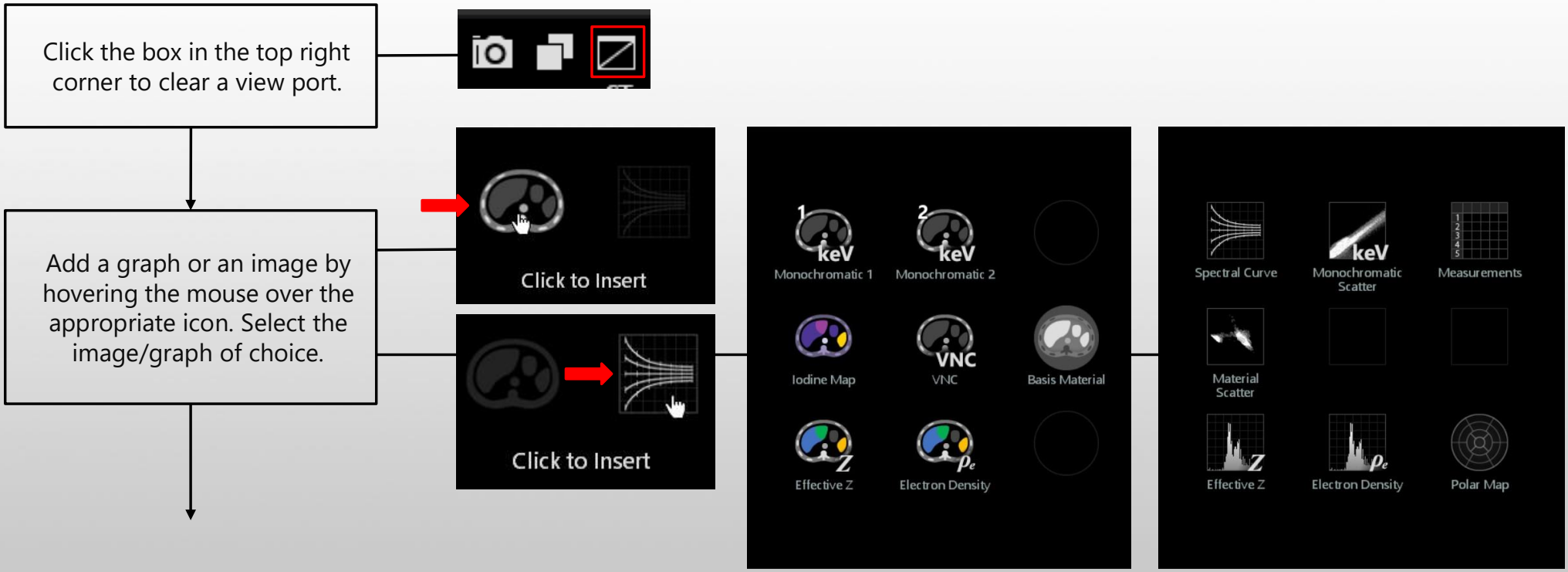
Note: These VMI volumes of various keV's can be loaded into other Cardiac applications.



Additional Procedures

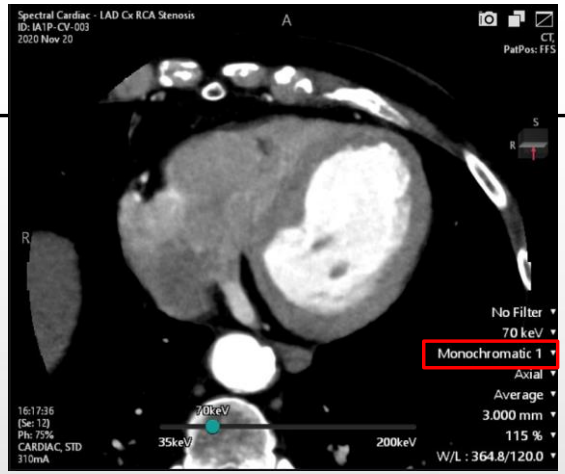
Spectral Cardiac – Customize Layouts

- The entire 6 up layout can be customized and saved as an additional layout.



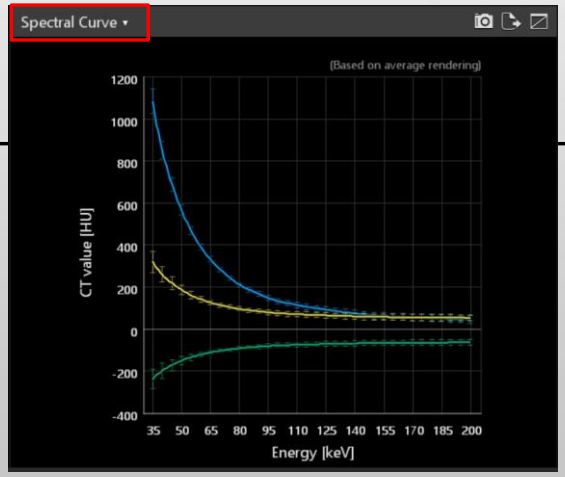
Spectral Cardiac – Customize Layouts

The image can also be changed by selecting a different image from the dropdown menu in the bottom right corner.



- Monochromatic 1
- Monochromatic 2
- Iodine Map
- VNC
- Basis Material
- Effective Z
- Electron Density

Select a different graph by selecting a different option from the dropdown list.



- Spectral Curve
- Monochromatic Scatter Diagram
- Measurements
- Material Scatter Diagram
- Effective Z Histogram
- Electron Density Histogram
- Polar Map

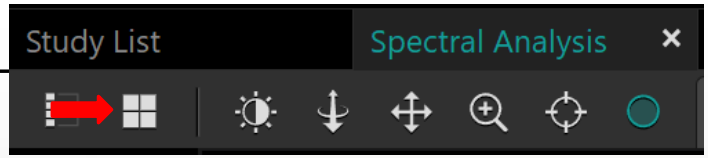
Spectral Cardiac – Save Customized Layouts

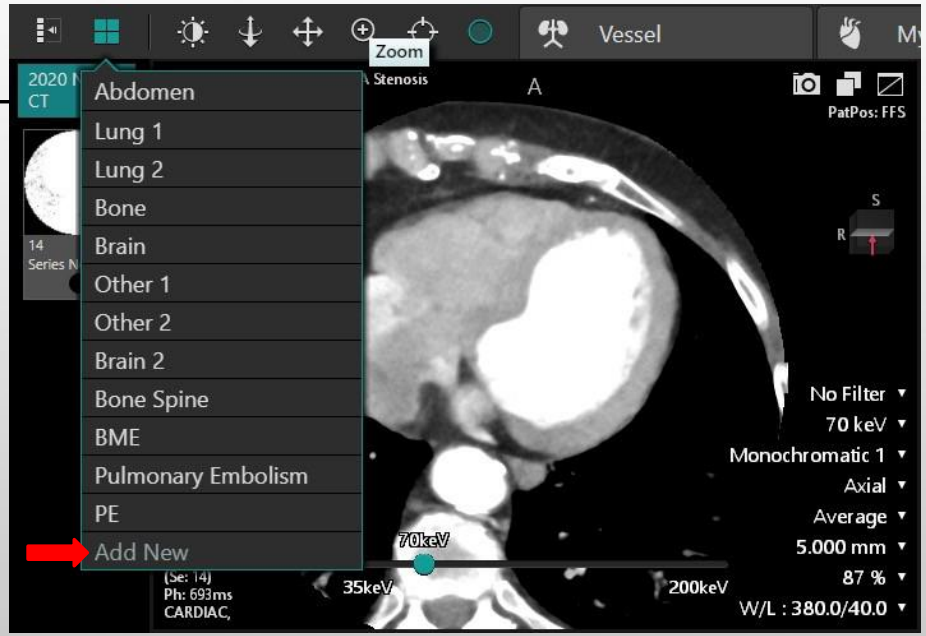
Click on the layout icon on the common toolbar.

Click on Add New.

Type in the new layout name.

Press **Enter** to save.





Tip: The data displayed in each image port is captured when saving a new layout including:

- Image control settings
- Fusion overlay
- Blending percentage
- keV value, etc.

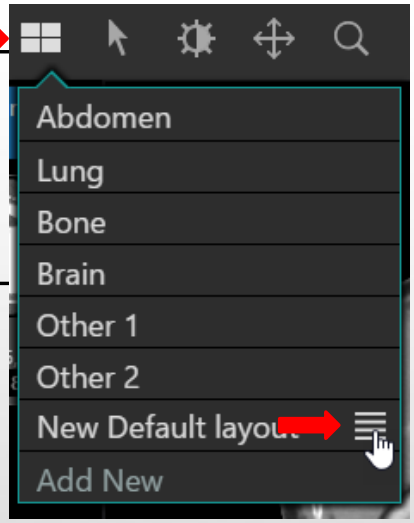
Spectral Cardiac – Change the default layout

Click on the layout icon on the common toolbar.

Hover the mouse over the menu icon that appears next to the layout.

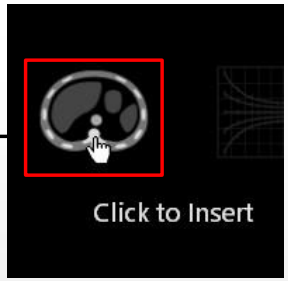
Left click on the menu icon and select **Rename**, **Delete** or **Set as default** from the list.

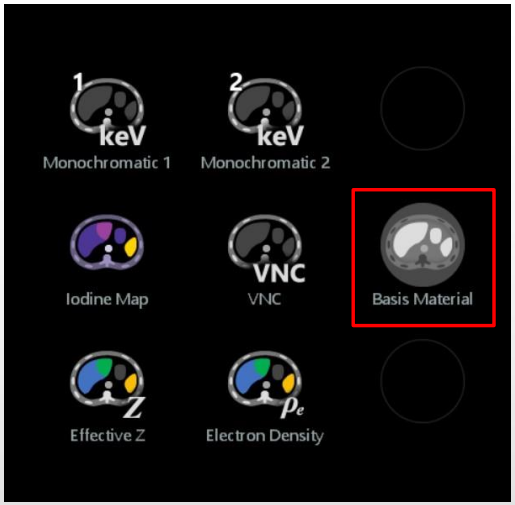
Tip: The layout selected as default will be the layout displayed when the application is next launched.



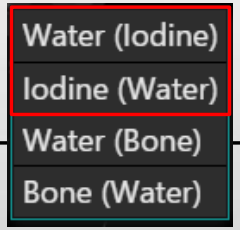
Spectral Cardiac – Select basis material pairs

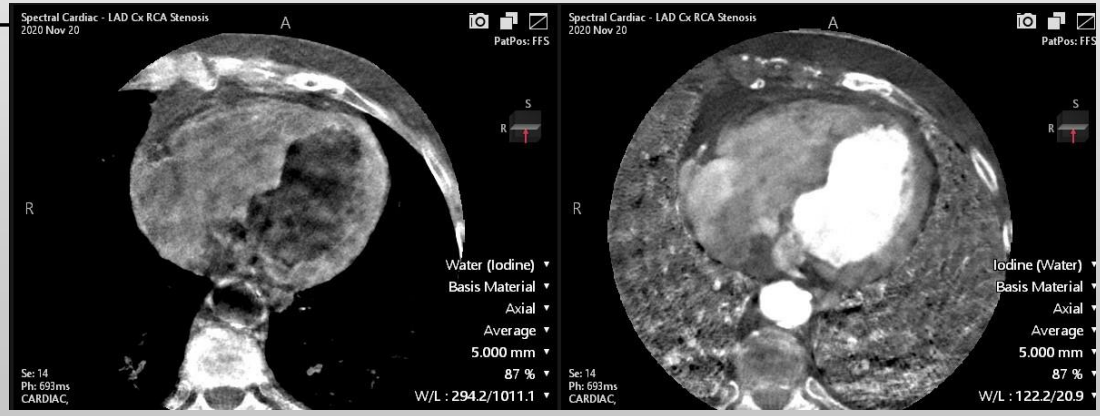
To load the basis material images, hover the mouse over the image icon in an empty image port and click on Basis Material.





Select the desired pair from the list.





Tip: The Basis Material images can be used to confirm what is seen in the iodine map and VNC images.

Spectral Cardiac – Create a new Iodine preset map

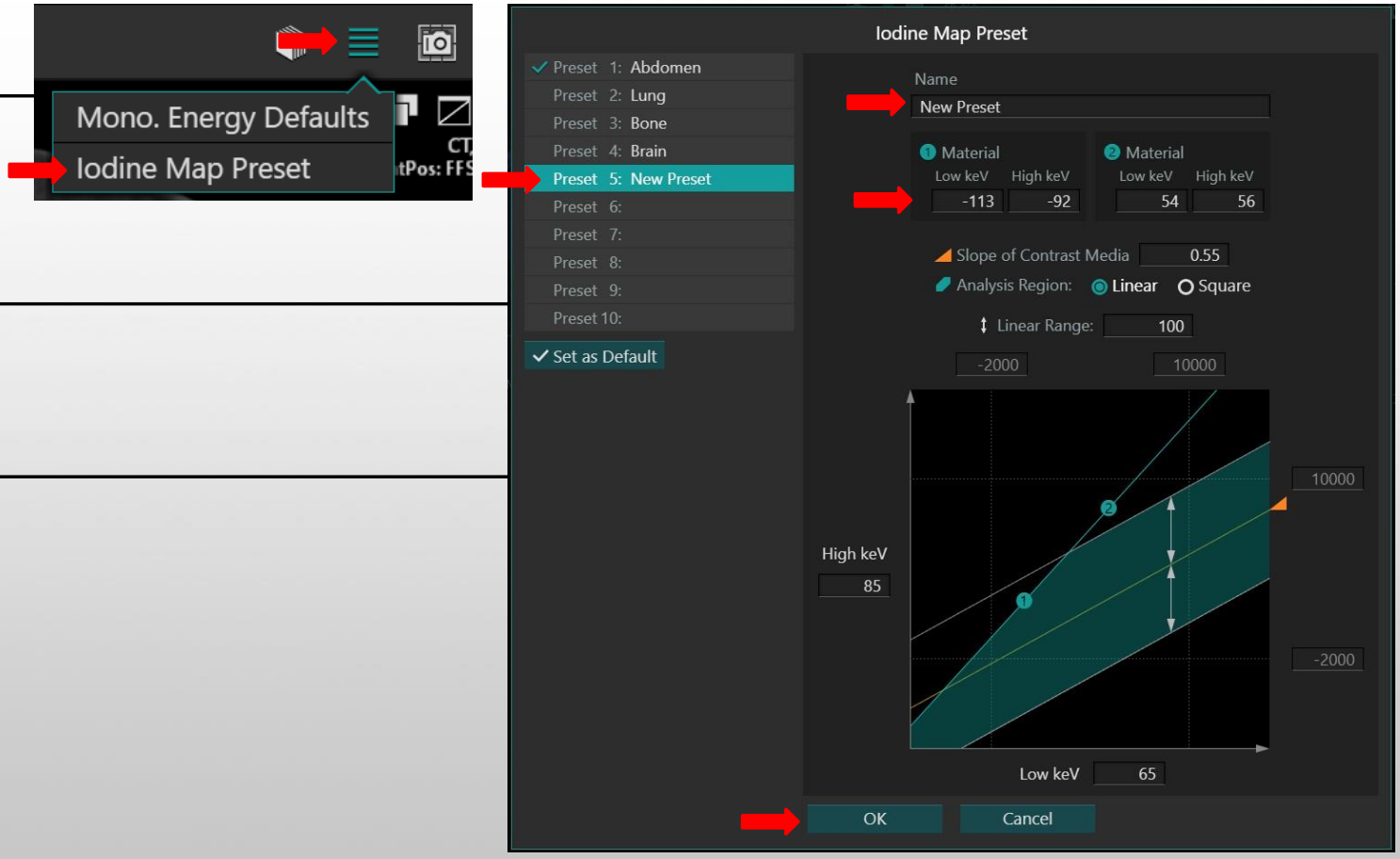
Click on the “pie” icon on the common toolbar. Click on Iodine Map Preset.

Select an empty line. Type in the Preset name.

Enter the values and click on OK to save.

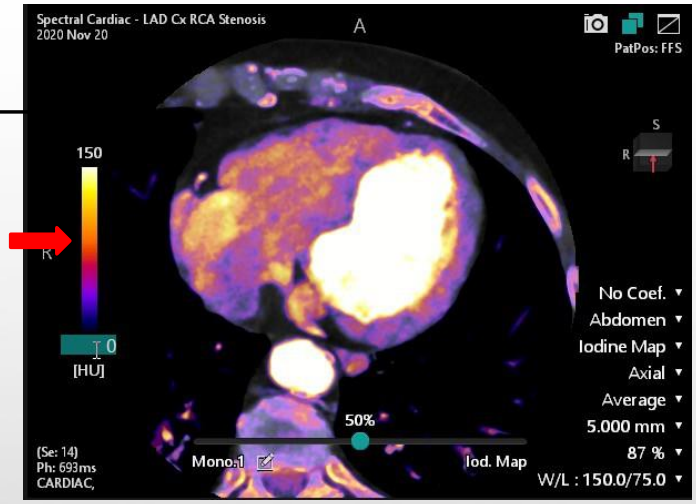
Note: 6 customized iodine map preset can be added.

Tip: Select **Set as Default**, to make the customized preset the default map setting.

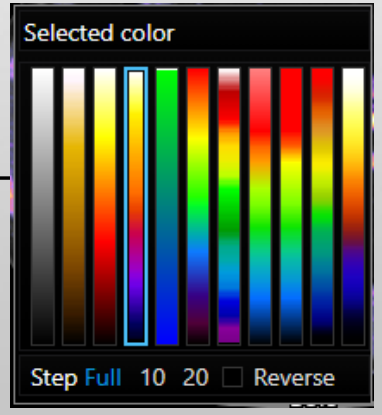


Spectral Cardiac – Adjust Color overlay threshold

To change the color overlay thresholds manually, type in a new number next to the graph to set the desired range.



The color overlay can be changed by right clicking on the color scale.



Spectral Cardiac – Best CNR Image

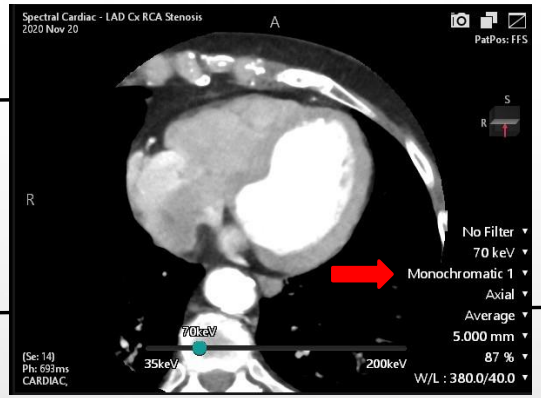
In the bottom right corner of the monochromatic image, click on the dropdown arrow.

Select the Best CNR option from the list.

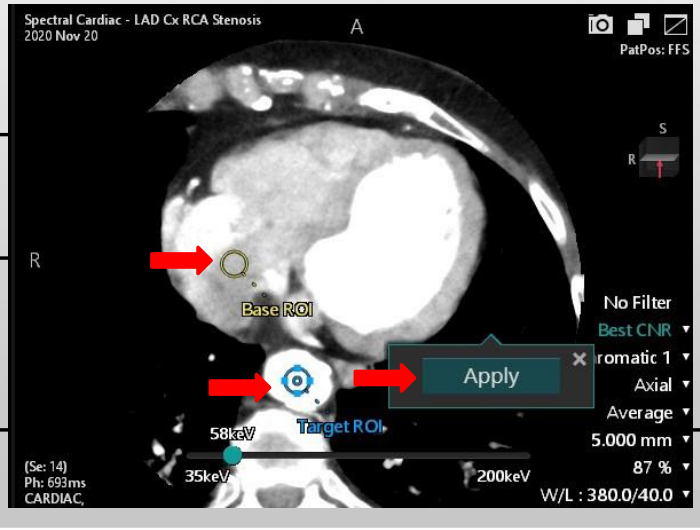
Place the Base ROI in the least enhancing soft tissue.

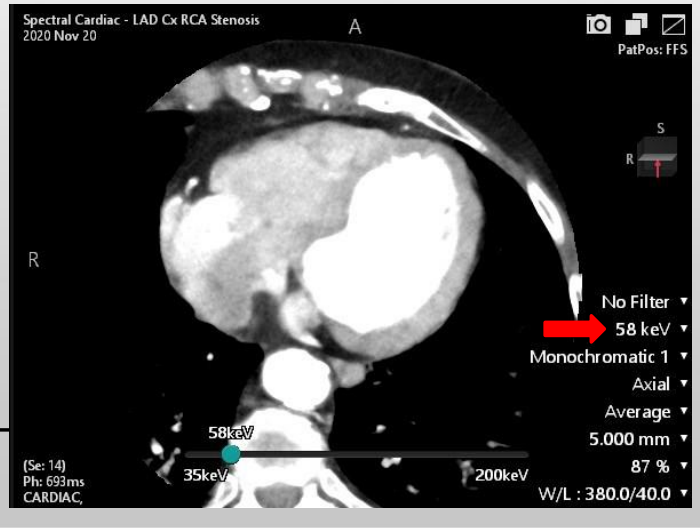
Place the Target ROI in a vessel.

Click on Apply to generate the Best CNR image.



Note: The keV value will change once the Best CNR image is processed.





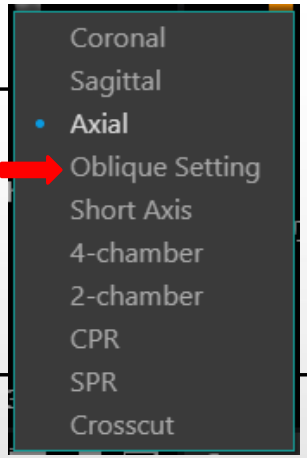
Spectral Cardiac – Change the image mode

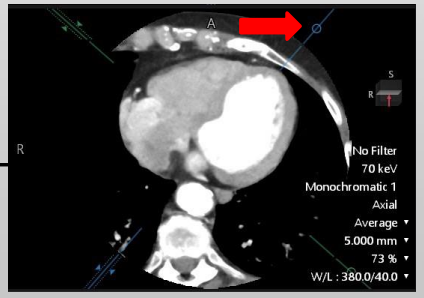
Click on the drop-down arrow next to Axial and select the desired plane from the list.

When Oblique mode is selected, a new viewport will open, showing the oblique settings.

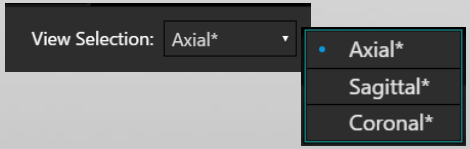
Use the rotate tool to rotate the image.

Use the circle at the end of the crosshair to rotate the crosshair.



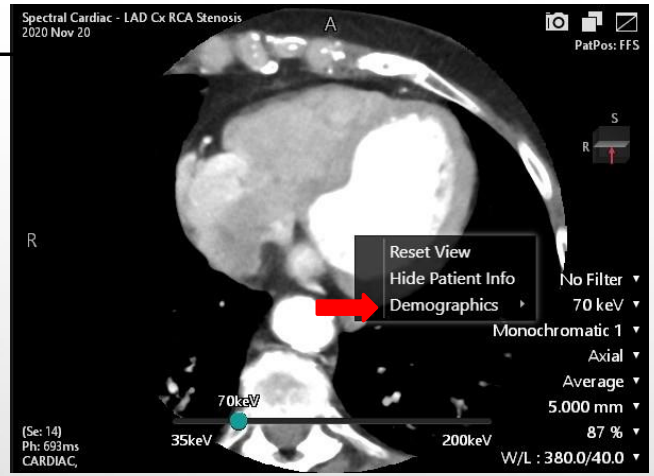


Note: Only one anatomical plane can be displayed at a time. Select the desired plane from the dropdown before oblique mode is closed.



Spectral Cardiac – Patient Demographics

Right click in an active image port and a menu will appear.



Hover the mouse over Demographics. Select the desired option from the list.

Tip: Selecting 'None' removes all demographics including the functional demographics in the bottom right. However, if the user hovers the mouse in the bottom right corner the functional demographics appear and can be activated.

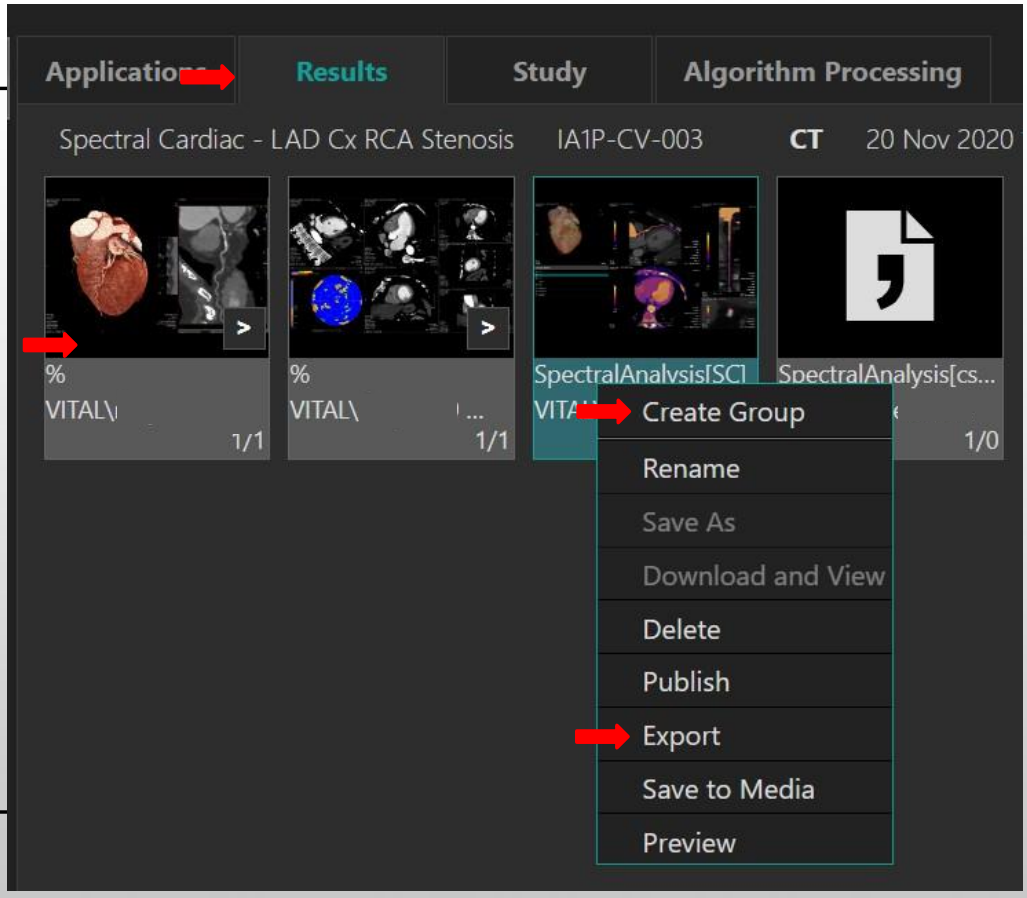
Spectral Cardiac - Distribute Findings

From Study List, select the **results** tab.

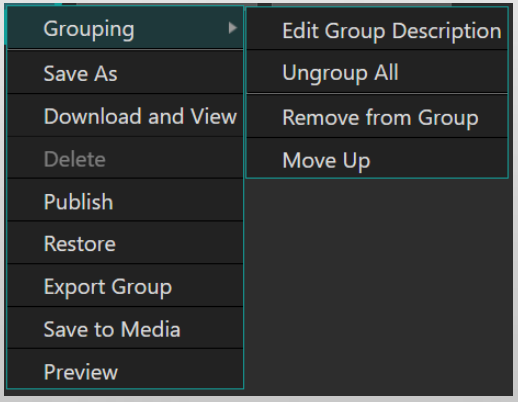
Use **Ctrl** to select all the snapshots to export.

To group evidence together, use **Ctrl** and select the findings to add to the group. Right click and select **Create Group** from the list.

Right click and select export.



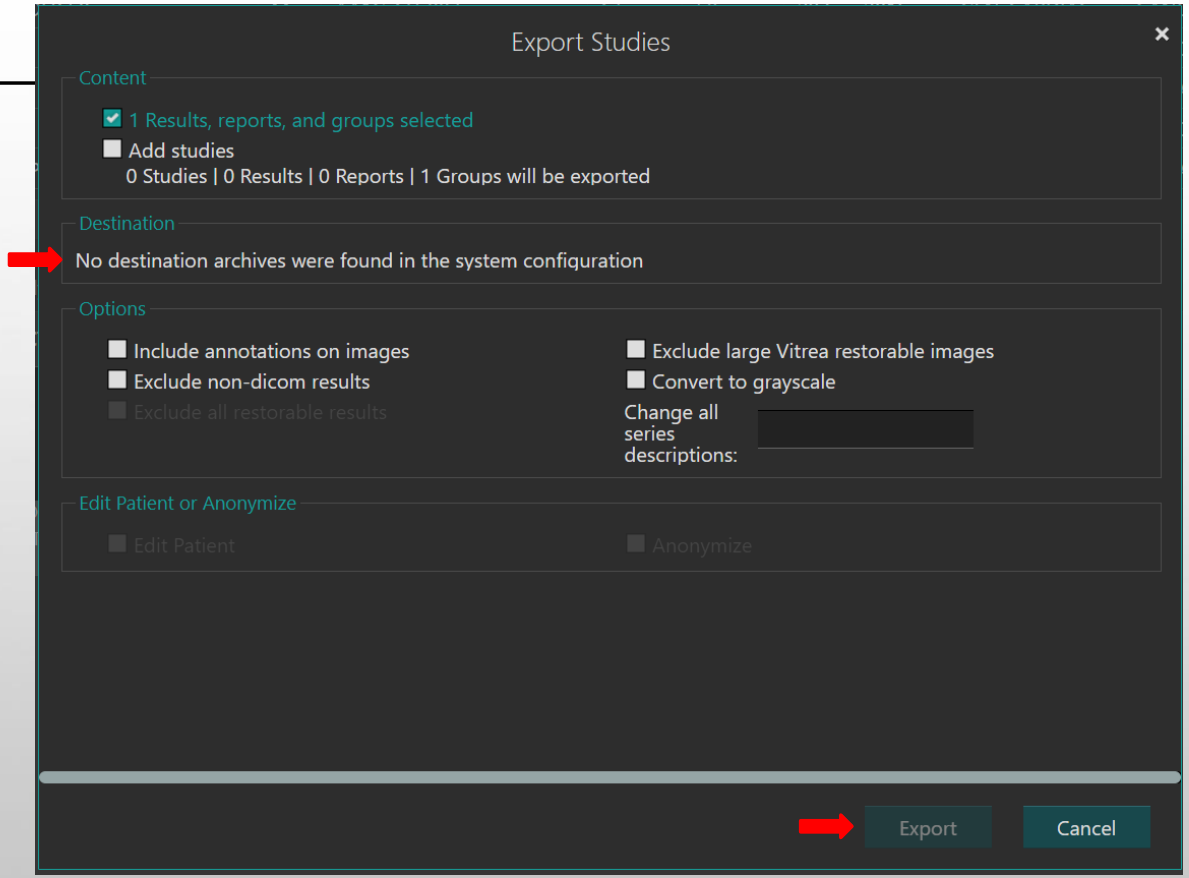
Tip: To delete, rename or edit a group description, right click on the group. Hover the mouse over the arrow and select the option from the list.



Spectral Cardiac - Distribute Findings: Export

Select the relevant DICOM destination.

Click on Export.



Spectral Analysis - Cardiac

Summary:

The Spectral Analysis application is a non – invasive image analysis solution, which may be used to aid in the visualization of iodine distribution in various anatomical structures, as well as quantification of iodine concentration in mg/ml. It can be used across all body regions, in a variety of clinical scenarios.

Features most commonly used:

- Material-based imaging
- Monochromatic imaging
- Iodine maps
- Image Fusion
- Virtual non-contrast imaging
- Effective Z Analysis
- Electron Density Analysis
- User specific customizable layouts
- Spectral Curve Analysis and Smart Batching

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