CT Cardiac CTA
Multi Vessel Analysis

VPMC-17332 A

Canon

Made For life

CT Cardiac CTA

Overview:

- The CT Cardiac analysis application provides a variety of tools and views to evaluate the heart, coronary arteries and surrounding tissues. The software automatically segments and track the centerlines of multiple coronary arteries, generates curved planar reformations and cross vessel views for lumen and diameter reviews. All views may be edited, measured, captured and exported.
  - Select protocol Cardiac Analysis Multi-vessel and load selected cardiac phases
  - Perform 3D Overview and Review Study Quality
  - Evaluate contrast enhancement
  - Click Heart Oblique Mode and view the short axis, 2 and 4 chamber views
  - Perform Vessel Walk, then Perform Vessel Probe to analyze vessels
  - Rename vessels
  - Click Extend Tool to add to the vessel length
  - Edit centerline and contours
  - Evaluate for stenosis using the Lesion Analysis Tool
  - Evaluate plaque burden using ^{SURE}Plaque
  - Click 3D Review Modes including the Cath view for analysis
  - Apply Inverted MIP reset
  - Create GIR image
  - Click Native thickness MPR to view a VR MIP image
  - Create 3D Batch Rotation of vessels with semi-transparent Heart
  - Create and export snapshots and batch reformats, and export findings.

CT Cardiac CTA - Load the study

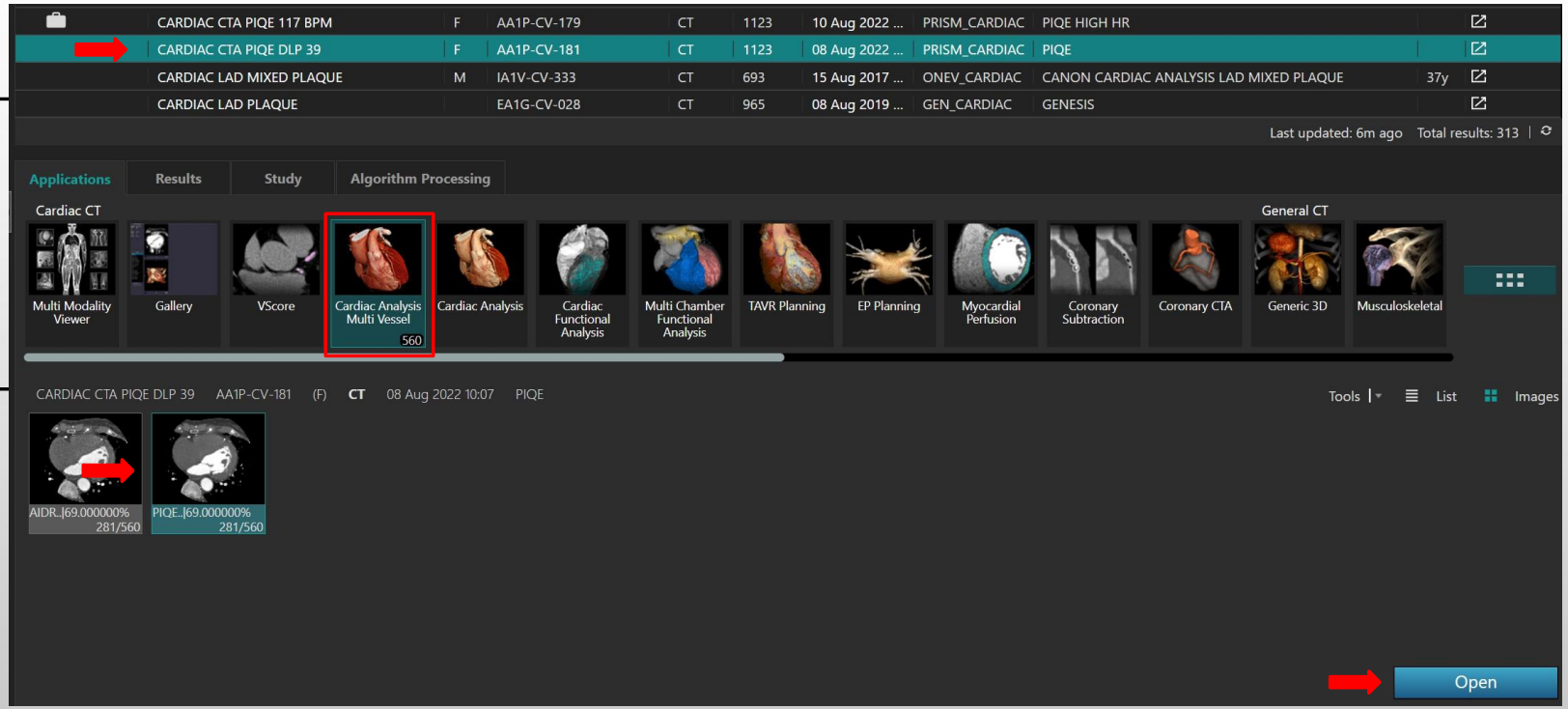
Select the patient.

Double click the **Cardiac Analysis Multi** Application.

OR

Single left click on the application. Verify that the correct volumes were selected and click on **Open**.

Tip: The multi-vessel application automatically probes up to 20 vessels of the LM, LAD, LCX and RCA tree.



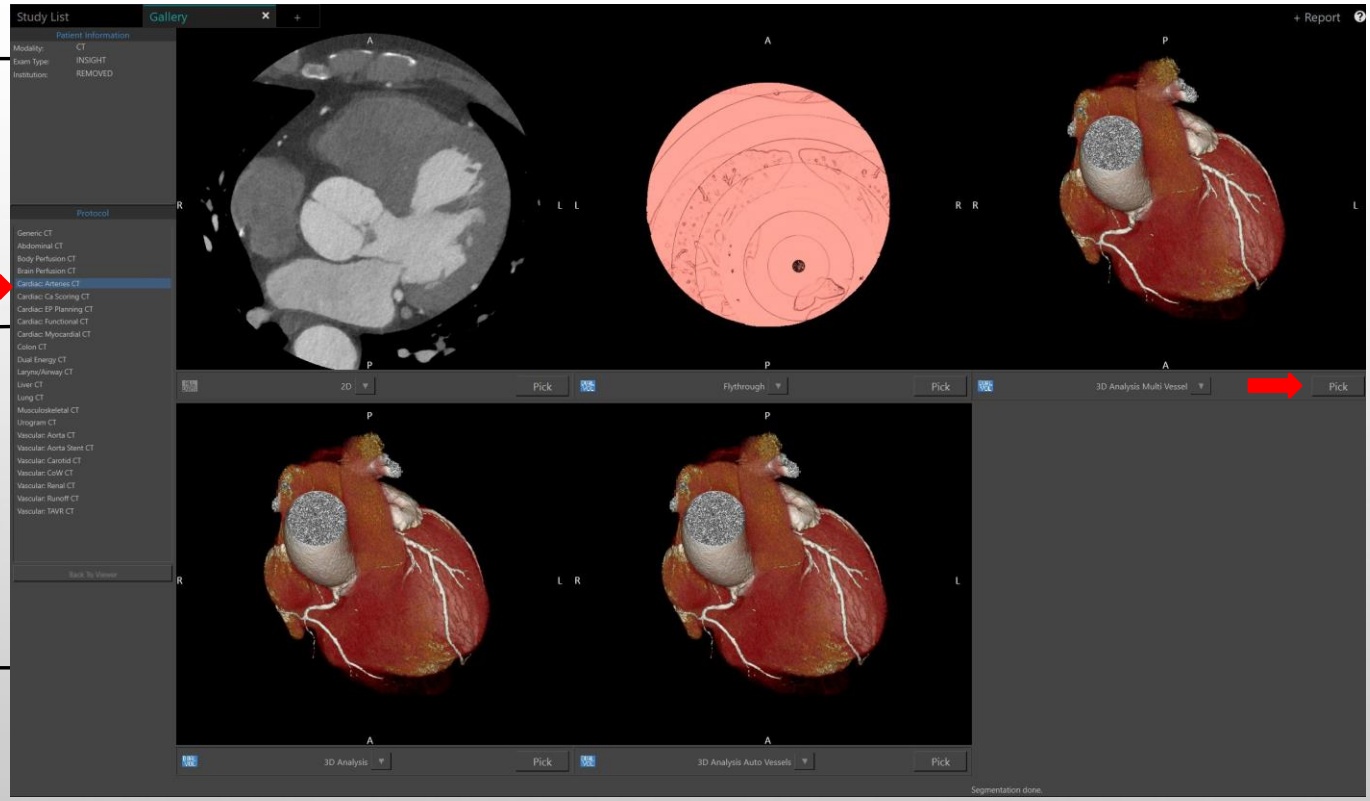
CT Cardiac CTA - Load the study from Gallery

Select Protocol **Cardiac Arteries CT**.

Select **3D Analysis** to **manually** select vessels. Click **Pick**.

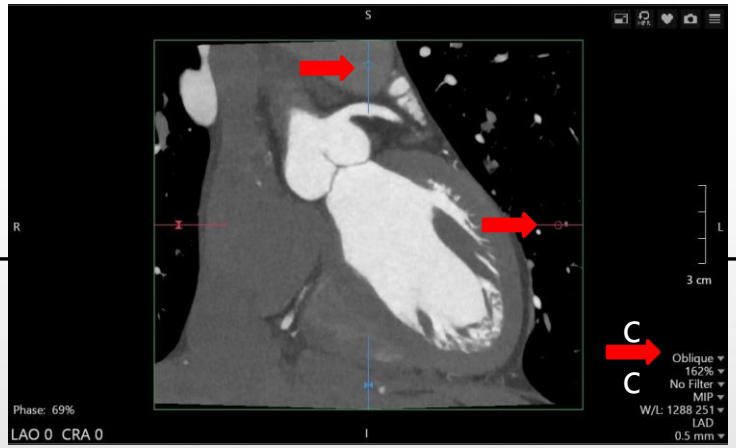
OR

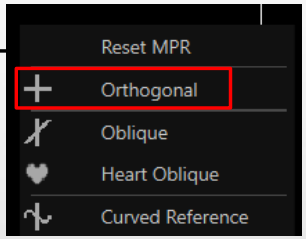
Select **3DAnalysis-Multi-Vessels** for **automatic** vessel segmentation. Click **Pick**.



CT Cardiac CTA - Perform 3D overview

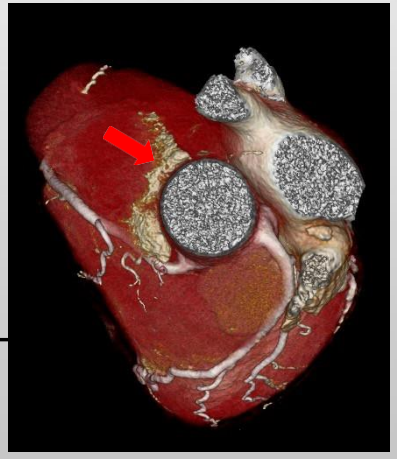
Double click on the circle at the end of the crosshair to select Orthogonal Mode. Or select Orthogonal from the dropdown in the bottom right corner of the viewport.





Right mouse and scroll through the Coronal images until the highest point of the LAD is seen.

Drag the green line to just above the LAD (or the vessel with the highest origin).

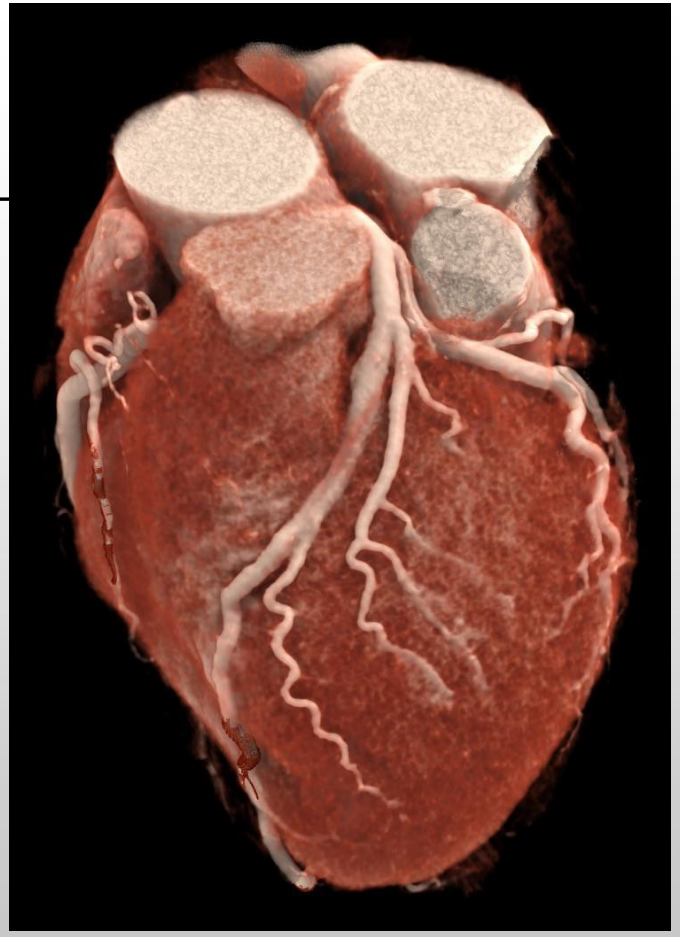


Tip: By cutting away the excess, the origins of the LAD and RCA will be more visible.

CT Cardiac CTA - Perform 3D overview

Double Click **anywhere in the** 3D image to view a one-on-one image.

Right click and drag to **rotate** the **3D** image. Double Click to go back to 4-1 view.

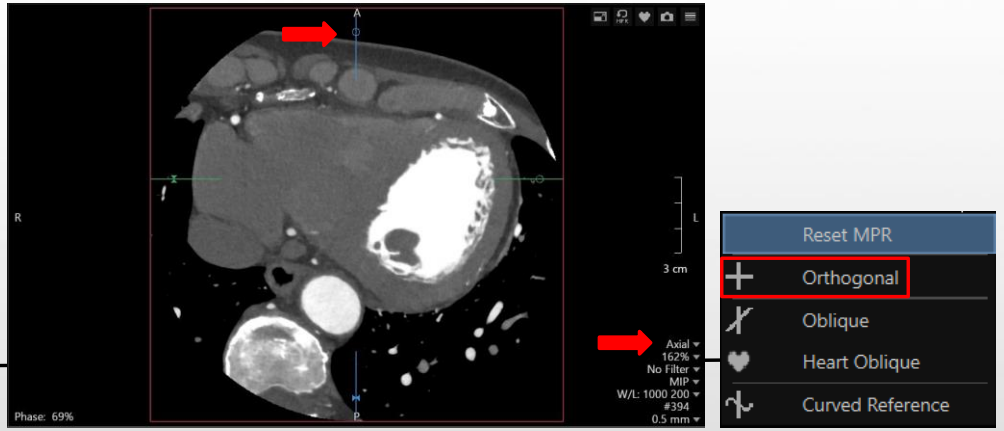


Tip: Review the anatomy and the image quality with the 3D view.

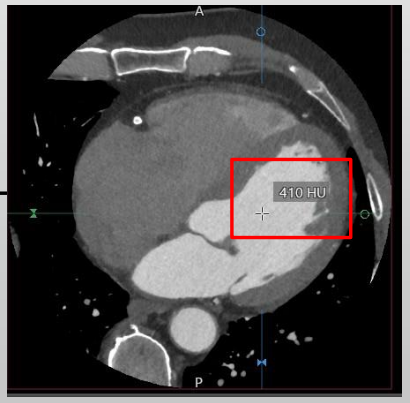
CT Cardiac CTA - Evaluate contrast density

Click **Crosshair**.

Click **Orthogonal Mode** from the bottom right of MPR, or double click on circle at the end of the crosshair.



Left click and **hold** the Crosshair to assess the density of the contrast bolus.



Desired HU Range 250-450

Tip: Survey HU in the ascending and descending aorta and the left ventricle. Right-click and scroll through the axial, coronal and sagittal images to access overall quality.

Note: Measured HU will be higher if the PIQE volume is used for the review.

CT Cardiac CTA - Check for motion artefacts

Right mouse and scroll to a mid-sagittal slice. Look at the sternum and spine and verify that no step artifacts are present.

Tip: If a step artifact is seen in the heart, but the sternum and spine is still intact, the step could potentially be removed with a Phase Xact reconstruction on the CT.

CT Cardiac CTA - Review Heart Oblique Mode

Click **Heart Oblique Mode** in the upper right corner of the MPR oblique view.

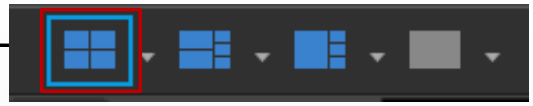
The Heart Oblique Mode button **toggles** between the orthogonal views, the cardiac short axis, 2 and 4 chamber views.

Right-click and scroll to review the cardiac chamber views.

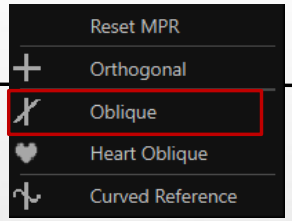
Tip: When the heart oblique mode is active the button changes to a blue color.

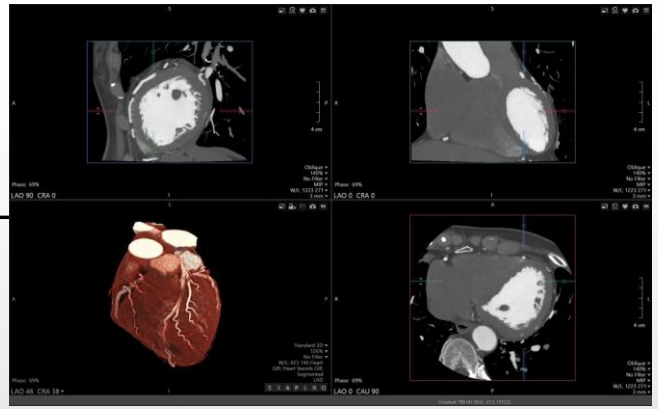
CT Cardiac CTA - Vessel Walk

Click the 4:1 image display. Click axial MPR.

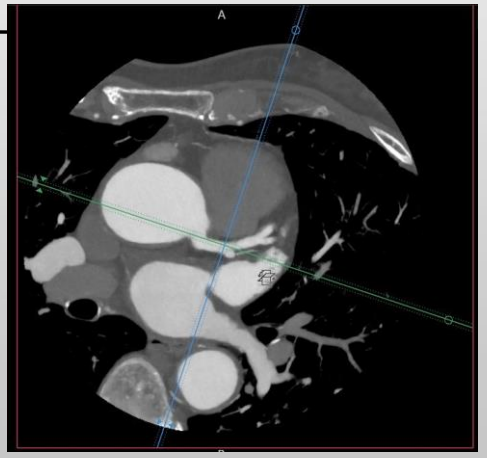


Click **Oblique** mode from the bottom right corner of MPR.

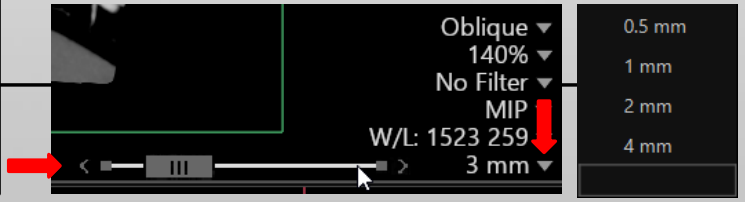




Click **crosshair** on the vessel. The cursor becomes an oblique orientation tool. Click and drag to rotate the image.



Thicken **MIP** by hovering the cursor next to slice thickness. A slider bar will appear. Drag the slider bar to adjust the slice thickness. Or click on the arrow next the thickness and select a different slice thickness from the dropdown.

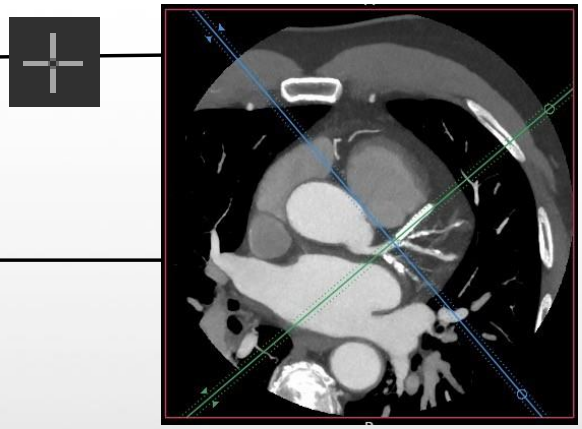


Tip: Oblique vessel walk can be performed in all viewports.

Tip: For the best results, set the thickness to the MIP thickness to the vessel diameter.

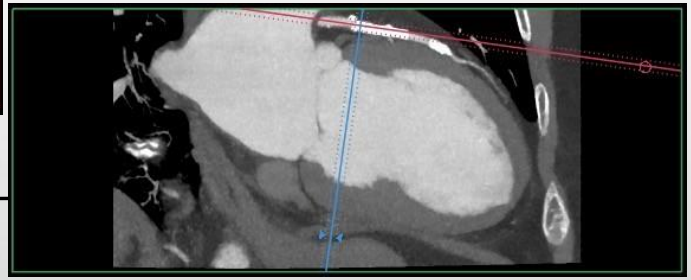
CT Cardiac CTA - Vessel Walk

Click the Crosshair in the vessel lumen in the **axial** MPR.

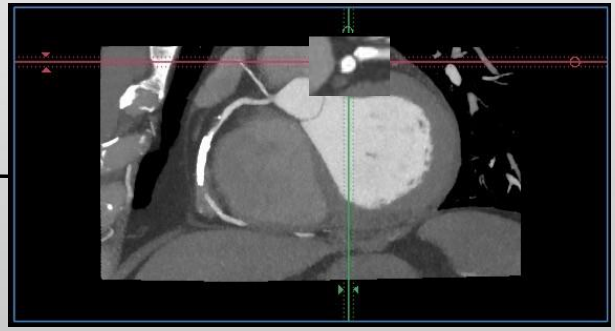


Move the mouse along the green coronal reference line and **two arrows** display. Click and **rotate** the green lines along the vessel lumen.

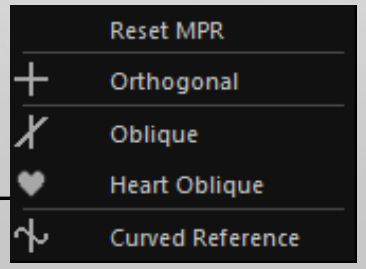
Zoom and Pan the image.



Click crosshair in **coronal** MPR. **Rotate** the red reference line along the vessel lumen.



The **sagittal** MPR displays a true cross-sectional view of the lumen.



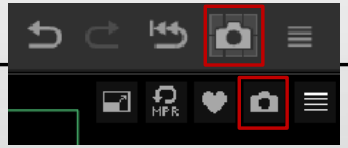
Click **Reset MPR**. Repeat the reference line alignment on any MPR.

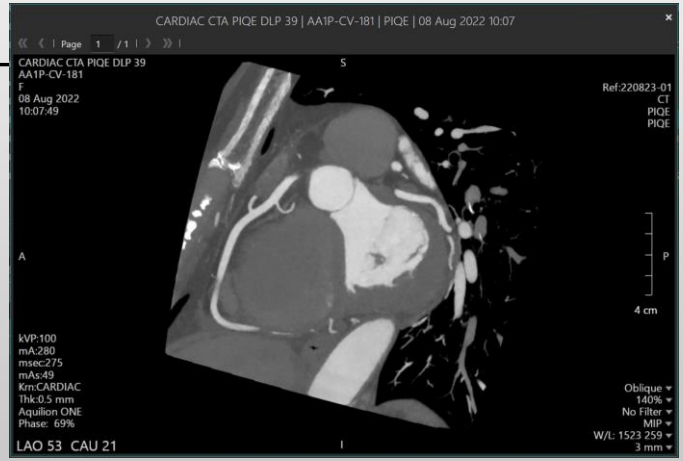
Tip: You must be in the Oblique Mode to perform these steps.

CT Cardiac CTA - Snapshot

Save a key image with the key image tool on the common toolbar or take a snapshot with the snapshot icon.

Snap icon can be accessed from the 3D or 2D image in the upper right corner of viewport to create the snapshot.





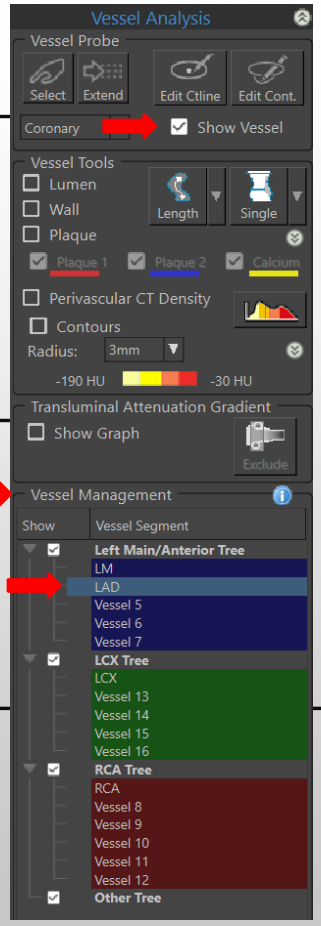
Tip: It is important to remember to take a snapshot. Only a snapshot can be restored later. Once a snapshot is restored you will be able to continue post processing your image.

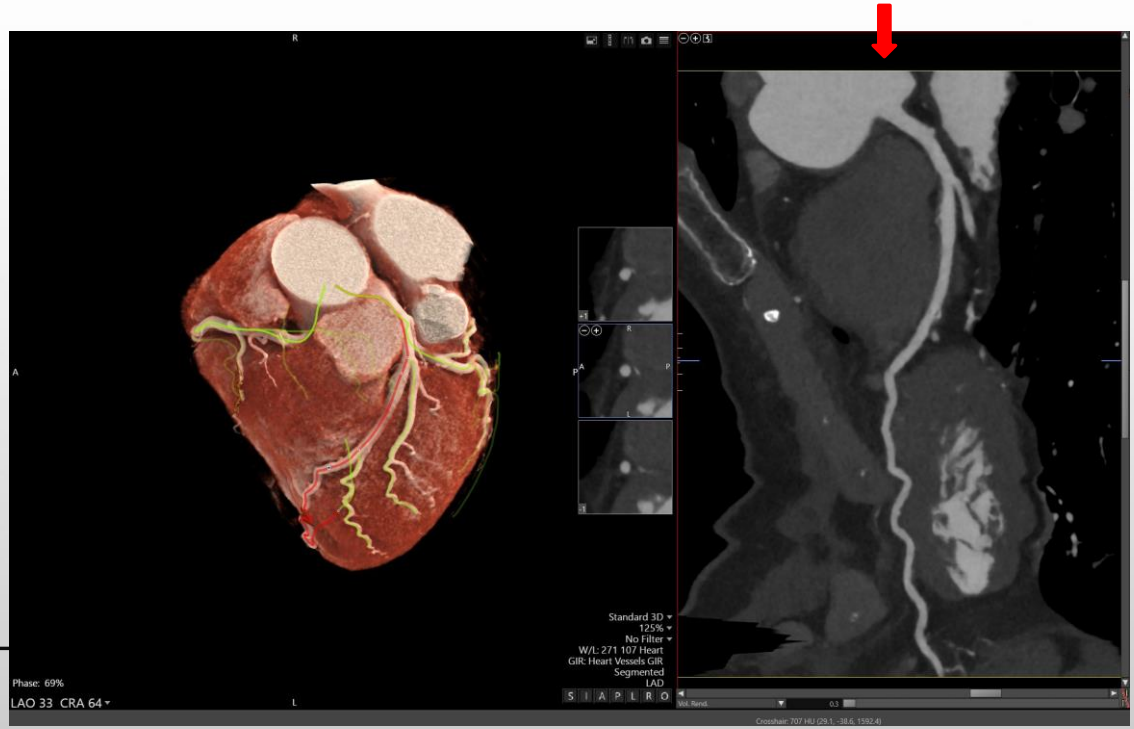
CT Cardiac CTA – Multi-Vessel

Verify that Show Vessel is selected.

With the **Multi-Vessel workflow,** the three main arteries and branches are automatically probed and listed in vessel Management.

Select vessel from list to display the CPR view.

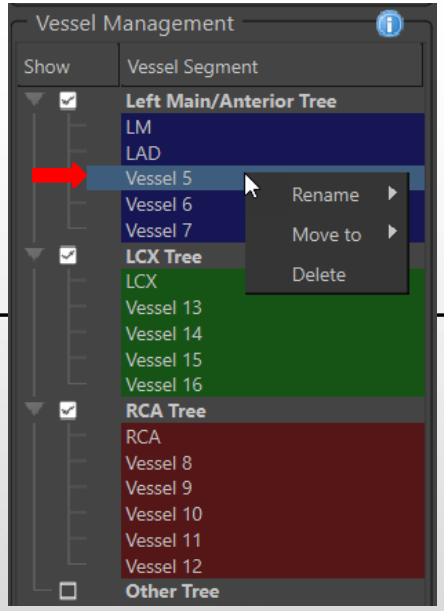


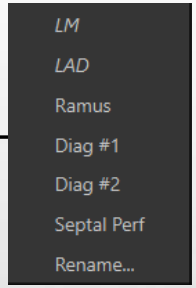


CT Cardiac CTA - Rename Vessels

In the vessel management list, select the vessel to rename.

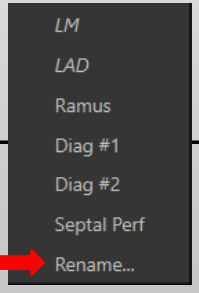
Right-click on the vessel name and select **Rename**. The Rename dialog box displays. Select the correct option from the list.

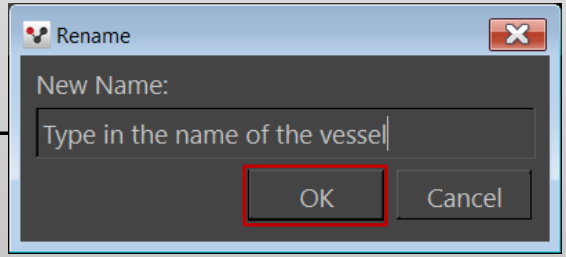




OR

Select **Rename**. Type in the name of the vessel. Click on **OK**.



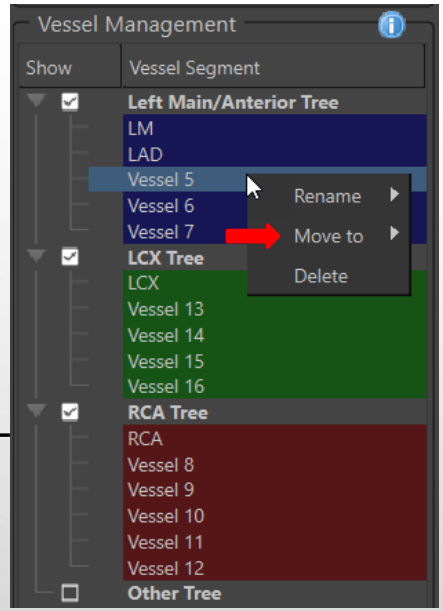


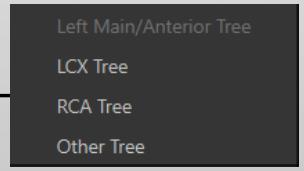
CT Cardiac CTA – Move a vessels to a different tree

In the vessel management list, select the vessel that must be moved.

Right-click on the vessel name and select **Move to**.

Select the new tree you would like to move the vessel to.



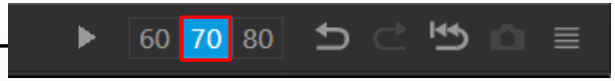


Tip: It is also possible to remove a vessel from the tree by clicking on **Delete.**

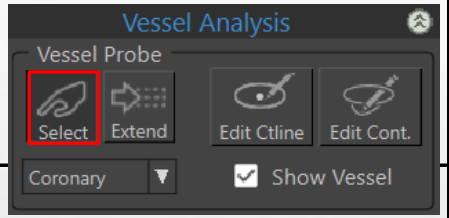
CT Cardiac CTA – Manual Vessel Probe Analysis

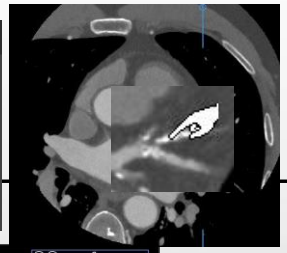
- Vessel Probe is an option for Cardiac CTA to isolate and analyse the vessel.

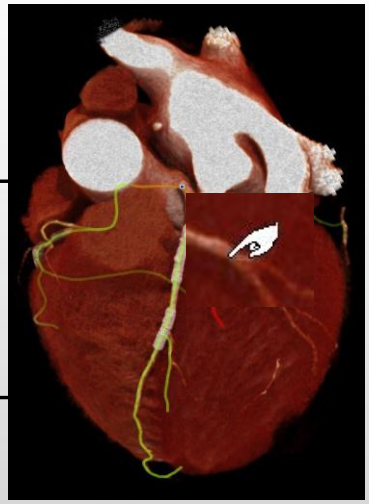
Select the cardiac phase from the common tool bar.



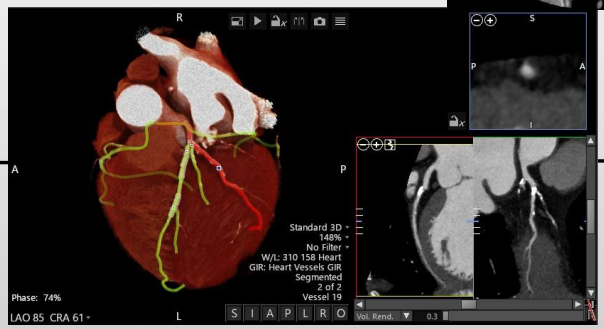
Click **Select**.
Click **on the vessel** in the 2D or 3D image.



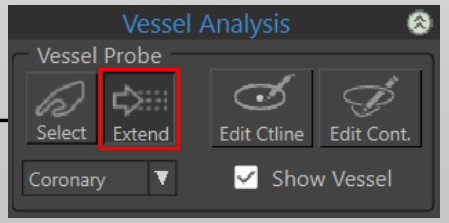




Vessel Probe lists the vessel under vessel management, generates a centreline and CPR view.



Click **Extend.** Click **proximal** or **distal** on the 2D or 3D image. This extends the visualized vessel.

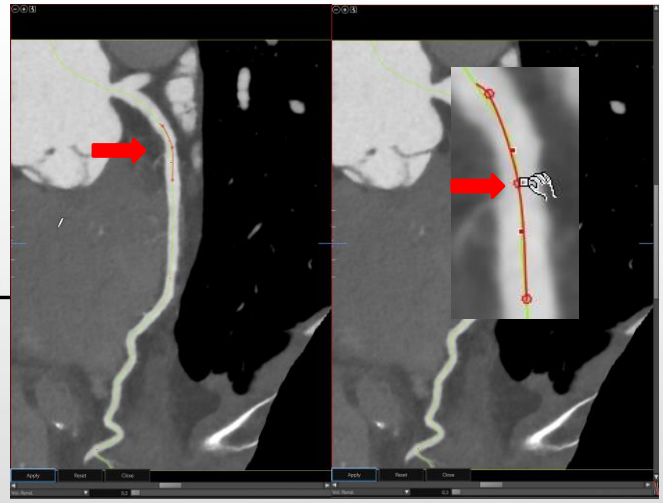


Tip: Use this process to add additional vessels.

Note: Extend will not go beyond the point you select.

CT Cardiac CTA - Centerline Edits

Right-click in the **CPR view.** Click **Edit Centreline**.



Tip: The yellow line is the centreline.

Click and **deposit red points** to adjust the centreline by dragging the points.

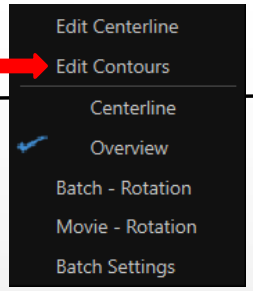
Note: Editing the centreline on the MPRs is only possible in the Cardiac CTA application.

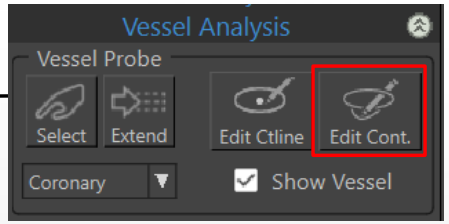
Click **Apply** saves the edits. Click **Close** to end.

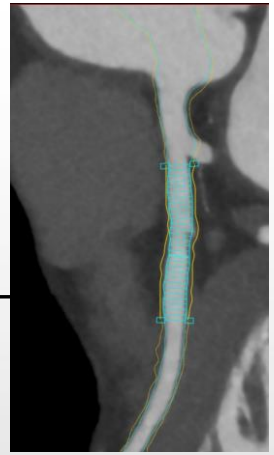
Click and **drag** the slider bar at bottom of the CPR view to rotate the image.

CT Cardiac CTA - Edit Contours

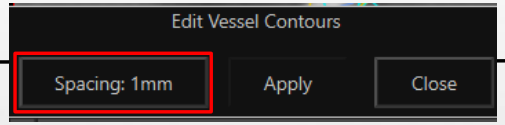
Right-click in the CPR view and select **Edit Contours** or click on **Edit Cont** under vessel analysis.



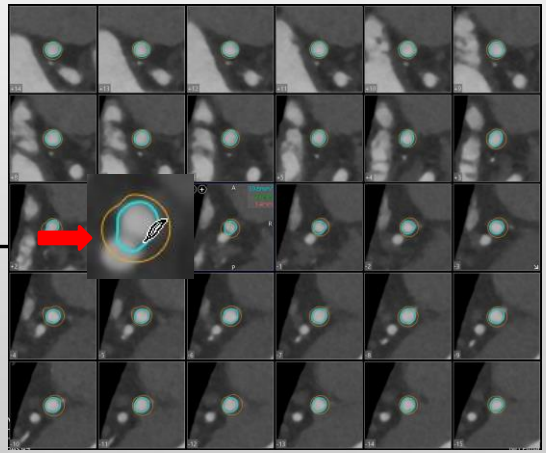




Change the spacing to 1mm. Click and **drag** the **landing zone** to the area of interest.

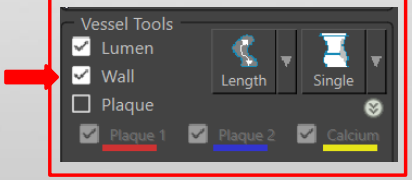


Move the mouse into ROI views. Click and **hold** the pen and redraw contours if required.

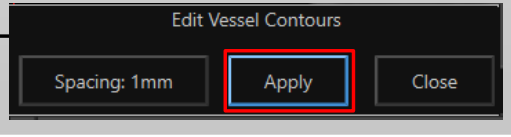


Note: Blue outlines the vessel lumen. Orange outlines the vessel wall.

Tip: Uncheck Wall to assist edits.



Click **Apply** and **Close**. You will need to make two edits.

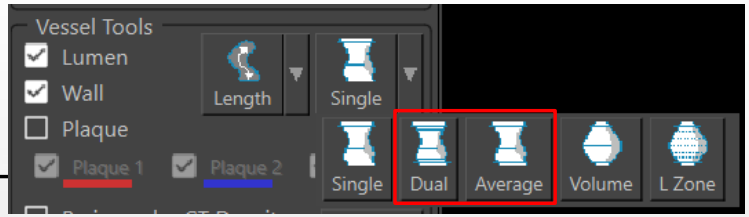


Note: Vitrea will interpolate between four ROIs edits.

CT Cardiac CTA - Lesion Tool Analysis

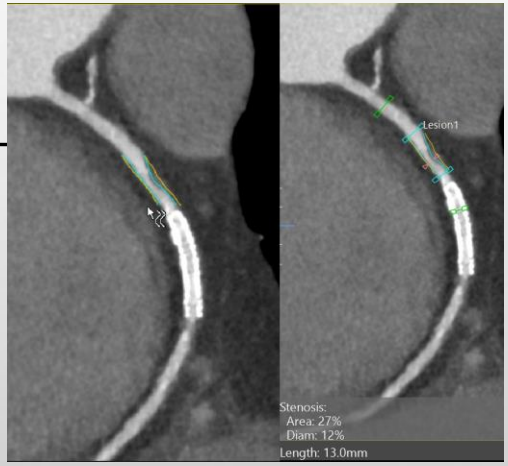
Double click in 3D image to go into a one-up image.

Locate **Vessel Tools**. Click Dual or Average.

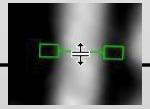


Tip: It is recommended to use dual reference point for a vessel that naturally tapers down (e.g. coronary artery) or a bifurcating artery.

Left click and **drag** on the vessel in the CPR view. Start **above the lesion** to just below the lesion.



In the CPR view **click** and **move** the green reference line to normal vessel diameter.



Tip: Stenosis value displays on the CPR image.

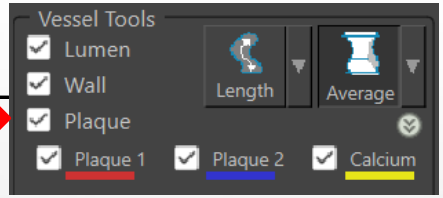
Verify the **red** lines display the stenosis. Click and **drag** to adjust.

Note: The stenosis point within an identified lesion is initialized to the minimum luminal area, and not to the minimum luminal diameter of the overall identified lesion.

CT Cardiac CTA - Plaque Burden

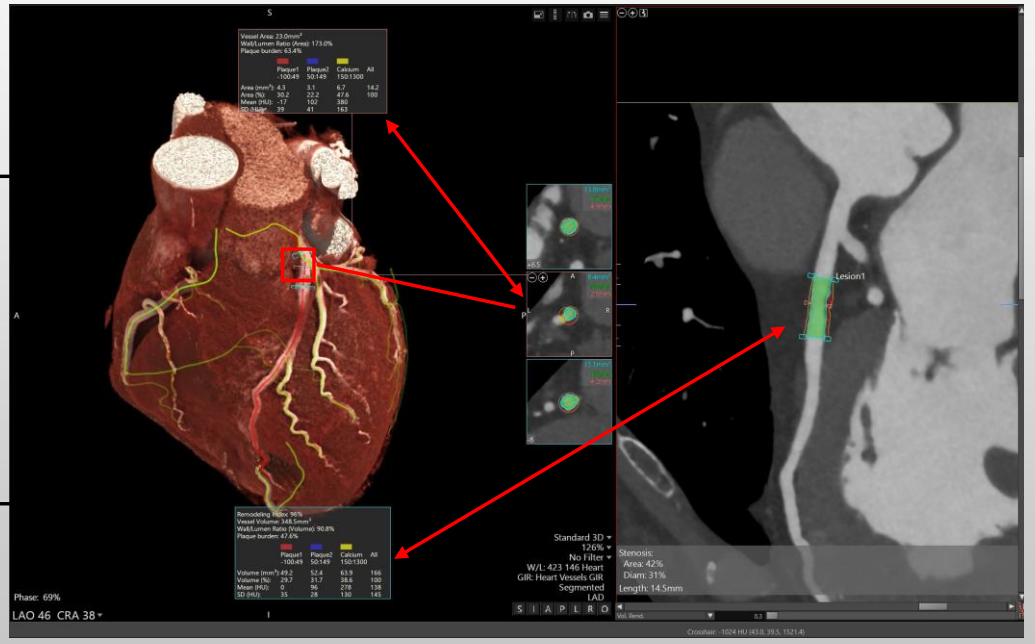
- SurePlaque visualizes the coronary lumen, walls and plaque.

Click Plaque. The HU color-coded parts of the vessel display on the screen.



The cross-sectional view is the current point of interest. Roll mouse wheel in the cross-sectional view to scroll through the vessel and update the values.

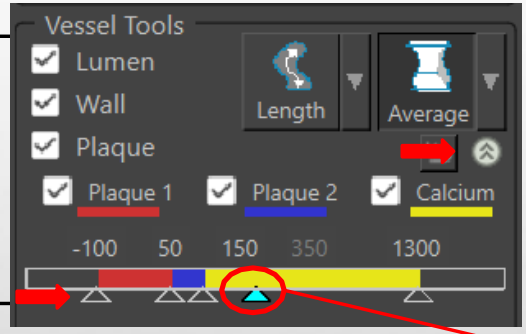
The plaque information for the narrowest point, as well as the entire lesion area, including the remodeling index is displayed in tables.



CT Cardiac CTA – Adjust HU settings for SurePlaque

Click on the chevron to open the threshold setting.

Click and drag the triangle or separation bar to increase or decrease the HU value range.



Note: The cyan filled triangle affects how the software detects the lumen boundary. Only change when the boundary results are not satisfactory, for instance in the presence of calcium, stent or high intensity artifacts.

CT Cardiac CTA - Perivascular CT Density

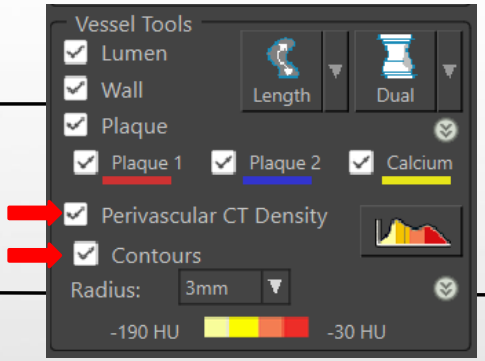
- Perivascular CT density can be used to visualize and obtain statistical analysis on perivascular densities in the coronary arteries.

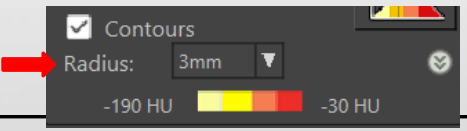
Click on the checkbox to enable Perivascular CT density.

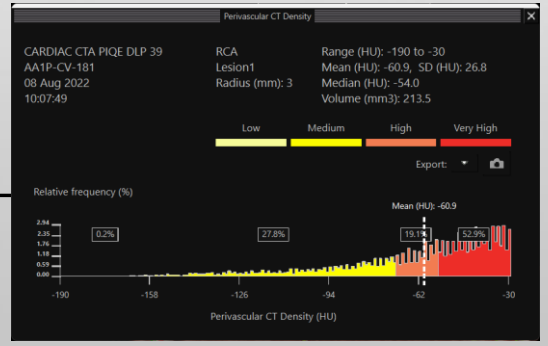
To display the inner and outer contours, check the Contours box.

Select the desired Radius from the dropdown menu.

Click on the histogram button to display the relative frequency percent of HU ranges defined in the settings bar.





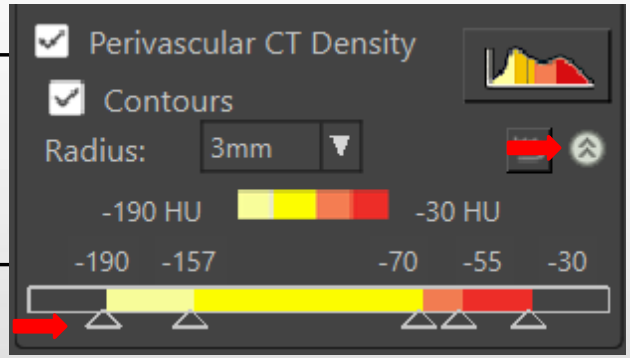


Note: Perivascular CT Density is a separately licensed feature.

CT Cardiac CTA – Adjust HU settings

Click on the chevron to open the threshold setting.

Click and drag the triangle or separation bar to increase or decrease the HU value range.



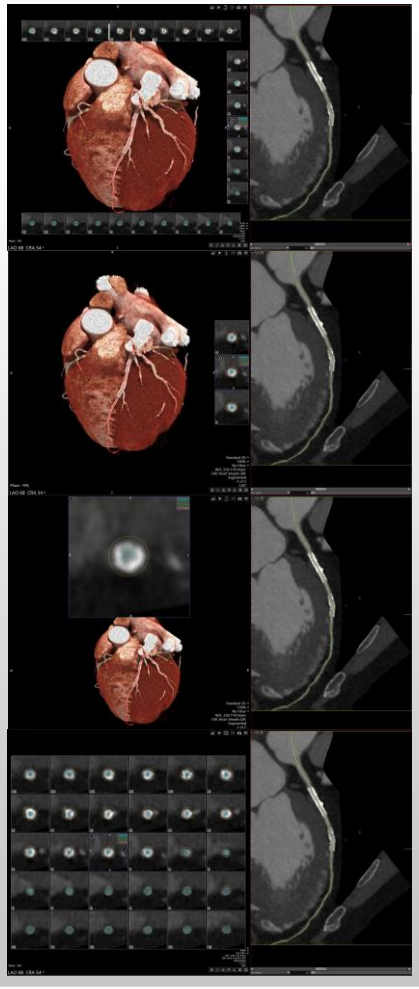
CT Cardiac CTA - 3D Review Modes

Double click in 3D image. A mode button is displayed next to the Snap icon in the upper right corner of viewport. Click to view the modes.

The Large Cross-Sectional Layout displays **three large cross vessel** views.

The Large Trans axial Layout displays **one large cross vessel** view. The default view is the middle of the CPR view.

The Contour Editing Layout displays several **1 mm transverse** views used for contour edits.



Tip: Default view displays 1mm cross-sectional vessel views.

CT Cardiac CTA - 3D Cath Mode

The Cath View Layout is an **interactive display** that updates when rotating the Cath or 3D volume view.

Click **Crosshair**. Click and **hold** the Cath image and drag in the desired direction.

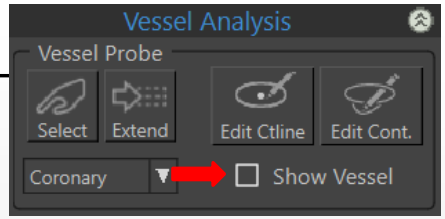
Click and **drag** to **rotate** the 3D volume image. The Cath view will update in real-time.

Click **Orientation** located at the bottom left corner of the 3D volume image. Select a standard Cath view from here.

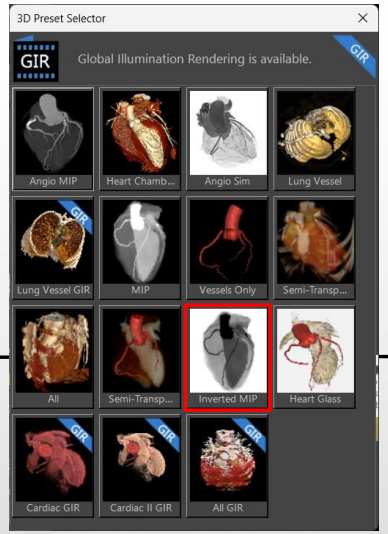
Tip: You can also use Shift + (F2-F8) keys to orientate the 3D image in the standard Catch Views.

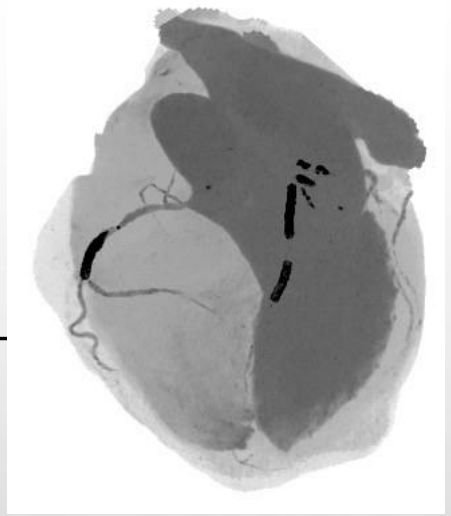
CT Cardiac CTA - Apply Inverted MIP

Clear **Show Vessels**.



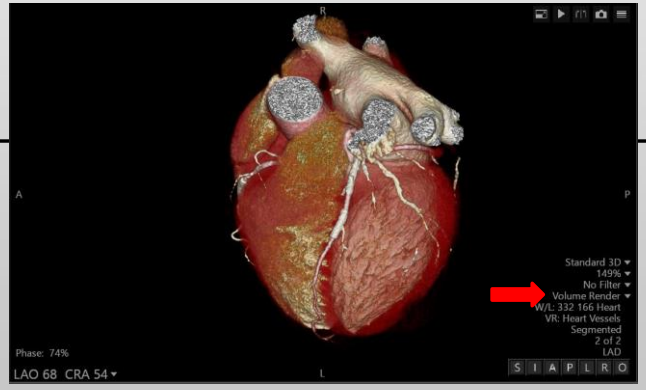
Click on the **Arrow** on Preset Selector. Click **Inverted MIP**.

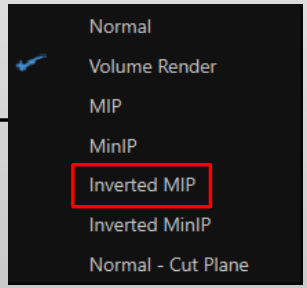




OR

Click the dropdown menu in the 3D image and click **Inverted MIP**.





Note: If a GIR preset was selected, first change the rendering to standard volume rendering before selecting inverted MIP.

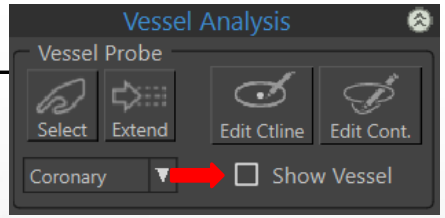
CT Cardiac CTA – Apply GIR to 3D view

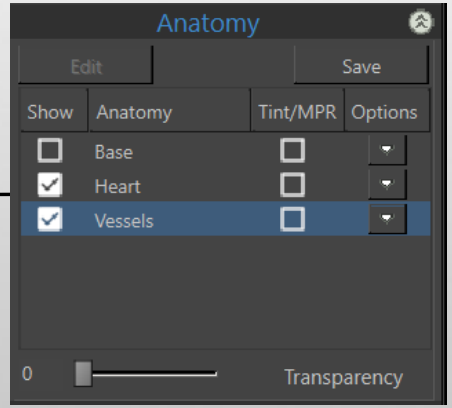
Clear **Show Vessels**.

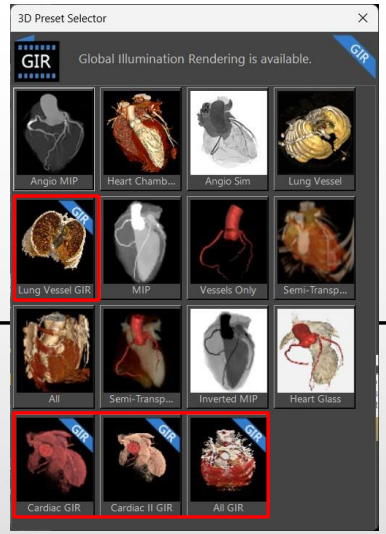
Select the 3D preset with the blue GIR ribbon on the top right corner or click on the arrow to find another GIR preset from the list.

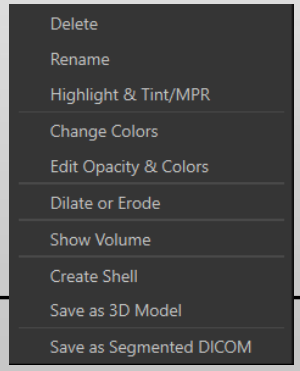
Click on the chevron next to anatomy to open the anatomy management folder. Click on the arrow under options and select Change Colors from the list.

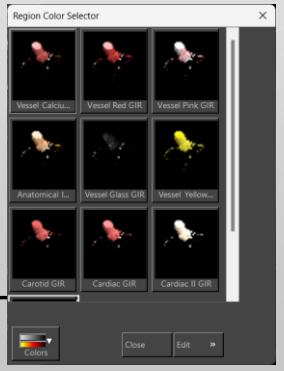
Under heart the user will have more GIR options to choose from.











CT Cardiac CTA - 3D Batch Rotation

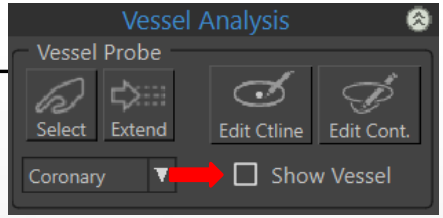
Uncheck Show Vessel.

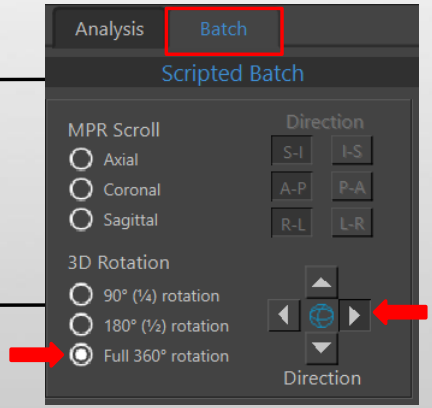
Click on the **Preset arrow** and select the Semi-Transparent Heart preset, or the present of choice.

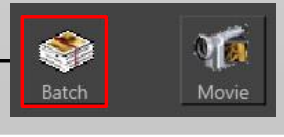
Select **Batch Tab.**
Select **3D Rotation**.

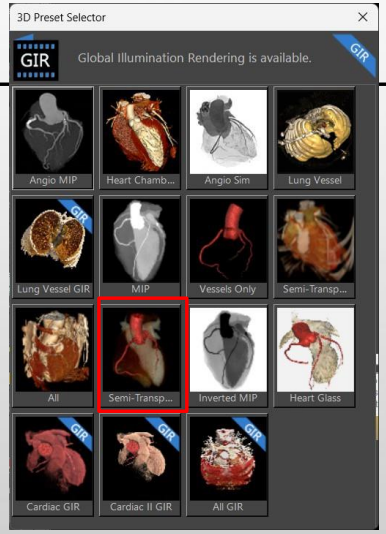
Select the **degree of rotation** and select the **direction** of the rotation.

Click **Batch**.





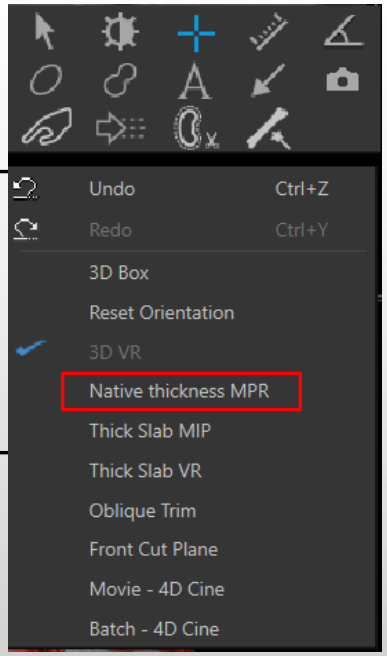




CT Cardiac CTA - Native Thickness MPR

Right-click on the 3D image to open the **Tool Panel**.

Click **Native thickness MPR**.

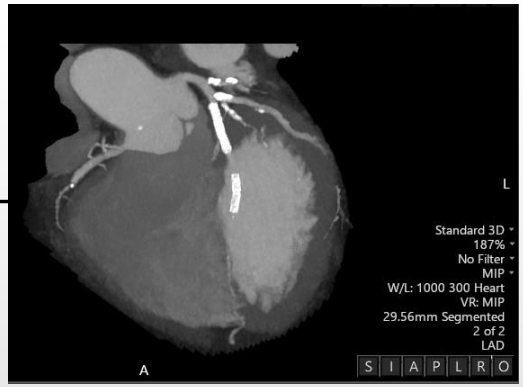


Tip: This tool provides the capability to view the heart in a VR MIP projection. The MIP thickness can be increased or decreased as you use right mouse to drag left and right.

CT Cardiac CTA - Native Thickness MPR

Hold down Right mouse and two arrows display.

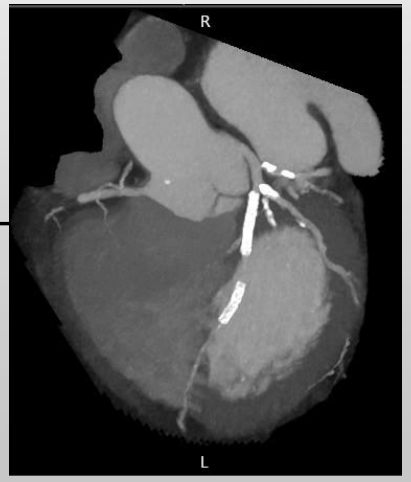
Continue to hold Right mouse and **move**.



Move **up** and **down** scrolls through the data set.

The cross-sectional view is the current

Move **side** to **side** to increase and decrease the MIP values.

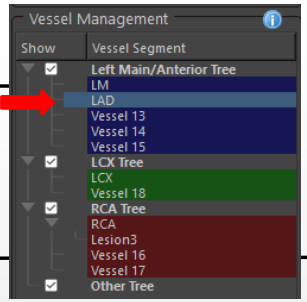


Choose arrow. Hold **left** to rotate the dataset.

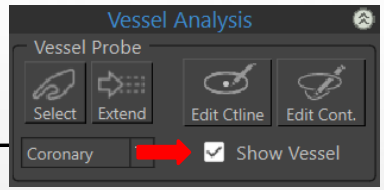
Tip: Locate the ROI. Press the wheel to display the yellow crosshairs and pan to place ROI in the center. This will lock the ROI at the center point and allow you to rotate around the surrounding vessels.

CT Cardiac CTA - Automated Batch Rotation

Locate **Vessel Management**. Click on the vessel name.



Click show vessel on. Change the CPR view to single inset view and right click in the CPR view.

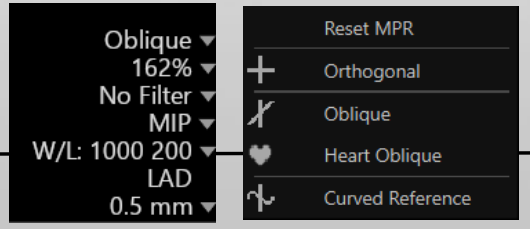


Select Batch Rotation from the list.

OR

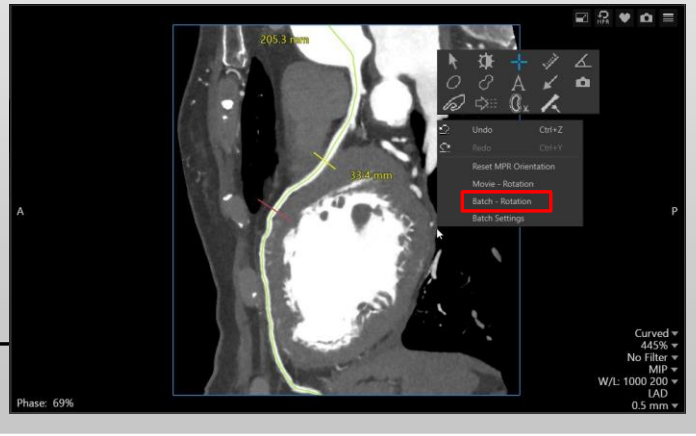
In MPR view click on **Curved Reference** in the drop-down menu.

Right-click the Curved view and select **Batch Rotation**.



Repeat steps for each vessel.

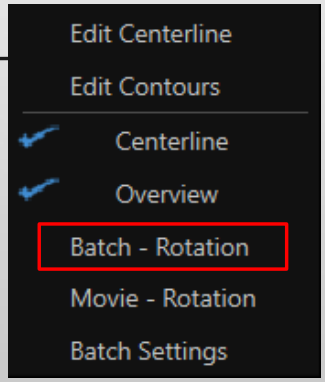
Tip: This creates a 360-degree curved batch rotation every 5 degrees. Click on Batch Settings to change.



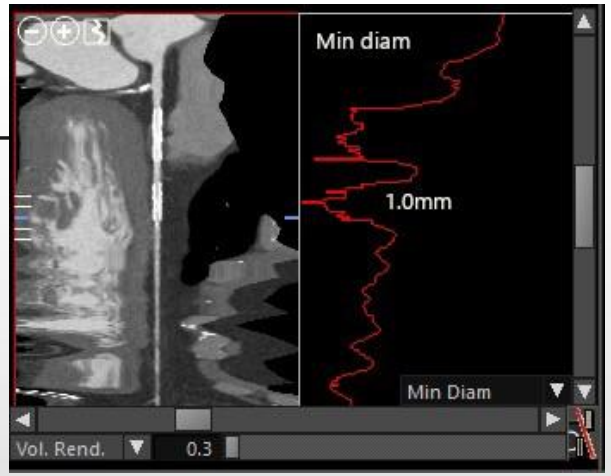
CT Cardiac CTA – Batch Rotation of Straightened Vessel

In CPR view, click on Red slash in the lower right corner.

Right-click the CPR view that displays the straightened vessel. Click **Batch Rotation**.



Batch views are in the Results tab on the Study List.

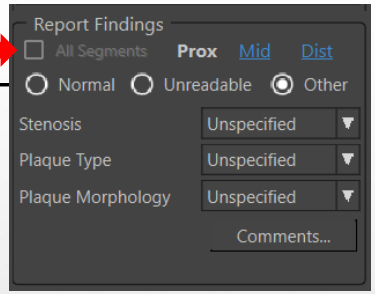


Tip: This creates a 360-degree curved batch rotation every 5 degrees.

CT Cardiac CTA – Cardiac Report Findings

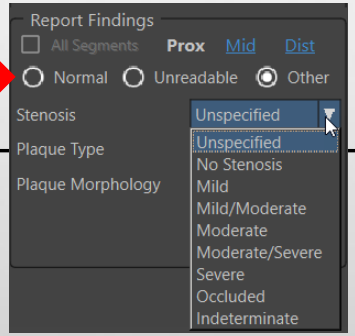
- Use Report Findings to report on vessels, grafts, and stents

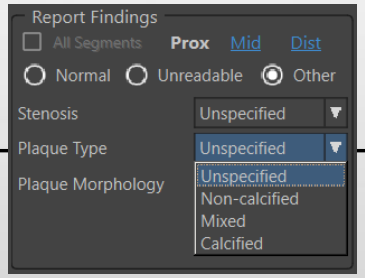
Select the segment that will be added to the report.

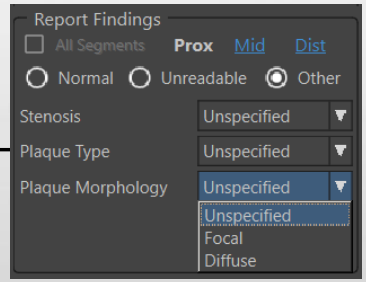


Tip: To report on the entire vessel, select All segments. The option will be greyed out until normal or unreadable finding is selected.

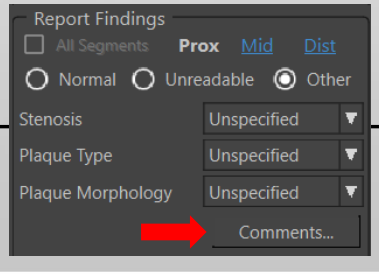
Select normal if no pathology is found. Otherwise select unreadable, or other and use the dropdown menus and select the appropriate option to describe stenosis, plaque type and morphology.

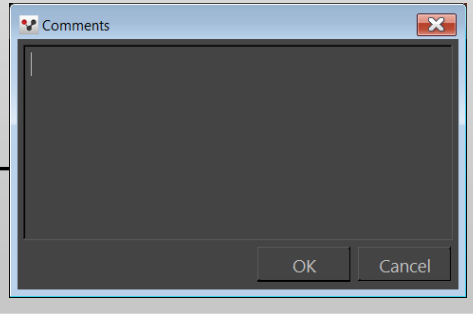




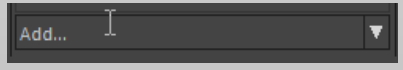


Click on comment to manually add additional comments.



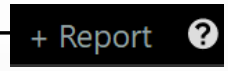


Note: If the 3D analysis, or 3D auto vessel protocol is used, the user will also have the option to add additional vessels to the report.

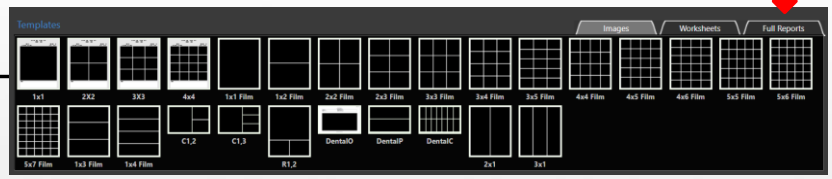


CT Cardiac CTA – Cardiac Report Findings

Click on Report

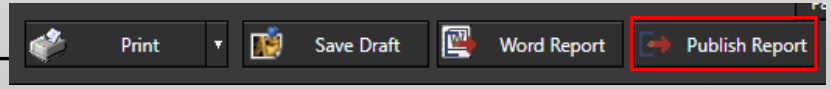


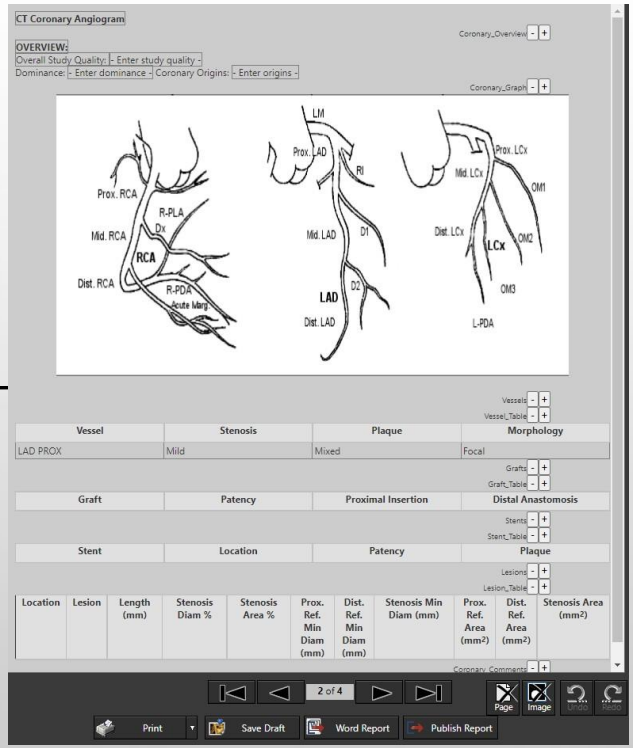
Select Full reports.



The entered findings will automatically be populated on the second page of the Coronaries report.

Click on Publish Report. The report will be available under Results in the study list to send to PACS.





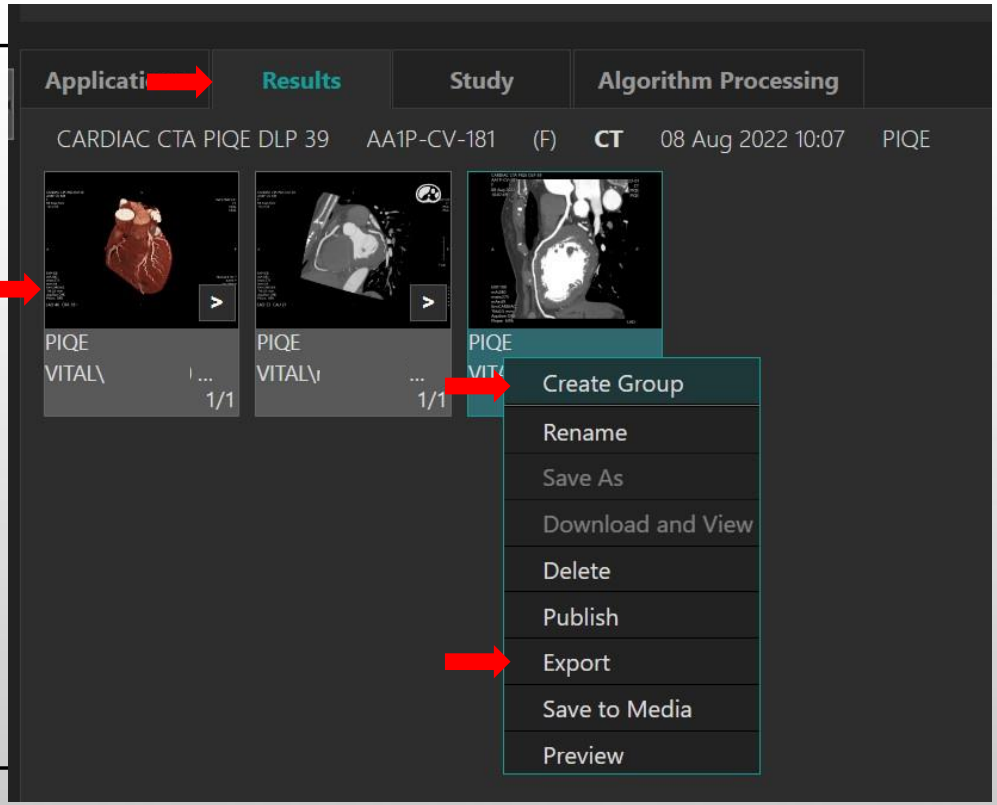
CT Cardiac CTA - Distribute Findings: Export

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

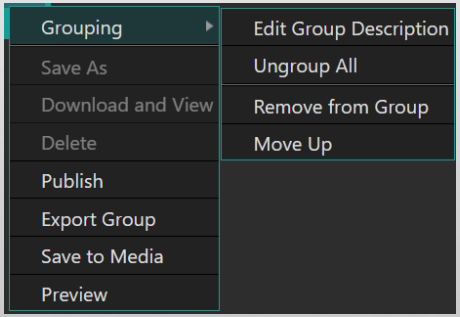
Use **Ctrl** to select all the snapshots to export.

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.



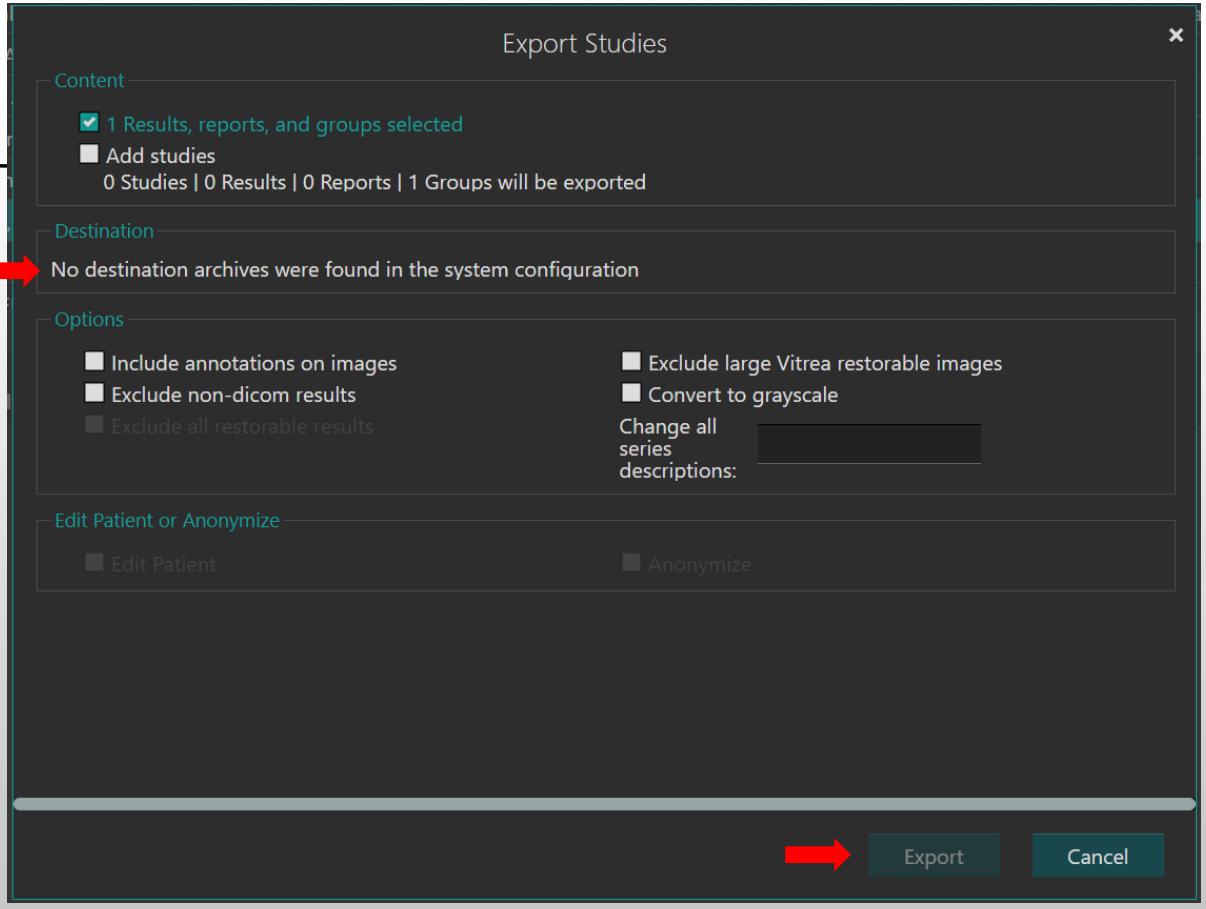
Tip: To delete, rename or edit a group description, right click on the group. Hover the mouse over the arrow and select the option from the list.



CT Cardiac CTA - Distribute Findings: Export

Select the relevant DICOM destination.

Click on **Export**.



CT Cardiac CTA

Summary:

CT Cardiac Analysis enables physicians to determine the presence and extent of coronary obstructive disease, evaluate the anatomy of the heart and surrounding tissues by displaying the extracted anatomy in a variety of views.

Review the steps for Cardiac CTA:

- Select protocol Cardiac Analysis Multi-Vessel.
- Review the quality of the study
- Review automated vessel selection and investigate vessels
- Perform Vessel Walk
- Capture Snapshots
- Use vessel probe to select additional vessels
- Edit the vessel Centerline and Contours where necessary
- Use lesion tool to investigate lesion and analyze plaque burden using SUREPlaque
- Click 3D Review Modes for analysis
- Review the vessels in the VR MIP view by selecting Native thickness MPR
- Generate snapshots and rotation batches with preferred rendering preset
- Export to PACS or other destination

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For over 100 years, the Canon Medical Systems `Made for Life' philosophy prevails as our ongoing commitment to humanity - generations of inherited passion creates a legacy of medical innovation and service that continues to evolve as we do. By engaging the brilliant minds of many, we continue to set the benchmark, because we believe quality of life should be a given, not the exception.

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