STEREOTAXIS

INTERVENTIONAL CARDIOLOGY
NAVIGANT v2.11
PCI CT NAVIGATION

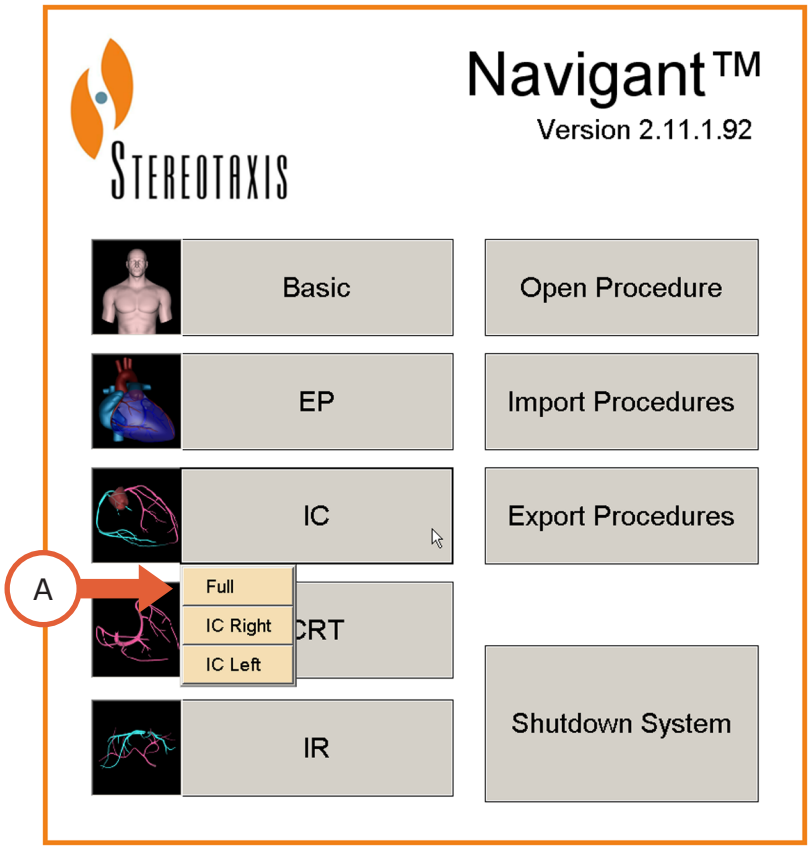
Getting Started

The **Opening Screen** displays the application procedure selection menu.

Click on IC and a sub-menu appears with 3 choices:

- Full
- IC Right
- IC Left

Select **Full** for this procedure.



Start Procedure Panel

Getting Started

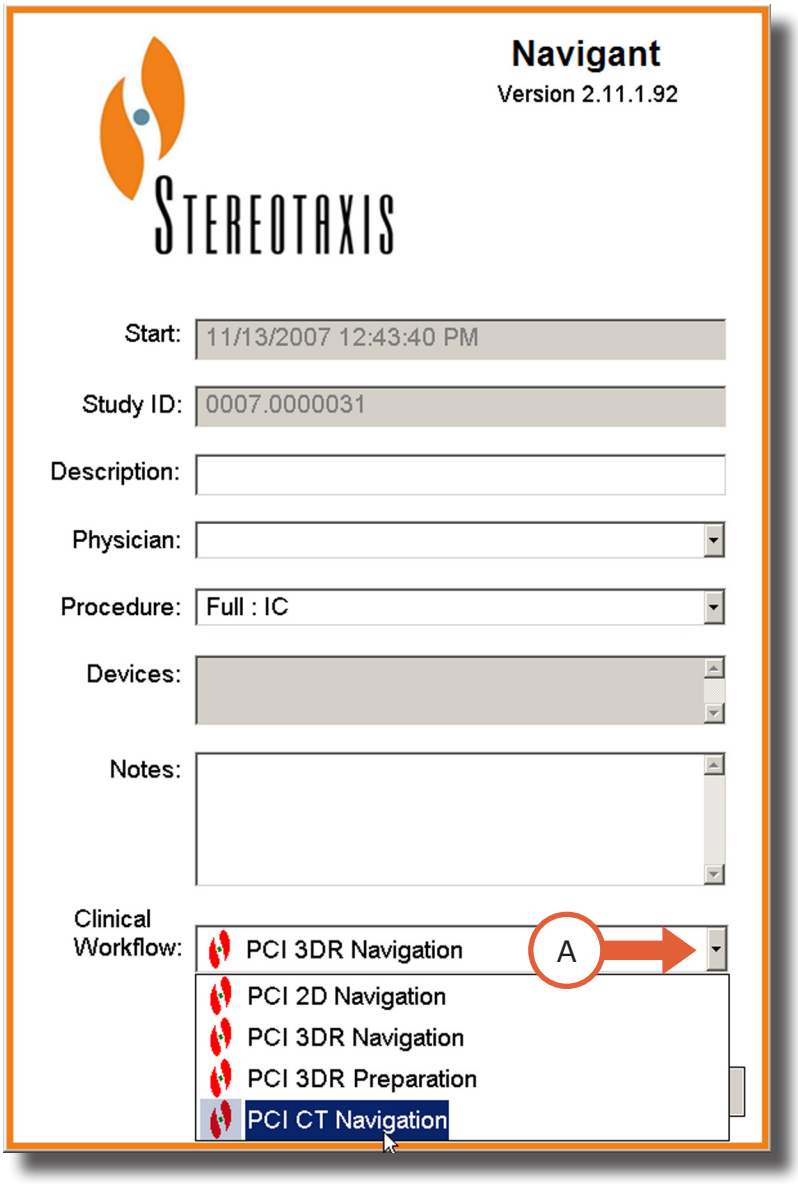
Once the procedure has been selected, the Procedure Information Window will appear. A start date, time, and a study ID are automatically assigned. Type in the description if needed. Enter a physician's name or choose one from the drop down list.

The devices window will be grayed out.

Choose a Clinical Workflow after clicking the drop-down triangle (A). Click OK.

TIP

You must fill in the physician and description in order to save a physician layout.



Information Window

Clinical Workflow Manager

Clinical workflows are designed to facilitate case progression in the following ways:

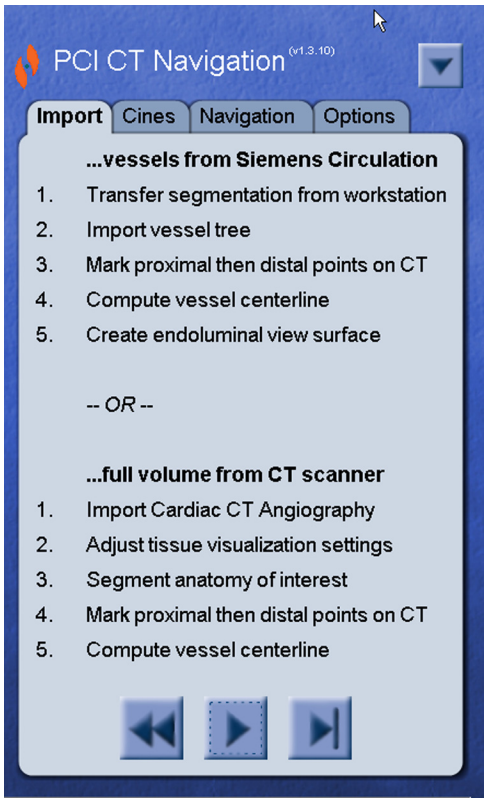
- By providing a simple step-by-step approach to automation and integration
- Keeping navigation and control options easily accessible throughout the case

The Clinical Workflow Manager menu will be on the left side of the monitor. Click **Execute step ▸** to advance to the next numbered step.

Once all steps have been completed, use the **Execute step ▸** button at the bottom of the tab window to advance to the next tab window.

Each tab on the CWM lists steps pertaining to a part of the procedure. By progressing through the appropriate steps, you can complete a portion of the study.

CWM Tab Controller buttons:
Start Over (left)
Execute step Step (middle)
Next Section (right)



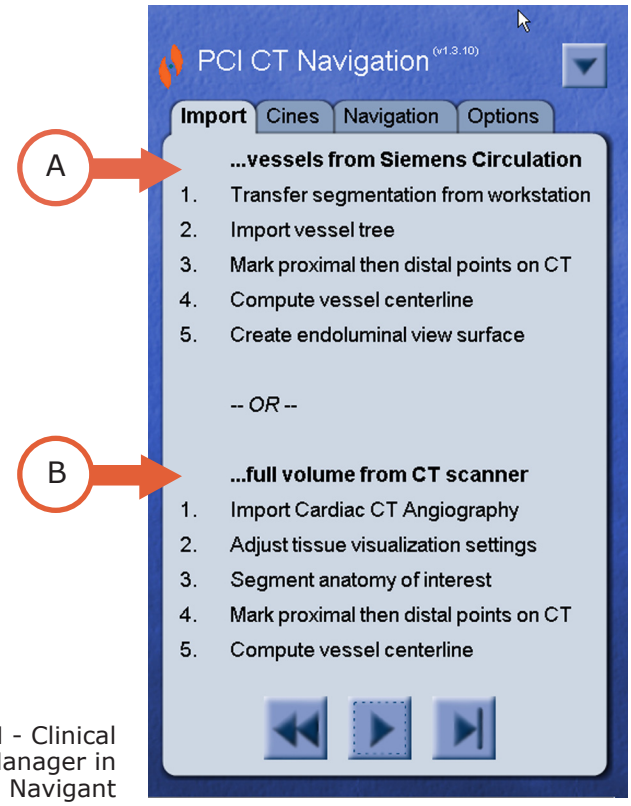
CWM - Clinical Workflow Manager in Navigant

Import Tab

In the initial tab of the PCI CT Navigation workflow the options are to import vessels from Siemens Circulation (A) or to import full volume from a CT Scanner (B).

There are two modules in this training guide. Refer to the appropriate module to use the **Siemens Circulation** or the **Full Volume** workflow.

Each module will explain the workflow and tabs for Cines, Navigation and Options.



CWM - Clinical Workflow Manager in Navigant

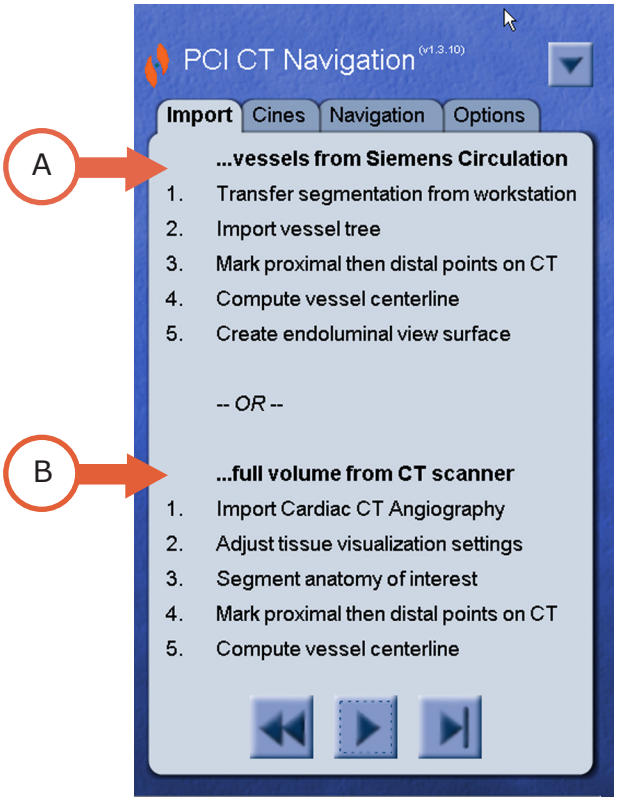
STEREOTAXIS

PCI CT Navigation
Siemens Circulation Workflow

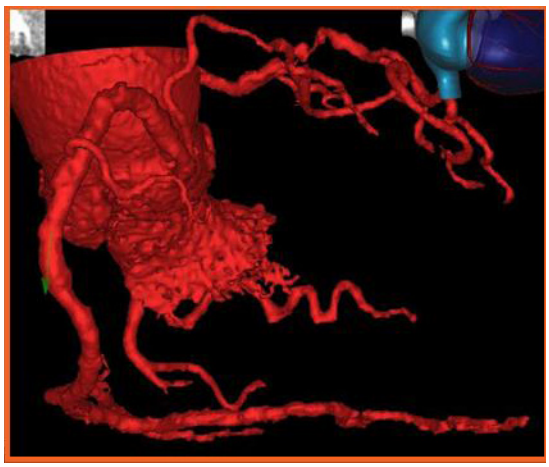
Import Tab

In the initial tab of the PCI CT Navigation workflow the options are either to import vessels from Siemens Circulation (A) or to import full volume from a CT Scanner (B).

Select **...vessels from Siemens Circulation.**



CWM Import Tab



Siemens Circulation

Dicom Import

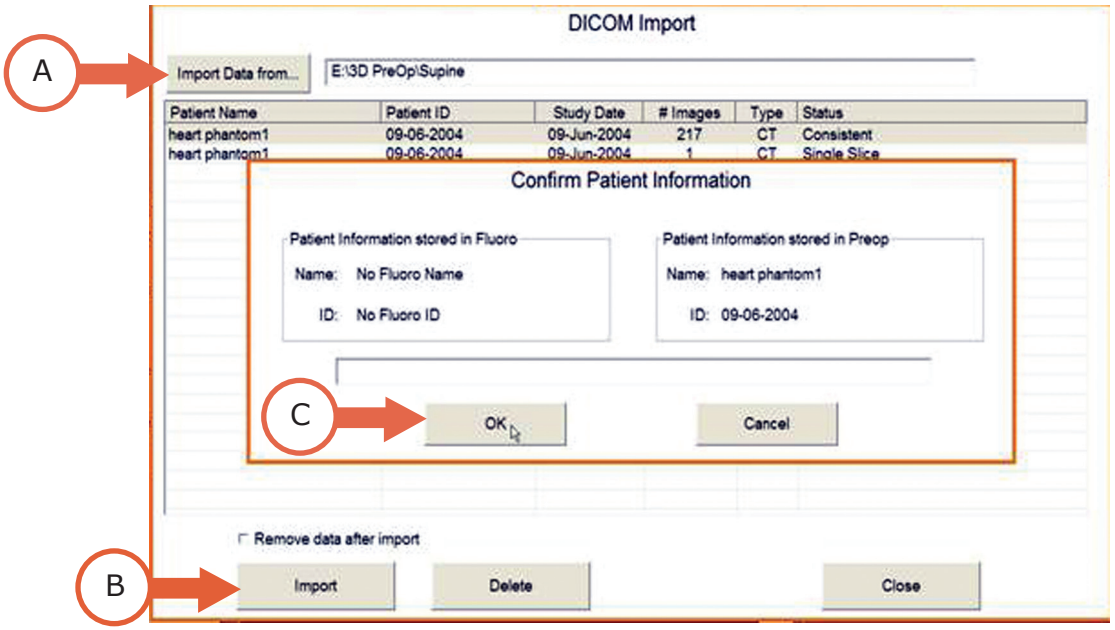
Import vessels from Siemens Circulation:

Click on **Step 2, Import vessel tree.** The Dicom Import Dialogue Box opens.

Or, right-click to import a pre-operative image.
Choose **Import DICOM**.

Select the data source by clicking on the **Import Data from...** (A) option and browse for the correct folder. Highlight the correct folder. Click **Import** (B) and verify the patient information which appears in the **Confirm Patient Information** dialogue box. Click **OK** (C).

Click **Execute step ▸** to advance to the next numbered step.



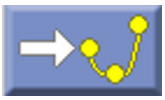
NOTE

Pay close attention to the accuracy of the patient information.

Mark Proximal & Distal Points on CT

Mark the proximal, then the distal points on the vessel. Keep in mind the direction of advancement of the device.

- Double-click on the proximal point on the vessel.
- Click the **store point** button on the keyboard's Navigant keys or the Navigant tool bar



Store Point Button

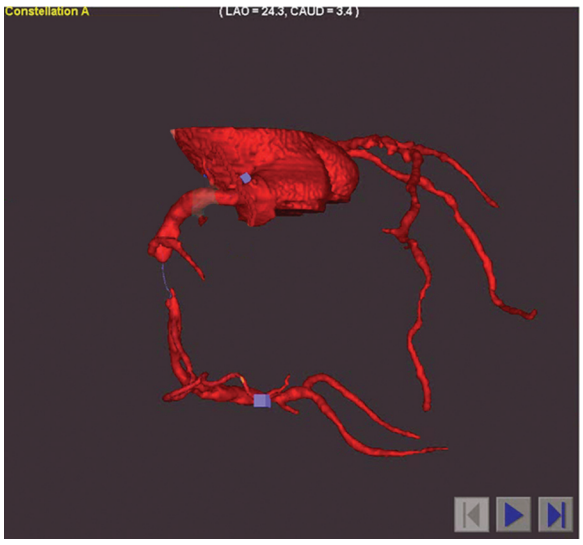
- Double-click on a distal point on the vessel.
- Click the **store point** button on the keyboard's Navigant keys or the Navigant tool bar
- Click **Execute step** ▸ to advance to the next numbered step to compute the center line of the vessel

The vessel center line will be extracted. The vessel group is indicated in the points and constellations panel.

If the extraction fails:

Return to the previous step and readjust the visualization settings. Check for the correct point placement.

Alternatively, try marking a portion of the vessel. Then add additional portions until the entire vessel is marked successfully.



Siemens Circulation

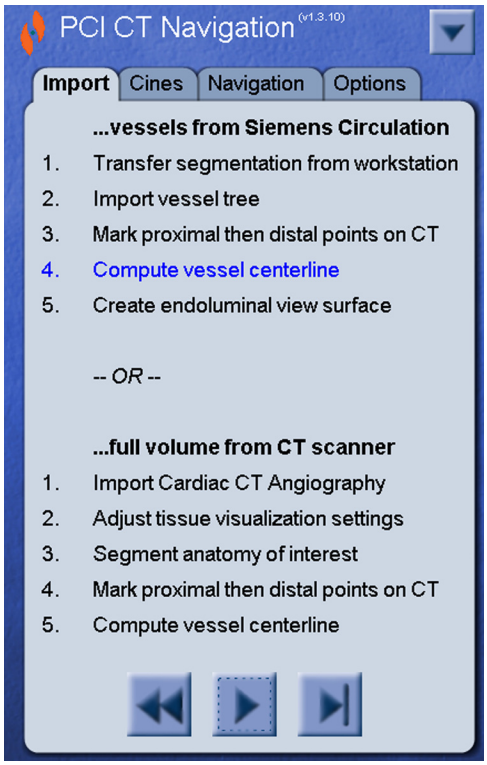
Compute Vessel Center line

Click **Execute step** ▸ to advance to the next numbered step, **Compute vessel center line**.

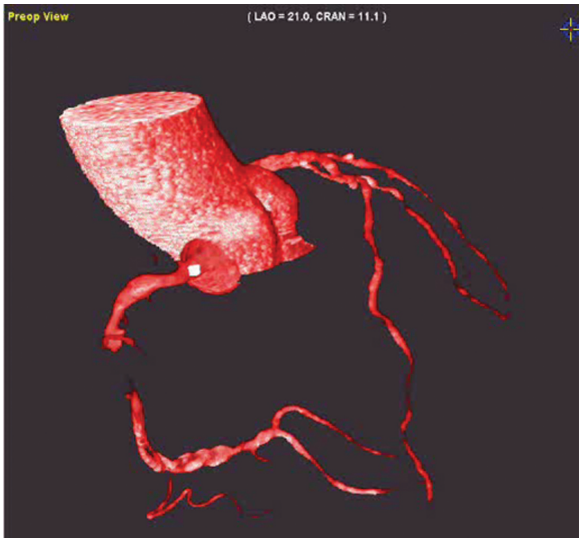
The vessel center line will be extracted and will display on the pre-op image.

The vessel group is indicated in the Points and Constellations Panel.

If the extraction fails, right-click on the group in the Points & Constellations Panel and choose delete. Repeat the marking of proximal, intermediate and distal points and repeat the steps above.



CWM Import Tab



Siemens Circulation

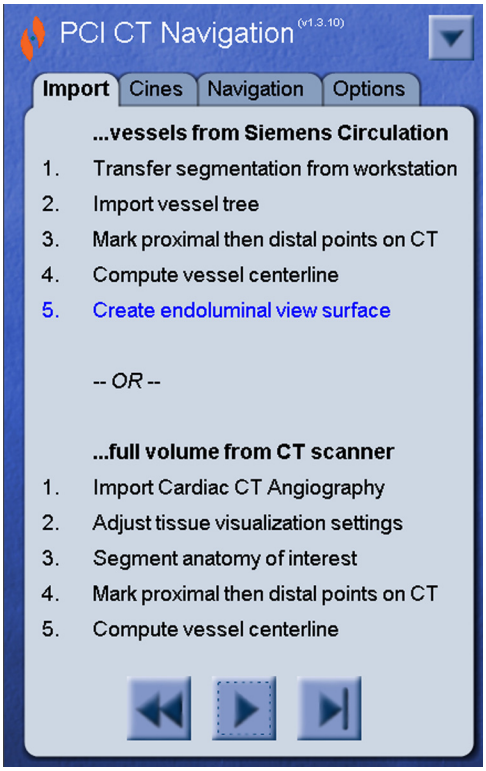
Create Endoluminal View Surface

Click **Execute step ▸** to advance to the next numbered step, **Create endoluminal view surface**.

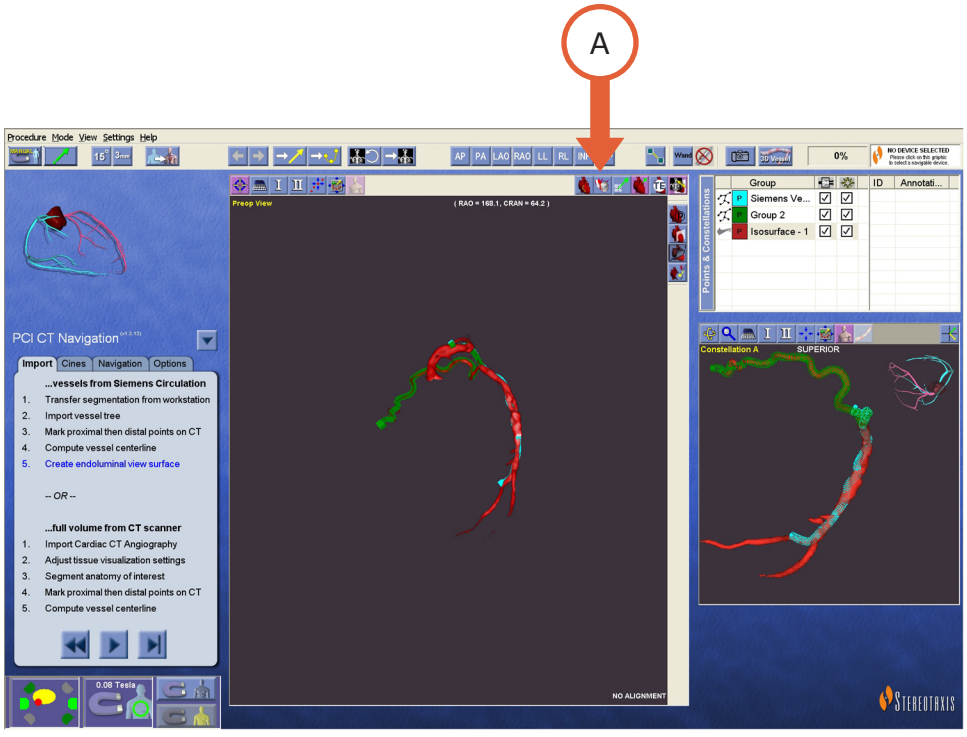
Create an Isosurface by clicking on the create endoscopic surface button (A). 

The endoscopic surface provides an inside view of anatomical structures. The extraction is made from the CT contrast information.

Once the extraction is completed, the endoscopic surface will appear as a point group named Isosurface-1. Each subsequently created endosurface will appear as Isosurface-2, etc.



CWM Import Tab

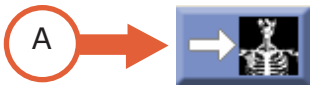


Pre-op view with points and constellations

Acquire Diagnostic Cines

Acquire angiograms with a minimum of 40º of separation.

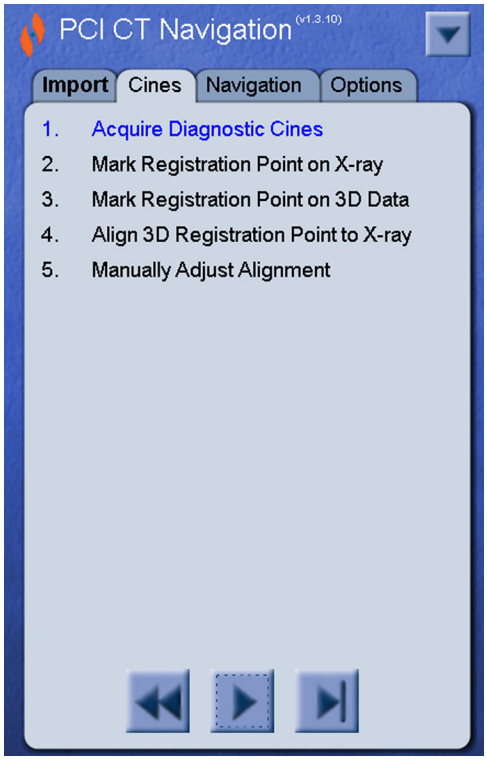
Optimally, gate the images in the same cardiac phase and similar respiratory motion.



Click the transfer image button (A) on the Navigant tool bar near the top of the screen.

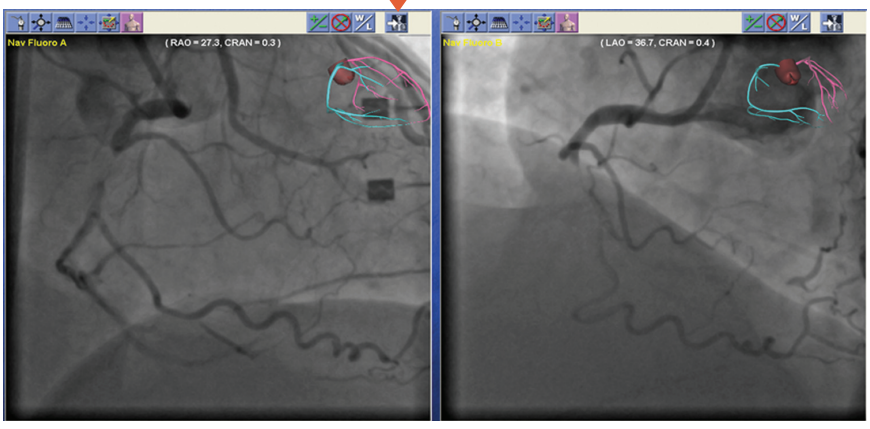
- RAO in Fluoro A
- LAO in Fluoro B

The images will load in the appropriate panels.



CWM - Cines Tab

Alternatively click the transfer image button on each fluoro window (B).



Fluoro A & B with Images Loaded

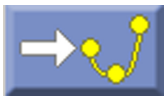
Click **Execute step** ▸ to advance to the next numbered step.

Mark Registration Point on X-ray

Identify a point on the desired vessel on the fluoro image that can also be identified on the CT (bifurcation of vessels). Click on the vessel to define the registration point in the Navigant Fluoro A window. A red target will appear.

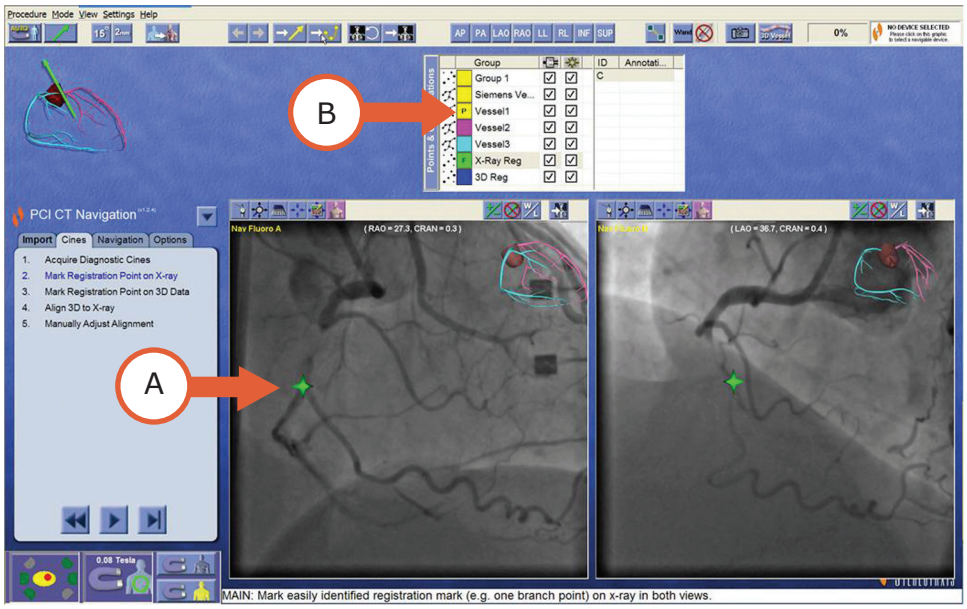
Click on the same location on the vessel in the orthogonal view in the Navigant Fluoro B. The reference line will appear. The cursor will turn green when within range. A green target will indicate the accepted point.

Click the **store point** button on either the keyboard's Navigant keys or in the Navigant tool bar.



Store Point Button

The point will be displayed as a star burst (A). Once stored it will automatically be identified in the Points and Constellations Panel (B). Click **Execute step** ▸ to advance to the next numbered step.

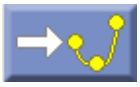


Mark Registration Point on 3D Data

Double-click a point on the pre-op data that matches the point identified on the fluoro images.

Store the point by clicking the store point button on the keyboard's Navigant keys or in the Navigant tool bar.

The point will be displayed as a yellow square and identified in the points and constellations panel.



Store Point Button

Click **Execute step ▸** to advance to the next numbered step.

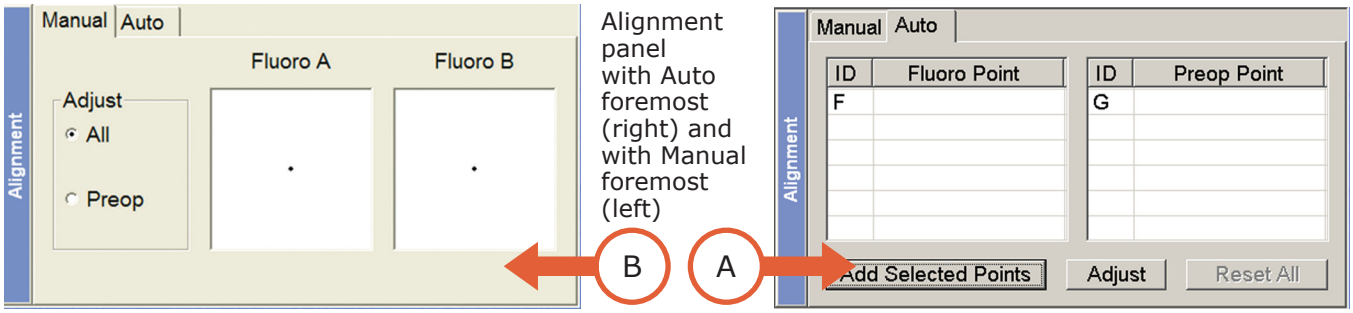
Align 3D Registration to X-ray

The Alignment Panel will appear above the main windows.

- Click the **Auto tab** (A) in the panel.
- Click on the **x-ray points group** in the Points and Constellation Panel
- Click on the **ID point for x-ray** in the right column
- Click on the **add selected points** button on the Alignment Panel
- Click the **3D/CT Points Group** in the Points and Constellations Panel
- Click on the **ID point for 3D Registration** in the right column
- Click **add selected points**

Once both have been transferred to the Alignment Panel click the **adjust** button.

The two defined points will overlay each other aligning the data. Click **Execute step** ▸ to advance to the next numbered step.



Manually Adjust Alignment

Utilizing the manual tab (B) on the Alignment Panel, click in the white boxes (Fluoro A and Fluoro B) with direct reference to the center dot to move the pre-op data so that it will overlay the fluoro image.

TIP

For the quickest overlay utilize the manual alignment and verify the correct alignment on live fluoro.

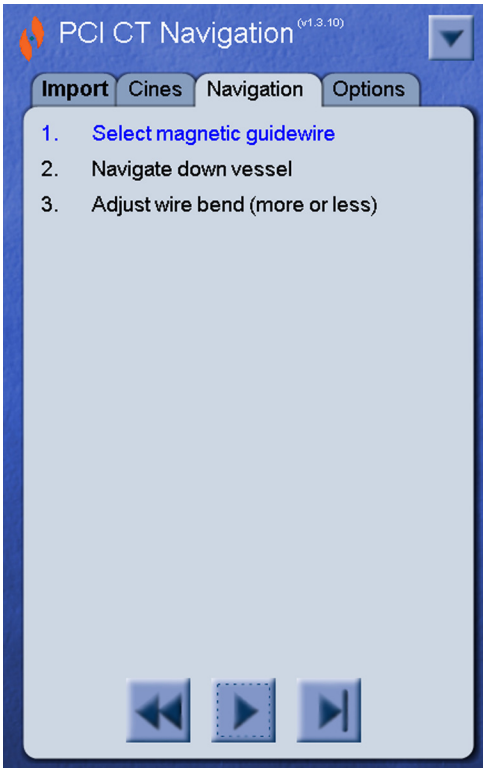
Click **Execute step** ▸ to advance to the next numbered step.

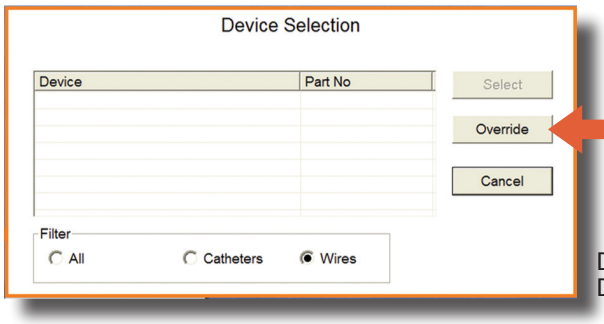
Navigation

The first step of the Navigation tab is to **Select a magnetic guidewire**.

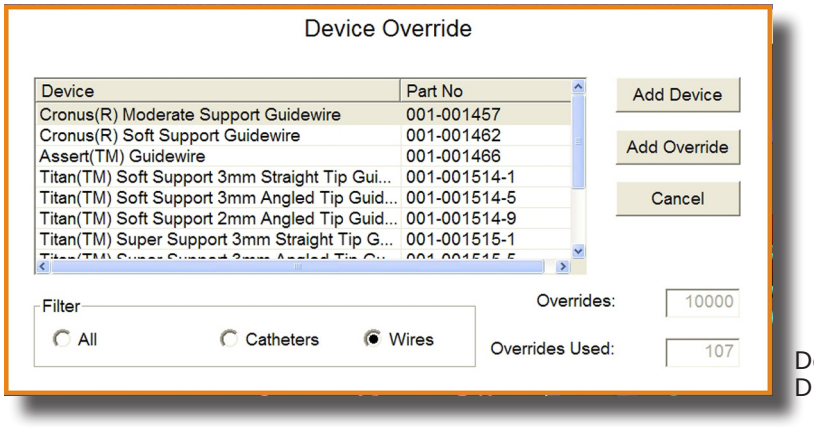
The device selection window opens automatically. Click the **override button** (A) to view the menu of available options. Either double-click the option of choice or select one, then click **Add Device** to choose a device.

The selected device (B) will be displayed in the upper right-hand corner of the Navigant screen. This icon can be clicked to change the selected device at any time.





Device Selection Dialogue Box



Device Override Dialogue Box

Current Selected Device

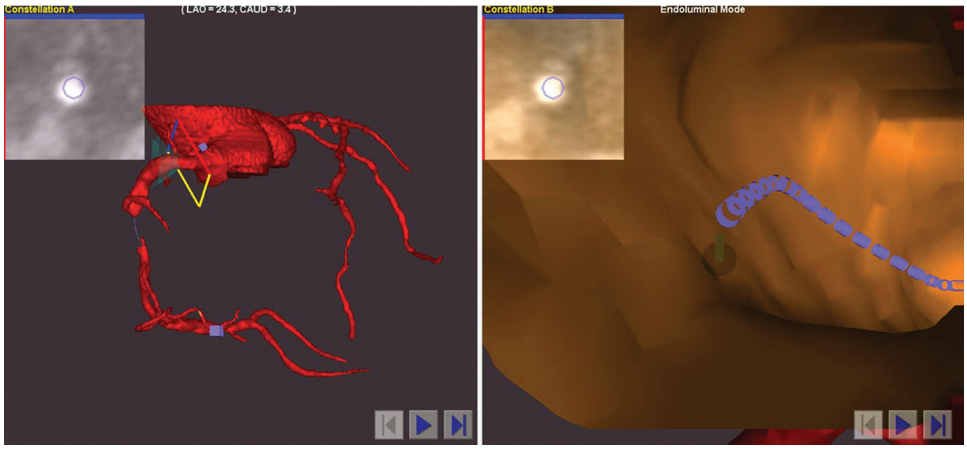
Navigate on vessels

In the procedure room the physician can operate both the touch screen and the Navigant screen. The touch screen should be covered with a sterile drape so the navigational controls can be operated at table side. The Navigant mouse should be covered as well to operate the Navigant main screen in the procedure room.

On the 3D roadmap double-touch on the touch screen at the location of the device.

The magnetic field will be applied and the indicator will appear. The center line will appear along the selected vessel with a yellow ball at the end indicating the selected vessel.

If multiple vessels have been created, first double-touch near the end of the reconstruction of the vessel to be navigated. The yellow ball and center line will be displayed on the desired vessel roadmap. Double-touch along the vessel from the proximal to the distal points to adjust the field while manually advancing the wire, or utilize vessel sequencing for navigation.



Constellation A
and Endoluminal View

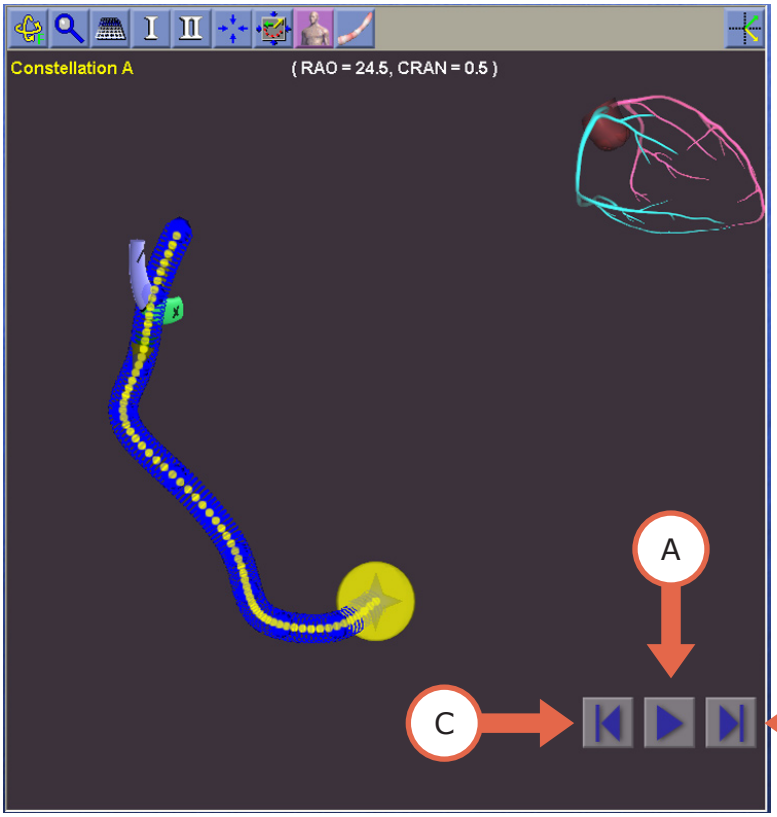
Vessel Sequencing

Vessel Sequencing moves the magnetic field direction along a reconstructed vessel automatically. There is a delay of 1 second (the default) after each application of the magnetic field. This vessel sequencing rate, the amount of time in between each auto advancement, can be changed in the General Settings Window.

It is initiated by clicking the play button (A) in the constellation window, lower right corner.

It will start at the location of the magnetic field direction indicated and travel along the reconstruction until one of the following occurs:

- It is stopped by clicking the stop button
- It is interrupted by a magnetic field adjustment
- It reaches the end of the reconstruction

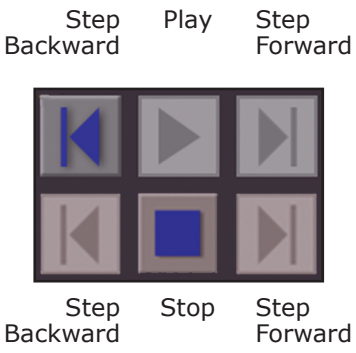


Vessel Sequencing Controls

The distance that the magnetic field is advanced along the reconstruction is determined by the Cardiodrive step size button located on the Navigant tool bar or the number keys on the keyboard.

Initially the play button appears. Once clicked, the stop button replaces it. There is also a step forward (B) and a step backward button (C) that will move one step at a time along the reconstruction.

Vessel Sequencing Control Buttons



Adjust Wire Bend

In essence, the Guidewire Bend tool can magnetically shape the distal tip of the wire. Utilize the tool to make field adjustments as the device is advanced.

- Increase/decrease bend
- Rotate clockwise/counterclockwise

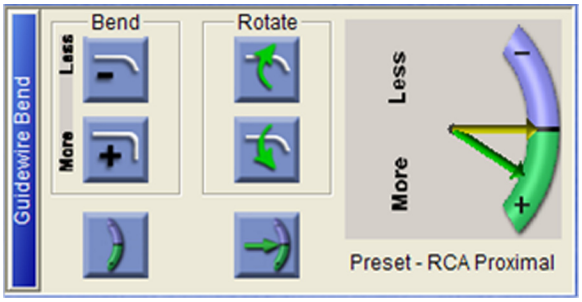
Each application of these buttons will make adjustments in the magnetic field in the amount indicated by the field angle step size button located on the touch screen Navigant tool bar.

- Show and hide bend plane tool

Utilize this to remove visualization of the tool from the Navigant window.

- Reset guidewire bend

This returns the tip of the wire to baseline.



Guidewire Panel

Click **Execute step** ▸ to apply the magnetic field and advance to the next CWM and create a 3D roadmap if indicated.

TIP

To change the degree of angle adjustments utilize the field angle step size on the Touch Screen or Navigant tool bar.

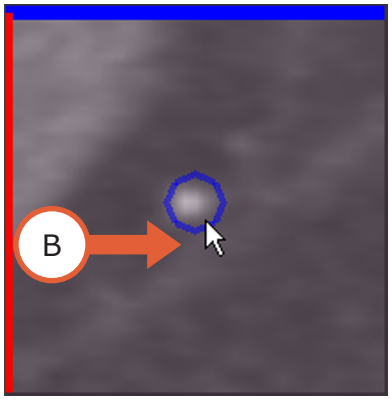
CTO Pathway Marking

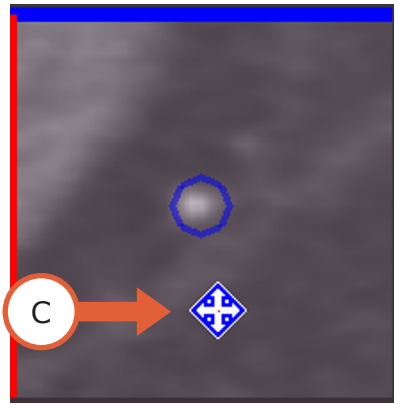
The Multiplanar Reconstruction (MPR) slice is a thumbnail cross-sectional image extracted from the CT that can be used to visualize the contrasted vessel.

The MPR slice is open in both the pre-op and the constellation views. It is in the upper left corner. It can be closed and reopened by selecting the Show/Hide button (A).

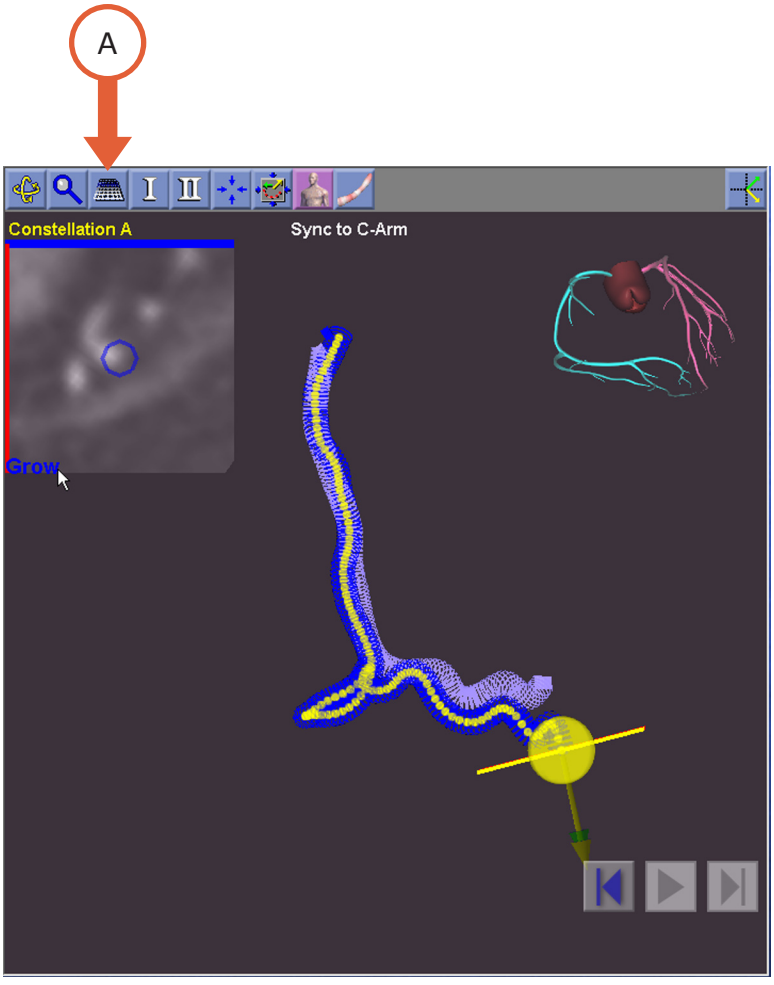
A 3 mm circle indicates the vessel. The color of the circle corresponds to the color of the reconstruction. To adjust the magnetic field direction hold the cursor over the circle until it becomes an arrow (B). Click, hold and drag to move the circle to a new area of interest.

To adjust the contrast of the MPR slice, click, hold and drag with the multi-directional cursor (C) over the thumbnail.





Enlargements of circle (above) and multi-directional cursor (below)

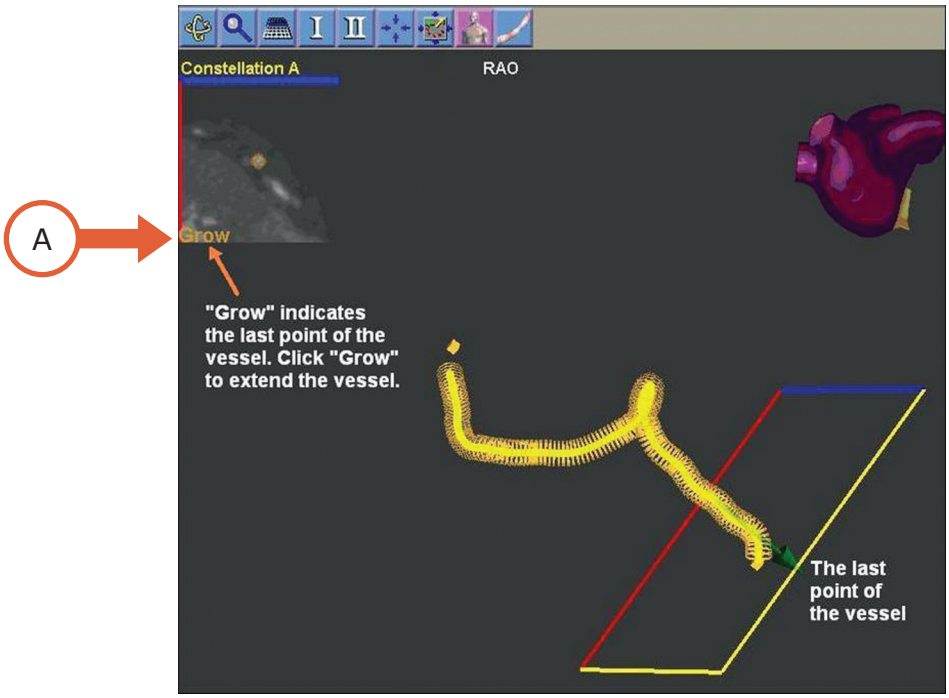


Constellation View

Using the Grow Feature

When the selected point is at the end of the vessel reconstruction, the word Grow displays in the thumbnail view (A). This enables vessel extension tangentially from the distal point.

- Set the length of extension by clicking the Step Size button on the main tool bar.
- Click Grow to extend the vessel. The thumbnail and 3D plane will update automatically.



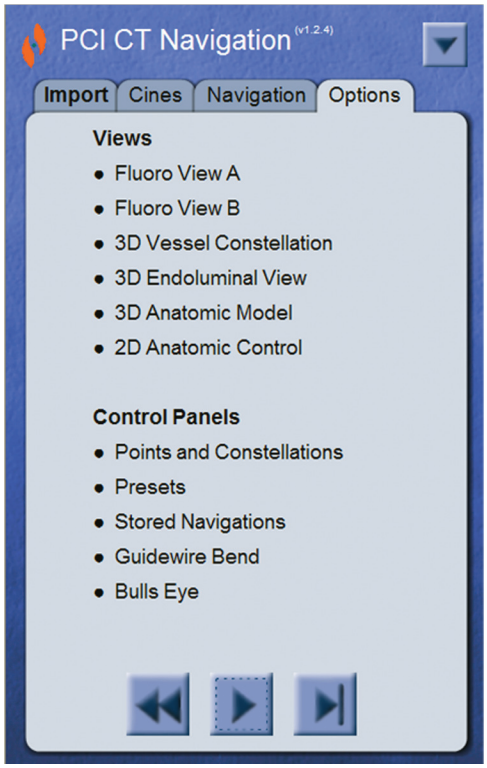
Extend a Vessel

Options Tab

Views

The Views section of the tab allows the user to change the Navigant window display.

- Fluoro (A and B)
- 3D Vessel Constellation
- 3D Endoluminal View
- 3D Anatomic Model
- 2D Anatomic Control



CWM - Options Panel

Control Panels

The Control Panels section allows the user to enable additional tools to assist in the procedure. The panels are displayed above the monitor windows.

- Points and Constellations
- Presets
- Stored Navigations
- Guidewire Bend
- Bulls Eye

The settings can be changed as needed.

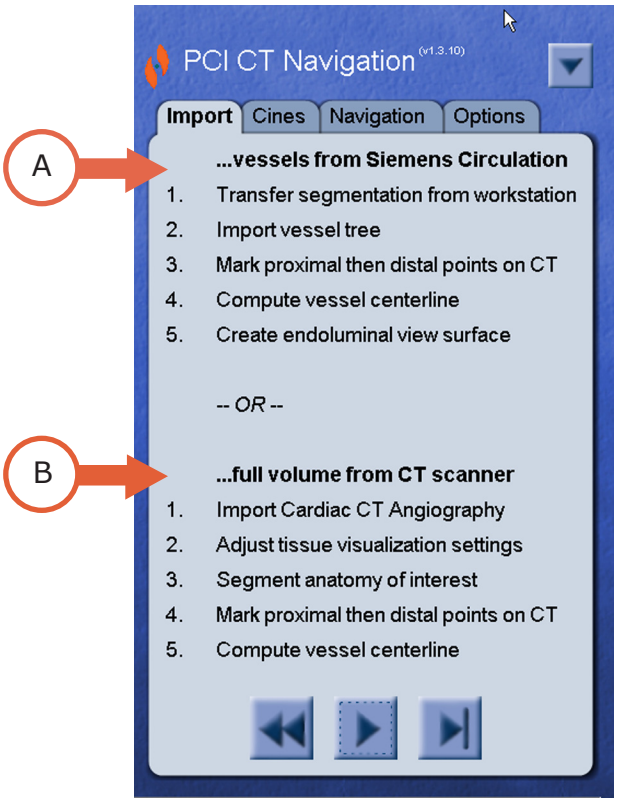
STEREOTAXIS

PCI CT Navigation
Full Volume Workflow

Import Tab

In the initial tab of the PCI CT Navigation workflow the options are either to import vessels from Siemens Circulation (A) or to import full volume from a CT Scanner (B).

Select **...full volume from CT scanner.**



Dicom Import

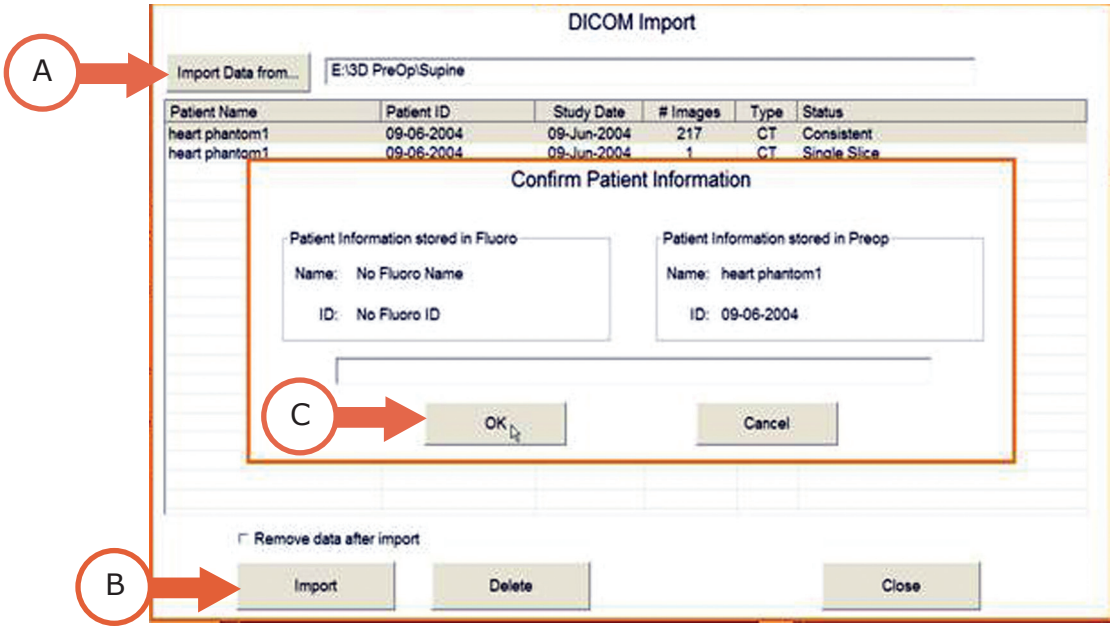
Import the CT into Navigant:

Click on **Step 1, Import Cardiac CT Angiography**. The Dicom Import Dialogue Box opens.

Or, right-click to import a pre-operative image. Choose **Import DICOM**.

Select the data source by clicking on the **Import Data from...** (A) option and browse for the correct folder. Highlight the correct folder. Click **Import** (B) and verify the patient information which appears in the **Confirm Patient Information** dialogue box. Click **OK** (C).

Click **Execute step ▸** in the CWM to advance to the next numbered step.



NOTE

Pay close attention to the accuracy of the patient information.

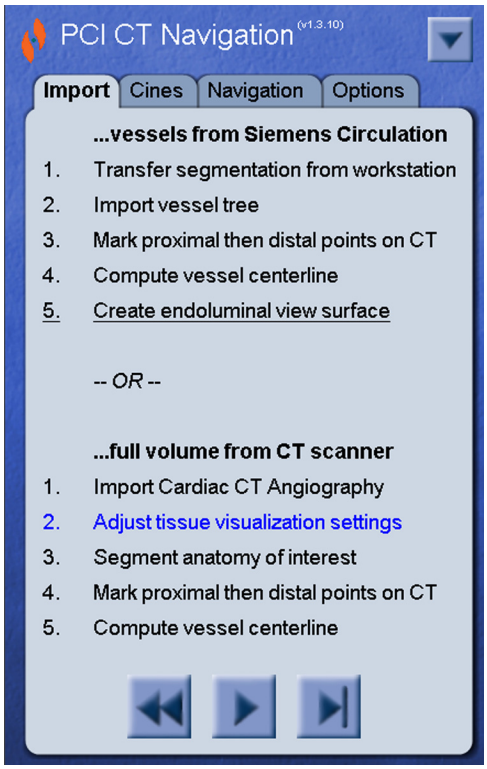
Adjust Tissue Visualization Settings

The **Transfer Function Editor** will open automatically. Adjust the levels to optimize the visualization of the vessels.

The Transfer Function Editor has a histogram that can be adjusted to optimize the contrast between the light and dark of the image (levels). This will bring out the vessel anatomy. Either use the sliders to adjust the various settings or click and drag the red points on the histogram (A).

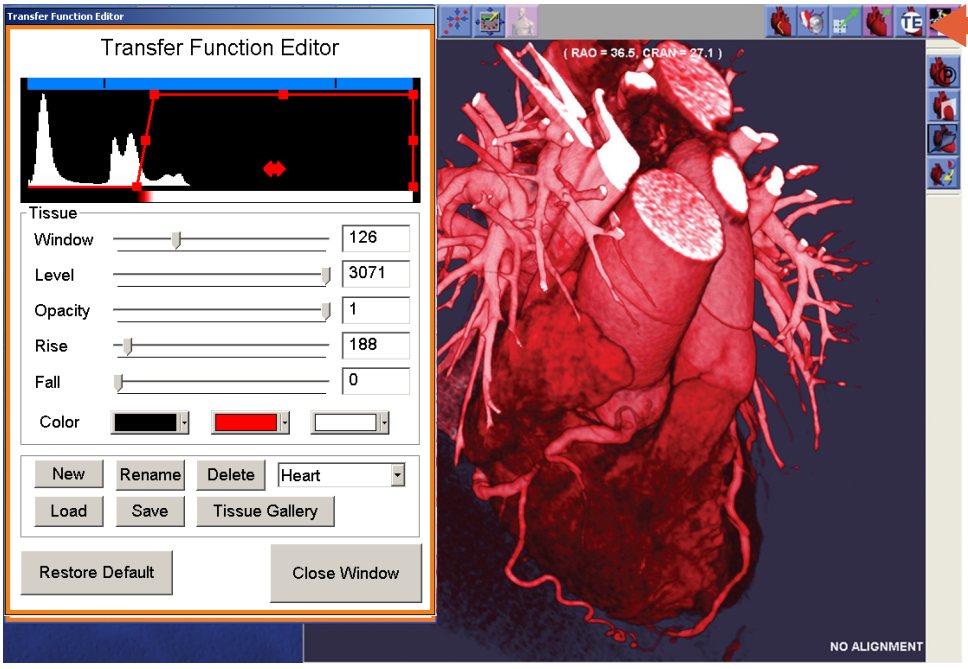
Click the **Close Window** button to close the window. To reopen, use the button in the pre-op window.

Click **Execute step ▸** to advance to the next numbered step.



Transfer Function Editor with optimal settings

A



Open Transfer Function Editor Button

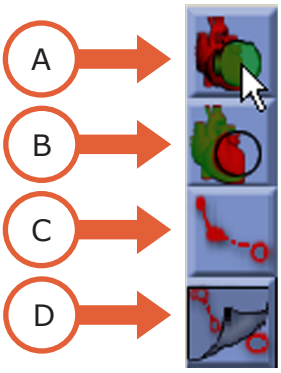
Segment Anatomy of Interest

The anatomy has rotated to a superior view. The workflow is now set to isolate a segment of the 3D image in order to focus on the area of interest. The cursor has changed to a scissors icon indicating the punch tool is selected.

To make a selection:

- Click, hold and drag to encircle the area of interest OR
- Click, release and repeat to set points in a polygon one-by-one. Remove the last point placed or remove all the points with the appropriate buttons (see below).

Use the rotation tool (left mouse mode button) to optimize the view.



Encircle the area of interest and use the Remove Inside Polygon button **(A)** to remove the unselected area.

Encircle the area to be removed and use the Remove Outside Polygon button **(B)** to delete it.

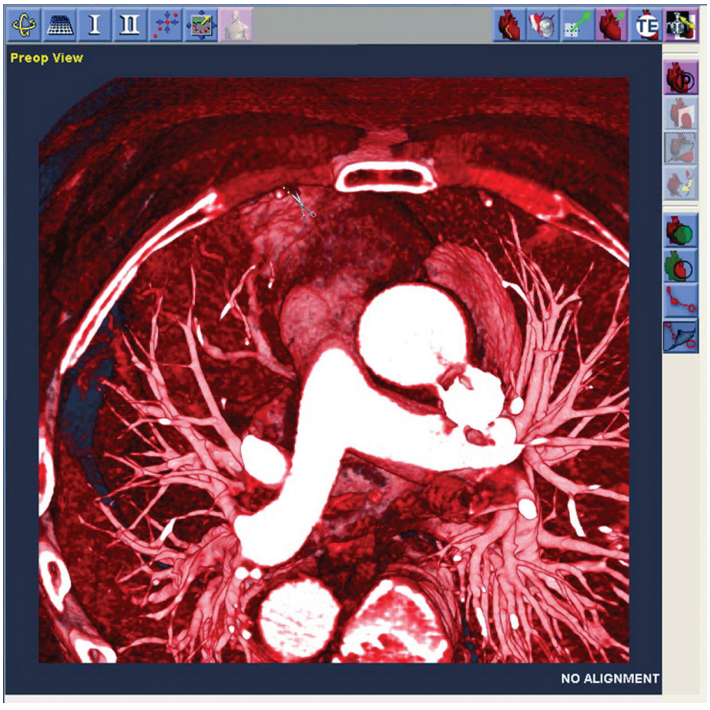
Click the Remove Last Punch Point tool **(C)** to delete the last point.

Click the Remove All Punch Points tool **(D)** to clear.

Click **Execute step ▸** to advance to the next numbered step.

TIP

When making selections, the green area will be removed. The red area will remain.

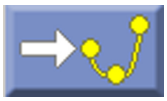


Pre-op View with image

Mark Proximal & Distal Points on CT

Mark the proximal, then the distal points on the vessel. Keep in mind the direction of advancement of the device.

- Double-click on the proximal point on the vessel
- Click the **store point** button on the keyboard's Navigant keys or the Navigant tool bar

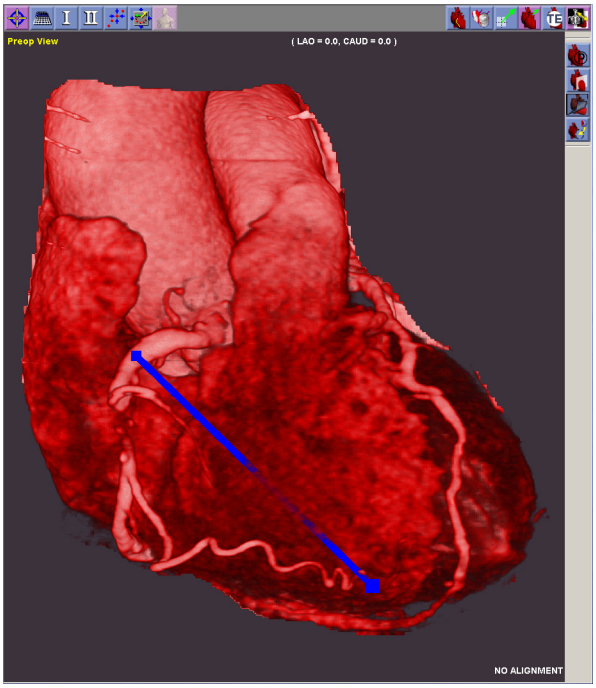


Store Point Button

- Double-click on a distal point on the vessel
- Click the **store point** button on the keyboard's Navigant keys or the Navigant tool bar

Readjust the tissue visualization settings if needed.

Click **Execute step** ▸ to advance to the next numbered step



Pre-op View with image

Compute Vessel Center line

Click **Execute step** ▸ to advance to the next numbered step, **Compute vessel center line**.

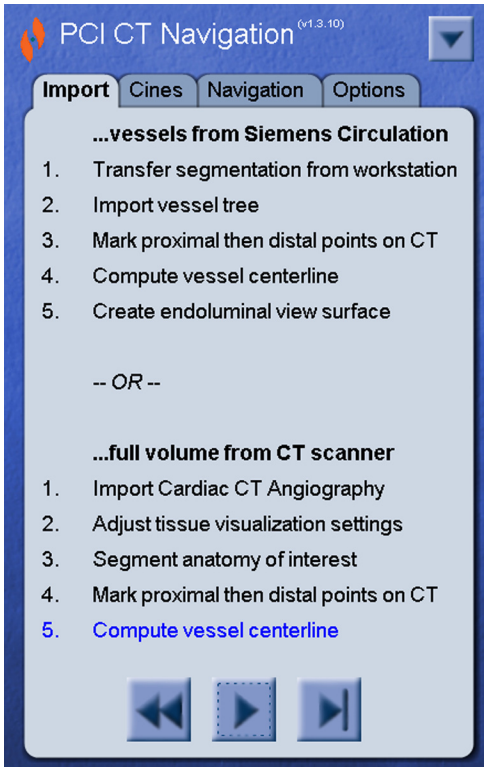
The vessel center line will be extracted.

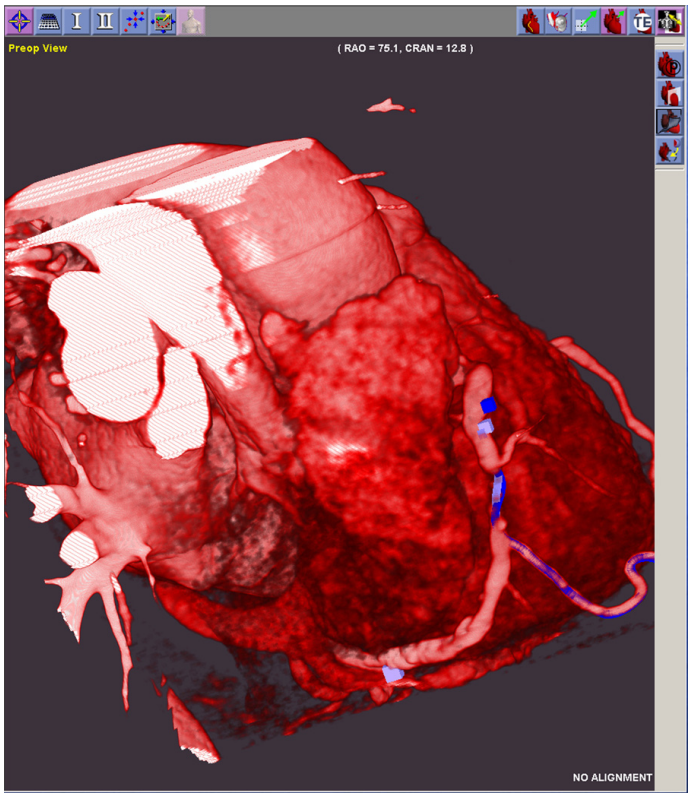
The vessel group is indicated in the Points & Constellations Panel.

If the extraction fails, right-click on the group in the Points & Constellations Panel and choose delete. Re-mark the proximal and distal points of the vessel. Click the extract vessel button.

Extract CT Vessel Button 

If the extraction fails again, delete the points. Mark the vessel by marking the proximal point, then marking several points along the vessel in the direction of the navigation. Extract the vessel in several sections.





Pre-op View Window

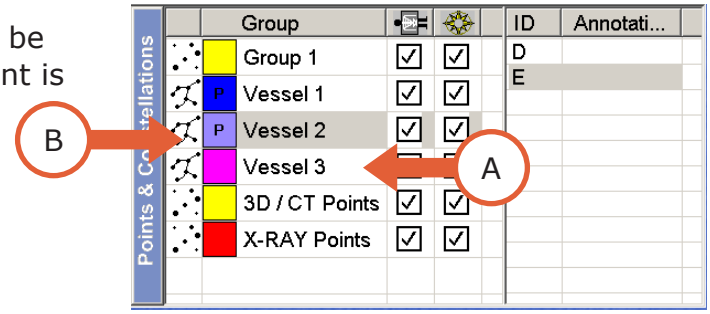
Multiple Vessel Extraction

For multiple vessels:

- Click on the next vessel group (A) in the Points and Constellations Panel or create a new group
- Repeat the steps to mark and store the vessel's proximal and distal points
- Click the extract CT vessel button to extract vessel from pre-operative data

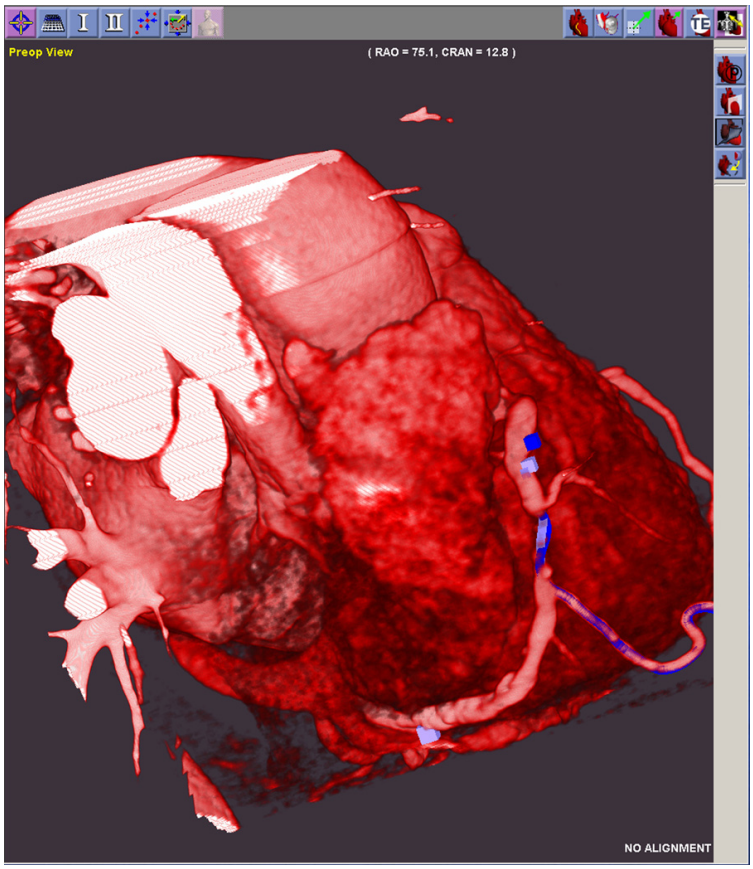
Extract CT Vessel Button 

All of these steps can be done before the patient is on the exam table.



TIP

The vessel to be extracted will be highlighted in the Points & Constellations Panel (B).

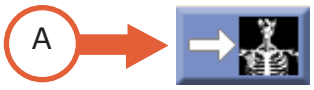


Pre-op view with image

Acquire Diagnostic Cines

Acquire angiograms with a minimum of 40º separation.

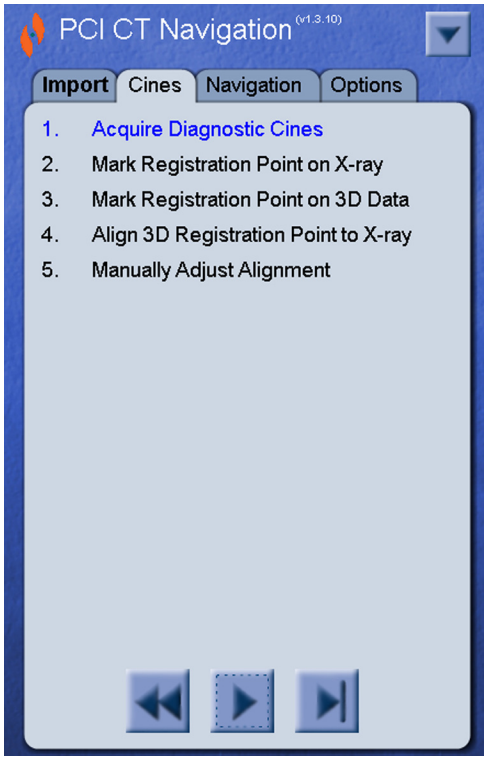
Optimally, gate the images in the same cardiac phase and similar respiratory motion.



Click the transfer image button (A) on the Navigant tool bar near the top of the screen.

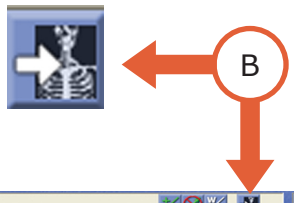
- RAO in Fluoro A
- LAO in Fluoro B

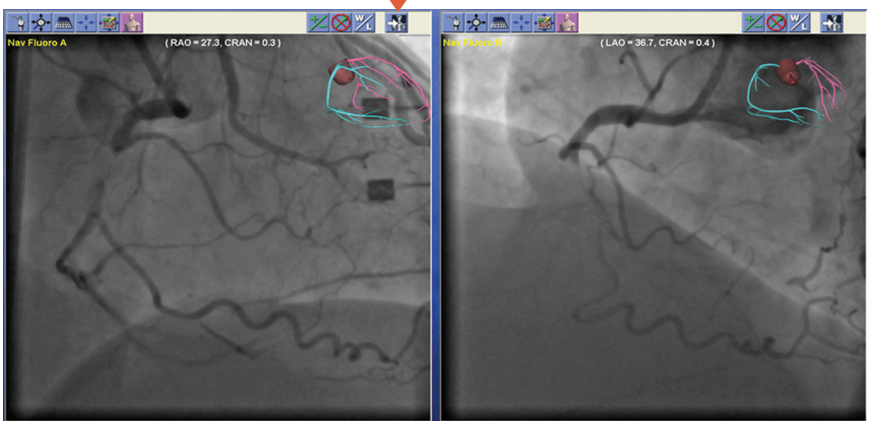
The images will load in the appropriate panels.



CWM - Cines Tab

Alternatively click the transfer image button on each fluoro window (B).





Fluoro A & B with Images Loaded

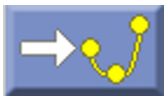
Click **Execute step** ▸ to advance to the next numbered step.

Mark Registration Point on X-ray

Identify a point on the desired vessel on the fluoro image that can also be identified on the CT (bifurcation of vessels). Click on the vessel to define the registration point in the Navigant Fluoro A window. A red target will appear.

Click on the same location on the vessel in the Navigant Fluoro B. A reference line will appear. The cursor will turn green when within range. A green target will indicate the accepted point.

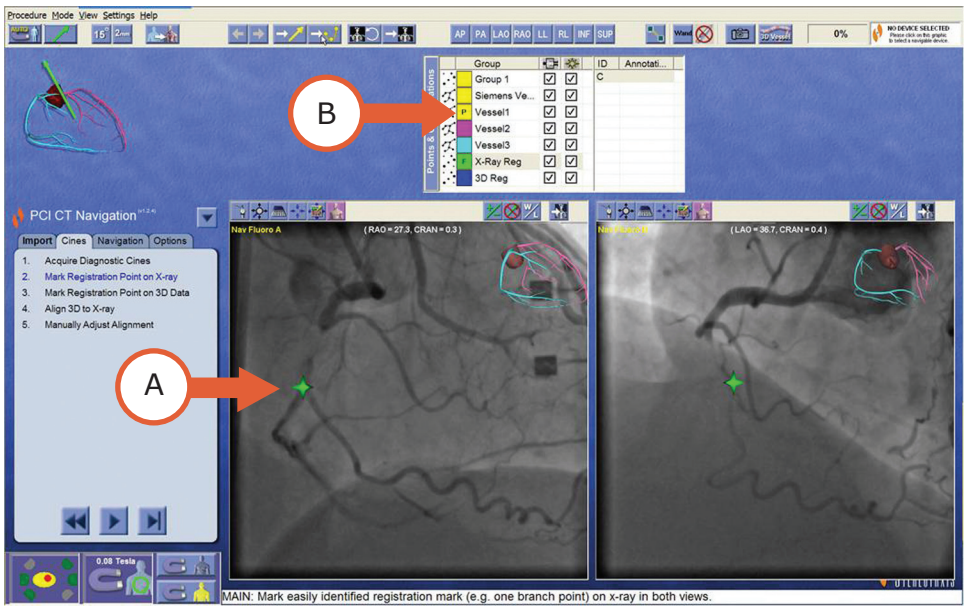
Click the store point button on either the keyboard's Navigant keys or in the Navigant tool bar.



Store Point Button

The point will be displayed as a star burst (A). Once stored it will automatically be identified in the Points and Constellations Panel (B).

Click **Execute step ▸** to advance to the next numbered step.



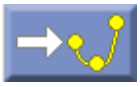
Navigant with two fluoro views

Mark Registration Point on 3D Data

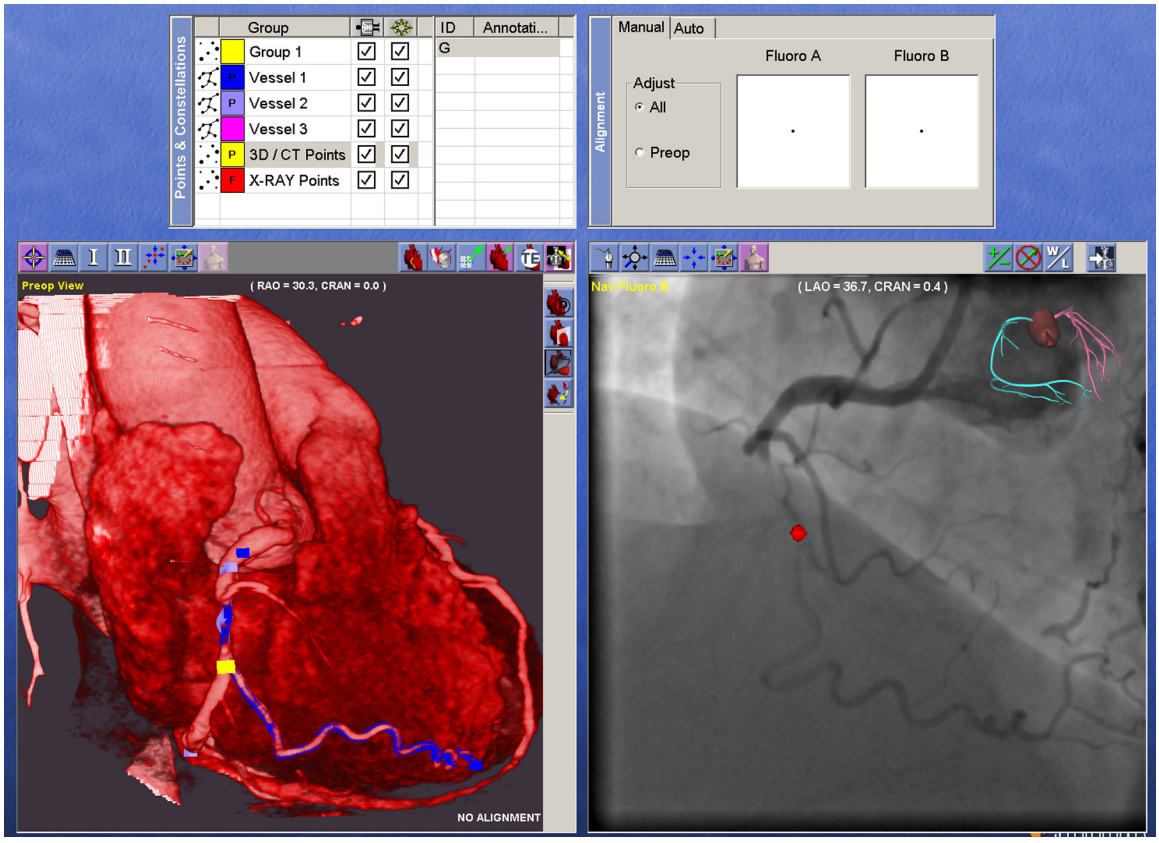
Double-click a point on the pre-op data that matches the point identified on the fluoro images.

Store the point by clicking the store point button on the keyboard's Navigant keys or in the Navigant tool bar.

The point will be displayed as a yellow square and identified in the points and constellations panel.



Store Point Button



Click **Execute step** ▸ to advance to the next numbered step.

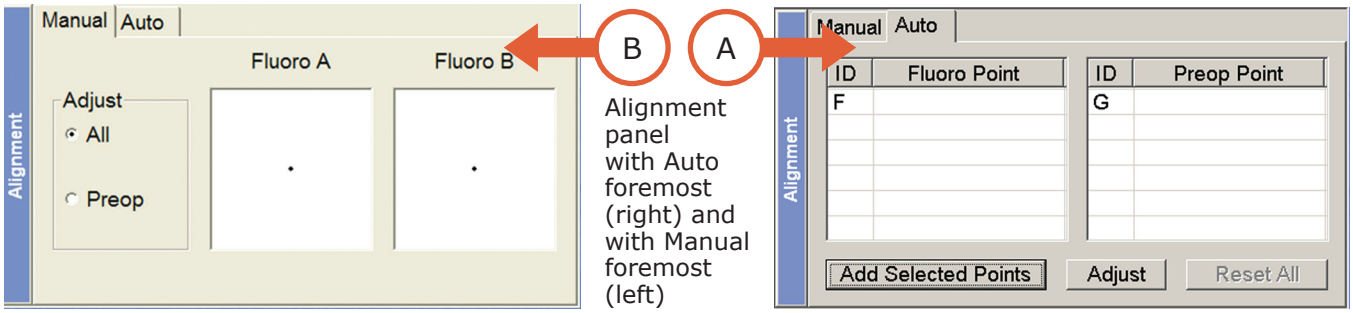
Align 3D Registration to X-ray

The Alignment Panel will appear above the main windows.

- Click the **Auto tab** (A) in the panel.
- Click on the **x-ray points group** in the Points and Constellation Panel
- Click on the **ID point for x-ray** in the right column
- Click on the **add selected points** button on the Alignment Panel
- Click the **3D/CT Points Group** in the Points and Constellations Panel
- Click on the **ID point for 3D Registration** in the right column
- Click **add selected points**

Once both have been transferred to the Alignment Panel click the **adjust** button.

The two defined points will overlay each other aligning the data. Click **Execute step** ▸ to advance to the next numbered step.



Alignment panel with Auto foremost (right) and with Manual foremost (left)

Manually Adjust Alignment

Utilizing the manual tab (B) on the alignment panel, click in the white boxes (Fluoro A and Fluoro B) with direct reference to the center dot to move the pre-op data so that it will overlay the fluoro image.

TIP

For the quickest overlay utilize the manual alignment and verify the correct alignment on live fluoro.

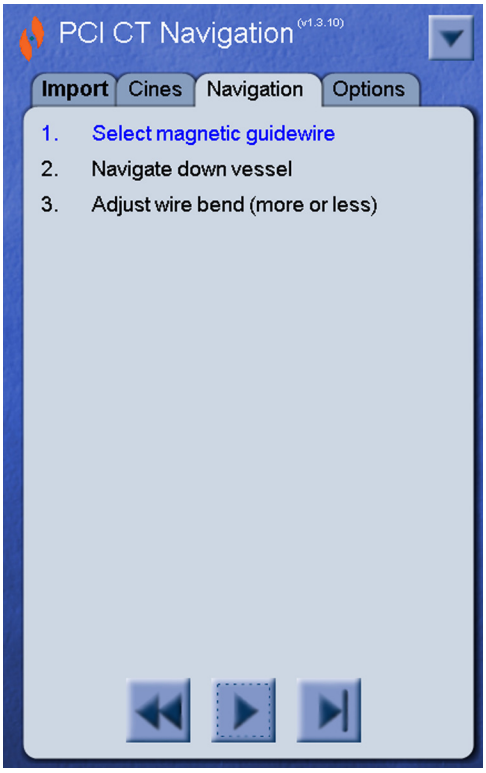
Click **Execute step** ▸ to advance to the next numbered step.

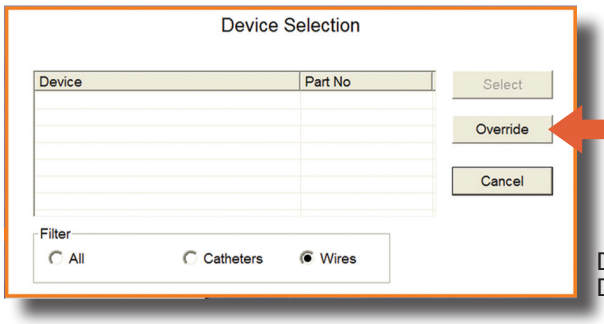
Navigation

The first step of the Navigation tab is to **Select a magnetic guidewire**.

The device selection window opens automatically. Click the **override button** (A) to view the menu of available options. Either double-click the option of choice or select one, then click **Add Device** to choose a device.

The selected device (B) will be displayed in the upper right-hand corner of the Navigant screen. This icon can be clicked to change the selected device at any time.





Device Selection Dialogue Box

Device Override Dialogue Box

Current Selected Device

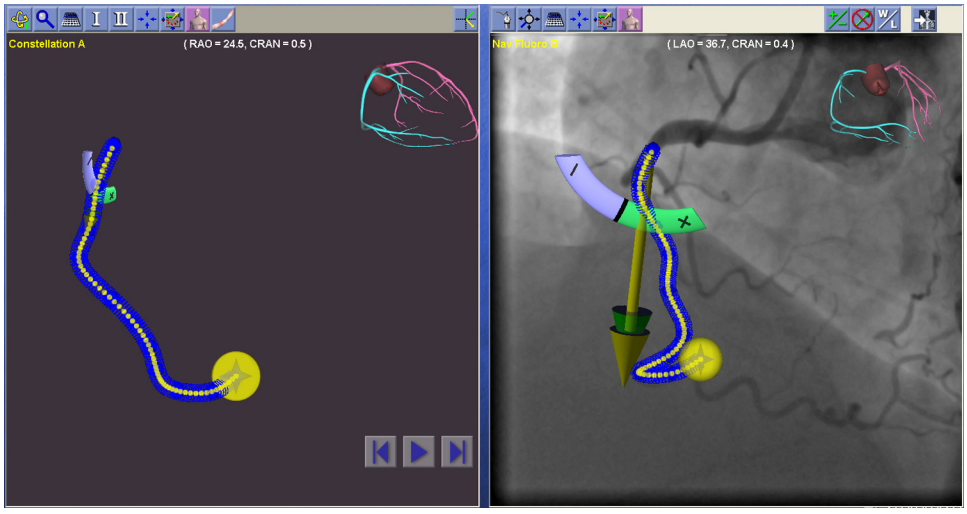
Navigate on vessels

In the procedure room the physician can operate both the touch screen and the Navigant screen. The touch screen should be covered with a sterile drape so the navigational controls can be operated at table side. The Navigant mouse should be covered as well to operate the Navigant main screen in the procedure room.

On the 3D roadmap double-touch on the touch screen at the location of the device.

The magnetic field will be applied and the indicator will appear. The center line will appear along the selected vessel with a yellow ball at the end indicating the selected vessel.

If multiple vessels have been created, first double-touch near the end of the reconstruction of the vessel to be navigated. The yellow ball and center line will be displayed on the desired vessel roadmap. Double-touch along the vessel from the proximal to the distal points to adjust the field while manually advancing the wire, or utilize vessel sequencing for navigation.



Constellation A
and Nav Fluoro B

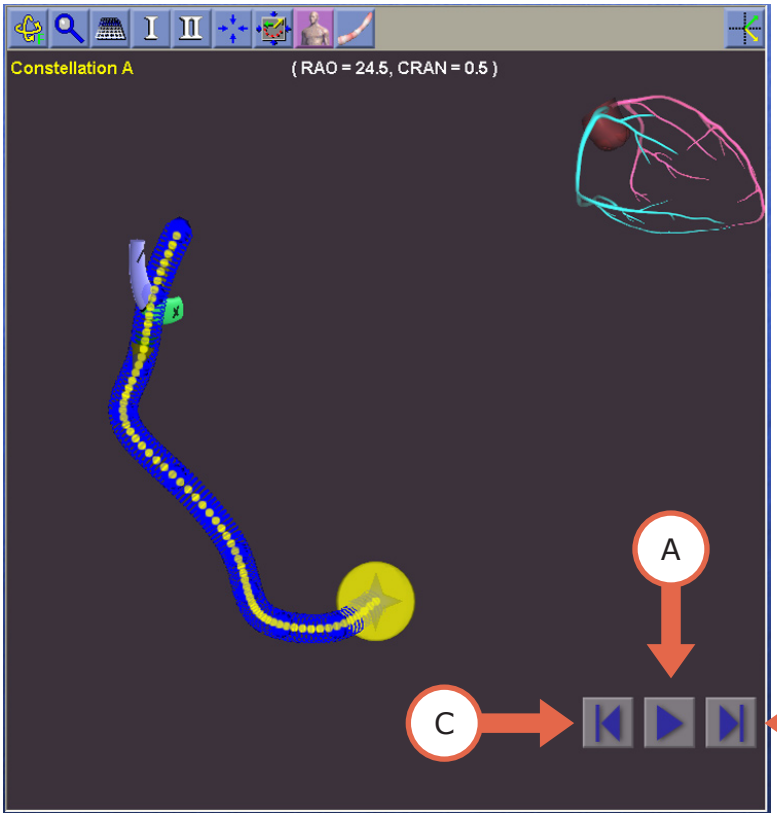
Vessel Sequencing

Vessel Sequencing moves the magnetic field direction along a reconstructed vessel automatically. There is a delay of 1 second (the default) after each application of the magnetic field. This vessel sequencing rate, the amount of time in between each auto advancement, can be changed in the General Settings Window.

It is initiated by clicking the play button (A) in the constellation window, lower right corner.

It will start at the location of the magnetic field direction indicated and travel along the reconstruction until one of the following occurs:

- It is stopped by clicking the stop button
- It is interrupted by a magnetic field adjustment
- It reaches the end of the reconstruction

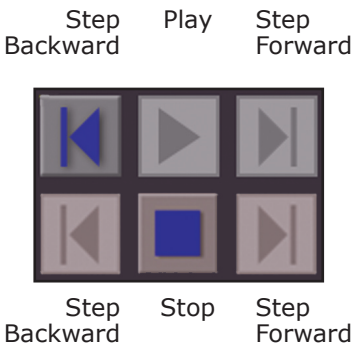


Vessel Sequencing Controls

The distance that the magnetic field is advanced along the reconstruction is determined by the Cardiodrive step size button located on the Navigant tool bar or the number keys on the keyboard.

Initially the play button appears. Once clicked, the stop button replaces it. There is also a step forward (B) and a step backward button (C) that will move one step at a time along the reconstruction.

Vessel Sequencing Control Buttons



Adjust Wire Bend

In essence, the Guidewire Bend tool can magnetically shape the distal tip of the wire. Utilize the tool to make field adjustments as the device is advanced.

- Increase/decrease bend
- Rotate clockwise/counterclockwise

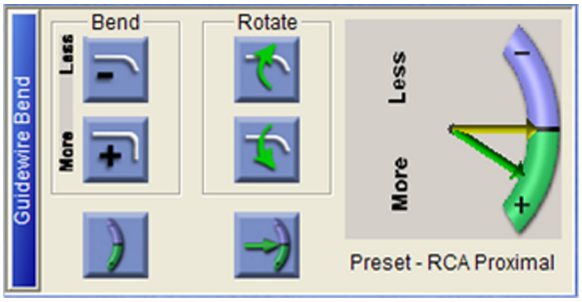
Each application of these buttons will make adjustments in the magnetic field in the amount indicated by the field angle step size button located on the touch screen Navigant tool bar.

- Show and hide bend plane tool

Utilize this to remove visualization of the tool from the Navigant window.

- Reset guidewire bend

This returns the tip of the wire to baseline.



Guidewire Panel

Click **Execute step** ▸ to apply the magnetic field and advance to the next CWM and create a 3D roadmap if indicated.

TIP

To change the degree of angle adjustments utilize the field angle step size on the Touch Screen or Navigant tool bar.

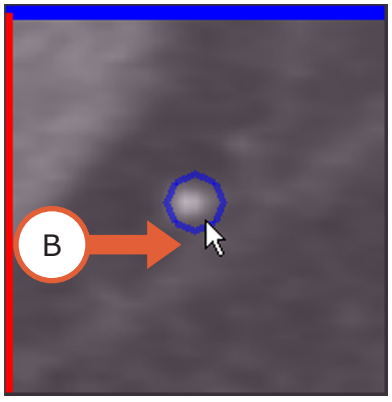
CTO Pathway Marking

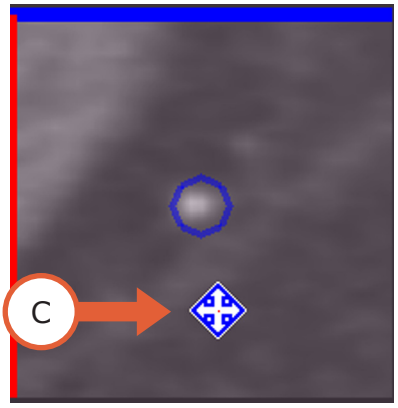
The Multiplanar Reconstruction (MPR) slice is a thumbnail cross-sectional image extracted from the CT that can be used to visualize the contrasted vessel.

The MPR slice is open in both the pre-op and the constellation views. It is in the upper left corner. It can be closed and reopened by selecting the Show/Hide button (A).

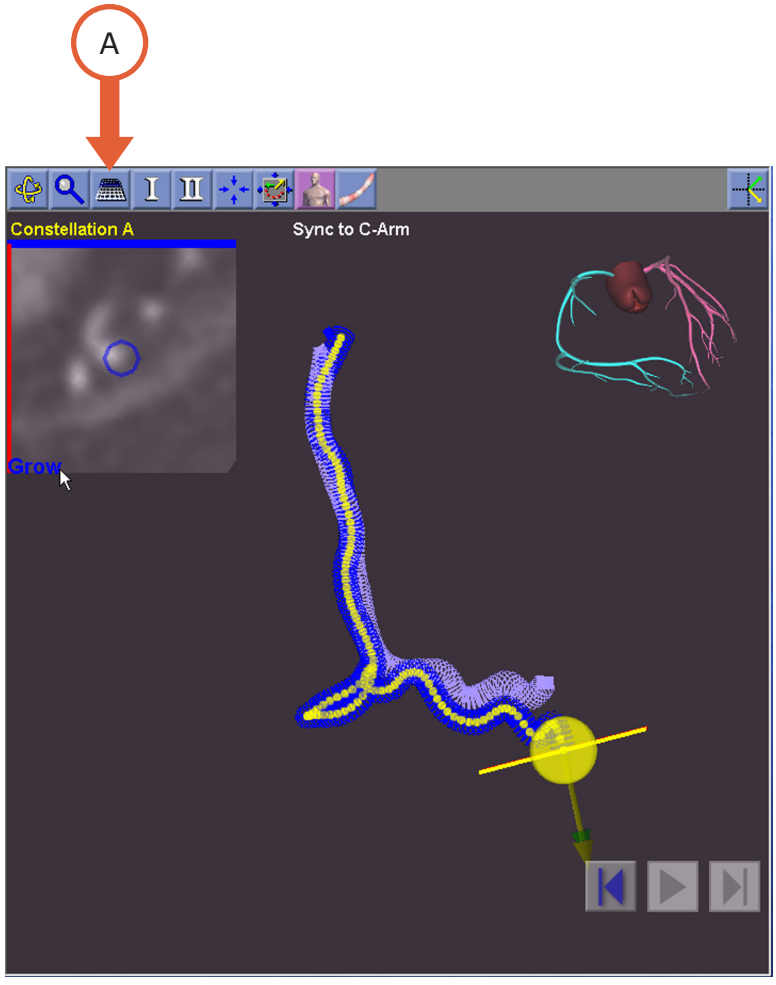
A 3 mm circle indicates the vessel. The color of the circle corresponds to the color of the reconstruction. To adjust the magnetic field direction hold the cursor over the circle until it becomes an arrow (B). Click, hold and drag to move the circle to a new area of interest.

To adjust the contrast of the MPR slice, click, hold and drag with the multi-directional cursor (C) over the thumbnail.





Enlargements of circle (above) and multi-directional cursor (below)

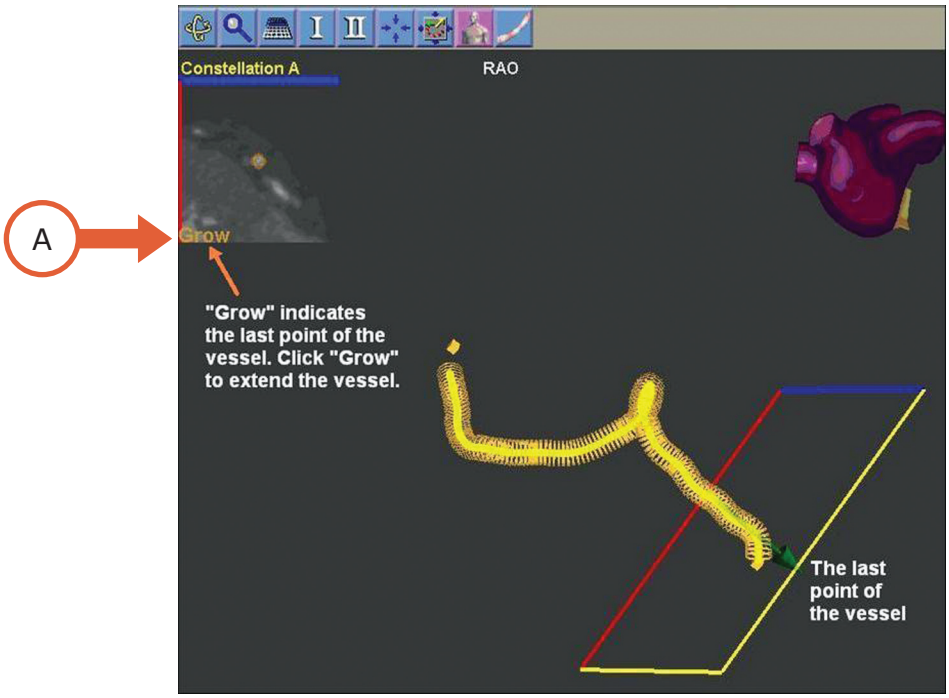


Constellation View

Using the Grow Feature

When the selected point is at the end of the vessel reconstruction, the word Grow displays in the thumbnail view (A). This enables vessel extension tangentially from the distal point.

- Set the length of extension by clicking the Step Size button on the main tool bar.
- Click Grow to extend the vessel. The thumbnail and 3D plane will update automatically.



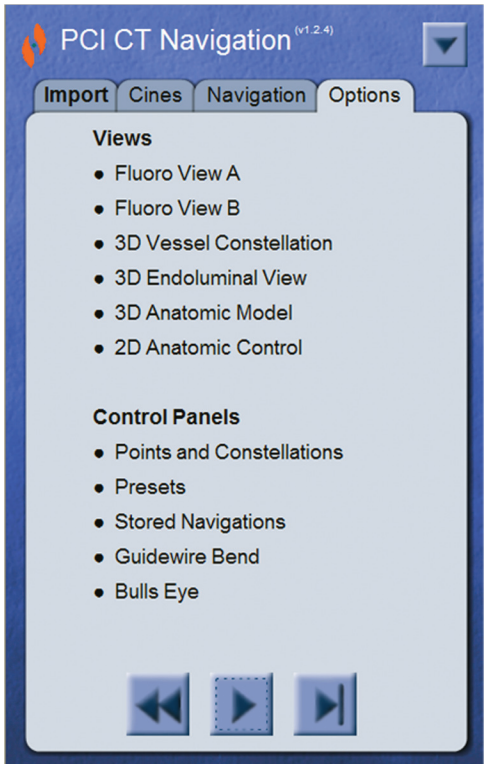
Extend a Vessel

Options Tab

Views

The Views section of the tab allows the user to change the Navigant window display.

- Fluoro (A and B)
- 3D Vessel Constellation
- 3D Endoluminal View
- 3D Anatomic Model
- 2D Anatomic Control



CWM - Options Panel

Control Panels

The Control Panels section allows the user to enable additional tools to assist in the procedure. The panels are displayed above the monitor windows.

- Points and Constellations
- Presets
- Stored Navigations
- Guidewire Bend
- Bulls Eye

The settings can be changed as needed.