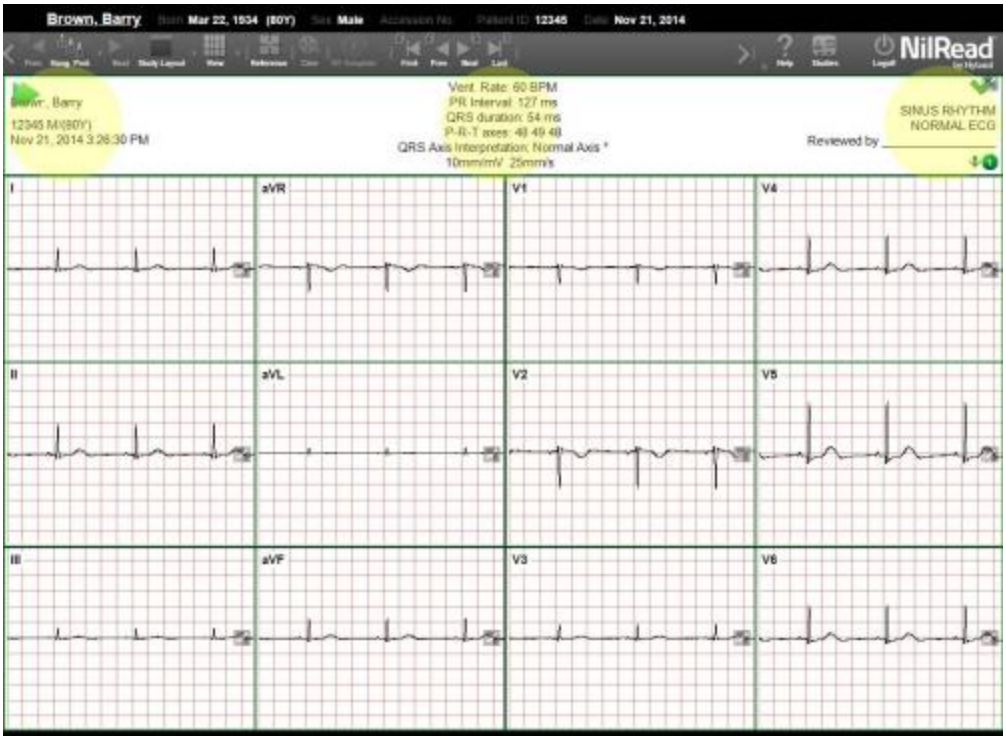
NilRead provides several views that can be used to review 12-lead electrocardiogram (ECG) images.

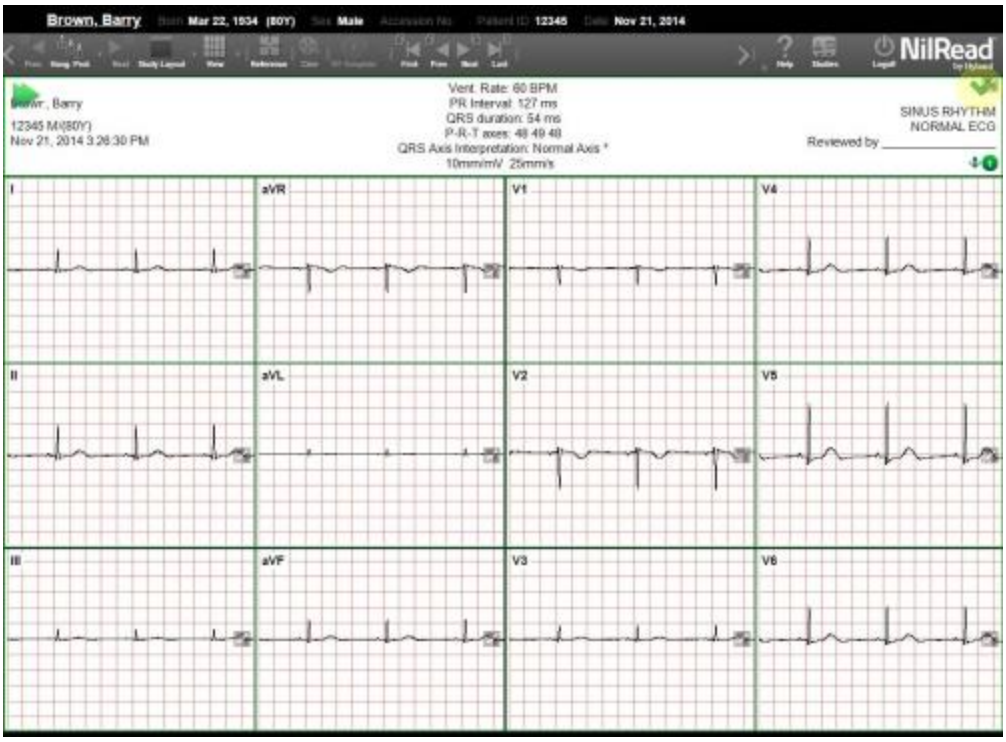
1. Open an ECG study.
2. (Optional) In the **View** menu, select the ECG leads you want to view.
3. In the **View** menu, select an **ECG View**. You can choose from standard views such as Rhythm and 3x4.

The following information is shown in the information bar above the image.

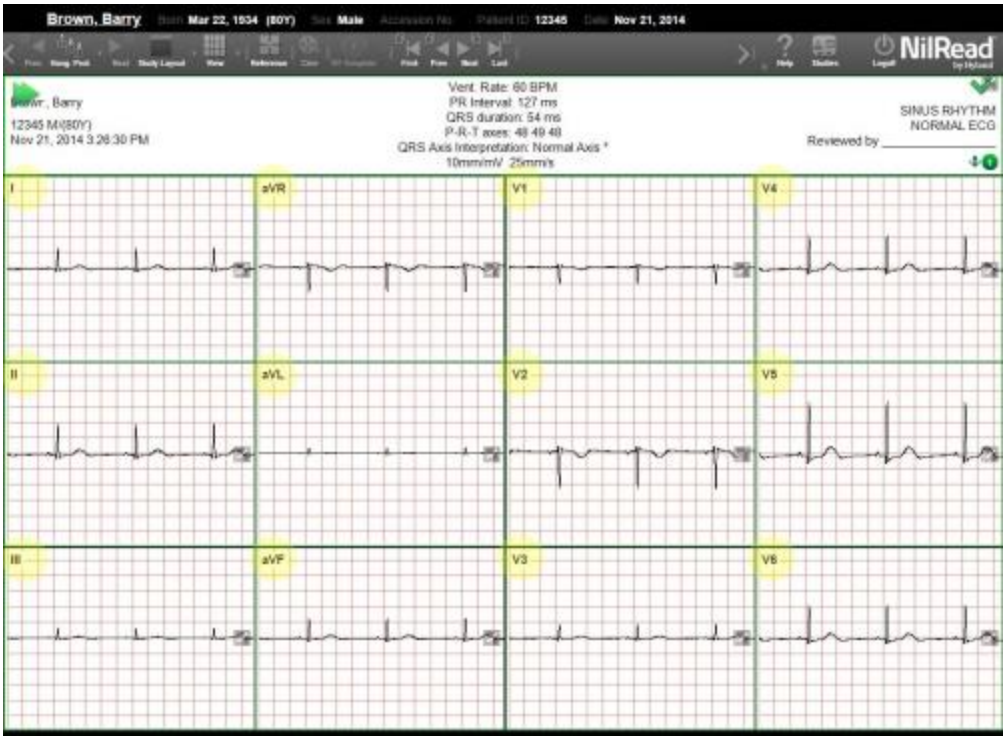


- Patient demographics (patient name, study date, etc.) are shown in the top-left corner.
- Metrics (ventricle rate, PR interval, etc.) are shown in the center. These metrics are taken from the study's DICOM attributes, with the exception of QRS Axis Interpretation, which is calculated by NilRead. For details, see **Understanding QRS Axis Interpretation**.
- Any comments are shown in the top-right corner.

To expand the information bar, double-click the bar or click in the top-right corner. To return the information bar to its original size, double-click the bar again or click .



The lead name is shown in the top-left corner of each graph.



Understanding QRS Axis Interpretation

The QRS axis interpretation is calculated using the "Three Lead Analysis (Lead I, Lead II and aVF)" method of ECG axis interpretation. Using this method, the QRS axis is determined to be normal, LAD Physiological, LAD Pathological, RAD, Extreme Axis, or Indeterminate.

The following table summarizes how the QRS axis is calculated.

	Normal Axis 0 to +90°	LAD Physiological 0 to -30°	LAD Pathological -30° to -90°	RAD 90° to 180°	Extreme Axis -90° to -180°	Indeterminate ?
LEAD I	POSITIV-E	POSITIVE	POSITIVE	NEGATIV-E	NEGATIV-E	EQUIPHASIC
LEAD II	POSITIV-E	EQUIPHASIC	NEGATIVE	POSITIVE	NEGATIV-E	EQUIPHASIC
LEAD III or aVF	POSITIV-E	NEGATIVE	NEGATIVE	POSITIVE	NEGATIV-E	EQUIPHASIC

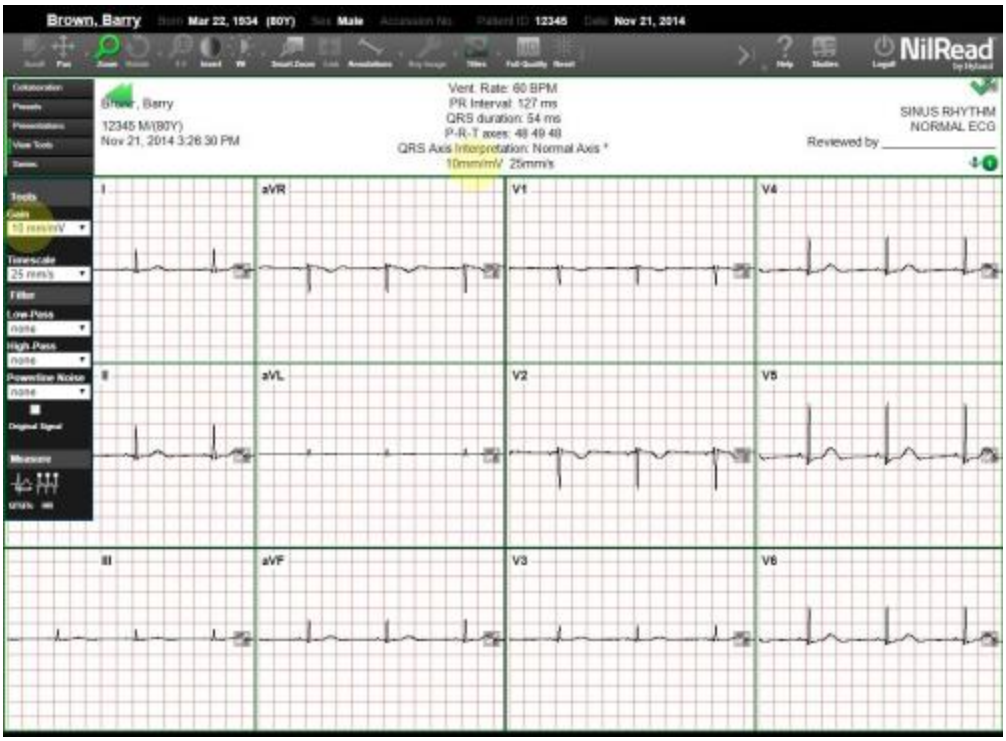
Use the ECG view tools

NilRead provides several tools that can be used to adjust the visualization of ECG images. To access these tools, select **View Tools** (side panel).

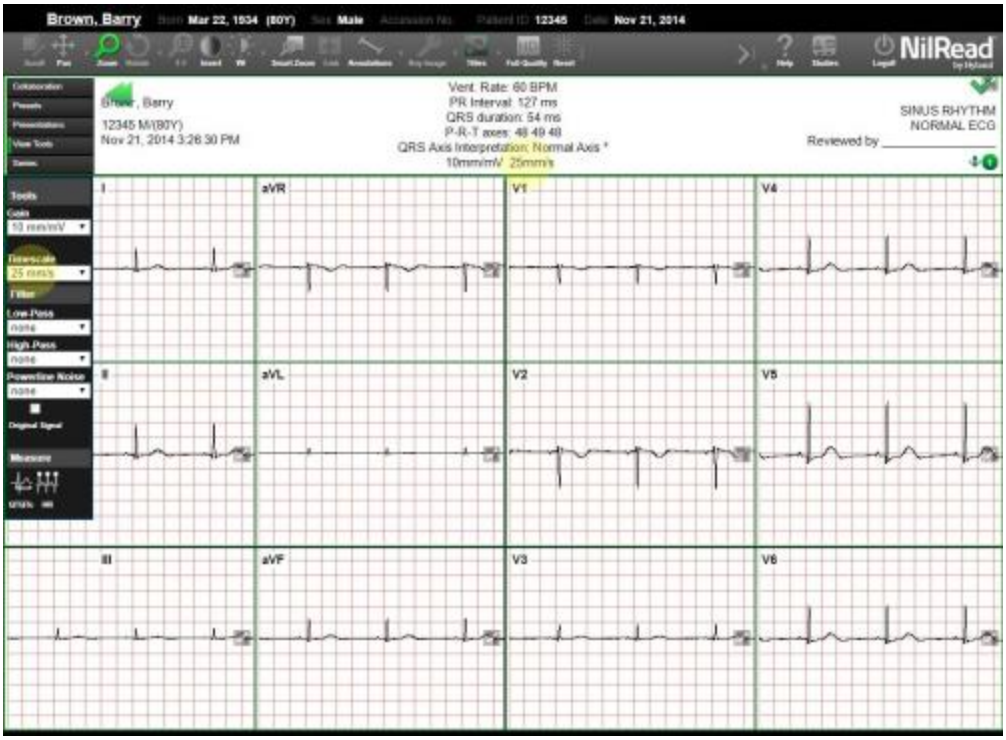
Gain and Timescale

You can adjust the gain and timescale for the graph to better define the waveforms.

Use **Gain** to change the height (amplitude) shown on the vertical axis. The current **Gain** value is shown in the center of the information bar. (Standard calibration for an ECG is 10mm/mV.)



Use **Timescale** to adjust the timescale shown on the horizontal axis. The current **Timescale** value is shown in the center of the information bar. (Standard timescale for an ECG is 25 mm/s.)

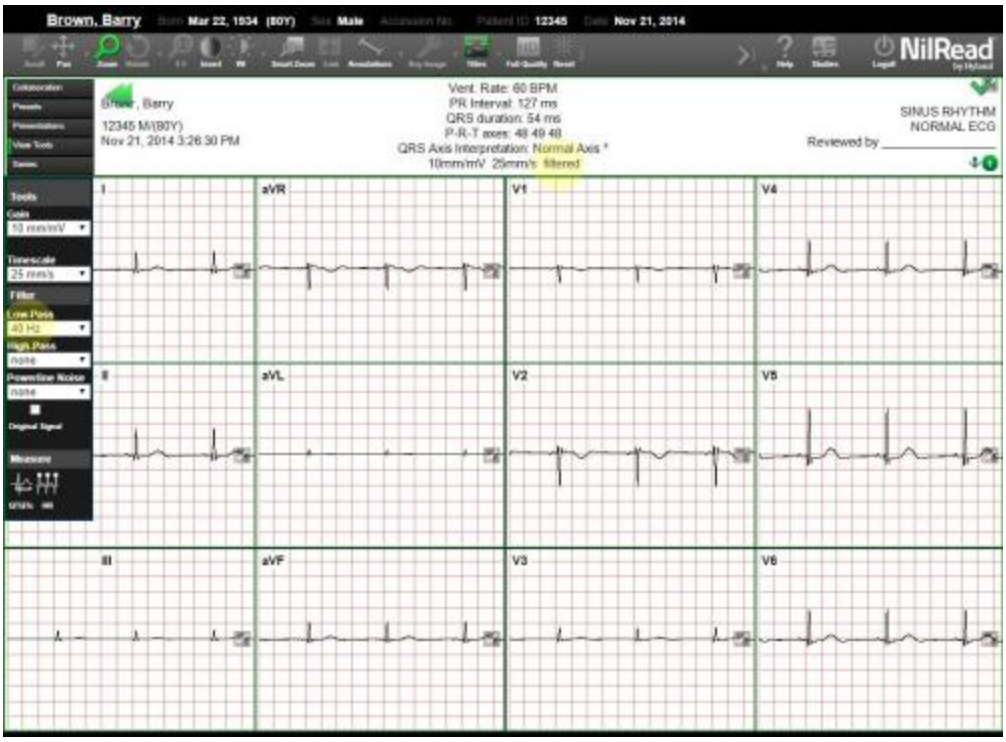


Filter

Use **Filter** to remove unwanted artifacts and noise from the ECG recording. You can use the following filters:

- **Low-Pass** Remove high frequency interference.
- **High-Pass** Remove lower frequency interference.
- **Powerline Noise** Remove powerline interference. Powerline interference may result from factors such as electromagnetic interference by power lines or nearby machinery.
- **Original Signal** Show the original signal and the filtered signal at the same time.

If a filter is applied, this is stated in the center of the information bar.



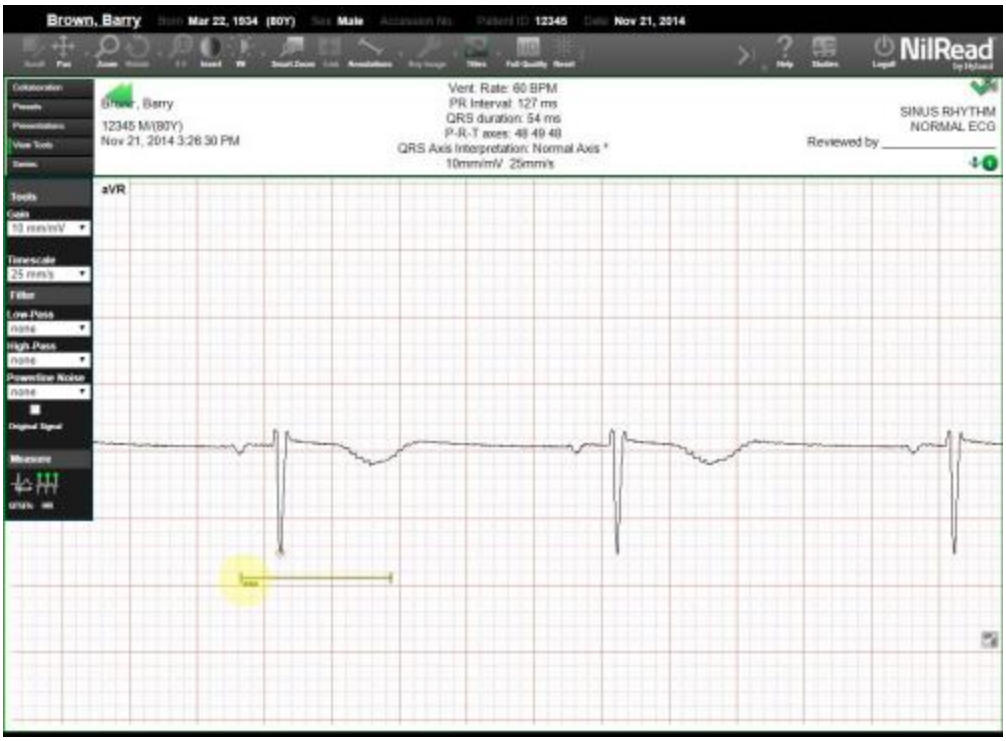
HR

Use the **HR** tool to calculate the number of heart beats per minute (bpm) between two points on a graph.

Click (or tap) and drag to create a line. After the line is drawn, the bpm is calculated and displayed. This calculation is based on the wave peaks included in the interval covered by the line. The peaks included in the calculation are circled.

The first number in the calculation represents the number of heart beats in the interval covered by the line. The second number represents the number of heart beats for the entire signal. A regular heartbeat will have the same values for the interval time and total time (for example: 80/80). An irregular heartbeat will have different values.

At least two peaks are required to calculate the heart rate for an interval. If less than two peaks are included in the interval, *** will be shown, indicating that the heart rate could not be calculated.

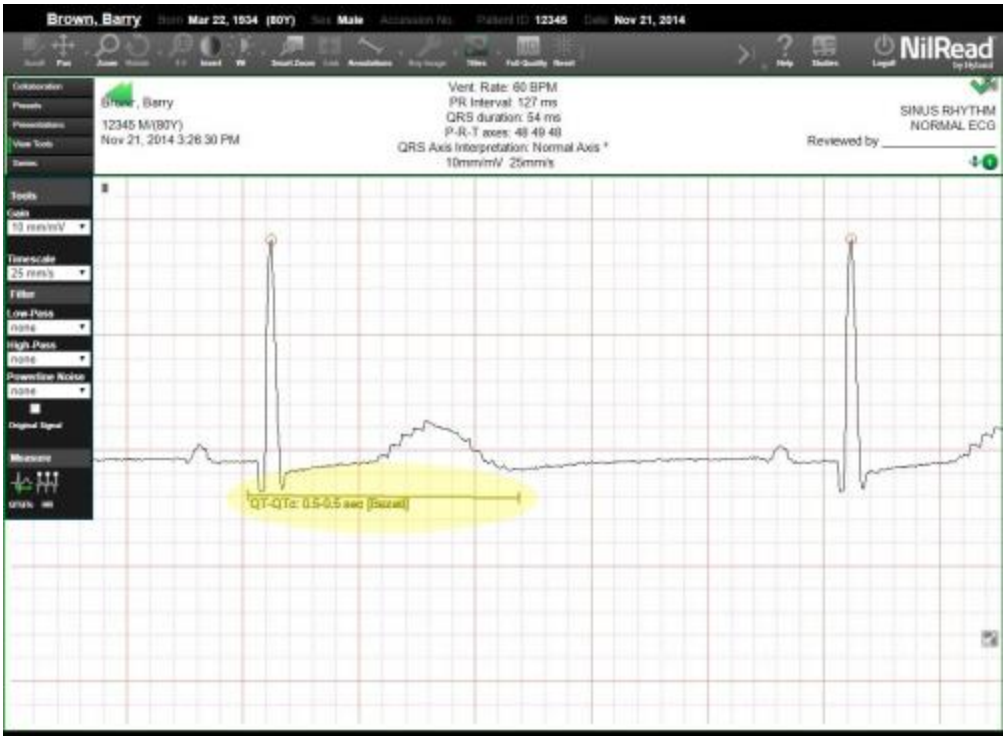


To delete a line, right-click the line, then select **Delete**.

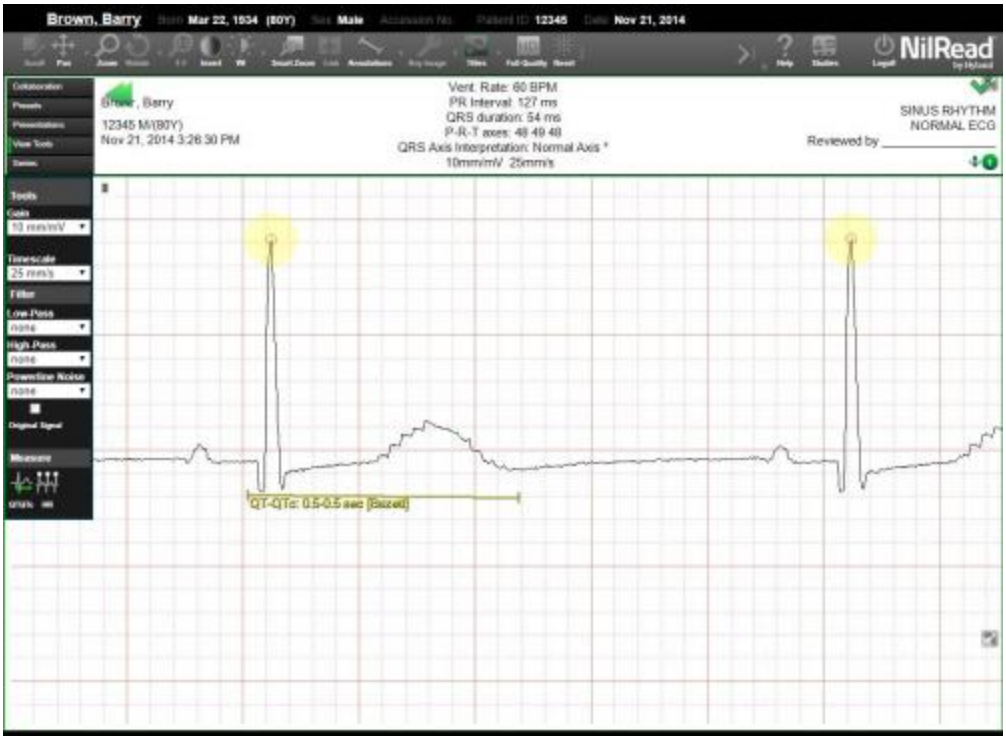
QTQTc

Use the QTQTc tool to measure the QT interval. NilRead also calculates the corrected QT interval (QTc). The QTc is calculated based on Bazett's formula.

1. Using lead II or V5-6, draw a line from the start of the Q wave to the end of the T wave. The QT and QTc are shown.



2. The two R peaks in the QT interval are circled. The first R peak is between the Q and P waves. The second R peak is used as a reference point.



If the line does not cover the required to calculate the QT interval, *** will be shown, indicating that the QT and QTc could not be calculated.

To delete a line, right-click the line, then select **Delete**.

Annotation Tools

There are some differences in how measurements are shown when using regular annotation tools with ECG images.

Linear and Area Measurements

For linear measurement tools (such as the ruler) and area measurement tools (such as the rectangle), horizontal measurements are shown in seconds and vertical measurements are shown in mV.

Angle

The measurement for an angle shows the time and signal value between the two points.

Change ECG preferences

You can change the zoom tool behaviour and the image viewer color scheme for ECG images.

> **Note**
> If you access **Settings** while viewing a study, select **Back to Viewer** to return to the image viewing area.

1. Select **Settings**.
2. Under **Preferences**, select **Modality Preferences**.
3. Enter the following information, then select **Save**.

Modality

Select **ECG**.

Zoom Policy

Determines the zoom behavior.

- **Zoom at center** Zoom in or out from the center of the image.
- **Relative zoom at mouse position** Zoom in or out from the mouse position.

ECG Color Scheme

Select the color scheme to use when viewing ECG images (**Dark** or **Traditional**).

Use the vessel tracer

About the vessel tracer

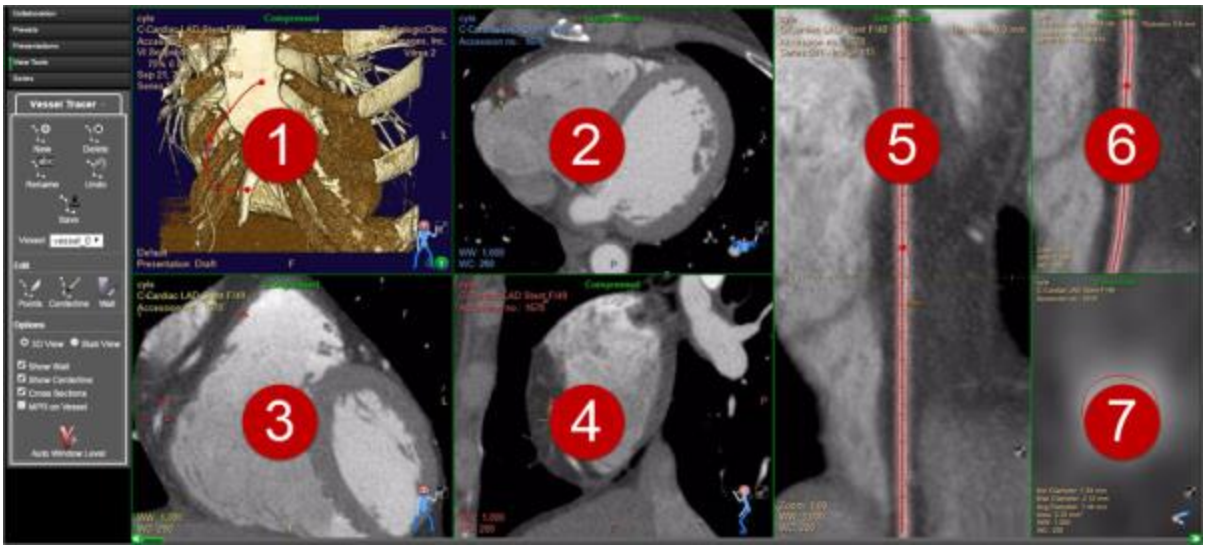
For CT studies, the vessel tracer tools allow you to extract a vessel from the volumetric data set in order to examine the vessel more closely.

Use the Vessel Tracer view

To use the vessel tracer tools, first apply the vessel tracer view. Select **View** (toolbar), then select **Vessel Tracer**. (You can also use the Study Layout options to place the vessel tracer view beside an

existing view. For details, see **Arrange images**.)

The default vessel tracer view contains seven viewports.



- By default, viewport 1 contains a 3D shaded rendering of the data. To change the viewport to a thick slab MIP rendering, select the **Slab View** option in the Vessel Tracer tools panel. To switch back to the 3D rendering, select the **3D View** option.
- Viewports 2, 3, and 4 contain MPR views on the three major planes (axial, sagittal and coronal).
- Viewports 5, 6, and 7 contain reformat views of the selected vessel. These views appear once you have created a vessel.
  - Viewport 5 contains a “stretched” ribbon view along the centerline of the vessel. This view has overlays showing the centerline, the intersecting inner wall curve of the vessel and a reference marker which identifies the location of the cross-section in viewport 7. The reference marker in this view is a pattern of distance ticks. You can edit the vessel in this viewport.
  - Viewport 6 contains a curved reformat view of the vessel. This view has overlays showing the centerline, the intersecting inner wall curve of the vessel and a reference marker which identifies the location and orientation of the cross-section in viewport 7. You cannot edit the vessel in this viewport; it is for viewing only.

- Viewport 7 shows an axial cross-section through the vessel at the location of the reference marker along the vessel's centerline. Several cross-section measurements are shown such as the minimum diameter, maximum diameter, average diameter and area of the lumen. Note that you can use the **Cross Sections** option to hide the cross-section view. If the cross-section view is hidden, the curved reformat view is expanded to fill the viewport.

To hide the cross-section view and expand the curved reformat view:

- In the Vessel Tracer tools panel, deselect the **Cross Sections** option.

To change the orientation of the MPR viewports according to the direction of the vessel:

- In the Vessel Tracer tools panel, select the **MPR on Vessel** option.

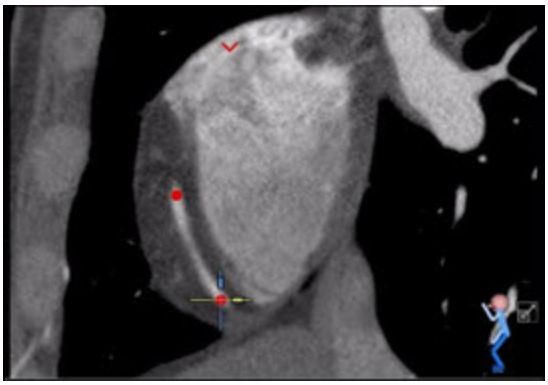
To apply a window level preset that tries to optimize the display of the vessel:

- In the Vessel Tracer tools panel, select **Auto Window Level**.

Define a vessel

Once you have applied the vessel tracer view, you can identify vessels using seed points. After defining a vessel, you can adjust the seed points, centerline and lumen wall.

1. Select **View Tools** (side panel). The Vessel Tracer tools panel appears below the side panel.
2. Select **New**. A new vessel is added to the **Vessel** list in the side panel. The vessel is given a default name, such as vessel_0. To change the vessel name, select **Rename**.
3. Note that the **Edit Points** option is now enabled. In one of the MPR viewports (or the 3D viewport), click (or tap) to place seed points within the lumen of the vessel. For example:



Note that if a point appears as an arrow (instead of a dot), this indicates that the seed point is not on the current plane.

If the arrow faces down, scroll down to view the seed point. If the arrow faces up, scroll up to view the seed point. You can also use the **Previous Seed Point** or **Next Seed Point** options that appear when you right-click (or touch and hold) a point.

Note that you can work with points in the ribbon view (5) in addition to the 3D and MPR viewports (1-4).

4. You must place a minimum of two points to define a vessel. Once a vessel is defined, reformat views of the vessel are shown in the ribbon view (5), curved reformat view (6), and cross-section (7).
   - To add more points to the vessel, select **Edit Points** and click (or tap) on the vessel to place a point. You can add (or move) points in any of the MPR, 3D or ribbon viewports.
   - To move a point, select **Edit Points** and drag a point to a new location.
   - To delete a point, right-click (or touch and hold) the point, then select **Delete Seed Point**.
   - To change the focus of the viewports to a specific seed point, right-click (or touch and hold) the point, then select **Focus to This Seed**.
   - To move through the seed points, right-click (or touch and hold) a point, then select **Previous Seed Point** or **Next Seed Point**.
5. In the Vessel Tracer tools panel, select **Save**. This will save all of the vessels that have been defined.

> **Note**
> Before saving, you can select **Undo** to remove your last change to the vessel.