12 Gastro Intestinal

This application provides data on the clearance time of stomach contents and calculates the T1/2 for gastric emptying. The application supports two isotope image sets: Tc for Solid and In111 for Liquid emptying calculations. A linear fit curve is used for Solid data and an exponential fit curve for Liquid. When both series are loaded, a new series of frames equal to the geometric mean is computed. It has these methods:

- Solid Posterior
- Solid Anterior
- Solid Anterior + Posterior
- Solid + Liquid
- Liquid Posterior
- Liquid Anterior
- Liquid Anterior + Posterior
- GI Bleed Display
- Custom Display

The methods are used to create these Preferences:

- Solid Posterior
- Solid Anterior
- Solid Ant + Post
- Solid + Liquid
- Liquid Posterior
- Liquid Anterior
- Liquid Ant + Post
- Solid Liquid Side by Side
- GI Bleed Display

For information on loading requirements, and on calculations and algorithms used in this application, see the appropriate section in the *NM Application Suite Reference Manual*.

NOTICE

For the Time Activity Curves displayed in this application, the first point is the time for the end of the first frame. For example, if the first frame is 60 sec., the first point in the curve is not 0, but 60 (if seconds are the units; it would be 1 if the units were minutes). This reflects the fact that the frame completion is at the end of the time span.

Gastro Intestinal Tutorial

In this tutorial you will learn how to perform a solid anterior/posterior analysis. You will learn how to load the gastric data, draw the necessary ROIs, and review the results and images.

NOTICE

This tutorial is designed to use a particular sample patient that works well to illustrate certain features of the software. Nothing prevents you from substituting your own patient, but be aware that it may not load the same way or produce similar results. If you try to load your own data and it fails because of automatching, see section “Editing Auto Matches” on page 27.

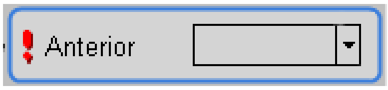
If you would like to start this tutorial over at any time, just click **Restart** in the application. This reloads the data as it does in the first workstep, as long as the default Preference has not been changed.

Setup

Loading GI data for this patient involves assigning multiple anterior and posterior images.

1. In the IntelliSpace Portal Patient Directory’s Local Devices list, select the NM Demo Data folder.
2. From the list of patients, select Patient Name **JETPack- Gastric Emptying with Normal DB** with Patient ID **Gastric (stomach)**.
3. Click on the arrow in the Analysis menu and select the NM Gastro Intestinal application.
4. If the Preferences Data Manager is not open, open it now and select the Solid Ant + Post Preference by clicking on its **Apply Preference** icon (💡).
5. Notice that the Solid bucket has a red exclamation point. This indicates that it requires data.

6. Open the bucket by clicking on the double down arrows and notice that the Anterior and Posterior buckets are also empty.
7. Click on the Anterior bucket dropdown list:



   This brings up a list of available images. In this application, you can use the checkboxes to specify multiple images to be bucketed.

8. In the image list, check all the anterior images (6 of them) and click on the bucket to hide the list.
9. Select all the posterior images for the Posterior bucket similarly.

10. Click the Next Workstep button to proceed to the Define Regions workstep.

Define Regions

When the workstep loads, you can see that the Next Workstep button is grayed out:

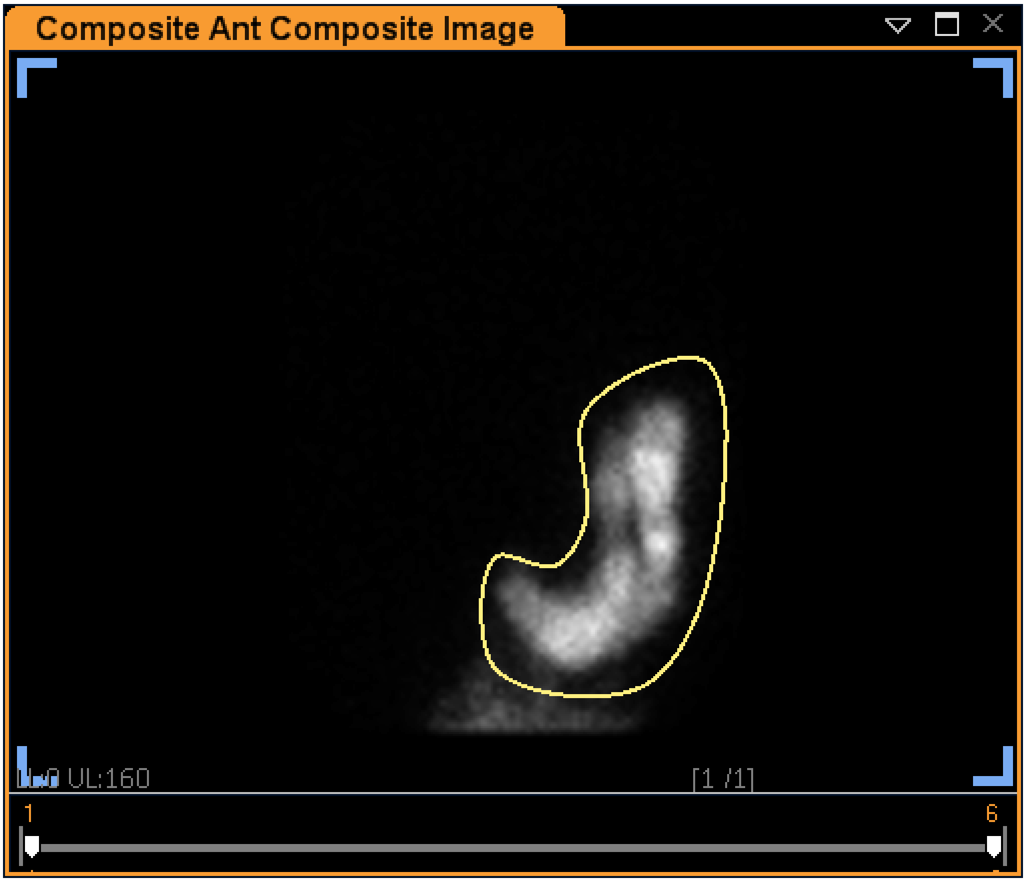
This indicates that a requirement for the workstep has not been met. Different applications may have different requirements: drawing certain ROIs, setting parameters, etc. When all requirements have been met, the button becomes available.

This application provides a composite image of the data so you can be sure to enclose all the pixels in all the images at once. The composite viewer includes a slider at the bottom so you can exclude some of the beginning or ending frames. It also displays a cine so you can refer to the whole sequence of images if necessary.

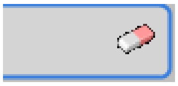
In the steps below, you are instructed to draw an ROI incorrectly. This is intentional, as it also illustrates how to recover from such a mistake

1. Adjust the slider at the bottom of the anterior composite viewer so only frames 1-3 are used in the composite by dragging the right-hand slider to the left.

2. Following the instruction at the top of the anterior composite image window to draw the anterior stomach, use the pencil to draw an approximate ROI (you will draw a more precise one later). When you reach the last point, double-click to end the drawing. Here is an example of an approximate ROI:



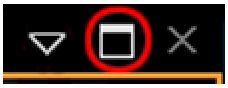
Notice that the Anterior Draw Region icon is now an eraser:



3. Click the eraser to delete the ROI.

   The eraser changes back to a pencil, indicating that you can redraw the ROI.

4. Click the viewer's Maximize button.



   This allows you to use a larger window if that is useful. If not, click the button again to restore the default view.

5. Now draw the ROI more correctly, using whatever conventions apply in your situation.
6. Hover the cursor over the ROI line and notice that the control points are indicated by boxes.
7. Drag the control points to edit the ROI so it is exactly correct, however you define that. (Remember, if you need to redraw the whole ROI, click the region's eraser.)

8. If you have not restored the viewer to the default view, do that now by clicking on the Restore icon (formerly Maximize).
9. Now follow the instruction in the posterior image to draw that ROI similarly.
10. Notice that the Next Workstep button is now available. This indicates that there are no more ROIs to be drawn.

11. Advance to the next workstep by clicking the Next Workstep button.

NOTICE

If Solid Liquid Side by Side is the selected preference, the single isotope selected will be applicable for both solid and liquid. Make sure that the correct isotope is selected, as this will be applicable for both methods.

Review Results

In this workstep, you can review the quantification results. For a list of the results displayed, see the “Results” section later in this chapter. You can also save the page as a Secondary Capture (as you can in any workstep). Secondary Captures can be either single-frame or multi-frame. Multi-frame allows you to embed a cine.

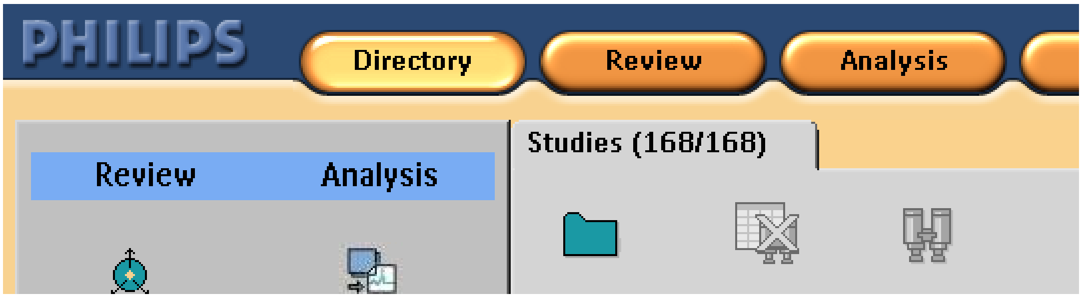
After reviewing the results, notice that the green and red timing markers in the Residual curve viewer are positioned at the max and min values. For other datasets, you may wish to adjust the fit curve by dragging the markers.

If you do move the markers, review the adjusted results in the results viewer.

Now create a Secondary Capture:

1. If it is not already selected, click the Scroll button () and drag upward in the cine viewer to scroll to the first frame. The frame number is displayed in the lower right of the viewer.
2. In the Image Tools Manager, click the arrow on the **Save all images** button () and select **Secondary Capture**.
3. Type in a description for the Secondary Capture.
4. Check the **RGB** option.
5. Click **Save**.

6. Click on the orange IntelliSpace Portal **Directory** button at the top of the screen (the active button in the image below) to display the Patient Directory and notice that the saved image is listed in the Series list at the bottom, and also in the NM Images list (which is the tab next to Series).



7. Return to the application by clicking on the orange IntelliSpace Portal Analysis button at the top.
8. Advance to the next workstep by clicking the Next Workstep button.

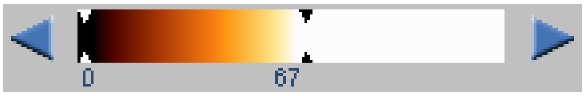
Review Images

This workstep provides multiple layouts to view the images. Click on each layout to view its contents. Layouts with a dark blue background are unavailable. You can also hide and show individual viewers:

1. Click the triangular Remove button in the upper left viewer:

   This removes the viewer from the display area.
2. From the Global Image Tools, select the **Utilities** tab.
3. Click **Show Hidden Viewers** (👁).

   This displays a list of all viewers that are currently hidden.
4. Select the hidden viewer to redisplay it.
5. Use the Image Colorbar in the Image Tools Manager to adjust the background (white bar) and brightness (black bar).
6. Right-click on the Image Colorbar to open a menu that lets you select Colormap, Intensity, and Pixel Values:



   When you are done, click **Exit** to exit to the Patient Directory. If you are prompted to save images, click **No** unless you want to save any new images.

Using Gastric Emptying

In the Setup workstep, you can load multiple dynamic or static datasets. The application will append datasets according to the time value in the DICOM header.

NOTICE

When loading anterior and posterior datasets, the bucketed data used for the analysis is determined by the preference applied. For example, when loading both Anterior and Posterior solid datasets, if the analysis preference selected is Anterior Solid, only the data within the Anterior Solid data bucket will be used for the analysis. The Posterior data will be available for review, but not be used for the results generation.

In the Review Results workstep, you can use the timing markers in the curve viewer to adjust the time range represented by the results values. Drag the timing markers to update the results.

Results

Depending on the Preference, the following results are available.

- Anterior composite image with ROIs
- Posterior composite image with ROIs
- Cine loop for Anterior with ROIs overlaid on all images
- Cine loop for Posterior with ROIs overlaid on all images
- Splash display for Anterior with ROIs
- Splash display for Posterior with ROIs
- Decay Corrected Curve (True/False)
- Time to Peak
- Time to Half
- Retention at 30, 60, 90, 120, 180, and 240 minute lag times (if data is present)
- Time Activity curve for each ROI
- Time Activity viewer containing the Fit curve and decay corrected Residual curve
- Time Activity viewer containing the decay corrected Retention and Limit curves based on Limit display value and Preference
- Limit Curves (SNM/User) (if Limit Display parameter is not set to None)
- Study Time to Half

NOTICE

If you have loaded geometric mean data, the Residual curve is actually the geometric mean curve.

If you do not see all the result images in the Review Results workstep, it may be that one or more viewers are hidden. If you suspect this, try using the Show Hidden Viewers tool in the Utilities Data Manager. See section “Review Results Workstep” on page 27 for details.

Preferences

To change the Preferences for this application:

1. Select the **Preferences** Data Manager.
2. Click **Open Preference Editor** at the bottom of the Preferences section (the second icon: 📝).
3. Make changes in the preferences window using the information in the table below.

See section “Creating and Editing Preferences” on page 59 for details on editing Preferences.

You can save these parameters for this application:

Parameter	Default	Description
Review Compress Factor	0	The factor by which the total number of frames is to be divided. The compressed data will contain the number of frames equal to the result of the division.
Smooth Curve	False	This determines whether the Residual Curve is smoothed.
Decay Correction	True	This determines whether the Residual Curve is decay corrected.
Results	Retention and T-1/2	This determines the results and corresponding curves to be displayed on the Review Results workstep: T1/2, Retention, Emptying, Retention and T1/2 or Emptying and T1/2. **Note**: In case of emptying, only the table values will be changed to display emptying results (retention value subtracted from 100). All existing retention calculations will be performed.

Parameter	Default	Description
Show Actual Times	False	Shows the values at the actual acquisition times instead of interpolated values.
Limit Display	None	This determines whether to use a Limit curve (“None”), and what values to use: “SNM” uses the SNM values in the table below; “User Defined” allows you to set your own values.
Curves Smoothing Factor	12	

SNM normal values:

Time Point (min.)	Lower limit for gastric retention	Upper limit for gastric retention
30	70%	
60	30%	90%
120		60%
180		30%
240		10%

Review Layouts

Below are the layouts in the Review workstep:

- Gastro Intestinal Dynamic Review
- Gastro Intestinal Splash
- Gastro Intestinal Static Review
- SC Images
- Custom Display