10 Endocrine

This application allows you to process and review thyroid and parathyroid imaging studies. Using this application, you can display and analyze both dual isotope (Tc-Tl) and delayed Mibi parathyroid studies, as well as thyroid studies, including calculation of differential uptakes. It has these methods:

- Parathyroid Subtraction: This subtracts the technetium image from the normalized thallium image and displays a subtracted image.
- Parathyroid Dual-Phase: This method allows you to compare the phases in dual-phase data. It is for display only, and has no ROIs or results.
- Thyroid: Thyroid uptake is calculated in the total area in up to six regions of interest. Full and Empty Syringe data from a gamma-camera image or Dose Calibrator input are used. The size of the thyroid is calculated in cm^2, weight in grams, and volume in cm^3.

The methods are used to create these Preferences:

- Thyroid + Marker
- Thyroid
- Parathyroid Subtraction
- Parathyroid Dual-Phase

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.*

Endocrine Tutorial

In this tutorial you will learn how to perform a thyroid analysis. You will learn how to load the thyroid 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

1. In the IntelliSpace Portal Patient Directory’s Local Devices list, select the NM Demo Data folder.

3000063441 81_A/881 * 2021-02-28

Philips

2. From the list of patients, select Thyroid Uptake.

   From the list of patients, select Patient Name **NM Endocrine** with Patient ID **Thyroid measure**.

3. Click on the arrow in the Analysis menu and select the NM Endocrine application.
4. If the Preferences Data Manager is not open, open it now and select the Thyroid Preference by clicking on its **Apply Preference** icon ( ).

   The patient data automatches with the Preference by default, so you do not need to load data into buckets individually. When this happens, the application proceeds directly to the next workstep (Define Regions) automatically.

   If you wanted to load different data, you would have to go back to the Setup workstep. By way of example, we will do that next.

5. Click the Previous Workstep button to go back to the Setup workstep
6. Open the Thyroid bucket by clicking on the double down arrows.
7. Click on the **Uptake** dropdown list.
8. Scroll down to the bottom of the image list and select **Clear Bucket**.
9. Notice that both the Thyroid and Uptake buckets have a red exclamation point. This indicates that they require data.
10. Click on the Uptake dropdown list again and select ANT.

    This clears the exclamation point and allows you to proceed to the next workstep.

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

Define Regions

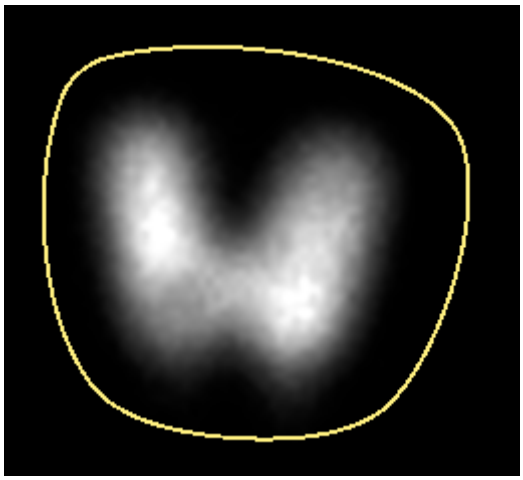
When the workstep loads, you can see that the Next Workstep button is grayed out:

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.

3000063441 81_A/881 * 2021-02-28

Philips

1. Following the instruction at the top of the Thyroid viewer to draw the Thyroid, 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 Thyroid Draw Region icon is now an eraser:

2. Click the eraser to delete the ROI.

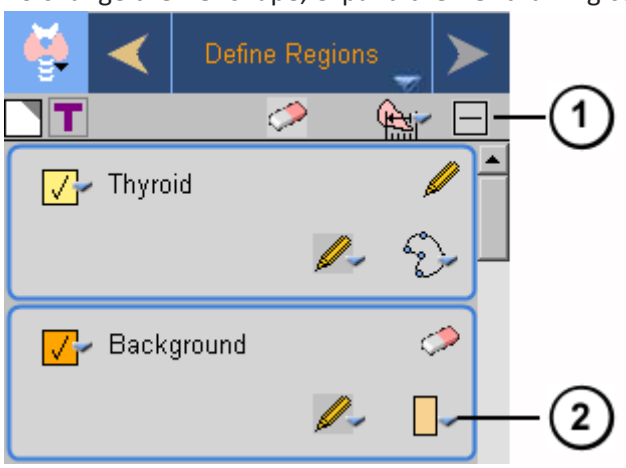
   The eraser changes back to a pencil, indicating that you can redraw the ROI.

3. 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.

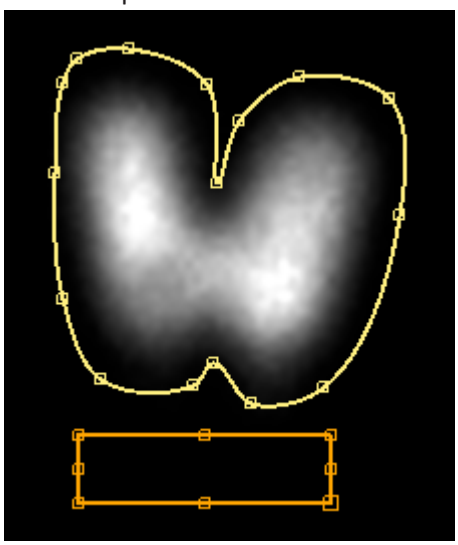
4. Notice the instruction to draw a Background ROI. We will use a box shape for the background ROI.

5. To change the ROI shape, expand the ROI drawing controls (#1 below).



3000006344181_A/881 * 2021-02-28

6. Select **Box** from the Background ROI Shape menu (#2 above).
7. Draw a box background ROI.
8. Hover the cursor over the Thyroid ROI line and notice that the control points are indicated by boxes.
9. Drag the control points to edit the ROIs so they are exactly correct, however you define that. (Remember, if you need to redraw the whole ROI, click the region's eraser.) Here is one example of the ROIs:



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.

Review Results

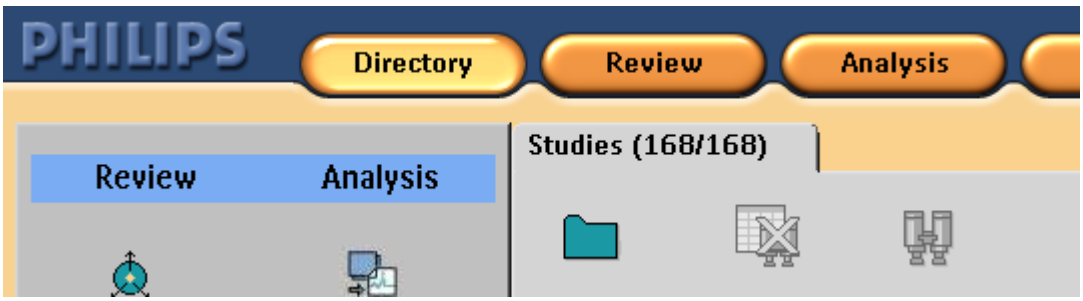
In this workstep, you can review the quantification results. For a list of the results displayed, see the "Results" section later in this chapter. You can also save the page as a Secondary Capture (as you can in any workstep). Secondary Captures can be either single-frame or multi-frame. Multi-frame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

Now create a Secondary Capture of the results:

1. In the Image Tools Manager, click the arrow on the **Save all images** button () and select **Secondary Capture**.
2. Type in a description for the Secondary Capture.
3. Check the **RGB** option.
4. Click **Save**.

3000063441 81_A/881 * 2021-02-28

5. 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.



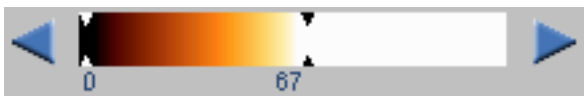
6. Return to the application by clicking on the orange IntelliSpace Portal **Analysis** button at the top.
7. Advance to the next workstep by clicking the Next Workstep button.

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 to remove the viewer from the display area.

2. From the Global Image Tools, select the **Utilities** tab.
3. Click **Show Hidden Viewers** () to list currently hidden viewers.
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.

Thyroid

Thyroid uptake is calculated in the total area in up to six regions of interest. Full and Empty Syringe data from gamma-camera image or Dose Calibrator input are taken. Size of the Thyroid is calculated in cm^2, weight in grams and Volume in cm^3.

Using Thyroid

In the Define Regions workstep, you may need to provide values for the Select Radionuclide parameter in the Inputs viewer. Additionally, if the Full or Empty syringe images are not present, you may need to provide the following parameters, which are used in the calculation of thyroid's percent uptake:

- Full Activity (MBq or MCi)
- Empty Activity (MBq or MCi)
- Calibration Factor (cpm/KBq or MCi)
- Full Measurement Time (M/d/yyyy h:mm:ss tt)
- Empty Measurement Time (M/d/yyyy h:mm:ss tt)
- Thyroid Measurement Time (M/d/yyyy h:mm:ss tt)

Calibration Factor: If Syringe or capsule data is used from a Dose Calibrator, a calibration factor must be determined to establish the relation between counts per minute and kiloBequerels (or microCuries). The calibration factor is determined using a known amount of activity in MBq (e.g. 37MBq or 1 mCi).

NOTICE

By default, the IntelliSpace Portal system is set to use Bq. To change to Ci, open the IntelliSpace Preferences and change it in the Viewing preferences in the PET preferences. If you use mCi, convert uCi for kBq in this example.

To calculate the Calibration Factor:

1. Assay the capsule (or syringe) in a dose calibrator and record the result.
2. Acquire a static image of the capsule in a thyroid phantom using the same collimator and distance from the collimator as that used for a patient.
3. Load the capsule image in the NM Viewer application by selecting it and clicking **NM Application Suite** in the IntelliSpace Portal Review panel.
4. Select a tool from the **Measure** list (right-click on the image or go to the Utilities manager).
5. Draw a tight ROI around the capsule.
6. Right-click on the ROI and select **Total Value** from the menu.
7. Note the number displayed for the ROI and convert it to counts per minute.
8. Divide the counts per minute by activity as expressed in kiloBequerels or microCuries (e.g. 37000 kBq or 1000 uCi) to obtain the calibration factor in cpm/kBq or cpm/uCi.

NOTICE

The calibration factor must be determined again if different collimators are used or when the gamma camera has been tuned.

300006344181_A/881 * 2021-02-28

Philips

If you are using capsule or syringe images you must preprocess the images to get accurate results:

1. In the Setup workstep of the NM Endocrine application, select the Full Syringe image tab.
2. Right click on the image and select **Measurements**.
3. Select a tool that allows you to draw a tight ROI.

NOTICE

You do not want to draw the region right on top of the displayed activity. You should allow some space between the edge of the ROI and the activity.

4. Draw the region. When the region is completed, right click on it and select **Mask out**.

   A dialog box displays to name the masked image.
5. Confirm or modify the image name and click **OK**.

   The masked image is displayed and automatically bucketed for use as the full syringe image.
6. Repeat the steps for other images as needed. After masking is completed, continue with the processing workflow.

Results

- Thyroid image with ROIs
- Counts (in the thyroid region and any optional regions)
- Number of Pixels (in the thyroid region and any optional regions)
- Uptake (%) (in the thyroid region and any optional regions)
- Thyroid Area
- Thyroid Weight
- Thyroid volume (cm^3)

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

Parathyroid Subtraction

The Subtraction method subtracts the thyroid image from the normalized parathyroid image and displays a subtracted image. You can use Mibi and delayed Mibi or Tl and Tc images.

3000063441 81_A/881 * 2021-02-28

Using Parathyroid Subtraction

In the Define Regions workstep, you are required to draw a background region first, and then the thyroid region. Usually the order is reversed, but for this application, drawing the background first allows the software to create a background-subtracted image so that the organ is better defined. This means that you can draw a more accurate ROI for the thyroid.

If the two images are not aligned and motion correction is required, draw the ROIs as usual on the Thyroid image. Then drag and adjust the ROI on the Parathyroid image so the ROI is correctly positioned around the organ. This will align the images before subtraction.

Subtraction Results

- The Thyroid and Parathyroid images side-by-side with the defined region overlaid on both images; each image also displays the total count at the bottom
- The subtracted image; use the bar at the bottom to set the Subtraction Factor (range = 0 - 3)
- 8 subtracted images with subtraction factors of 3.0F, 2.0F, 1.5F, 1.0F, 0.9F, 0.8F, 0.7F, 0.6F

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.

Review Layouts

Below are the layouts in the Review workstep:

- Parathyroid Side by Side
- Parathyroid Static Review
- Thyroid Static Review
- SC images

300006344181_A/881 * 2021-02-28

Philips