15 Hybrid Calibration

The Hybrid Calibration tool allows you to perform four calibrations:

- Alignment Calibration
- CT Calibration
- PSF/LSF
- XCT QA

Using Alignment Calibration

The image alignment Calibration generates a correction matrix representing static offsets between the CT and NM image volumes. The image alignment QA checks the registration between the CT and NM image volumes when the correction offsets are applied. The same acquisition protocol and processing tools are used for both Calibration and QA.

NOTICE

You must perform image alignment calibration after NM image calibrations, COR calibration, or after CT calibrations. Perform an alignment QA after XCT detector or XCT calibrations.

NOTICE

This procedure uses six Gd-153 sources.

You will need the CT and NM images generated from the Alignment QA acquisition protocol to utilize this tool. Please reference your camera's Users Manual for performing the acquisition.

Processing Protocol

1. Launch the Patient Browser.
2. Select the CT volume image and the projection image from the list.
3. In the Analysis window in the upper left corner of the screen, click the arrow and then select the Hybrid Calibration icon from the grid.
4. Click Alignment Calibration.

300006344181_A/881 * 2021-02-28

NOTICE

The first time you perform alignment calibration, you are establishing a baseline. If the alignment calibration fails in subsequent attempts and reports an error that the alignment parameters exceed the baseline limits, contact Customer Support at 1-800-722-9377 (US and Canada) or your local distributor for assistance.

5. In the Pictorial Index, click the CT image and then Ctrl-click to select the NM projection data.
6. Click **Proceed**.

   The data loads into memory, and reconstruction and alignment QA take place. The QA Status Dialog Box appears.

   If alignment calibration has already been performed, the software applies the correction values and assesses the effectiveness of the calibration (run in a QA mode).

   If alignment calibration values have not been saved to the camera, a dialogue that allows saving of correction values appears.

   - If the threshold is ≤ 4 mm or ≤ ½ the NM pixel size (whichever is greater), no recalibration is necessary.
   - If the threshold is between 4 mm and 15 mm or > ½ the SPECT pixel size, click **Proceed with Calibration**.
   - If the threshold is ≥ 15 mm, the calibration fails. Click **Proceed** to retry the calibration.

NOTICE

If the system meets the acceptance criteria, you can click Cancel to end the QA. If not, click Proceed to continue calibration.

NOTICE

If the system does meet the acceptance criteria, you can still click Proceed if you want a new calibration.

7. After you save a calibration file, repeat this procedure to make sure that the QA is acceptable.

Using CT Calibration

The CT Calibration utility is provided to generate the calibration lookup table file for separate CT systems you want to use for attenuation correction, for example when the hybrid imaging is performed on separate SPECT and CT systems. When performing CTAC processing on IntelliSpace Portal, a calibration lookup table file is used to convert Hounsfield units to a SPECT

300006344181_A/881 * 2021-02-28

attenuation coefficient. This calibration file is specific for the CT system being used to acquire the images for attenuation correction. If this calibration file does not exist for the specific CT model and acquisition parameters used on the patient data, you will not be able to perform Attenuation Correction using the CT within AutoSPECT Pro.

The calibration requires a Philips-designed solid phantom consisting of water-equivalent material (material that has the same density and photon attenuation characteristics as water over a wide energy range) with an inner core of bone-equivalent material. The phantom is available as a option for purchase for IntelliSpace Portal.

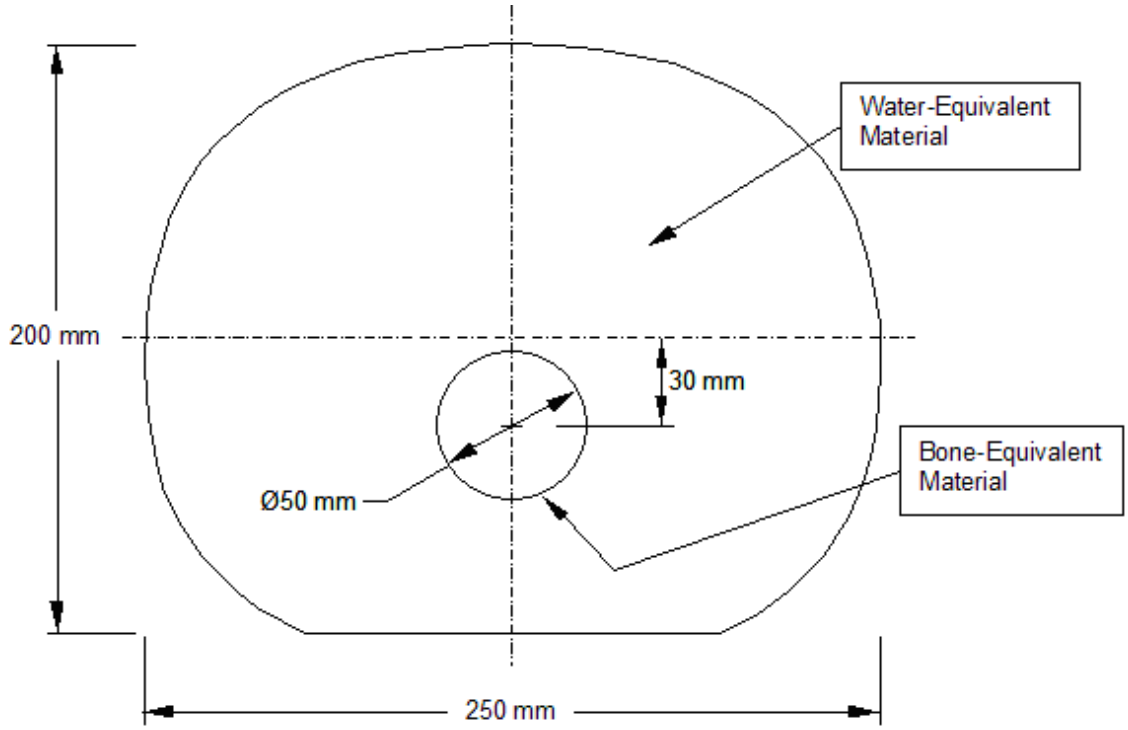

Fig. 51: Cross section of the CTAC phantom

The calibration should be done when the CT system is in good working order, (following successful completion of daily or monthly QC procedures for your CT system, for example).

CAUTION

Failure to perform CTAC calibration upon installation or after major service may result in incorrect attenuation values, which may in turn lead to misdiagnosis.

Important

You must perform this calibration for each CT system that you are planning to use for CTAC.

The CTAC calibration consists of the following general tasks:

3000006344181_A/881 * 2021-02-28

- Acquiring CT images of the phantom using each of the different kVp settings available for your system which are used for patient acquisitions. For example, if you have a Brilliance 16P CT system, you would acquire three separate phantom images at 90 kVp, 120 kVp, and 140 kVp.
- Preparing the data for processing, which includes transferring the CT images in DICOM format to your IntelliSpace Portal NM and verifying their quality.
- Processing the CT images using the CT Calibration utility within Hybrid Calibrations on your IntelliSpace Portal NM.

Processing the CT Images on the IntelliSpace Portal NM

After you have acquired acceptable datasets and transferred them to the IntelliSpace Portal NM, continue the calibration by processing the images using the following procedure.

To process the images using the CT Calibration utility within the Hybrid Calibration application:

1. On the IntelliSpace Portal NM, select the patient study which contains the CT volumes acquired using the phantom.
2. Select the Hybrid Calibration application from the IntelliSpace Portal NM Analysis Palette.
3. Select the CT Calibration application from the list.
4. Click on each of the datasets in the Pictorial Index.

   The images display in the dataset box.
5. Click Proceed.

The application runs automatically and generates and saves the calibration file on the IntelliSpace Portal NM. Successful completion is reported in a message popup, as are any error messages.

Using the PSF/LSF Tool

The Point Spread Function / Line Spread Function Tool provided within the Hybrid Calibration application is used specifically with the Philips BrightView XCT system. It is used to measure the resolution and slice thickness measurements on the system.

Resolution measurement is provided by a FWHM analysis, and performed on the 0.5mm Cu wire insert in the QA phantom.

1. Select the HiRes image from the patient directory.
2. Select Hybrid Calibration from the Analysis palette.
3. Click on PSF/LSF Tool combo button.
4. Click on the HiRes image in the Pictorial Index.
5. Scroll through the images in the display until you have a slice displayed showing the wire and ramp inserts (1 and 2 are Ramp, and 3 is Wire in figure below).

300006344181_A/881 * 2021-02-28

Philips

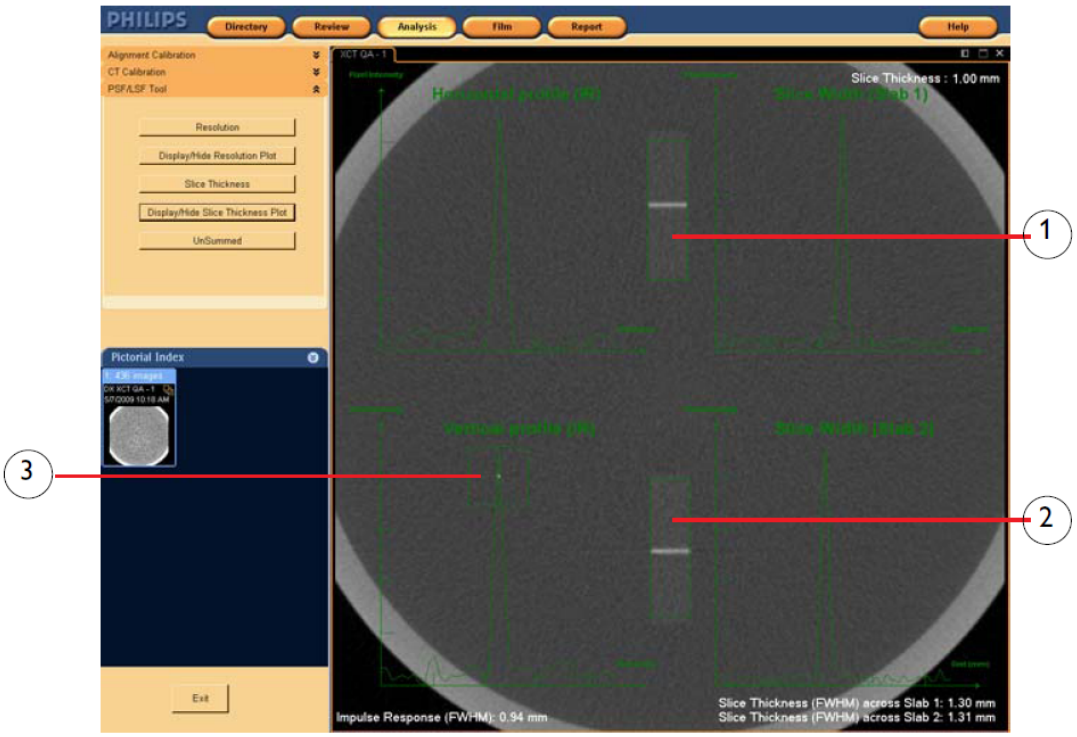

Fig. 52: XCT QA phantom HiRes image in Hybrid Calibration viewer

6. Once a slice is selected, click on Resolution.
7. A box should be displayed around the wire insert. Confirm that the wire is centered within the box. If not, readjust the box position.
8. Click Display/Hide Resolution Plot.
9. Check that the Impulse Response (radial FWHM) is < 0.75 mm.

Slice thickness measurement is provided by a FWHM analysis, and performed on the aluminum ramp images in the QA phantom in the physics layer.

The analysis can be performed on the same slice as the resolution check.

1. Click Summed.
2. Click Slice Thickness, two rectangles should be displayed surrounding the ramp inserts. Confirm that the ramps are centered within the regions. If not, readjust the box position.
3. Click Display/Hide Slice Thickness Plot.
4. Check that the slice thickness for both is 1.0 +/- 0.5mm.
5. Click Unsummed.
6. Click Slice Thickness, two rectangles should be displayed surrounding the ramp inserts. Confirm that the ramps are centered within the regions. If not, readjust the box position.
7. Click Display/Hide Slice Thickness Plot.
8. Check that the slice thickness for both is 0.8 +/- 0.3mm.

300006344181_A/881 * 2021-02-28

Using the XCT QA

The XCT QA tool is used to analyze the Daily QC images from the Philips BrightView XCT system. Refer to the *BrightView XCT Imaging System Instructions for Use* for the appropriate acquisition protocol.

To analyze the daily QC images:

1. In the Pictorial Index, select the daily image. It may take a few seconds to load.
2. If the phantom is accurately positioned, you may be able to uncheck **Manual Mode**. If you do, the correct slice for each test is selected automatically. In **Manual Mode** you must scroll to the correct slice for each test.
3. If you need to adjust the slice width, use the **Slice Width** control.
4. See the sections below for details on the tests. Click **Clear ROI's** to remove the text and ROIs from the screen before running a new test.

XCT Uniformity Results

This reports HUs for each ROI. To use this test, first scroll to the center of the water section. Then click XCT uniformity.

300006344181_A/881 * 2021-02-28

Philips

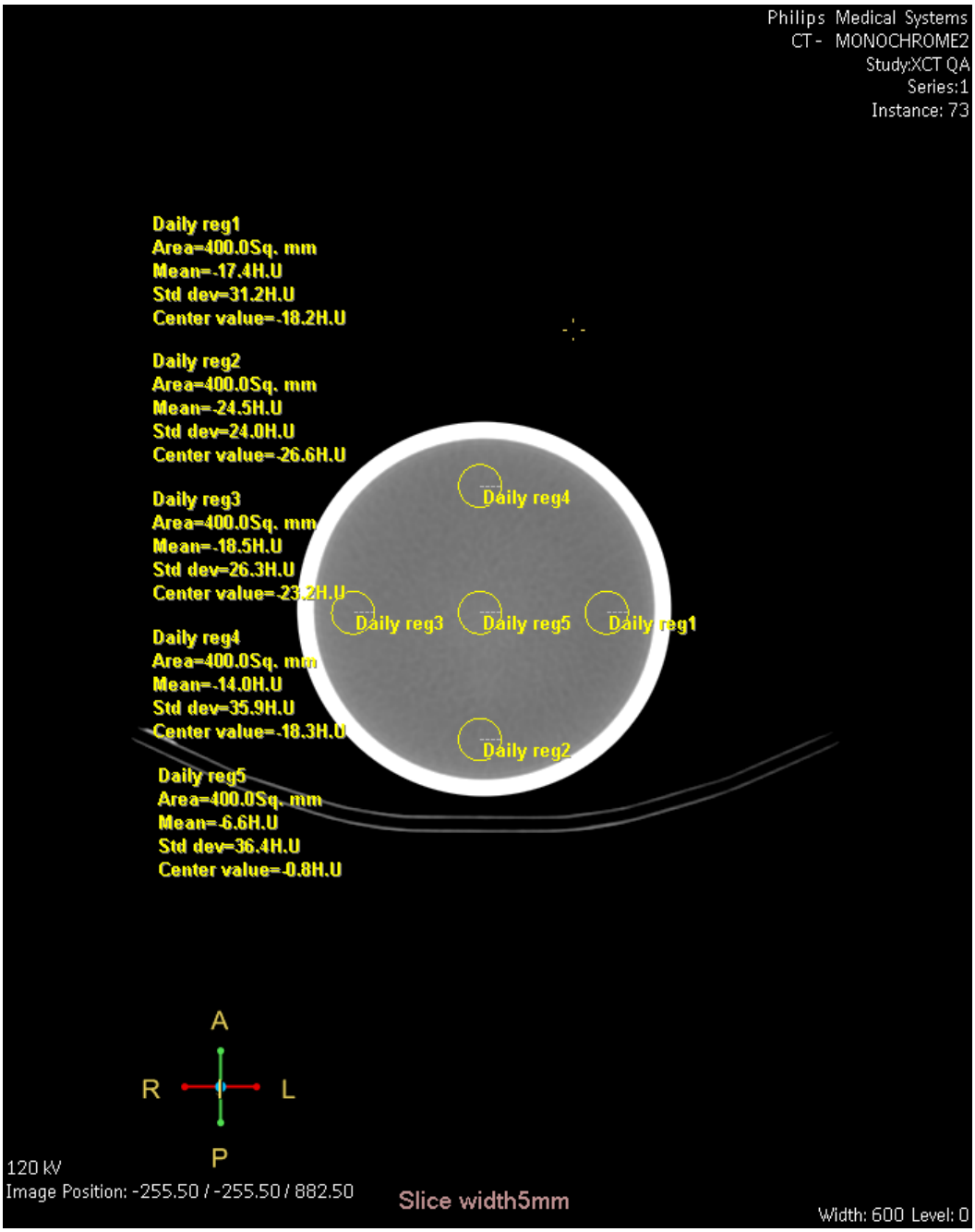

Fig. 53: Uniformity screen

Refer to the BrightView XCT Imaging System Instructions for Use for valid values and ranges.

If artifacts are detected, check that the water layer is the only portion of the phantom in the scan field, and then repeat the procedure.

If the artifacts remain, contact Customer Support at 1-800-722-9377 (US and Canada) or your local distributor for assistance.

Noise Check Results

To evaluate noise, first scroll to the center of the water section. Then click **Noise check**.

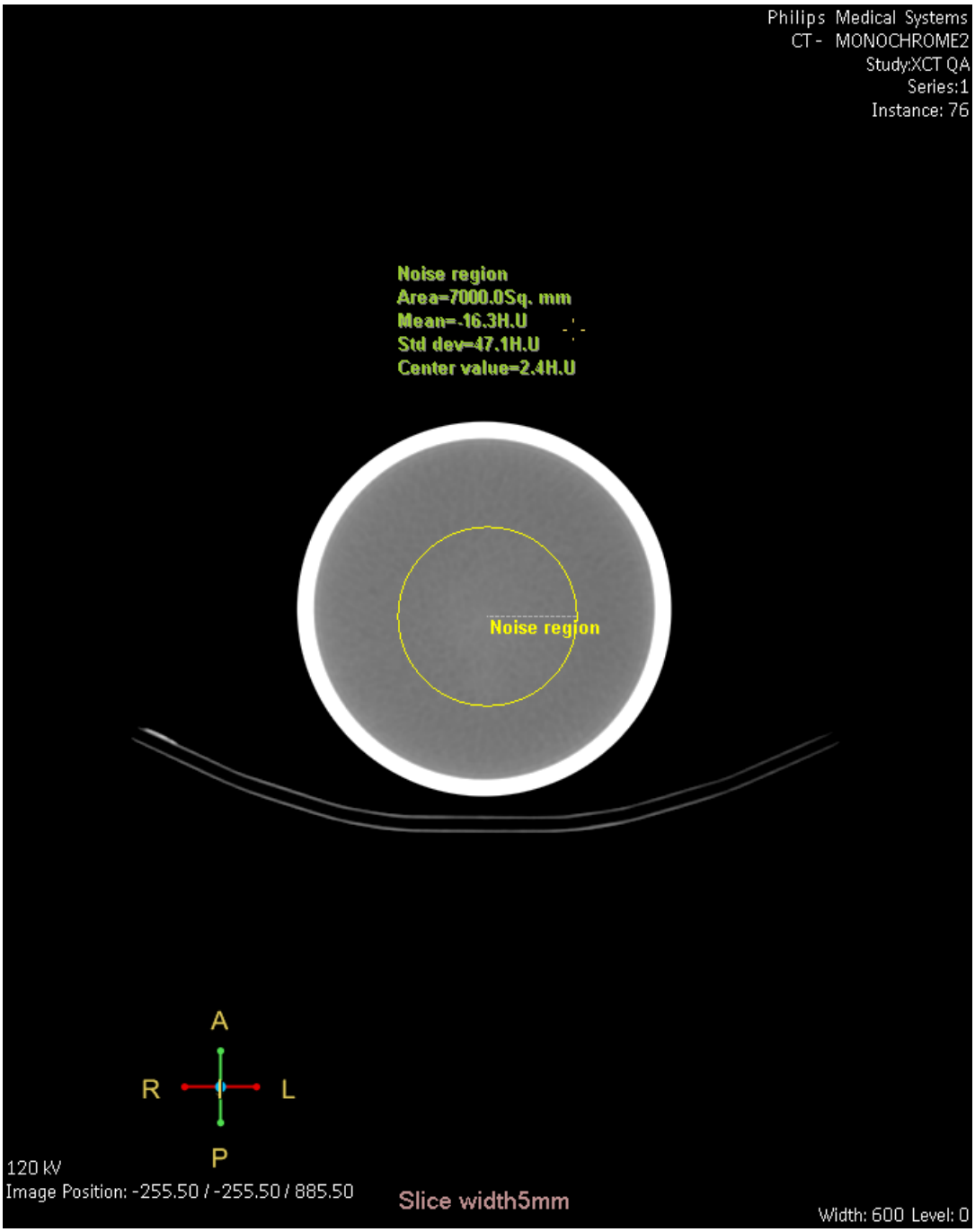

Fig. 54: Noise screen

Evaluate the results:

- AV (average) = 0 ± 40 HU
- SD (Standard Deviation) < 10

Linearity Results

To evaluate noise, scroll to the multi-pin slice. Then click **Linearity**.

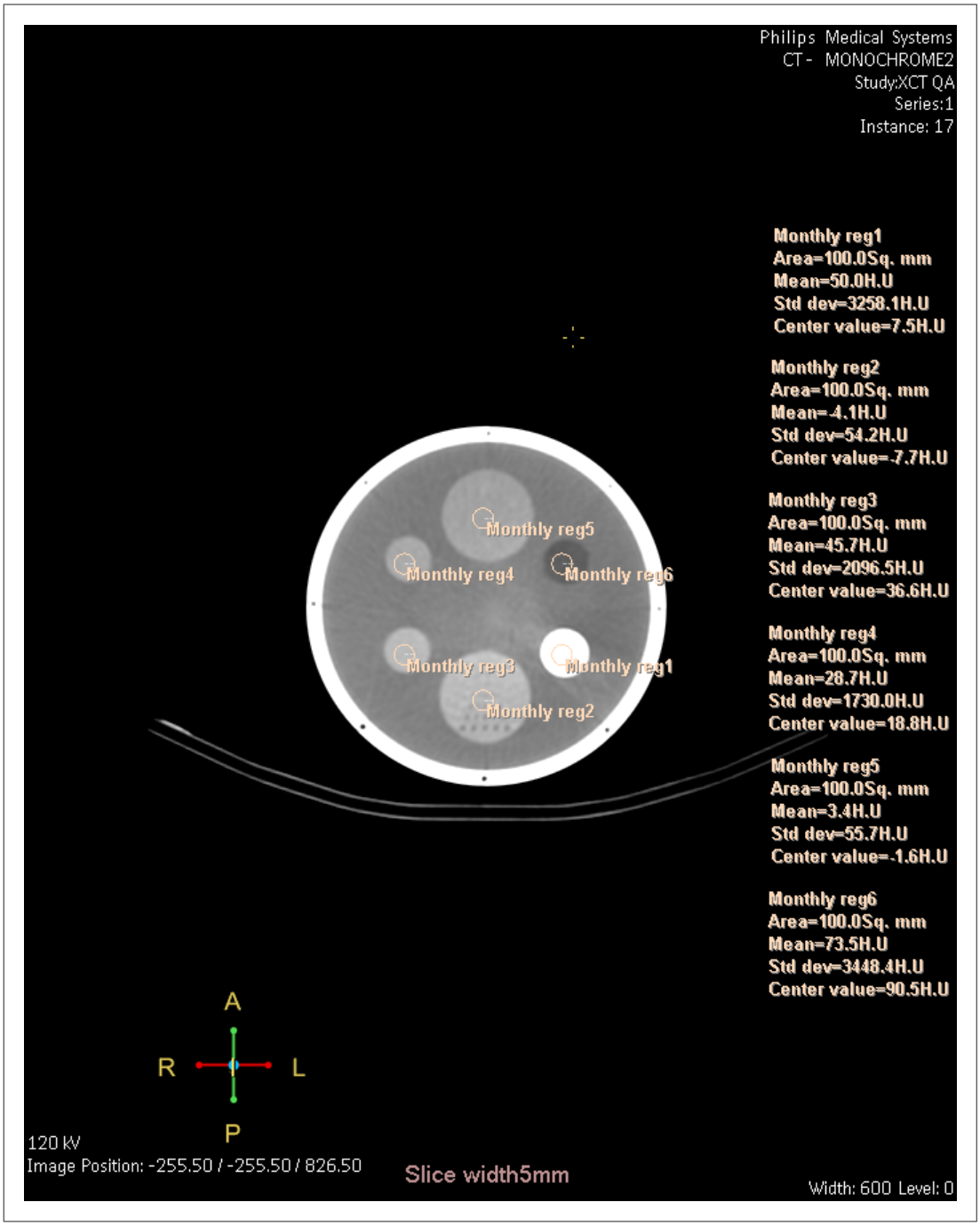

Fig. 55: Linearity screen

Use the table below to check the linearity results.

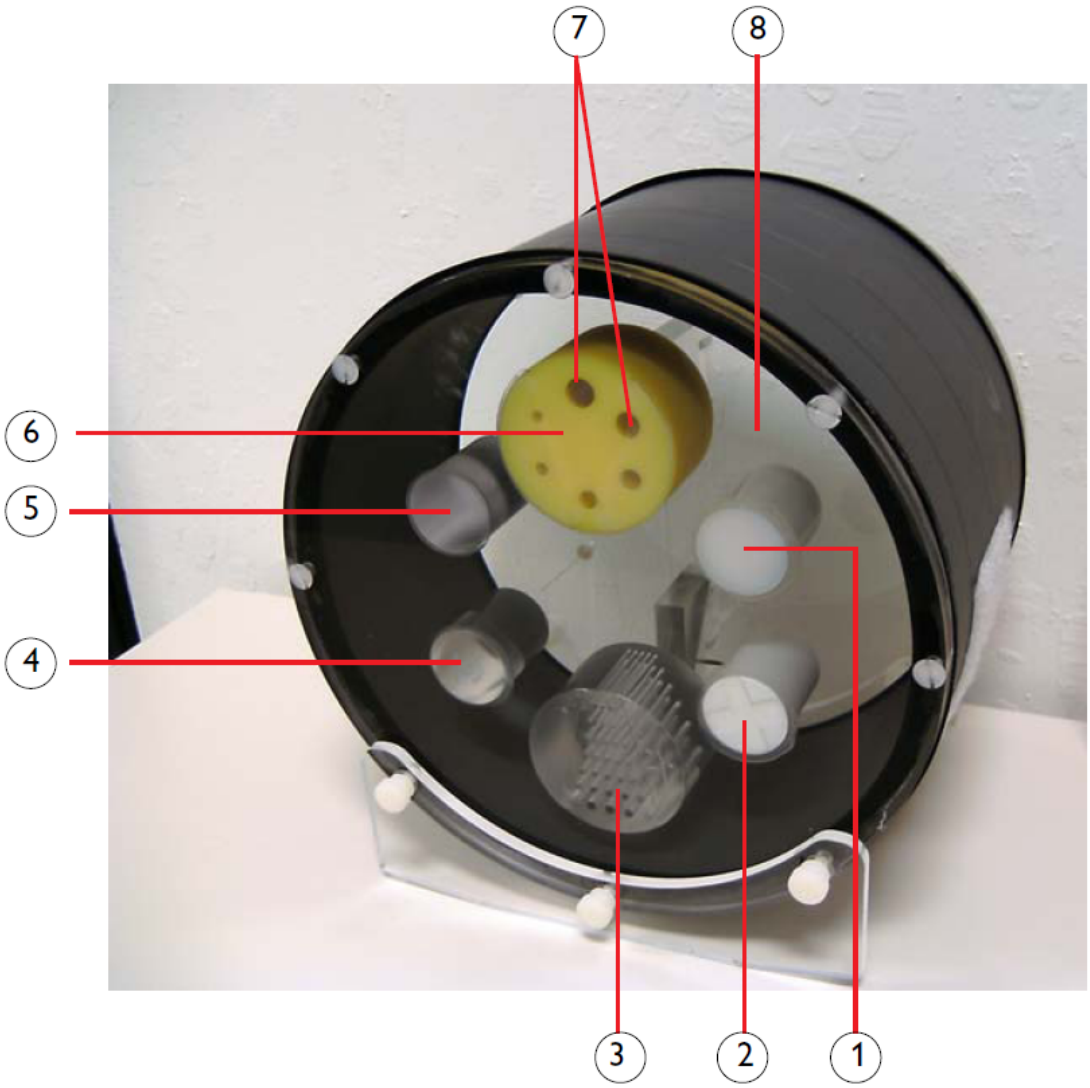

Fig. 56: XCT QA System phantom

	Phantom	Absorption (values in CT numbers)
1	Polyethylene	-70 ± 40
2	Teflon	+950 ± 75
3	Perspex (Acrylic)	N/A
4	Perspex (Acrylic)	+140 ± 40
5	Lexan	+116 ± 40
6	Nylon (Aculon)	+100 ± 40
7	Lexan pins	N/A
8	Water	0 ± 40

300006344181_A/881 * 2021-02-28

Saving Results

Use Save **current display** to save a multi-frame secondary capture of your Hybrid Calibration tool results. This displays the **Save Secondary Capture Dialog**.

Fig. 57: Save current display button

1. Use the **Save As** pull-down menu to select an image format.
   - Single-Frame Secondary Capture
   - JPEG
   - Multi-Frame Secondary Capture
   - AVI
2. Type a **Description** and choose the appropriate settings.
3. For multi-frame and AVI formats, you can check **Frame** and specify the **Start** and **End** frames, and the number of frames to **Skip**.
4. For gated formats, you can check **Bin** and specify the **Start** and **End** bins, and the number of bins to **Skip**.
5. Check **RGB** to save color images, or **Grayscale** for grayscale images.
6. Click **Save** to save the images to the IntelliSpace Portal Patient Directory.

300006344181_A/881 * 2021-02-28

Philips

300006344181_A/881 * 2021-02-28

Philips