THE UNIVERSITY OF CHICAGO MEDICAL CENTER

Department of Radiation and Cellular Oncology
CAM 1D, MC9006
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Monthly CT QA Procedure

Phantom Setup

1. Set up the Gammex CT phantom on the CT table in the stand provided, with the end marked "head" toward the gantry.
2. Turn on and zero the position of the external lasers.
3. Position the phantom so the BB's near the "foot" are aligned with the external lasers, and the "head" end of the phantom is near the gantry. There is a mark on the stand that should align with the white crosshair on the phantom, and the table height digital indicator should be about 145 on the Brilliance (XXX on the AcQSim) when the phantom is correctly positioned.

Data Acquisition

AcQSim

1. Click "New Patient"
2. For the patient information, enter:

   MRN: 0001

   Last Name: AcqsimQA

   First Name: Date and year (i.e. Jan09)
3. Click "Protocol Selection"
   - Select the phantom-shaped icon in the lower right of the gray box that has a body in it.
   - Highlight "Monthly QA Gammex" and click "Select"
4. Click "Planning", then "Confirm". This zeros the table.
5. Go into the room and move the table to -500mm.
6. Click "Orientation" and click "Confirm" again to re-zero the table.
7. Click "Plan/Edit" and highlight the plan in the top left box.
8. Click "Add Plan" three times to get 4 plans total. This corresponds to four axial slices at different positions. Set the "Start" and "End" extents to the folowing:

Scan	Start and End Positions
1	0
2	40
3	80
4	120

9. Click "Scanning/Recon"
10. Click "Start Scan". This is the scan that you will perform the "Image Quality Parameters" tests.

Brilliance Big Bore

1. Click "Start Study"
2. For the patient information, click "Anonymous Patient" and set the boxes shaded with blue appropriately.
3. Click "Protocol"
4. Select "QA", then "Monthly QA Gammex".
5. Set the "Start" parameter for each scan to the number in the name of the scan.
6. Press "Go" and follow the on screen instructions.

Image Quality Parameters

Slab 1

Contrast Scale

In slab 1, you will see 5 plugs as shown in Fig. 1. Create an ROI and place it in each plug. The ROI should be small enough so the entire ROI is well within the plug. You should get values for AV (the average CT number)" as shown below:

Plug	Nominal CT#	**Brilliance**	**AcQSim**
Polyethylene	-95 ± 15	-100 ± 15	-95 ± 15
"Bone"	955 ± 50	992 ± 50	913 ± 50
Air	-1024 ± 5	-1024 ± 2	-988 ± 5
Acrylic	120 ± 15	139 ± 15	120 ± 15
Water	0 ± 4	0 ± 4	0 ± 4

Slab 2

Low Contrast Detectability

In Slab 2 (Fig. 2), you should be able to discern the 6 mm plugs with a window/level = 100/100. You may have to squint and lean back.

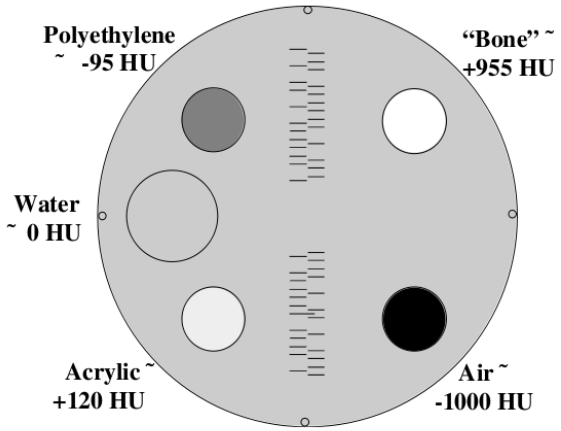

Figure 1: Slab 1 of the GAMMEX phantom.

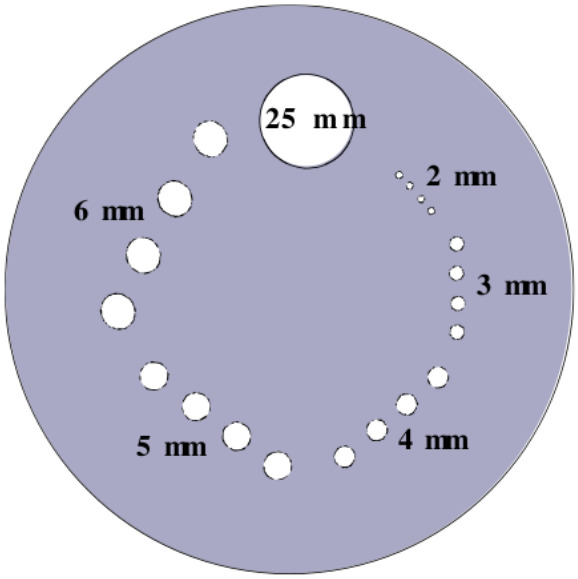

Figure 2: Slab 2 of the GAMMEX phantom.

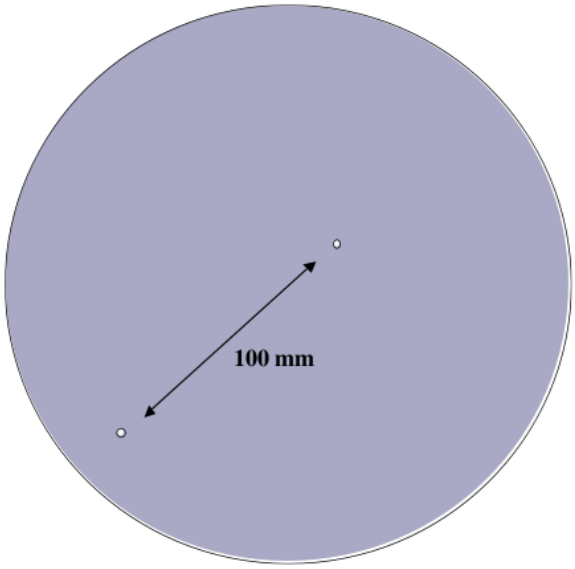

Figure 3: Slab 3 of the GAMMEX phantom.

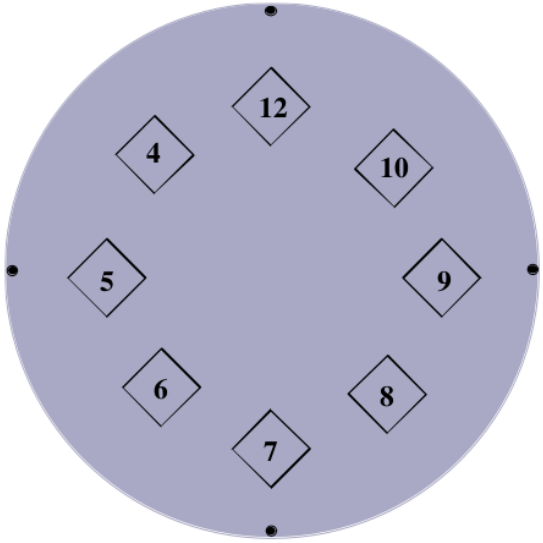

Figure 4: Slab 4 of the GAMMEX phantom.

Slab 3

Spatial Integrity

There are two BB's that are exactly 100 mm apart in Slab 3 (Fig. 3). Measure the distance between them: it should be 100 ± 1 mm.

Field Uniformity

If you are using the Brilliance Big Bore scanner, you can use the automated ROI placement tool under Graphics→Uniformity Check→Head. Record the CT# and STD Deviation for each ROI. The average CT#'s should all be 0 ± 4 and the STD deviations should be 4 ± 2 for the Big Bore, and 9 ± 5 for the AcQSim.

Slab 4

High Contrast Resolution

In Slab 4, there are several sets of wires embedded in the solid water as shown in Fig. 4. They correspond to increasing numbers of line pairs per cm. Look for the set of wires with the highest lp/cm that you can still see the individual wires. This should be greater than 8 for both scanners.

Lasers

External Laser Alignment and Accuracy

- Place the Willke phantom (Fig. 5 and its platform on the CT table and level it using a bubble level.
- Set the external lasers to 0,0,0.
- Line up the grooves on the outside of the phantom so that all the external lasers lie in the center of a groove.
- Zero the table.
- Move the table into the scanner 511 mm for the Big Bore, and 500 mm for the AcQSim. **ZERO THE TABLE AGAIN.**
- Enter Patient data as described above. Use the name like "Brilliance Feb09, Laser QA". On the AcQSim, make sure Auto-transfer to "Pinnacle" is enabled.
- **Brilliance:** Scan the phantom using the "QA → Laser QA" protocol. (Look under the "Axial scans" tab in the QA protocol section.) Use -23 and 23.5 for the start and stop positions.
- **AcQSim:** Scan the phantom using the "QA → MONTHLY QA LASER" protocol. Use -20 and 20 for the start and stop positions.
- On the resulting axial scans, place a crosshair with the origin at zero. The crosshairs should fall inside the notches in the sides and top and bottom of the phantom. This tells you that the lasers in the x and y directions are within 2mm of the center of the scan plane.

- Determine which slice the axial laser was on by finding the center of the phantom in the z-direction. Do this by scrolling through the images, and find which slices the all the notches on the sides of the phantom disappear. The middle slice in this group of slices is the center of the phantom. Record the z-coordinate of this slice (it should be within 2 mm of zero).

Laser Motion Accuracy

- With the Willke phantom still positioned on the table, transfer the scan to Pinnacle.
- Read the scan into Pinnacle.
- In Pinnacle: Under Localize, move the laser center to the BB.
- Click Absolute Localization and print out the results.
- Move the sagittal laser and the table as directed by the printout.
- Lasers should all be within 1mm of the BB.

Table

Table Incrementation

- Position the table so that the overhead lasers project onto the surface near the head of the table.
- Underneath the overhead external laser, put a piece of tape on the table. Mark the cross of the laser on the tape.
- Zero the table.
- Move the table into the scanner 300 mm, according to the digital readout on the scanner. Put another piece of tape under the lasers and mark the crosshair.
- Move another 300 mm (should read 600.0 on the digital). Another piece of tape, another mark.
- Repeat twice more (for 900.0 and 1200.0 on the digital readout).
- With a ruler, measure the distance between each of the crosshairs. They should all be 300 $\pm$ 1mm.

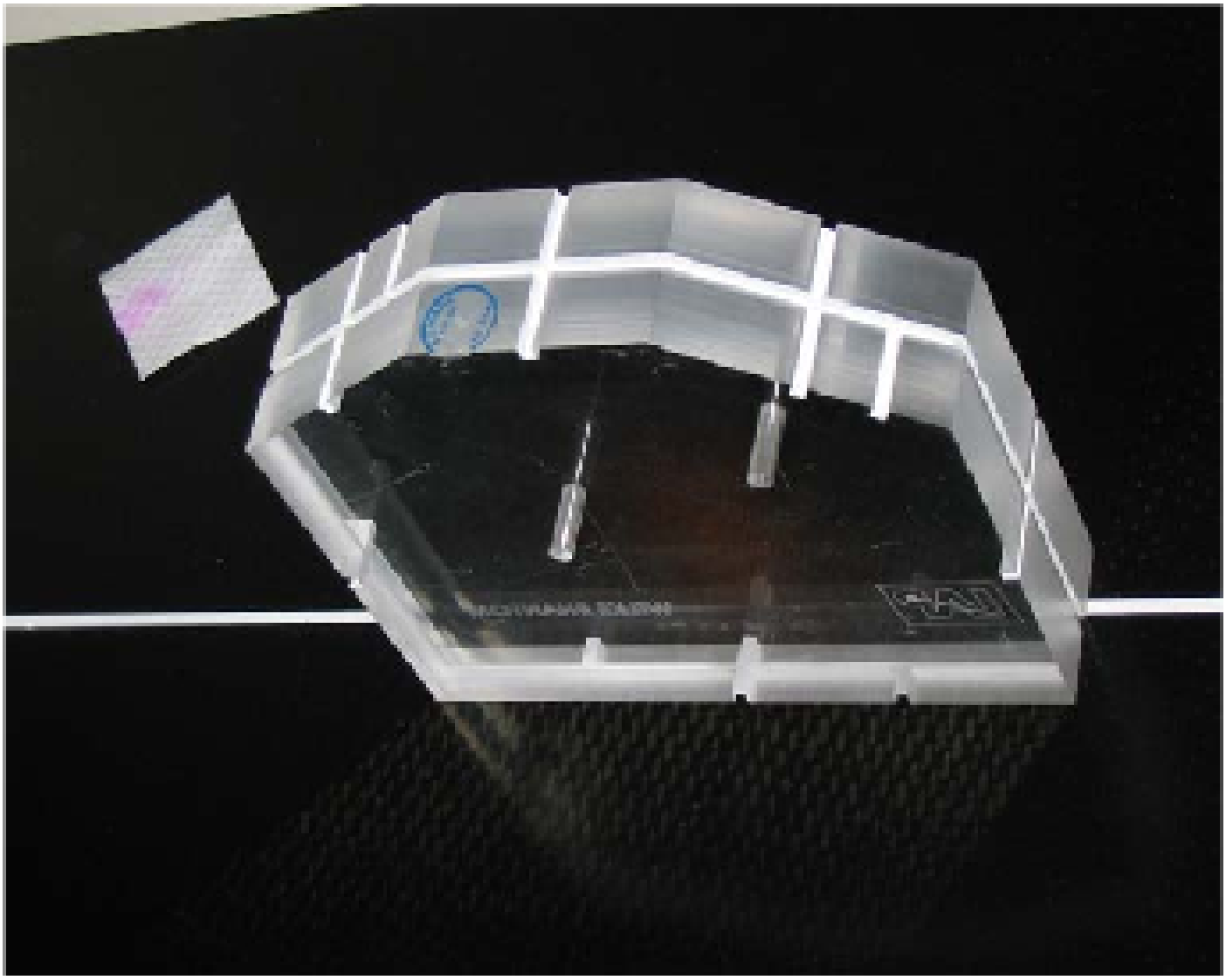

Figure 5: The Wilke phantom for laser alignment.