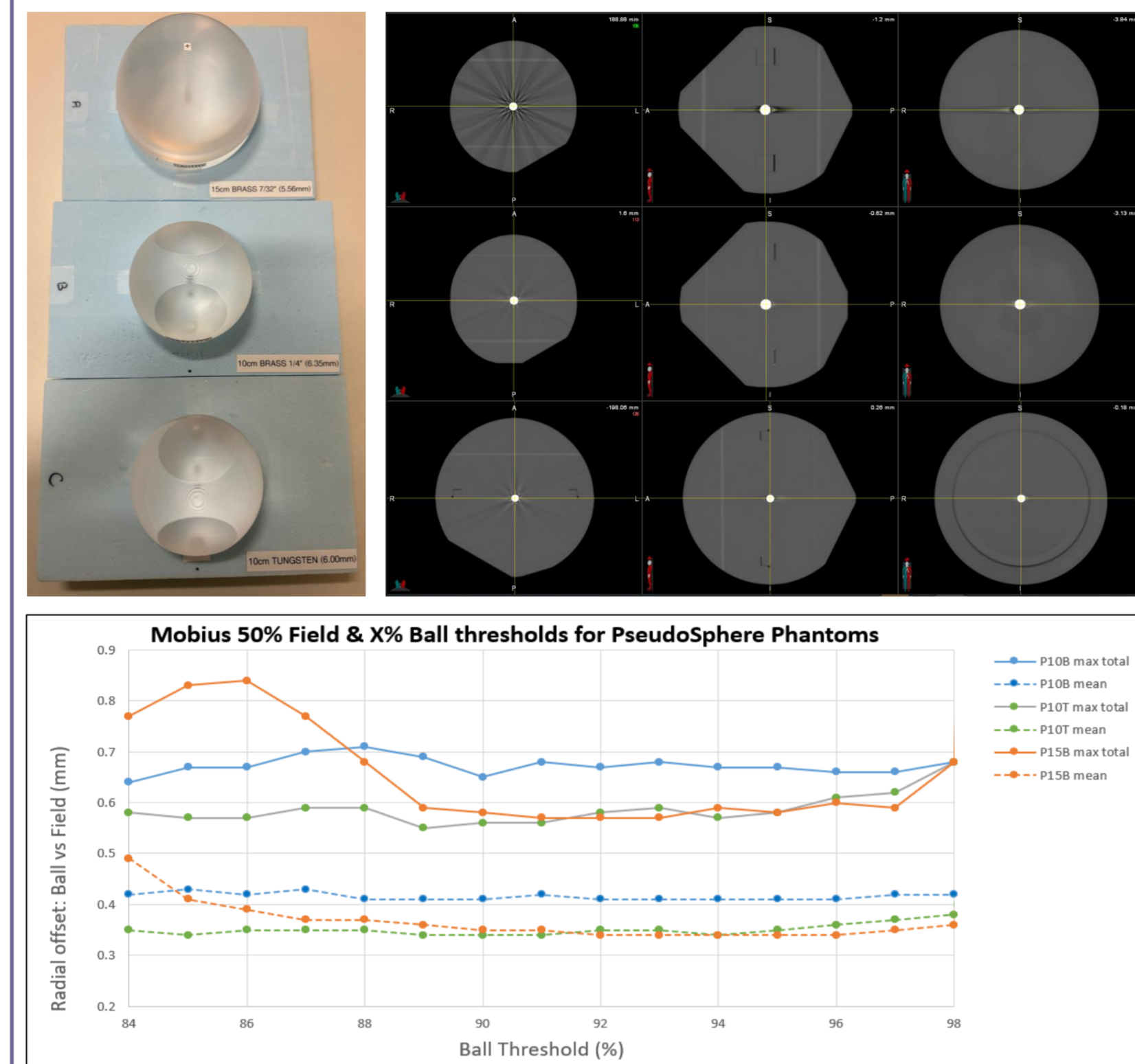
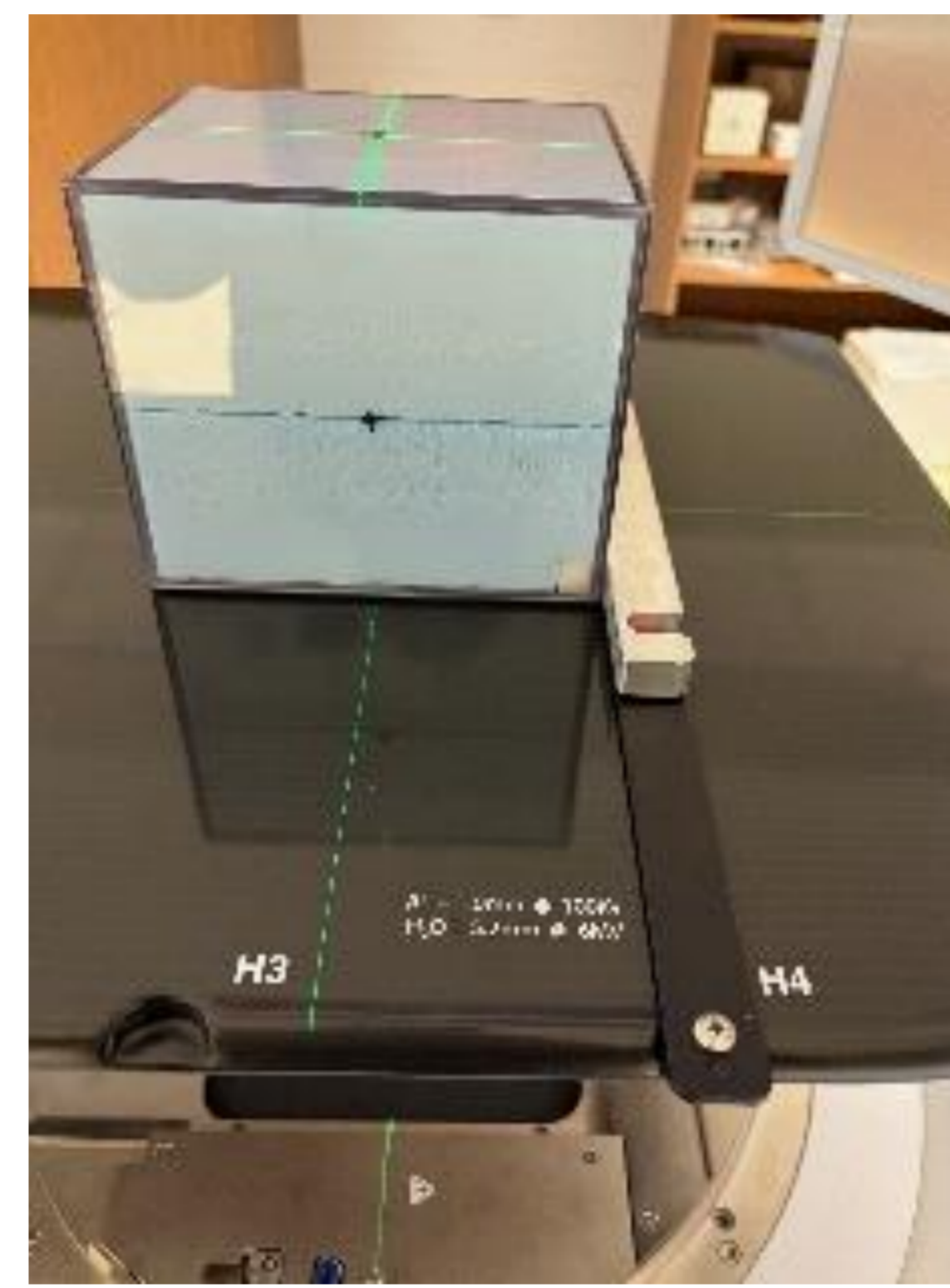


AIM

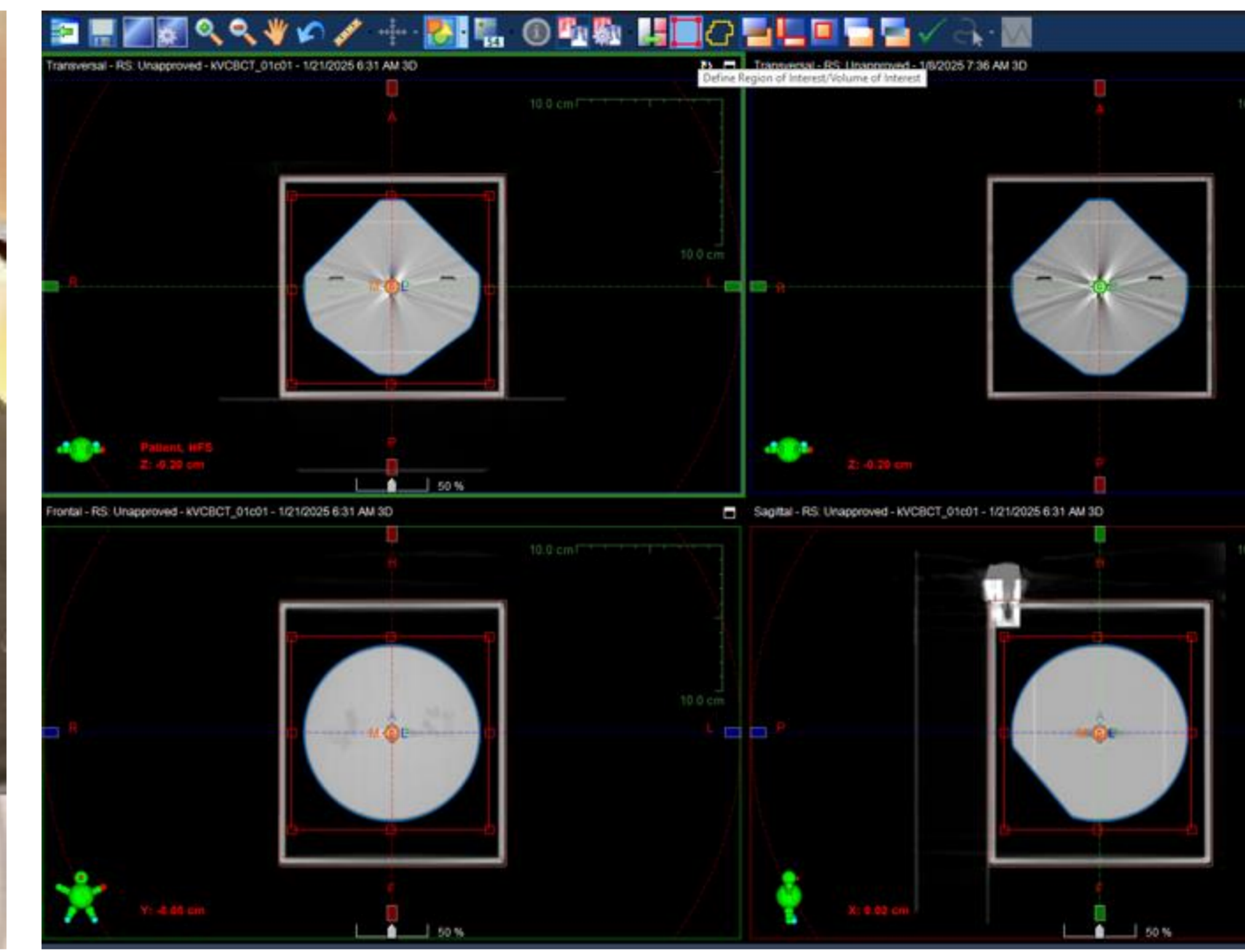
A commercial cube phantom for daily kV/MV Winston Lutz QA required 2D/2D matching with manual corrections using orthogonal image alignment for optimal agreement. We designed a phantom to enable reliable CBCT-based alignment which mimics clinical patient alignment workflows without the need for user dependent corrections.



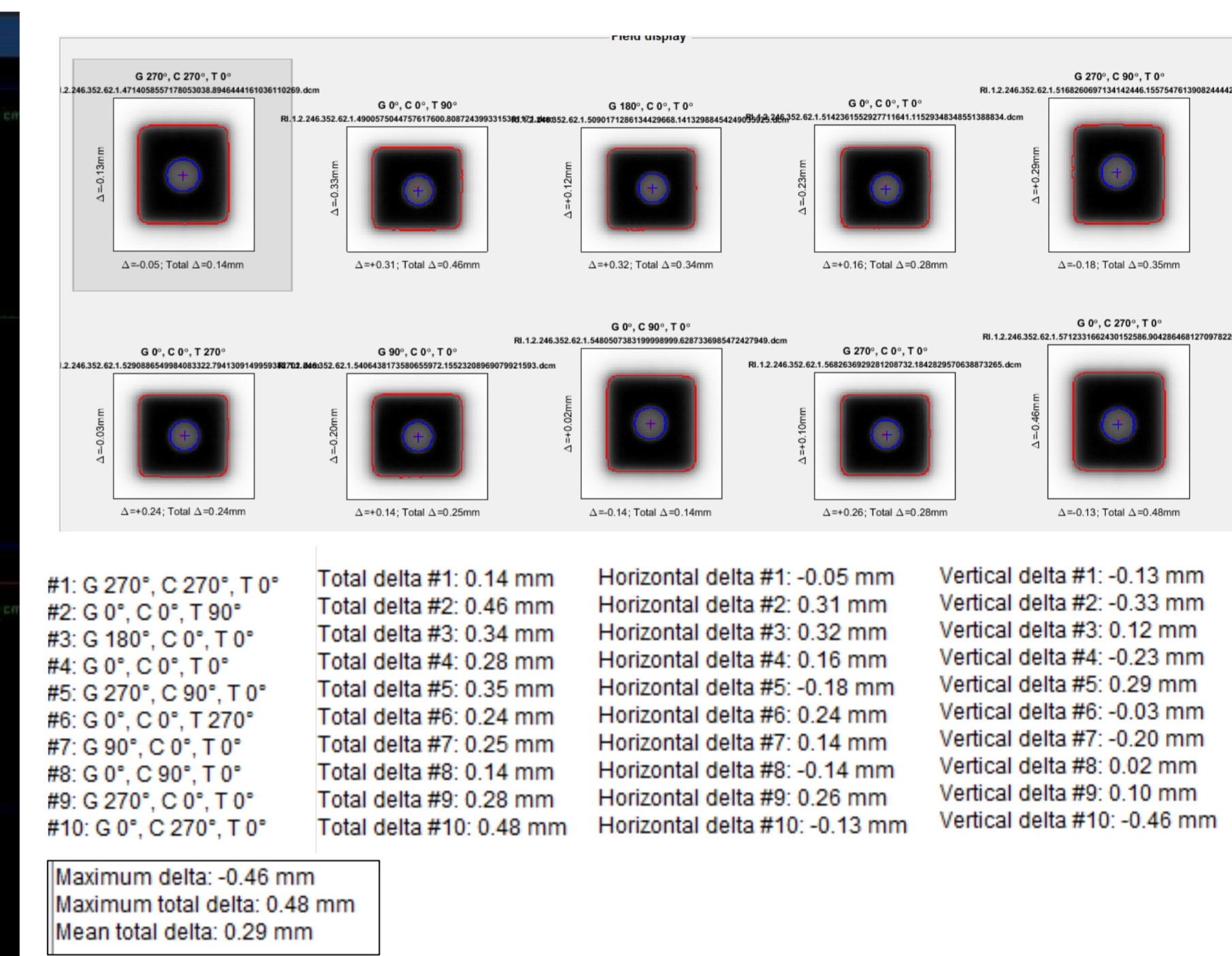
Prototype phantoms, CT scan and sample threshold analysis



Clinical phantom



Linac console registration



Typical Mobius 3D analysis result from custom clinical phantom.

METHOD

Alternate phantom shapes were designed using Solid Works and manufactured using a CNC machine. Phantoms with solid 120 and 150mm diameter pseudo-spherical acrylic cores were fabricated as two halves with multiple flat outer edges. A ball bearing target was inserted in each sphere. Targets were either Tungsten (6.00mm OD) or Brass (5.56mm or 6.35mm OD) to reduce imaging artifacts. The phantom halves were then glued together. Conformal solid Styrofoam bases were fabricated to elevate the phantoms from the couch. Each phantom was CT scanned using 0.625mm slice thicknesses. CBCT-based Winston Lutz tests were performed to assess artifacts, sensitivity to window/level thresholds using Mobius Dose Lab software.

RESULTS

Analysis of the larger phantom with the 5.6mm Brass ball was most sensitive to ball detection thresholding due to phantom attenuation. Smaller phantom results were similar with either the larger Brass or Tungsten ball targets, with the later providing slightly better visualization but more image artifacts.

CONCLUSIONS

Based on the comparison of the various phantoms, we designed a more robust version of the small phantom with tungsten target. The phantom was modified for routine clinical use by surrounding it with solid Styrofoam encapsulating in a Polycarbonate shell which is indexed to the couch for efficient workflow. A full rotation iCBCT is performed for registrations on the Linac.