AbstractID: 9184 Title: Calibration of the geometry in a stationary digital breast tomosynthesis system

Purpose: To accurately estimate the parameters those describe the geometry of a stationary digital breast tomosynthesis system, namely, the source-detector distance and the location of the focal spots.

Method and Materials: Our novel stationary tomosynthesis system consists of 25 x-ray sources *linearly* arranged to cover an angle of 48°. With a limited number of images, the tomosynthesis reconstruction becomes very sensitive to geometric alignment. It is vital that we accurately calibrate the geometry of the system with a suitable phantom. We have designed and built such a phantom that consists of two 6 mm stainless steel balls mounted on a low-density plastic base. We obtained twelve evenly spaced projection images of the phantom over 360° for each x-ray source. The motion of the two objects in a circle during data acquisition will cause their projections to trace ellipses on the detector. We calculated the centroids of the two objects in the detector plane and used these to derive the ellipse parameters. Together with the known distance between the two objects, this enabled us to analytically solve for the geometry parameters.

Results: The source-detector distance was calculated to be 69.4 ± 2 mm. The calculated distances between the sources were also in good agreement with the designed values. The parameters were used for the tomosynthesis reconstruction of a sponge phantom and the results showed improved image quality and geometric accuracy.

Conclusion: We have designed and tested a calibration phantom that can accurately estimate the geometry of a stationary tomosynthesis system. We are continuing to assess the accuracy of our method to optimize our results. Further, we are looking at ways in which to make the process more efficient by calibrating for only the central source using this phantom and estimating the locations of the other sources using a simpler secondary phantom.