AbstractID: 14025 Title: Phase-Contrast Enhancements Within Digital Tomosynthesis Images

Purpose: Phase-contrast edge enhancement uses x-ray phase shifts to enhance the visualization of boundaries between different materials. While observable in phase-contrast radiographs or in phase-contrast computed tomography images, the impact of digital tomosynthesis on this edge enhancement effect has not been studied previously. An experiment was performed to determine if phase-contrast edge enhancement is improved by using digital tomosynthesis. While this work was performed using phantoms, the ultimate goal is to improve soft-tissue lesion detectability in clinical mammography.

Materials and Methods: An unmodified, commercially available cabinet x-ray system (Faxitron LX-60) was used in this experiment. This system contains a tungsten anode x-ray tube that was operated at 24 kVp and 3 mAs for each radiographic image taken, with an effective focal spot size of about 0.010 mm. The digital detector uses CsI/CMOS with a pixel size of 0.054mm x 0.054mm. The phantom used was a 50mm long, 14mm diameter cylinder made from resin with three holes, each with a 2mm diameter, drilled into it.

The phantom was attached to a computer-controlled rotating motor and was rotated ± 25 degrees about a central position in one degree increments. At each increment, three phase-contrast radiographs were taken and then averaged to reduce the effect of noise. These images were then placed into our custom written tomosynthesis algorithm (as an ImageJ plugin) that produced a series of 56 longitudinal tomographic images reconstructed with an image offset increment of about 0.7mm.

Results: Tomographic z-plane resolution was measured to be <4.7 mm and, when compared to planar PC images, the tomosynthesis images exhibited an improvement in the edge contrast.

Conclusion: The results of this work show that one may combine digital tomosynthesis with phase-contrast edge enhancement that may be used to further improve soft-tissue conspicuity.