AbstractID: 3946 Title: Imaging properties of cone beam breast CT- effects of detector properties and imaging conditions.

Purpose: To investigates the effects of detector properties and imaging conditions on the imaging properties of cone-beam breast CT with both computer simulations and imaging experiments.

Methods and Materials: Cone beam breast CT was simulated with the breast analytically modeled as cylinder embedded spherical shape soft tissue masses and calcifications. X-ray spectrum, breast attenuation, geometric magnification, focal spot blurring, x-ray detection, detector blurring, image pixelization and digitization were all incorporated in computing the projection images. Quantum noise, system noise, detector blurring were also simulated and incorporated in the model. Image filtering and reconstruction were then performed using the Feldkamp algorithm. Simulation was performed for two flat-panel detectors, one CsI based and the other a-Se based. Images of phantoms and breast specimens were also obtained to demonstrate the ability of our experimental cone beam breast CT system to image the 3-D structures of the breast with embedded cancers and calcifications.

Results: Our simulation results shows that the a-Se detector performs slightly better at 30 and 40 kVp's while the CsI detector performs better at 50 or higher kVp's. Image SNRs are optimized at 50 and 60 kVp for the s-Se and CsI detector, respectively. Phantom images obtained with our experimental system show that with higher dose and smaller pixel size, calcifications as small as could be resolved. Images of breast specimens show excellent separation between glandular and adipose tissues. The speculated nature of the tumor masses can be clearly seen in selected projection while ambiguous in other projections or in regular mammograms. It was also found that inclusion of surgical clips (used to indicate tumor location) had caused detrimental reconstruction artifacts.

Acknowledgment: This work was supported in part by a research grant EB000117 from the NIBIB and a research grant CA104759 from the NCI.