AbstractID: 5278 Title: Computational Evaluation of Breast Geometry from Breast CT

Purpose: Estimation of breast skin thickness and breast shape using a radial-geometry segmentation algorithm on breast CT images.

Method and Materials: Forty-two breast image data sets were obtained from a prototype breast CT scanner, and were used to evaluate breast skin thickness and effective diameter. Patients were imaged at 80-kVp using x-ray tube currents (0.7 – 7.6 mA) depending on the patient's breast size. For each coronal breast image, the breast silhouette was segmented using a threshold value computed by a histogram-based iterative algorithm. Breast area was also computed from the thresholded coronal images. A 360-degree radial scan, originating at the center of mass of each breast CT image and continuing to the image edge, produced a radial profile of breast tissue intensity as a function of angle. A derivative filter was used to identify the inner and outer breast skin layers. In order to accurately estimate breast skin thickness, a tangent-finding algorithm was developed to correct the thickness measurement in non-circular breast geometries. A standard-deviation-based iterative algorithm was also implemented to reduce noise in the skin thickness estimation.

Results: Among 42 patients, breast skin thickness was determined to be between 1.50 – 1.55 mm. Plots of effective breast diameter as a function of posterior-anterior position serve as a concise method for characterizing idealized 3D breast shape, and these parameterized curves are reported for breasts of different size classes based on the cup size metric.

Conclusion: Breast CT acquisition techniques, combined with algorithms designed for determining specific breast metrics, were useful for classifying breast shape and skin thickness. Most breast dosimetry coefficients (DgN) are based on the assumption of a 4 mm skin thickness, and the thinner skin dimensions found in this study will likely have a small but significant influence (increase) on breast dosimetry in mammography.