Purpose: To characterize 2D and 3D scatter-to-primary ratios (SPR) and investigate the dependence of SPR on breast density based on clinical patient imaging on our dedicated SPECT-CT mammotomography system.

Methods: As a part of an on-going IRB approved protocol, 7 consented women underwent a breast imaging study with our SPECT-CT system. Using a quasi-monochromatic x-ray cone beam and flat panel detector, 240 projections were obtained. 6 beam stop array (BSA) projections were also obtained over 40 degree intervals. The CT data were scatter corrected using a phantom-validated algorithm based on the BSA technique. For each projection, 2D scatter fluence was determined behind each beam stop shadow through the patient's breast, and cubic spline interpolated throughout the thresholded breast region. 2D SPRs were calculated as the average of 6 measured ratios of scatter projections to scatter corrected (primary) projections. Angular cubic spline interpolation was performed to obtain the remaining 234 azimuthal BSA projections for reconstruction correction. Corrected and uncorrected projection images were individually reconstructed and 3D SPRs calculated as the ratio of difference between primary and un-corrected volumes to primary volumes. Histograms of the reconstructed patient data-sets yielded distinct peaks representing linear attenuation coefficients of glandular+skin and fatty tissue. Percentage glandular and fatty tissue was estimated by fitting a double Gaussian to the histogram and integrating area under the curve.

Results: Only 4 CT data sets devoid of motion and truncation artifacts were suitable for scatter correction. Preliminary results show that 2D SPR values peak at the center of breast volumes and were greatest (~50%) for the most glandular breast, whereas 3D SPR values remained fairly constant throughout the breast and did not obviously correlate with density, consistent with prior phantom results.

Conclusions: 2D SPR values are greater in breasts with higher glandular tissue composition, whereas 3D SPR values appear independent of breast composition.

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