AbstractID: 14087 Title: Correction for multiple and coherent scatter in first generation incoherent scatter CT for in-vivo breast imaging

Purpose:
We are currently working on a bench top system to investigate the benefits of reconstructing electron density (ED) images of the breast. Single incoherently scattered photons can be directly related to ED but multiple and coherent scatter cause additional scattering which lead to image artifacts. This work presents a correction for multiple and coherent scatter in first generation incoherent scatter CT of the breast.

Method and Materials:
Monte Carlo (MC) simulations were used to quantify the increase of scatter for breasts with different sizes and compositions. Scatter increase correction ratios (SICR) as a function of radiological path length were fitted to an empirical equation. The equation allows us to analytically calculate SICR using transmission CT. The accuracy of the correction was tested by reconstructing ED images of MC simulated scans for a homogeneous and an inhomogeneous breast.

Results:
Coherent scatter contributes ~9% to the total scatter signal for a typical breast, demonstrating that multiple scatter is the major source of image artifacts. The fitted equation corrects for multiple and coherent scatter with errors of 11% ± 2% for the homogeneous breast and 21% ± 10% for the inhomogeneous breast. The errors in ED images are of – 9% ± 4% for the homogeneous breast and -4% ± 3% for the inhomogeneous breast. The corrected ED image is twice as accurate as the uncorrected image and twice as precise as the image based on the linear attenuation coefficient.

Conclusion:
The scatter increase due to multiple and coherent scatter is weakly dependent on breast size and composition. This allows an empirical equation to be used to correct multiple and coherent scatter artifacts. Our study shows the feasibility of reconstructing ED breast images using our approach and future efforts will be devoted to its practical implementation.