AbstractID: 2869 Title: Scatter Radiation in Digital Tomosynthesis

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Purpose: To investigate the characteristics of scattered radiation and its effects on image quality in digital breast tomosynthesis.

Method and Materials: A GEANT 4 based Monte Carlo package was used to simulate a rotating target/detector tomosynthesis system. The compressed breast was modeled as a cubic block imbedded with 24 small cylinders of different radii and heights in the central layer. An 11cm air gap between the breast and detector was modeled. The incident photon energy was set to 20 keV to avoid the complexity of beam hardening effects. A primary image and a scatter image were generated for each projection. The gantry was rotated around the breast from –25 degree to 25 degree with a 5 degree increment. Reconstructions of the 3D breast were computed from the 11 projection images using primary x-rays only, and primary plus scattered x-rays.

Results: The magnitude of scatter radiation does not change very much from one projection to another because the scatter volume does not change. However, the primary radiation detected can be significantly different in different projections due to different path length. As a result**,** scatter to primary ratio is very different for different projection. Even with the 11 cm air gap, scatter to primary ratio was observed to be as high as 0.4 for a 5 cm thick breast. 3D breast images reconstructed from projections with only primary x-rays showed higher contrast than those reconstructed from projections with both primary and scatter. Further evaluation is needed to determine if this reduced contrast can affect tumor detectability.

Conclusion: Scatter to primary ratio changed significantly from one projection to another and was observed to be as high as 0.4 for a 5 cm thick breast. Tomosynthesis slices showed a moderate decrease in contrast due to scatter.

Conflict of Interest (only if applicable):