AbstractID: 4737 Title: Optimization of Mammography Linear Grid Geometry

Purpose: Anti-scatter grids have been commonly used to reduce the amount of scatter in mammography. However, using grids require increasing the radiation dose to the breast in order to have an acceptable exposure to the image receptor. We used Monte Carlo simulation to optimize liner grid design for mammography imaging in a way to achieve best contrast improvement with lowest dose to the breast.

Materials and Methods: We used Monte Carlo Simulation Code MCNP5 to determine the amount of Scatter to Primary Ratio (SPR) for different x-ray tube peak voltage (kVp), breast thicknesses, and grid geometries. We used a Molybdenum target/Molybdenum filtered x-ray spectra, materials and geometrical dimensions that closely mimic the clinical situation. We used a semicircular shaped breast phantom made of 50 % adipose and 50 % glandular tissue equivalent materials. The grid septa were made of lead and inter-space was made of carbon fiber.

Results: Our calculated SPR values agree within 5 % with previously published clinical data. We have obtained significant contrast improvement for low bucky factors. For a 5 cm thick breast equivalent phantom, we found an optimal septa height of 0.9mm, septa thickness of 12µm and an inter-space thickness of 100µm gives an optimal combination of 0.2 SPR, a 2.43 bucky factor, and a 1.31 contrast improvement factor (8 % error). With this geometry, the maximum SPR was lowered from 0.58 without the grid to 0.2 with the grid.

Conclusion: We have optimized the geometry of the linear grid and achieved very significant contrast improvement with low SPR while minimizing the bucky factor and hence the mean-glandular dose to the breast.