AbstractID: 9200 Title: The effect of variable exposure distribution on microcalcification detectability in tomosynthesis

Purpose: To investigate the fundamental limitation of tomosynthesis acquisition on the detectability of microcalcifications (MCs) and to investigate the effects of employing unequal dose distribution (variable exposure) across the tomosynthesis projections. Method and Materials: Ray tracing was used through a 5-cm thick homogeneous slab phantom, which contained 150-, 280-, and 400-micron diameter spheres embedded at the center. In this study we accounted for acquisition geometry and x-ray quantum noise. Detectability was calculated using a nonprewhitening observer. In the sinogram data, detectability was computed by integrating observer response over all projection views. In the reconstructed image, observer response was computed using a 2D matched template at the in-focus slice of the sphere. To test variable distribution of exposure, 50% of the exposure was concentrated in the center three projection views, and the rest was divided equally among the remaining projection views. Results: We determined that the detectability of MCs is reduced for larger projection angles because of the increased pathlength through the phantom and larger source-to-detector distance. The spheres are projected on the detector as ellipses at larger angles, which blurs the MCs and decreases detectability. Detectability of MCs using the variable exposure method is approximately 10-20% higher than detectability in the equal exposure distribution method. Conclusion: The detectability of MC is reduced in a tomosynthesis acquisition because of the acquisition geometry if all projections are made with the same exposure. A variable exposure method can improve MC detectability in DBT systems. In future work we will examine the effect of breast structure noise on the variable exposure method. Conflict of Interest: Research sponsored by Hologic, Inc. and Dexela Ltd.