AbstractID: 3670 Title: A computer simulation platform for the optimization of breast tomosynthesis system

Purpose:
In breast tomosynthesis there are tradeoffs between optimization of resolution, noise and acquisition speed with a given glandular dose. Our purpose is to provide a simulation platform to investigate any plausible configuration for a tomosynthesis system, and find an optimal combination of these parameters.

Method and Materials:
Simulated projections of a slanted thin tungsten wire placed in different object planes are modified according to a detector's MTF (binned or not binned). In addition, the focal spot blur (FSB), which depends on the location of the wire, the system geometry, the source-detector movement speed and exposure time, is also incorporated into the projections. Then a maximum likelihood (ML) algorithm is used for 3D reconstruction. The in-plane and in-depth MTF were determined. To evaluate the noise performance, simulated noiseless projections of calcification and tumor in uniform breast tissue were modified with real detector's NPS and for a given detector noise and dose. The signal to noise ratio (SNR) of the reconstructed images is calculated with different configurations, e.g. view number and angle, pixel binning and FSB.

Results:
The FSB is determined by the exposure time of each view at a fixed gantry travel speed. For SID = 65cm and exposure time $\leq$ 80ms per view, the 2x2 binning causes more degradation for the in-plane resolution than the FSB and reconstruction blur. The in-depth resolution can be improved by increasing the number of views and the span of view angle. However the SNR will be degraded because with the lower exposure per view (total dose constant), the detector performance is degraded by electronic noise.

Conclusion:
Many design parameters need to be considered for optimizing a tomosynthesis system. We provide a simulation platform to predict system performance with different configurations in advance. It will be helpful for practical implementation of breast tomosynthesis.