

Purpose: To study the effect of angular acquisition on the slice sensitivity profile (SSP) in tomographic breast imaging, for both breast CT and tomosynthesis.

Methods: Brass disks (0.025 mm thick) ranging in diameter from 2.5-20 mm were placed within mammography phantoms of varying thicknesses (3 - 6 cm). The disks were imaged using a prototype digital tomosynthesis system (Selenia Dimensions, Hologic Corporation, Bedford, Ma). The tomosynthesis system acquires images over an angular acquisition range of 15-degrees. The same brass disks were used to measure the SSP in breast CT, using a 14cm-diameter cylindrical polyethylene phantom. The bCT angular range spanned from 15 to 360-degrees. A subset of the projection images were reconstructed with a filtered back projection algorithm to simulate limited-angle acquisition. The SSP was determined by measuring the mean gray-scale (GS) in the tomographic images along the z axis of the scan corresponding to the disk position. Normalized profiles of the background-corrected mean GS values were generated as a function of the distance away from the detector. The full-width at half maximum (FWHM) GS intensity was determined.

Results: As the angular acquisition range increases, the SSP narrows and results in a smaller FWHM value. The FWHM values of the SSP for the smallest disk at (2.5 mm-diameter) were 8.6 mm, 4.2 mm, and 0.8 mm for 15, 40, and 180 degrees, respectively.

Conclusions: Limited angle tomography results in a broadening of the SSP, inversely proportional to the angular range of acquisition. The SSP approaches a minimum as the angular coverage exceeds 180 degrees.