AbstractID: 6574 Title: A high precision geometry calibration method for digital tomosynthesis systems

Purpose: To develop a high precision geometry calibration method and an efficient image reconstruction algorithm for digital tomosynthesis system.

Method and Materials: A geometry calibration phantom was constructed with 40 markers arranged in two planes parallel to the breast holder. A 3x4 projection matrix which maps the coordinates (x,y,z) of a point in the object to the coordinates (u,v) of the correspondent projection point on the detector was constructed for each projection angle based on the projection images of the calibration phantom. All information for the system geometry, such as source-to-detector distance, source to ISO distance, central ray offset on the detector (u_0, v_0), and detector angle offsets, can be extracted from the projection matrices. The projection matrices, not explicit geometry parameters, were used in a modified Feldkamp algorithm to reconstruct the imaged object. A prototype tomosynthesis system and a CIRS anthropomorphic breast phantom with multiple embedded structures were used to test the geometry calibration accuracy and the reconstruction algorithm.

Results: 3-D image of the breast phantom was reconstructed using the projection matrices. 4 fibers, 6 masses, and all 12 speck groups were visible in the focal plane.

Conclusion: Geometry calibration based on the projection matrices is accurate and reconstruction using the projection matrices is efficient.