AbstractID: 11034 Title: Characterization of Multi-Beam Field Emission X-ray Source for Stationary Digital Breast Tomosynthesis

Purpose: The current prototype digital breast tomosynthesis (DBT) scanners are based on the regular full-field digital mammography systems and require partial isocentric motion of a mammography x-ray tube over certain angular range to record the projection views needed for reconstruction. This prolongs the scanning time and in turn degrades the imaging quality due to motion blur. We are developing a *stationary* DBT (s-DBT) scanner to mitigate the above limitations.

Method and Materials: The proposed s-DBT system is based on the carbon nanotube multi-pixel field emission x-ray (MBFEX) technology demonstrated by our group. The pixilated and spatially distributed MBFEX source can generate x-ray radiation from multiple views without any mechanical motion of the source, detector, or object. This enables the design of tomography systems with great flexibility in source configuration and imaging sequence. It further enables multiplexing imaging – simultaneously collection of multiple images using one detector.

Results and Conclusions: To demonstrate the feasibility of the s-DBT scanner, we have designed and constructed a proof-of-concept full-field s-DBT system. The configuration of the system, in terms of angular coverage, number of views, and dose, etc., closely resembles the Siemens DBT scanner for a more realistic comparison. In the Siemens DBT scanner, the x-ray tube moves along an arc with the exposure points evenly distributed along the rotation route. Our s-DBT scanner is designed with the MBFEX pixels positioned in a straight line parallel to the detector plane. We will report a detailed study on the design and the performance characteristics of the MBFEX source. In particular evaluation on key parameters including the x-ray flux, the lifetime of the x-ray source, effective x-ray focal spot size, variation between different source, system spatial resolution, and x-ray energy spectrum will be reported. These preliminary results demonstrate the feasibility of the proposed s-DBT scanner.