AbstractID: 7327 Title: a novel gantry-free DBT system using a stationary multi-beam field emission X-ray source array based on carbon nanotubes (CNTs)

Purpose: To test the feasibility of a novel gantry-free digital breast tomosynthesis (DBT) system using a stationary multi-beam field emission X-ray source array based on carbon nanotubes (CNTs) and to compare the system performance with the conventional devices.

Method and Materials: Two tomosynthesis imaging systems have been built: a compact model and a full scale model, which contain 9 and 25 individual X-ray pixels, respectively. The compact model can only image a partial breast phantom due to the limited span of the X-ray source array and the small FOV of the detector. The full scale system is capable of full field digital mammography by utilizing a detector with 20-cm FOV. The geometry of the full scale system is also comparable to the conventional DBT devices (refer to the supporting material). The system geometry, such as the source to detector distance (SDD) and X-ray source position, is calibrated. The slice images at different depths are reconstructed using ordered subset convex (maximum likelihood) method. The system performance is evaluated by measuring parameters such as MTF and SNR.

Results: By eliminating the rotary gantry, the system design is simplified and the issue if image blurring due to x-ray source motion is removed. The total scan time can potentially be further shortened with a faster detector readout speed.

Conclusion: By eliminating the rotary gantry, the system noise and equipment cost of the tomosynthesis imaging system are reduced. The total scan time can be further shortened with faster detector readout speed. The novel stationary tomosysthesis system shows great potential in clinical imaging.

Conflict of Interest (only if applicable):