

AbstractID: 4656 Title: A Stationary Scanning X-Ray Imaging System Based On Carbon Nanotube Field Emitters

Purpose: Most tomographic imaging systems available today use a single x-ray source and multiple projection images are obtained by rotating the x-ray source around the object. Therefore the data acquisition rate is limited by the gantry rotation speed, which is approaching the physical limit. We proposed to develop a novel stationary scanning x-ray imaging system based on carbon nanotube field emission x-ray (FEX) technology. Instead of a single x-ray source the proposed system is based on a multi-pixel FEX source. The new scanner promises a dramatically faster data acquisition rate by reducing or totally eliminating the mechanical motion.

Method and Materials: We have constructed a prototype stationary scanning x-ray imaging system with an array of 9 individually addressable x-ray source pixels, each of which can produce a different projection image of the object. The core of this novel x-ray imaging technology is a gated carbon nanotube field emission cathode array. By programming the gate voltage of the cathode array, the multi-pixel x-ray source can generate an electronically triggered scanning x-ray beam and produce multiple projection images from different viewing angles without mechanical motion. A Hamamatsu C7921 flat panel x-ray sensor was used to collect all 9 projection images.

Results: Tomosynthesis images of a mouse and a standard breast-imaging phantom (Stereotactic Needle-biopsy Tissue Equivalent Phantom, Nuclear Associates, NY) using the prototype stationary scanning x-ray imaging system are acquired. Tomosynthesis reconstructions were applied to the breast phantom. The slice images reconstructed using an iterative reconstruction algorithm clearly show the internal structures of the breast-imaging phantom at different depths.

Conclusion: We have developed a stationary scanning x-ray imaging system using a carbon nanotube based multi-pixel FEX source. The mechanical motion free approach can lead to a faster and simplified tomographic imaging system.

Conflict of Interest: Research partially supported by Xintek Inc.