AbstractID: 7850 Title: Nanotube Based Multi-Pixel Field Emission X-Ray for CT and Radiotherapy

Purpose: To develop a new field emission x-ray source with multi-pixel and multiplexing capability for high speed computed tomography

Method and Materials: The new x-ray source utilizes the carbon nanotubes (CNTs) as the "cold cathode" to replace the thermionic cathode used in the conventional x-ray tube. The x-ray tube current is generated by applying an external electrical field to extract the electrons from the carbon nanotubes. By controlling the triggering signal, x-ray radiation with programmable waveforms can be readily generated. One- and two- dimensionally pixilated x-ray source with spatially distributed focal spots is constructed by using a matrix addressable multi-pixel CNT cathode. The electronics for controlling and integration of the x-ray source have been demonstrated.

Results: A new x-ray source based on the CNT field emission technology has been developed. The x-ray source is capable of generating the flux, energy and spatial resolution required for medical imaging. A micro-focus x-ray source with 30-50μm isotropic focal spot size has also been developed. A micro-CT scanner using the field emission x-ray source was constructed for imaging for small animal models with respiratory and cardiac gating capability. The results from preliminary studies will be discussed

Conclusion: The CNT based field emission x-ray source offers unique capabilities that are attractive for high speed CT imaging such as spatially distributed x-ray pixels. It enables collection of multiple projection images from different viewing angles without mechanical motion either sequentially or simultaneously which can potentially lead to stationary gantry-free CT scanners for high resolution and high-speed imaging.

Conflict of Interest (only if applicable):