AbstractID: 11319 Title: High throughput micro-CT scanner using a distributed multi-beam field emission x-ray source

Purpose: To investigate the feasibility of a stationary gantry-free micro-CT scanner using spatially distributed multi-beam x-ray source. A prototype multi-beam micro-CT (MBμCT) scanner has been developed and its imaging performance characterized.
Method and Materials: The MBμCT system consists of a 20-beam carbon nanotube (CNT) field emission x-ray source; an object table; a flat panel x-ray detector; a MOSFET based control circuitry and a control console with a customized software user interface written in LabVIEW for data acquisition and processing. The x-ray beams are individually controlled and can generate a scanning beam covering an angle span of 36º. It takes merely 9 steps to finish a full rotation in less than 10s. The projection images are acquired and stored for imaging processing and CT reconstruction.
Results: The performance (focal spot size, field emission I-V characteristics and current stability) of the multi-beam x-ray source has been characterized. The control circuitry and LabVIEW based control software have been implemented and tested. A mouse carcass has been scanned using the prototype MBμCT system and the acquired projection images showed decent imaging quality. We are currently working on refining the system geometry calibration and developing the corresponding CT reconstruction algorithm for this novel MBμCT imaging system, and some preliminary data will be presented.
Conclusion: The feasibility of a stationary gantry-free MBμCT has been evaluated based on the study of the as-developed prototype system. Our preliminary results showed that the MBμCT scanner has the potential to deliver fast CT scan speed as a result of its novel scanning configuration. As a prototype system, it will be used to perform various feasibility tests for the future development of a fully stationary multi-beam micro-CT scanner. Once fully developed, this system would potentially provide fast screening, image registration and guidance for radiotherapy in pre-clinical studies as well.