AbstractID: 9449 Title: Tetrahedron Beam Computed Tomography: A New Design of Online Imaging System for Image Guided Radiotherapy

Purpose: Cone-beam computed tomography (CBCT) is an important online imaging modality for image-guided radiotherapy (IGRT) as well as other forms of image guided interventions. However, current CBCT image quality is inferior to that of the diagnostic fan beam CT. We have designed a novel Tetrahedron Beam Computed Tomography (TBCT) imaging system that may achieve the same diagnostic quality as helical CT scanners.

Material and Methods: The TBCT imaging system is comprised of a linear scan x-ray source and a linear discrete x-ray detector array. The axis of linear x-ray tube and the detector array are aligned perpendicular to and within the rotation plane, respectively. The x-ray beams are narrowly collimated into fan beams and focused to the linear detector. Detector and x-ray tube rotate slowly while the fan beams scan quickly along the axis. The TBCT reconstruction geometry is similar to CBCT. Approximate and exact reconstruction algorithms can be modified for TBCT reconstruction.

Results: TBCT will produce diagnostic quality online images due to its scatter rejection mechanism and the use of high-performance discrete x-ray detectors. TBCT also has several other advantages such as larger clearance, ease of performing dynamic field size and mAs controls, etc.

Conclusion: TBCT will significantly improve online image quality. Clinical implementation of TBCT would be of importance in IGRT as well as other forms of image guided interventions.

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