

AbstractID: 3685 Title: Helical Cone-beam CT for Radiation Therapy

Purpose: To develop the helical cone-beam scanning capability on a simulator CT system and apply a recently developed backprojection-filtration (BPF) algorithm to reconstruct exact 3D images from data obtained in this system.

Method and Materials: Helical cone-beam CT is an emerging technology with many advantages over conventional CT scans, such as fast volume coverage speed, efficient use of x-ray power, and sufficient data for exact 3D image reconstruction. We developed the helical cone-beam capability on a simulator CT device (Acuity, Varian Medical Systems), which includes a kV x-ray source, a patient couch, and an amorphous silicon flat-panel detector (Varian PaxScan 4030CB). We fabricated a small motorized leadscrew mechanism on the couch of the Acuity, which allows for longitudinal translation of the patient couch at a constant speed as the gantry rotates. We applied the BPF algorithm to reconstruct exact 3D images from data obtained in this system.

Results: A CatPhan phantom was used for data acquisition. 683 projection data were collected during a one-turn gantry rotation while the couch was translated longitudinally with a helical pitch of 187.2 mm. The x-ray source was operated at 125 kVp and 560 mAs. Before projection data were used for reconstruction, a number of corrections were performed, such as bad pixel, dark field, flood field, detector sag. We also applied simple corrections for beam hardening and scattering. 3D images were reconstructed from the corrected data by use of the BPF algorithm.

Conclusion: We have developed for the first time the helical scanning capability on a simulator cone-beam CT system and performed a preliminary phantom study. The BPF algorithm was used to reconstruct exact 3D images from the helical cone-beam data. Such approach can readily be extended to cone-beam CT components on a LINAC to provide more accurate image representations of the patient.