AbstractID: 7059 Title: Assessment of Carbon Fiber and Synthetic Fiber Radiation Therapy Tabletops for Kilovoltage Cone Beam CT Imaging

Purpose: The Calypso® System uses electromagnetic fields to localize and continuously track implanted Beacon® transponders. For sub-millimeter localization accuracy, a non-conductive surface is required. We studied kilovoltage (kV) cone-beam CT (CBCT) image quality of a non-conductive synthetic fiber composite tabletop (Qfix Systems, kVue IGRT™).

Material and Method: CBCT images were acquired with 3 tissue phantoms (CatPhan®) through carbon fiber tabletop (Medical Intelligence) and synthetic fiber tabletop (Kevlar®). Image resolution, low contrast sensitivity, 3D uniformity, circular symmetry and spatial uniformity with carbon and synthetic fiber tabletops were compared. Multiple protocols were used to evaluate image registration accuracy. Impact of side rails incorporated in the synthetic fiber model was evaluated.

Results: Both tabletops demonstrated better than 2% of low contrast sensitivity, 3D uniformity was within 2%. Circular symmetry and spatial uniformity were within 1mm. Carbon tabletop and synthetic fiber tabletop with rails outside the kV field achieved equal resolution of 8 lp/cm while the synthetic fiber tabletop with rails inside the field provided a resolution of 7 lp/cm. Compared with the carbon fiber, image pixel values for six materials with relative electron densities ranging from 0.28 to 1.69 were found to be within 4% and 11% for the Kevlar with rails inside and outside of the field respectively. Phantom images of head-and-neck, chest, and pelvis were registered to reference images via bony and gray-value auto-registration methods. Accuracy measured within 2 mm for both designs.

Conclusion: CBCT imaging characteristics using synthetic and carbon fiber tabletops are comparable. Synthetic fiber tabletops are compatible with electromagnetic localization systems and meet image quality performance criteria.