AbstractID: 13479 Title: Performance Evaluation of a Dual Cone-Beam CT (Dual CBCT) System

Purpose: Very little information is available for clinical CBCT imaging using a dual-detector system. This study assesses the performance of a recently developed bench-top dual large-flat-panel detectors cone beam computed tomography (CBCT) system and to characterize the imaging quality of the system for image-guided radiation therapy (IGRT).

Method and Materials: A dual-detector CBCT system with two large flat panels has been developed in our laboratory. Two systems were arranged orthogonally to each other on one optical bench. The designed source-to-detector distances and source-to-isocenter distances are 150 cm and 100 cm, respectively. The detectors are 40 x 30cm^2 in size with 194μm-pixels (Varian Paxscan 4030CB flat panels). A custom bow-tie filter was designed for each subsystem. A tungsten wire phantom was scanned in order to evaluate the spatial resolution of the system. The Catphan phantom was also scanned to characterize noise, and Hounsfield unit (HU) linearity. The noise is evaluated by the homogenous slice and HU measurement is characterized by the sensitometric slice inside the Catphan. The performance of dual-detector CBCT system is compared to that of single-detector subsystem.

Results: The spatial resolution of the dual-detector CBCT system was almost the same as a single-detector system and is mainly confined by the more inferior subsystem. No degradation in the noise performance of the dual CBCT system in comparison to a single CBCT system was observed. The measured signal-to-noise ratio was approximately 27.2 across one uniform slice. The reconstructed pixel values have demonstrated good linearity against known HU numbers. Linear fitting has shown an r^2 value of 0.9985 for the sensitometric inserts.

Conclusion: The dual-detector CBCT system has comparable physical characteristics compared to a single-detector CBCT system and therefore warrants further advanced application of the whole system.

Conflict of Interest: This work is supported in part by Varian Medical Systems.