AbstractID: 11481 Title: Improvement of megavoltage cone-beam CT image quality using a low-atomic number x-ray target

Purpose: to investigate the application of an unflattened photon beam, generated using a low atomic number (Z) x-ray target, to MV cone-beam computed tomography (CBCT) imaging. Improvements of image contrast and contrast-to-noise-ratio (CNR) versus dose are quantified and compared to the standard 6MV beam. Limitation of the contrast advantage with patient separation is examined. **Method and Materials:** The experimental beam was generated by a 2100EX linac (Varian Medical, Inc) by placing a 1.0 cm-thick Al target 9 mm below the primary collimator vacuum window and operating the linac in 6 MeV electron mode. The flattening filtration was removed. Projections were acquired using an AS1000 detector every 2° through 360°. CBCT contrast was compared for both the low-Z-target and 6MV beams. CNR was measured as a function of dose using a bone/lung phantom containing a central ionization chamber. The same phantom was located in cylindrical containers ranging in diameter from 13 cm to 25 cm to measure the rate of reduction of CBCT contrast with separation. Finally, a pig head was imaged allowing a qualitative comparison. **Results:** Contrast is improved by a factor ranging from 1.8 to 3.4 (mean 2.3) with the low-Z-target beam. Over an imaging dose range from 3 cGy to 23.5 cGy, CNR improves by a consistent factor of 1.7 and 2.4 for bone and lung, respectively. Contrast deteriorates with separation more rapidly for the low-Z-target beam than for 6MV; however for the maximum diameter of 25 cm contrast remains superior by a factor of 1.4 and 1.5 for bone and lung, respectively. Images of the pig head demonstrate qualitatively improved CNR and preservation of spatial resolution. **Conclusion:** Contrast and CNR are improved significantly in CBCT images using the low-Z-target beam, over a clinically-useful range of patient separation. **Conflict of interest:** Research sponsored by Varian Medical, Incorporated.