AbstractID: 13960 Title: Image quality improvement in megavoltage cone beam CT using an ultrafast ceramic scintillator system

**Purpose:** To quantitatively and qualitatively assess improvement in megavoltage cone beam CT (MVCBCT) image quality afforded by a 4.2 MV imaging beam line (IBL) with a carbon electron target and new pixelated ultrafast ceramic scintillator (UFC) detector, relative to the 6 MV treatment beam line (TBL). Detector blur is reduced with the UFC since light generated in a pixel is less likely to escape laterally.

**Methods:** A prototype IBL+UFC system was installed on a Siemens ONCOR linear accelerator equipped with the MVision<sup>TM</sup> IGRT system. A UFC strip consisting of four tiles and measuring ~40 cm by ~10 cm was installed on the flat panel imager, with the long dimension in the cross-plane direction. Phantom images were acquired at doses from 2-60 cGy with the TBL, IBL with conventional scintillator, and IBL+UFC. Several head and neck, thoracic, and pelvic patients were imaged with the three systems at doses from 2-15 cGy. **Results:** Phantom images indicate that the IBL+UFC images have lower noise and higher contrast than the IBL and TBL images. The contrast-to-noise ratio (CNR) for the IBL was 1.5-2 times higher than for the TBL, and

the IBL+UFC CNR was 1.5-2 times better than for the IBL at all doses. CNR saturated near 30 cGy for the IBL+UFC and at 60 cGy or greater for the IBL and TBL. IBL+UFC patient images showed improved soft tissue contrast at all doses and sites examined.

**Conclusions:** The IBL+UFC combination increases the CNR by up to a factor of four relative to the TBL with the conventional scintillator, and a factor of two relative to the IBL with the conventional scintillator. Image noise and soft tissue contrast in head and neck, thoracic, and pelvic patients improved dramatically in the IBL+UFC images relative to the TBL images.

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