AbstractID: 14214 Title: A novel scatter reduction and correction method to improve cone-beam CT (CBCT) image quality

Purpose: To develop a novel scatter reduction and correction method to improve the CBCT image quality for IGRT applications. **Method and Materials:** A one-dimensional grid composed of lead with equal interspacing was positioned between the x-ray source and the imaging object during CBCT acquisition. The grid provides direct scatter reduction by blocking half of the beams. Partial image data were obtained from the grid inter-space (unblocked) region while scatter was measured from the blocked region beneath the grid in the projection images. Scatter was corrected by subtracting the measured scatter from the original projection image. Information in the penumbra region of each grid septa was derived. Three modes were developed to reconstruct full CBCT images from partially blocked projections. In single rotation axial mode, interpolation was used to fill in the missing data in the half-fan projections. In dual rotation mode, two-rotation half-fan scans were acquired with the grid offset by half a grid cycle, and complimentary projections were merged to form complete projections for reconstruction. In single rotation helical mode, one-rotation full-fan scan was acquired with the grid offset by half a grid cycle at the scan center. Both CatPhan and anthropomorphic pelvis phantoms were used to evaluate the method. **Results:** In the CatPhan study, CNR was improved using our approach from 4.3 to 6.4 in comparison to conventional CBCT, and CT-number linearity correlation coefficient increased from 0.88 to 0.998. Scatter induced streak artifacts were significantly reduced. In the pelvis phantom study, complete sets of CBCT images were reconstructed and scatter related artifacts were significantly reduced in all three modes. **Conclusion:** Our method enhances CNR and provides much more accurate measurement of scatter with reduced or equivalent dose to conventional CBCT. Scatter-related artifacts are substantially reduced, and the CBCT images generated are of appropriate quality for adaptive radiation therapy.