AbstractID: 14211 Title: Reduce patient dose and improve image quality in CBCT for image guided radiotherapy

Introduction: We have demonstrated that cone beam CT (CBCT) image quality was substantially improved in terms of eliminating scatter related artifacts and enhancing contrast-to-noise ratio, using a 1D grid placed between the x-ray source and the imaging object. The grid serves to physically reduce scatter while also enabling measurements of scatter simultaneously for post-scan scatter correction. A full set of CBCT images can be generated from the partially-blocked imaging data using either one- or dual-rotation modes. Using one-rotation has particularly the advantage of reducing imaging dose by a factor of two in comparison to conventional CBCT. The tradeoff is that longitudinal resolution is degraded. This study evaluates the feasibility of using CBCT images from the single-rotation mode for image-guided radiotherapy (IGRT). **Methods and material:** A lead grid of approximately 1-mm septa width and interspace was placed at a source-to-grid distance of approximately 30-cm in a Varian Trilogy CBCT system for the single-rotation mode. An anthropomorphic pelvis phantom was used for the test. Various steps in imaging processing were performed for each projection, including measuring the scatter distribution, performing scatter correction, deriving imaging information in the grid penumbral regions by dividing the projection with a blank scan, and interpolating the remaining blocked information. Rigid body image fusion was performed for the reconstructed CBCT images with the simulation CT, and compared with CBCT images from the two-rotation and conventional CBCT. **Results**: The single-rotation CBCT images showed substantially reduced scatter-related artifacts. Despite the degradation in longitudinal resolution, the visibility of anatomic structures (an important requirement of IGRT) was not significantly affected. The auto-registration error was 0.8±0.3 mm in longitudinal direction, and was negligible in AP and lateral directions and three rotational directions. **Conclusion:** CBCT images from the single-rotation mode can achieve reasonable longitudinal resolution for anatomic structure visualization and accurate auto-registration in IGRT.