AbstractID: 12763 Title: A novel scatter correction scheme for cone-beam computed tomography using moving 1D blocker strips

Purpose: One well-recognized challenge of CBCT is the presence of scatter pollution within the projection images. Scatter signal degrades the CBCT image quality by decreasing the contrast, introducing shading artifacts and leading to inaccuracies in the reconstructed CT-number. We propose a novel blocker-based approach to simultaneously estimate scatter signal and reconstruct the complete volume within the field of view (FOV) from a single CBCT scan.

Method and Materials: A blocker of one-dimensional (1D) strip pattern is inserted between the x-ray source and the patient. Each blocker strip is aligned along the ramp-filter direction of the analytical Feldkamp-Davis-Kress (FDK) algorithm. The blocker moves perpendicular to the ramp-filter direction during the gantry rotation. By such design, the data required for the filtering step of FDK algorithm is complete in the un-blocked region and the entire volume within the FOV has the measurements at different views. The 2D scatter fluence is estimated by interpolating the signal from the blocked regions. A modified FDK algorithm and an iterative reconstruction based on the constraint optimization are used to reconstruct CBCT images from un-blocked projection data after the scatter signal is subtracted. A phantom simulation study is performed to evaluate the performance of the proposed scatter correction scheme.

Results: The scatter-induced shading/cupping artifacts are substantially reduced in the images obtained using the proposed strategy. After the scatter correction, the reconstruction error is reduced from 25.12% to 3.02% and 1.74% in the images reconstructed by the modified FDK and constraint optimization respectively.

Conclusion: A novel scatter correction scheme is proposed for CBCT. A moving 1D blocker strip is inserted between the x-ray source and the patient during CBCT acquisition. The proposed method allows us to estimate the scatter signal in projection data, reduce the imaging dose and obtain complete volumetric information within the FOV simultaneously.