AbstractID: 11008 Title: Feasibility of a Pre-object-grid to Reduce Scatter and Improve Image Quality in Cone-Beam Computed Tomography (CBCT)

Introduction: Scattered radiation is a major contributor to the degradation of image quality in Cone-beam Computed Tomography (CBCT). The purpose of this study is to demonstrate a novel technique that samples scattered radiation during imaging acquisition, and subsequently account for it during image processing, thereby significantly improving CBCT image quality.

Methods and material: A grid composed of multiple, interspaced, lead strips is placed between the x-ray source and the imaging object. The grid alternately blocks half of the entrance radiation and divides the imaging field into multiple strips of fan-beam fields. In each projection, scatter is sampled in the shadowed strips, then interpolated and subtracted from the original imaging data in the fan-beam fields. Half of the 3D-CBCT images in an alternate pattern can be obtained from these projection data with one rotation. A complete set of CBCT images can be obtained by two rotations in axial mode, or one rotation in helical mode. We have tested the feasibility of the method by comparing an incomplete set of CBCT images of an enlarged Catphan phantom using the Varian Trilogy CBCT system using 3 settings: (A) without the grid; (B) with the grid, but without scatter correction; (C) with the grid including scatter correction.

Results: CBCT image quality improved dramatically using setting C (grid with scatter correction). Streaking artifacts around the air and high-density inserts, apparent in A and B, were almost completely removed in C. CT number linearity (R^2) was improved from 0.880 (A) and 0.967 (B) to 0.998 (C). Contrast scales were 0.42, 0.71 and 1.47 for A, B and C respectively. The corresponding contrast-to-noise ratios were 4.29, 6.60 and 6.42, respectively.

Conclusion: Preliminary results suggest that the proposed pre-object-grid method can be used to substantially reduce scatter in projection data and therefore improve image quality in CBCT.