AbstractID: 10673 Title: A fast scatter-correction algorithm for keV CBCT

Purpose: To develop a fast Monte-Carlo-based scatter-correction algorithm for clinical keV cone-beam CT (CBCT) images. **Method and Materials:** Estimates of the scatter in the projection-views of a CBCT scan were obtained by an iterative process, each step consisting of: (1) a coarse CBCT reconstruction; (2) simulation of photon histories for projections using a purpose-written Monte Carlo code; (3) scoring scatter contributions to fixed points on the detector (a “forced detection” technique); and (4) subtraction of scatter-estimates from the measured pixel-values. The scatter signal at each pixel was estimated using linear interpolation spatially between the values calculated at the fixed points and angularly between projection angles. Following convergence to a set of scatter-corrected profiles, a final full-resolution scatter-corrected reconstruction was performed. All CBCT reconstructions were performed using software developed in-house. The x-ray tube spectrum and the energy-response of the detector were both modeled. To validate the technique, projection measurements (120 kV and 0.4 mAs per projection) of a Catphan quality-assurance phantom (The Phantom Laboratory) were obtained using a Synergy XVI CBCT unit (Elekta Limited). **Results:** Typically the algorithm took less than 2 min to complete 4 iterations on a desktop PC, after which convergence was obtained. Qualitatively, the algorithm resulted in an improved image with the characteristic ‘cupping’ artifacts, due to scatter, disappearing. Quantitatively, non-uniformity was decreased after correction from about 15% to 1% or less at a cost of an increase in image noise from 3.7% to 5.1%. CT number accuracy was also markedly improved. **Conclusion:** It was shown Monte-Carlo-based scatter-correction of clinical keV CBCT images does not have to be prohibitively slow. Such a scatter-correction can be successfully performed in a few CPU minutes.