AbstractID: 9554 Title: Application of a Direct Scatter Correction Algorithm to EPID-based Megavoltage Cone-Beam CT

Purpose: To investigate the application of the Scatter and Primary Estimation from Collimator Shadows (SPECS) scatter correction algorithm to EPID-based megavoltage cone-beam CT imaging, and to characterize the qualitative and quantitative effect of algorithm parameter choice on image correction. **Method and Materials:** A series of EPID projection images were acquired through 200 degree gantry rotation around a 15cm diameter quality assurance test phantom. Using the reconstructed CT images of the sensitometry and uniformity inserts, five SPECS algorithm parameters were tested and the effects on cupping artifacts, contrast-to-noise ratio, root mean square error and CT number accuracy were determined. Nominal parameter combinations were then applied to anthropomorphic phantom reconstructions. **Results:** The algorithm parameter used to define the collimator edge was found to have the largest impact on image reconstruction quality in comparison to the other parameters studied. An investigation of approximately 800 parameter combinations yielded a nominal set of five parameters, which when applied to the reconstruction of the uniformity insert reduced the cupping artifact to less than one percent. Application of the nominal algorithm parameters to the sensitometry insert reconstruction produced improvements in reconstructed CT number in Teflon by 125%, acrylic by 100%, and low-density polyethylene by 75%, with a slight improvement in the contrast-to-noise ratio of acrylic to water. In the anthropomorphic head phantom reconstruction, the average CT number of bone increased from 200 to 670, while the average CT number of soft tissue increased from -200 to -30. **Conclusions:** This work outlines the application of the SPECS algorithm as an option for scatter correction in EPID-based megavoltage cone-beam CT imaging. The algorithm was found to provide a reduction in cupping artifacts and improvement in CT number reconstruction using scatter information derived directly from projection data, without necessitating additional modeling of system and patient-specific geometrical conditions.