

AbstractID: 4691 Title: Correction of streaking artifacts in CT images and its influence on Monte Carlo dose calculations

Purpose: To quantify the impact of streaking artifacts in CT images due to metal implants in patients on Monte Carlo dose calculation and to determine the impact of their correction.

Method and Materials: For CT artifact correction a method of interpolation of missing data in sinograms was developed. Three contrast phantoms were constructed containing two steel cylinders that produced streaking artifacts. CT scans of the phantoms were obtained and the images were corrected for the artifacts. Three sets of Monte Carlo dose calculations (MCDC) using EGSnrc/DOSXYZnrc code were performed. Dose was calculated on: (1) the original CT image, (2) the CT artifact corrected image, and (3), the exact phantom geometry. The dose distributions of the original CT images and the CT artifact corrected images were then compared to the dose calculated on the exact geometry.

Results: A calibration point for metal had to be added to the default EGSnrc CT calibration curve to improve dose calculation results. Additional improvement in dose calculation results and in image quality was noted after the artifact correction was done. MCDC without adding the extra calibration point and without correction for streaking artifacts was found to lead to large dose errors. The error in dose calculations performed with the default calibration was found to be 25% in the original CT images. The error improved greatly when the CT images were corrected for artifacts and when the extended calibration was used; the error decreased then to less than 2 %.

Conclusion: This work proves that the correction of streaking artifacts is important for MCDC; it significantly decreases dose calculation error and it improves image quality. The work also suggests that for MCTP an additional calibration point for a metallic material should be added to the default CT calibration curve.