AbstractID: 11759 Title: Generating attenuation-based Tube Current Modulation (TCM) schema based on voxelized patient models to be used in simulations estimating organ dose from CT

Purpose: There are several TCM algorithms in CT acquisition currently used including x-y plane modulation, z-axis only modulation and combined (x,y,z) modulation techniques. While these have been used to reduce radiation dose in general, methods do not yet exist to assess their impact on reducing organ dose. This study establishes a generalizable process to generate TCM schema from various attenuation-based algorithms for use in Monte Carlo simulation methods to assess organ dose from voxelized patient models.
Methods and Materials: A previously validated scanner-specific Monte Carlo-based CT scanner model was altered to allow simulation of a topogram with the x-ray tube held at an assigned gantry angle. An Anterior-Posterior (AP) and a Lateral topogram were simulated on a voxelized patient model. A cylindrical mesh tally was used to calculate attenuation for every slice location along the cranial-caudal direction of the patient and for angular increments around the gantry of the patient. A plot of patient attenuation versus table position was obtained for both topograms. The ideal TCM was calculated for each table position and the entire three-dimensional TCM schema was generated by interpolating between the ideal TCM plots to maintain smooth tube current transitions for the remainder of the gantry rotation.
Results: Using this generalizable model, we were able to generate the attenuation-based TCM schema for a voxelized patient model.
Conclusion: The results of this study demonstrate the ideal TCM schema for a specific TCM algorithm, but this generalizable model can be used to generate the ideal TCM schema for any combination of gantry angle, table location, and width of detector data. Therefore, this generalizable model can be used to generate TCM schema based on all types of attenuation-based TCM algorithms and for any voxelized patient model.