AbstractID: 14069 Title: Patient-Specific Dosimetry for Pediatric X-ray Computed Tomography

Purpose: CT radiation dose estimates are commonly reported as CTDI (mGy) values derived from measurements made with standard phantoms for a specific technique (kVp, mAs, collimation and pitch). Estimates of effective dose (mSv) are generally calculated from the dose-length-product (mGy cm) and a weighting factor that is also derived from a standardized model. These dose estimates are not patient specific and further, do not include dose estimates for specific organs. There is general agreement that there is a need for more accurate dose estimates for x-ray computed tomography examinations in the pediatric patient. The purpose of our research is to investigate methods that can lead to more patient-specific dosimetry. **Methods and Materials:** We used the Monte Carlo particle transport methods in the GEANT4 toolkit to investigate radiation dose estimates in patient-matched deformable NURBS models (based on non-uniform rational B-spline surfaces) to determine if this method could accurately predict organ doses in specific pediatric patients. Validation was performed with patient CT scans for which several abdominal organs were hand-segmented and the resultant voxel data used in the GEANT4 code. **Results:** Dose calculations were made for NURBS models that were chosen to be similar to previously acquired pediatric CT scans of the chest, abdomen and pelvis. With sufficient run time, the error in the radiation dose for most organs is on the order of 1-3%. **Conclusion:** The use of patient-matched NURBS models may lead to accurate patient-individualized, organ-specific dosimetry for pediatric CT examinations. Patient-matching to the most appropriate NURBS model is based on anatomical dimensions and landmarks thus allowing dose estimates to be made prior to any exposure.