AbstractID: 4654 Title: A series of 4D pediatric hybrid phantoms developed from the UF series B tomographic phantoms

Purpose: To develop a series of the pediatric hybrid computational phantoms based on the non-uniform rational B-spline (NURBS) technology by converting the existing series of UF pediatric tomographic phantoms.

Method and Material: The series of UF tomographic phantoms, newborn female, 9-month male, 4-year female, 8-year female, 11-year male, 14-year male, which were developed by the researchers at University of Florida, were employed for this study. The tomographic phantoms were imported to the 3D-DOCTOR (Able Software Corp., Lexington, MA) segmentation and 3D rendering software, and polygon mesh models representing internal organs and body contour were generated. The polygon mesh models were imported to the Rhinoceros software (McNeel, Seattle, WA) based on NURBS-technology, and Smooth NURBS surfaces were developed for organ and tissue contours, and the NURBS-based organ models were generated organ-by-organ. The NURBS organ models were integrated into hybrid human phantoms by the Rhinoceros software.

Results: A total of 6 hybrid human phantoms were developed from the existing 6 UF tomographic phantoms. The cube-shaped organ contours in the tomographic phantoms were innovatively smoothed in the resulting hybrid phantoms based on NURBS surfaces. The organ volumes calculated from tomographic and hybrid phantoms were in agreement within 5 %.

Conclusion: The resulting phantoms are deformable and can thus be used to represent 25^{th} or 75^{th} percentile subjects through the adjustment of control points surrounding each organ and body contour. The NURBS-based pediatric phantoms developed in this study can be imported into Monte Carlo calculation code, and broadly utilized for dosimetry calculation. The techniques developed in this study will be also applied to the development of NURBS-based 3D phantoms representing 50^{th} and other percentile adult male and female subjects for use in radiation protection applications, as well as occupational or medical exam dose reconstruction.