AbstractID: 10450 Title: Next-Generation Deformable Patient Modeling for Monte Carlo Assessment of Organ Doses

Purpose: Whole-body patient models of various sizes and postures are needed for the assessment of organ doses in CT imaging, internal nuclear medicine and external-beam radiation treatment procedures. This paper discusses a deformable mesh-based modeling method to create patient-specific phantoms that are morphed by changing to 5^{th}- to 95^{th}-percentiles of body height and weight, as well as internal organ volume and masse. **Method and Materials:** The mesh-based reference adult male and female phantoms were deformed by mainly two different percentile data: 1) the whole-body size percentile data which were defined by the anthropometric parameters such as height and weight from the National Health and Nutrition Examination Survey (NHANES). 2) individual internal organ percentile data which were derived by the cumulative pattern analysis based on the International Commission on Radiological Protection (ICRP) 23 and 89 references. These mesh-based percentile phantoms were converted into the voxel-based phantoms. The final step is to link the voxel phantom with correct tissue density and elemental composition, so that radiation transport through the human-body phantom was modeled correctly in a Monte Carlo code. **Results:** The whole-body size percentile models have been created by the NHANES anthropometric data and the details of organ percentiles derived from ICRP references. The deformability of the RPI reference adult phantoms has been shown through the demonstration of percentiles- and postures- specific adult models. **Conclusion:** A next generation deformable patient modeling method has been demonstrated. With the mesh deformation algorithms, the individual organs are able to be deformed to match the volumes and masses with desired organ percentiles. The flexible modeling allows patients to be represented in various sizes and postures for the purpose of Monte Carlo dose calculations. This study also identified the need for further research to develop method to run Monte Carlo calculations in mesh geometry directly.