AbstractID: 8739 Title: Development of Whole-Body Phantoms Representing An Average Adult Male and Female Using Surface-Geometry Methods

Purpose: To apply a series of Whole-Body Phantoms Representing An Average Adult Male and Female Using Surface-Geometry Methods to the study of external radiation dosimetry.

Method and Materials: Boundary reprentation was used to deform the original organs automatically into two sets of standard RPI Adult Male/Female phantoms with volume/mass matched with those of the ICRP. To finally define the phantom geometries in Monte Carlo codes for dose calculations, we developed a software to convert the finished surface phantoms into the voxel phantoms at any desired voxel size. The voxelization used the parity count method together with the method of ray stabbing on polygon surface. The corresponding Monte Carlo input file was derived automatically by our program "Phantom Processor". Average absorbed doses to organs were obtained by MCNPX.

Results: The volume/mass data of the standard RPI Adult Male/Female phantoms match with those of the ICRP. After mesh voxelization, the volume/mass data of the voxel phantoms have the relative error less than 0.5%. The voxel resolutions of the Male/Female are 3.2 mm and 3.0 mm respectively. The average absorbed doses of internal organs were calculated using the 6 external neutron irradiation geometries. All results were normalized by the unit source fluence in accordance with the standard usage in radiation protection dosimetry for reporting fluence to absorbed dose conversion coefficients. Typically, 10^7 histories were simulated and the uncertainties were better than about 1% for most of the target organs.

Conclusion: A series of RPI Adult Male/Female phantoms have been developed. Using our software we have developed additional registration and deformation algorithms that allow a mesh-based phantom to “morph” into a different individual. This series of phantoms were voxelized and implanted into MCNPX. The results suggest that Monte Carlo calculations can be performed for various internal and external exposures to ionizing radiation.