PIMAL: A GUI for Enabling Radiation Dose Assessment Using Phantoms with Realistic Postures

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ABSTRACT

Previously, a computational phantom with moving arms and legs and an accompanying graphical user interface (GUI), PIMAL, was developed to enable the dose estimation using realistic postures in a user-friendly manner. The dose estimation for realistic posture is especially important for occupational exposure, in which the worker is being exposed to radiation in different postures (i.e., glove-box worker or physician performing operation on a patient). The use of standard vertical-upright phantom models for the analysis of these cases would normally yield inaccurate dose estimations. Therefore, PIMAL was developed to serve as a flexible software tool to ease the burden of setting up and executing radiation transport simulations using different postures, using MCNP, for dose estimations. However, the first version of the PIMAL was somewhat limited in its features, i.e., it contained only a hermaphrodite phantom model and allowed only isotropic source definitions. Currently, the features of PIMAL are being further enhanced by incorporating additional phantom models, improving source features, and improving user-friendliness in general. In this new version, in addition to the original hermaphrodite phantom model, male and female phantom models are added. The user can still change the posture using slider bars in addition to the added text boxes. Furthermore, the source features have been enhanced significantly. The source specification now includes internal and external source options in a pull-down menu. For internal organs, the source is assumed to be uniformly distributed within the organ. For external sources, in addition to a point source, the user can select from the standard ICRP external source geometries (AP, PA, LLAT, RLAT, ISO) using the pull-down menu. Once the phantom model is selected, the posture is defined, and the simulation parameters are set, the user can generate the input and perform the MCNP computations using the GUI. After the radiation transport simulation is complete, the estimated organ dose values are displayed in a tabulated form. In this paper, the main features of the PIMAL software are described. *This work was funded by the Nuclear Regulatory Commission.