Computational Phantoms, ICRP/ICRU and further developments

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Abstract–Phantoms simulating the human body play a central role in radiation dosimetry. The first computational body phantoms have been based upon mathematical expressions describing idealized body organs. With the advent of more powerful computers in the 1980s, voxel phantoms have been developed. Being based on three-dimensional images of individuals, they offer a more realistic anatomy. Hence, the International Commission on Radiological Protection (ICRP) decided to construct voxel phantoms being representative of the adult Reference Male and Reference Female for the update of organ dose coefficients. Further work on phantom development has focused on phantoms that combine the realism of patient-based voxel phantoms with the flexibility of mathematical phantoms, so-called boundary representation (BREP) phantoms. This phantom type has been chosen for the ICRP family of pediatric reference phantoms. Finally, due to the limited voxel resolution of the adult reference computational phantoms, smaller tissues, such as the eye lens, skin and micron-thick target tissues in respiratory and alimentary tract regions could not be properly segmented. In this context, ICRP Committee 2 initiated a research project with the goal of producing replica of the ICRP 110 phantoms in polygon mesh format, including all source and target regions, even those with micron resolution.