EFFECTS OF THE SHAPE OF PHOTON ENERGY SPECTRUM ON THE BEAM DATA IN WATER

The energy spectrum is important for photon dose-calculation algorithms using convolution or superposition techniques. However, the impact of its shape on the beam data in water may be small because of the insensitivity of the cross-sections for the various photon interactions in water on the photon energy. We compared energy spectra generated with three different techniques for the same photon beams. One is based on the best fit to the PDDs measured in water; one (MC) uses Monte-Carlo modeling of the accelerator head, and the third (analytical) uses modeling of the thick target spectrum. The analytical spectrum generally agrees with the MC spectrum. Beam data in water was generated using MC simulation for each spectrum giving: a) the electron disequlibrium factor in the buildup region, b) the narrow beam attenuation, c) the phantom scatter factor, and d) the percentage depth dose normalized to 10 cm depth. The calculated PDD agrees with measurement to within 3% for the three energy spectra examined. The phantom scatter factor agrees with measurement to within 1% at 10 cm and within ±2% at depth of maximum dose. The buildup curve (excluding electron contamination) agrees quite well between measurement and calculation for all spectra. We conclude that the most sensitive way to select photon spectrum is by using the measured electron disequilibrium factor and PDD together. The effect of maximum photon energy is examined by changing the electron energy.