Monte Carlo Simulation of Large Electron Fields at Extended Distances

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ABSTRACT

Development of a Total Skin Electron Treatment (TSET) requires a substantial amount of physical measurements. Therefore, Monte Carlo simulation of TSET can facilitate optimization of this technique. The goal of this study was to simulate a single large electron field produced by a TSET scatterer, at extended distances. Although a combination of beam angles is used in TSET, this simulation was used as the first step for developing a needed TSET optimization process. This study describes the results from simulation of a 6 MeV electron beam scattered by a control scatterer using EGS4 code on a VAX 11/780. Total CPU time was cut to less than half by performing simulations in separate manageable parts. Dnear variable and Presta algorithm were also used to speed up calculations, with no effect on accuracy of results. CPU time for each part was: 10 hours for simulation of a Philips SL-20 treatment head including a flattening scattering foil, air spaces and collimators for 105 initial electrons; and 12 hours for transport of particles from scatterer into a cylindrical water phantom (r=50 cm) at SSD=300cm. To calculate uncertainty limits, calculations were divided into 10 batches (106 initial electrons) and a new starting random generator seed was used for each batch. Generally a good agreement was found between calculated and measured depth dose distributions, dose profiles, and x-ray contamination levels (deviations <1%). However, central axis surface dose and output values were underestimated by 5% and 3% accordingly. Also calculated radial distribution of x-ray contamination were inconsistent with measured values.