On Monte Carlo simulation of electron cut-outs in treatment planning.

In simulation of electron beams for treatment planning, it is possible to simulate and collect the beam characteristics in terms of phase space data at the top of the patient dependent cerrobend cut-outs. Simulation times of these cut-outs can be greatly reduced with variance reduction techniques, such as sampling from particles inside the block aperture only and raising the cut-off energies, and range rejection techniques. We have studied the effect of the cut-out walls and cut-off energies on both the CPU time and the dose distributions. The calculations were carried out for a Varian 2100C using the BEAM/DOSXYZ Monte Carlo codes, for beam energies between 9- and 20- MeV. Below 9-MeV the effect of the scatter from the block is marginal, but significant at higher energies, on both the profiles, and on the central axis depth doses. At 16-MeV the scattered electrons increase the dose on the central axis by up to 5% for depths at and beyond d_{max}. The shoulders and tails of the profiles can both drop by up to 3% of the maximum dose, if the scatter is ignored. Minimisation of the transport region in the block improves the computational speed, with CPU times reduced by a factor of 2.0 and 5.0 for 2.0mm and 10.0mm wall thickness compared to no tracking in block material. Raising the cut-off energies for the charged particle also reduces the fluence of these particles.