Monte Carlo modelling of a medical linear accelerator and asymmetric field head scatter

Olivia F Naismith and M E Hosseini-Ashrafi
Department of Medical Physics, St Mary's Hospital, Portsmouth, UK.

ABSTRACT

The photon beam produced by a linear accelerator is inhomogeneous both in energy and intensity, especially when additional beam-shaping tools such as the physical wedge are employed. Accurate non-Monte Carlo computation of radiation penetration and dose deposition therefore requires comprehensive information about the beam incident on the patient. The required information may be difficult, if not impossible, to obtain by measurement. Although Monte Carlo calculations are still considered to be too slow for routine treatment planning of photon beams, they are used to generate the necessary spectral input for faster alternative algorithms such as the convolution/superposition methods of dose calculation.

We used the Monte Carlo N-Particle radiation transport code MCNP on a personal computer to simulate the MLC-produced open and wedged 6 MV photon fields. For model verification, the depth dose distributions and dose profiles at various depths for different field sizes were simulated and found to be within acceptable limits. The model has been applied to the simulation of asymmetric fields, linear accelerator head scatter studies, and for superposition/convolution model set-up and verification.

Results of linear accelerator characterisation will be presented. Monte Carlo simulated head scatter factors will be compared to measured data, and asymmetric head scatter simulated data will be presented and discussed.