AbstractID: 7876 Title: Fast Monte Carlo Calculation of Linear Accelerator Head Scatter Factors

The dose rate from a linear accelerator is known to change as a function of field size due to changes in scattered radiation from within the patient (phantom scatter, Sp) and from structures within the head of the accelerator (head scatter, Sh). While most modern treatment planning systems can adequately predict phantom scatter contributions to dose, many do not model the accelerator and hence are unable to predict the effects of head scatter. In this work, we present a Monte Carlo method for quickly and automatically calculating head scatter factors for monitor unit calculations. The approach employs pre-calculated phase-space profiles based on detailed Monte Carlo simulations of the linear accelerator using the BEAM Monte Carlo code. MLC positions from the treatment plan are used to model an ideal collimator. Photon position and direction information from the phase space file are used to determine which photons pass through the collimator onto the scoring (isocenter) plane. The energy fluence of these photons through a small scoring volume is used to calculate kerma, which we show to be an acceptable approximation to absorbed dose for the calculation of Sh. The calculation takes approximately 1 second on a standard 450 MHz Windows PC. Agreement with measured head scatter factors is generally good (within 1%) for small field sizes (between 4 cm and 15 cm equivalent square). The technique is particularly applicable to small MLC-shaped fields as used in conformal radiation therapy and IMRT.