

AbstractID: 8677 Title: Use of BEAMnrc and DOSXYZnrc to Model Modulated Electron Beams Delivered Through a Photon Multileaf Collimator

Purpose: To use Monte Carlo programming methods to accurately model electron beams delivered through a photon multileaf collimator (pMLC) in preparation for their use in modulated electron radiotherapy.

Methods and Materials: Electron transport through a Varian Clinac 2100C linear accelerator was modeled using BEAMnrc. The linear accelerator is equipped with Milenium 80 multileaf collimator (MLC). The linac was first verified using the electron applicators against measurements taken in water. Then the applicators were removed and electron fields were shaped using the MLC. A phase space files was generated at the end of the accelerator structure (after the MLC) and was used as input in DOSXYZnrc to calculate the dose distributions in a water phantom. Various field sizes ranging from 2cm x 2cm to 10cm x 10cm were measured using Gafchromic EBT and Kodak EDR2 films modeled for energies of 6, 9, 12, 16, and 20 MeV at source- to-surface distances ranging from 70cm to 85cm. The beam profiles and depth dose curves from the film measurements were compared against the dose distributions obtained from the Monte Carlo calculations. .

Results: Good agreement was achieved between the experimental data and calculated values for our relative depth dose curves and beam profiles, with deviations of less than 2 mm in the penumbra region and within 1.5% in depth dose. The penumbra increased with increasing SSD and decreased with increasing energy. Deviations between measured and calculated values were affected by artifacts associated with the Gafchromic film used.

Conclusion: The use of BEAMnrc and DOSXYZnrc is a highly effective method for modeling electron beams shaped by a pMLC. Care must be taken when using Gafchromic film for beam measurements in order to avoid artifacts that may affect measured values.