AbstractID: 9473 Title: Investigating discrepancies between Monte Carlo dose calculations and measurements in the buildup region for Megavoltage photon beams

Abstract

Major advances, in terms of accuracy and rapidity, have been made in the development of Monte Carlo algorithms for dose calculations in radiotherapy. It is however necessary to validate these algorithms against measured dose distributions in clinics. The BEAM code (based on the EGS4 Monte Carlo system) has been extensively used for simulating linac photon and electron beams. Dose calculations based on BEAM outputs (phase space data) show generally good agreement with measurements for a wide range of photon beams. However, different investigators have reported systematic differences with measurements for large field sizes (e.g. 40 cm x 40 cm). Calculations lead to lower dose values in the buildup region. These differences may come from inaccurate physics modeling or incorrect modeling for the linac compounds. To investigate these differences, independent geometry routines are developed to model a linac head. The geometry routines are used in conjunction with two independent Monte Carlo systems: GEPTS and EGSnrc (updated version of EGS4). Both systems include more accurate physics models in comparison with EGS4 (e.g. electron multiple scattering, electron boundary crossing, atomic relaxation after photo-absorption…etc.). Percent depth dose distributions and lateral dose profiles are calculated for high-energy photon beams. Both GEPTS and EGSnrc predictions are in good agreement with measurements for 6MV and 18 MV photon beams (10 cm x 10 cm and 40 cm x 40 cm) from Siemens linac. Work in progress includes simulating Varian photon beams, analyzing differences in phase space data from the different systems and ultimately explaining the reported discrepancies.

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