AbstractID: 7619 Title: High Precision Data Set For Benchmarking of Electron Beam Monte Carlo

Purpose:
In treatment planning, and particularly in beam commissioning, Monte Carlo dose calculation algorithms are finding increasing application. This research aims to create high accuracy reference data, which will be used for benchmarking of Monte Carlo models.

Method and Materials:
Using the Vickers research linac with beam energy known to 0.5 % and a translational stepping slide with positioning accuracy of 0.2 mm in-air beam profiles were obtained. The measurements were made using an Exradin A16 microchamber and PTW Electron Diode type 60012 and these were compared to a BEAMnrc Monte Carlo simulation and also to ICRU report 35 mass scattering powers.

Results:

i) An experimental data set has been obtained using a well-known beam energy, spot size and irradiation geometry. Measurement data was acquired for a range of scattering foils and with different scattering gases between foil and detector. The uncertainty in the detector position is 0.2 mm and the uncertainty in the measured fluence is 0.1 %.
ii) There was good agreement between the profiles measured by the two detectors.
iii) The initial Monte Carlo results indicated that a divergence of the incident beam must be included in the simulation to give agreement with the experimental data.
iv) A simple scattering model, using mass scattering powers from ICRU report 35, was used to obtain an estimate of the initial beam divergence. A value of 10 – 15 mrad was obtained, which is in good agreement with the Monte Carlo results.

Conclusion:
We now have a high accuracy data set for the benchmarking of electron beam Monte Carlo models at better than 1 % /1 mm level. An initial BEAMnrc calculation has indicated that the angular divergence of the beam has a significant affect on the width of the in-air beam profile.

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