AbstractID: 6594 Title: Clinical electron beam characteristics investigations using the Monte Carlo Method for absorbed dose determination

Purpose: This work proposes a methodology to build electron beam models capable to accurately represent clinical beams using a simple assumption that it can be represented by a linear combination of monoenergetic beams. Simulations with beam aperture were also performed in order to study the influence of the beam direction on Percentage Depth Dose, PDD.

Method and Materials: The representation of a clinical electron beam is made assigning weighting factors to each monoenergetic component. For this purpose, depth dose curves were obtained from the Monte Carlo simulations of a set of monoenergetic beams of various energies from 1 to 21 MeV. We defined a parameter so-called as LDED, the Limit Distance for Energy Deposition, which assesses the distance from where the energy deposition drops to less than 1 % of the maximum value. The weighting factors are then estimated focusing on the behavior of each of these parameters as a function of beam energy.

Results: The PDD close to the phantom surface up to d_{max} (depth of maximum dose) is not affected by the variation of beam aperture, μ, but from this point on its influence becomes very strong. The values of μ adopted were 0.997 and 0.995 for 9 and 15 MeV, respectively. Comparisons between calculated and measured PDD show discrepancies less than 1.3% and 2.8% respectively for 9 and 15 MeV in the build-up region. Twenty million electron histories were simulated to achieve maximum standard deviations of 0.6% and 0.7%.

Conclusion: This work demonstrates that a simple beam model based on a linear combination of monoenergetic beams and trial and error method can be used to represent clinical electron beams. PDD can be achieved using homogeneous intensity spectra but this it is not adequate for the beam profile, requiring heterogeneous intensity spectrum to reproduce measured data.