

AbstractID: 7068 Title: Comparison of Monte Carlo Simulation Results to an Experimental Thick-Target Bremsstrahlung Benchmark

Objective: To determine the accuracy of Monte Carlo simulation of bremsstrahlung from thick-targets for radiotherapy energies.

Materials and Method: An accurate set of published experimental benchmarks of thick-target bremsstrahlung from 10-30 MV was used to assess the accuracy of three general-purpose Monte Carlo systems: EGSnrc, Geant4.8.1 and MCNPX. The benchmarks are the most accurate available in the radiotherapy energy range. The measured quantity is fluence per energy interval per incident electron, for 10-30 MV x-rays, including the angular distribution at 15 MV.

Results: The following results are for the 15 MV beam. Calculated spectra were in excellent agreement with the measured data. Total fluence for both Monte Carlo systems agreed with experiment within twice the experimental uncertainty of 5%. Of greater relevance to radiotherapy is the relative fluence out to 30 degrees, covering even the largest clinical fields. Calculations agreed with experiment within twice the experimental uncertainty of 3%.

Conclusions: The Monte Carlo codes are in good agreement with the experimental benchmark for calculation thick-target bremsstrahlung for the 15 MV beam. More accurate experimental benchmarks are needed to assess fluence calculation to the 1-2% accuracy required for treatment planning, treatment head design, and other applications in radiotherapy.

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