AbstractID: 10480 Title: EGSnrc benchmarking against high-precision lateral distributions of x-rays produced in thick targets

Purpose:

The EGSnrc Monte Carlo code was benchmarked against newly measured angular distributions of x-rays produced by electron beams stopping in thick targets.

Method and Materials:

The electron beam was generated using the National Research Council Canada (NRC) Vickers linear accelerator. Five materials: Be, Al, Cu, Ta and Pb, were used as targets and measurements were made at 20 MeV. The absolute absorbed dose was measured at different lateral positions with various ionization chambers (PTW 30013, Exradin A19, and NE2505/3) using various build-up caps made of PMMA, Brass, Cu, Sn and W alloy. The BEAMnrc code was used to simulate the experimental setup. The geometry, beam and material properties were implemented in BEAMnrc, while the “cavity” user code was used to score the absorbed dose in the ionization chamber air cavity per incident electron up to angles of 25º.

Results:

For medium-Z targets the shape agreement between measured and simulated distributions is better than 1 % for the entire scanning range. In terms of absolute dose, it was found that there are differences of up to 4 % related to the build-up caps used for the ionization chamber. When considering the five targets, a trend with Z of the target material is noticed. For medium-Z targets the ratio of calculated to measured dose has a variation below 1 %, for the Be target the ratio increases 12 % with the scanning position, while for the Pb target the ratio decreases 5 %.

Conclusion:

The present study shows that the EGSnrc code predicts x-ray angular distributions with shapes in agreement with the measured data at the 1 % level for medium-Z targets. There are still unresolved discrepancies in the absolute dose related to the build-up cap used for the ionization chamber and the target material.

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