AbstractID: 6666 Title: Monte Carlo study of an electronic brachytherapy source using MCNP5 and EGSnrc

Purpose: To compare calculated dose rates and photon spectra for the Xoft Axxent™ electronic brachytherapy source using the MCNP5 and EGSnrc Monte Carlo codes.

Method and Materials: The source was modeled using `cavity.cpp`, which is a Monte Carlo user code distributed as part of the EGSnrc C++ class library. The same dimensions and material compositions were used in EGSnrc as were used in MCNP5 by Rivard *et al.* (Med. Phys. 33, 4020–4032, 2006), with the exception of an approximation for the plastic cooling catheter. Both codes were used to calculate the dose to water at 1 cm along the transverse axis of the source, the air kerma at 100 cm from the source, and the photon spectrum in vacuum at 1 cm from the source. Air kerma was also scored at 1 cm in vacuum using track length estimator tallies with both codes.

Results: Several variance reduction techniques were available in MCNP5 that helped increase the efficiency of the simulations relative to `cavity.cpp`. There were no significant differences between the calculated doses to water or the air kerma at 100 cm with the two codes, but this could be due to the poor statistics in the `cavity.cpp` simulations (2-3%). The air kerma at 1 cm in vacuum was 3.8% ± 0.4% higher in `cavity.cpp` compared to MCNP5, which can be partially attributed to the tungsten L-shell fluorescent photons present in the `cavity.cpp` photon spectrum.

Conclusions: EGSnrc and MCNP5 produced very similar dose rates and photon spectra for the Axxent™ sources, but the statistics were poor for the EGSnrc simulations. Once accurate photon spectra are known they can be used to calculate the corrections required to develop a primary measurement standard for these sources.

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