AbstractID: 4637 Title: Benchmarking MCNP Low-Energy Bremsstrahlung Modeling for Electronic Brachytherapy Simulations

Purpose: Electronic brachytherapy (eBx) sources have been used clinically for over a decade; however, dosimetric characterization methods using measurements or calculations are not well-established. Monte Carlo methods for simulating electron transport, and subsequently photon production, have not been benchmarked to the same degree as for photon-emitting HDR ^{192}Ir or LDR ^{125}I brachytherapy sources. **Materials & Methods**: Towards better understanding the capabilities of MCNP5 to simulate radiation transport for the Xoft Axxent eBx source, this study presents a comparison of calculated MCNP5 results obtained using coupled electron:photon transport with measured bremsstrahlung spectra from the literature. Given the electron energy and target material, MCNP5 bremsstrahlung modeling accounts for photon energy, angle, and probability based on the cross-sections and angular distributions from NIST (Seltzer and Berger, 1985). The Axxent eBx source currently operates at 50 kV with electrons bombarding a ~ 1 μm thick high/low Z target. Pertinent high/low Z comparisons for thin targets, defined as materials thin enough to produce negligible electron absorption in the target, were available from Motz and Placious (1958) using 50 kV on 5 nm Au and 63 nm Al, from Cosslett and Dyson (1957) using 10 kV on 25 nm Au, and from Doffin and Kuhlenkampff (1957) using 34 kV on 25 nm Al. **Results**: Comparisons of calculations and experimental data indicate that bremsstrahlung angular peak, relativistically shifted forward, agreed within a few degrees with measurements in the literature. However, the overall simulated distribution exhibited angularly invariant regions in the forward direction, attributed to MCNP low-energy physics simplifications of the NIST dataset. Given that the brachytherapy target is ~ 50 times thicker, with resultant smearing of the energy/angular distributions, the practical impact of this effect is under investigation, and complementary EGSnrc simulations are in progress. **Conflict of Interest**: This research was sponsored in part by Xoft, Inc.