AbstractID: 12611 Title: Comparison of TLD measured dose, TG-43 dose, and grid-based Boltzmann solver dose from intracavitary APBI for multiple reference locations in a phantom

Purpose: To quantify the difference between inhomogeneity-corrected brachytherapy treatment planning dose calculations and regular homogeneous (TG-43) dose calculations and to compare the results from both calculation methods with TLD measurements for well-defined phantom geometries.

Methods and Materials: Well-characterized TLD-100 chips were used to measure the dose at multiple reference locations on a torso phantom with gel breasts attached simulating a HDR ^{192}Ir intracavitary APBI treatment. A CT scan of the phantom was obtained and the dose to each reference location was calculated in the treatment planning software, both with the standard TG-43 dosimetry formalism and with a grid-based Boltzmann solver (GBBS) that calculates the dose distribution for the actual patient dimensions and tissue compositions.

Results: The TLD measured doses ranged from approximately 40 cGy to 300 cGy and were 5% lower, on average, than the GBBS calculated doses and 17% lower, on average, than the TG-43 calculated doses. The GBBS doses were always lower than the TG-43 doses, with the discrepancy becoming more pronounced at lower doses (further from the source) and at the surface of the phantom. The discrepancy between the TLD measured doses and the GBBS doses did not appear to trend with dose.

Conclusion: The application of inhomogeneity corrections reduces the discrepancy between the TPS calculated and TLD measured doses. When inhomogeneity corrections were not applied, the TPS overestimated the dose at each reference location.