AbstractID: 6870 Title: Comparison of Calculated and Measured Superficial Depth Doses for Static TomoTherapy Beams

Purpose: To compare computed superficial doses from the TomoTherapy treatment planning system (TPS) to measured doses from a static TomoTherapy beam.

Method and Materials: Simulated CT datasets of flat phantoms were created to calculate static TomoTherapy beams at normal and oblique incidence. Calculated doses for depths ≤ 2cm were compared with superficial dose measurements made with a Gammex/RMI model 449 parallel-plate chamber and LiF TLD powder for a static TomoTherapy beam at normal incidence for source to detector distances (SDDs) of 55, 70, and 85cm and oblique angles of 30˚, 45˚, 60˚, 75˚ and 83˚ for typical TomoTherapy jaw sizes (40x2.5cm^2 and 40x5cm^2).

Results: For all measurement conditions, when accounting for the effective depth of each calculation point, the TPS under predicted the dose at the surface. For all normally incident conditions, and 30˚ and 45˚, the TPS under predicted the dose at a depth of 0.1cm by more than 5% of the maximum dose. For 55cm SDD, the TPS under predicted the dose at a depth of 0.2cm by more than 5% of the maximum dose. For highly oblique angles (75˚ and 83˚), the TPS over predicted the dose at superficial depths (i.e., depths between 0.1 and 0.3cm) by as much as 7% of the maximum dose. For all measurement conditions, the measured and calculated data agreed to within 5% of the maximum dose at a depth of 0.3cm and beyond.

Conclusion: The disagreement between calculated and measured surface doses was expected because the TomoTherapy treatment planning system does not currently model electron contamination. The disagreement found at depths between 0.1 and 0.3cm for the highly oblique angles is likely due to the failure of the convolution/superposition algorithm to account for reduced scatter dose near the tissue/air interface.

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