

AbstractID: 13312 Title: Investigation of dosimetric characteristics for lung tumor geometries for a 6 MV photon beam

Purpose: The uncertainty in heterogeneous geometry dosimetry can have a significant impact on lung SBRT. This study investigated dosimetric characteristics of complex heterogeneous geometries for validation of calculation algorithms.

Methods and materials: Solid Water and lung-equivalent phantom blocks were used to construct homogeneous and heterogeneous geometries. The simulated tumor was composed of $3 \times 2 \times 3 \text{ cm}^3$ pieces of Solid Water. The lung equivalent media was $12 \times 8 \times 18 \text{ cm}^3$ imbedded in Solid Water. The five geometries used were tumor-in-lung geometry with tumor and beam axis at 6.5 cm and at 1.5 cm from the interface, lung-only geometry with beam axis at 6.5 cm and at 1.5 cm from the interface, and homogeneous Solid Water. A field size of $4 \times 4 \text{ cm}^2$ was used to cover the simulated tumor. Gafchromic™ EBT film was mounted in the phantom and was scanned in a known orientation and position using a flatbed CCD scanner. Film was used to measure dose parallel and perpendicular to the beam axis. Film perturbation in heterogeneous geometry was investigated to determine an appropriate method for parallel film measurements. The doses for CT-scanned geometries were calculated using the Dose Planning Method (DPM) Monte Carlo algorithm in the University of Michigan Treatment Planning System (UMPlan) and results were compared with the measurements.

Results: The influence of film perturbation in lung material increases with increasing depth. Using a gantry angle ($\sim 2^\circ$) for parallel film measurements reduced the film perturbation but still showed a $\sim 3\%$ discrepancy. The dose distributions along the central axis and off-axis vary with heterogeneous geometry as expected. DPM was able to track the dosimetric characteristics for the different heterogeneous geometries.

Conclusions: Measurements in multiple planes provide more confident information for complex heterogeneous geometries for evaluating the accuracy of calculation algorithms, which increases confidence in lung SBRT dosimetry.

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