

AbstractID: 4619 Title: Heterogeneity dose calculation accuracy in IMRT using an anthropomorphic thorax phantom

Purpose:

To evaluate the accuracy of heterogeneity dose calculation algorithms from two commercial IMRT treatment planning systems

Methods and Materials:

The Radiological Physics Center (RPC) anthropomorphic phantom was irradiated by 6MV photons on a Varian linear accelerator from treatment plans created on the Corvus and Pinnacle treatment planning systems (TPS). The phantom has with TLD located in the tumor, heart, and spinal-cord and radiochromic film in three anatomical planes intersecting the tumor center and extending into the lung. Comparisons were made between each TPS calculation and measurement. Routine clinical procedures were followed and patient IMRT QA was performed on a homogeneous water phantom. Ion-chamber measurements were compared to the calculated values and the calculated dose distributions were adjusted, accordingly. A re-calculation by Pinnacle was made based on the MLC sequence files and monitor unit settings generated by Corvus, and compared to measurement. The Pinnacle recalculation of the Corvus beam definitions was performed for the anthropomorphic phantom and the QA water phantom deliveries. Criteria for the comparisons were per TG-53.

Results:

The Pinnacle IMRT TPS predicted dose within 1% of the TLD value at the tumor center, while the Corvus IMRT TPS overestimated the dose by 5%. The radiochromic films show at least 96% of the region was in agreement at the $\pm 5\%/3\text{mm}$ criteria level when compared to the Pinnacle TPS regardless of which delivery parameters were used. The Corvus TPS predicted about 61% of the region met the criteria at a $\pm 5\%/3\text{mm}$ level.

Conclusion:

The Pinnacle IMRT superposition convolution dose calculation algorithm provided clinically acceptable results ($\pm 5\%/3\text{mm}$). The Corvus IMRT finite-size pencil beam based algorithm with 1-D correction overestimated the dose and failed to meet the $\pm 5\%/3\text{mm}$ criteria within a majority of the PTV and penumbra regions.

This work was supported by PHS grant CA10953 and CA081647 awarded by NCI.