AbstractID: 7218 Title: Accuracy of heterogeneity correction algorithms used with step and shoot and sliding window IMRT

Purpose: To evaluate the accuracy of tissue heterogeneity dose correction algorithms for IMRT delivery using step and shoot and sliding window techniques.

Method and Materials: A solid water phantom incorporating a lung equivalent heterogeneity layer along with several planning targets was constructed. The phantom was CT scanned and contouring of targets was done. Several anatomical dose constraints and penalty functions were defined. A commercial treatment planning system was used to evaluate the optimal fluence for several IMRT field setups. Each fluence was then run through a leaf motion calculator to provide deliverable fluences using both step and shoot and sliding window techniques. Heterogeneity correction algorithms were used in both the dose optimization process and the final dose calculations. GafChromic EBT film was strategically placed within the phantom. The phantom was irradiated with each set of IMRT treatment fields and each film was then processed. The measured dose distribution was compared to the predicated distributions.

Results: Preliminary studies with static fields (1x10 cm^2 through 10x10 cm^2) showed that heterogeneity algorithms became less accurate with decreasing field width. The largest difference between the predicted and the delivered dose on the beam axis inside the lung equivalent material was 28% found for the EqTAR algorithm for the 1x10 cm^2 field size. Not surprisingly, calculated dose distributions were most accurate for step and shoot delivery where field widths are typically larger than those used with sliding window delivery.

Conclusion: Current heterogeneity correction algorithms were found to become less accurate with decreasing field widths. The accuracy of IMRT dose delivery in regions of tissue heterogeneity is therefore dependent on the delivery technique. Since sliding window techniques typically irradiate with narrower fields, heterogeneity algorithms are more accurate for step and shoot delivery where fewer but larger fields are typically used.