AbstractID: 3713 Title: Correlation analysis of MLC leaf separation and patient specific IMRT QA

Purpose: We examined IMRT beams for potential correlations between properties of the MLC files and the agreement between the expected and measured dose distributions for patient specific QA.

Method and Materials: We studied the significance of the incomplete modeling of the MLC rounded leaf edge in the Pinnacle-v6.2b TPS. Test beams were generated with opposed leaf separation widths of 0.5, 0.7 and 1.0 cm. Different percentages of the total MU were delivered with these small separation segments with the remaining MUs delivered via an open field. A diode array was used to measure the delivered dose. The agreement between the planned and delivered beams (pass-rate) was based on a 3%-3mm dose-difference and distance-to-agreement criteria. A software program examined the MLC files and identified opposed leaves separations less than 0.5, 0.7 and 1.0cm and calculated the fractional area (Area) exposed by the separated leaves as well as the percentage of MUs (%MU) delivered via that segment. Correlations between the product of the %MU and Area and the pass rate were examined.

Results: For the test beams, strongly statistically significant Spearman correlations were found for %MU*Area and pass rate for leaf separations of 0.5 and 0.7cm (ρ=0.9 and ρ=0.8). An analysis of the 350 step-and-shoot beams indicates a possible correlation between the pass rate and the %MU*Area value for separation thresholds of 0.5 and 0.7cm (ρ=0.5 and ρ=0.51).

Conclusion: The pass rates and leaf separation were correlated in the test beams, however the ability of the small separations to predict pass rates in real beams was not significant. For real beams, there are contributing factors such as interleaf leakage and leaf position errors which can cause the low pass rates. For 1.0cm separations, the pass rate was 100% indicating that the systematic errors for leaf separation greater than 1cm were not significant.