AbstractID: 5566 Title: Comparison of correction and model based dose algorithms in lung cancer retrospective dose recalculation and treatment outcome evaluation

Purpose: To perform a systematic comparison of the Monte Carlo (MC), convolution/superposition (CS), and equivalent path length (EPL)-based dose calculation algorithms for the purposes of outcomes modeling in lung cancer treatment planning.

Methods: Several treatment plans (originally planned using EPL) from a large database of patients treated on a lung dose escalation protocol were retrospectively recalculated using MC and CS. Doses were computed in the homogeneous (unit-density) and heterogeneous geometries; homogeneous calculations were used to elicit differences in the beam models To evaluate algorithmic differences due to heterogeneity effects, beam model differences were minimized by adjusting beam weights in the homogeneous plans to achieve the same prescribed dose with each algorithm. These beam weights were then applied to the heterogeneous geometries. Absolute dose distributions were compared using: color-wash dose difference displays, isodose lines, EUD (for the target) and mean lung dose (MLD) and NTCP (for the normal lungs).

Results: For the target, MC and CS-computed EUDs were in good agreement for both homogeneous and heterogeneous cases, with maximum dose differences of 1.2 Gy noted. Differences between EPL and MC (or CS) were generally much larger, in the heterogeneous plans extending up to 6 Gy. Differences in MLD computed with MC and CS ranged between 2% and 15% in the heterogeneous plans. These differences were similar in the corresponding homogeneous geometries, illustrating the importance of beam model disparities. For EPL, differences in the MLD and NTCP (relative to MC or CS) were much larger in the heterogeneous plans indicating systematic differences in the normal lung dose prediction.

Conclusion: Evidence thus far is suggestive that discrepancies in dose computed with EPL and MC (or CS) will lead to differences in correlations of dose with outcome with respect to the target as well as normal tissue complications (radiation induced pneumonitis) and calculated NTCP.