AbstractID: 1582 Title: Monte Carlo Corrected DVHs for Retrospective Dose-volume Modeling

Normal tissue complication probability modeling may be adversely affected by poor or absent corrections for heterogeneity. To address this issue for lung treatment plans, we have developed a process to recalculate the dose volume histograms using Monte Carlo methods. Beam geometry information is extracted from archived treatment plans. Beam weights, which were not archived, are determined by minimizing the difference between the Monte Carlo dose distribution assuming a water-equivalent medium and the original treatment plan without heterogeneity correction. These beam weights are then used for a Monte Carlo dose distribution calculation incorporating the actual CT scans. I. Kawrakow's VMC++ Monte Carlo program was used. Calculations performed on a cluster of 20 PCs (1.6GHz processors) typically required 10 minutes per plan (3 mm voxels, 200,000 particles per sq. cm., leading to an uncertainty of 2% in the 50% dose region). The Monte Carlo results were tested against treatment planning system dose distributions, calculated with and without heterogeneity corrections, using an accurate convolution-superposition algorithm. Including heterogeneity corrections led to an 8% change in mean and maximum lung dose. The Monte Carlo and convolution-superposition mean and maximum lung doses agreed to within 1-2% with or without heterogeneity correction. In addition, the beam weights were accurately derived. In cases where heterogeneity-corrected dose distributions are missing or may be inaccurate due to over-simplified algorithms, these results support the use of this technique to recalculate lung dose volume histogram parameters.

This research was supported by NCI grant CA85181.