AbstractID: 2041 Title: Investigation of Heterogeneity Corrections in Lung Cancer Radiotherapy

The purpose of this inter-institutional project was to investigate the heterogeneity corrections in lung cancer radiotherapy. We used the Monte Carlo method and ionization chamber measurements to obtain the heterogeneity correction factors (*Kc*) in a specially designed lung phantom for 6 and 15 MV photon beams for Varian 2100CD accelerators, and compared the calculated *Kc* from different dose algorithms in some commercial planning systems (XiO, Theraplan plus, Pinnacle and Eclipse). Our Monte Carlo calculations showed that the heterogeneity correction was significant, especially for low energy, and oblique photon beams: The average *Kc* was 1.03 for 15MV AP-PA and was 1.06 for 6MV parallel oblique (30°) beams, at the points along the central axis in the lung phantom. Agreement within 1.5% was achieved between the Monte Carlo calculations and the ionization chamber measurements. Compared with the Monte Carlo calculations, we found that some dose algorithms were more accurate than others. The variation in dose calculation between commercial planning systems was 2-3%. Agreement within 2% was observed between the Monte Carlo and Superposition dose algorithms. For the selected 12 patients in a clinical trial, the difference between doses calculated (corrected for heterogeneity) and doses prescribed (uncorrected) was clinically significant. The *Kc* values ranged from 0.97 to 1.04 depending on the treatment plans, calculated by the Superstition dose algorithm in XiO planning system. Our study shows that the heterogeneity corrections should be implemented in lung cancer radiotherapy, most commercial dose algorithms are accurate enough to perform heterogeneity corrections in future lung cancer protocols.