AbstractID: 9271 Title: Estimation of Dose Volume Histogram for partial volume irradiation of rat lung

Recent DNA assay studies of partial volume irradiation in rat lung showed a regional dependent 'out-of-field' effect. That is, the shielded lung apex experienced DNA damage when the base was irradiated but the reverse did not occur. Possible mechanisms associated with this phenomenon have been largely speculative. A Monte Carlo (MC) study was conducted to investigate the effect of electronic disequilibrium in the dose distribution within the lung to help assess the possible impact on the associated lung damage.

The EGSnrc MC code together with DOSXYZ, a 3-D voxel dose calculation module, was used in this study. A rat anthropomorphic phantom was obtained from rat CT dataset. Lung base (65% of lung volume) and apex (35%) irradiation with ^{60}Co gamma-ray were examined. Dose volume histograms (DVH) as well as profiles were generated for comparison between the two irradiation schemes.

MC simulations showed a significant difference between the base and apex DVHs for both irradiation conditions. Base irradiation resulted in a higher dose to both irradiated and shielded volumes compared to that in apex irradiation. Base irradiation also resulted in a higher penumbra width, a further evidence of the increased electron migration outside the field due to the larger irradiated lung volume. However, the difference in dose for the base and apex under either irradiation scheme did not appear large enough to account for the regional variation of the 'out-of-field' effect. This simulation method is potentially useful in dose calculation for irradiation of small fields in a highly heterogeneous environment.