AbstractID: 3558 Title: Impact on tumor dose coverage due to the second buildup for lung tumour treatment using an 18 MV photon beam

Purpose: Conformal radiotherapy requires accurate dose prediction in the planning target volume and organs at risk. This study is to investigate the target dose coverage in lung tumor treatment and to assess the impact of the second dose buildup as a function of irradiated field sizes when an 18 MV photon beam is used.

Method and Materials: The Monte Carlo codes BEAMnrc/DOSXYZnrc are used to simulate photon beams from a Varian accelerator and to calculate dose distributions in a lung phantom. The dose distributions in lung and tumor were calculated for various field sizes to investigate the effect of the incident field size. The Monte Carlo calculated dose distributions are also compared with those predicted by commercial treatment planning systems.

Results: There is no significant tumor dose reduction (<1%) due to the second buildup for treatment field sizes >10×10cm^2 for an 18 MV photon beam treated with parallel opposed beams. However there are about 4% to 12% dose reductions at the interface due to the second buildup when treatment fields are 7×7cm^2 to 3×3cm^2 respectively. The simple inhomogeneity correction methods (Batho and ETAR) employed in a commercial treatment planning system can give rise to inaccuracies up to 20% in the lung and tumor dose for a small field.

Conclusion: There is a benefit to using a higher energy 18 MV beam for larger treatment fields (>8×8 cm^2) to reduce hot spots and there is negligible dose reduction at the interface due to the second buildup. However the second buildup can cause significant dose reduction at the interface for field sizes <7×7 cm^2 and an 18 MV beam should be not be used for a small fields in the lung. Batho or ETAR correction methods result in large errors in predicting the dose in lung and tumor for a small field.