AbstractID: 1184 Title: Monte Carlo dosimetric evaluation of using high energy vs low energy beams in low density materials

Lower photon energies are often used in radiotherapy when low-density heterogeneities are involved because higher energies show some undesirable dosimetric effects due to increased electron ranges. This work is aimed at investigating the energy selection for low-density materials. We have used the BEAMnrc Monte Carlo system to simulate typical treatment setups in a lung phantom and an air-channel phantom. Three photon energies were studied including 6, 15 and 20 MV by comparing central axis dose distributions and lateral profiles using the single, AP/PA and three-beam arrangements. A clinical lung case was also investigated. Our results showed no significant changes in the penumbra width in lung when a pair of opposed fields were used. The underdosage at the tumor edge caused by the dose buildup at the lung-tumor interface reached 7% for a 5 cm x 5 cm AP/PA setup. Shrinkage of the 90% isodose volume was noticed for the same setup, which could be rectified by adding a lateral field. In the lung patient case, the AP/PA setup using lower energies offered better tumor coverage but for the three-field technique, higher energies offered better lung sparing. For the air-channel setup, adding an opposed field reduced the penumbra width. Using higher energies resulted in a 7% cold spot around the air-tissue interface for a 5 cm x 5 cm field. It is concluded that the choice of energy for treatment in low-density areas should be made based on a number of parameters including the beam arrangement and the dosimetric criteria.