

AbstractID: 8030 Title: An Experimental Investigation on Interplay Effect between dMLC Leaf Motion and Respiration-Induced Tumor Motion in Lung IMRT Treatment

Respiration-induced tumor motion has complicated the use of IMRT as a potential dose escalation tool for lung tumor treatment. We have experimentally investigated the interplay effect between MLC motion and tumor motion. An in-house made motor-driven platform, which moves sinusoidally with an amplitude of 1 cm and a period of 4 seconds, is used to mimic tumor motion. Dose to tumor center was measured according to geometric and dosimetric parameters from two 5-field lung IMRT plans. For each field, measurement was done for: 1) two dose rates (300 and 500 MU/minute), 2) three dMLC modes (sliding window, step-and-shoot with 10 and 20 intensity levels), 3) eight equally spaced starting phases in the breathing cycle, and 4) four angles between MLC/phantom motions. The overall delivered dose was calculated for both a single fraction and 30 fractions, by randomly sampling from measured doses of each field at different initial phases. It is found that the mean dose to a moving tumor differs slightly ($< 2-3\%$) from that to a static tumor. The variation around mean dose, caused by the variation in breathing phase at the start of radiation, can be greater than 30% for one field, 10% for all five fields of a single fraction, but less than 1-2% after 30 fractions. It is also found that low dose rate is preferable for lung IMRT, and there is no apparent dependence of interplay effect on either dMLC delivery mode or the angle between MLC motion and tumor motion.