

AbstractID: 4741 Title: On the Dose Delivered to a Moving Target When Employing Different IMRT Delivery Mechanisms

Purpose: To investigate the influence of target motion on dose distributions generated using unmodulated open fields, solid intensity modulator (SIM), Step and Shoot MLC (SMLC) and dynamic MLC (DMLC).

Method and Materials: For two lung cancer cases, four treatment plans were generated using Pinnacle³ 7.9t consisting of an open field, SIM, SMLC and DMLC delivery on a Varian Clinac 600C/D equipped with a 120 leaf Millennium MLC. The coordinates (x, y, z, t) of the 4D motion trace for each of the tumors were determined using 4D-CT from which a 4D motion kernel was generated. For each beam used in the experiment, the beams-eye view tumor motion due to breathing was simulated using a computerized 2D tabletop apparatus. A MAPcheck diode array was incorporated into the apparatus for dose distribution analysis. Each of the four static treatment plans was delivered to the breathing MAPcheck ten times at various points of the breathing cycle.

Results: The variation in diode dose readings within the tumor motion envelope was compared for the open field, solid, segmented, and dynamic IMRT deliveries. The open field provided the most uniform dose to the entire set of tumor mimicking diodes followed by SIM, SMLC, and DMLC IMRT, respectively. On an individual diode by diode basis over ten trials, the open field had the smallest average coefficient of variation of 0.122% followed by SIM (0.98%), SMLC (2.22%) and DMLC (3.88%) IMRT delivery, respectively.

Conclusion: For the three IMRT delivery methods (SIM, SMLC, and DMLC), SIM consistently provided a more uniform dose to the tumor over many trials. SMLC performed as well as the solid modulators in many cases or was slightly outperformed by SIM. DMLC consistently delivered the least uniform dose to the tumor over many trials.