AbstractID: 3076 Title: Synchronized delivery for DMLC IMRT for stationary and moving targets

Purpose: To eliminate tongue and groove (TG) underdosage effects during DMLC IMRT delivery for stationary and moving targets by synchronizing leaf pair trajectories using a non iterative algorithm.

Method and Materials: Optimal leaf trajectories to deliver the desired intensities are calculated independently for all leaf pairs. The mid-time trajectories for all leaf pairs are also determined. From the mid-time trajectories of all leaf pairs one common synchronized mid-time (MT) trajectory is determined. Trajectories for all leaf pairs are reconstructed from this synchronized mid-time trajectory. Properties of the mid-time trajectory guarantee that no violation of velocity constraints occurs. The same procedure works for both moving and stationary targets.

Results: The intensity delivered in the overlapped region without leaf synchronization, and with leaf synchronization, is examined using two examples. One example shows the leaf synchronization of five leaf pairs to deliver clinical intensity for stationary target and other shows ten leaf pair synchronization to deliver clinical intensity for moving target. The no collision property between the leading and following leaves of neighboring leaf pairs for MT-synchronized trajectories is assured. This property is illustrated in snapshots of the MLC leaves at different times of irradiation for moving targets.

Conclusion: The mid time synchronization based solutions remove TG underdosage in DMLC IMRT delivery for stationary and moving targets. The delivery based on these solutions (i) removes TG underdosage in overlapped region in the sense that the intensity in the region is guaranteed to be equal to the lower intensity delivered by any one of two pairs of neighboring leaves (ii) facilitates simultaneous multiple leaf correlation and thus avoids iterative algorithms (iii) minimizes the time of delivery provided all constraints imposed on leaf motions are satisfied (iv) assures that no collisions between leading and following leaves of neighboring leaf pairs occur.