AbstractID: 1729 Title: Optimized Delivery of DMLC IMRT for Translating Rigid Target

Recent advances in radiotherapy aim at integrating image-tracking of moving organs with IMRT delivery. The most efficient method of delivering intensity-modulated treatments to mobile targets can be achieved through appropriately modified DMLC techniques. Delivery based on continuous, unidirectional motion of MLC leaves that minimizes the number of monitor units per fraction is the optimal solution to the problem. The problem of optimizing DMLC delivery to a moving target can be formulated as a one-dimensional optimization problem with two constraints. One constraint demands that the predefined intensity profile is indeed delivered. The other constraint limits the maximum speed of each leaf. The optimal control problem so defined has been solved in the literature[1]. In this presentation the computer code based on this solution is investigated. Quantitative examples of optimized delivery in DMLC IMRT for moving, rigid targets are presented, explained and analyzed. The computer code is designed in a generic, modular format so that it can be applied to irradiations based on arbitrary intensity profiles and for any translational target motion. Results of numerical calculations uniquely determine leaf trajectories as functions of time (monitor units). Results presented determine also values of duration of treatment, verify delivered intensity, and confirm preservation of imposed constraints. Solutions obtained allow comparing parameters of delivery based on the optimizing algorithm with those that are obtained through non-optimal solutions.

1. L.Papiez, The Leaf Sweep Algorithm for an Immobile and Moving Target as an Optimal Control Problem in Radiotherapy Delivery, Math. Comp.Mod. 37, 735-745 (2003).