AbstractID: 13450 Title: Improving IMRT-plan Quality with MLC Leaf Position Refinement post Plan Optimization

Purpose: To effectively decrease the MLC step size and improve the IMRT-plan quality without a significant impact on the computational burden, we have implemented and evaluated a method that makes fine adjustment of leaf positions after plan optimization.

Method and Materials: At the completion of a conventional plan optimization of IMRT with optimal beam segments, two pencil beams adjacent to the aperture boundary with half of the MLC step size are computed for each optimized leaf position. A greedy search is conducted by looping through all of the involved MLC leaves to see if moving the MLC leaf in or out by half of the original step size will improve the objective function. The half-sized pencil beams is derived from those of the full-sized pencil beams by using a matrix shift and subtraction. The scheme is tested using a planning system based on direct aperture optimization (DAO).

Results: An IMRT benchmark case with a C-shaped target was used for the simulation study. Seven equispaced 6MV photon beams were used with seven apertures per beam direction. Both Elekta (10 mm in width, 5 or 10 mm in step size) and Varian (5 mm in width, 5 mm in step size) MLCs were tested using the same prescription parameters. After plan optimization, 25-35% of boundary-related leaf positions were refined in the greedy search, and the objective value was improved by 20-30%. Comparing with the solution before refinement, the PTV doses are more conformal and uniform. The mean doses to the OARs decrease by 2.9-4.2%.

Conclusion: A greedy search method is applied to refine the MLC leaf positions to improve IMRT-plan quality. By adding a very small computational burden, the objective value can be improved with such a post-optimization refinement. The dosimetric benefits have been demonstrated with a benchmark case.