AbstractID: 3153 Title: Time-resolved aperture modulated radiation therapy

Purpose: To develop a method to incorporate organ motion into aperture modulated arc therapy treatment plan optimization and evaluate the performance of this method by applying it to prostate cancer cases.

Method and Materials: A 36 beams treatment plan was prepared using PLUNC treatment planning system to simulate arc therapy. To take into account the effect of organ motion, a 3D distribution function was supposed to describe the displacement resulted from organ motion at different breathing phases. Doses to voxels were calculated using the displacement information at any phase; the deformed doses could be mapped back to the primary breathing phase which is a deformation free phase. Then an optimization objective function about multileaf collimator leaf positions could be defined based on the mapped doses; and adapted simulated annealing (ASA) approach was employed to minimize the objective function subject to clinical prescription requirements. After optimization, an aperture (leaf positions) optimized treatment plan could be gotten. A conventional IMRT treatment plan was also designed for comparison. The aperture optimized treatment plan could be exported to Eclipse treatment planning system and recalculated to observe its performance on Varian accelerators.

Results: Compared with IMRT treatment plan, aperture optimized treatment plan can produce more conformal dose distribution around the target and critical structures can be spared more effectively, the delivery time and machine MU are also reduced significantly.

Conclusion: Organ motion can be incorporated into the aperture modulated arc therapy treatment plan optimization with the information of displacement information. A more realistic distribution function can be employed conveniently to produce more significant clinical result.