AbstractID: 11845 Title: Time Optimal Delivery of Intensity Modulated Arc Therapy

Purpose: Delivery of arc therapy can be achieved with multiple solutions for speed of gantry rotation, beam dose rate variation in time and with various speed trajectories of MLC leaves. The goal is to find the most time efficient realization of the arc delivery provided all constraints of the delivery system are satisfied.

Methods: The starting point for our considerations is that the specific plan of treatment has been derived for arc radiation therapy. The parameters of the plan that have to be kept unchanged during delivery to preserve the integrity of the plan include file defining apertures of MLC as function of gantry angle and file defining beam intensity (MU) as function of gantry angle. The other point of our considerations exemplifies limitations of delivery systems for arc therapies. These constraints include gantry angle angular speed limit, beam dose rate limit and MLC leaf speed limits. Provided above invariants and limitations are satisfied there exist multiple solutions for arc therapy delivery. We derive formula for such determination of gantry rotation speed, beam dose rate variation and MLC leaf speeds during delivery that lead to minimal time of arc delivery of a given plan.

Results: We investigate example of arc therapy comparing delivery performed under Varian delivery algorithm and our time-optimized delivery. We first solve the optimization problem, define delivery files. We simulate deliveries based on parameters derived from standard algorithms and from our solutions. In our preliminary study we find that both deliveries provide identical dose distributions and observe our algorithm leads to 10-15% decrease in delivery time.

Conclusions: Investigation of minimal delivery time arc therapy demonstrates that this provides a viable option for arc therapy implemented with clinical TPS and linear accelerators. Simulation study shows that minimal delivery time arc RT improves treatment efficiency without compromising dosimetric integrity.