AbstractID: 12610 Title: Efficiency and cost of RapidArc to deliver highly heterogeneous dose for simultaneous integrated boost plans: A dosimetry study

Purpose: A set of parameters unique to heterogeneous dose distribution is used to standardize the evaluation of RapidArc (RA) for simultaneous integrated boost (SIB).

Methods and Materials: RA plans were run on both phantom and patients. 30 Gy was prescribed to PTV and 35-90 Gy were prescribed to boost tumor volume (BTV) with varying size and location inside the PTV. Dose contrast, defined as the mean dose to the BTV divided by that of PTV, was used to evaluate the ability of RA system to escalate BTV doses without over-treating the rest of PTV. A biological contrast was computed using biological equivalent dose (BED). To calculate standardized efficiency, both contrast indices were normalized to ideal cases that boost dose can be delivered without other changes to the plan. The integral dose to the entire phantom excluding PTV was used to assess the cost to other normal tissue. Five brain patients with SIB prescription were planned and analyzed based on the same methodology. SIB plans are subsequently compared with sequential boost (SEB) plans.

Results: Efficiency decreases non-linearly with the size of the BTV and the boost doses. An optimal boost dose at 45 Gy was observed using the metric. For BTVs located in the center of the PTV, the integral dose to the normal tissue increased by less than 5% comparing to the PTV only plan, and surprisingly stays almost constant with increasing boost doses. For BTVs close to the edge of PTV, the integral dose increased by 5-20% with boost dose. SIB plans are dosimetrically more favorable than SEB plans. The patient plans are consistent with phantom plans.

Conclusion: The nonlinearity of cost and efficiency to delivery SIB plan was demonstrated, indicating the feasibility to selectively boost small tumor volume to a very high dose on the RapidArc platform.