AbstractID: 5402 Title: Arc Sequencing – An Inverse Planning Technique for Intensity Modulated Arc Therapy

Purpose: Intensity modulated arc therapy (IMAT) is a rotational approach to IMRT in which the leaves of the multileaf collimator move continuously during arced beam delivery. Overlapping arcs are used to deliver optimized intensity patterns from each beam direction. Despite the promising nature of IMAT, its potential has gone largely unrealized due to a lack of robust inverse planning tools. To address this, we have developed an IMAT arc sequencing algorithm that translates optimized intensity maps into deliverable IMAT plans.

Material and Methods: The arc-sequencing algorithm uses simulated annealing to simultaneously optimize the aperture shapes and weights throughout each arc. The sequencer enforces the delivery constraints while minimizing the discrepancies between the optimized and sequenced intensity maps. The performance of the arc sequencer has been tested for ten patient cases. An IMRT plan was developed for each case using the Pinnacle^3 treatment planning system, and the arc sequencer translated the optimized plans into deliverable IMAT plans.

Results: Ten IMAT patient plans were developed covering the following sites: 3 prostate, 3 brain, 2 head-and-neck, 1 lung, and 1 pancreas. Seven coplanar IMAT plans were created using an average of 4.6 arcs and 685 monitor units. Additionally, three noncoplanar plans were created using an average of 16 arcs and 498 monitor units. The results demonstrate that efficient IMAT delivery plans can be developed that combine the dosimetric advantages of arc therapy with the dose painting capabilities of IMRT. Only modest degradation was seen between the pre and post sequenced plans. Plan accuracy was verified using Monte Carlo dose calculations with each arc approximated as static beams separated by two degrees. An average sequencing time of under 25 minutes was observed.

Conclusions: An arc-sequencing algorithm has been developed that can serve as the first robust inverse planning tool for IMAT.