AbstractID: 9522 Title: A generalized inverse planning tool for arc-based IMRT delivery

Purpose: The recent development of new linac control systems that are capable of delivering Volumetric Modulated Arc Therapy (VMAT) has attracted significant attention. There remains, however, a lack of robust inverse planning tools for VMAT. In this study, we will present a generalized inverse planning tool that can provide highly conformal VMAT solutions using either single-arc or multiple-arc deliveries for both Varian and Elekta MLCs.

Materials and Methods: To generate VMAT plans, we first created optimized multi-field IMRT plans with equal-spaced beam angles in Pinnacle^3 using direct machine parameter optimization (DMPO). A "deliverable" fluence map was reconstructed using the resulting apertures for each beam. Next, we applied our home-grown arc sequencer to translate these fluence maps into VMAT plans. Based on the user-defined requirements, the sequencer can provide either single-arc or multiple-arc plans that meet the predefined VMAT leaf-motion constraints. The obtained VMAT plans were then loaded into Pinnacle^3 for a final dose calculation. In this study, 10 cases were tested in this study covering a variety of treatment sites including head-&-neck(5), prostate(3), lung(1) and brain(1).

Results: A total of 24 VMAT plans were created using these 10 cases. Results demonstrated that highly conformal VMAT dose distributions can be achieved with an average sequencing time of under 8 minutes. On average, the VMAT plans required 513 MUs to deliver between 1 to 3 arcs. The average standard deviation in the target dose was 5.79 cGy/fraction; while the average target volume covered by 95% prescribed dose was 98.1%. Our results show that comparable VMAT plans can be achieved using either the Elekta 80-leaf MLC or the Varian 120-leaf Millennium MLC.

Conclusions: Our generalized arc-sequencing algorithm serves as a robust inverse planning solution for VMAT. Highly conformal single-arc or multiple-arc VMAT plans can be created for Elekta and Varian MLCs.