AbstractID: 9276 Title: A Technique For Creating VMAT Plans Using Direct Machine Parameter Optimization

Purpose: The objective of this study was to develop a technique for single rotation volume modulated arc therapy (VMAT) treatment plans using the current clinical version of the Pinnacle Treatment Planning system. The goal was to create treatment plans using only tools currently available in Pinnacle.

Methods and Materials: Treatment planning for VMAT was performed using the Direct Machine Parameter Optimization (*DMPO*) algorithm. With DMPO, inverse planning is performed by optimizing MLC leaf positions and segment weights. The treatment delivery was modeled and optimized as 51 equally spaced fixed beams. This beam geometry was selected to generate comparable plans to helical tomotherapy. Upon completion of optimization, the MLC delivery files were exported and converted into a single arc. Fixed-gantry IMRT plans were also created for comparison by analyzing dose statistics, volume histograms, and differences. Calculated doses and MLC controller files were extracted from Pinnacle and imported into MATLAB for analysis. Gamma analyses were performed between the fixed-gantry and VMAT plans. In addition, the modulation factor was calculated for the VMAT plans.

Results: A total of 11 treatment plans were created for VMAT and fixed-gantry IMRT. In all cases, the DMPO algorithm was able to optimize a plan resulting in one beam aperture. For prostate and H&N cases, the modulation factors ranged from 1.25-1.87 and 1.86-4.26. The VMAT delivery had less sparing of the parotids than the fixed-gantry IMRT. For one patient, the volume of the parotids receiving over 20 Gy was 20% for the fixed-gantry and 25-30% for VMAT. In addition, the dose uniformity through both the prostate and H&N PTVs were less with VMAT.

Conclusions: Two conclusions can be drawn from the study: 1.) It is possible to create VMAT plans using DMPO in Pinnacle; and 2.) The VMAT plans have dose distributions similar to fixed-gantry IMRT.