AbstractID: 7003 Title: A Simple Geometric Algorithm to Predict Optimal Starting Gantry Angles Using Equiangular-spaced Beams for IMRT of Prostate Cancer

Purpose: A fast, geometric beam angle optimization (BAO) algorithm for intensity-modulated radiation therapy (IMRT) was implemented on ten localized prostate cancer patients on the Radiation Therapy Oncology Group 0126 protocol.

Method and Materials: Fifteen segmental IMRT plans per patient were generated in Pinnacle^3 using 5 equiangular-spaced beams with 5° increments of the starting gantry angles. Constant target coverage was ensured for all plans in order to isolate the variation in the rectal dose metrics as a function of starting gantry angle. A geometric BAO algorithm computed the beam intersection volume (BIV) within the rectum using 5 equiangular-spaced beams as a function of starting gantry angle for comparison to the rectal V 75 Gy and V 70 Gy.

Results: The variations in rectal V 75 Gy and V 70 Gy as a function of starting gantry angle using 5 equiangular-spaced beams were statistically significant ($p < 0.001$) with dosimetric importance. The class solution 'W' pattern in the rectal V 75 Gy and V 70 Gy (with two separate minima centered near 20° and 50°) was reproduced by the 5 BIV within the rectum. A strong correlation (Pearson's correlation coefficient > 0.70) was found between the rectal 5 BIV and the rectal V 75 Gy and V 70 Gy. The geometric BAO algorithm predicted the location of the two dosimetric minima in rectal V 75 Gy and V 70 Gy (optimal starting gantry angles) to within 5°.

Conclusions: This BAO method is the first geometric algorithm capable of predicting an optimal IMRT dose distribution with typical computation times of only a few minutes. Given the clinically infeasible computation times of many dosimetric BAO algorithms, this robust geometric BIV algorithm has the potential to facilitate beam angle selection for prostate IMRT in clinical practice.