AbstractID: 7353 Title: Monte Carlo kernel-based convolution-superposition dose calculation for intensity-modulated arc therapy (IMAT)

Purpose: Dose calculations for intensity-modulated arc therapy (IMAT) have traditionally been performed by approximating continuous arcs with multiple static beams. Not only that the calculated dose may not truthfully represent the delivered dose, but also the large number of beams used to approximate an arc requires very long calculation time. We propose to use our homegrown Monte Carlo (MC)/superposition dose calculation algorithm to compute doses for rotational delivery.

Method and Materials: We first generate static IMRT plans with Pinnacle^3 P3 IMRT module utilizing 36 equi-spaced beams. The resulting intensity maps are inputted to the continuous intensity map optimization (CIMO) IMAT leaf sequencer. CIMO outputs deliverable arcs, each represented by aperture shapes spaced at 10-degree intervals. The apertures are then interpolated at 1-degree intervals. Dose calculations for both 36-field plan and 351-field plan (which closely represents the actual delivery) are performed using our homegrown MC-based dose calculator. The time needed for calculating dose for the two plans are compared and the differences in dose distributions are also examined.

Results and Conclusion: Four IMAT plans, a prostate, a head and neck, an orbit, and a brain, were selected for the study. Using history-based sampling, the dose computation time only increased slightly for the 351-beam plans. Each case took approximately 30 minutes to compute on a single CPU running Mac OSX. No significant differences in plan quality between the 36-beam and the 351-beam plans were observed. However, finger-like artifacts at the lower isodose levels became evident when using 36 beams to approximate an arc. The dose calculation time using our MC-based dose calculator is largely independent of the number of beam portals. For the cases studied, using 36 beams to approximate an arc delivery is sufficient, but more accurate calculation with finer angular spacing is achievable without a significant increase in computation time**.**