AbstractID: 9563 Title: On the Quantification of the Dosimetric Accuracy of Collapsed Cone Convolution Superposition algorithm for Small Lung Volumes using IMRT

Purpose: To quantify the accuracy of a collapsed cone convolution superposition (CCCS) algorithm against Monte Carlo (MC) simulations for small lung lesions subject to electronic disequilibrium when very small segments are used during the IMRT optimization process.

Method and materials: IMRT plans for eleven (n=11) lung patients were created using Pinnacle^3 7.6 planning system (TPS). Lung lesions measuring <3 cm in max. diameter and <27 cm^3 were previously treated in our institution with SBRT techniques. The optimized intensity maps of each plan were then used to calculate the dose distributions using the CCCS algorithm. For each patient, seven optimized plans were created with varying MLC minimum segment sizes—0.25cm^2 to 6cm^2. The linear accelerator was modeled using MC code EGSnrc\BEAMnrc and verified against commissioned measured data. Intensity maps for each plan and the patient CT dataset from the TPS were exported to our MC software. All patients were planned using a 5-field IMRT plan (Millennium 120-leaf MLC and Varian 2100C 6MV beam). Dose distributions were calculated and normalized so that the isocenter receives 45.0Gy. Isodose distributions, DVH, and ROI statistics were used for comparison between the two calculation methods.

Results: Comparison of the DVHs from Pinnacle^3 and MC show similar target coverage between CCCS algorithm and MC. Differences in the minimum, maximum and mean dose of the PTV were less than ±5% while doses to critical structures agreed within ±6% for all cases investigated. Discrepancies in the dose to very small structures have been observed and due to volume effects between the two systems.

Conclusion: Good agreement exists in the dose distributions predicted by the CCCS algorithm and MC method. The CCCS algorithm can accurately predict doses to small lung tumors.