AbstractID: 8773 Title: Feasibility Study of Adaptive Intensity-Modulated Radiotherapy Using Field Aperture Re-optimization

Purpose: To study the feasibility of adaptive intensity-modulated radiation therapy (IMRT) using field aperture re-optimization on a new CT set showing target volume change and to evaluate its potential clinical benefit. **Method and Materials:** A lung cancer patient who had a significant change of target volume during treatment with helical tomotherapy and required a plan adaptation was selected for the study. Two CT scans were performed: one was taken before radiotherapy, and the other was taken after 21 treatment fractions. A six-field step-and-shoot IMRT plan was generated on the initial CT and transferred to the second CT after image registration. The MLC segment field apertures and weights were re-optimized using direct machine parameter optimization (DMPO) for 10 iterations in Pinnacle inverse planning system on the second CT set. The dose distributions and dose volume histograms were compared between the original and the adaptive plans for both helical tomotherapy and the six-field IMRT plan to evaluate the potential benefit of adaptation. The method is also applied to a clinical case by propagating contours from planning CT to daily MVCTs and calculating cumulative dose distributions based on a deformable model using both non-adapted and daily-adapted IMRT plans. **Results:** Both the adaptive helical tomotherapy and six-field IMRT plans give dose distributions that yield better dose coverage of target volumes and spare more healthy lung tissue compared to the original plans for the clinical case studied. Re-optimization of the six-field step-and-shoot IMRT plan only required 5 minutes using DMPO. The time required for the whole IMRT adaptation process including contour propagation will also be reported. **Conclusions:** An IMRT plan can be adapted very quickly using field aperture re-optimization based on the new CT images with contours adjusted to reflect changes in gross tumor volume and sensitive structures.