AbstractID: 3383 Title: A fluence deformation based technique for portal image-guided adaptive head-and-neck IMRT

Purpose: Recent studies have shown significant inter-fraction patient anatomy changes over the courses of fractionated head-and-neck IMRT. Current IMRT planning uses a fixed 3D-margin around CTV to account for these changes and patient setup errors, which results in high-dose to the normal tissues in the margin and may limit the treatment. We are developing an online portal image-guided adaptive technique aimed at reducing the margin by adapting the photon fluence to these inter-fraction changes.

Methods and Materials: This technique uses portal images taken at each treatment gantry angle and compares them with the corresponding DRRs from the planning CT. First, a deformable registration is performed to determine a 2D transformation between the two images. This transformation is then applied to the originally optimized fluence to obtain a deformed fluence map that adapts to the detected changes. Finally, MLC sequences and deliverable fluences are re-calculated for adaptive dose delivery. Initial development used planning studies where rigid anatomy changes were simulated in the plan by shifting the isocenter, gantry angle and couch angle. Simulated DRRs were used as approximate representations of online portal images. Dose distributions and DVHs were calculated and compared to those from the originally optimized IMRT plan.

Results: Preliminary results of applying this technique to head-and-neck patient data: 1) Deformed fluences calculated from transformations obtained by registering the portal images to the DRRs; 2) Comparisons of the resulting dose distribution of the adaptive technique to the one from the originally optimized plan.

Conclusion: Preliminary results suggest that this fluence deformation based adaptive technique can geometrically account for simple rigid anatomic variations including 2D shifts-rotations. Evaluation of the full extent of dosimetric outcome from applying this technique and implementation of deformable registration algorithms for adapting to more complex anatomic changes, such as 3D deformation and volume change, are in progress.