AbstractID: 7105 Title: Retrospective IMRT dose reconstruction based on cone-beam computed tomography (CBCT) and the MLC positional log-file recorded during treatment

Purpose: Most CBCTs performed nowadays are only used for setup correction. In reality, CBCT-derived 3D patient model can also be used for dose reconstruction to reflect the delivered dose taking into account the inter-fraction organ motion/deformation. The purpose of this work is to establish a methodology to reconstruct the delivered IMRT dose by using on-treatment CBCT images and the actual dynamic leaf positions recorded during the treatment.

Method and Materials: A CT phantom with different inserts was scanned using planning CT (pCT) and CBCT, respectively, and the corresponding electron density calibration curves were established. Five head-and-neck (HN) patients were selected and, for each patient, three CBCT scans with the patient at his/her treatment positions were taken at different fractions during the course of radiation therapy. The target and organ contours were mapped from the pCT onto the co-registered CBCT for DVH analysis. The actual leaf positions in IMRT delivery were recorded by the MLC workstation and the log-files were retrieved to reconstruct the fluence maps for the corresponding treatment fraction. The delivered dose was then obtained using the reconstructed fluence maps and the CBCT data, and the results were compared to the original pCT-based treatment plan.

Results: A retrospective dose reconstruction procedure has been implemented and applied to 5 HN cases. For cases in which the tumor shrinkage is not obvious, the reconstructed and planned doses are consistent to within 3% in high dose region. The DVHs of the target and other organs do not have significant differences. Large dosimetric changes (5-8%) were observed, however, for a case with tumor shrinkage, indicating the need for re-planning or adaptive radiation therapy in this situation.

Conclusion: IMRT dose reconstruction provides a powerful way to examine the actual patient dose delivery at a particular fraction and represents an essential step toward adaptive radiotherapy.