

AbstractID: 9305 Title: Integrating an Online Adaptive IMRT Process to the Prostate IGRT

Purpose: To investigate the feasibility of a novel online IMRT re-optimization process. This online process can be an integral part to the current prostate IGRT paradigm to augment the existing patient alignment techniques for cases with complex daily organ motion and deformation.

Methods & Materials: Initial IMRT planning is designed with simulation CT using commercial treatment planning system. The planning data is exported to the in-house adaptive treatment planning platform (ART). Prior to daily treatment, a 3D imaging guidance is performed. If the position correction can not ensure the optimal dose coverage/sparing, ART is performed. Deformable registration of two sets of organs/structures is performed so the original planned dose distribution matches the CBCT anatomy. This matched dose is set as prescription dose distribution for re-optimization. The IMRT plan is re-optimized using a goal programming optimization model in less than 2 minutes and the adaptive plan is evaluated. Dynamic MLC sequencing of the fluence map is calculated by 2 independent algorithms for verification and QA.

Results: Six prostate IMRT patients were tested. For each patient 5 daily CBCTs were selected. A total of 30 adaptive IMRT plans were performed; and the re-optimization was less than 2 minutes for all cases. The soft-tissue based IGRT technique works for 24 out of 30 cases. The failed cases were indeed due to complex geometrical change among the target volumes and the organs. The adaptive technique achieved optimal target coverage for all cases. To assess the quality of the re-optimization algorithm, the OAR sparing in adaptive plans were compared with the new plans generated from the Eclipse system, and were found to be of comparable quality.

Conclusion: The feasibility of integrating an online adaptive IMRT process to the prostate IGRT paradigm is presented, and its applicability is demonstrated with limited clinical cases.