AbstractID: 13637 Title: An Online Replanning method for independently moving structures

Purpose: The current IGRT repositioning, based on rigid-bady registration, fails to align organs with independent dislocation and deformation such as those in the abdomen. This work aims to extend a previously developed online replanning method to handle independent multiple organ movement.

Methods and Materials: Daily CTs acquired during pancreatic cancer treatments using a respiratory gated CT-on-Rails (CTVision, Siemens) were used to test the method. Contours of the target and organs at risk (OAR) were generated on the daily CTs based on deformable registration with manual editing if necessary. A replanning method composed of a segment aperture morphing (SAM) and segment weight optimization (SWO) were applied. The SAM was applied separately on each structure (target and OARs), and the final aperture shape was formed by prioritizing individual aperture shapes. Each structure imposes specific penalties on leaf position deviations from their SAM values which mainly depends on the importance of the particular structure., Penalties for leaf opening vs. closing are different for target vs OAR. Conflict apertures are also detected automatically by SWO, which employs segment splitting along with an objective function scheme that updates the power of individual goals to prevent multiple trial and error runs. Plans for the current patient repositioning were generated for comparison.

Results: The mean doses of stomach and duodenum for repositioning plans are increased by 66% and 10% from their planning values, which are reduced to 5% and 1% for the adaptive plans based on modified by SAM without compromising the target coverage. SWO further improved the plan quality resulting in the final plans that are comparable to the original plan. The SAM and SWO algorithms for multiple structures can be executed within 10 min.

Conclusion: The modified SAM+SWO algorithms that can handle multiple independent organ motion and deformation can be implemented for online adaptive replanning.