

AbstractID: 6513 Title: Evaluation of the Dosimetric Differences Resulting from the Application of Gated IMRT Plans to a Non-gated Patient Anatomy

Purpose: To evaluate the dosimetric impact of applying a plan optimized for gated delivery to a free-breathing/different breathing phase CT data set, due to gating failure.

Method and Materials: A retrospective investigation was performed on two lung IMRT patients. Each patient had a free-breathing and a 4D CT scan. Tumors and OARs were contoured on each CT data set. The targets are GTV, CTV, and PTV, while OARs are spinal cord, heart, and each lung. IMRT step-and-shoot Direct Machine Parameter Optimization (Pinnacle v.7.4f) method was employed in the treatment planning. Evaluated were DVHs and gEUDs for a single fraction. The point marked by the BBs was used as a reference in the plan transfer from the standard (where the plan was optimized) to the compared CT data set. Thus, beam angles, energies, jaw settings, and MLC files were transferred preserving the relative geometry.

Results: The coverage for GTV, CTV, and PTV changes within 1%-2%, 1%-7%, and 3%-10% respectively, as planning and delivery CT data sets are interchanged. The OAR gEUDs in the optimized gating plan are lower by as much as 28% than the corresponding gEUDs in the plan delivered to a free-breathing CT data set, although it may not be significant if the tolerance doses are not exceeded. The lung sparing deteriorates by up to 14% when a plan optimized for an exhale gating is delivered via an inhale gating.

Conclusions: The daily dose variations of the order of 7% to 10% may be non-negligible and may lead to biological consequences. Therefore, an interlock in the record and verify system, coupled to the gating system, will prevent the occurrences of erroneous deliveries and will maximize the patient benefit from the use of new technologies in radiotherapy.