AbstractID: 9457 Title: Optimization of Translational Corrections to Compensate For Rotational and Deformable Target Deviations in Image Guided Radiotherapy

Purpose: To develop a strategy to optimize the translational corrective shifts to compensate for rotational and deformable deviations in IGRT. **Method and Materials**: The proposed optimization strategy involves two steps: a volume-based optimization followed by a dose-based optimization. The planned PTV is first exported in DICOMRT format to an in-house software package and made readily available. After patient is positioned on the treatment table following initial setup reference, CBCT images are acquired. The treatment CTV is determined based on these CBCT images, and is imported into the in-house software package. The volume-based optimization process is started to optimize the translational corrections so that maximum amount of the treatment CTV is located within the planned PTV. These translational corrections are applied and dose calculation is then performed based on the acquired CBCT images without any alteration of planed beam parameters. Since any change of patient external contours is imaged on the CBCT, this dose calculation yields the initial dose distribution in which the change of patient external contour is taken into account. Thereafter, the translational corrections are further optimized by maximizing a dose-based objective function. During this optimization process and as the translation corrections are adjusted, dose is constantly recomputed to take into account the changes of depth and distance relative to beams, because the translation movements may cause changes of depth and distance of the treatment CTV. The Hill-Climbing optimization algorithm is used in the optimization processes. **Results and Conclusions**: The proposed optimization strategy and the corresponding software package have been developed and validated. This strategy was applied to three fractions of treatment of a prostate patient. It was found that the developed optimization strategy might potentially compensate for certain rotational and deformable deviations with translational correction. Further evaluation is needed for cases in which more dramatic deviations are observed.