AbstractID: 7616 Title: A Method to Determine the Necessity of Rotational Correction in Image Guided Radiotherapy

Introduction: IGRT technologies have enhanced the abilities to detect temporal and spatial deviations of target relative to beams. Correcting these deviations may improve the accuracy of dose delivery to target. Frequently, a clinical decision has to be made on the necessity to correct some of the deviations since the relevant dosimetric impact may or may not be significant. The decision should be based on an objective criterion. This study developed a method to determine the necessity of rotational correction during treatment verification process.

Method and Materials: At treatment stage, treated volume should be almost geometrically identical to that of the PTV while the goal is to treat the CTV. Various uncertainties may move the CTV outside of the treated volume leading to suboptimum coverage. In many cases, the CTV can be approximated as an elastic semi-rigid body and its geometry in the treatment space can be derived by using translational and rotational matrices. These matrices can be determined with an image registration tool between plan and treatment verification images. A software package was developed to perform the transformation, and to evaluate whether the transformed CTV remains inside the treatment volume. With the method, the spatial deviation caused by target rotation is computed and the margin size between the PTV and CTV is used as criterion for the necessity of rotational correction.

Results: The related equations and algorithm have been developed and was evaluated by applying to a clinical prostate cancer case. For this particular patient, there existed a 26 degree rotation around one axis. Without rotational correction 30% of the CTV would be located outside the treatment volume.

Conclusions: A method has been developed to evaluate the necessity of rotational correction. It is potentially useful in IGRT where elastic semi-rigid body model is a good approximation for target volumes.