AbstractID: 11254 Title: Clinical Management of Detected Target Deviations in IGRT: A Geometrical Approach

Purpose: To investigate an efficient method for assessing the impact of target deviations detected by daily image-guidance on planning volumes. We hypothesize that, using this method, on-line daily correction may not be warranted.

Method and Materials: Geometrical surface models of the CTV and PTV were generated from the respective planning volumes via a surface reconstruction algorithm. Given a set of target deviations, represented by 6-degree positioning shifts (*translation, pitch, roll, yaw*) from IGRT systems (e.g. Varian's OBI/CBCT), collision detection was performed to find geometric distance between CTV and PTV surface models when the shifts are applied to the CTV. Since the method is based on shifts, which do not incorporate intra-fraction motion, a criterion was defined such that on-line shifts are not applied if the CTV and PTV surfaces are greater than a distance defined by a population-based margin for intra-fraction motion.

Results: A software module was developed to: import IMRT plans, generate surface models, communicate with the IGRT system, and calculate CTV/PTV spatial geometric distances. Surface model generation is performed off-line. Collision detection between CTV and PTV surface models from daily shifts is done on-line within minutes on a desktop PC. In the examples shown, "collisions" are defined by minimum distances of 3 mm in any direction (intrafraction motion margin) between the CTV and PTV. If a collision is detected, an on-line shift is applied; otherwise the treatment proceeds as planned.

Conclusions: The proposed method represents a quick and quantitative way to manage target deviations determined during image-guidance, without the need to apply on-line corrections. The approach is not limited to target analysis, but may also include normal tissues, such as the bladder and rectum. Adaptive and on-line treatment planning studies are under way to determine the validity of the hypothesis, and to improve the collision detection criteria.