AbstractID: 14202 Title: Development of a quantitative target localizing and tracking method for IGRT

Purpose: To develop a quantitative target localizing and tracking method based on the contrast-to-noise ratio (CNR) that is derived from the images.

Methods and materials: The kV, MV, CT and CBCT images for Catphan504, a phantom including high contrast sensitometric objects with different attenuations and CT numbers were included in this study. Contrast-to-noise ratio is defined by CNR = (T-B)/σ, where T is the target and B the background in the surrounding area and determined by the corresponding pixel values; σ is the noise caused by photon scatters and related to the regional standard deviation. A region of interest (ROI) was selected to cover the target, which measured T, and a relative larger ROI encompassing the target and surrounding tissue was defined as the background which provided B. CNRs were calculated for the targets in CT and other images used for target localization, and the correlations between them can be used to localize and track the target.

Results: The CNR obtained from CT was 2.91 for air, 2.37 for LDPE, and 2.16 for Delrin, while corresponding CNRs from CBCT were 2.91, 2.36 for, and 2.14, respectively, which were comparable. For a sagittal image, CBCT provided better image quality (CNR 1.18) than kV imaging (1.02) and the quality of MV image (0.37) was poor. The CT and CBCT images for a lung patient were used to test the method. The CNR for the tumor was 0.564 for CT and 0.567 for CBCT, which were comparable. The CNR for the tissue adjacent to the tumor was 0.418 for CT and 0.421 for CBCT. This showed that the target can be distinguished and tracked with CNR.

Conclusions: CNR was used to quantify the visibility of the targets in multi-modality images and can be potentially used for automated target localizing and real-time tracking.