

AbstractID: 14171 Title: A Single Phantom Study for the Evaluation of Accuracy of Three IGRT Techniques

Purpose: Ultrasound, CBCT, and Electro-Magnetic image-guided radiotherapy (IGRT) techniques are widely used in prostate localization. Using a single phantom, our aim is to investigate the accuracy of these technologies.

Method and Materials: A CT scan (1 mm slice) of an ultrasound phantom with three implanted transponders was acquired for this study. Ten treatment plans with 10 different isocenters within a range of 5 cm from the origin of the phantom were created. The contoured cavity and coordinates of the isocenters were exported to the three systems. The origin of the phantom was aligned to the lasers and the isocenters were localized by the three techniques. During the 30 localization experiments, the phantom was not moved. The measured shifts from each localization method were compared with the known shifts from the treatment plans. The differences between these shifts were analyzed.

Results: The mean vector differences are 2.7 ± 0.5 mm, 0.9 ± 0.3 mm and 0.3 ± 0.1 mm for Clarity, CBCT, and Calypso system, respectively. Specifically, the mean differences in the lateral direction are 2.1 ± 0.4 mm, 0.3 ± 0.3 mm, and -0.17 ± 0.09 mm, respectively. In the longitudinal direction, the mean differences are -1.6 ± 0.6 mm, 0.3 ± 0.3 mm, and -0.1 ± 0.1 mm, respectively; and 0.4 ± 0.2 mm, 0.6 ± 0.2 mm, and -0.1 ± 0.1 mm, respectively in the vertical direction. The maximum deviation from the known shifts is 3.1 mm for Clarity, followed by 0.9 mm for CBCT, and 0.3 mm for Calypso. These shifts are independent of the distances from each isocenter to the origin of the phantom

Conclusion: The three IGRT systems achieve different accuracy and it is important to understand the limitation of each system. Further studies for the impact of rotation on localization are warranted.