AbstractID: 3699 Title: Intrinsic Accuracy of I-Beam's Coordinate Positioning System Technology

Purpose: I-Beam, a 3D-ultrasound guided prostate localization system, uses Coordinate Positioning System (CPS) Technology in registering live ultrasound images of the patient to the treatment machine coordinate system. The goal of this study is to verify the accuracy of I-Beam's camera system and its precision in localizing the US images to the isocenter.
Method and Materials: The first part of the study was to examine the I-Beam camera system for integrity in tracking the probe position while translating the US probe in 3D-space. We then examined alignment correctness when registering the captured US images and contours. A robotic arm of the Nomos BAT system was used for accurate translations. Both the arm and camera system were fixed to the treatment couch. Longitudinal translations of the camera system were confirmed by the Nomos Auto-crane. An ultrasound phantom mimicking pelvic anatomy was employed in quantifying the precision of the image localization and contour alignment. The phantom was translated to known distances, recapturing the 3D-ultrasound volume, and aligned the contours to determine the shifts computed by the I-Beam system.
Results: X-, Y- and Z- translations recorded by the robotic system were subtracted from the coordinates of the camera system in computing the errors. When the camera system was repositioned within ±10 cm of the 3D-space, the CPS technology predicted the ultrasound probe position within ±0.5 mm. The absolute deviations were (mean ± SD): 0.3±0.2, 0.2±0.2 and 0.2±0.2 in lateral, longitudinal and vertical directions, respectively. I-Beam's image registration and contour alignment were accurate within ±1mm.
Conclusion: The I-Beam camera system is accurate to within ± 0.5mm in tracking the US probe position. Phantom measurement showed the US image acquisition and the contour alignment is also accurate within ±1mm. These new tests assured that the I-Beam system is accurate in tracking, image-registration and alignment.