AbstractID: 7450 Title: A phantom study on the 3-D target localization accuracy using CBCT of an On-Board Imager

Purpose:
To evaluate the three-dimensional target localization accuracy using CBCT of an On-Board Imager (OBI) system by determining the detection error and residual error associated with image registration and patient repositioning.

Method and Materials:
An anthropomorphic pelvis phantom was used to simulate a range of shifts in the three translational directions and rotations around each of the three axes. First a simulated shift or rotation was applied. Then a CBCT scan was followed by 3D3D matching between the CBCT 3D volumetric image with the planning CT image. The detected shift vector was compared to the actual shift vector to calculate the detection error. Next the phantom was automatically realigned to the planned position by the OBI system. Subsequently, a second CBCT scan and 3D3D matching was performed to verify the re-positioning accuracy (residual error). In each of the three translational direction, simulated shifts of 1, 2, 5 and 10 mm were evaluated. In the longitudinal direction large shifts of 20 and 50 mm were evaluated to see whether accuracy was dependant on shift magnitude. Simulated rotations of 1, 3 and 5 degrees around the three axes were also evaluated.

Results:
On the average, the detection error for translational shifts is 0.4+/-0.3 mm. The average of the corresponding residual error is 0.6+/-0.4 mm. For simulated rotations the average detection error is 0.2+/-0.1 degrees. The average of the corresponding residual error is 0.4+/-0.5 mm.

Conclusion:
The results indicate that CBCT is capable of detecting target shifts and patient rotation to within 1 mm and 0.5 degree respectively. The shifted target could be realigned to the planned isocenter to within 1mm accuracy when correcting for translational shifts and within 1.8 mm when correcting for rotations.

This study is partially supported by a Varian research grant