

AbstractID: 9399 Title: Comparison of a commercial 3D-3D auto-registration tool vs. manual alignment to the target

Purpose: The purpose of this project is to compare a commercial 3D-3D auto-registration tool vs. manual alignment to the target.

Method and Materials: Cone beam computed tomography (CBCT) images were acquired immediately before patient treatments for thoracic lesions. An automatic 3D-3D matching system (OBI, Varian Associates, Palo Alto, CA) was used to align the entire CT volume against the respiratory averaged CT from a 4DCT. The suggested shifts were recorded but were not used to treat the patient, those from an in-house system were used. The in-house system also allowed us to retrospectively perform a manual match using only the target and not the entire volume. The shifts between these two methods were compared for 47 weekly CBCT data-sets acquired for 17 patients. The couch shift necessary for re-alignment was recorded in the 3 vector components (vertical, longitudinal and lateral, rotation corrections were not used).

Results: For all 47 CBCT sessions, the largest couch shift differences were 0.6 cm, 2.9 cm, and 0.8 cm in the vertical, longitudinal and lateral direction, respectively. The mean difference in the magnitude of the vector was 0.69 cm. The target volumes were further divided into 24 mediastinal cases and 23 solid tumors in the lung parenchyma. The mean difference in the couch shift vectors were 0.35 cm for mediastinum cases and 1.05 cm for solid tumor cases. The difference of 0.70 cm between the two means was significant ($p < 0.0001$). We believe the differences between the automatic and manual matches are due to soft tissue deformation, changes in respiratory motion, and/or the auto-alignment cost function locking onto a local minima.

Conclusions: Caution must be used when performing automated 3D-3D matching as changes in patient anatomy and/or the occurrences of local minima in the alignment cost-function can lead to significant geometric misses.