AbstractID: 8605 Title: Evaluation of Automatic Volume Match Function for Kilovoltage Cone-beam CT (CBCT) Guided Patient Setup

Purpose: To evaluate the automatic volume match function provided by a commercial Cone-beam CT (CBCT) guided patient setup system.

Method and Materials: CBCT images from 10 patients treated with stereotactic body radiotherapy for primary liver cancers in the stereotactic frame were acquired by On-board Imager (OBI, Varian Medical System) following initial treatment setup. Manual volume registration of CBCT to the planning CT was performed by physicians to adjust patient positioning. Retrospective automatic volume match was also performed for each dataset and compared to the manual registration. To further assess the automatic volume match, simulation of patient rotational offsets was generated. Automatic volume matching of the simulated data was used to investigate potential setup errors due to patient roll.

Results: A total of 27 CBCT datasets were acquired and analyzed. The average differences between manual and automatic match are 2.4 ± 1.7mm, 3.2 ± 2.6mm and 1.8 ± 1.6mm in the right-left, superior-inferior and anterior-posterior directions, respectively. The simulation study demonstrated a significant limitation of the automatic 4 degrees of freedom (4DOF) correction mode with regard to the patient's rotational offset. This occurs because the 6 degrees of freedom (6DOF) registration algorithm is always internally applied, even in 4DOF shift calculation mode, although the two dimensions of pitch/roll offsets are not displayed. Our simulation revealed that this can cause patient setup error which becomes significant as the distance between the patient rotation axis and the treatment isocenter increases.

Conclusion: Caution needs to be taken when using automatic volume match function for CBCT-guided patient setup since the conventional treatment couch is only capable of translational and limited rotational shifts. Using the full degrees of freedom automatic volume match without caution can lead to significant error in patient treatment.