Abstract ID: 16783 Title: Respiratory Motion Assessment of Liver Tumor During Free-Breathing CBCT Scans Using Continuous B-spline Deformation

Purpose:To assess three-dimensional liver tumor movements during free-breathing CBCT scans.

Methods:In this study, two CBCT scans were acquired for the same treatment position: one with breath hold (BH) and the other with free breathing (FB). First, BH-CBCT images were reconstructed. Then the BH-CBCT images were deformed into FB-CBCT images through a bspline deformation map estimated based on scatter-corrected FB-CBCT projections. The FBCBCT projections were taken as a continuous data stream. As the gantry rotated, the deformation map was updated continuously. A liver case was studied using two methods. One method is to only use projections from current breath cycle and the other one is to combine projections of same respiratory phases from three breath cycles. Both methods were implemented based on an open source software (plastimatch) and accelerated by GPU. We evaluated the performance of the proposed methods by comparing tumor centroid trajectories in 4D CT and 4D CBCT images.

Results:Both methods were able to detect tumor movements along all three dimensions. In the tested case, the tumor moved 11.0, 3.7, and 4.3 mm along the longitudinal, lateral, and vertical directions, respectively. The maximum detection errors were 0.8, 1.4, and 3.2 mm for the single-breath-cycle method. The maximum detection errors were 1.5, 1.0, and 1.2 mm when projections from three breath cycles were combined.

Conclusions: The study showed that it is feasible to detect three-dimensional respiratory motion of liver tumor using continuous B-spline deformation.