AbstractID: 9590 Title: Feasibility of CBCT Images Organ Motion Combined Target Position Based Localization

Purpose: This work quantifies the organ motion artifact magnitudes on Cone Beam Computed Tomography (CBCT) images by comparing to 4DCT with Maximum Intensity Projection (MIP) and Average Intensity Projection (AIP) phase-combination methods and thus to recommend a target oriented alignment procedure.

Method and Materials: Varian Trilogy on-board ExactArms kV CBCT system and GE LightSpeed 4-slice CT integrated with Respiratory Position Management (RPM) 4DCT scanner are used in this study. An in-house made motor driven lung-shaped phantom with a 4 cm diameter golf ball, which simulates the same sinusoidal movement with a changeable motion amplitude, is scanned by both CBCT and 4DCT. The motion of phantom was set along patient superior-inferior direction with a 1-cm peak-to-peak amplitude and a 5-second cycle. The signal gradients, target elongations and shapes in both organ motion direction and the orthogonal motion-free direction are compared between MIP, AIP based phase combinations of 4DCT, as well as helical CT and CBCT images. The Contrast-to-Noise Ratio (CNR) is also studied in CBCT for identifying the streaking artifacts from motion artifacts.

Results: We observed a blurred CBCT image with organ motion artifacts. The CBCT images have less steep signal gradient at the edge, so FWHM is used to judge the motion artifact magnitude. To compare to full-phase-combined MIP images, which reflects a full range of 1 cm motion for 5 cm total length at motion direction (S-I) and 4 cm width at motion-free direction (L-R), CBCT shows a up to 2mm pure streaking artifact at L-R direction and an up to 2 mm combined blurred and streaking artifacts at S-I direction. Streaking artifacts at the target image is not pronounced from CNR calculations.

Conclusions: CBCT images show good presentation (within 2 mm) to perform the daily localization procedure based on the soft tissue target alignment to full-phase 4DCT plans.