AbstractID: 8501 Title: Motion Artifacts in Fast kVCT and Slow MVCT and Their Effect on Indirectly Derived Target Delineation in Adaptive Radiation Therapy

Objectives: Liver tumor cannot be directly delineated from MVCT, or kVCT without contrast. The external boundary of the organ in which the tumor resides is used for automatic segmentation of the PTV in adaptive radiation therapy (ART), and we study the effect of imaging speed on the accuracy of automatic segmentation and its dosimetric impact using a motion phantom.
Methods and materials: A motion platform was programmed to move with a sinusoidal motion by amplitude of 1.9cm peak-to-peak and period of 3 seconds to simulate respiratory motion. A 15cm cubic water equivalent phantom was carried by the motion platform. 5 kVCT scans using a Philips Brilliance CT and 5 Tomotherapy MVCT scans were obtained. The external contour of the cube was manually and automatically delineated. A cylindrical PTV was created on the kVCT and a Tomotherapy was created. The contour of the PTV was generated based on the deformation of the cube in the MVCT and the effect on the DVH determined.
Results: The volume of the contoured cube in the kVCT scans showed significant variation (±10%). However, the external contours derived from the MVCT scans were reproducible (+/- 1%), agreeing with previous reports. The external contour based on kVCT scans was larger than the MVCT in 3 cases and smaller in 2 cases. In the cases where the kVCT scan volume was larger than the MVCT scans, ART resulted in an underdosing of 10% of the PTV by 7% of the prescription dose.
Conclusion: Without anatomical deformation or respiratory variation, the morphology of a solid moving phantom show significant differences between fast kVCT and slow MVCT, resulting in differences in automatic target delineation and subsequent dosimetric errors. The uncertainty needs to be taken into consideration for ART application.