

AbstractID: 3406 Title: Respiratory gated radiation therapy directly using patient's fluoroscopic images instead of external or internal markers

Purpose: To develop a respiratory gated radiation therapy (RGRT) technique by directly matching the patient's anatomical structures acquired during the imaging cycles to that in a reference image.

Materials and Methods: Studies showed that the external markers and the internal treatment volume are not always well correlated during the RGRT. Here we propose to measure the correlations of a reference image to the fluoroscopic images acquired during the breathing cycles. Such correlation measurement can be the surrogate for the external markers. A threshold of the correlation can be used to trigger the linear accelerator (Linac) for RGRT. With the capability of acquiring fluoroscopic images from the on-board imaging (OBI) device developed by Varian, this approach becomes available. In this study, we measured the correlation coefficient (cc) and the root mean square (rms) error of the reference image to the on-line fluoroscopic images.

Results: In order to do efficient gating, the calculation of the correlation of one image to the reference should be 1-10ms and this can be easily achieved in our preliminary study. Also, the correlation can be better calculated by sparsely sampling the calculation pixels around the treatment volume rather than using a local ROI inside the volume. In the former, we found that both the cc and the rms demonstrated good periodicity. As we expected, the external marker locations recorded by the RPM software not always correlate well with the cc and rms.

Conclusion: We demonstrated that RGRT by matching the patient's anatomical structures is highly feasible. The reference image can be the one from a gated fluoroscopic image or DRR from a gated CT scan. This technique will allow both gating and tracking and can be significant for high dose high-precision radiation therapy with reduced margins for moving targets.