AbstractID: 6665 Title: Prostate Intrafraction Motion Measurement using kV Fluoroscopy During Treatment Delivery

Purpose: Margin reduction for prostate radiotherapy is limited by uncertainty in prostate localization during treatment. We investigate the feasibility and accuracy of measuring prostate intrafraction motion using kV fluoroscopy performed simultaneously with radiotherapy.

Method and Materials: Three gold coils used for target localization are implanted into the patient's prostate gland before undergoing a hypofractionated online image-guided step-and-shoot IMRT on an Elekta Synergy. At each fraction the patient is aligned using a CBCT, treatment delivery and fluoroscopy are performed simultaneously, and a post-treatment CBCT is acquired with the patient still on the table. To measure the intrafraction motion we developed an algorithm to register the fluoroscopy images to the projection images of the post-treatment CBCT, and we combined information from fluoroscopy images at different gantry angles to obtain the motion of the coils in 3D. The accuracy and robustness of this technique were evaluated by comparing measured results with those from an independent clinical 3D CBCT registration.

Results: The coils can be detected and successfully registered using fluoroscopy images for all gantry angles, and at some angles they can be tracked with frequency > 1 Hz. Fluoroscopy images containing MV scatter can be detected and if necessary removed to improve image quality. The mean of the difference between our intrafraction measurement technique and the independent 3D CBCT registration for 40 measurements was 0.04 ± 0.47 mm, -0.07 ± 0.76 mm, and –0.21 ± 0.80 mm in the RL, AP, and SI axes respectively.

Conclusion: These results show that measuring prostate intrafraction motion using kV fluoroscopy is feasible and can be performed with sub-millimeter accuracy and adequate temporal resolution. Future work includes improving 2D registration to account for prostate rotation and deformation, and reporting clinical results.

Conflict of Interest: Partially supported by NIH Grant CA118037.