AbstractID: 8810 Title: Optimizing kV Fluoro Acquisition for Prostate Intrafraction Motion Evaluation

Purpose: Commercially available gantry mounted kV imagers are currently restricted to manual fluoroscopy acquisitions with fixed mAs & frame rate, limiting use of fluoroscopy for prostate intrafraction motion measurement. For consideration in future acquisition improvements, we investigate the parameters required to optimize the 3D accuracy of prostate intrafraction localization while minimizing imaging dose.

Method and Materials: Prostate intrafraction motion is measured at our clinic using simultaneous kV fluoroscopy to visualize implanted markers for a hypofractionated radiotherapy protocol. For a 5-beam step-and-shoot IMRT delivery we compare the current technique with acquiring images between MLC segments. Effects of imaging frequency and of including acquisitions during gantry rotation were also considered. The 3D localization accuracy was evaluated using simulations with existing sagittal cine-MRI images from 6 patients consisting of 490 motion tracks for ~8 minutes/track. Dose was evaluated using surface and central axis measurements on a 30-cm diameter acrylic phantom, assuming adequate mAs values to achieve 80% registration success rate.

Results: Simulations with the cine-MRI data showed that 3D accuracy is acceptable even for low imaging frequencies: 95% of measurements were within 1.0 mm when imaging every 30s, and within 1.2 mm for 60s. 3D accuracy is adequate when imaging between MLC segments only (95% within 1.0 mm, 98% within 1.6 mm), with minor improvement when acquiring also during gantry rotation (95% within 1.0 mm, 98% within 1.5 mm). Maximum dose was lowered to 1.4 mGy when imaging only between MLC segments with gantry dependant mAs, compared to 3.3 mGy for the current technique and 21.1 mGy for a CBCT.

Conclusion: Optimal intrafraction fluoroscopy measurement is achieved with adjustable acquisition frame rate, synchronization with MV beam delivery (acquisition between segments), and programmable gantry dependent mAs, resulting in high 3D accuracy and low imaging dose.

Conflict of Interest: Partially supported by NIH Grant CA118037.