

AbstractID: 14281 Title: Investigation of Combined MV-KV Prostate Treatment Dose Planning for Real-Time MV-KV IGRT

Purpose: As a result of internal organ motion, the ITV used during treatment planning must be larger than the CTV, reducing the benefit of highly conformal RT. In prostate cancer cases, there is no strong correlation between internal organ motion and externally visible motion, so application of IGRT requires internal imaging. Previous work has shown the effectiveness of real-time 3D fiducial tracking using reduced aperture combined MV-kV imaging. The aim of this work further advances MV-kV tracking by incorporation of delivered kV tracking dose at the treatment planning stage through combined MV-kV beam modeling. **Method and Materials:** A Monte Carlo scheme was developed to model dose deposition kernels that were imported into Phillips' Pinnacle treatment planning system. The kV source of an on-board-imager from a Varian Trilogy LINAC was commissioned in the TPS. Using previously treated 9-field prostate patients, the TPS was used to calculate dose that would be delivered by the kV beam during real-time tracking. To provide stereoscopic imaging at each gantry angle during treatment, the kV and MV beam times were matched. Apertures studied included a small 3x3 cm field capable of tracking closely placed fiducials in prostate cases. **Results:** In the four patients studied, the average prostate dose from a 3x3 cm field was 5 cGy, increasing to 9 cGy per fraction for a CBCT aperture, 2-5% of the prescribed dose. The 3x3 cm aperture spared more tissue, delivering 5 cGy or more per fraction to less than 1% of a patient volume, compared to 80% for the full field. **Conclusion:** The use of conformal kV apertures shaped to the tracking region of interest can lead to significant reductions in total kV diagnostic radiation delivered. This allows for the kV beam to provide useful tracking information, while simultaneously delivering therapeutic dose to the prostate.