AbstractID: 11134 Title: Real-time motion detection of prostate target during volumetric arc therapy using onboard imaging devices

Purpose: To develop a real-time prostate position monitoring technique for modern arc radiation therapy through novel usage of cine-MV imaging together with as-needed kV imaging. **Methods and Materials:** We divide the task of monitoring intrafraction prostate motion into two separate but related parts: (1) to detect potential target motion beyond a pre-defined threshold and (2) to confirm whether it is beyond the threshold and how large the displacement is. By taking advantage of the gantry rotation during arc therapy, MV images from different viewing angles were used to stereoscopically evaluate the motion status of the prostate/marker and to allow us to detect potential over-threshold displacement. If a potential over-threshold event is detected by MV images, the onboard kV imager is turned on to confirm this through combined data from MV-kV imaging. The position information acquired from combined MV-kV data can be used as input for further motion management techniques. A Varian Trilogy linac with onboard kV imager was used to examine selected typical trajectories using a 4D motion phantom capable of moving in accordance with a pre-programmed trajectory. Performance analysis of the proposed method has been done using 536 patient-measured trajectories from 17 patients. **Results:** Prostate displacement beyond a set threshold (3mm) was detected for over 99.8% of the time with better than 1mm detection accuracy. Compared to other fluoroscopy-based tracking techniques, kV usage is significantly reduced to on average of ~15 times per arc delivery. **Conclusions:** Cine MV imaging during arc therapy provides a valuable tool for detecting non-negligible intrafraction prostate motion with as-needed low kV usage. Our motion detection method is distinguished from current motion monitoring techniques which seek to continuously and accurately localize a moving target. The proposed technique can be readily implemented with linacs equipped with EPID and onboard kV imaging devices.