AbstractID: 13379 Title: The effect of tomosynthesis acquisition geometry on automated feature extraction applied to image guided radiation therapy of the prostate

Purpose: Gantry mounted kV imaging enables volumetric imaging of patients in the treatment position using cone beam computerized tomography (CBCT) reconstruction algorithms. Tomosynthesis techniques offer the ability to produce volumetric imaging with reduced set of projections, at the cost of significantly reduced image quality, but may be advantageous in terms of patient dose and scan time. Adaptive radiation therapy requires imaging and fast objective feature extraction algorithms to localize anatomic landmarks and determine treatment adjustments. This work analyzes the relation between tomosynthesis scan angle and localization accuracy, including automated feature extraction, in the setting of image guided radiation therapy (IGRT) of the prostate using a rectal balloon for daily immobilization. **Method and Materials:** A FDK-based CBTS reconstruction was applied to selected sets of projection data to simulate volumetric imaging achievable from tomosynthesis for a range of scan angles. Projection data was calculated from planning CTs of 10 patients treated with rectal balloon immobilization. An intensity based edge detection algorithm was used to objectively identify over 50 points at the tissue-air interface. Point locations were compared to the location of the corresponding points extracted for full-rotation-CBCT reconstruction. A similar process was applied to rectal-balloon phantom measurements. **Results:** Reducing the tomosynthesis scan angle reduces the ability to identify the prostate-rectum interface. However a level based thresholding algorithm can be used to automatically identify the air-tissue interface. The accuracy is quantified in terms of the mean discrepancy as a function of reconstruction angle as well as the fraction of points identified as a function of distance to agreement to full-rotation-CBCT. **Conclusion:** This work quantifies and presents the accuracy of automatic extraction of rectal balloon-prostate interface from tomosynthesis as a function of scan angle. Such results may guide the choice of scan parameters used for patient localization based on the desired localization accuracy.