AbstractID: 8763 Title: Dose distribution improvements for prostate cancer patients using hybrid image guidance systems

Purpose: Daily setup variations may compromise the precision of dose delivery, tumor control and normal tissue avoidance. This study analyzed the setup variations predicted by kilo-voltage Cone Beam CT (CBCT) combined with 3D Ultrasound image guidance. The overall integrity of prostate dose distribution was considered to define an offset threshold above which image guidance becomes crucial for dose delivery.

Methods and Materials: Initial immobilization was performed using three-point in-room lasers. The residual positional errors were assessed using CBCT from Varian Trilogy™ and Ultrasound guidance by Sonarray™ system. Superposition of offset vectors on the initial prostate plans enabled detailed evaluation of resultant changes in dosimetric and biological aspects for target and organs at risk. On-line CBCT images were used for calculation. Dose volume histograms (DVH), Gamma Index (GI), equivalent uniform dose (EUD) and tumor control probability (TCP) were calculated. Other indices such as mean total dose (mTd) and maximal total dose (MTD) for normal structures were also considered in defining the threshold.

Results and conclusions: After initial laser alignment, the mean vector of residual displacements over all prostate patients is 6.2mm with a 5.0mm standard deviation. The decrease in EUD for defined tumor volumes was up to 66% when the largest offset was applied and 10% in the composite plan which incorporated overall offset histories. Results show that if patient's offsets were smaller than the applied PTV margin (5mm), unappreciable changes in dose coverage and tumor control were revealed. However, if offsets were larger than the PTV margin, tumor control and normal tissue sparing can be significantly compromised if proper couch shifts are not made under the imaging guidance system. In this situation, special attention is needed especially on organs at risk and even the adaptive radiotherapy might be necessary.