

AbstractID: 13370 Title: Adaptive intensity modulate proton therapy (IMPT) for prostate with online patient realignment

Purpose: Based on online image, the prostate relative shift to the bony anatomy can be corrected by realign the patient. In photon therapy, the realignment does not distort the dose distribution significantly. However, in intensity modulated proton therapy (IMPT), the realignment may introduce large dose variations. This effect is studied in this work and an adaptive procedure based on the online image is proposed to restore the planned dose.

Method and Materials: An anthropomorphic phantom is constructed by using real prostate patient CT. The original contours are imported. Except the bone, other part of the body is replaced with water. 2-field lateral opposing spot scanning (SS) and 24-field full arc distal edge tracking (DET) plans are generated with PTV prescription of 70 Gy. Considering the relative shift of prostate to the bone, non-adaptive and adaptive procedures are developed. The non-adaptive procedure refocuses the beam to the prostate by realignment. On top of that, the adaptive procedure re-determines the beamlet energy from the online CT image without recalculating or optimizing the beamlet. The delivered dose with relative prostate shift of ± 5 mm, ± 10 mm, ± 15 mm along the AP direction is re-calculated for both procedures. Multi-fraction delivery will be simulated at the time of presentation.

Results: With relative prostate shift, the dose distribution changes significantly in the non-adaptive procedure for both DET and SS. The adaptive procedure can restore the dose distribution in the DET but not in the SS.

Conclusion: The adaptive procedure by re-determine the beamlet energy is necessary for IMPT. With light calculation, the planned dose can be restored. The adaptive procedure is better performed with the DET than the SS.

Conflict of Interest (only if applicable): Thomas Mackie has financial interest in TomoTherapy, which may commercialize some aspects of this work.