

AbstractID: 4964 Title: Dosimetric Comparison of the No Action Level Alignment Protocol with Daily Alignment Techniques for Prostate Cancer

Purpose: To compare the effectiveness of two off-line “No-Action-Level” (NAL) correction protocols with daily image-guided alignments using bony registration (simulating electronic portal image alignment), ultrasound, and CT for direct prostate target localization.

Method and Materials: Ten prostate patients received 3 CT scans per week using an integrated CT-LINAC system immediately prior to radiotherapy (243 CT scans total). A clinical treatment plan was designed on the planning CT image using current clinical margins and copied onto the daily CT images. Two NAL protocols, based on CT measurements of the internal prostate shift relative to bony anatomy, were simulated for correcting the predicted internal systematic prostate shifts after 1 week or after 2 weeks of treatment. The NAL protocols were compared to three daily alignment methods, which simulated pelvic bone alignment, ultrasound alignment, and CT alignment. The dosimetric impact on target coverage for each scenario was reported. Reducing the planning margins to 3mm was also evaluated.

Results: Daily CT scans are more accurate than daily ultrasound measurements for determining the prostate systematic positional shift, particularly in the anterior/posterior direction. The average minimum prostate dose was greatest with CT alignment (75.8Gy, $p<=0.028$), then with the two NAL protocols (both 74.Gy, $p<=0.017$), followed by ultrasound alignment (73.2Gy) and bone alignment (70.2Gy). For plans with 3mm margins, the average minimum dose was greatest with CT alignment (75.1Gy, $p<=0.007$), then with the two adaptive alignments (71.4Gy and 70.8Gy respectively, $p<=0.022$), followed by ultrasound alignment (68.4Gy) and bone alignment (63.9Gy).

Conclusions: An off-line NAL correction protocol for reducing systematic internal target shifts proved to be effective when performed after only one treatment week. The target dosimetric coverage from the NAL protocol was as good as daily ultrasound alignments but not as great as daily CT alignments. Using a 3mm planning margin exacerbated the differences in target coverage.