Purpose: We conducted an investigation to evaluate the robustness of different proton therapy delivery technique for treatment of prostate cancer. Three commonly used delivery techniques; intensity modulated, double-scattered, and single field uniform dose delivery was investigated for one field verses two field daily fraction.

Method: Computer tomography (CT) for a patient was deformed based on acquired daily MVCTs obtained during the course of treatment by a Tomotherapy unit. The deformed CTs were used for proton planning retrorespectively using intensity modulated (IMPT), double-scattered (DSPT), and single field uniform dose (SFUD) delivery technique. The plans were evaluated for single-field versus two-field per fraction for each technique. The plans robustness was evaluated for each technique by comparing the maximum dose to rectum, bladder, prostate and CTV as well as the minimum dose to prostate and CTV. In addition, 95% coverage to prostate and CTV compared for each plan.

Results: The average and STD for deformed prostate volume was 22.4 ±0.5 (1̅f) for the course of treatment. On average the maximum dose delivered to rectum and bladder with single-field verses two-field IMPT were higher by 2.5%. With same respect, the single-field verses two-field for DSPT were 0.5% higher for rectum but the same for bladder. Single-field SFUD delivered 1% higher dose to both rectum and bladder compare to two-field delivery. Table 1 summarizes the results.

Conclusion: Single-field IMPT delivered higher dose to rectum, bladder, prostate, and CTV than any other technique. But two-file IMPT delivered most homogenous and consistent dose to prostate and CTV with much lower dose to rectum and bladder compare to DSPT and SFUD. With same respect two-field SFUD delivery produced better dose coverage to prostate and CTV compare to DSPT. The two-field IMPT with conjunction of daily cone beam CT can be considered a better dose delivery technique.