

Purpose: This work employs the Monte Carlo method to recompute the IMRT dose distributions from four TPS to provide a platform for independent comparison and evaluation of the plan quality in terms of target conformity.

Method and Materials: Eleven prostate cases were planned with the Corvus, Xio, Pinnacle and Eclipse TPS using appropriate optimization parameters and dose constraints. The plans were recalculated by Monte Carlo using leaf sequences and MUs for individual plans. Dose-volume-histograms and isodose distributions were compared. Other quantities such as D_{\min} (the minimum dose received by 99% of CTV/PTV), D_{\max} (the maximum dose received by 1% of CTV/PTV), the volume of rectum and bladder receiving 65 and 40Gy, and the volume of femur receiving 50Gy were evaluated. Total segments and MUs were also compared.

Results: Special care must be taken to reproduce the dose distributions from different TPS due to their implementation of effective leaf locations. This may introduce up to a few percent differences in the absolute dose between treatment plans. The Monte Carlo results agreed with the dose distributions from the TPS to within 3%/3mm. The Xio, Pinnacle and Eclipse plans show less target dose heterogeneity (smaller D_{\max}) and lower V_{65} and V_{40} for the rectum and bladder compared to the Corvus plans. The PTV D_{\min} is about 2Gy lower for Xio plans than others and the Corvus plans have slightly lower V_{50} than others. The Corvus plans require significantly most segments and MUs to deliver and the Pinnacle plans require fewest segments and MUs.

Conclusions: We have tested an independent Monte Carlo dose calculation system for dose reconstruction and plan evaluation. This system provides a platform for the fair comparison and evaluation of treatment plans to facilitate clinical decision making in selecting a TPS and beam delivery system for particular treatment sites.