AbstractID: 6487 Title: Dosimetric Comparison of high-Z inhomogeneity in IMRT: A Collaborative Study

With increased longevity, more prostate cancer patients with hip prosthesis are anticipated. Prosthetic devices have high atomic numbers (Z) and produce dose perturbation that is dependent on Z, beam energy, and depth. TG-63 provided recommendations for high-Z prosthetic devices in 3D conformal therapy. In IMRT, the dosimetric implication of the high-Z prosthesis remains uncertain which is investigated in this collaborative study with 10 different treatment planning systems (TPS). Planning target volume (PTV), and the organs at risk (OAR) namely, the bladder, the rectum and a bilateral titanium hip-prosthesis were contoured on a CT data set of a patient and sent to each collaborator with proper guidelines for beam arrangements, energy and dose volume constraints for planning. Due to significant streaking artifacts in the CT data, users were encouraged to use their own method to correct for redistribution of CT numbers, and assign the appropriate electron densities. Since dose perturbation is significant for low energy and less sensitive with multiple fields, equally distributed 7-fields were planned. Beam energy was also studied for comparison. One common constraint, 95% PTV must receive at least 95% of dose was strictly followed by each planner. A variety of dose algorithms were used in different TPS, such as pencil beam, superposition, and convolution. Although the results of some planning systems are closer to each other, in general, there is a wide variation in dose distribution in PTV and the OARs, as well as the minimum, the maximum and the median doses which are commonly used in plan evaluation. The variation in MU and the number of segments also vary significantly. High energy beam provided slightly better but not significant dose distribution. Ranking of TPS cannot be established based on a single clinical case. A well-controlled phantom study is planned to validate the merit of each TPS.