AbstractID: 11193 Title: Software Quality Assurance with and beyond TG-53 for the Cyberknife MultiPlan System

Purpose: To evaluate the application of AAPM-TG53 to the Cyberknife MultiPlan™ treatment planning software with additional use of an inhomogeneity phantom to QA the new Monte Carlo algorithm, and using motion phantom for QA of the 4D treatment planning algorithm.

Method and Materials: An inhomogeneous Quasar phantom (Modus Medical Devices Inc) and a 4D-motion phantom (Accuray Inc) with known density inserts were used in this study. Both phantoms accommodate film loading. The Quasar phantom also has an insert for a PTW 0.6cc farmer chamber. Both phantoms were scanned using GE PET/CT scanner with 1.25 mm thickness. The 4D phantom was scanned and planned with a full 4D scan. The Quasar phantom was scanned in 3D with a variety of density inserts with defined volumes. These known volumes were compared with the calculated volumes which were contoured using different drawing tools. The treatment plans for the inhomogeneous MC plan and the 4D plan was done using both the pencil beam and Monte Carlo algorithms.

Results: The volumetric information differed from the actual volume based on the contouring tools. The contours made with the ellipse, bumper and rescale tool showed <25% error in volume in 8 out of 9 structures. For the MC plan with a prescription dose of 10 Gy, the measured dose with the farmer chamber was 9.99 Gy. The dose measured in the 4D delivery agreed with the 4D plan dose, whereas the 3D plan overestimated the dose to a static critical structure.

Conclusion: **T**G-53 offers basic guidance for software QA, but additional QA must be added to cover new software components. The choice of contouring tools affects the calculated volume of the structures contoured in MultiPlan™. Both MC algorithm QA and 4D planning QA can be implemented in a comprehensive clinical software QA program with commercially available phantoms.