AbstractID: 8874 Title: Assessment of an in-house independent phantom dose calculation algorithm for IMRT QA

Purpose: To test the RTP-Filter, an in-house independent phantom dose calculation system for IMRT QA.

Method and Materials: The dose from all IMRT beams delivered in treatment position was calculated in coronal planes where actual film densitometry for 100 cases was performed in solid water phantoms. A ray trace through the phantom determines the depth and location of points relative to an MLC shape, whose leaf pairs define integration elements for TPR, head scatter and phantom scatter. A virtual scatter source determines the head scatter. Factors for the off-axis ratio, penumbra, and out-of-field scatter and leakage are applied. The calculations were compared with the pinnacle planned dose to create 3%-3mm and 5%-5mm decision maps. The same analysis was performed for the original film measurements. Eight physicists scored 200 cases as pass, conditional, or fail, resulting in 1600 scores. Cases exceeding tolerances but that might be clinically acceptable were conditional.

Results: Excellent agreement between pinnacle convolution calculations and the RTP-Filter was obtained, with 89.4% passing, 10.2% conditional, and 0.4% failing. The respective values for the film-to-pinnacle comparisons were 67.1%, 26.3%, and 6.6%. Both the film and the RTP-Filter had the best plan agreement for prostate cases and the least agreement for brain cases. While the trends for error identification were the same (e.g., presence of many small fields), the RTP-Filter represented more closely the historical decisions that were made, with errors in film densitometry and MLC mis-calibration identified as the causes for out-of-tolerance deviations. The good results of the RTP-Filter are most likely due to careful modeling of the out-of-field and penumbra components.

Conclusion: The RTP-Filter provides fast and robust IMRT QA, decoupling the plan and machine QA. The rate of plan disagreement is lower than that for film due to the absence of film and MLC errors.