AbstractID: 9385 Title: The extraction of true profiles for TPS commissioning and its impact on IMRT patient-specific QA

Purpose: to develop methods to extract the true cross-beam profiles for TPS commissioning and investigate its clinical impact on patient-specific IMRT QA.

Method and Materials: Two photon beam models, BM6 and BM4, were commissioned using photon beam profiles measured with a 6 mm diameter and a 4 mm diameter ion chambers, respectively. A method was developed to extract the "true" cross-beam profiles, free of volume averaging effect, using analytic fitting/deconvolution. The method was validated using beam profiles measured with a small (0.8 mm) diode detector for small ($\leq 10 \times 10$ cm^2) field sizes. These profiles were used to commission a third beam model (BM08). Planar dose distributions for 8 IMRT plans (total of 53 fields) were calculated using the three beam models and measured with a 2-dimensional detector array. Analysis using percent dose difference and distance-to-agreement criteria was done to benchmark the performance of each beam model.

Results: Excellent agreement between deconvolved profiles and diode measured profiles validated our analytic deconvolution method. The average passing rates between calculation and measurement were 93.8%, 98.9% and 99.4% for BM6, BM4 and BM08, respectively, when 3%/3mm criteria were used. A gradual increase in passing rates was noticed with the decrease in the size of the detectors used to collect commissioning data. When 2%/2mm criteria were used, the average passing rates increased significantly from 81.6% (BM6) to 92.6% (BM4) and 96.8% (BM08).

Conclusion: Our study indicates that volume-averaging effect can significantly affect the accuracy of dose calculation for IMRT plans. By removing the volume-averaging effect in beam commissioning, excellent passing rates can be achieved with more stringent criteria such as 2%/2mm. The use of more stringent criteria for IMRT patient-specific QA would likely result in higher chances of detecting any dosimetric errors arising from the treatment planning or delivery system.