

Purpose: To demonstrate the improvement in IMRT patient specific quality assurance (QA) by considering a more accurate absolute dose calibration in MapCHECK, machine hardware characteristics and modification in beam modeling in treatment planning system (TPS).

Method and Materials: MapCHECK, a 2D diode array system, was used in our routine IMRT patient specific QA on Elekta Synergy S LINAC with Beam Modulator (BM). To explore the absolute dose calibration in MapCHECK, dose at 10 cm water equivalent depth under same reference conditions was calculated for a 6 MV beam for both MapCHECK phantom (CT scanned MapCHECK with 8 cm solid water buildup) and a water phantom (50X50X50 cm³) by Pinnacle TPS, then was compared to each other. 2D dose measurements using film and MapCHECK for 4X4 and 16X16 cm² were compared with water tank measurements to evaluate the field asymmetry.

Results: (1) A 2% systematic difference has been detected in MapCHECK absolute dose calibration. If the QA plan is generated on a solid water phantom rather than on the scanned MapCHECK plus buildup, the pass-rate can be improved by 1-2%. (2) Accounting for the asymmetric field in superior-inferior direction associated with beam modulator design, a collimator rotation by 90 degrees in original patient IMRT plans can improve QA pass-rate by up to 10%. (3) After reducing the source size in Pinnacle TPS beam model to better describe the penumbra, the pass-rate increased several percent. Comparing QA results before and after implementing steps 1 through 3 in our clinical practice, the pass-rate increased from 94.7%±2.5%(SD) to 98.6%±2.5%(SD) averaged over 28 patient QAs in each group.

Conclusions: By correcting the systematic error in MapCHECK absolute dose calibration, rotating collimator by 90 degrees in patient plans and using a smaller source size in Pinnacle beam model, QA pass-rate has been significantly improved.