AbstractID: 11056 Title: A novel approach to machine specific QA for volumetric modulated arc therapy

Purpose: Due to the dynamic nature of the delivery, Volumetric Modulated Arc Therapy (VMAT) demands additional machine specific QA measurements as compared with fixed-field IMRT. In this study, we will present a comprehensive QA method for VMAT that simultaneously verifies the accuracy of the gantry angle, MLC leaf positions, and dose rate during the delivery of a single VMAT arc.

Materials and Methods: A QA plan with specially designed patterns of leaf motion, gantry rotation, and dose rate variation was created and calculated in Pinnacle^3. Next, the plan was delivered on an Elekta Synergy equipped with a conventional 80-leaf MLC. The resulting dose distribution was measured using an IBA MatriXX^{TM} 2D ion chamber array inserted in a MULTICube^{TM} Phantom with a sampling time of 100 ms. A home-grown software was applied to extract the gantry angle, leaf positions, and dose rate as a function of time. The accuracy of all three parameters was then verified through comparisons with the corresponding theoretical values.

Results: A total of 833 frames of data were collected which agrees with the theoretical delivery time of 83.33s. The actual gantry angle was determined by the average leaf projection width on the MatriXX^{TM} detector plane. Our QA results suggest an excellent agreement between the measured and planned gantry angle with a maximum deviation of 2.6° and a standard deviation of 1.0°. The mean deviation of dose rate was 2.7 MU/Minute or 3.2% in relative mode. The mean deviation of leaf positions was 0.2mm with a standard deviation of 1.1mm and a maximum deviation of 3.1mm.

Conclusions: The proposed method can be effectively delivered and implemented as a machine specific QA tool for VMAT technique. The three key dynamic variables during VMAT delivery can be checked simultaneously through a single measurement.

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