Comparison between PTW 2D-array Octavius and EPIbeam measurements of a complex Head&Neck VMAT plan

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Introduction

Quality control of VMAT plan is a time consuming task for all medical physics team. The PTW Octavius matrix is widely used for the validation of VMAT plans. The main disadvantage of this system is that the measurement is done only in a fixed plan that is not always representative of the delivered dose. The time required for the set-up is also quite significant.

The goal of this work is to use the benefits of the integrated panel (iViewGT -Elekta Infinity platform) to measure the dose of each arc thanks to the EPIbeam software solution.

Material and methods

The 2D-array Octavius is a two-dimensional detector array consisting of 729 ionization chambers arranged in a 27x27 matrix with a center to center distance of 1cm. This detector is inserted in the Octavius phantom which is specially designed for rotational treatments.

EPIbeam (Dosisoft S.A.) is a software that enables the use of the iViewGT panel for dosimetry purposes and in particular pretreatment verification. The main advantages are that there is no time consuming set-up and the panel is always in front and perpendicular to the beam.

The VMAT plan consists of 2 complete arcs (gantry from 182 to 178° ClockWise and CounterClockwise) and 6 partial arcs (3 CC – 178 to 135°, 70 to 290°, 225 to 182° and the same in CW direction) with a 6 MV beam delivered by the Elekta Infinity with Agility head.

The planar doses calculated from the TPS (Pinnacle 9.10) were compared to the measurements and the evaluation was based on the gamma-index. The criteria for gamma-index analysis are 3mm for the DTA and 3% relative to local dose for the dose difference. Correspondence is acceptable if the fraction of passed gamma values is above 95%.

Results

The first encountered problem was the size of the 2D array. The delivered fluence for some arcs were outside the 27cm allowed in the cross-plane direction. The evaluation is therefore missing some parts of the delivered dose (see blue circles in Fig. 1).

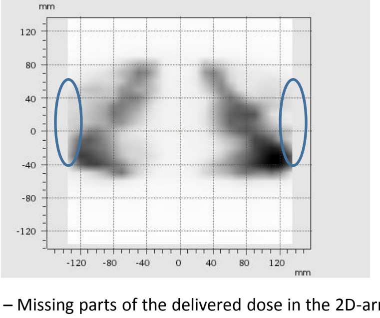

Fig. 1 – Missing parts of the delivered dose in the 2D-array cross-plane direction

This problem disappears with the iViewGT panel, all the fluences are within the 25x25cm² panel detector area.

The gamma-index analysis for 2 arcs were below 95% with the Octavius detector (see Fig. 2), this is maybe due to the high complexity of the dose distribution in the specific matrix plan for these two arcs. This problem is solved when the iViewGT panel remains perpendicular to the fluence.

The results of the EPIbeam measurements and gamma-index analysis are presented in Figure 3, all the 8 arcs are passing the predefined criteria.

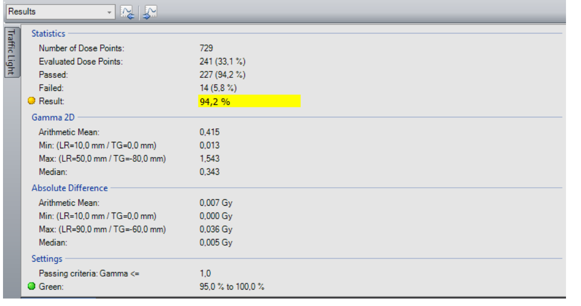

Fig. 2 – Gamma-index analysis results for arc #2 measured with the Octavius 2D-array (3% local dose and 3mm DTA)

Fig. 3 – Gamma-index analysis results for the EPIbeam measurements of the 8 arcs

A key advantage of EPIbeam solution is the use of the intrinsic spatial resolution of the EPID. The pixel size of 0,25x0,25mm² allows a comparison almost continuous of the planar dose (Fig. 4), in contrast to the PTW matrix which requires interpolated dose values between each ionization chambers.

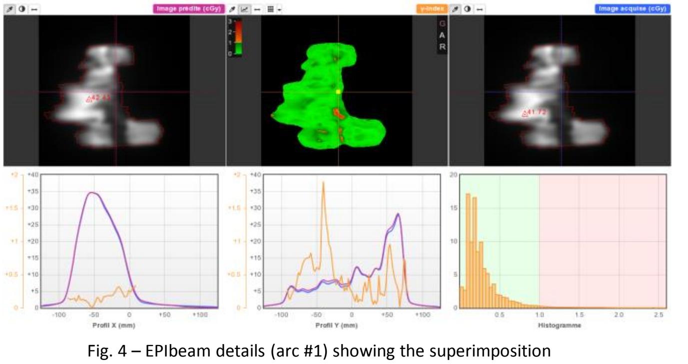

Fig. 4 – EPIbeam details (arc #1) showing the superimposition of the measured and predicted dose and the good gamma-index agreement

Conclusion

EPIbeam offers an alternative solution for patient delivery QC using the iViewGT panel. The advantages are in the set-up time, the spatial resolution of the detector and the perpendicularity of the panel with the beam fluence. Although the detector is always in front of the beam and is not sensitive to gantry error position, it should be noted that the influence of the gantry rotation is taken into account by a specific EPID-arm sag-effect correction applied on the measurement that may returns possible deviations in comparison to ideal operating conditions.