

Purpose: In our study DICOM files of clinical Rapidarc plans were modified with in-house developed software to mimic leaf alignment errors and gravitation shifts. The Octavius 2D-ARRAY (PTW-Freiburg) in sagittal and coronal orientation and the Delta4 device (Scandidos) were used to investigate the effect of the simulated errors on the passing rate of quality assurance results. The manipulated Rapidarc plans were recalculated in Eclipse.

Methods: Different errors were simulated and applied to five prostate (two arcs), three 2-arc head&neck cases and three 3-arc head&neck cases: (1) both MLC banks are opened by 0.25mm, 0.50mm and 1.00mm in opposing directions resulting in larger fields, (2) both MLC banks are closed by 0.10mm, 0.25mm and 0.50mm, (3) both MLC banks are shifted in the same direction for lateral gantry angles to simulate effects of gravitational forces onto the leaves by 1mm, 2mm and 3mm, (4) 25%, 50% 70% and 100% of all active leaves are shifted by 3mm as in (3). Evaluations were performed according to a gamma-index criterion of 3mm/3% and 2mm/2%.

Results: With the standard criteria (3mm, 3%) even the largest modifications would satisfy a >90% passing rate. This indicates that a global criterion for the passing rate may not be sufficient in all cases. All unmodified plans and the majority of the plans with the smallest modification pass the gamma-index criterion of 2%/2mm with >90%. After that the passing rate drops below 90%. For the largest modifications passing rates were typically below 85%. The drop of the passing rate is slightly higher for the Delta4.

Conclusions: Both devices are able to detect MLC positional errors of the investigated magnitude. A stricter gamma-index (2mm, 2%) is necessary in order to detect MLC positional errors and a passing rate of >90% should be expected.

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