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Purpose

As specified in TG142, MLC position accuracy needs to be tested on weekly/monthly basis, with 1mm tolerance. This study focuses on developing techniques, hardware and software tools for implementation of MLC QA tests for Elekta Linacs.

Method and Materials

This process was tested with an Elekta Synergy S, Beam Modulator™, which has 40 leaf pairs of 4mm width (maximum 16 cmx21cm field size). Based on the machine characteristics, two picket-fence IMRT plans were designed: one has 5 2cmx16cm strips separated by 2cm gap; the other has the same setup with individual leafs intentionally displaced by ±1mm, ±1.2mm, etc. Both plans used 6MV x-rays and 50MU on each strip. We overcame the limitation of Xio planning system in generating picket-fence IMRT plan by modifying leaf positions from a DICOM RT plan file. In-house software was executed to validate the files before imported into Record and Verify system (Mosaiq) for delivery. Radiographic images were acquired using Kodak XV films. The borders of a 16 cmx21cm light field were first traced on the film. These reference lines helped reduce the orientation errors during image registration. Two sets of films were exposed with full buildup. After development, each film was digitized with 0.06mm resolution using a high-resolution scanner. The images were then imported into Matlab. Inhouse code was used to detect leafs exceeding the 1mm threshold.

Results

The plans were delivered smoothly. Leaf positions in the first image were used as baselines, instead of using reference leaf positions from the same exposure. This reduced systematic errors. After image registration, leafs displacing from the baseline by 16 pixels (1mm) or more were detected.

Conclusion

This efficient procedure provides a sufficiently accurate test for MLC positioning reproducibility. It is a simple and straightforward procedure that can be used for routine MLC position checks..