

AbstractID:9658Title:Automated Quality Assurance for MLC -based Stereotactic Radiosurgery

Purpose:

We present an automated method of Linac mechanical quality assurance (QA) for MLC-based Stereotactic Radiosurgery. The test is designed to determine 3D deviation of the Linac beam central axis defined by the center of the collimator aperture defined by the MLC leaves from the isocenter defined by the small tungsten sphere target.

Method and Materials:

The automation is achieved using Portal Imager as a 2D detector. Based on the approach of Winston-Lutz Alignment Test, we monitor the alignment of the isocentrically-placed tungsten sphere target, mounted on a metal stem, with the center of the MLC-defined small square field. Multiple projection images are acquired for a specified set of gantry angles. After acquisition, the EPID images are saved in DICOM format by the imager's software for subsequent automated analysis on a Windows-based PC running MATLAB®.

Results:

The center of the sphere deviated by 0.75 ± 0.17 mm (1SD) from the MLC defined field center. The lateral, longitudinal and vertical sphere displacements were $[0.66 \pm 0.17, 0.20 \pm 0.18, 0.217 \pm 0.13]$ mm, respectively. The average extent of the MLC motion in the direction parallel to the electron beam within 0.2 mm maximum span, which is the range of motion in the perpendicular direction ranged from 0.2 mm for $5 \times 5 \text{ cm}^2$ field to 1 mm motion for $2 \times 2 \text{ cm}^2$ field. All results were automatically processed using GUI.

Conclusion:

Our test is capable of sub-millimeter sensitivity to the MLC leaf position and carriage position, as well as gantry sag and carriage height due to the effect of gravity at multiple gantry angles. The system employs a graphic interface, which is intended to facilitate the frequent clinical use of the present QA technique.

Conflict of Interest (only if applicable):

This work is partially supported by Varian Medical Systems (Palo Alto, CA).