AbstractID: 5595 Title: Dependence of Planar IMRT QA on MLC positional inaccuracies

Purpose:
This work aims to investigate the sensitivity of IMRT QA done by means of planar dosimetry to MLC positional inaccuracies. Also we propose an accurate method for measurement of MLC positioning errors using the 2D diode array.

Methods:
A method to measure the MLC position errors by using 2D-array of 455 diodes (MapCheck, Sun Nuclear) is developed. Our method utilizes the fact that each diode's signal will be most sensitive to the MLC position error when its center coincides with the edge of a MLC leaf where a small deviation from the accurate position produces sharp increase or decrease in the diode output. We designed various multi-segmented test patterns based on this principle that can evaluate the MLC deviations with sub-mm accuracy at multiple MLC banks simultaneously. By using this information as a deviation histogram, we created deliberately erroneous IMRT fields with varying standard deviations of MLC leaf position error. MapCHECK planar dose analysis is performed and the sensitivity of the IMRT QA procedure to MLC position inaccuracy using MapCHECK device is evaluated.

Results:
Our results indicate that for SIEMENS Primus and MD machines, the MLC positional errors show a standard deviation of about +/- 0.7mm. Right after the MLC calibration, this deviation might reduce to 0.55mm. It has been found that a single leaf position can vary by as much as 1mm between two consecutive measurements. Fields with less number of segments that are generated by Direct Aperture Optimization are found to be less sensitive to these errors by measurements with deliberately modified fields with random MLC inaccuracies.

Conclusion:
A method to accurately quantify MLC position is proposed and used to obtain a distribution of leaf position errors for many leaves at multiple banks. The sensitivity of planar dosimeter to the MLC positioning errors is investigated.