AbstractID: 4648 Title: Use Of A 2D Array Of Diodes To Test The Accuracy Of MLC Leaf Position And Gap Width

Purpose: For MLC-modulated IMRT fields, it is important that the leaf positioning be accurate and that the gap between opposing leaf pairs be precisely set. One test of the MLC is the "picket fence" pattern, which consists of narrow, sequentially delivered, abutting sub-fields of radiation. Typically in current practice, a radiographic film is irradiated and visually inspected for a discontinuous radiation pattern. Here, a 2D-array of 455 diodes (MapCheck, Sun Nuclear, Melbourne, FL) was used to detect the radiation pattern.

Method and Materials: The array was oriented such that 120 diodes aligned with the center of the MLC leaves at each of their sub-field edges. Measurements were compared against a dose distribution calculated by the XiO treatment planning system (Computerized Medical Systems, St. Louis, MO) for a picket-fence segment pattern delivered to a flat phantom. MapCheck software was used to obtain the relative percent difference, normalized to the center diode, between the 455 diode-measured and calculated points. Spreadsheet software was written that extracted the desired 120 sample points from the 455 measured points and performed routine data analysis in less than 30 s.

Results: Four different Siemens accelerators equipped with 29-leaf pair MLCs were measured over a two-month period. By careful adjustment of MLC leaves, the percent difference between measurement and calculation, averaged for 120 points, could be kept within ±5% with a standard deviation of 6.0%. This standard deviation is attributable to individual MLC leaves and deviations in leaf position for various set positions across the field. The trial-to-trial variation is about 2% for the average difference for the 120 points. A 1-mm leaf offset in the picket fence delivery corresponded to an average difference of about 17%.

Conclusion: A rapid, quantitative method, sensitive to sub-millimeter changes in MLC leaf positioning and gap width has been devised.