Dosimetric characteristics of 2-D ion chamber array matrix for IMRT dose verification
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**Introduction**

Intensity Modulation Radiotherapy (IMRT) planning demands stringent quality assurance and accurate dose determination for delivery of highly conformal dose to the patients. Generally 3-D dose distributions obtained from a treatment planning system have to be verified by dosimetric methods. Mainly a comparison of two-dimensional calculated and measured data in several coplanar planes are performed. In principle, there are many possibilities to measure 2-D dose distributions such as films, EPID, ion chambers and ionization chamber arrays. Radiographic and radiochromic films cannot be applied for fast real-time measurements. The flat-panel EPIDs shows a good resolution and offers a possibility for real-time measurements but their calibration is complicated. The 2-D ion chamber array system offers the real-time measurements and it can be easily connected to the PC. Good agreement in measurements between films and ionization chambers for verification of radiotherapy plans were reported by Spezi et al. In this study, dosimetric characteristics of 2-D ion chamber array matrix (I’matriXX, Scanditronix, Wellhofer) were analyzed for verification of IMRT plans.

**Results and Discussion**

The I’matriXX device gives the absolute dose values based on the Kuser factor. The reproducibility of measurements was good. The system response to dose was found to be linear with in the range of 2-500 cGy, the response of the detector was found to be independent of dose rate from 100 MU / min to 600 MU / min. Output factor matches very well with the chamber measurements. The IMRT fluence patterns generated from TPS like field-in-field, pyramidal and chair test were measured with the I’matriXX and film dosimetry system. IMRT treatment plans were also verified with I’matriXX and film dosimetry.

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D_{ij} = (M-B)_{ij} x N_{DW}^{(60\text{Co})} x K_{uni}^{ij} x K_{TP} x K_{user}
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where \((M-B)_{ij}\) is corrected reading for background, \(K_{TP}\) is pressure and temperature correction, \(K_{uni}^{ij}\) is uniformity calibration factor and \(N_{DW}^{(60\text{Co})}\) is 60Co calibration factor. The \(K_{user}\) factor is determined for 6 MV and 18 MV photons based on the dose estimated by calibrated Farmer chamber (FC65G). The stability, output factor, dose linearity and dose rate behavior of the device were also studied. The IMRT fluence patterns measured by I’matriXX and film dosimetry for field-in-field, pyramidal and chair test were found to be in good agreement with the calculated fluence. IMRT treatment plans were also verified with I’matriXX and film dosimetry.

**Materials and Methods**

The ionization chamber array consists of 1020 single air-vented plane-parallel plate ion chambers arranged in 32 x 32 matrix. Each chamber consists of 4.5 mm diameter, 5 mm height and 0.08 cc of sensitive volume. The minimum read out time is 20 ms, which allows us to measure dynamic processes as the start-up process of the linear accelerator. The depth of effective point of measurement located at 3.6 mm from 2-D array surface. The measurements were performed in Clinac DHX linear accelerator with 6 MV and 18 MV photons in the solid water phantom was used with I’matriXX for all measurements. The absolute dose was estimated using I’matriXX and it is given by

**References**


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