AbstractID: 7472 Title: Characterization of a 2D ionization chamber array for IMRT QA

Abstract:

Background and purpose: Measurement-based methods of quality assurance (QA) for Intensity Modulated Radiotherapy (IMRT) fields often include individual field verification at a neutral gantry angle using film or other 2D detector in addition to a composite ionization chamber check. Unfortunately, film is time-consuming to use. Diode systems are currently available but these arrays are limited in size and spacing of the diodes. This work characterizes a new 2D ionization chamber array (MatriXX, Scanditronix-Wellhofer) that can be used for treatment verification at neutral and planned gantry angles.

Material and methods: The 2D array consists of 1020 ion chambers, arranged in a 32x32 cm^2 grid. Each chamber is separated by 7.62 mm center to center and has a volume of 0.08 cm^3. Properties such as linearity, reproducibility, pressure dependence, homogeneity, and accuracy of the 2D array have been evaluated for 6 and 16MV beams at neutral and planned gantry angles.

Results: The 2D array response was found to be linear with dose from 0-800 cGy. The 2D array readings were reproducible to within a SD of ±0.14%. Examination of the array's pressure dependence, homogeneity, sensitivity as a function of ion chamber location, and the interpolated dose showed accuracies of better than 0.3%. Absolute dose measurements were done with the array and a calibrated ion chamber. Agreement was better than 0.6%. TPR measurements were made and found to agree with commissioning data in our planning system (UMplan). Measurements done using a 2 x 2 cm^2 field placed randomly around the array show a standard deviation of 0.21%. Delivery of IMRT plans using multiple gantry angles showed excellent agreement with calculated results.

Conclusions: The 2D array offers an excellent solution to simplifying QA and saving time, particularly for IMRT pre-treatment QA. The device can be used for both relative and absolute dose measurements.