Purpose: To determine the impact of dose delivery errors due to multileaf collimator bank offset and gantry angle offset on the resulting gamma value of an IMRT Quality Control (QC) test as determined by a planar 2D dosimeter. Also to determine the impact of the planar 2D dosimeter array resolution on the gamma.

Methods: Systematic errors such as MLC leaf bank offset and gantry angle offset were numerically introduced in IMRT verification plans. The dose received by a phantom was calculated using the anisotropic analytical algorithm with a grid size of 1 mm. A coronal 2D plane (30x30 cm2) was selected for each modified plan and compared to the original using the geometric gamma approach in absolute or relative dose using a 3%/3 mm criteria. The plans were then irradiated in a phantom composed of 20x20 cm2 slabs of plastic water. The phantom was imaged using a CT scan and imported into the treatment planning system Eclipse (Varian inc.). A radiochromic EBT2 (ISP Corp. inc.) film was placed at a depth of 4 cm.

Results: Absolute dose measurements are much more sensitive to MLC bank offsets than relative measurements. In contrast, modifying the gantry angle by 1 degree has little effect on the relative or absolute gamma value. There is a clear increase in the variance of the gamma value as the detector spacing is increased beyond 2-3 mm.

Conclusions: Absolute dose measurements should be performed to maximize QC sensitivity. Ideally, the detector spacing in a 2D planar array should be less than 2-3 mm in order to minimize the uncertainty on the gamma.

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