AbstractID: 13672 Title: Eliminating errors in setup and positioning for patient-specific IMRT QA

Purpose: In patient-specific IMRT quality assurance (QA), measured planar dose distributions are usually compared to calculated planar dose distributions. Any discrepancies between the two distributions can be due to: 1. Uncertainties in the linac delivery system. 2. Uncertainties in beam modeling in the treatment planning system. 3. Uncertainties in positioning the QA device/dosimeter. The purpose of this study is to develop and implement a method to eliminate all positioning uncertainties that affect the QA results, including the dosimeter or device positioning and MLC positioning errors, and thereby determine residual errors that are attributed to beam modeling and non-positioning delivery system uncertainties.

Method and Materials: Measured and calculated dose distributions are usually compared using a similarity measure such as gamma test or DTA/dose difference (composite) test based on which a pass percentage is determined. We have developed an efficient algorithm that eliminates the affect of setup and positioning errors on the gamma or composite pass percentages. The algorithm is designed to be optimal and fast so as to operate on high resolution (1 mm) dose distributions for misalignments (typically up to 10 mm).

Results: An algorithm to align high resolution dose distributions using translation has been implemented in C++ and executes within a few seconds on a PC. The algorithm has been rigorously tested on randomly generated matrices for known misalignments and it is able to predict the shifts very accurately.

Conclusion: We have developed a method that eliminates the impact of setup and positioning uncertainties on pass rates for IMRT QA. Any residual discrepancies between measured and calculated planar dose distributions can then be truly attributed to beam modeling and machine output variations.