

AbstractID: 2015 Title: Verification of the PEREGRINE Monte Carlo model of a 120 leaf MLC for highly modulated IMRT fields at 6 MV using mutual information for dose registration

The verification of the MC model of the linac and the associated beam shaping devices is a pre-requisite for the clinical use of MC as a QA tool for IMRT. Our verification process of the PEREGRINE model of a 120 leaf multi-leaf collimator involves, absolute depth-dose and dose-profile comparisons for simple open fields ranging from $2 \times 2 \text{ cm}^2$ to $40 \times 40 \text{ cm}^2$ fields, as well as leakage tests and 2-D relative dose comparisons for simple (consisting of a series of open and closed leaf positions) and heavily modulated intensity patterns (ranging from a single 1×1 field to multi-segmented fields ranging in intensity from 5% to 100%). We use ion chambers for 1-D and EDR2 film for 2-D dose measurements. In the registration process of the measured and calculated 2-D distributions, we employ a mutual information maximization method which minimizes registration errors that are typically introduced through the landmark-based or other semi-manual methods. A Mathematica-based program compares the calculated and measured distributions and provides pass or fail statements using the γ -factor evaluation technique which unifies the 2%/2mm dose difference and distance-to-agreement criteria. This process has enabled us to very effectively verify the accuracy of our Monte Carlo models for un-modulated as well as highly modulated intensity patterns at different energies and for different linac/MLC configurations.

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