

Innovation/Impact: We consider this study to be innovative because it explains and validates a unique quantitative approach for comparing two dose distributions. This tool will be invaluable for comparing two different dose distribution calculations or dose distribution measurements to calculations and is especially useful for IMRT dose distributions with their complex dose gradients.

Key Results: The test experiments are all conducted in two dimensions and use a model of an open $10 \times 10 \text{ cm}^2$ megavoltage field (Figure 1) with $2.0 \times 2.0 \text{ mm}^2$ pixels. The field is divided into four quadrants, and the reference distribution remains unaltered. The evaluated distribution, however, is adjusted as a function of the quadrant (Figure 2). Quadrant 1: Reference and evaluated distributions equal; Quadrant 2: Evaluated distribution shifted in position orthogonal to the field edge; Quadrant 3: Evaluated distribution is modified by an additive dose error as a function of the off-axis distance parallel to the field edge, providing an evaluation of γ for variations of dose magnitude, rather than position; Quadrant 4: Combination of the dose and position shifts is applied.

Figure 3 shows the dose difference between the reference and evaluated distributions. Figure 4 shows the value of γ with 3% and 3 mm criteria. Because two-dimensional distributions are difficult to quantitatively evaluate, a cumulative histogram is prepared as a function of γ .

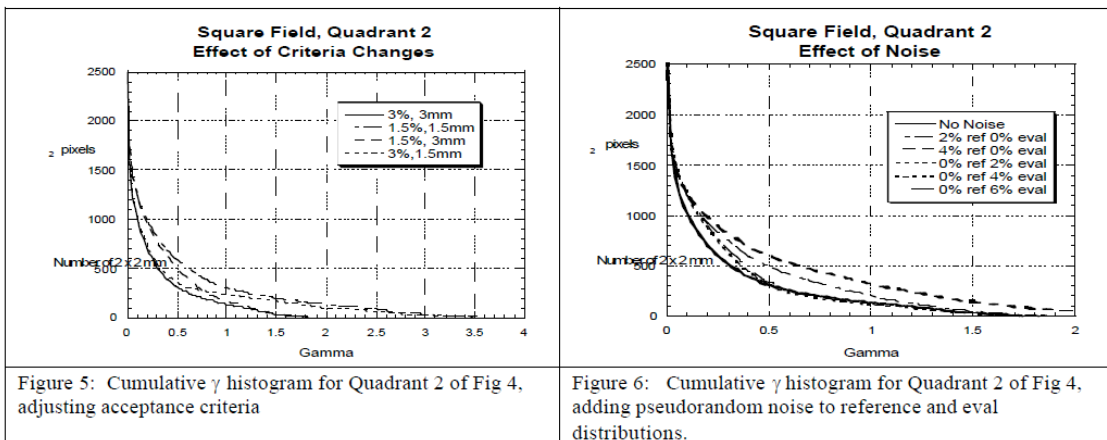
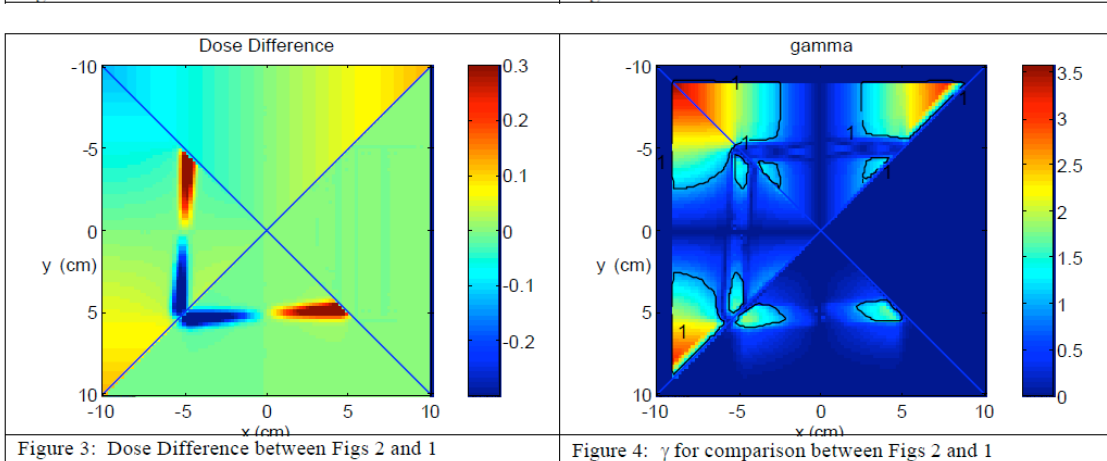
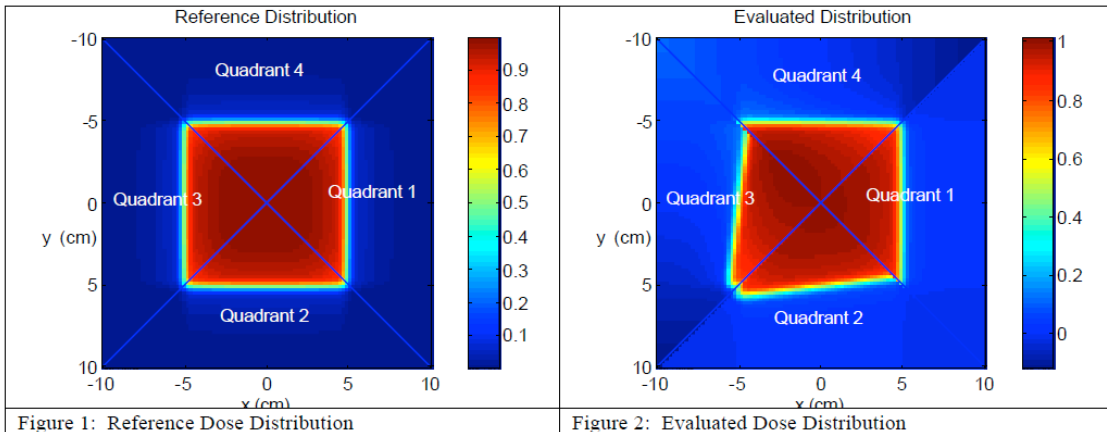


Figure 5: Cumulative γ histogram for Quadrant 2 of Fig 4, adjusting acceptance criteria

Figure 6: Cumulative γ histogram for Quadrant 2 of Fig 4, adding pseudorandom noise to reference and eval distributions.