We evaluated a dose comparison tool that can be used to evaluate measured and calculated dose distributions (1,2). The tool can be used to evaluate dose calculation algorithms by comparison against measurements, or calculations against calculations. (2) and is a measurement of the disagreement between a reference distribution and an evaluated distribution. The distance and dose axes are normalized to a distance-to-agreement and dose-difference test criteria, respectively, so the axes are unitless. The minimum distance in this normalized space is labeled by the symbol γ. **The comparison passes if $\gamma \leq 1$ and fails if $\gamma > 1$**. This presentation will detail our work on evaluating the influence of **pixel size, criteria selection, or measurement noise** on the results on the selectivity of the tool.

The test experiments are all conducted in two dimensions and use a model of an open 10 x 10 cm^2 megavoltage field (Figure 1) with 2.0 x 2.0 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 g 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.

Pixel Size: In regions of steep dose gradient, the value of γ can be incorrectly determined because of the rapid change in dose as a function of position. For example, in a one-dimensional case if two distributions are exactly the same, but are offset by a half a pixel with width Δx , the calculation of γ will take place in the neighboring pixel centers, and the error in the calculation of γ will be $\delta\gamma \leq \Delta x/2 \, \nabla D/\Delta d$ where ∇D is the gradient of the dose distribution, and Δd is the dose-difference criterion. Therefore, in these examples, the evaluated distribution was bilinearly interpolated to locate the point corresponding to the minimum distance in the combined space.

This tool will be valuable 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.

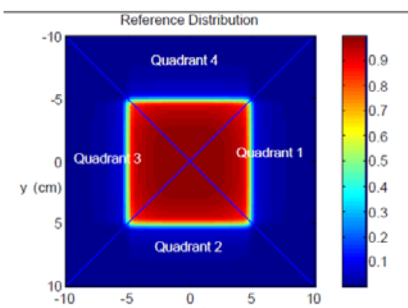

Figure 1: Reference Dose Distribution

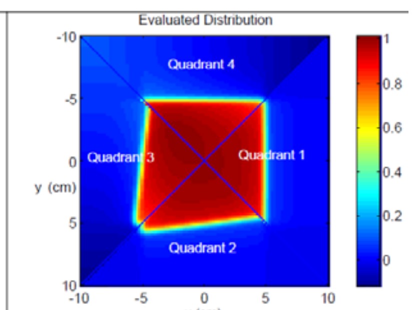

Figure 2: Evaluated Dose Distribution

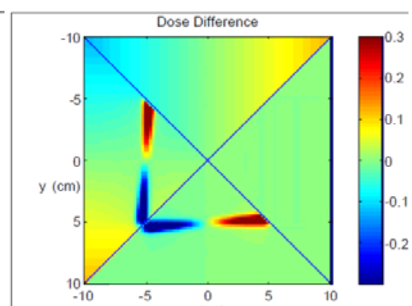

Figure 3: Dose Difference between Figs 2 and 1

References:

[1]D. A. Low, W. B. Harms, S. Mutic, and J. A. Purdy, Medical Physics **25**, 656-61 (1998).
[2]W. Harms, D. A. Low, J. W. Wong, and J. A. Purdy, Medical Physics **25**, 1830-6 (1998).