Successful evaluation and validation of radiation therapy dose calculation algorithms requires accurate, self-consistent measurements, quantitative assessment criteria, and automated test tools to enable comprehensive data analysis. Unfortunately, there are both uncorrelated and correlated noise components in the reference and measurement detectors used in moving-detector dose measurements. To compare the position of the calculated and measured isodose contours in the buildup/builddown and penumbra regions of the measured dose distributions, we use Savitsky-Golay smoothing to directly estimate the smoothed derivative of the data. We then apply a generalized second-difference Gaussian detection filter to the derivative to accurately determine the positions of isodose contours at beam edges. This serves as a robust technique for automatic edge detection in the noisy measured data. For regions in which the dose is changing slowly, we compare calculated to measured doses. Figures-of-merit for both positional accuracy and absolute dose have been developed to assess the accuracy of calculations. We have also developed automated data analysis tools to complete large-scale data comparisons with modeling results. We present representative data comparing results from the PEREGRINE dose calculation system and measurements on clinical systems to show the efficacy and general applicability of these methods.

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