AbstractID: 10550 Title: Effect of point spread function, x-ray quantum noise, and additive instrumentation noise on the accuracy of the angulated slit method for determination of pre-sampled detector MTF.

Purpose: To evaluate the accuracy of the angulated-slit method for determining the detector Modulation Transfer Function (MTF) and thus, for the first time to determine the accuracy of the method for various physical circumstances. We quantify the difference between "true" MTF's and "measured" MTF's obtained using the angulated-slit method.

Method and Materials: A series of simulated slit images were initially generated without blur, with different slit-widths, different slit-angles relative to the detector matrix, and with and without Poisson distributed x-ray quantum noise. We used the angled-slit method to calculate the MTF and compared it with the "true" MTF (a sinc-function given by the pixel aperture). We then introduced known Gaussian blur and additive instrumentation noise to simulate more realistic slit images. The MTF's "measured" with the slit method and the "true" MTF's were compared.

Results: For the ideal slit without blur, there was an increased error in the measured MTF with increasing slit-angle and slit-width, with the greatest error at higher spatial frequencies. Larger slit widths and angles resulted in even greater deviations. Slit images simulated using Poisson distributed quanta, known Gaussian blur, and additive instrumentation noise, resulted in an overall increase in the MTF when compared with the "true" MTF, especially at higher spatial frequencies and increasing deviation with increasing width of the Gaussian blur (around 15% difference at 50% of the Nyquist for a PSF with 3 pixels FWHM and 1% additive noise).

Conclusion: These results show the angulated-slit method to be sensitive to slit-angle and slit-width. The presence of quantum noise, additive instrumentation noise and the width of the blur function are shown to severely affect the angled-slit method accuracy, especially at higher spatial frequencies. Although the slit method provides accurate MTF values at low spatial frequencies, it overestimates the MTF at higher spatial frequencies.
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