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An experimental study on frequency-dependent noise-resolution trade-off of an indirect x-ray detector

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Noise and spatial resolution are two key intrinsic characteristics to describe the performance of an x-ray detector and quantified by the imaging performance metrics of noise power spectrum, modulation transfer function, and detective quantum efficiency (DQE). To improve two characteristics of an x-ray detector, image processing algorithms are widely used. However, there exists a trade-off between noise and spatial resolution due to the presence of noise-resolution uncertainty in imaging system. In this work, we investigated the influence of image processing on the frequency-dependent noise-resolution trade-off, which is defined as DQE multiplied by the ratio of a pixel size to spatial resolution, with different x-ray doses. We conducted an experiment using a tabletop setup and some linear image processing algorithms such as smoothing and sharpening filters. Measurements were made on a flat-panel detector, DR tech EVS 4343 at 70kVp. Experimental results showed that the frequency-dependent noise-resolution trade-off is hardly influenced by image processing and do not exceed the upper limit at a fixed incident x-ray dose.

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