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Performance Evaluation of an A-Si Based Flat-Panel X-Ray Imaging System for Field Feasibility Studies

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In this study, we have evaluated the imaging performance of an a-Si:H based flat-panel X-ray imaging system with various testing conditions to test its feasibility for medical field applications. The imaging system consists of a commercially available a-Si:H flat-panel photosensor array of 143 μm x 143 μm pixel size and 446 mm x 446 mm active area, directly coupled with an 100 μm thick CsI(Tl) scintillator of bulk structure. Imaging performance was evaluated in terms of system response with exposure, MTF (modulation transfer function), NPS (noise power spectrum) and DQE (detective quantum efficiency). The system response was measured up to 10 mR, and showed good linearity with exposure. The presampled MTF was measured using a slanted-slit method, and the NPS was determined by 2-dimensional Fourier analysis. Both the measured MTF and NPS, and the X-ray spectral analysis from the SRS-78 program were used to determine the spatial frequency-dependent DQE. The spatial frequency at 10% MTF was about 3.5 LP/mm at the RQA5 condition, and the NPS and the DQE at zero frequency measured at 6.5 mR were about $1.4 \times 10^{-5} \text{ mm}^2$ and 0.31, respectively. In this paper, we will also present the possible ways to enhance the image performance.

Keywords : Digital X-ray Imaging, Flat Panel Detector, Image Quality