An amorphous silicon thin film transistor (TFT) x-ray detector system was evaluated experimentally, and computer simulations related to the device were also performed. The system (Varian Imaging Products, Palo Alto, CA) is composed of a 1536 x 1920 array of 127 micrometer pixels, encompassing a field of view of 195 mm by 243 mm. In fluoroscopic mode (at 30 frames per second), the pixel array is read out by binning pixels, for example pixels can be binned as 2 x 2, 2 x 4, or 4 x 4. The performance of this x-ray imaging system was evaluated in 2 x 2 binning mode by measuring the modulation transfer function, the noise power spectrum, the noise-equivalent quanta, and the detective quantum efficiency. These performance indices were measured as a function of exposure rate, over a clinically realistic range. Due to the presence of an additive electronic noise component, the DQE at low exposure rates was low but improved as exposure rate increased. By incorporating a real-time temporal filter (exponential tail), which was capable of adding lag characteristics similar to image intensifier/vidicon based fluoroscopic systems, the DQE at typical fluoroscopic exposure rates (1-3 microRoentgen per frame) could be improved substantially. The influence of additive noise on the DQE measurements was verified using computer simulation techniques. The results of this investigation, which covered hundreds of DQE assessments, suggest that the TFT based fluoroscopic system is a completely equivalent to similar field of view image intensifier based systems for fluoroscopic imaging.

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