

X-ray imaging performance comparison between CMOS and TFT sensors for a high speed fluoroscopy and CBCT system

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The physical performance characteristics of complementary metal oxide semiconductor (CMOS) and thin film transistor (TFT) x-ray imaging sensors are compared for the fluoroscopy and cone-beam computed tomography (CBCT) medical imaging application. In this paper, our developing CMOS x-ray imaging sensor has been designed with the 14.3 bit extended counting analog to digital converter (ADC) and fabricated by using a 0.35 μm 1Poly 4Meta CMOS process. CMOS sensor has a 100 μm pixel pitch, and provided a 120 \times 120 mm² (1200 \times 1200 pixels) field of view (FOV). Thallium-doped cesium iodide (CsI:Tl) scintillator screens are used as converters for incident x-ray to visible light photons. The compared amorphous silicon (a-Si) based TFT x-ray imaging sensor (PaxScan 4030CB, Varian inc.) having a 397 \times 298 mm² active area with 194 μm pixel pitch and 2048 \times 1536 pixels is used. The most important factors that affect the image quality are contrast, spatial resolution and noise. The evaluation is made in terms of the modulation transfer function (MTF), the normalized noise power spectrum (NNPS), and the resultant detective quantum efficiency (DQE) in full and 2 \times 2 binning modes.

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