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P2.53: Scintillators and image characterization of a flat-panel X-ray detector for single-exposure dual energy imaging

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In recent years, digital X-ray imaging detectors with indirect detection technology have been widely used in many medical imaging applications such as radiography, fluoroscopy and cone-beam CT. These indirect X-ray imaging detectors are based on the combination of a thin film transistor (TFT) array with several scintillating screens such as typical CsI, GOS materials. Currently, dual-energy (DE) imaging task using a dual-layer X-ray detection type allows the soft and hard structures (e.g. soft and bone tissues) in the object to be selectively visualized,

In this work, we have designed and employed dual-layer based a-Si array backplanes with top layer and bottom layer for X-ray imaging tasks. A prototype large area image detector consists of TFT array with a 43cm x 43cm active area with 3072x3072 pixel array and 140um pixel pitch. Different scintillation combination such as columnar CsI:Tl and Gd2O2S:Tb(GOS) with various thickness and spectral middle filters were used to investigate the imaging characterization. The specific scintillators in dual-layer configuration were selected and implemented for good image quality at low X-ray dose condition.

For imaging characterization of the dual-layer X-ray imaging detector, different scintillating screens were directly coupled on the prototype photodiode array panel. The preliminary important X-ray characterization such as the detector sensitivity to X-ray exposure dose, signal-to-noise-ratio (SNR) and modulation transfer function (MTF) and phantom imaging were measured under practical imaging systems with 60-120kVp tube voltage and adjustable tube current. The experimental results with a dual-layer based flat panel detector using combination of different scintillators and intermediate filter demonstrated its ability to perform accurate dual-energy imaging with single –exposure.

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