AbstractID: 9589 Title: Detector characterization of Trixel (Pixium 4343RF) Flat Panel Imager - prospects for image quality improvement

Purpose: To characterize the imaging performance of a new flat-panel-imager (FPI) with respect to metrics such as detector gain, linearity, lag, modulation transfer function (MTF), noise-power spectrum (NPS), and detective quantum efficiency (DQE) and to evaluate its potential application in fluoroscopy and cone-beam CT for radiation therapy guidance.

Method: The detector examined was a Trixell (Pixium 4343RF) indirect- FPI with a 2881x2880 array of 0.143x0.143 mm^2 pixels, 43x43 cm^2 FOV and a 0.06 mm thick CsI:Tl x-ray converter. The FPI was operated at a frame rate 3 fps. Gain, linearity and NPS were calculated using gain-corrected flood images. MTF was measured using an edge-spread function method. DQE was calculated from the measured MTF and NPS. Image lag was characterized as a function of incident exposure. NPS, MTF, DQE and lag were compared with a FPI design (Perkin Elmer RID1640) currently employed in image-guided radiotherapy.

Results: The dark current stabilizes after 30 minutes. The detector has high gain and linearity with R^2~1. The 50% MTF was achieved at 1.51 and 0.91 lp/mm at 120 kVp for Trixel and Perkin Elmer (PE) FPI, respectively. The spatial resolution was limited by the focal spot size. The NPS(f) is found lower than the PE at 120 kVp for the same pixel saturation. The DQE is calculated 55 and 34% at 1.25 lp/mm for Trixel and PE, respectively. The first frame lag is 7 times lower than Perkin Elmer for the same pixel saturation at 120 kVp. Radiographic images of a head phantom show high contrast and spatial resolution.

Conclusions: Imaging performance metrics (in particular, the high linearity, low lag, and high DQE(f)) suggest a significant improvement for the Trixell FPI and strongly support potential application of this detector for fluoroscopy and cone-beam CT.

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