AbstractID: 4873 Title: Development of a novel high quantum efficiency flat panel detector for megavoltage cone beam CT/DT: Construction and evaluation of a prototype single-row detector

Purpose: Most electronic portal imaging devices (EPIDs) developed so far have low x-ray absorption, *i.e.*, low quantum efficiency (QE) of 2-4% for megavoltage x rays. A significant increase of QE is desirable for applications such as megavoltage cone-beam CT (MV-CBCT) and digital tomosynthesis (MV-CBDT). Our overall goal is to develop a new generation of area detectors for MV-CBCT/DT, with a QE an order of magnitude higher than that of current EPIDs and yet an equivalent spatial resolution**.** To this end, a novel direct-conversion design of such a high QE detector was introduced recently [Pang and Rowlands, Med. Phys. 31, 3004 (2004)]. The purpose of this work is to construct and evaluate a prototype single-row detector.

Method and Materials: A prototype single-row detector was constructed based on the novel design. It consists of a single custom-made printed circuit board (with microsize cavities, charge collection electrodes and microstrip spacers) sandwiched between two identical tungsten plates. The detector array has 128 pixels each with dimensions of 0.45mm (width)×0.6mm (length)×22mm (height). The detector array was placed inside a sealed vessel filled with Xe gas (ionization medium) and then connected to a data acquisition board (XDAS, Electron Tubes Ltd.) for readout. Some fundamental imaging properties including QE, noise power spectrum (NPS) and detective quantum efficiency (DQE) were measured with a 6MV beam.

Results: Phantom images were obtained using a dose as low as one Linac pulse. The QE of the prototype is ~ 66% at 6MV. The DQE at zero frequency is more than an order of magnitude higher than that of current EPIDs.

Conclusion: This work demonstrated the feasibility of our novel design for a high QE MV detector. Construction and evaluation of a prototype flat-panel area detector is in progress.

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