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# INVITED: High-flux CdZnTe detectors: Spectral Computed Tomography and Beyond

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Recent advances in THM growth and contact engineering of high-flux CdZnTe sensors have enabled dramatically improved hole mobility-lifetime product resolving historical problems with detector polarization. To illustrate superior performance of high-flux CZT we will show some experimental studies in Spectral Computed Tomography (SCT), High-Intensity X-Ray Imaging and Theranostics.

Computed Tomography (CT) is a state-of-the-art X-ray imaging modality that uses either dual tube, kVpp switching, or dual scintillator detectors. Further improvements in tissue discrimination, spatial resolution and development of new clinical applications, as K-edge contrast imaging, are expected as a result of currently deployed Spectral CT scanners that utilize 4-8 energy bins and operate under 650+ Mcps/mm2 count rates. To illustrate this technology potential, we have performed spectral CT acquisition of a small phantom with three contrast agents with a 330-µm pixel pitch detector. Spectral CT images were reconstructed for all six energy bins matched to the K-edges of the contrast agents as well as for integrated signal mimicking a photon-integrating CT. The K-edge contrast-only images were in excellent agreement with true contrast agent locations and provided a complimentary information to the integrated CT image.

Outside of medical applications, there is also a growing need for CdZnTe-based detectors amongst the high-energy physics community. Over the next decade, the development of diffraction limited storage ring (DLSR) synchrotrons and continuous wave (CW) free electrons lasers will see an increase in average source brightness and a move towards higher X-ray energies (>10 keV). At these energies and fluxes the poor radiation hardness and stopping power of traditional silicon-based detector systems is driving a move to CdZnTe detectors. Recent testing of CZT detectors at the Linac Coherent Light Source (LCLS) FEL have demonstrated the capability of this material to carry out X-ray imaging at extreme fluencies of 8 GeV mm-2 per 40 fs wide X-ray pulse. We anticipate future use of high-flux CZT detectors in other photon sciences experiments.

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