Keck-PAD

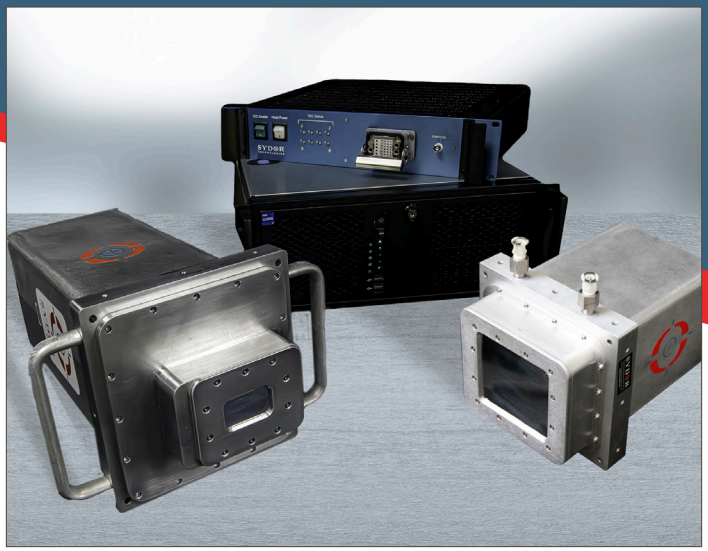
Direct Detection of Hard X-Rays at MHz Rates

SYDOR TECHNOLOGIES

COMPLEX MEASUREMENTS—CRITICAL RESULTS

Applications:

- Materials in Extreme Conditions with x-ray and/or laser probes
- Shock Physics
- Time-resolved experiments
- Destructive experiments



With sensitivity to a single x-ray photon, the Sydor Keck-PAD is a direct x-ray detector with ultra-wide dynamic range and low noise, enabling the study of the temporal evolution of complex materials under dynamic loading.

The Sydor Keck-PAD is a burst rate, direct x-ray imager capable of acquiring up to 8 successive images at frame rates of up to 10 MHz with single x-ray sensitivity, making it ideal for irreversible or single-shot experiments. More importantly, each of the eight frames can be individually configured and triggered. Image data is stored on-chip until readout which takes 1 ms per image. Exposures can be triggered by an external sync to coordinate with time- resolved events.

The Sydor Keck-PAD has a full well capacity of greater than 10^3 8 keV x-rays/pixel/frame. The current Sydor Keck-PAD capabilities have been extended to x-ray energies from 20 keV to 150 keV by replacing its silicon sensors with cadmium telluride sensors.

The Sydor Keck-PAD is comprised of 8 sub-modules of 256 x 128 pixels having a pixel pitch of 150 microns and resulting in an overall format of 512 x 512 pixels. Custom array sizes may be available upon request. Each sub-module can also be triggered individually for up to a 10 MHz frame rate with the 8 frames.

Benefits:

- Frame rates up to 10 MHz
- Maximum QE with silicon (Si) or cadmium telluride (CdTe) sensor
- Configurable frame length and inter-frame spacing for up to 8 frames in a burst
- Full well exceeds 10^3 photons/pixel/frame
- Tiled design enables potential for custom configuration

At 8 keV, read noise is ~0.5 photons/pixel and dark currents are 2 photons/pixel/s. A thermoelectric cooling system is integrated with the Keck-PAD to maintain the least possible dark current. Cooling and general detector functions are controlled via ethernet connection to the user's PC and support the EPICS control interface or a proprietary Sydor control interface.

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PRODUCT SPECIFICATIONS

- **Sensor Material:** 500 µm thick Si or 750 µm CdTe
- **Sensor Format:** Eight submodules of 256 x 128 pixels; Standard detector array is a 512 x 512 pixel format
- **Pixel Pitch:** 150 µm
- **Full Well Capacity:** ~10^4 photons
- **Read Noise:** ~ 0.5 photons/pixel @ 8 keV
- **Dark Current:** 2 photons/pixel/s @ 8 keV
- **Frame Rate:** up to 10 MHz (for 8 frames)
- **Minimum Integration Time:** 50 ns
- **Maximum Continuous Frame Rate:** up to 1 kHz
- **Spectral Range:** up to 20 keV with Si sensor or greater than 20 keV with CdTe sensor
- **Cooling Method:** Thermoelectric Cooler (TEC) with water waste heat removal
- **Physical Dimensions:** 220 x 220 x 300 mm, 10 kg
- **User Interface:** EPICS and/or proprietary Sydor Control Interface

QE Curve for Si and CdTe Options

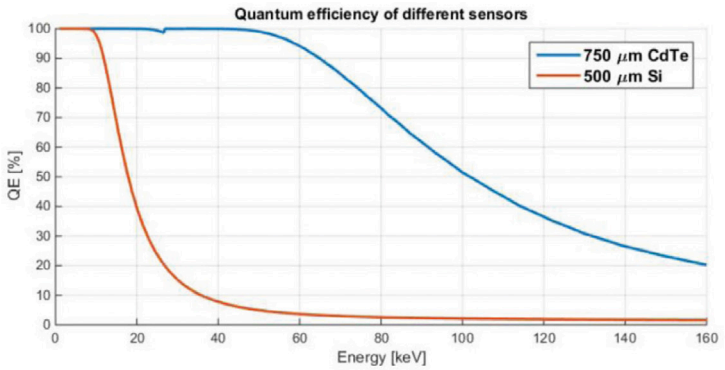
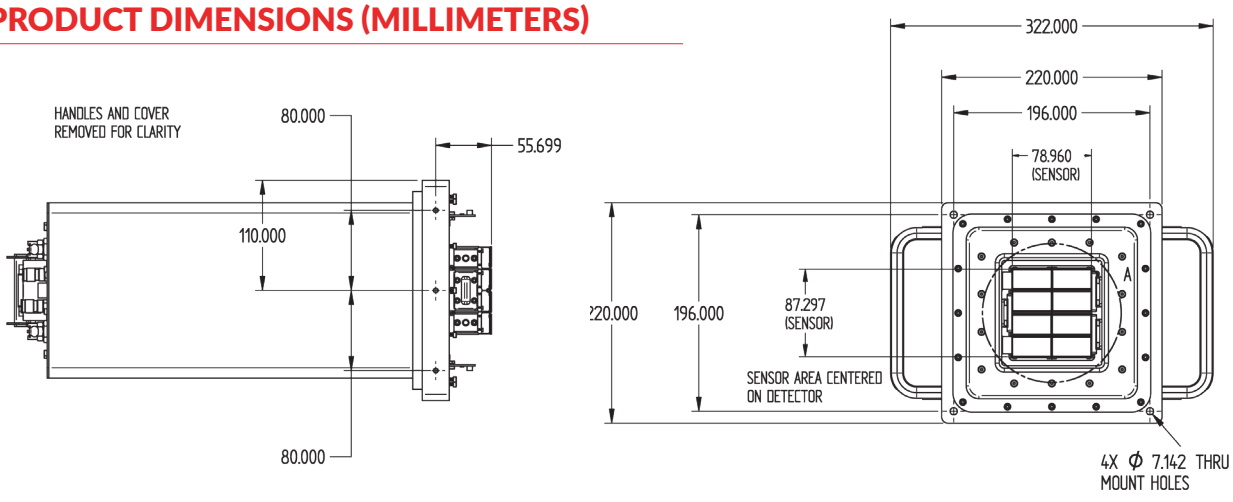


Figure 1. Quantum efficiency of 750 µm CdTe and 500 µm silicon sensors

Characterization of CdTe sensors with Schottky contacts coupled to charge-integrating pixel array detectors for X-ray science." Journal of Instrumentation 11.12 (2016): P12013

PRODUCT DIMENSIONS (MILLIMETERS)



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