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DECTRIS Innovations: Shaping the Future of X-ray Detection Technologies

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DECTRIS's innovations strive to set new standards in detector technology, driving groundbreaking advancements in scientific research on both X-ray photon and electron science.

Our work addresses the evolving requirements of next-generation synchrotron light sources and high-precision laboratory systems used in diffraction scattering, and spectroscopy.
In parallel, we are expanding the reach of our innovations into electron microscopy, medical and industrial applications, including computed tomography (CT) imaging and electronics inspection.

Our success relies on delivering application-optimized detectors and software that meet these new scientific frontiers and on achieving detection excellence across various parameters, including high frame rates, exceptional count rates exceeding 10 MHz per pixel, pushing energy resolution limits down to 600eV (FWHM), and providing a broad energy coverage from few keV to 100 keV by the use of both silicon and cadmium telluride sensor materials for direct detection.

In this presentation, we will highlight our latest research and development efforts in X-ray detector technologies.

Some examples of our ongoing R&D have yielded the SELUN detector, engineered for high-frame-rate applications exceeding 100 kHz, which is crucial for techniques such as ptychography, BCDI, and XPCS. The SELUN features a 192 x 192-pixel array, each 100 μm in size, which creates a 19.2 mm x 19.2 mm active area. With advanced front-end electronics
and an instant retrigger capability, it supports non-paralyzable counting at rates over
20 Mcts/pixel/s. Moreover, when configured to a 2x2 digital binning mode, and a novel floating point compression, SELUN can achieve frame rates surpassing 100 kHz.
Simultaneously, we have developed the PILATUS4 detector to accommodate applications requiring larger active areas. Ideal for scanning powder XRD, XRD-CT, time-resolved XRD, scanning XRD, and SAXS, these detectors offer up to 4 million pixels with a 150 μm pixel size covering an active area of 311×327 mm^2. They can operate up to 2 kHz in 16-bit mode and 4 kHz in 8-bit mode, with minimal dead-time of 100 ns, ensuring an effective duty cycle of over
99.9%.
Such a high frame rate and the high detection efficiency at high energies are also a critical specification for imaging systems used in industrial applications such as battery inspection, where the performance of the imaging device must sustain the high throughput of modern gigafactories. PILATUS4 features four energy discriminating thresholds, which can also be employed for spectral imaging and tomography. Successful examples of this include the simultaneous discrimination of multiple contrast agents in preclinical settings.

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