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Single Photon Counting at 700 eV using LGADs

Tuesday, 13 January 2026 13:45 (20 minutes)

Hybrid pixel, single-photon counting detectors have been instrumental in advancing measurement techniques at synchrotron facilities. They enable fine slicing of the rotation angle and shutterless data acquisition for protein crystallography. Fast and efficient detectors are also essential for many modern techniques such as ptychography.
Although incredibly successful for hard X-rays, the large in-pixel capacitance resulting from the bump bonds represents an intrinsic barrier to low-energy detection, with most modern systems being limited to around 3–5 keV. LGAD sensor technology addresses this issue by amplifying the signal on the sensor side and is therefore not affected by capacitance in the same way.
In this talk, we will share our experience, from a detector developer's view, operating the first 512×512-pixel Eiger detector with an LGAD sensor for soft X-ray ptychography imaging. Scientific results from SLS and MAX-IV down to a photon energy of 500 eV are complemented with characterization data and an outlook toward next-generation systems which we will build around the new Matterhorn readout chip. It has the same pixel geometry, but is specifically designed for 4th generation synchrotrons supporting count rates up to several MHz/s/pixel and a frame rate of 10 kHz continuous. The chip will be available in 2026 and we plan to build the first single photon counting systems using improved LGAD sensors by 2027.
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