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XIDer: a Novel X-ray Detector for Next-Generation High-Energy Synchrotron Radiation Sources

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The ESRF Extremely Brilliant Source (EBS) is the world's first fourth generation synchrotron radiation source. Latest generation x-ray sources like the EBS impose increasing demands on sensors and readout electronics. Apart from fast signal processing and high spatial resolution, detectors used at such facilities have to handle a broad dynamic range with fluxes of up to billions of photons per second while still providing single photon sensitivity at low noise levels. Additionally, the targeted high energy range forces detector systems to use less conventional high-Z sensor materials which usually come with additional challenges. As a result, effects like afterglow, sensor leakage and bias- as well as flux-induced leakage have to be handled and corrected for.

The XIDer project aims to build a 2D pixelated hybrid X-ray detector to tackle the aforementioned challenges. It incorporates a novel digital integration readout scheme to combine the high-rate capabilities of charge integration with the noise and leakage suppression of photon counting systems. The final detector is planned to cope with the conditions imposed by the EBS such as fluxes of up to 10^9 ph/px/s, photon energies of up to 100 keV as well as different beam modes ranging from pulsed to near-continuous illumination.

This contribution is meant to introduce the XIDer project, its challenges and the progress that has been made so far. This will be supported by the presentation of first characterisation measurements of the readout ASIC as well as test prototypes equipped with cadmium telluride sensors.

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