Advances in hybrid detector development at PSI

Anna Bergamaschi*, Marie Andrä, Rebecca Barten, Martin Brückner, Sabina Chiriotti Alvarez, Roberto Dinapoli, Erik Fröjdh, Dominic Greiffenberg, Carlos Lopez Cuenca, Davide Mezza, Aldo Mozzanica, Sophie Redford, Christian Ruder, Bernd Schmitt, Xintian Shi, Dhanya Thattil, Gemma Tinti, Seraphin Vetter, and Jiaguo Zhang

Paul Scherrer Institut, Switzerland

**anna.bergamaschi@psi.ch*

The SLS Detector Group develops hybrid detectors for synchrotron and XFEL applications, both microstrip and pixels, with photon counting and analog readout architectures.

These detectors are well established at synchrotrons for diffraction applications. However, only recent developments in the noise reduction and improvements in the sensor design paved the way for their use as energy dispersive and soft X-ray detectors; while progress in the bump bonding technique allowed a higher segmentation for high resolution imaging. Therefore, at PSI, we are exploring the limits of the hybrid detector technology in terms of spatial resolution resolution and minimum detectable energy in order to extend the field of applications at synchrotrons and XFELs.

Concerning single photon counting detectors, in parallel with commissioning of large area EIGER pixel detectors, we are designing a new generation of MYTHEN microstrip readout chip with multiple independent counters and improved performance in terms of noise, threshold dispersion, frame rate and count rate capability. In the next years, we plan to transfer these improvements to a new photon counting pixel detector.

Additionally, we are characterizing Low Gain Avalanche Detectors (LGADs), which could greatly extend the low energy limits of single photon counting detectors.

In the case of charge integrating detectors, the 75 μm pitch JUNGFRAU pixel detector has successfully started operation at the SwissFEL and we are developing the low noise 25 μm pitch MOENCH pixel detector. These detectors are optimized for XFELs, but thanks to their fast frame rate and large dynamic range, they can find applications also at synchrotrons for high flux experiments, which are currently limited by the count rate capability of single photon counters.

The presentation will showcase the new developments which are being carried out by our group, focusing on the optimization for the soft X-ray energy range.