Contribution ID: **16** Type: **Talk**

Hybrid pixel detector developments for Synchrotrons and Free Electron Lasers at the Paul Scherrer Institut

Monday, 4 September 2017 14:10 (30 minutes)

The X-ray detector group at the Paul Scherrer Institute (PSI), Switzerland, has a long history in hybrid detector developments for use at the Swiss Light Source (SLS) and other synchrotrons worldwide. One of the developments for synchrotrons is the EIGER single photon counting detector, which is characterized by $75\times75\tilde{}\mu\text{m}^2$ pixels and a frame rate as high as $23\tilde{}(6)\tilde{}$kHz for a $4\tilde{}(12)$ bit counter. Detector systems ranging from 0.5 to $9\tilde{}$Mpixels are being integrated into beamline operations. Some experimental results and challenges for large area detector operations will be presented. EIGER has also proved to be a competitive detector for electrons with energy ranging from $8-20\tilde{}$keV in photo-emission electron microscopes and from $100-300\tilde{}$keV in transition electron microscopes. Measurements will be presented.

The construction of the Swiss Free Electron Laser (Swiss-FEL) at PSI and other FELs worldwide has shifted developments towards charge integrating detectors, which are able to sustain a high number of photons in pulses with length of order of tenth of fs. The versatile JUNGFRAU detector has $75\times75\tilde{}\mu\text{m}^2$ pixels, like EIGER. It is characterized by single photon resolution and high dynamic range. These characteristics can be simultaneously achieved through a dynamic gain switching mechanism. Details on the detector concept and results on the characterization will be shown. Although JUNGFRAU has been designed for FEL applications at photon energies in the 2−20 keV range, a frame rate as high as $2\tilde{}$kHz enables the use of the JUNGFRAU detector also at synchrotron sources like the SLS. The use of charge integrating systems for synchrotron applications will allow to sustain higher incoming photon rates per pixel, which have to be limited when single photon counting systems are used. Pros and cons of the use of both technologies at synchrotrons will be presented.

Finally, the M\"{O}NCH charge integrating detector, characterized by small pixels of $25\times25\tilde{}\mu\text{m}^2$, will be shown. This research project is meant to investigate perspectives for hybrid detectors with high spatial resolution thanks to the small pixel size and low noise, which allows to detect soft X-rays at synchrotrons and FELs. Moreover, by exploiting the charge sharing effect, the sub-pixel spatial resolution is achieved and opens possibilities for high resolution imaging at synchrotrons and with X-ray tubes.

Primary authors: Dr TINTI, Gemma (Paul Scherrer Institute); BERGAMASCHI, Anna (PSI); BRÜCKNER, Martin (Paul Scherrer Institut); DINAPOLI, Roberto (Paul Scherrer Institut); GREIFFENBERG, Dominic (PSI - Paul Scherrer Institute); Dr FROEJDH, Erik (PSI); MOZZANICA, Aldo (PSI - Paul Scherrer Institut); Dr MEZZA, Davide (PSI); RAMILLI, Marco (Paul Scherrer Institut); Dr REDFORD, Sophie (psi); Dr SHI, Xintian (Paul Scherrer Institute); Dr ZHANG, Jiaguo; Dr RUAT, Marie (PSI - Paul Scherrer Institut); SCHMITT, Bernd (Paul Scherrer Institut); Ms ANDRAE, Marie (Paul Scherrer Institut); LOPEZ CUENCA, Carlos (PSI)

Presenter: Dr TINTI, Gemma (Paul Scherrer Institute)

Session Classification: Detectors for synchrotron and free electron laser radiation (I)