

Semiconductor radiation detectors for synchrotrons and XFELs”.

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Synchrotron radiation and XFEL experiments exploit the interaction of X-rays with the sample under examination in order to investigate its properties.

Depending on the application, the detector should detect the X-rays transmitted, scattered, diffracted or produced by the samples or the photoelectrons emitted, providing high temporal, spatial or energy resolution.

The requirements on the dynamic range are particularly demanding due to the high fluxes provided by synchrotron beamlines and to the need to detect signals also from weakly interacting samples.

Starting from the requirement of the experiments we will review some of the detectors used at synchrotrons:

- Diffraction/scattering: hybrid detectors;
- Fluorescence emission spectroscopy: SDD, MAIA, crystal based spectrometers;
- High resolution imaging: Scintillator-coupled detectors and hybrid detectors with interpolation;
- Soft X-rays: CCDs

The requirements become even more challenging in the case of XFELs where several thousands photons per pixel should be detected in one shot and therefore special solutions for extending the dynamic range have to be found.

We will review some of the detectors used at existing XFELs (CSPAD, pnCCD, MPCCD, GOTTHARD) and developed for the future sources (AGIPD, LPD, DSRC, JUNGFRU, PERCIVAL).

Author: BERGAMASCHI, Anna (PSI)

Presenter: BERGAMASCHI, Anna (PSI)

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