MS39-P11 EIGER: The next generation of Hybrid Photon Counting detectors

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PILATUS detectors have set new standards for data quality and collection efficiency in crystallographic data acquisition. EIGER, the next generation of Hybrid Photon Counting (HPC) detectors, takes a great leap towards smaller pixel size and substantially shorter readout times. The first EIGER detectors start operation at various synchrotron beamlines in 2015 and are also available for laboratory instruments.

This presentation will describe the novel features of EIGER and how crystallographers can benefit from these. Furthermore, first results obtained with EIGER detectors will be presented.

Keywords: Hybrid Pixel Detectors, X-ray detectors, Hybrid Photon Counting detectors

MS39-P12 Application of a pnCCD for energy-dispersive Laue diffraction with ultra-hard X-rays

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The use of highly brilliant synchrotron radiation allows precise analyses of crystalline materials by means of diffraction experiments. However, in a variety of applications, the availability of structural information is limited due to the insufficient performance of conventional detector systems for X-ray spectroscopy. New experimental possibilities are offered by energy-resolving area detectors based on the concept of the pn-junction charge coupled device (pnCCD). In particular, structure determination can be achieved in a single-shot exposure of the crystal to white synchrotron radiation in an energy-dispersive Laue diffraction experiment. Until now pnCCDs have successfully been applied for analyses of inorganic crystals and fast screening techniques quantifying polycrystallinity in organic samples of macromolecules with white X-rays between 10 keV and 35 keV.

In this work the spectroscopic performance of a pnCCD detector in the ultra-hard energy range between 40 keV and 140 keV is tested by means of an energy-dispersive Laue diffraction experiment on a GaAs crystal. About 100 Bragg peaks were collected in a single-shot exposure of the arbitrarily oriented sample to white synchrotron radiation provided by a wiggler and resolved in a large reciprocal-space volume. The positions and energies of individual Laue spots could be determined with a spatial accuracy of less than one pixel and a relative energy resolution below 1%. In this way the unit-cell parameters of GaAs were extracted with high accuracy allowing for a complete indexing of the recorded Laue pattern. Experimental structure-factor amplitudes could be obtained from the three-dimensional data sets taking into account photoelectric absorption as well as Compton scattering processes inside the detector. The agreement between measured and theoretical kinematical structure-factor amplitudes calculated from the known crystal structure is in the range of 10%. The results of this experiment demonstrate the potential of pnCCD detectors for applications in X-ray structure analysis using the complete energy spectrum of synchrotron radiation.

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