MS39-P22 XPAD, a hybrid pixel detector for accurate and time resolved X-ray data collection at laboratory

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The new generation of X-ray detectors, the hybrid pixel area detectors known as 'pixel detectors', is based on direct detection and single-photon counting processes that leads to noise immunity and very high counting dynamic. Moreover their electronic architecture allows for an electronic shutter and fast readout time. These characteristics render them very attractive and explain their broad use on synchrotron beam lines since a few years. A long-standing collaboration between the CRM2 laboratory and the society imXPAD led us to develop an original laboratory diffractometer made from a Nonius Mach3 goniometer equipped with an Incoatec Mo micro source and a XPAD pixel area detector at the CRM2 laboratory four years ago. In this poster we will present the detector and the first laboratory applications: pump-probe (time resolved) experiments and accurate electron density measurements.

For the pump-probe experiment [1], we have developed a dedicated firmware for the FPGA (Field-Programmable Gate Array) inside the detector (a firmware allows programming the electronic architecture inside the FPGA to build any complex function). This particular flexibility of the XPAD detector was used to multiplex and sum the images inside the detector, synchronous with the pump-probe experiment, enabling the rapid data collection (independent of the image size) over thousands of cycles under external constraints whereby the measurement (and constraint) windows can be adjusted in the range of a few milliseconds to a few tens of milliseconds.

The capacity of this detector to perform very accurate data collection [2] will also be shown by comparison between charge density models obtained after multipolar refinements with identical strategies on data collected with three diffractometers, Mach3 XPAD, Agilent Atlas CCD and BRUKER PHOTON100 CMOS, on the same crystal of a relatively weakly scattering organic compound ($C_{15}H_{14}O_3$) to a maximum resolution of 0.96 $Å^{-1}$.

[1] Diffraction studies under in-situ electric field using a 2D hybrid pixel XPAD detector : P. Fertey, P. Allé, E. Wenger, B. Dinkespiler, S. Hustache, K. Medjoubi, F. Picca, C. Lecomte and C. Mazzoli, *Journal of Applied Crystallography*, **46**, 1151-1161, 2013.

[2] XPAD X-ray hybrid pixel detector for charge density quality diffracted intensities on a laboratory equipment : E. Wenger, S. Dahaoui, P. Allé, P. Parois, C. Palin, C. Lecomte and D. Schaniel, Acta Crystallographica B, 70, 5, 783-791, 2014.

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