The XPAD project.
The 3rd generation synchrotron sources have been a major progress in materials sciences. The hybrid pixel detectors have been developed to take a full profit of the intense monochromatic X-ray beam provided by these sources.

Following the previous XPAD detectors [9], the XPAD3 hybrid pixel detectors [2] has been designed with chips using the IBM 0.25 µm technology.

XPAD3 hybrid pixel detector applications.
J.-F. Bérar for the XPAD collaboration
D2AM/CRG-ESRF Inst. NEEL, CNRS

XPAD3 prototypes.
Single chip test detector using 500 µm thick Si sensors.

Module of 7 chips with Si sensors of 15 × 76 mm and 7 × 8 detector under assembly.

XPAD3S Si and CdTe hybrided : counting linearity

Intensities in adjacent pixel measured on D2AM beamline in 16 bunch modes : the beam size is bigger than the pixel size, the count in pixel is related to beam shape and not to cross-talk.

At 15keV, with Si diode the saturation reach 6 10⁵/s/pixel, the linearity being good up to 3 10⁵/s/pixel. At 24 keV, quite the same limits are obtained even if the charge amount increase the time constant.

XPAD3S spatial resolution using 500µm Si sensor.

Scan of a narrow (10µm) beam along detector pixels at 17keV. Even on a log scale the cross-talk vanish on less than one pixel.

The image let us measure about 40 times pair / cm using a non perfect instrumental settings (source size 0.3mm at 270mm and detector at ∼ 15 mm of test chart).

XPAD3S CDTe bounded : high energy becomes available

Such detector, limited by CdTe sensor size (2 XPAD3 chips), can be used at 40-60keV. The CdTe detector was designed to improve the efficiency at high energy and to allow 60 keV X-ray to be used, but slow detection systems are still used.

XPAD3S CdTe and CdTe hybrided : counting linearity

Intensities at adjacent pixel measured. The data have been carried out on small prototypes.

XPAD3 detector readout system

Pixel detector can be build using modularity, this allow to improve the readout system which consist in 3 major stages in case of XPAD3 detector.

XPAD3 detectors for Material Sciences Scattering

Intensity range in scattering experiments
1 → 10³
1 → 10⁷
1 → 10³
1 → 10²

Complex shape of the diffusion around Bragg peak obtained by adding numerous CCD frames.

Aim : characterises distortions in a few layers.

Surface diffraction results.

Surface diffraction experiment have strong experimental requirements : measuring the contribution of few atomic layers at surface of perfect crystal, this means a very weak signal near intensities more than 10³ stronger.

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XPAD Collaboration
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Weak diffusion between quasicalk crystal Bragg peak.

XPAD counts have their real statistical meaning, with Poissonian fluctuation of the intensity : count ≈ 1.435, σ ≈ 26. This allow physical interpretation of data.

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