

# XPAD detectors:

## from the laboratory to industrialization

Hybrid pixel detectors will mark the end of the CCD camera era in some experiments using synchrotron radiation. The XPAD technology, born of a collaboration which involved SOLEIL, is one example. Its development led in 2010 to the birth of ImXPAD, a Marseille startup dedicated to its commercialization.



“  
Our contribution  
was to optimize  
all the XPAD  
performances  
and parameters  
”

**Stéphanie Hustache,**  
Head of the Detector  
Group - Experimental  
division

### How did the XPAD project start?

To start with, hybrid pixel detectors were designed for particle physics. Then, groups who worked with these detectors saw that there was a real interest in using them around synchrotrons. Three competing detectors have thus emerged, which have been marketed. The Swiss synchrotron, Swiss light source (SLS) backed by the Paul Scherrer Institute, has developed a version called Pilatus. On the French side, scientists at the Centre de Physique des Particules de Marseille (CPPM), in collaboration with a beamline based at the Grenoble synchrotron (CRG-D2AM), have also developed this type of detector. At SOLEIL, we became involved at the beginning of the collaboration between Marseille and Grenoble to develop the next generation: the XPAD3.

### What advantages does the XPAD have over earlier detectors?

XPADs are hybrid pixel detectors. They measure the number of incident photons and their positions with specific new characteristics compared to detectors that were previously used in synchrotrons. Often, detectors based on CCD cameras are used. The accumulation of photons over a given period is measured, but they are not counted individually, whereas they are in these new detectors. They therefore have the advantage of reduced noise. In addition, it is possible to accumulate more photons without any notion of saturation, therefore gaining “dynamic range”. Finally, the reading speed is much greater than

in CCD cameras: a few frames per second at best for a CCD compared to hundreds or up to one thousand of frames per second for XPADs.

### What did SOLEIL contribute specifically to the design of these detectors?

The CPPM had the necessary expertise for the overall design of the microelectronics and sensor. At SOLEIL, our contribution was to optimize all the performances and all the parameters to create a detector useful for beamlines. Given their performance, we designed, with SOLEIL scientists, potential new experiments that would have been impossible with conventional detectors. Currently, we are working on improving still further the integration to the software framework of SOLEIL.

### The development is nearing completion. Will the collaboration continue?

Nothing has been formalized yet but we plan to continue. XPAD detectors presently use silicon sensors as the technology has been well tested, but detection efficiency is quickly lost from 15-20 keV onwards. In parallel to the conventional silicon XPAD detector, we have also worked on the use of more efficient sensors and during the XPAD collaboration. We obtained very good results with CdTe-type sensors (cadmium telluride). The prototypes are still only available in limited size, so it is hoped to renew our collaboration with Marseille to create CdTe detectors for larger surfaces.

→ **Contact :** [hustache@synchrotron-soleil.fr](mailto:hustache@synchrotron-soleil.fr)

## IN BRIEF

### SOLEIL AT THE CENTRE OF FRENCH NANOMETROLOGY

Created at the initiative of the “Laboratoire National de métrologie et d’Essais” (LNE) and the “Centres de Compétences en Nanosciences” (C’Nano) network and launched on the 6<sup>th</sup> October 2011 during the MesurExpoVision trade show, the Nanometrology Club now has over 110 French members, of whom 1/3 are industrialists and 2/3 research scientists. SOLEIL is a member of the limited first circle of club partners, which also includes the industrial group ARKEMA and the Essonne company 3S PHOTONICS.

### SOLEIL PRESENT FOR THE SECOND CONSECUTIVE YEAR AT THE “RENDEZ-VOUS CARNOT” IN LYON

In the context of the 4<sup>th</sup> edition of this R&D rendez-vous for companies, aimed specifically at industrialists looking for scientific and technological know-how adapted to their innovation projects, SOLEIL was present on the 12<sup>th</sup> and 13<sup>th</sup> October 2011 among the 800 professional exhibitors of research partnerships and will participate in business meetings.