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The PixFEL project: progress towards a fine pitch X-ray imaging camera for next generation FEL facilities

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The PixFEL project, funded by INFN, is developing the fundamental building blocks for a large area X-ray imaging camera to be deployed at next generation free electron laser (FEL) facilities with unprecedented intensity.

Improvement in performance beyond the state of art in imaging instrumentation will be explored adopting advanced technologies like active edge sensors, a 65 nm node CMOS process and vertical integration. These are the key ingredients of the PixFEL project to realize a seamless large area focal plane instrument composed by a matrix of multilayer four-side buttable tiles.

In order to minimize the dead area and reduce ambiguities in image reconstruction, a fine pitch active edge thick sensor is being optimized to cope with very high intensity photon flux, up to 10^4 photons per pixel, in the range from 1 to 10 keV. A low noise analog front-end channel with this wide dynamic range and a novel dynamic compression feature, together with a low power 10 bit analog to digital conversion up to 5 MHz, has been realized in a 110 μm pitch with a 65 nm CMOS process. Vertical interconnection of two CMOS tiers will be also explored in the future to build a four-side buttable readout chip with high density memories.

The long term goal of the PixFEL collaboration will be the development of a versatile X-ray camera to be operated either in burst mode, typical of the European X-FEL, or in continuous mode to cope with the high repetition rates of future FEL facilities.

Collaboration

On behalf of the PixFEL Collaboration. The PixFEL project is funded by INFN. The members of the PixFEL Collaboration are affiliated with Università di Bergamo, Università di Pavia, Università di Pisa, Università di Trento and INFN, Italy.

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