

X-ray imaging camera using INTPIX4NA SOIPIX detector with SiTCP-XG 10GbE based high-speed readout system

The SOIPIX (Silicon-On-Insulator PIXel) detector is a unique monolithic structure imaging device which is under development by the SOIPIX group led by High Energy Accelerator Research Organization (KEK).

We, the detector team in KEK Photon Factory (PF), are developing an X-ray camera using INTPIX4NA [1]. This detector has a $14.1 \times 8.7 \text{ mm}^2$ sensitive area, 425,984 (832 column x 512 row matrix) pixels and the pixel size is $17 \times 17 \text{ um}^2$.

And this detector has high resolution and sensitivity for low intensity X-rays.

The characteristics of this detector is suitable for imaging in optical systems with lower X-ray intensity, such as an X-ray zooming microscope using two Fresnel zone plates (FZP), which is also under development at PF [2].

To enable imaging under such conditions, we have developed a detector cooling system using a Peltier element to support longer exposure time (~0.5 sec per frame).

We have also developed new readout system using a newly developed DAQ boards, also developed by PF, equipped with SiTCP-XG (network controller implemented on FPGA) that supports 10 Gbps Ethernet to enable high frame rate imaging at several hundred hertz.

Our new X-ray camera was tested at the PF BL-14A, BL-14B and AR-NE1A experimental station, and the expected resolution and sensitivity characteristics were confirmed.

Reference

[1] R. Nishimura, S. Kishimoto, T. Sasaki, S. Mitsui, M. Shinya, Y. Arai and T. Miyoshi, "INTPIX4NA" —new integration-type silicon-on-insulator pixel detector for imaging application, JINST, 16, P08054, (2021).

[2] D. Wakabayashi, Y. Suzuki, Y. Shibasaki, H. Sugiyama, K. Hirano, R. Nishimura, K. Hyodo, N. Igarashi and N. Funamori, X-ray zooming microscopy with two Fresnel zone plates, Rev Sci Instrum, 93, 033701, (2022).

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Author: Dr NISHIMURA, Ryutaro

Co-authors: Dr WAKABAYASHI, Daisuke (KEK); Dr HIRANO, Keiichi (KEK); Prof. IGARASHI, Noriyuki (KEK); Prof. ARAI, Yasuo (High Energy Accelerator Research Organization (JP)); Dr SUZUKI, Yoshio (KEK); Dr SHIBAZAKI, Yuki (KEK)

Presenter: Dr NISHIMURA, Ryutaro

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