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Development of 5.04 Mpixel CITIUS detector for high-resolution ptychography

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We have developed and deployed CITIUS detectors for the XFEL facility SACLA and the synchrotron radiation facility SPring-8. At SACLA, we are building a 20.2 Mpixel detector system that can run at a maximum frame rate of 5 kHz. The CITIUS detectors for synchrotron radiation applications were demonstrated to operate at the maximum frame rate of 26.1 kHz at the full-image readout condition and have a detection capability of 1 Gphoton/s/pixel at 10 keV while keeping the single photon sensitivity. These high performances are achieved by the new integration-type pixels without charge amplifiers; it eliminates the major analog power dissipation source, thus enabling camera heads to be compact even at the high frame rate operation. Feasibility demonstration to coherent diffraction experiments was reported previously for Bragg CDI at ESRF [1] and ptychography at SPring-8 [2] with 280k and 840k pixels, respectively, and reviewed in a commentary [3]. In this talk, we report the development status of a new 5.04 Mpixel CITIUS detector for high-resolution ptychography. The system will have a clock trigger distributor to suppress any false beat signal arising from the frame rate comparable to the revolving frequency [3]. The stream data rate from the sensors reaches 30.6 petabytes/day. We report our development on the data acquisition system with FPGA cards in the edge servers and the SPring-8 data center for on-the-fly data reduction. We also briefly address the development status of a high-speed analog digitizer, which synchronously operates with CITIUS, for recording incident X-ray intensities/positions and stage positions.

References

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