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Applications of soft X-ray Synchrotron camera based on Back Side Illuminated CMOS sensor

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In recent years, an effort has been done by major sensor compagnies to increase the performances of 2D CMOS sensors. Principally, the development of thin Back Side Illuminated CMOS sensors (CMOS-BSI) has achieved a high detection efficiency in visible and relatively good in UV, a high frame rate and a good signal to noise ratio. One example of this development is the performant and cost efficient GSENSE400BSI sensor, from GPIXEL (https://www.gpixel.com). This sensor has been integrated at SOLEIL synchrotron in a vacuum compatible camera and its good characteristics have been demonstrated [1] in soft X-ray domain. This sensor is based on 2048 by 2048 pixels matrix of 11 µm pitch. Two gains per pixel allow achieving a dynamic up to 92 dB with a low readout noise (< 2 e- rms) and a relatively large charge capacity (80 ke-). The acquisition speed can reach 48 Hz, however, it has limited in this version of the camera at 24 Hz.

Currently, three detectors are in operation at beamlines at the SOLEIL synchrotron. The main contribution of this work is to recall the measured characteristics of the sensor in the soft X-ray range (30 eV to 2000 eV) and to present the first user applications in different domains: (i) a soft X-Ray Ptychography [2] above the Carbon K-edge (at 280-300 eV) at HERMES beamline (ii) diffraction and spectroscopy applications in the tender X-ray domain with camera installed on FORTE (multipurpose high-vacuum diffractometer) experimental station at SIRIUS beamline and (iii) X-ray Fourier Transform Holography (FTH) experiments on COMET II instrument at SEXTANT beamline [3] and also (iv) time resolved X-ray scattering [4] performed with XUV FEL beam at FERMI.

[1] Desjardins, K. et al. Journal of Synchrotron Radiation, 27(6), pp.1577-1589 (2020)
[2] Mille, N. et al., Communications Materials, 3(1), 1-8 (2022)
[3] Popescu et al., SRI 2022 proceeding (submitted). (2022)
[4] Léveillé C.. et al. J. Synchrotron Rad. (2022). 29, 103-110

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