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P1.33: Development of a medium sized photon-counting UFXC-demonstrator at SOLEIL synchrotron

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A medium sized hybrid photon-counting detector for hard X-ray diffraction experiments is under development at the SOLEIL synchrotron. This demonstrator is based on the small two-chips camera prototype described in [1] with the pixelated UFXC32k readout chip [2], which has proven its performance in several experiments at the beamlines of SOLEIL, e.g., time resolved pump-probe measurements [3].

Thanks to a four times larger sensor size, the new demonstrator overcomes the main limitation of reduced sensitive area of the two-chip camera. Furthermore, the new firmware and data acquisition system enable an increased frame rate from 3.4 kHz up to 23 kHz with several acquisition modes while the mechanical design of the system stays very compact.

The demonstrator (illustrated on Figure 1-left) comprises one single pixelated Silicon sensor of $4 \times 4 \text{ cm}^2$ (two thicknesses are available), bump-bonded to eight UFXC32k readout chips. The hybrid pixel module is wire bonded to a ceramic electronic board, which is mounted on a water-cooled support frame. The head of the detector is then connected to the control- and data acquisition board which streams out the data via four 10Gb UDP connections. The optimized firmware with several readout modes as well as a software library and integration into the TANGO environment are also part of the development.

This contribution presents the main characteristics of the demonstrator, the validation tests of the first hybrid pixel modules (e.g. gain behaviour, Figure 1-right) and current state of the demonstrator under development.

[1] A. Dawiec et al., AIP Conf. Proc. 2054, 060067, (2019)

[2] P. Grybos et al., IEEE Trans. Nucl. Sci. 63 1155, (2016)

[3] D. Bachiller-Perea et al., J. Synchrotron Rad. 27, (2020)

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