MS16-2-2 Dynamic XRD measurements with new features of the EIGER2 detector
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Abstract
Over the last two decades, the dynamic nature of synchrotron experiments was manifested in three ways: (i) increasing the temporal resolution of classical PXRD experiments without compromising data quality, (ii) further development of scanning techniques, such as ptychography, coherent diffractive imaging, and XRD computed tomography, and (iii) performing time-resolved scanning techniques. Such dynamic measurements typically require a large amount of data to be collected in a short time. Consequently, the ideal experimental setup would include a detector with a very large sensor area, high frame rate, negligible readout time, high efficiency and the ability to discern very weak and very strong signals. Over the last several years, EIGER2 detectors were extensively used for such dynamic measurements. However, the large sensor area and high frame rates were sometimes mutually exclusive. In 2022, the new features of EIGER2 detectors allowed for an even more flexible optimization between detector area and speed, and with this enabled new, interesting dynamic experiments.
The first part of this work will address the newly released features that enable faster and cleaner data collection: 8-bit readout mode, lines ROI region-of-interest mode, and double-gating mode. In the second part, we will demonstrate how these features were put to use for various X-ray applications: fast scanning modes for high-resolution PXRD studies [1], increased scan speed for low-dose ptychography [2], sub-millisecond time-resolved PXRD [3], suppression of higher harmonics and cosmics, and shot-to-shot background correction in pump-probe-type experiments. The highlighted experiments cover proof-of principle and scientific studies, and they are carried out as collaborative projects at several synchrotron sources: ESRF (Grenoble, France), BSRF (Bejing, China), Elettra (Trieste, Italy) and the Australian synchrotron (Melbourne, Australia).

References
[1] Fitch, A., Dejoie, C. (2021) J. Appl. Cryst. 54, 1088-1099.
[2] Jones, M.W.M. et al. (2021) J. Syn. Rad. 29(2).
[3] Zhang, D. et al. (2022) Rev. Sci. Instrum. 93, 033902