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Test with Synchrotron Light of ASCANIO: an Innovative Backscattering Geometry Spectrometer

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Abstract

We present the results of the development of ASCANIO: an innovative X-ray spectrometer based on backscattering technology. This project, supported by DESY, aims to improve the current performances in X-Ray Fluorescence Microscopy (XFM) by maximizing photon detection throughput. The instrument uses 1mm thick Silicon Drift Detectors (SDDs) modules to improve adsorption efficiency to 65% at 20 keV and implements an optimized backscattering geometry that provides 1 sr at 8 mm distance from the sample. Furthermore it provides a uniform exposition of the sensing elements thanks to an innovative tilted SDD disposition, reaching up to 20 MCPS aggregate output count rate. The testing phase indicates Mn-Kalpha FWHM around 136eV at 1us peaking times and around 186 eV at 32 ns peaking time, indicating good performances in high count rate use cases. Commissioning of the instrument in PETRA P06 beamline is planned for May 2025, there we can observe the capabilities of the optimized geometry and measure known samples to assess the performance of the system, that will be reported in the conference.

References

[1] C. Rumancev, A. Gräfenstein, T. Vöpel, S. Stuhr, A. R. von Gundlach, T. Senkbeil, J. Garrevoet, L. Jolmes, B. König, G. Falkenberg,S. Ebbinghaus, W. H. Schroeder, and A. Rosenhahn, “X-ray fluorescence analysis of metal distributions in cryogenic biological samples using large-acceptance-angle SDD detection and continuous scanning at the hard x-ray Micro/Nano-Probe beamline P06 at PETRA III,” Journal of Synchrotron Radiation, vol. 27, no. Pt 1, pp. 60–66, Jan. 2020.

[2] D. P. Siddons, R. Kirkham, C. G. Ryan, G. De Geronimo, A. Dragone, A. J. Kuczewski, Z. Y. Li, G. A. Carini, D. Pinelli, R. Beuttenmuller, D. Elliott, M. Pfeffer, T. A. Tyson, G. F. Moorhead, and P. A. Dunn, “Maia x-ray microprobe detector array system,” Journal of Physics: Conference Series, vol. 499, no. 1, p. 012001, apr 2014. [Online]. Available: https://dx.doi.org/10.1088/1742-6596/499/1/012001

[3] G. Ticchi, M. Venturelli, G. Utica, M. Carminati, G. Borghi, N. Zorzi, G. Falkenberg, and C. Fiorini, “Optimization of solid angle and count rate capability of an x-ray detector with backscattering geometry,” Journal of Physics: Conference Series, vol. 2380, no. 1, p. 012099, dec 2022. [Online]. Available: https://dx.doi.org/10.1088/1742-6596/2380/1/01299

[4] F. Iguaz, L. Bombelli, S. Meo, F. Orsini, S. Schöder, A. Tocchio, N. Trcera, and D. Vantelon, “Dante digital pulse processor for xrf and xas experiments,” Journal of Instrumentation, vol. 18, no. 06, p. T06011, jun 2023. [Online]. Available: https://dx.doi.org/10.1088/17480221/18/06/T06011