Contribution ID: **1033** Type: **Invited talk**

The Angular-Resolved Schottky CdTe (ARC) pixel detector for the I15-1 XPDF beamline at Diamond

Thursday 29 August 2024 16:35 (20 minutes)

on behalf of the WP2 LEAPS-INNOV consortium

X-ray Absorption Fine Structure spectroscopy (XAFS) is crucial to investigate the electronic and atomic structure of different kinds of samples [1]. The efficacy of this technique, widely deployed at synchrotron facilities, is constrained by the performance limitations of the current generation of Ge detectors. To perform XAFS measurements, energy-resolving detectors capable of handling high count rates are essential [2]. While efforts have been focused on developing arrays of Silicon Drift Detectors (SDDs), less attention has been given to enhancing the performance of High Purity Germanium (HPGe) detectors for synchrotron applications. HPGe detectors offer better detection efficiency at high energies compared to SDDs.
To address this, a detector consortium under the European project LEAPS-INNOV [3] launched an ambitious R&D program aimed at developing a new generation of multi-element monolithic HPGe detectors specifically tailored for X-ray detection [4]. Two detector prototypes are currently under development and are anticipated to undergo characterization in the second half 2024. Simulations of the detector prototypes have been conducted to optimize the detector performance. Each prototype is equipped with a 10-element monolithic HPGe sensor, one with a 5 mm2 area pixels and another with 20 mm2 area pixels. Additionally, a novel electronic chain has been engineered, allowing crosstalk and charge-sharing correction, and enabling the processing of higher count rates ranging from 20 kcps/mm2 up to 250 kcps/mm2, while preserving reasonable energy resolution and minimizing dead time within the required energy range.
This work presents a comprehensive overview of the detector prototypes, encompassing mechanical design details, HPGe sensor specifications, electronic configurations, and their individual performance. Furthermore, results from simulations aimed at optimizing the detector's functionality are presented and analysed.

Acknowledgement
This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No.101004728.

References
[1] G. Bunker, "Introduction to XAFS: A Practical Guide to X-Ray Absorption Fine Structure Spectroscopy". Cambridge, U.K., Cambridge Univ. Press, 2010.
[2] N. Tartoni, et al., "Hexagonal Pad Multichannel Ge X-Ray Spectroscopy Detector Demonstrator: Comprehensive Characterization,"in IEEE Transactions on Nuclear Science, vol. 67, no. 8, pp. 1952-1961, Aug. 2020.
[3] LEAPS pilot to foster open innovation for accelerator-based light sources in Europe, European Union's Horizon 2020, Grant Agreement No. 101004728.
[4] F. Orsini, et al., "XAFS-DET: a new high throughout X-ray spectroscopy detector system developed for synchrotron applications", Nucl. Instrum. Meth. A, Volume 1045, 2023, 167600, https://doi.org/10.1016/j.nima.2022.167600.

I plan to submit also conference proceedings

Yes

Primary author: GIMENEZ-NAVARRO, Eva (Diamond Light Source)

Presenter: GIMENEZ-NAVARRO, Eva (Diamond Light Source)

Session Classification: Mikrosymposium 4/2: New Detector Developments

Track Classification: 4. New detector developments