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Progress in the Development of Multi-Element Monolithic Germanium Detectors in LEAPS-INNOV Project: Insights from Detector Performance Simulation

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The **XAFS-DET** (Work Package 2) of the European **LEAPS-INNOV project** has undertaken an ambitious research and development program for a new generation of multi-element monolithic germanium detectors best suited for synchrotron applications XAFS-DET: A new high throughout X-ray spectroscopy detector system developed for synchrotron applications. The detector has a new age sensor design for charge-sharing event rejection, an optimized mechanic design based on thermal simulations, and a new full electronics. In this regard, we have conducted simulations of the detector response by integrating the versatile *Geant4* toolkit and *Solid State Detector (SSD)* packages Simulation of semiconductor detectors in 3D with SolidStateDetectors.jl. With this code, we can estimate the induced waveforms in adjacent pixels based on event positioning, aiming to reject the multi-site and pile-up events using a Digital Pulse Processor (DPP) DANTE Digital Pulse Processor for XRF and XAS experiments, for an active refinement of the detector performance Development of multi-element monolithic germanium detectors for X-ray detection at synchrotron facilities.

Our findings shed light on the performance characteristics of Germanium detector prototypes using a known soil sample in environmental science (EnviroMAT), which allowed us to build a background model and to predict the expected signal at a given Photon flux. The simulation chain was calibrated by experimental data taken with a commercial high-purity germanium (HPGe) detector in the SAMBA beamline of Synchrotron SOLEIL and is illustrated in Fig 1

Fig 1: Full simulation chain: (i) Geometry of big pixel configuration of Ge detector produced using SSD simulation packages; (ii) simulated waveform for an event collected in a single contact using the hit information from Geant4 ; (iii) Comparison of simulations with the data acquired with commercial HPGe detector using EnviroMAT soil sample.

I plan to submit also conference proceedings

Yes

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