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Status update of Allpix Squared simulations for Multi-element Germanium Detectors for Synchrotron Applications

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Synchrotron experiments using X-ray fluorescence (XRF) techniques are currently limited by the sensitivity of fluorescence detectors, where the maximum counting rate, the energy resolution and the signal-to-background ratio are key performance features. The two last features are highly affected by charge sharing events, i.e., events where photon energy is shared between pixels. This undesirable effect is avoided in current commercial detectors using a collimator in front of the detector sensor, at a cost of a significant reduction of the detector active area, which is undesirable in detectors where smaller pixels will be required. The impact of charge sharing in detector sensitivity is being studied in the conception of a new generation of multi-element germanium detectors, developed by the LEAPS-INNOV project, using Allpix Squared framework.

This talk presents a fully operational simulation based on Allpix Squared framework, developed by the Detector group of Synchrotron SOLEIL, customized to multi-element germanium detectors, and combined with three-dimensional simulation of the electric field and the weighting potential, based on COMSOL Multiphysics®. Ongoing changes in the simulation chain will be also presented: 1) the implementation of beamline environment and detector components in GDML format, 2) non-standard pixel shapes (hexagonal and trapezoidal) at the germanium sensor and 3) the use of electrostatic simulations generated by Solid State Detectors code. A first estimation of detector sensitivity in XRF experiments will be also presented.

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