Contribution ID: **132** Type: **Oral Presentations**

Simulating monolithic active pixel sensors: A technology-independent approach using generic doping profiles

Thursday, 7 September 2023 11:20 (20 minutes)

The optimisation of the charge collection behaviour in the sensitive region of CMOS sensors with nonlinear electric fields requires precise simulations, and this can be achieved by a combination of finite-element electrostatic field simulations and Monte Carlo methods. Monolithic active pixel sensors (MAPS) produced using commercial CMOS imaging processes are attractive in a particle physics context, as they allow for a reduced material budget and reduction of production complexity and cost compared to hybrid sensors. The use of commercial processes enables relatively cheap large-scale production of sensors, but it also means that precise information of the doping concentrations and manufacturing process may not be publicly available. Exact predictions of sensor behaviour are thus difficult to make, as the detailed electric field configuration in the sensitive material is highly dependent on the extent and concentration of different doping regions in the silicon.

This talk aims to demonstrate that by making basic assumptions and performing simulations based on the fundamental principles of silicon detectors and using generic doping profiles, performance parameters of MAPS can be inferred and compared for different sensor geometries. A procedure for this will be described in detail, along with example results. The described procedure utilises Sentaurus TCAD and Allpix Squared, and serves as a toolbox for performing sensor response simulations without detailed knowledge of the sensor doping concentrations and manufacturing process.

Primary authors: SIMANCAS, Adriana (DESY); Dr VELYKA, Anastasiia (Deutsches Elektronen-Synchrotron (DESY)); RASTORGUEV, Daniil; DANNHEIM, Dominik; ECKSTEIN, Doris; FEINDT, Finn (DESY); VIGNOLA, Gianpiero (DESY); WENNLÖF, Håkan (DESY); GREGOR, Ingrid-Maria; DORT, Katharina (CERN); MENDES, Larissa (DESY); HUTH, Lennart (DESY); DEL RIO VIERA, Manuel Alejandro (Deutsches Elektronen-Synchrotron (DESY)); STANITZKI, Marcel (DESY); SCHÜTZE, Paul (DESY); RUIZ DAZA, Sara (DESY); Dr SPANNAGEL, Simon (Deutsches Elektronen-Synchrotron (DESY)); LACHNIT, Stephan (DESY); SNOEYS, Walter (CERN)

Presenter: WENNLÖF, Håkan (DESY)

Session Classification: F5