



Contribution ID: 13

Type: ORAL

## Enhanced Lateral Drift Sensors: charge sharing and resolution studies

*Thursday, 13 December 2018 14:35 (25 minutes)*

Future experiments in particle physics foresee few-micrometer single-point position resolution in their vertex detectors, motivated by e.g. b- and light-quark-tagging capabilities. Silicon is today's material of choice for high-precision detectors and offers a high grade of engineering possibilities. Instead of scaling down pitch sizes, which comes at a high price for an increased number of channels, our new sensor concept seeks to improve the position resolution by increasing the lateral size of the charge distribution already during the drift in the sensor material. To this end, it is necessary to carefully engineer the electric field in the bulk of this so-called enhanced lateral drift (ELAD) sensor. This is achieved by implants deep inside the bulk which influence the charge carriers' drift paths.

In order to find an optimal sensor design, detailed simulation studies were conducted using SYNOPSIS TCAD. The geometry of the implants, their doping concentration and the position inside the sensor were optimised. The electric field simulation shows that the deep p- and n- implants create repulsive and attractive areas inside the bulk of the sensor. Transient simulations with a traversing particle were used to optimise the charge carriers drift path inside the sensor. Finally, to estimate the position resolution of an ELAD sensor, test beam simulations using the AllPix2 software have been performed using the realistic electric field profile from the TCAD simulations.

Results of the geometry optimisation are shown realising an optimal charge sharing and hence position resolution. A position resolution of a few micrometers is expected by using deep implants without relying on a Lorentz drift or tilted incident angle. A description of the multi-layer production process is presented, which represents a new production technique allowing for deep bulk engineering. Finally, an estimate of the position resolution of ELAD sensors is presented based on the simulations with AllPix2.

**Primary authors:** VELYKA, Anastasiia (DESY); JANSEN, Hendrik (Deutsches Elektronen-Synchrotron (DE))

**Presenter:** VELYKA, Anastasiia (DESY)

**Session Classification:** Pixel sensor

**Track Classification:** Pixel sensor technology