Contribution ID: **299** Type: **Poster**

Recent results and perspectives of the Monopix Depleted Monolithic Active Pixel Sensors (DMAPS)

Tuesday, 28 May 2024 15:51 (1 minute)

The integration of readout electronics and sensor into a single entity of silicon in monolithic pixel detectors lowers the material budget while simplifying the production procedure compared to the conventional hybrid pixel detector concept. The increasing availability of high-resistivity substrates and high-voltage capabilities in commercial CMOS processes facilitate the application of depleted monolithic active pixel sensors (DMAPS) in modern particle physics experiments. TJ-Monopix2 and LF-Monopix2 chips are the most recent large-scale prototype DMAPS in their respective development line originally designed for the ATLAS Inner Tracker outer layer environment.

LF-Monopix2 is a 1x2 cm² chip with a 50 x 150 um² pixel pitch design in 150 nm LFoundry technology. All in-pixel electronics are embedded in a large charge collection electrode relative to the pixel size, rendering short drift distances and a homogeneous electric field across a pixel. The resulting sensor capacitance of O(250fF) originating from the collection node compromises the noise performance requiring more analog power for optimal operation. LF-Monopix2 wafers have successfully been thinned-down to 100 um and backside processed.

Designed in 180 nm Tower Semiconductor technology, TJ-Monopix2 features a 33x33 um² pixel pitch on a 2x2 cm² chip. The small charge collection electrode relative to the pixel size requires the separation of the in-pixel electronics into p-wells. The resulting small detector capacitance of O(3fF) allows for large signal-to-noise ratio with low power consumption. Additionally, process modifications are implemented to minimize regions with low electric field and improve the charge collection efficiency impaired by the long drift distances.

In this contribution, the latest laboratory characterizations and beam test results of both DMAPS are presented. Timing studies of TJ-Monopix2 as well as performance of highly irradiated LF-Monopix2 chips after a fluence of up to 2e15 neq/cm² are highlighted. Furthermore, potential future applications of these sensors in particle physics experiments are discussed.

Collaboration

Role of Submitter

I am the presenter

Primary authors: Mr BESPIN, Christian (University of Bonn); HUEGGING, Fabian (University of Bonn); Prof. DINGFELDER, Jochen (University of Bonn); SCHALL, Lars

Co-authors: Dr KRÜGER, Hans (University of Bonn); Mr CAICEDO, Ivan (University of Bonn); Prof. WERMES, Norbert (University of Bonn)

Presenter: HUEGGING, Fabian (University of Bonn)

Session Classification: Solid State Detectors - Poster session

Track Classification: T3 - Solid State Detectors