13th International ”Hiroshima” Symposium on the Development and Application of Semiconductor Tracking Detectors (HSTD13), Vancouver, Canada

Contribution ID: **83** Type: **Oral**

Beam test studies of depleted monolithic active pixel sensors (DMAPS) in 150 nm and 180 nm CMOS technology

Friday 8 December 2023 09:00 (20 minutes)

Monolithic active pixel sensors featuring depleted substrates (DMAPS) present a promising alternative for pixel tracker detectors operating in high-radiation and high-rate environments. The utilization of higly resistiv silicon substrates and high-voltage capabilities within commercial CMOS technologies holds the potential to significantly enhance radiation tolerance with respect to MAPS. TJ-Monopix2 and LF-Monopix2 chips are the most recent large-scale prototype chips in their respective development lines with a column-drain readout architecture.

Designed in 150 nm LFoundry technology, LF-Monopix2 uses a large charge collection electrode with pixel electronics embedded in it. Benefits of this design are short drift paths and a homogeneous electric field across the sensor that increase the radiation tolerance. Optimization of the pixel layout minimizes potential coupling from the digital circuitry into the sensor node while reducing the pixel size to 50 x 150 um² compared to its predecessor.

TJ-Monopix2 is designed in 180 nm Tower Semiconductor technology. Featuring a small charge collection electrode design with separate readout electronics, the pixel pitch of this sensor could be reduced to 33 x 33 um². A small detector capacitance allows for a large signal-to-noise ratio while an additional n-type layer across the pixel ensures full depletion of the sensitive volume.

In this talk, the latest test beam results of both DMAPS are presented. Timing studies and charge collection measurements of TJ-Monopix2 are highlighted. Performance of irradiated LF-Monopix2 chips after a fluence of up to 2e15 neq/cm² is shown.

Submission declaration

Original and unplublished

Primary author: SCHALL, Lars Philip (University of Bonn)

Co-authors: BESPIN, Christian (University of Bonn (DE)); HUEGGING, Fabian; KRUEGER, Hans (University of Bonn); PERNEGGER, Heinz (CERN); CAICEDO SIERRA, Ivan Dario (University of Bonn (DE)); DINGFELDER, Jochen Christian (University of Bonn (DE)); MOUSTAKAS, Konstantinos; BARBERO, Marlon B. (CPPM, Aix-Marseille Université, CNRS/IN2P3 (FR)); WERMES, Norbert (University of Bonn (DE)); BREUGNON, Patrick (Centre National de la Recherche Scientifique (FR)); Mr PANGAUD, Patrick (CPPM, Aix Marseille Université, CNRS/IN2P3, Marseille, France); RIEDLER, Petra (CERN); Prof. SCHWEMLING, Philippe (Université Paris-Saclay (FR)); BARRILLON, Pierre (Aix Marseille Univ, CNRS/IN2P3, CPPM, Marseille, France); RYMASZEWSKI, Piotr (University of Bonn (DE)); ZHANG, Sinuo (University of Bonn (DE)); WANG, Tianyang; HIRONO, Toko (KIT - Karlsruhe Institute of Technology (DE)); HEMPEREK, Tomasz (University of Bonn (DE)); SNOEYS, Walter (CERN); DEGERLI, Yavuz (CEA - Centre d'Etudes de Saclay (FR))

Presenter: SCHALL, Lars Philip (University of Bonn)

Session Classification: Day 5 - Session 1

Track Classification: Pixel sensors for tracking