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Results and perspectives of the Monopix2 depleted monolithic active pixel sensors

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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 compliance with the ATLAS Inner Tracker outer layer requirements.

LF-Monopix2 is a 1x2 cm² chip with a 50 x 150 um² pixel pitch designed in 150 nm LFoundry technology. All in-pixel electronics are embedded in a large charge collection electrode relative to the pixel size, rendering a homogeneous electric field and short drift distances 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.

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) facilitates 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.

This contribution provides an overview of laboratory characterizations and beam test results of both DMAPS. Furthermore, potential future applications of these sensors in particle physics experiments are discussed.

Type of presentation (in-person/online)

online presentation (zoom)

Type of presentation (scientific results or project proposal)

Presentation on scientific results

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