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First results on monolithic sensors with additional gain produced with a 110 nm technology for the ALICE 3 Time of Flight detector

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One of the main challenges of the near-future high-energy physics experiments will be the dramatic increase of the spatial density of particle collisions and the need to carry also precise timing information with silicon detectors to perform an accurate reconstruction of tracks. To cope with such requirements one of the recent developments exploits the integration of the Low Gain Avalanche Diode technology (LGAD) in the design of fully depleted Monolithic Active Pixel Sensors (MAPS). One of the possible applications of this innovative sensor is the Time-Of-Flight (TOF) system for a next-generation heavy-ion experiment, named ALICE 3 at the LHC. The ALICE 3 TOF requires a timing resolution of 20 ps. Currently, the time resolution of CMOS sensors needs to be pushed significantly beyond the present state-of-art, and to achieve the desired value, a vigorous R&D is necessary.

This presentation will focus on the study of the first production of a Monolithic sensor with additional gain produced with a commercial 110 nm technology. The presentation will be divided into two macro sections: the first part will be devoted to results achieved with sensor simulation performed to design the sensor and define its characteristics. In the second part, the experimental results obtained with the laboratory tests of the first prototypes to study the static and dynamic performance of the monolithic sensor will be reported. To conclude the sensor characterization performed in a test beam at the CERN Proton Synchrotron in October 2023 will be described in detail. The description of the aforementioned studies will be followed by an overview of the next steps of the R&D.

Collaboration

ALICE Collaboration

Role of Submitter

I am the presenter

Primary author: GIOACHIN, Giulia (Politecnico di Torino)

Presenter: GIOACHIN, Giulia (Politecnico di Torino)

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