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Characterization of analogue monolithic pixel sensors fabricated in 65 nm technology for the ALICE ITS3

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CMOS Monolithic Active Pixel Sensors (MAPS) have become a prominent technology choice for tracking and vertexing detectors in high-energy physics
experiments over the last decades. The ALICE ITS3 project foresees the use of ultra-light MAPS, developed in the 65 nm imaging process, for the vertex
detector in the ALICE experiment at the LHC to improve the vertexing performance drastically. This new process, developed by an international consortium
of the ALICE ITS3 collaboration and the CERN EP R&D project, should enhance the overall MAPS performance, such as spatial & timing resolution, hit
rate capability, power dissipation, radiation hardness, and large sensitive area capability.
This contribution discusses the Analogue Pixel Test Structure (APTS), a small 6x6 pixel matrix with a fast direct analogue readout of the central 4x4
pixels, and the Circuit Exploratoire 65 (CE-65), featuring a 1k to 2k pixel matrix with a rolling shutter analogue readout. These prototypes are used to
understand the analogue properties of the TPSCo 65 nm technology and to compare the charge collection performance in different processes, pitches, pixel
geometries, and collection diode arrangements. This contribution presents recent results from lab and test beam characterisation, detailing the global and in-pixel efficiency and the spatial resolution of the APTS with different pixel geometries and pitches. A quantitative evolution
of the charge collection and sharing among pixels in the CE-65 with the pitch and collection layer modification will be detailed. Attaining a spatial resolution
better than 3 µm with a 10 µm pitch and over 99% efficiency in the moderate irradiation environment of ALICE supports the viability of using 65 nm MAPS
for FCC-ee vertex detectors. This contribution will discuss the shared requirements that pave the way to implementing MAPS for the vertex detector for
FCC-ee, exploiting the synergy between the ALICE ITS3 project and FCC-ee.

Collaboration

ALICE-ITS3 and CERN-EP R&D WP1.2

Role of Submitter

I am the presenter

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