

A versatile pixel matrix in TPSCo 65 nm for future trackers

Monday 17 June 2024 15:20 (20 minutes)

This project addresses the development in the TPSCo 65 nm CMOS process of prototype monolithic active pixel sensors matching the needs of the next generation of trackers in high energy physics.

The guiding principle is to establish a versatile pixel matrix design suited for various trackers with possibly diverse hit-rate (1 to 100 MHz/cm²), time resolution (1 to 100 ns), radiation tolerance (10¹¹ to 10¹⁵ 1 MeV n_{eq}/cm²) and power constraints (20 to 100 mW/cm²) but similar pixel pitch (below 50 μm) requirement and read-out architecture. The adaptation to a given set of constraints is expected to be reached without any redesign but using the following possibilities: modifying the process (which requires splitting wafers during fabrication), tuning pixel front-end parameters, changing clock frequency of some specific functionalities and switching on/off some digital features.

Though the project does not plan to produce a reticule-size sensor dedicated to a specific experiment, the sensors developed in this project should offer sufficient sensitive area and testability to validate the concept. The prototype sensor periphery should contain the functional blocks allowing to test the matrix performances under all required conditions. The digital logic at matrix periphery for a given application should then either be re-designed quickly from these initial blocks or, in the ideal case, simply be reprogrammed.

The ambition of this project is such that a relatively large consortium of groups is needed to complete all design and test activities within a limited number of years (typically 2024 to 2027). The versatile aspect of the pixel matrix is thought to trigger interest in various scientific communities, listed here in alphabetical order: ALICE3, BelleII, EIC, FCCee, LHCb.

In addition, synergies can be identified with a project targeting excellent position resolution (3μm or below) for future vertex detectors and planning to use the same TPSCo 65 nm technology.

The presentation will expose the motivations, concepts and a preliminary work programme for the project.

Type of presentation (in-person/online)

in-person presentation

Type of presentation (scientific results or project proposal)

project proposal for future work

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Session Classification: WG/WP1 - CMOS technologies