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Simulation and Test Beam Measurements in MAPS in a 65 nm CMOS Imaging Technology

The TANGERINE group is advancing Monolithic Active Pixel Sensors (MAPS) based on 65 nm CMOS technology for future lepton colliders and beam telescopes. This work provides a comprehensive overview of the research and development of these sensors, covering the design, simulation, and testing phases. It includes the characterization of chip prototypes such as DESY CHIP V2 (also known as DESY ER1) and sensor behavior simulations using a genetic algorithm approach.

Preliminary characterization results from laboratory measurements and test beam campaigns of the four-pixel analog test structure of DESY CHIP V2 are presented. Key performance metrics, including efficiency, are discussed, along with initial findings on in-pixel rise-time variation.

On the simulation side, this study examines both conventional square/rectangular pixel layouts and hexagonal pixel arrangements. The simulation strategy integrates Monte Carlo methods with electrostatic field simulations using Technology Computer-Aided Design (TCAD). A comparative analysis of efficiency, cluster size, and spatial resolution was performed to assess the potential advantages of hexagonal pixels over traditional layouts.

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