

[C01] A 55 nm HV-CMOS Pixel Sensor Design for High-Energy Particle Tracking with High Hit Rate and Precise Time Resolution

This work presents a design framework of a High-Voltage CMOS pixel sensor for high energy particle tracking, which can provide a time resolution of $\sim$ ns order under the hit rate exceeding 100Mhz/cm². Signal collection, amplification, and digitization are all implemented within each individual pixel. Furthermore, a pixel-level coarse-fine Time-to-Digital Converter (TDC) is also integrated into each pixel; the leading edge (LE) and trailing edge (TE) time information of particle hits is first stored locally within the pixel, then transmitted along with the address of the activated pixel to the bottom of the array in priority order. The total time accuracy is expected to be less than 5ns, including contributions from signal collection time, time walk effects, jitter and the quantization noise of the TDC. The design is based on a 55nm CMOS process with a pixel layout size of 40×145 μm². Detailed electronic designs, simulation results, and preliminary test results will be presented.

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Session Classification: Poster

Track Classification: Detector and System: 12: Silicon Detector