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Design of a fast readout CMOS pixel sensor for the first prototype of CEPC Vertex Detector

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CMOS pixel sensors are attractive for the design and construction of the CEPC (Circular Electron Positron Collider) vertex detector due to the low material budget, high spatial resolution, fast readout speed and low power consumption. A series of CMOS pixel sensors were developed for CEPC vertex detector with different study purposes. This study aims to construct a fully functional large-scale CPS for the first CEPC vertex detector prototype. In order to satisfy the high hit rate in the CEPC vertex detector, we adopted a fast in-pixel readout combined with a hit-driven readout architecture in the pixel array, and designed a fast peripheral readout circuit combined with real-time data compression and sharable FIFO tree. The simulation results indicate that the hit rate of 120 M pixels/s can be satisfied. In the chip test, the time walks are about 60 ns to 90 ns under different power consumptions viewing from the statistics of digital output. Finally, 24 chips were installed in the first 6-layer CEPC vertex detector prototype. In the beam test, a spatial resolution of below 5 μm can be achieved and the detection efficiency is about 99%.

Minioral

Yes

IEEE Member

No

Are you a student?

No

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