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Test-beam performance results of the FASTPIX Sub-Nanosecond CMOS Pixel Sensor Demonstrator

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Within the ATTRACT FASTPIX project, a monolithic pixel sensor demonstrator chip has been developed in a modified 180 nm CMOS imaging process technology, targeting sub-nanosecond timing precision for single ionising particles. It features a small collection electrode design on a 25-micron-thick epitaxial layer and contains 32 mini matrices of 68 hexagonal pixels each, with pixel pitches ranging from 8.66 to 20 micron. Four pixels are transmitting an analog output signal and 64 are transmitting binary hit information. Various design variations are explored, aiming at accelerating the charge collection and making the timing of the charge collection more uniform over the pixel area. Signal treatment of the analog waveforms, as well as reconstruction of time and charge information, is carried out off-chip. This contribution introduces the design of the sensor and readout system and presents performance results for various pixel designs achieved in recent test-beam measurements with external tracking and timing reference detectors. A time resolution below 150 ps is obtained at full efficiency for all pixel pitches.

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