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A monolithic pixel sensor with fine space-time resolution based on silicon-on-insulator technology for the ILC vertex detector

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We have been developing a silicon-on-insulator (SOI) pixel sensor optimized for vertexing at the International Linear Collider (ILC) experiment. The SOI monolithic pixel detector is realized using standard CMOS circuits fabricated on a fully depleted sensor layer. We are currently designing and evaluating the prototype sensor named SOFIST. The SOFIST can store both position and timing information of the charged particles in each 20×20 μm pixel. The pixel circuit contains a comparator for hit-signal discrimination. If the charge signal is over the threshold voltage level, this analog signal and hit-timing information are captured to analog memory and embedded time-stamp circuits, respectively. The position resolution of the sensor is further improved by the position weighted with the charges shared among multiple pixels. The target performance of the position resolution is better than 3 μm. The sensor also has column-parallel analog-to-digital conversion (ADC) circuits and zero-suppression logic for high-speed data readout. In this presentation, we report the status of the development and evaluation of the prototype sensor.

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