

Development of a pixel sensor with fine space-time resolution based on SOI technology for the ILC vertex detector

We are developing an SOI pixel sensor optimized for vertexing at the ILC (International Linear Collider) experiment. The SOI (Silicon-On-Insulator) monolithic pixel detector is realized by standard CMOS circuits fabricated on a fully depleted sensor layer. The circuit and sensor layers are insulated by SiO₂ layer called buried oxide (BOX). The sensor layer is thinned to 50 μm for reduction of multiple scattering. The new SOI sensor SOFIST is designed to store both position and timing information of hits in each 20 × 20 μm pixel. The position resolution is further improved by the position weighted with the charges spread to multiple pixels. The target performance of the position resolution is better than 3 μm. The pixel also records the hit timing of the charged particle by an embedded timestamp circuit. The timestamp circuit has about 4 μsec resolution. In order to store 2 hit events during accumulation, there are 2 analog signal buffers and 2 timestamps in a pixel. The pixel output signals can be readout by an 8-bit ADC implemented on each column. In this presentation, we report the design principle, status of the design and development of the sensor.

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