

Study of Position Sensitive Silicon Detector (PSD) for SiW-ECAL at ILC

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The International Linear Collider (ILC) is a future electron-positron collider for precise measurements of Higgs bosons and various BSM searches. Silicon-tungsten electromagnetic calorimeter (SiW-ECAL) is one of the candidates to be used in the International Large Detector (ILD), one of the detector concepts for the ILC. The silicon sensor of the SiW-ECAL is segmented by 5.5 mm square cells to maximize performance of Particle Flow Algorithm (PFA). We are investigating possibility of implementing Position-Sensitive Detector (PSD) technique to each cell of this sensor in order to improve position resolution of particles, which may lead improvements on PFA performance, π^0 reconstruction with kinematic fit, searching BSM with displaced neutral particles and so on.

Our PSD is a silicon sensor with multiple cells as same as the sensor of SiW-ECAL. Each cell has an electrode at each corner, and the signal is divided to the electrodes with a resistive layer on the surface. The hit position can be obtained from the ratio of the signal on each electrode. In contrast to using smaller cells, the position resolution can be improved with minimal increase of the readout channels if we replace the silicon pads with PSDs in SiW-ECAL.

We have been developing the PSDs for several years. In the first production we found that the charge separation is not optimally done due to the readout impedance. To avoid the issue, we produced new PSDs with higher surface resistance with additional resistive layer on the surface. We also implemented several techniques to decrease position distortion and increase signal-to-noise ratio which is essential for the optimal position resolution. In this talk we will report study of the latest PSD sensors with signal by gamma and beta radiation source and laser injection. We also plan to conduct a test beam with sub-GeV electrons. The setup and quick view of the results of the test beam will also be shown.

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