

Ultra-Thin All-Silicon Module for High Precision Vertexing at Belle-II

The latest generation of fully depleted DEPFET active pixel sensors, designed for Belle-II at SuperKEKB, is currently in production. And for the first time the thinning technology developed for the ILC vertex detector finds now its application in a HEP experiment. The DEPFET is a field effect transistor with an additional implant underneath the channel and integrated on a fully depleted substrate. It combines the functions of a detector and the first amplification stage in one single device. This in-sensor amplification stage makes it possible to create very thin sensors with an excellent signal/noise ratio for minimum ionizing particles. In particular for the very soft spectrum of the charged particles from the $Y(4S)$ resonance in Belle-II (most charged particles from the decaying B-mesons have transverse momenta of the order of several 100 MeV) the ability to build highly transparent vertex detectors is of paramount importance. The required performance can only be achieved by a combination of excellent space point resolution and an extremely tight control of multiple scattering contributions. The material budget must be kept to a minimum, severely constraining the sensor thickness, power consumption and the design of detector services. This paper will describe the concept and the evaluation of an all-silicon module designed to meet the challenging requirements of future high precision vertex detectors.

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