

The pixel vertex detector at Belle II

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The vertex detector at Belle II has four outer layers of silicon strip detectors (SVD) and two inner pixel layers (PXD) at a distance of 14 and 22 mm to the interaction point. The PXD is based on DEPFET technology, which combines signal generation and first amplification in a single device and allows for the construction of a very light-weight device. The material budget of a single layer inside the acceptance region is only about 0.2% of a radiation length including all structures needed for support and thermal management. This is only possible with the unique approach of the “all-silicon module” where all read-out ASICs and interconnects are integrated in a micro-machined piece of silicon with the active DEPFET pixel sensor as its integral part.

The Belle II PXD Collaboration designed and fabricated the sensor, the read-out and steering ASICs, the low-mass module and ladder concept, services and power supplies, cooling, DAQ system and slow control. It is the first time that the DEPFET technology is deployed in a HEP experiment.

The PXD is in operation as part of the Belle II experiment at KEK since March 2019 and is taking data with very good performance meeting the expectations. Since start of operation, the accelerator SuperKEKB reached a peak luminosity beyond $1e34$ /cm²s and about 10 fb⁻¹ have been recorded at the time writing. The final goal for the peak luminosity of the machine is $8e35$ /cm²s and the pixel detector is designed to be operated at this final luminosity up to the accumulated data set of 50 ab⁻¹.

The lessons learned during construction, commissioning, and operation of the first DEPFET based vertex detector will be presented.

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