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The Belle II Pixel Detector –Operation and Performance

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After multiple dedicated commissioning phases, the SuperKEKB accelerator in Tsukuba, Japan, started providing e+e- collisions to the Belle II experiment equipped with a new 6 layer silicon Vertex Detector (VXD) in 2019. The two innermost layers of the VXD are comprised of two layers of Pixel Detector (PXD). It is made from all-silicon modules integrating support structure and sensor. The sensors are pixel matrices of Depleted P-channel Field Effect Transistors (DEPFET) which are steered and read out by 14 ASICs bump-bonded to each module. Due to unforeseen difficulties during construction a de-scoped detector has been installed.

The PXD has been reliably operating as part of the Belle II detector over the last three years. The efficiency and vertex resolution are within the expectations. Expected module degradation due to radiation damage is mostly compensated by continuous recalibration. The global module performance is only partially affected by unexpected effects like local radiation induced bulk current changes in the sensors and faults in individual channels of the fast voltage-switching ASICs (Switchers) due to radiation bursts. These effects could be reproduced in x-ray and electron beam irradiation measurements.

The talk will present a summary of the operation experience and performance and give an outlook on the ongoing preparation for a full-sized replacement of the PXD expected within the next year.

Primary experiment

Belle II

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