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[A05] The Silicon Vertex Detector of the Belle II Experiment

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The Belle II experiment is taking data at the asymmetric SuperKEKB collider, which operates at the Y(4S) resonance. The vertex detector is composed of an inner two-layer pixel detector (PXD) and an outer four-layer double-sided strip detector (SVD). The SVD-standalone tracking allows the reconstruction and identification, through dE/dx, of low transverse momentum tracks. The SVD information is also crucial to extrapolate the tracks to the PXD layers, for efficient online PXD-data reduction.
A deep knowledge of the system has been gained since the start of operations in 2019 by assessing the high-quality and stable reconstruction performance of the detector. Very high hit efficiency, and large signal-to-noise are monitored via online data-quality plots. The good cluster-position resolution is estimated using the unbiased residual with respect to the track, and it is in reasonable agreement with the expectations.
The SVD dose is estimated by the correlation of the SVD occupancy with the dose measured by the diamonds of the radiation-monitoring and beam-abort system. First radiation damage effects are measured on the sensor current and strip noise, although they are not affecting the performance
Currently the SVD average occupancy, in its most exposed part, is still < 0.5%, which is well below the estimated limit for acceptable tracking performance. With higher machine backgrounds expected as the luminosity increases, the excellent hit-time information will be exploited for background rejection, improving the tracking performance. The front-end chip (APV25) is operated in “multi-peak”mode, which reads six samples. To reduce background occupancy, trigger dead-time and data size, a 3/6-mixed acquisition mode based on the timing precision of the trigger has been successfully tested in physics runs. Recent developments demonstrate that the Belle II event time obtained from SVD data is calculated faster than alternative estimations, while achieving the same accuracy.

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