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Operational experience and performance of the Silicon Vertex Detector after the first long shutdown of Belle II

In 2024 the Belle II experiment resumed data taking after its Long Shutdown 1, which was required to install a two-layer pixel detector and upgrade components of the accelerator. We describe the challenges of this upgrade and report on the operational experience during the subsequent data taking. With new data, the SVD confirmed high hit efficiency, large signal-to-noise and good cluster-position resolution. SuperKEKB's instantaneous luminosity is expected to increase significantly, resulting in a larger SVD occupancy caused by beam-related background. Considerable efforts have been made to improve the SVD-reconstruction software by exploiting the excellent SVD hit-time resolution to determine the collision time and reject out-of-time hits caused by the beam-related background. A novel procedure to group SVD hits event-by-event, based on their time, has been developed by using the grouping information during reconstruction, significantly reducing the fake rate, while preserving the tracking efficiency. The front-end chip (APV25) is operated in "multi-peak" mode, reading six samples. During data taking, we tested a 3/6-mixed acquisition mode, based on the timing precision of the trigger, that reduced background occupancy, trigger dead-time and data size. Studies show a moderate radiation-induced increase in sensor current and strip noise. However, such damage will not degrade the performance during the lifespan of the detector.

Secondary track

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