

Integration of readout of the vertex detector in the Belle II DAQ system

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The Belle II data acquisition system is one of the biggest challenges in the Belle II, a next generation of B factory, experiment, which is designed to collect data streams from the seven sub detectors with much higher trigger rate and larger data size up to 30 kHz and 30 GB/s at the level-1 trigger due to the 40 times higher luminosity of the Belle experiment. The Belle2Link, a common detector readout scheme using COPPER (common pipeline electronics readout) and HSLB (high speed link board) boards, was developed to handle data from the all sub detectors except for the PXD (pixel vertex detector) and then merge them to the HLT (high level trigger) PC farm while The DHH (Data Handling Hybrid), a dedicated readout system for the PXD with FPGA based data processing electronics has newly developed to handle with huge event size from the DEPFET ultra-fine pixel sensors. A reduction scheme of the pixel event size by selectin of RoIs (regions of interests) on the pixel surfaces is also developed based on online track reconstruction in the HLT farm using data from the SVD (silicon vertex detector) and the CDC (central drift chamber).

Integration of readouts of the SVD and PXD, the inner vertex detectors, is ongoing for the phase II detector commissioning run using the first beam collisions from the SuperKEKB accelerator in parallel to the DAQ system operations for the outer sub detectors in the phase I cosmic ray run. The outer sub detectors are fully installed in the phase II run while the inner detectors are partially installed with dedicated background sensors to measure the beam background and confirm the radiation resistance in the phase III physics run with the full Belle II detector. In addition to the beam data taking, we will also operate several slow control systems; configuration of the detector readout electronics, the high voltage / low voltage power supplies, environment monitors, and cooperation with the SuperKEKB accelerator.

Toward the phase II and III runs, we have been accumulating operation experiences of the inner vertex detector during three times of beam tests in the DESY electron test beam facility. There were a mount of issues to be tested; the establishment of the data links, the readout performances in the SVD-COPPERs and the PXD-DHHs, the online tracking for the RoI extraction and the slow control including the detector power supplies, and demonstration of the data taking shift by non-experts. The final beam test will be carried out in Feb. 2017 to finalize the sensor / readout systems and confirm our achievements.

In this presentation, we will report the achievements in the integration of the Belle II DAQ system into the readouts of the vertex detectors based on the results in the final beam test. And then we will discuss prospects of the coming physics run in 2018.

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