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Development and Performance of the Belle II DAQ Upgrade

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Belle II is a new-generation B-factory experiment operating at the beam intensity frontier, SuperKEKB accelerator, dedicated to exploring new physics beyond the standard model of elementary particles in the flavor sector. Belle II started data-taking in April 2018, using a synchronous data acquisition (DAQ) system based on a pipelined trigger flow control. Belle II DAQ system is designed to handle 30 kHz trigger rate, under the assumption of a raw event size 1 MB. Because the event size and rate could be larger than the designed value depending on the background condition, and the difficult maintainability of the current readout system during the Belle II entire operation period is expected, we decided to upgrade the Belle II DAQ readout system with state-of-art technology. A PCI-express based new-generation of readout board (PCIe40), which was originally developed for the upgrade of LHCb and ALICE experiments, has been used for the upgrade of Belle II DAQ system. PCIe40 is able to connect to a maximum of 48 frontend electronics through multi-gigabit serial links. PCI-express hard IP-based direct memory access architecture, the newly designed timing and trigger distribution system and slow control system made the Belle II readout setup as a compact system. Three out of 7 sub-detectors of Belle II experiment has been operated with the upgraded DAQ system. In this submission we present the development of firmware and software for the new Belle II DAQ system, and its operation performance during physics data-taking.

In-person participation

No

Primary author: ZHOU, Qi-Dong (IAR/KMI Nagoya university)**Co-authors:** BESSNER, Martin; BISWAS, Diptaparna; CHARLET, Daniel; HARTBRICH, Oskar; HIGUCHI, Takeo; ITOH, Ryosuke; JULES, Eric; KAPUSTA, Piotr; KUNIGO, Takuto; LAI, Yun-Tsung; LAU, Tak-Shun; LEVIT, Dmytro; NAKAO, Mikihiro; NISHIMURA, Kuris; PLAIGE, Eric; Dr PARK, Seokhee; PURWAR, Harsh; POBBE, Patrick; SUGIURA, Ryohei; SUZUKI, Soh; TAURIGNA, Monique; VARNER, Gary; YAMADA, Satoru**Presenter:** ZHOU, Qi-Dong (IAR/KMI Nagoya university)**Session Classification:** Detectors for Future Facilities, R&D, novel techniques**Track Classification:** Operation, Performance and Upgrade (Incl. HL-LHC) of Present Detectors