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Operation and performance of the Belle II Aerogel RICH detector

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The Belle II experiment at the SuperKEKB asymmetric-energy e^+e^- collider is a B factory experiment to study rare decays with high precision such as $B \to \rho(\to \pi\pi)\gamma$ and $B \to K^*(\to K\pi)\gamma$. In order to study these processes, particle identification, especially the separation of charged kaons and pions is very important. In the Belle II detector, a proximity focusing Aerogel Ring Imaging CHerenkov counter (ARICH) is implemented to separate kaons from pions with momenta up to 4 GeV/c. The ARICH detector consists of a silica aerogel radiator and Hybrid Avalanche Photo Detector (HAPD) as the photon detector. Using the emission angle of the Cherenkov photon, the separation of the charged kaons from pions is performed.

The performance of the particle identification is studied using the collision data. The good separation between charged kaons and pions is observed, close to our expectations. We report the performance of the particle identification in the ARICH detector using the data.

The Belle II experiment started the physics run with full detectors in 2019 and accumulated more than 300 fb^{-1}of collision data. The ARICH detector has been operated stably and the performance of the HAPDs is consistent with our expectations. The concern is the deterioration of HAPDs due to silicon bulk damage by neutron radiations. The increase of the leakage current is observed due to the radiation, but the fluency of the neutrons is below the tolerable level. Currently, 94% of channels are operational and good performance is provided. The single event upset in the FPGAs due to the radiation is also considered. We implemented the scrubber of correcting radiation-induced errors in the firmware. Thanks to this implementation, the readout firmware has been running stably. In this presentation, we report the operation of ARICH including the fraction of dead channels and stability of HAPDs.

Author: UNO, Kenta

Presenter: UNO, Kenta

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