Development of the Level-1 Trigger system in the Belle II experiment

Belle II Level-1 trigger system

- Belle II and superKEKB: high luminosity e+e- collider
- High trigger efficiency for various physics targets: B, D, τ, dark
- Level-1 requirements: 30kHz rate, 4.4μs latency, 10ns event timing resolution

Universal Trigger board (UT)

- Universal FPGA board developed for Belle II
- QSFP optical transceiver (GTX,GTH,GTY)
- Register access through VME
- Total ~30boards, common in subtrigger

CDC trigger

- Trigger charged particle
- Various tracking algorithms
- Hough transform: long track finding
- Neural network: vertex measurement
- Pattern matching: short track finding

KLM trigger

- Sandwich structure of Iron and scintillator/RPC
- Detect muon by counting #hits in each sector (>4hits required)
- Matching with CDC and ECL on GRL for single muon trigger

GRL/GDL and Trigger conditions

- GRL/GDL: combine all subtriggers information and decide Level-1 trigger
- Trigger conditions: 100% efficiency for BB pair. Special conditions for τ and dark physics.

Summary

- Belle II Level-1 trigger system has been developed for taking various physics events
- Trigger rate, efficiency and latency satisfy their requirements
- Next step is to upgrade the Level-1 system for the incoming higher luminosity and background