A study for hit-time reconstruction of Belle II SVD

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Belle II, SVD

- $e^+e^-$ collisions @SuperKEKB
- Design luminosity: $\sim 6 \times 10^{35} \text{cm}^{-2}\text{s}^{-1}$
- Time-dependent analysis possible
- Asymmetric energy
- Decay vertex measurement

- Vertex detector
- Cylindrical
- Pixel 2 layers + strip 4 layers (SVD)

-SVD: Double-sided strip detector (DSSD)
Tracking with 4 layers of 2D hits
Future update for stable SVD operation

◆ **We will go to higher luminosity**
  → More background hits and higher trigger rate

◆ **Data rate will reach its limit**
  ■ 6-sample DAQ → 3-sample DAQ
  ■ 3/6-sample mixed-mode under test

◆ **BG hits will deteriorate the tracking performance**
  ■ Offline hit rejection using hit-time
Hit-time reconstruction study

AIM:
check that SVD hit-time is OK even with 3-sample

1. Developed novel hit-time estimation methods for 3-sample DAQ
2. Applied them to current 6-sample DAQ data and check hit-time distributions
3. Also analyzed simulated data to see the performance of hit-time cut
Result: Hit-time resolution in data

◆ Analyze a set of data with $\bar{B}B$-like events
◆ We can separate the signal from BG using hit-time!
◆ Intrinsic resolution of 2.35 ns
Result: Hit-time cut and tracking efficiency in MC

◆ Study Monte-Carlo simulation
  ■ various amount of BG

◆ Try applying cut on hit-time
  ■ [-35,+35] (width 70 ns) cut
  ■ signal hit efficiency > 99%
  ■ background hit rejection ~ 81%

◆ tracking efficiency improved
  ■ promising result for future reconstruction under higher BG

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