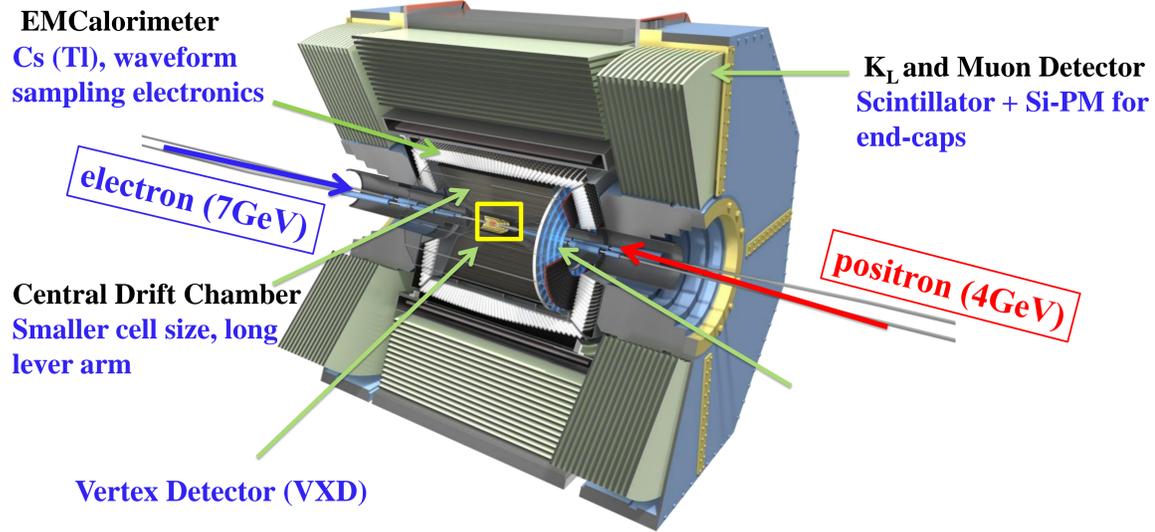


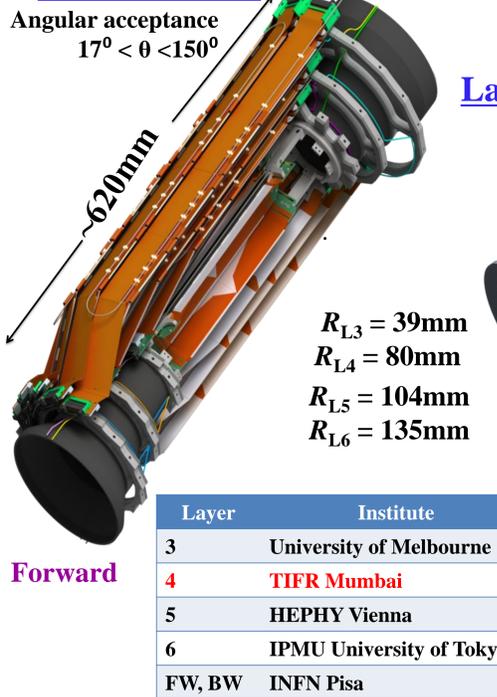
Introduction

- Design luminosity of SuperKEKB: $8 \times 10^{35} \text{ cm}^{-2} \text{ s}^{-1}$ that would enable Belle II to collect 50 ab^{-1} of data, 50 times more than its predecessor (Belle).
- Leads to harsh background environment in the Belle II.
- To validate the performance of the SVD, a systematic study is needed in the offline reconstruction software.
- The excellent performance of the Belle II SVD will provide the measurements of CP asymmetry in the B-meson system with higher precision.
- To achieve the physics goals, reconstruction of tracks with a high efficiency and a good resolution is needed.

Belle II Detector

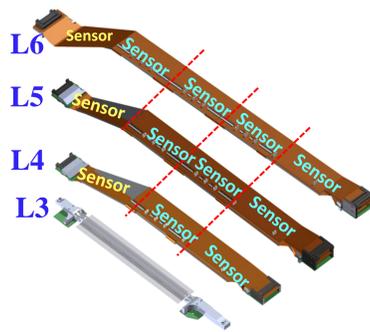


SVD Structure

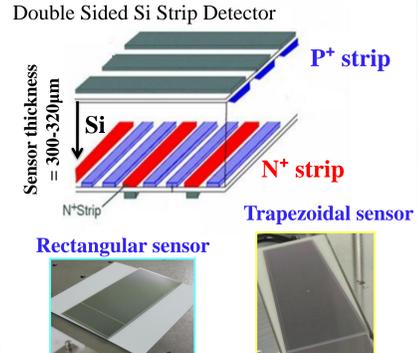


Belle II Silicon Vertex Detector (SVD)

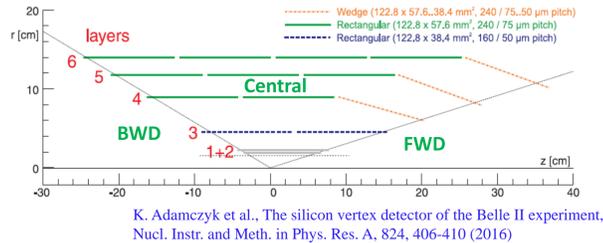
Ladder Structure



Si-Sensors



Cross-sectional view of SVD (r-z plane)

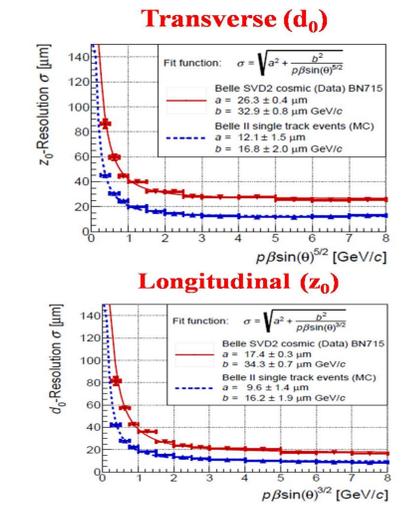


	Rectangular	Trapezoidal
No of Strips	768	768
# of p-strips (μm)	75 (L3:50)	50...75
# of n-strips	512 (L3:768)	512
n-strip pitch (μm)	240 (L3:160)	240
Active area (mm ²)	7030 (L3:4738)	5890

The Belle II SVD will provide:

- Better vertex resolution
- Low p_T track finding efficiency
- Improved K_S^0 reconstruction efficiency

Impact Parameter Resolution

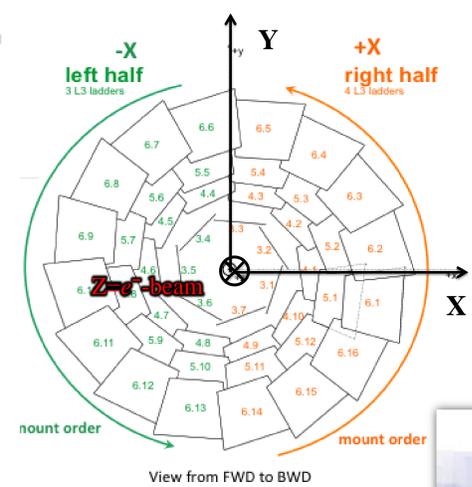


Commissioning of the SVD

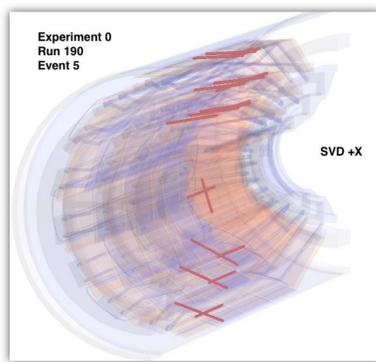
- The two SVD half shells have been assembled in KEK, Japan.
- Testing of SVD half shells with cosmic rays is carried out from July to Sep., 2018.
- Total 30×10^6 cosmic events have been collected.
- Performance studies of the SVD using offline reconstruction software are in progress.

Results: Commissioning Data Analysis

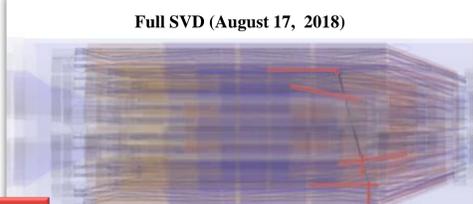
Complete SVD +X/-X half shells



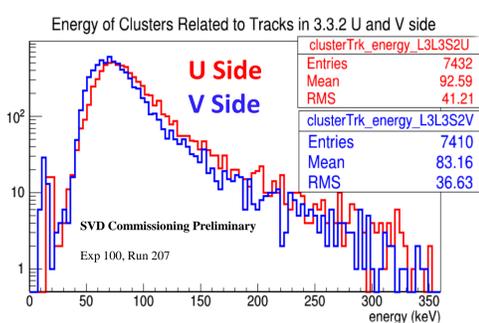
First cosmic event



Full SVD (August 17, 2018)

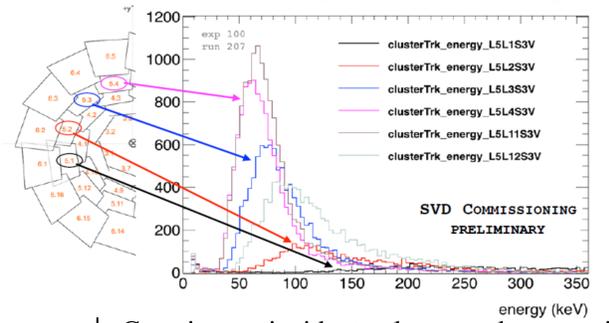


Horizontal Sensors



Cluster Energy Distributions

Cluster Energy vs Azimuthal Angle

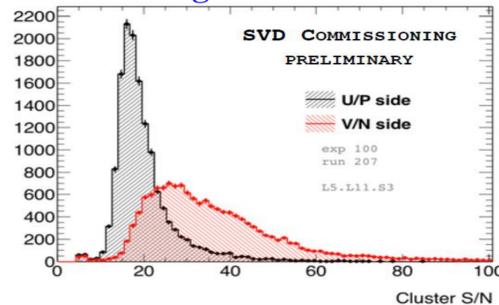


- The cosmic track is perpendicular to the Horizontal sensors.
- Clusters are correctly reconstructed on both sides (U, V)
- Cluster energy are in agreement for both sides (U, V).

Cosmic rays incident at large angle on vertical sensors as compared to horizontal sensors.

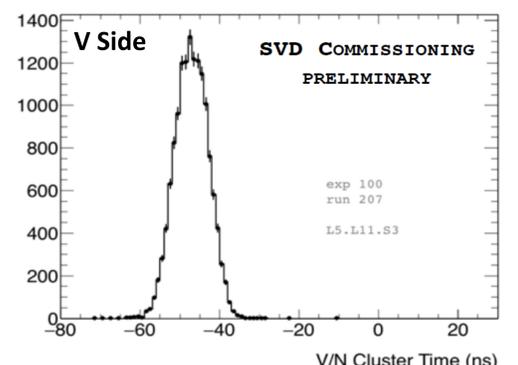
Relatively high energy deposited in vertical sensors.

Cluster Signal to Noise Ratio



The S/N ratio > 20 for N-side performing better than the P-side, for 1 strip cluster. This was expected due to the longer P side strips resulting in larger capacitive load to the charge preamplifier used for the readout and than higher noise on P side.

Cluster Time



The RMS of cluster times is measured to be ~5ns.

Summary

- The two SVD half shells have been assembled at KEK and run smoothly during the commissioning period from July 2018 to Sep. 2018.
- Performance of SVD is evaluated with cosmic runs for each side/sensor.
- Cosmic rays are incident at very large angle on vertical sensors as compared to the horizontal sensors.
- Cosmic rays deposits higher energy in vertical sensors as compared to the horizontal sensors.
- It is demonstrated that the N side of the SVD sensor performs better than P side.
- The RMS of signal hit time corresponding to a bunch crossing is found to be in the order of 5 ns (expected).

Reconstruction Software: BASF2

