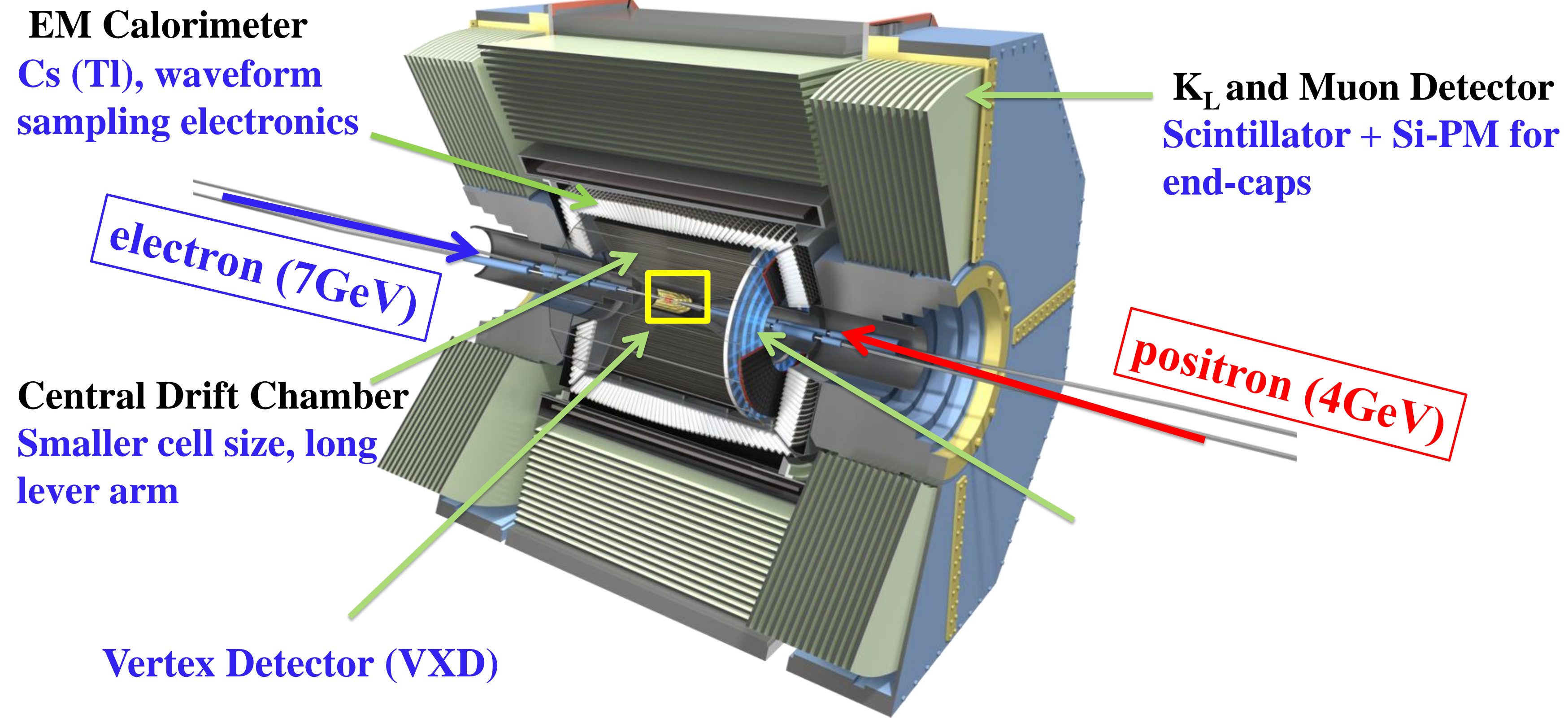


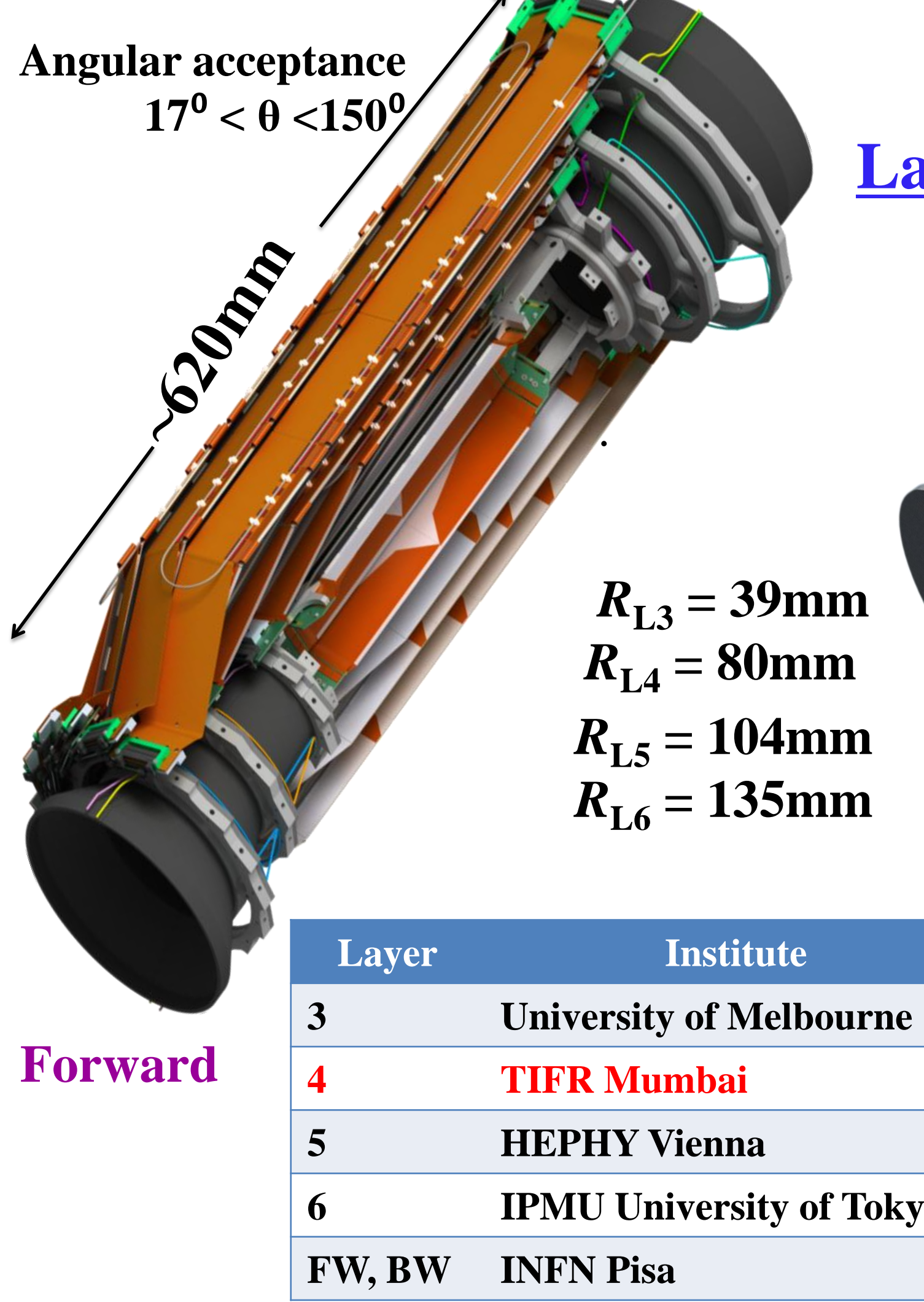
### Introduction

- Design luminosity of SuperKEKB:  $8 \times 10^{35} \text{ cm}^{-2}\text{s}^{-1}$  that would enable Belle II to collect  $50 \text{ ab}^{-1}$  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

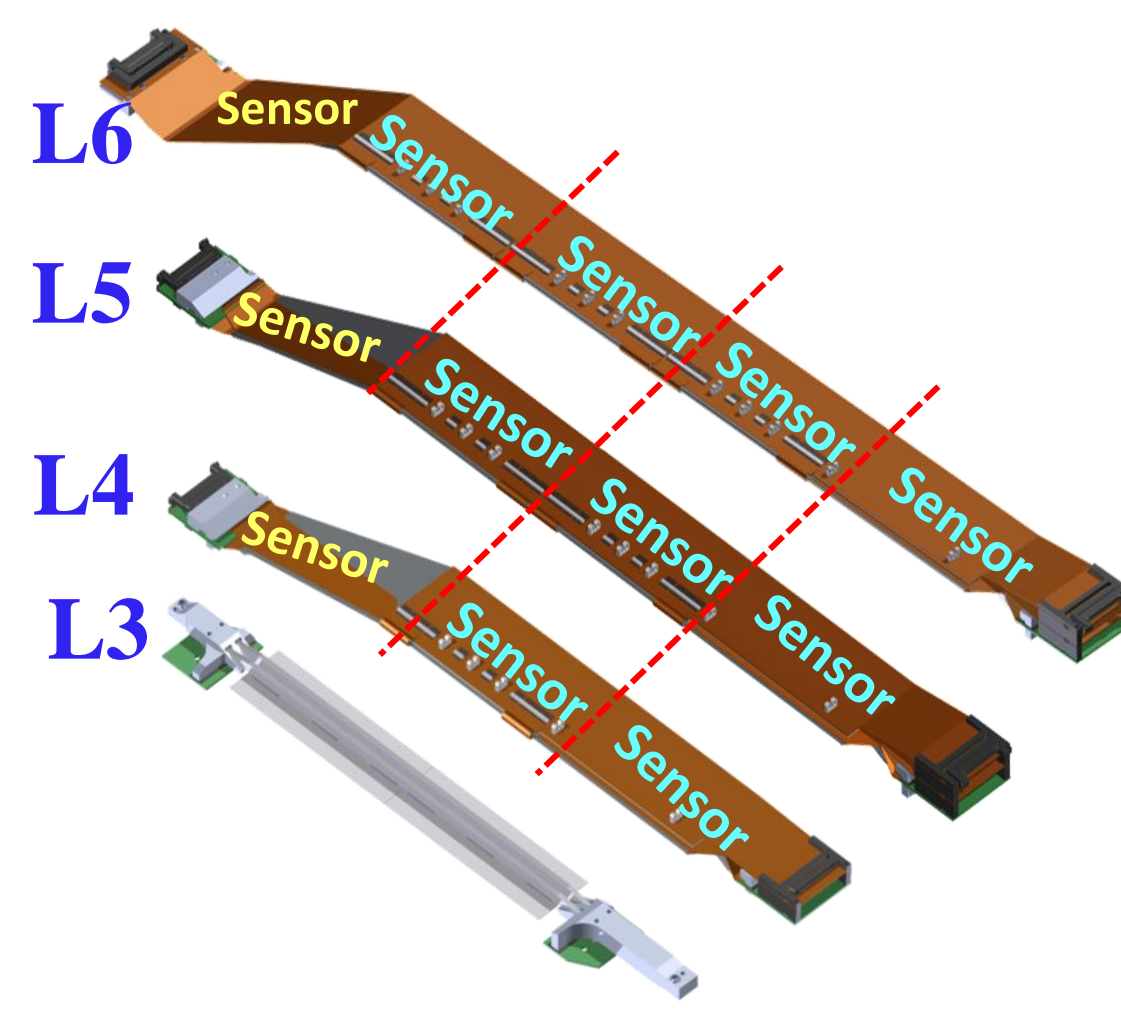


### SVD Structure

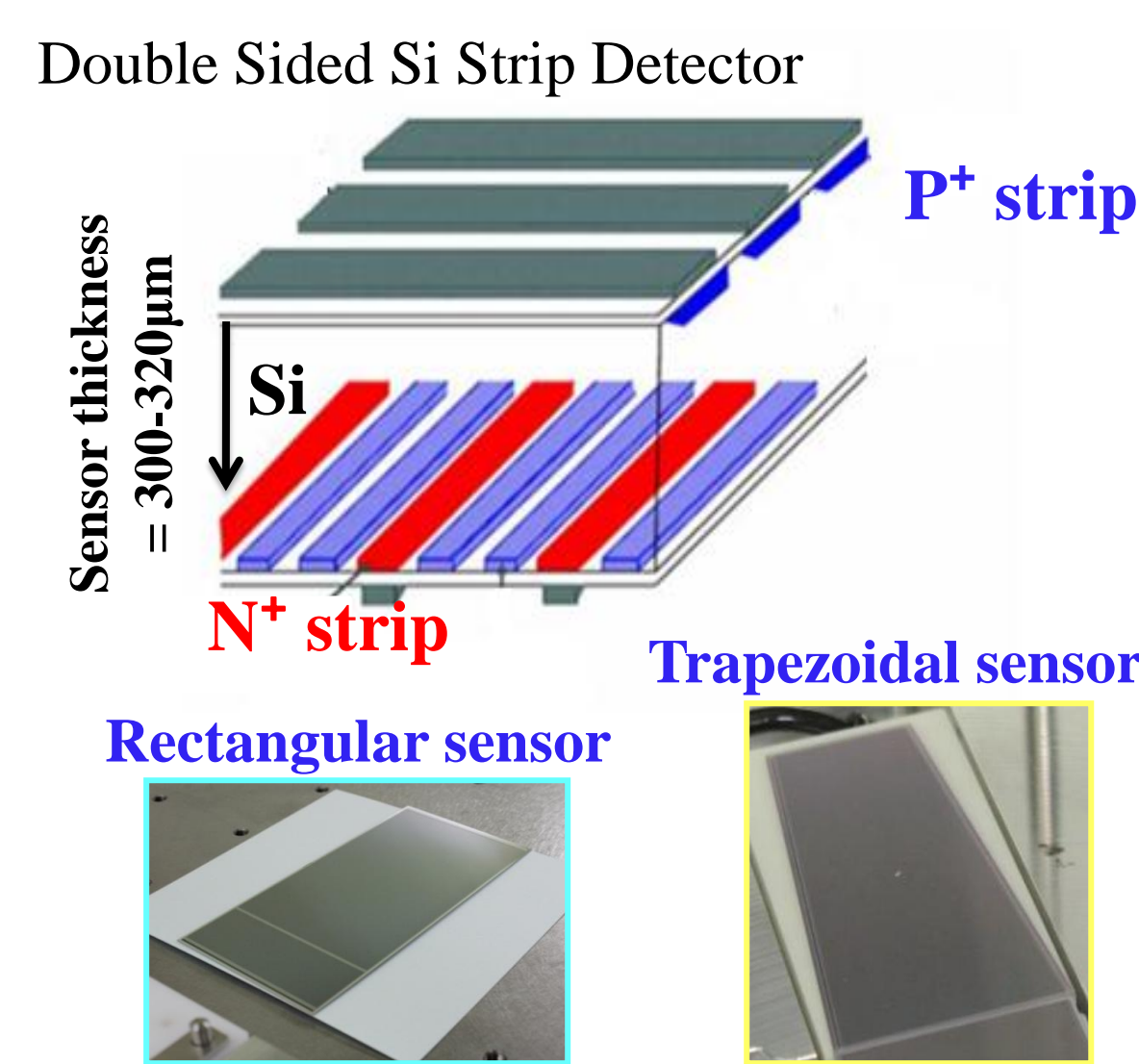


### Belle II Silicon Vertex Detector (SVD)

#### Ladder Structure

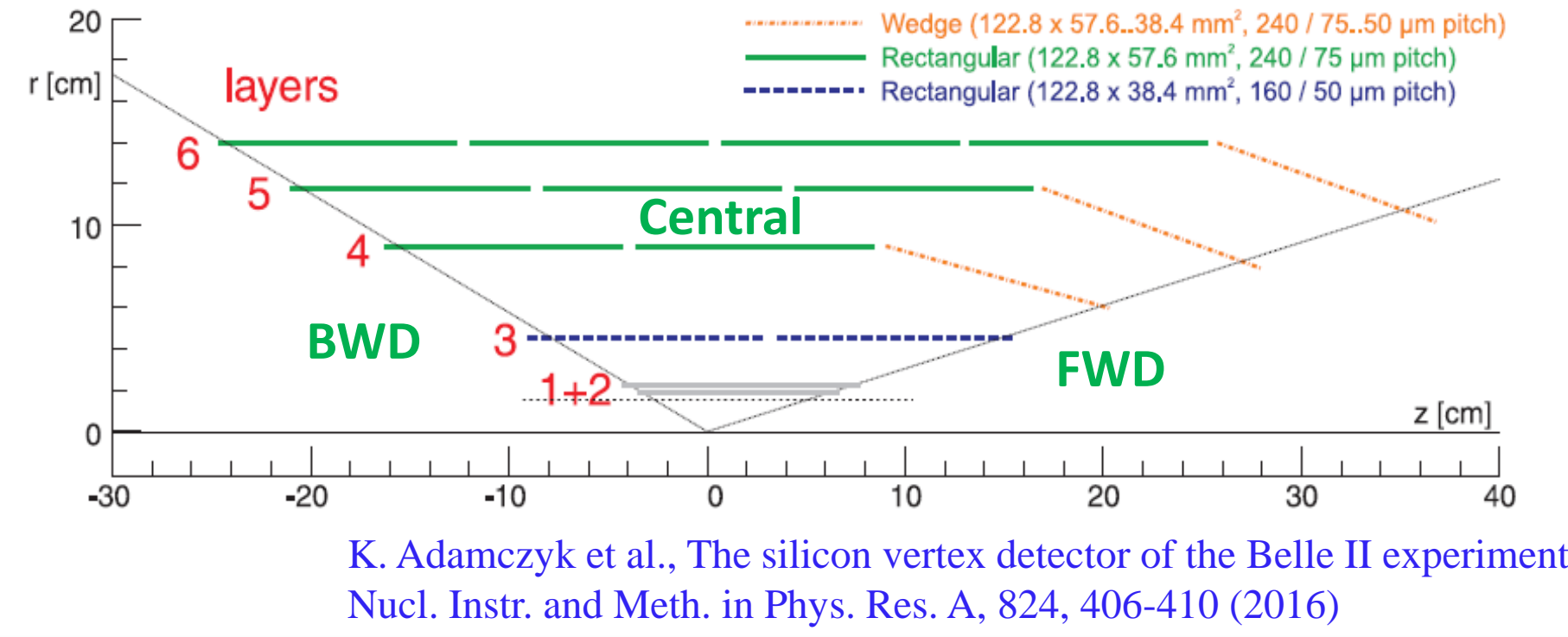


#### Si-Sensors



	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 <sup>2</sup> )	7030 (L3:4738)	5890

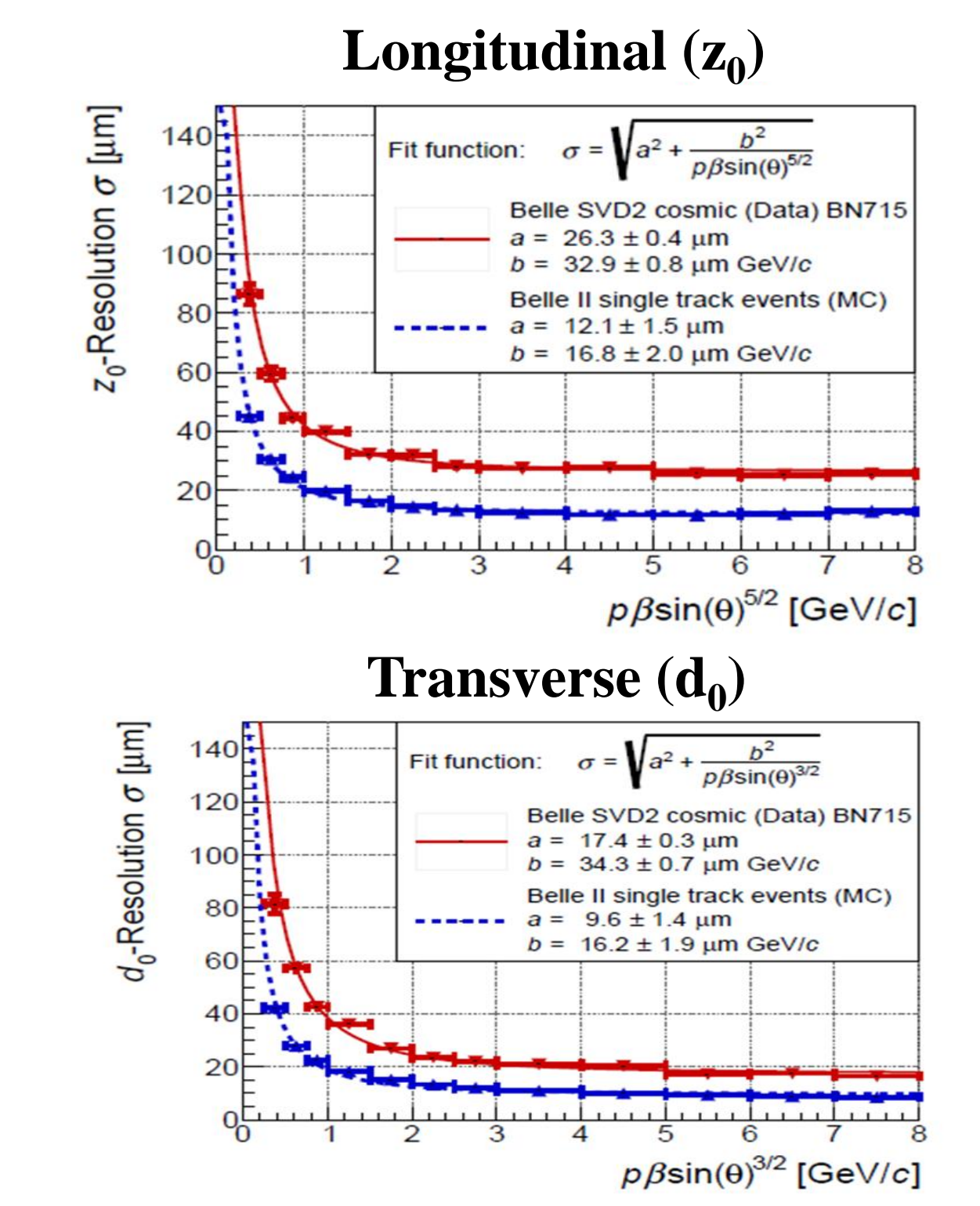
#### Cross-sectional view of SVD (r-z plane)



The Belle II SVD will provide:

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

### Impact Parameter Resolution



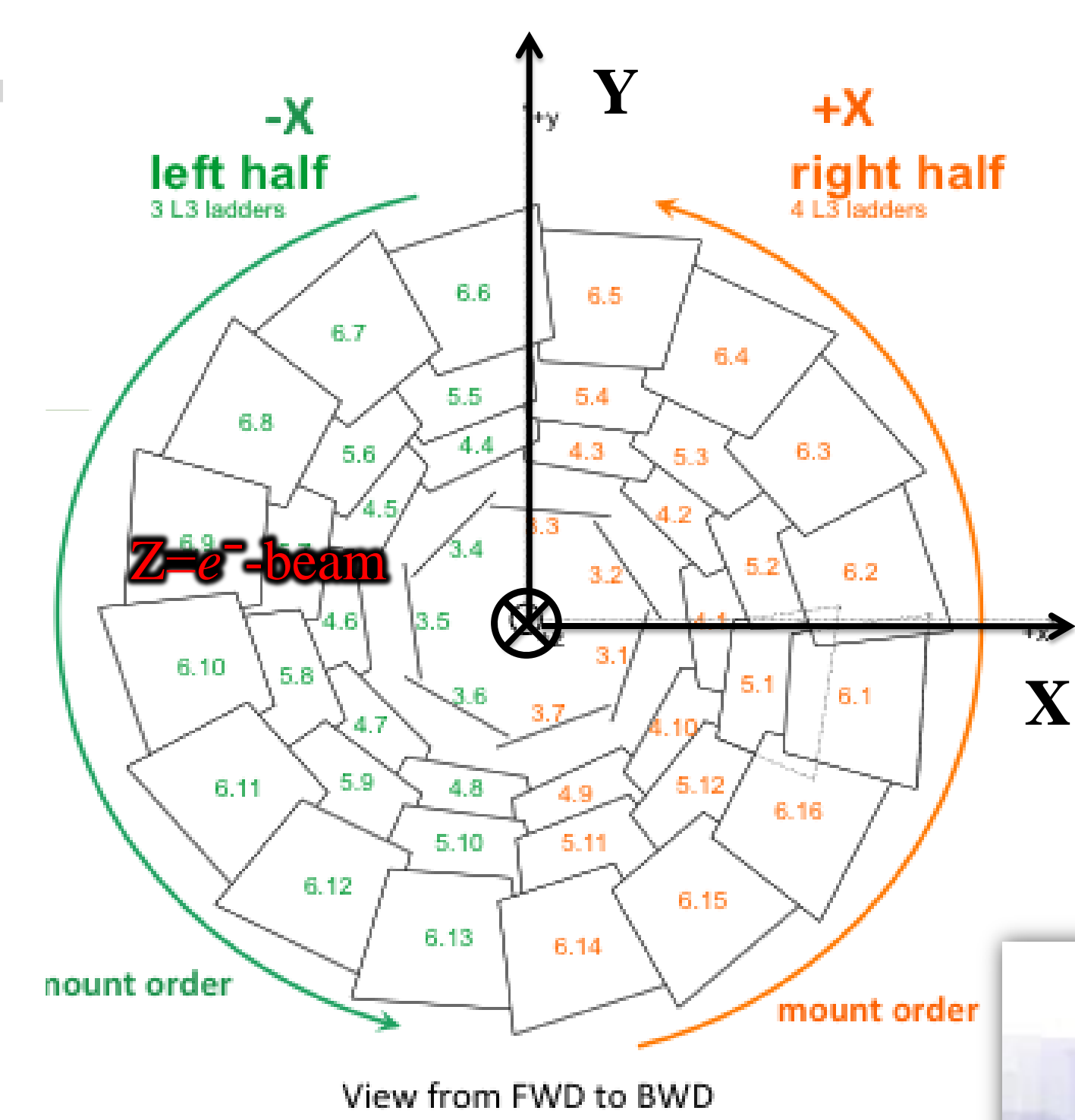
Improved resolution at IP with respect to Belle ( $20\mu\text{m}$  @ 2 GeV/c). (PTEP-2018).

### Commissioning of the SVD

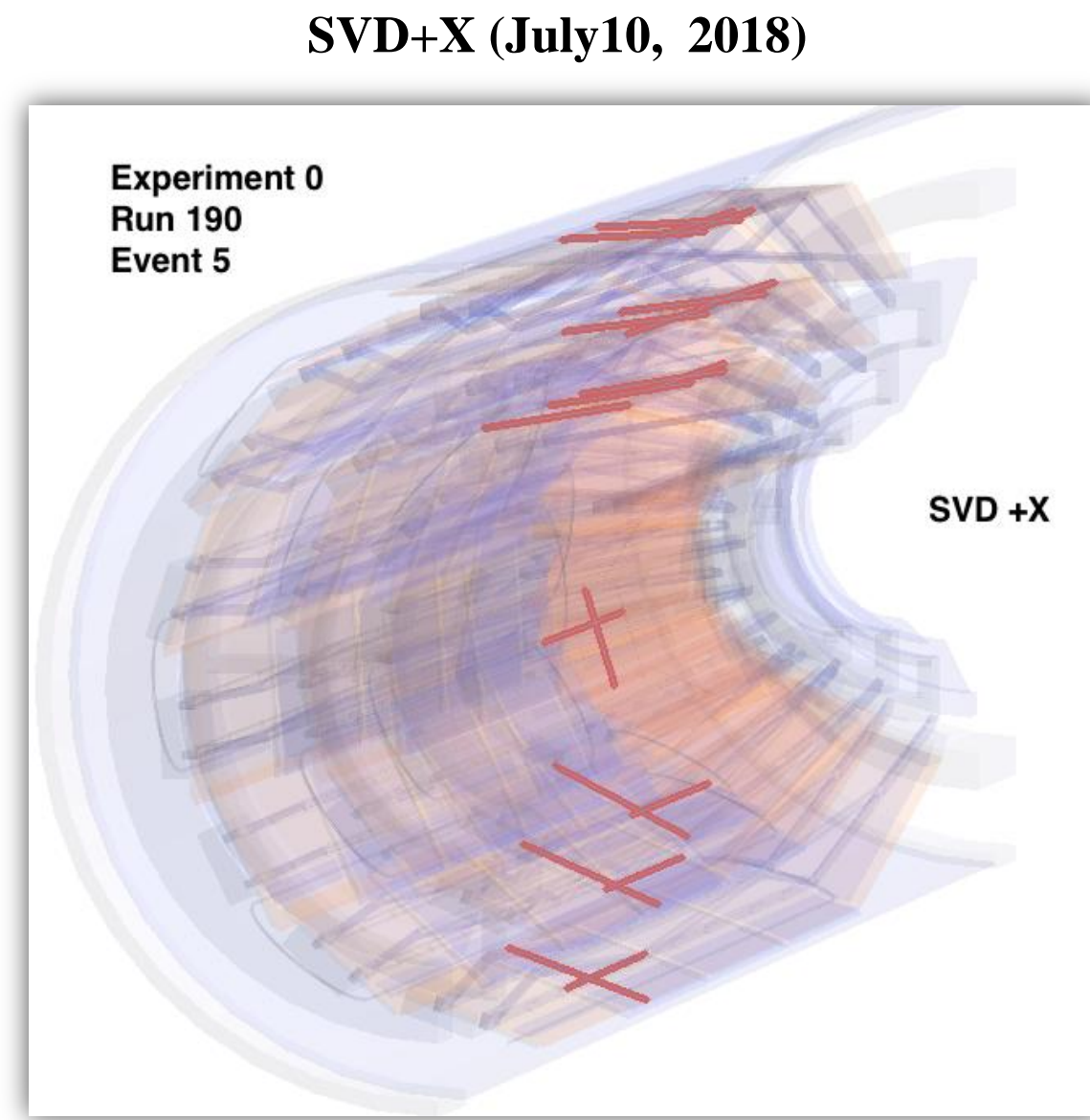
- The two SVD half shells have been assembled in KEK, Japan.
- Testing of SVD half shells with cosmic rays is carried out from July to Sep., 2018.
- Total  $30 \times 10^6$  cosmic events have been collected.
- Performance studies of the SVD using offline reconstruction software are in progress.

### Results: Commissioning Data Analysis

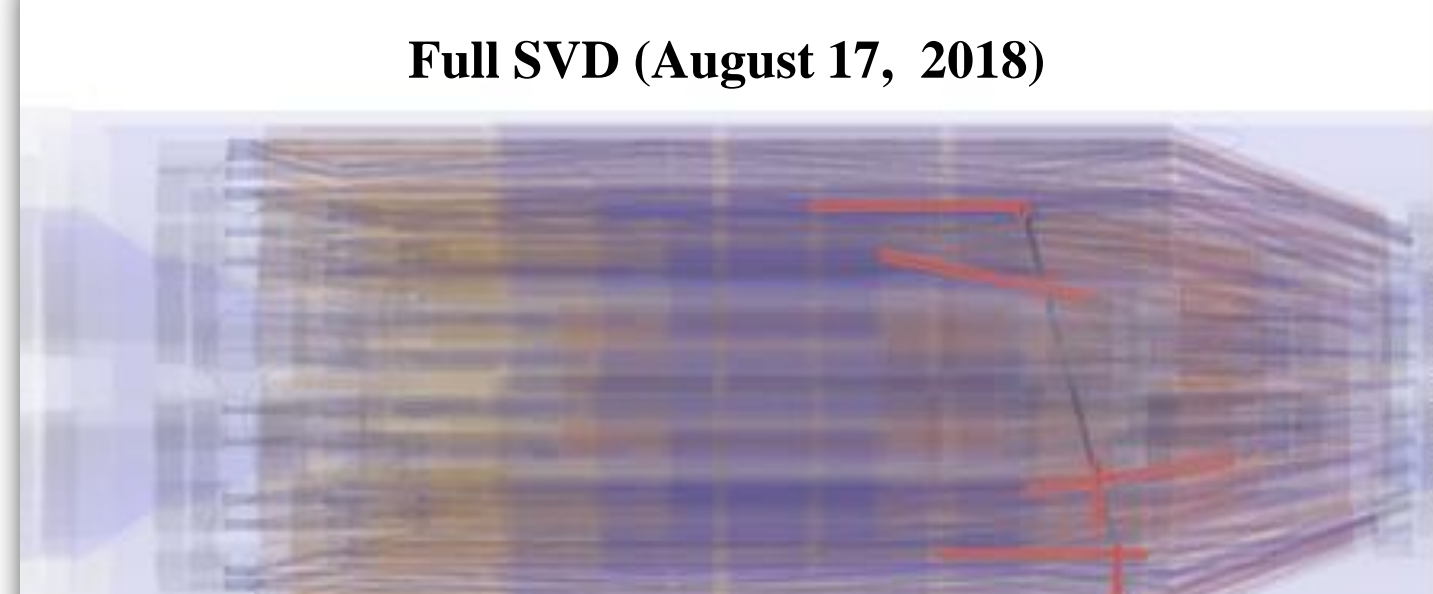
#### Complete SVD +X/-X half shells



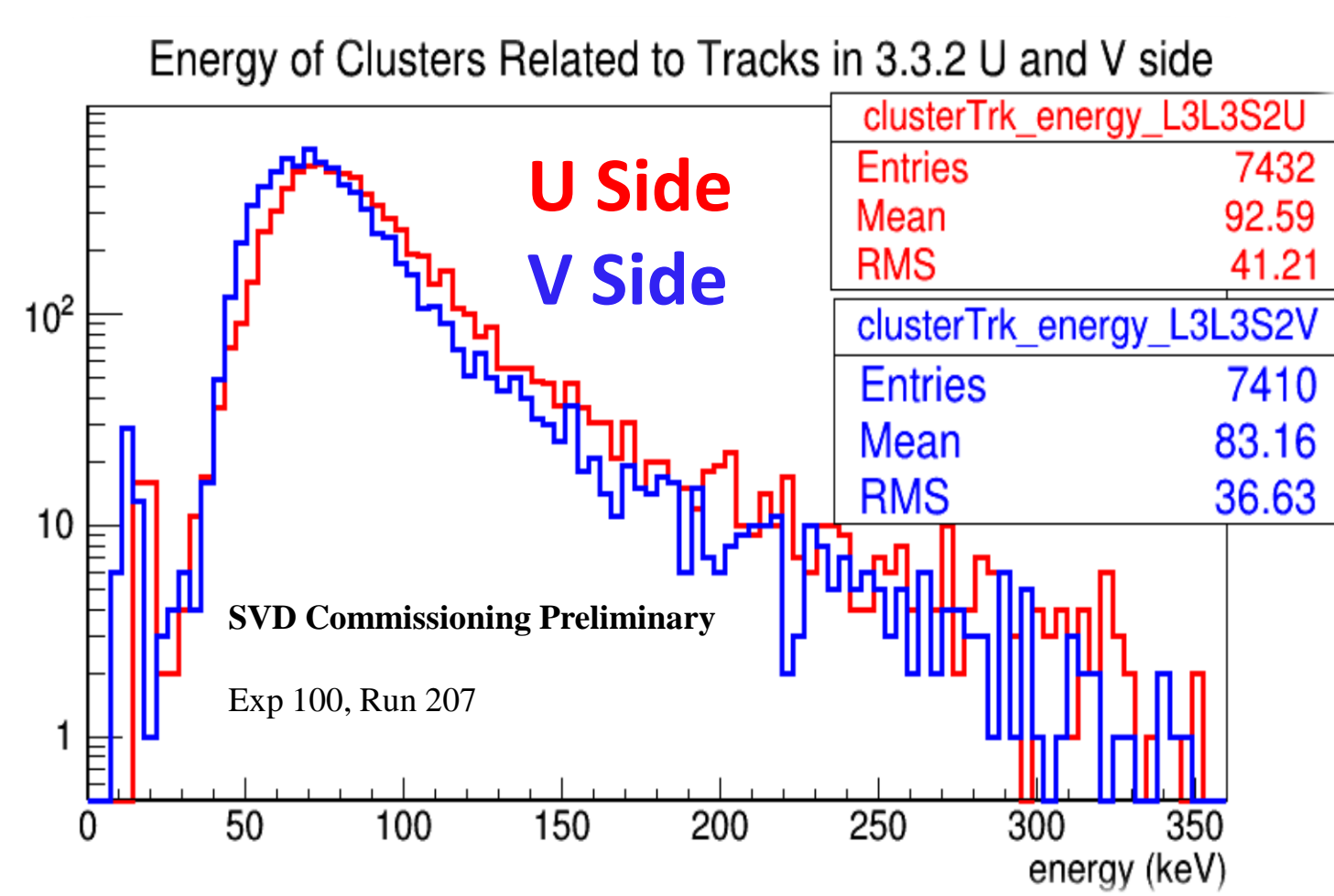
#### First cosmic event



#### Full SVD (August 17, 2018)

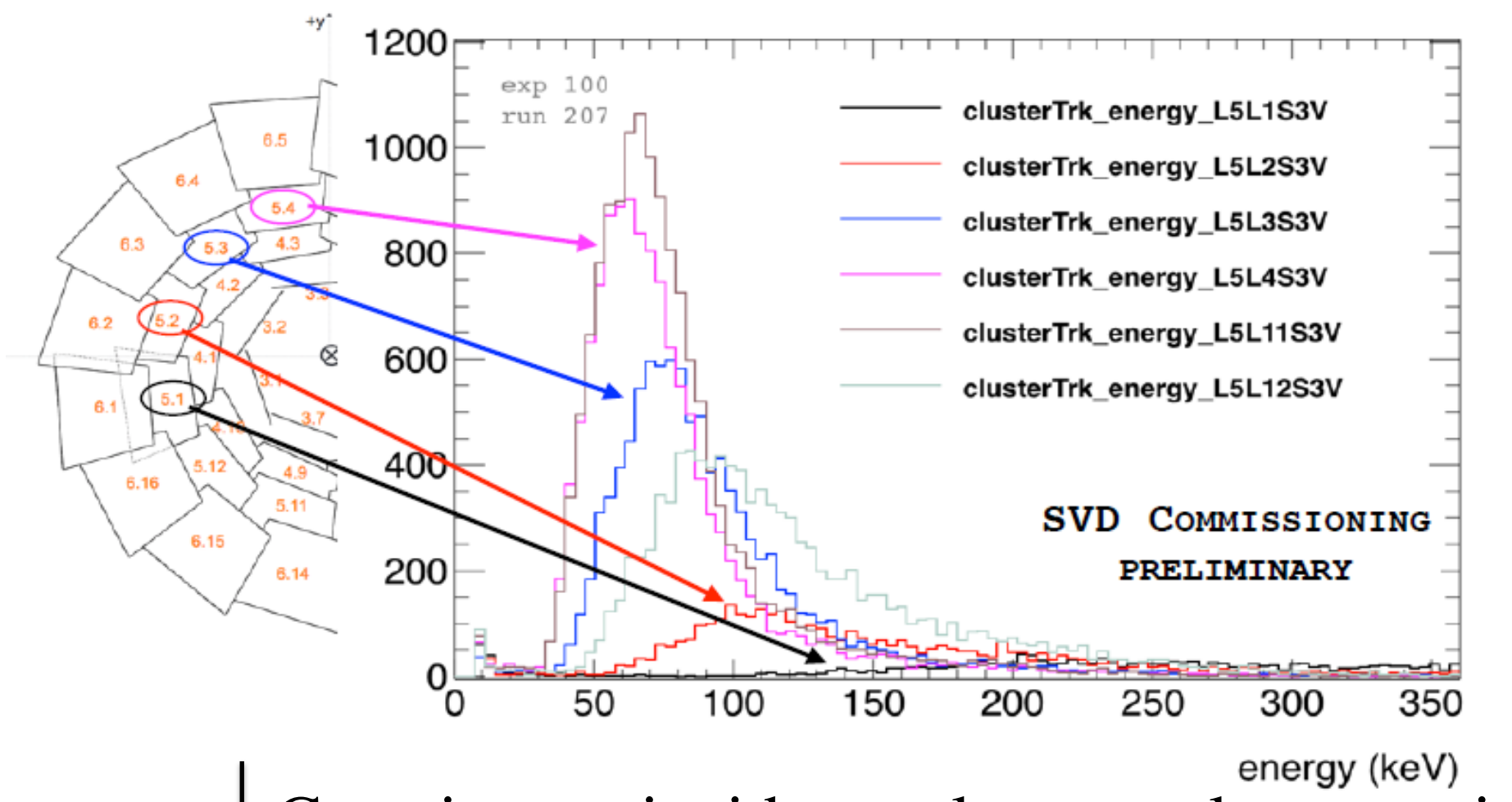


#### Horizontal Sensors



#### Cluster Energy Distributions

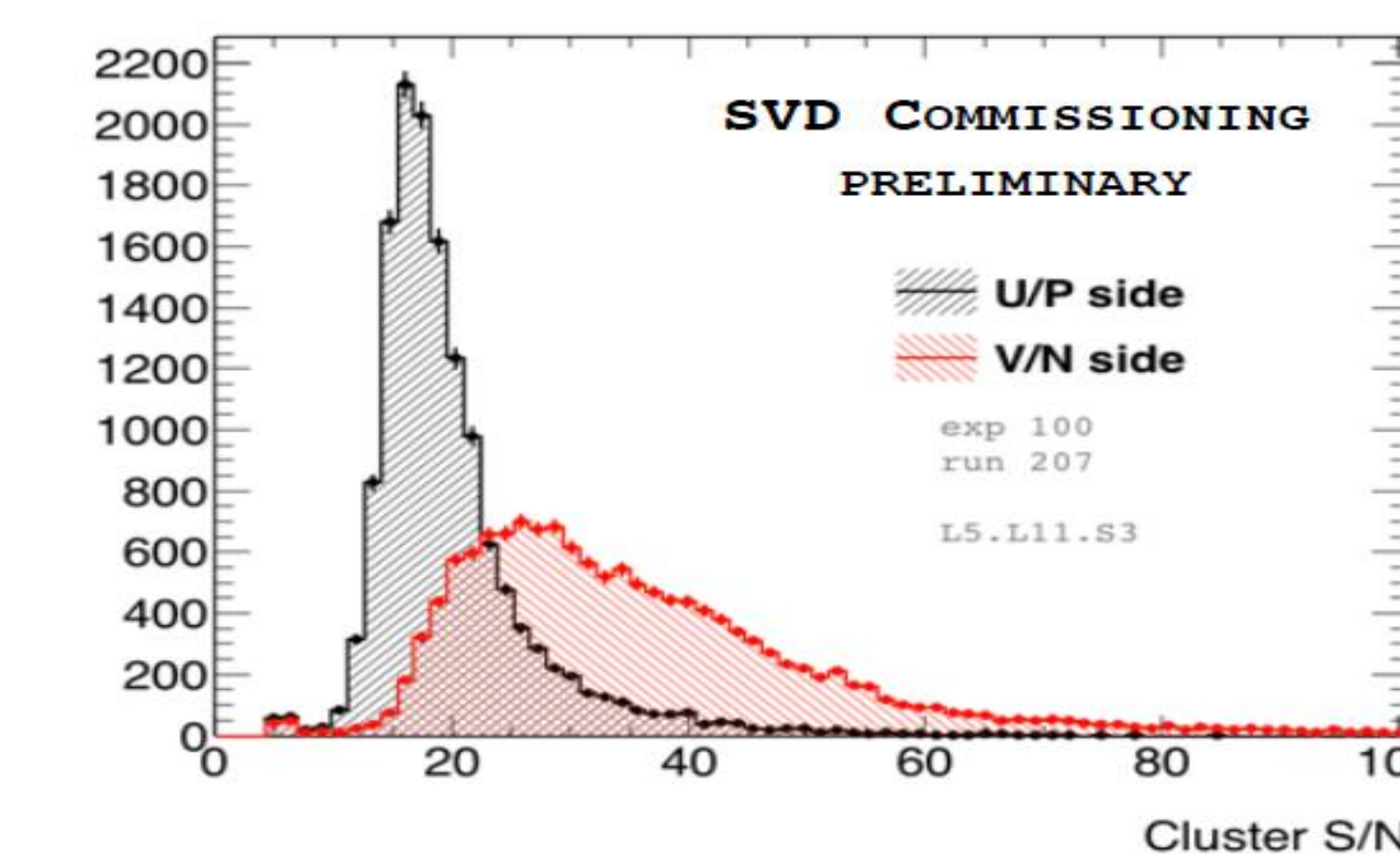
##### Cluster Energy vs. Azimuthal Angle



- 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).

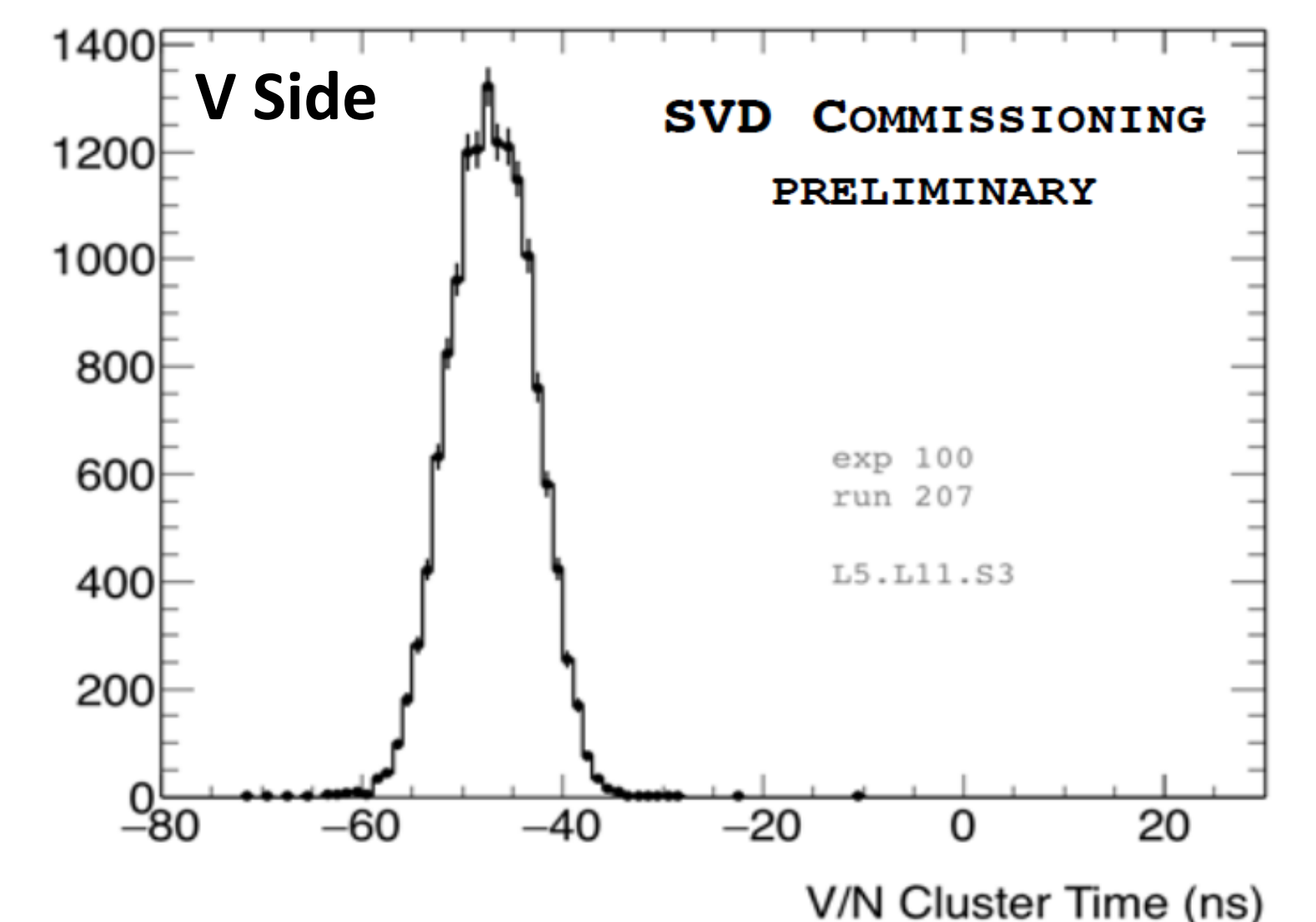
Cosmic rays incident at large angle on vertical sensors as compared to horizontal sensors.  
➔ Relatively high energy deposited in vertical sensors.

#### Cluster Signal to Noise Ratio



The S/N ratio is larger than 25 for N side, slightly lower on P side due to the longer strips and larger capacitance load to the preamplifier.

#### 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.
- 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

