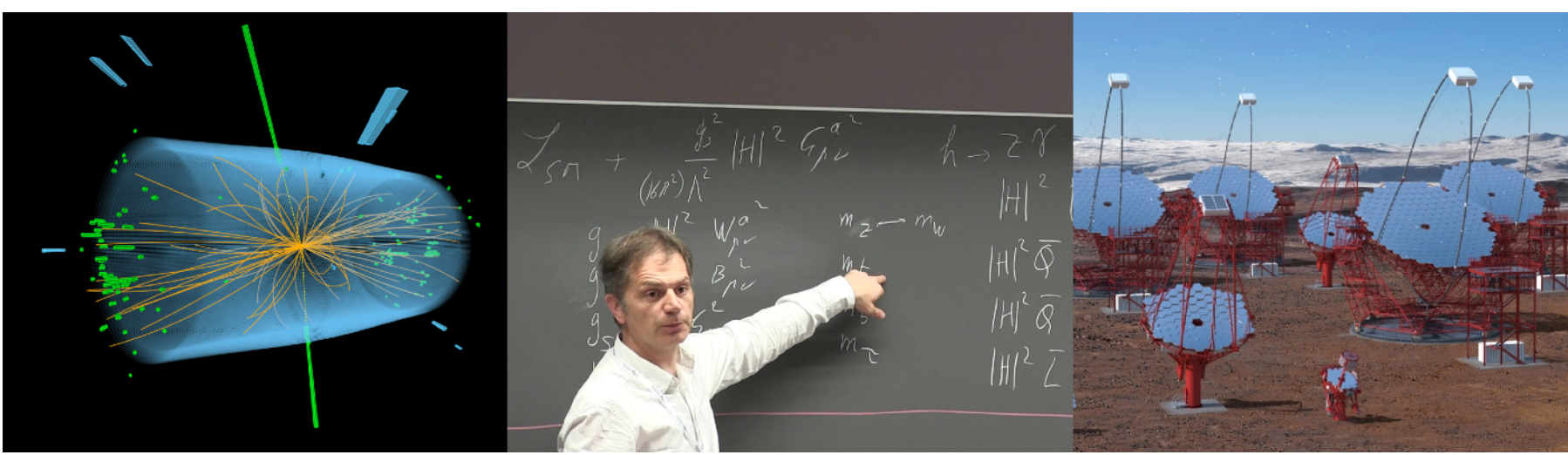


Belle II @ DESY

Hua YE

On behalf of the DESY Belle II Group

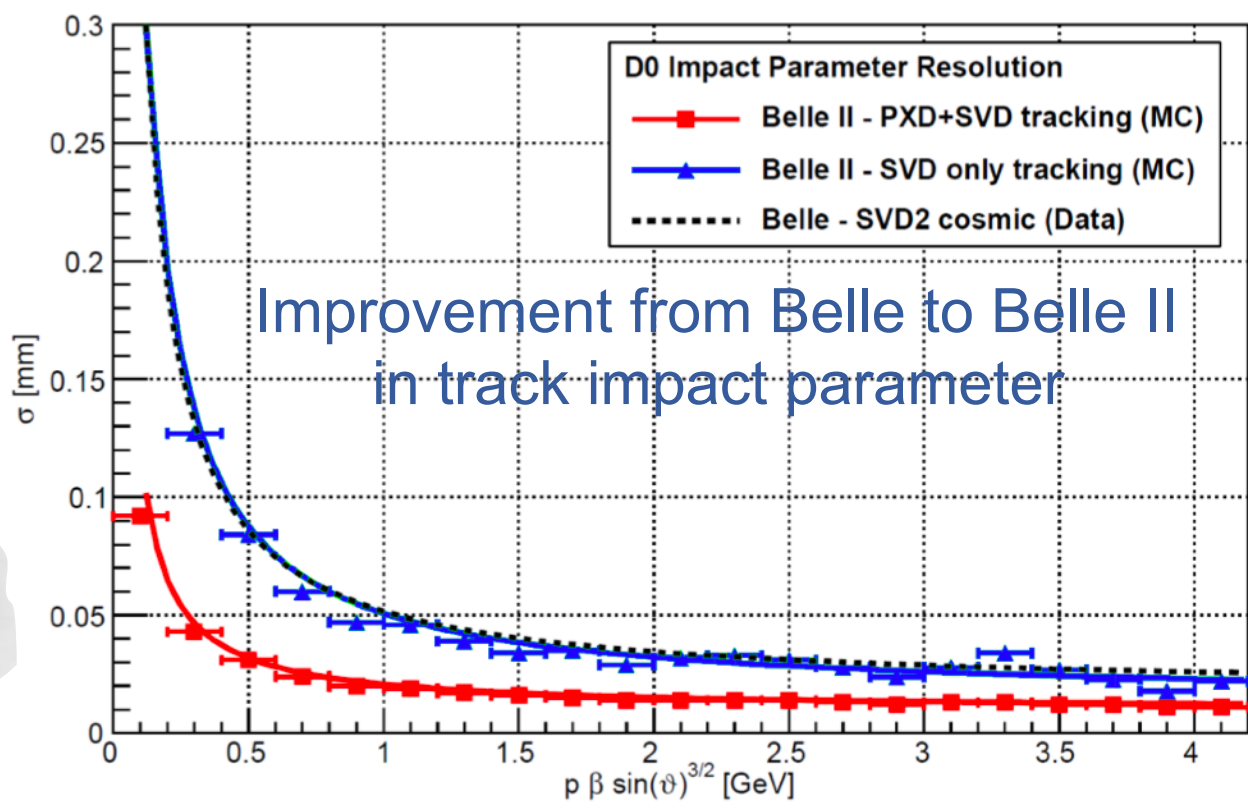
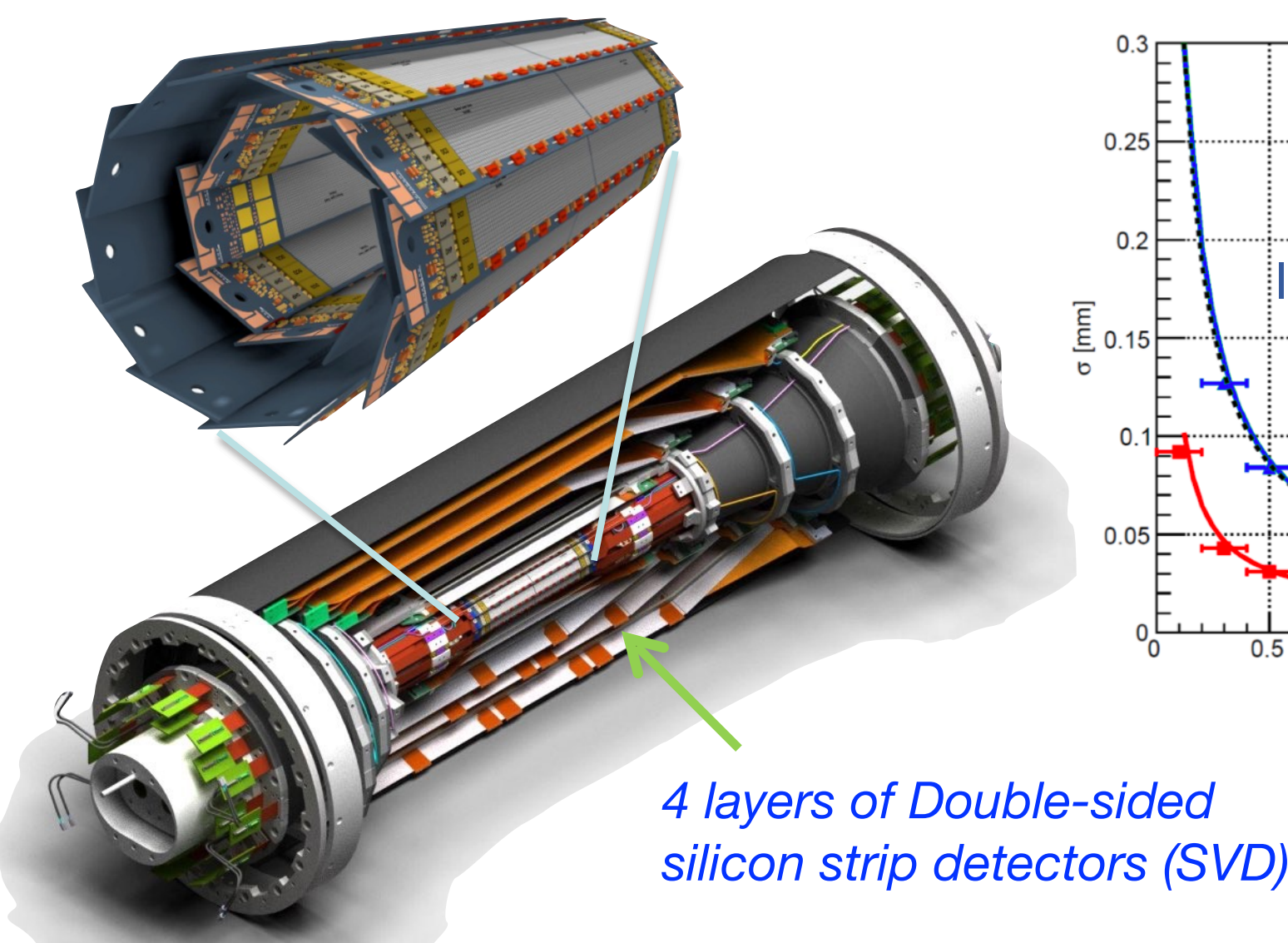
Matter and the Universe
Experimental/Theoretical/Astro Particle Physics



Belle II Vertex Detector

Increased beam background and reduced boost arising from SuperKEKB call for a upgraded vertex detector with a pixel detector at small radius.

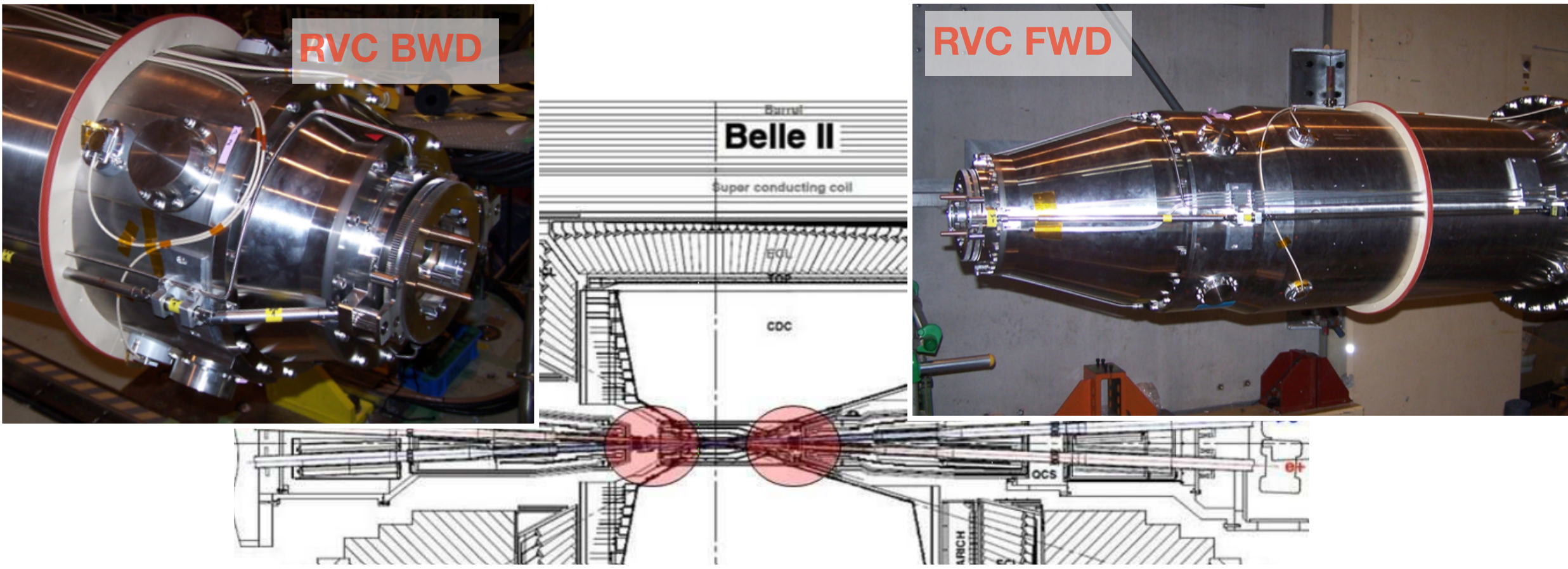
2 layers of DEPFET pixel detector (PXD)



Remote Vacuum Connection

Crucial interface between SuperKEKB and Belle II

- ❖ Limited space between VXD and the final focusing magnets (QCS) requires a remotely actuated vacuum coupling joint - Remote Vacuum Connection, which is designed and built by the DESY group.
- ❖ In Jan.2018, RVC closed the QCS to the central beam pipe.

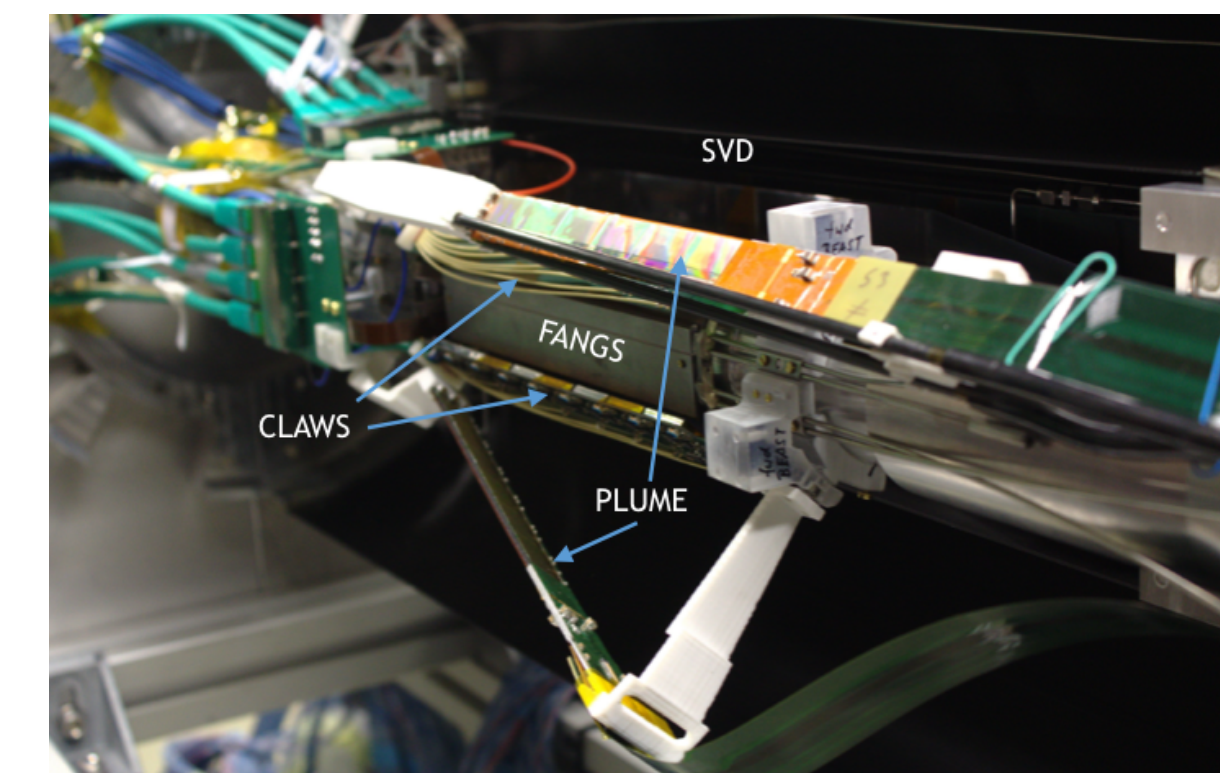


BEAST II Campaign

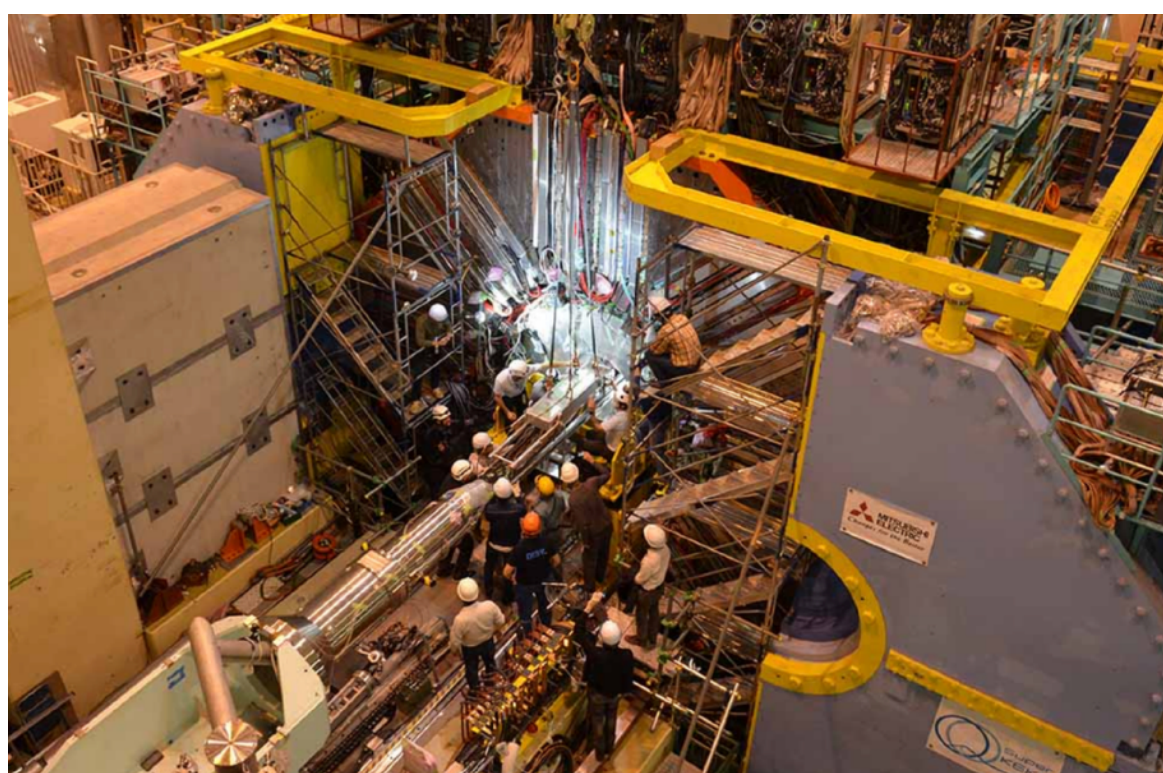
To further study the beam background, the Beam Exorcism for A STable experiment (BEAST II) with partial Belle II VXD has started.

- Goal for BEAST II Phase II
- ❖ Machine commissioning and tuning.
 - ❖ The target luminosity is $1 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$.
 - ❖ Ensure radiation safe environment for VXD operation.

- BEAST II VXD:
- ❖ 4 PXD modules and 4 SVD ladders
 - ❖ Dedicated radiation monitors: FANGS, CLAWS and PLUME



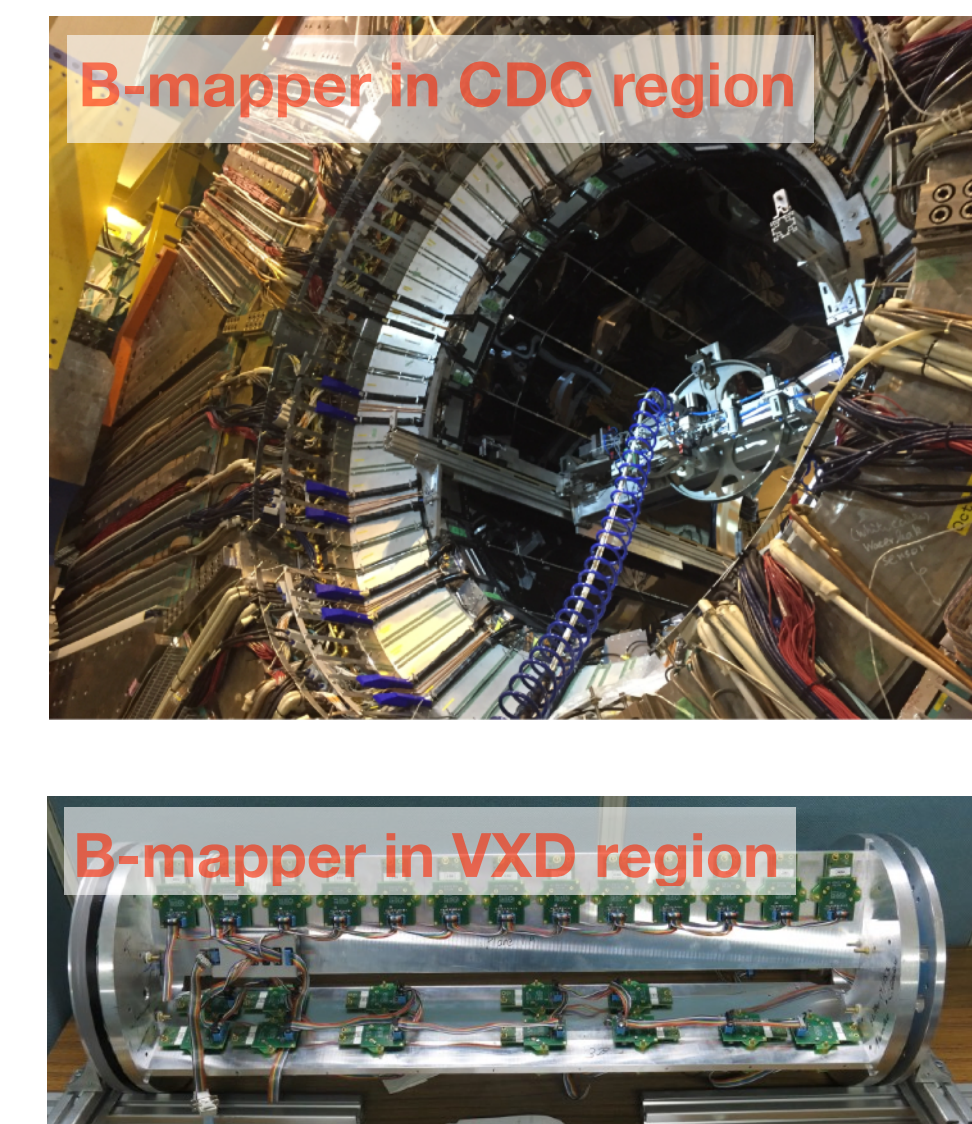
Integration Campaign @ DESY



BEAST II VXD was successfully installed in Nov. 2017 @ KEK

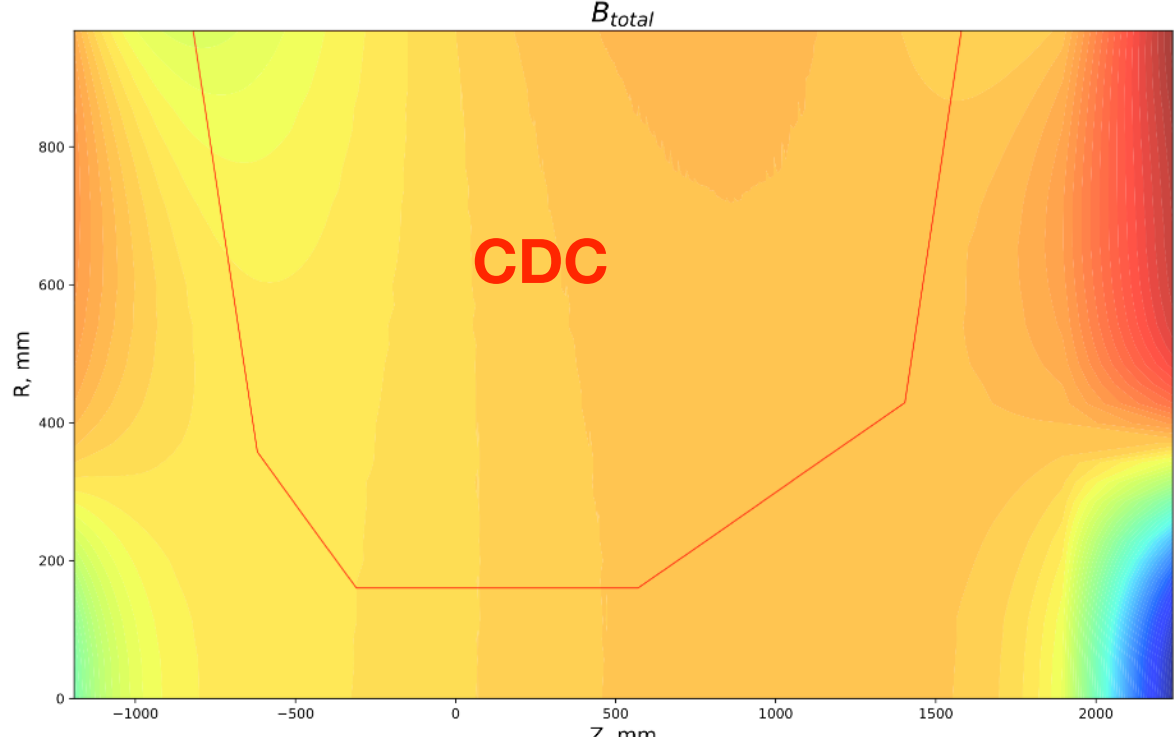
B-field Measurement

Measure the magnetic field in tracking and vertexing regions, to achieve accuracy of better than 0.1%.



The magnetic field was mapped in 2 different stages:

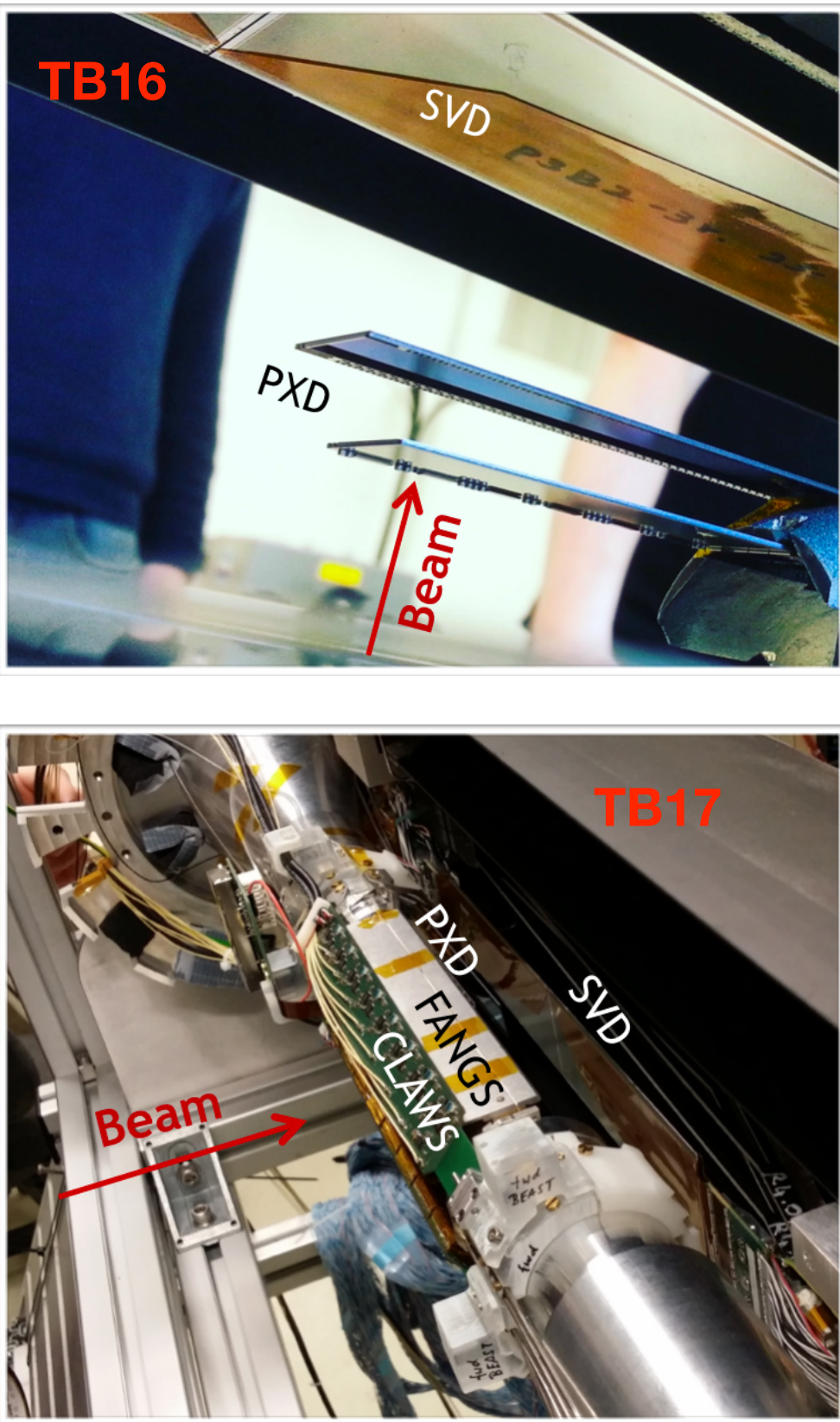
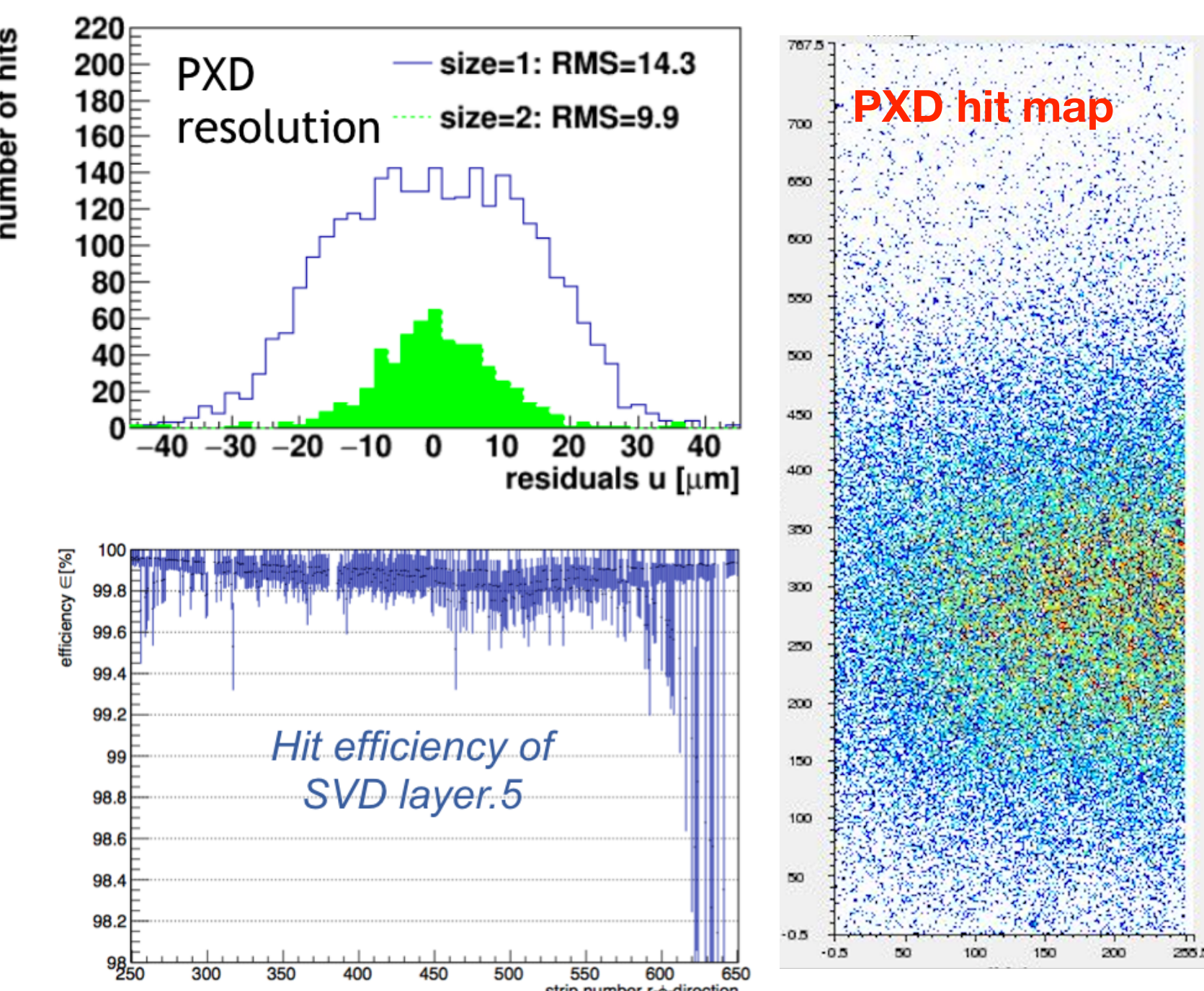
- ❖ Measurement in the entire tracking volume (without QCS)
- ❖ Measurement in VXD region and near QCS



Test beams @ DESY

Detailed characterization of the Belle II VXD modules

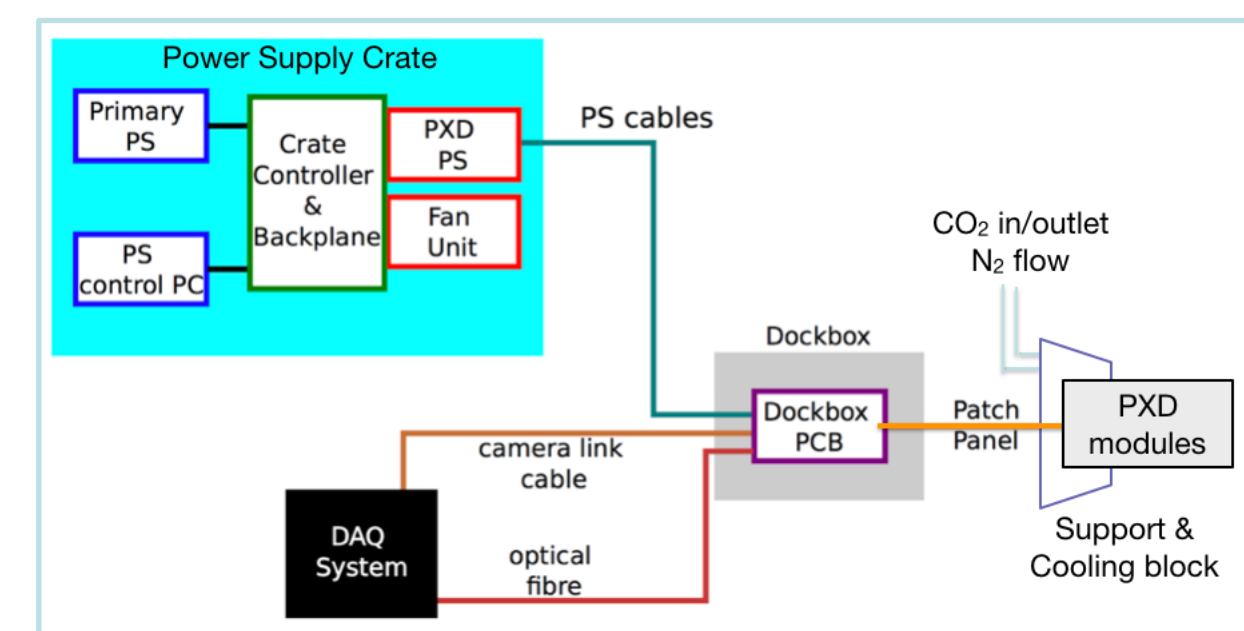
- ❖ VXD performance was tested using (up to) 6 GeV e^- in solenoidal magnetic field up to 1T in 2016 and 2017.
- ❖ Complete VXD readout chain and service: High level trigger, region of interest selection, CO₂ cooling, slow control, environmental monitoring.



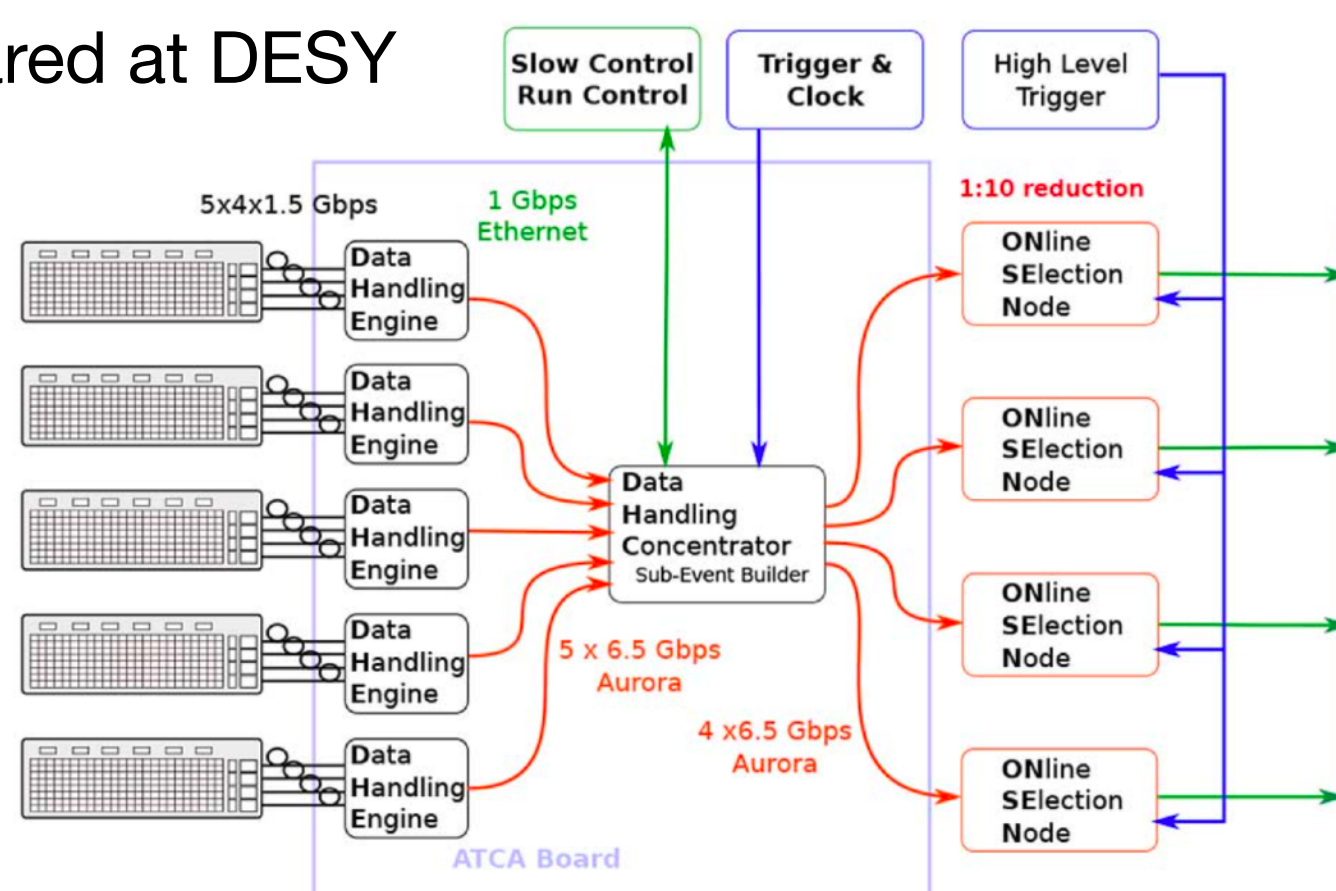
PXD Commissioning and Integration

The full PXD system will be integrated and thoroughly tested at DESY before being shipped to KEK.

- ❖ The DAQ/electronics and services are prepared at DESY



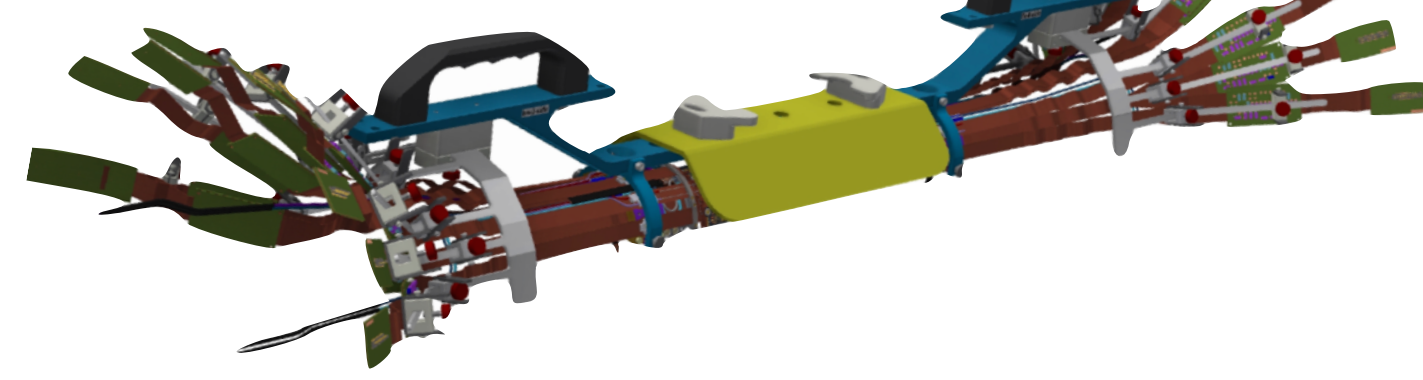
Services for PXD, i.e. power supply, cooling etc.



Data readout chain of PXD

- ❖ Half-shell Mounting & Commissioning

Half-shell grabbing tool



VXD Thermal mock-up

Verify the thermal and mechanical performance of VXD and 2-phase CO₂ cooling system.

- ❖ The temperature on sensors and ASICs need to be well controlled for Signal-to-noise ratio improvement, an optimal CO₂ temperature of -30°C has been established.
- ❖ Power consumption: PXD 420W, SVD 700W, together with the heat load through 9m of vacuum isolated flex lines, required a cooling capacity of 2-3kW.
- ❖ VXD needs to be thermally isolated against the Central Drift Chamber and the beam pipe.

