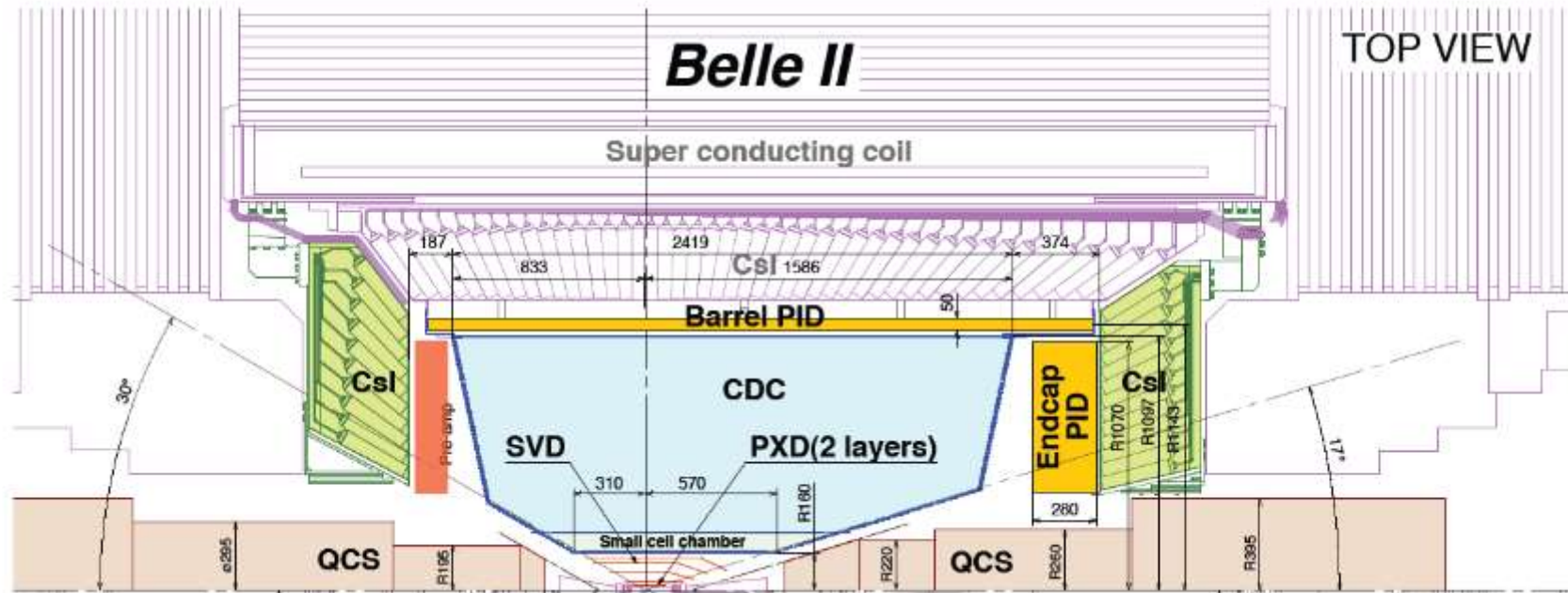# Status of CDC

Shoji Uno (KEK)

JENNIFER general meeting

2018.10.30

Paris

Belle-II CDC

Belle II CDC vs. Belle CDC

- **Larger outer radius thanks to a compact BPID**
- **Larger inner radius to make SVD space more and to avoid high radiation region**
- Conical endplates were machined to meet final focusing magnets.
- A small cell chamber was installed as same as the Belle CDC.
- **New compact electronics is located near backward end plate.**
- **3D charged trigger scheme is adapted.**

2

Wire Configuration

Superlayer Type and No.	No. of layers	Signal cells Per layer	Radius (mm)	Stereo angle (mrad)
Axial 1	8	160	168.0 – 238.0	0.
Stereo U2	6	160	257.0 – 348.0	68.1 – 69.3
Axial 3	6	192	365.2 – 455.7	0.
Stereo V4	6	224	476.9 – 566.9	-55.3 – -64.3
Axial 5	6	256	584.1 – 674.1	0.
Stereo U6	6	288	695.3 – 785.3	63.1 – 70.0
Axial 7	6	320	802.5 – 892.5	0.
Stereo V8	6	352	913.7 – 1003.7	-68.5 – -74.0
Axial 9	6	384	1020.0 – 1111.4	0.

Belle II CDC   Small cell chamber

A   U   A   V   A   U   A   V   A
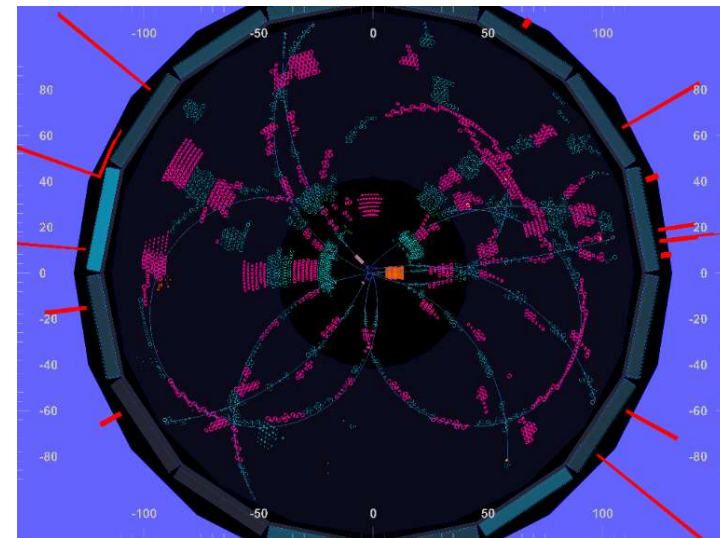
250 mm

1200 mm

3
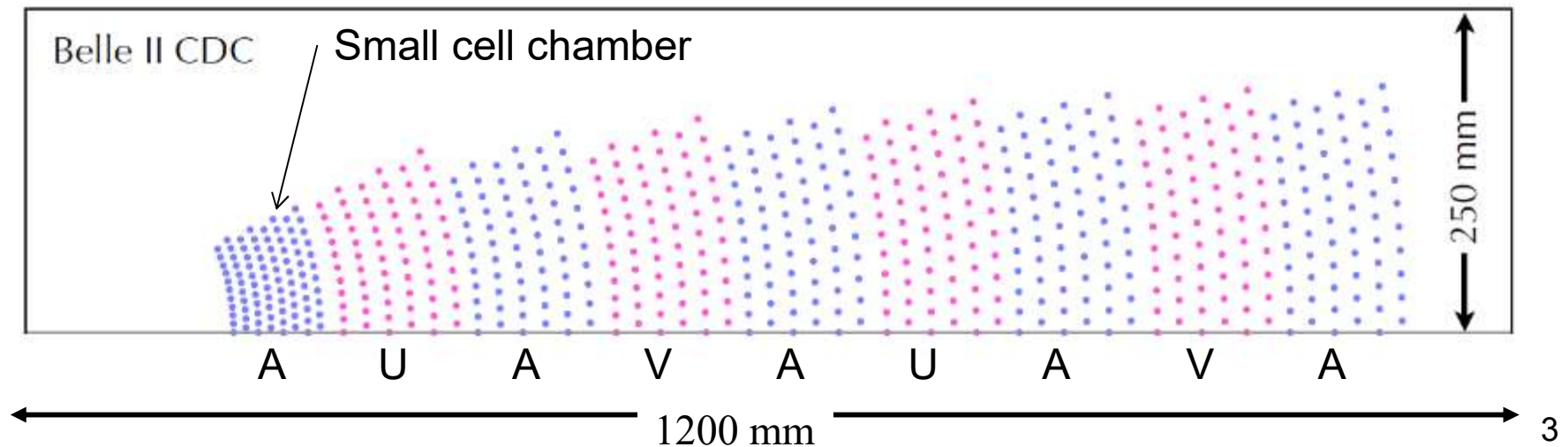
First collision Events

CDC is basically working.
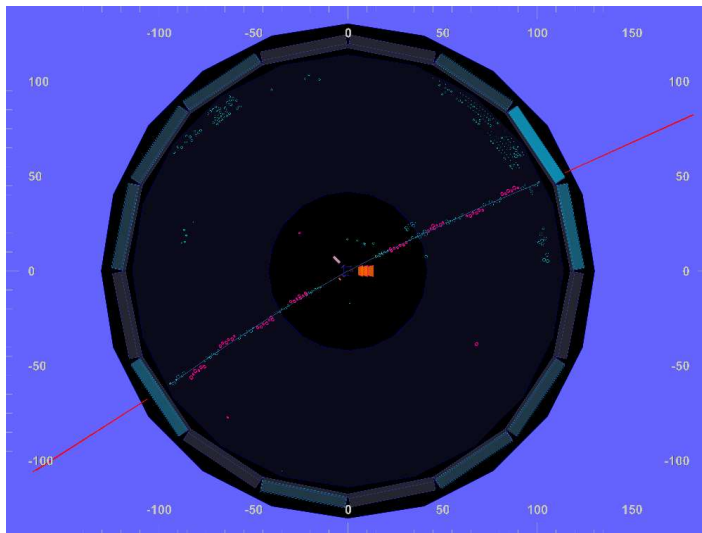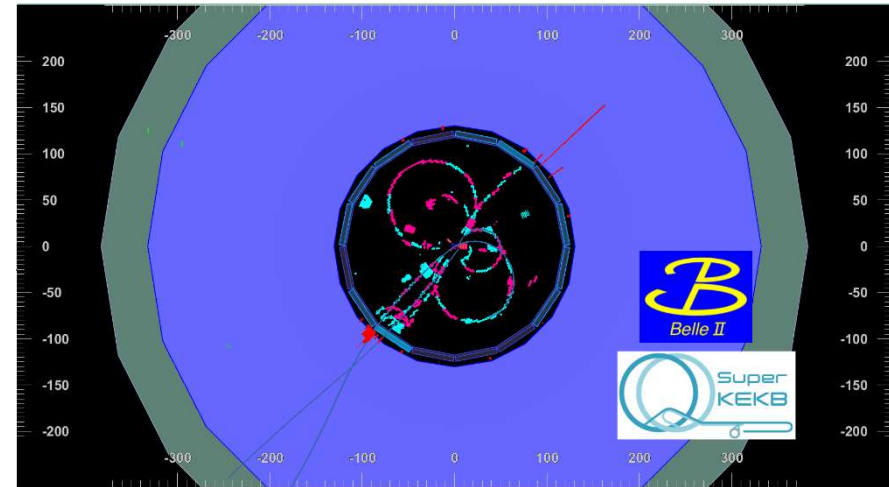
Bhabha event

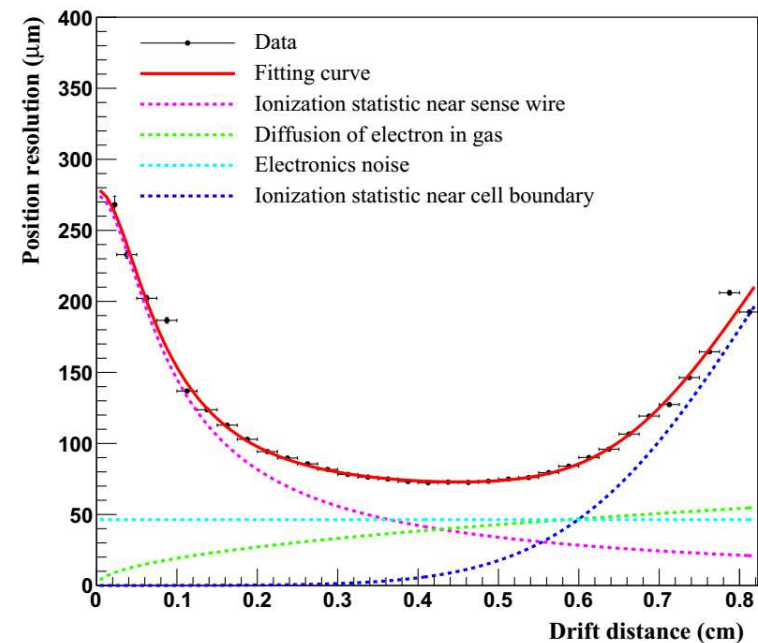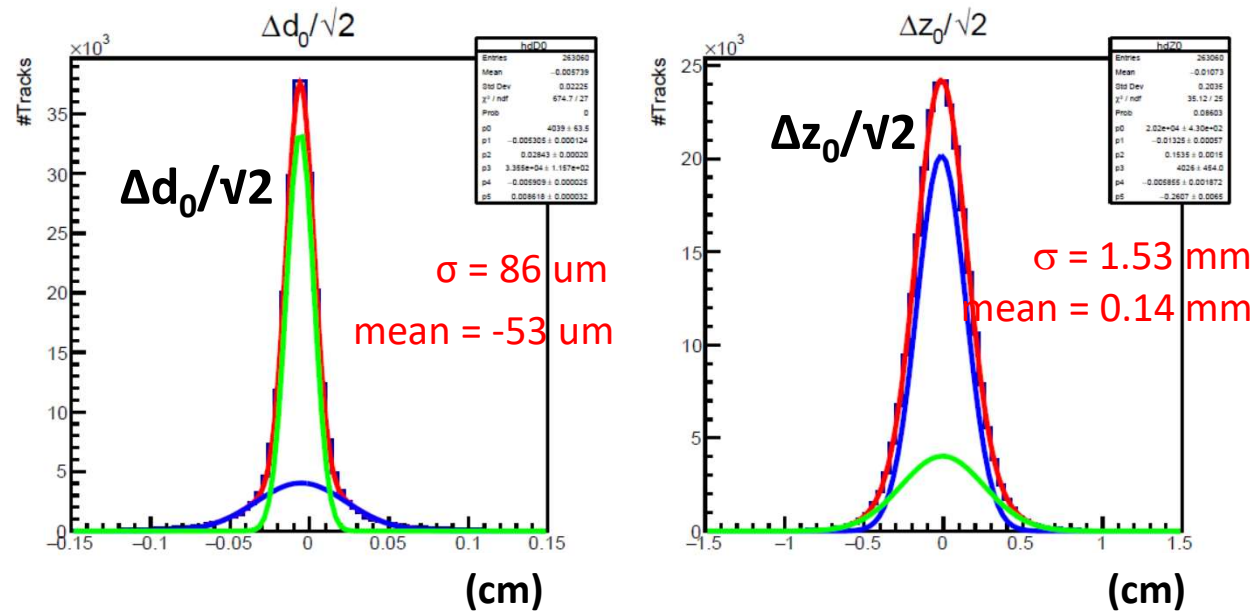B$\overline{\text{B}}$ like event

4

Calibration and Alignment

- Calibration was done.
    - T0, time walk, Propagation velocity
    - xt function   (56 layers, 7 θ bins, 18 α bins, left-right),
  – Position resolution

- Alignment was done.
  – Using cosmic ray
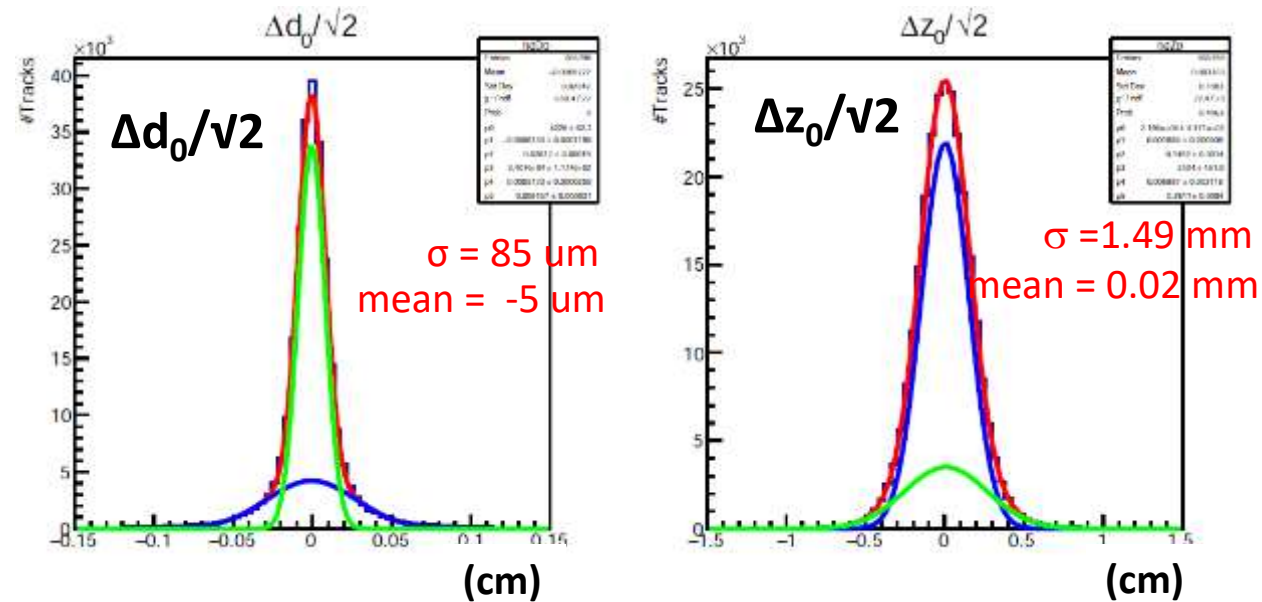   without magnetic field.

d_0 and z_0 resolutions

Before alignment

$\Delta d_0/\sqrt{2}$

σ = 86 um
mean = -53 um

$\Delta z_0/\sqrt{2}$

σ = 1.53 mm
mean = 0.14 mm

After alignment

$\Delta d_0/\sqrt{2}$

σ = 85 um
mean = -5 um

$\Delta z_0/\sqrt{2}$

σ = 1.49 mm
mean = 0.02 mm

P$_t$ resolution

$$\frac{\sigma_{P_t}}{P_t} = \left(\frac{\sigma_{P_t}}{P_t}\right)_{\text{meas}} \oplus \left(\frac{\sigma_{P_t}}{P_t}\right)_{\text{MS}}$$

$$\left(\frac{\sigma_{P_t}}{P_t}\right)_{\text{meas}} = \frac{P_t \sigma_{r\phi}}{0.3\, L^2 B} \sqrt{\frac{720}{N+4}}$$

$$\left(\frac{\sigma_{P_t}}{P_t}\right)_{\text{MS}} = \frac{0.05}{L B \beta} \sqrt{1.43 \frac{L}{X_0}} \left[1 + 0.038 \ln \frac{L}{X_0}\right]$$

$\sigma_{r\phi}$: position resolution
B: magnetic field (1.5 T).
X_o: radiation length.
L: lever arm.
N: number of measurement point

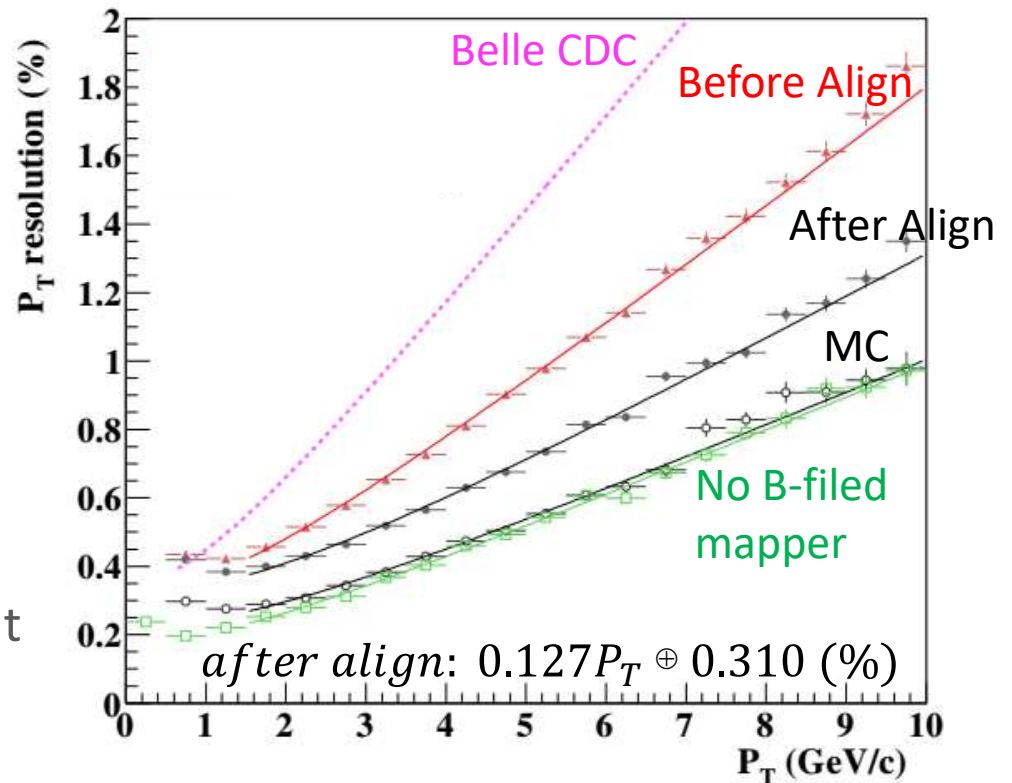$$\frac{\sigma_{Pt}}{Pt} = \sqrt{(aP_t)^2 + b^2}$$

Belle → Belle II

L: 77.5 → 94.84 cm
N: 50 → 56
Belle CDC only: $0.28 P_t \oplus 0.35$ (%)
=> Estimate for Belle II : $0.19 Pt \oplus 0.32 (\%)$
    Obtained :   : $0.127 P_t \oplus 0.310 (\%)$
                          P_T (GeV/c)

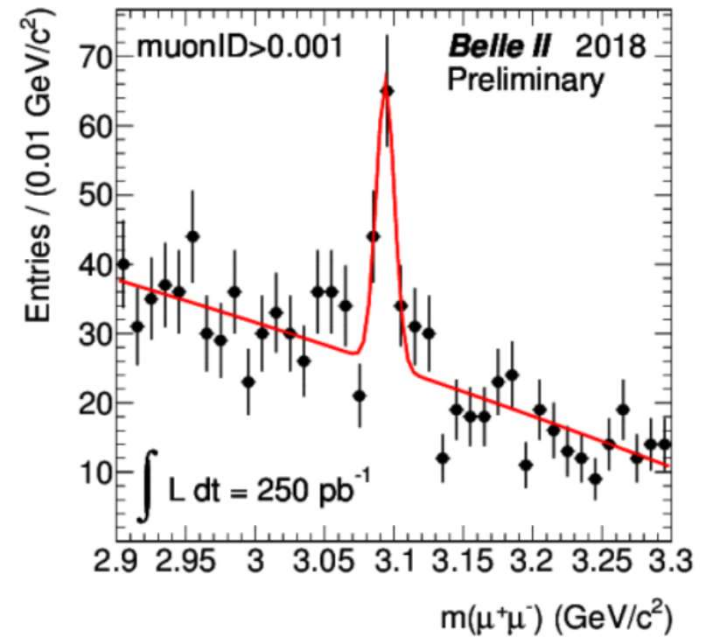*after align*: $0.127 P_T \oplus 0.310$ (%)

- P$_T$ resolution is much improved compare with Belle CDC.
- Much better than the expectation (extrapolation from Belle CDC)
- Observed constant term is not improved as expected because of the multiple scattering on the B-field mapper
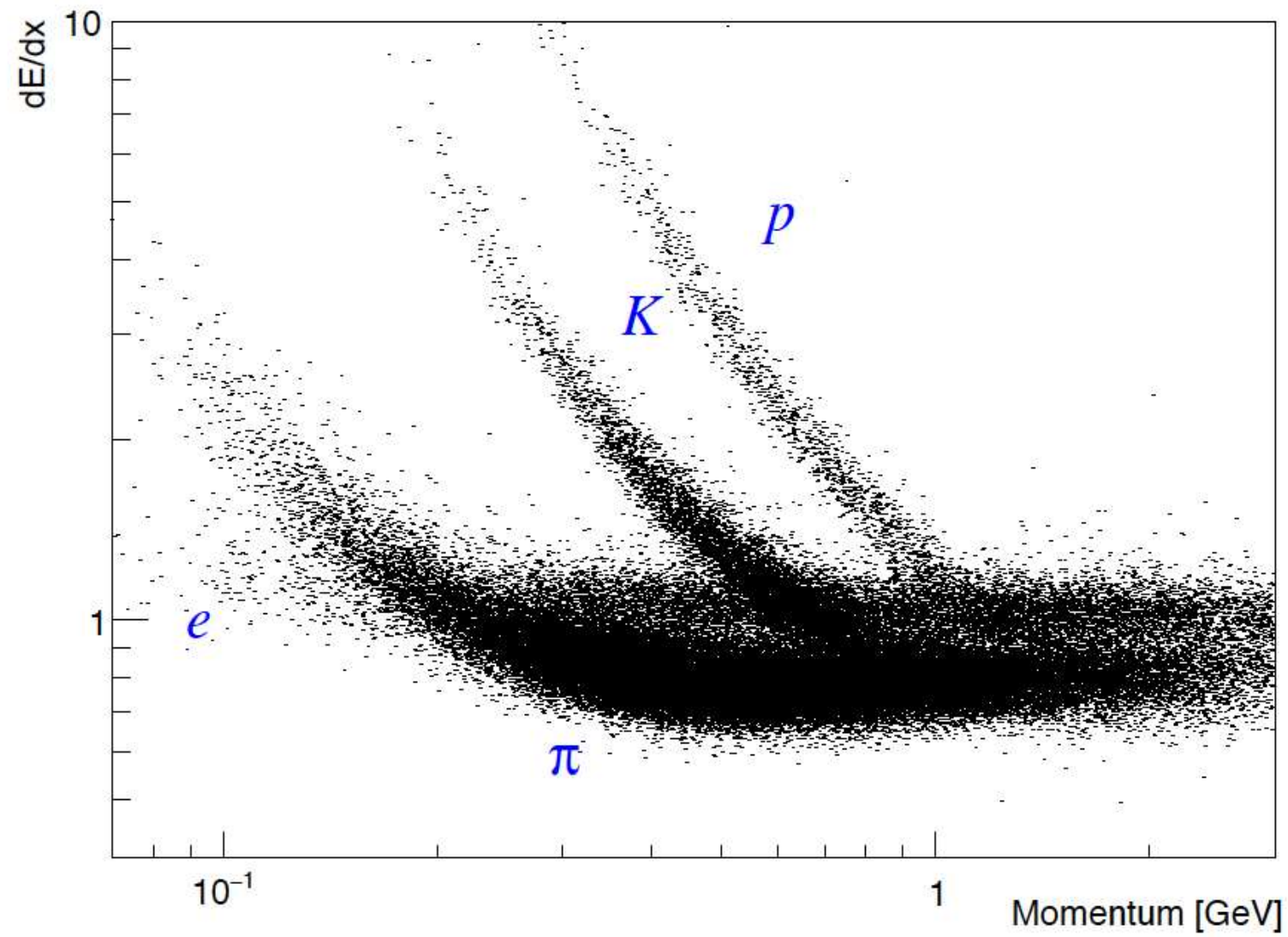
7

Mass peaks for charged tracks
for Phase 2 data

$J/\psi \rightarrow \mu^+\mu^-$

$K_s^0 \rightarrow \pi^+\pi^-$
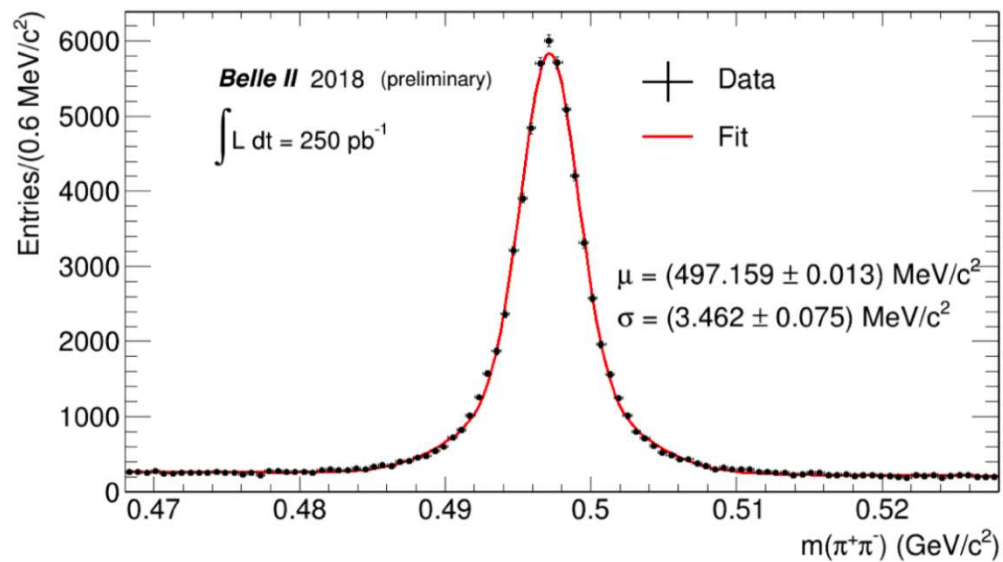
Phase 2 dE/dx performance

R. Briere et al.

Summary

- CDC is basically working.
  - Reasonable performances were obtained for the momentum and energy loss measurements.
    - Initial calibration and alignment were done.
  - The track parameter is provided to other subdetectors.

- Further calibration and alignment are necessary to obtain the designed performance.

Backup