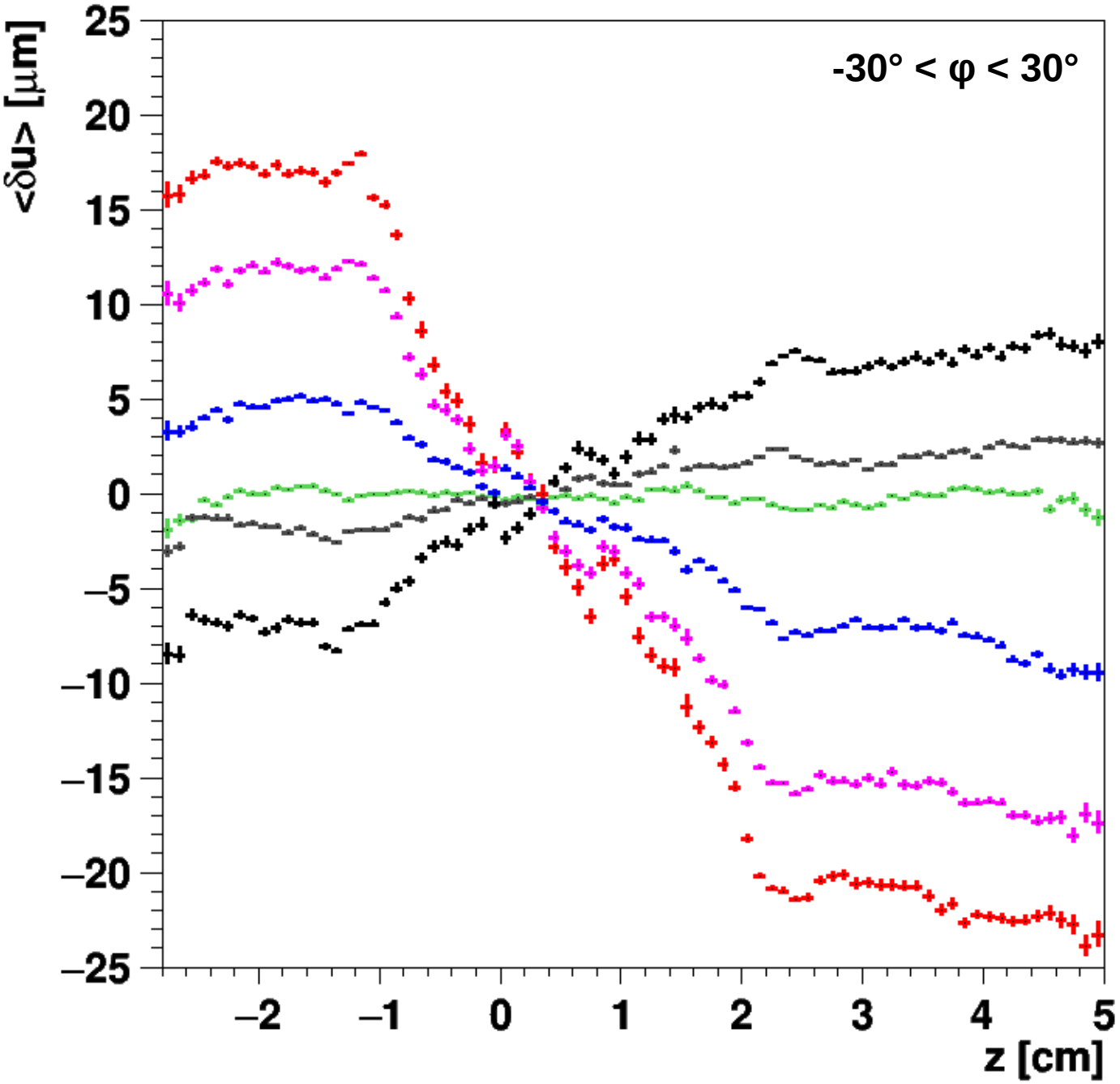
recent PXD performance raw and mdst

Daniel Pitzl, DESY

Belle II PXD workshop, 17.5.2022

- Mar 2022 earthquake
  - effect on raw data
  - effect on mdst?
- efficiency on raw and mdst
- hit resoltion from overlaps

PXD – SVD residuals on raw



- raw data:
  - my alignment for exp 24 run 813
  - PXD hits vs SVD tracks

16.3.2022 run 997

12.3.2022 run 926

5.3.2022 run 813

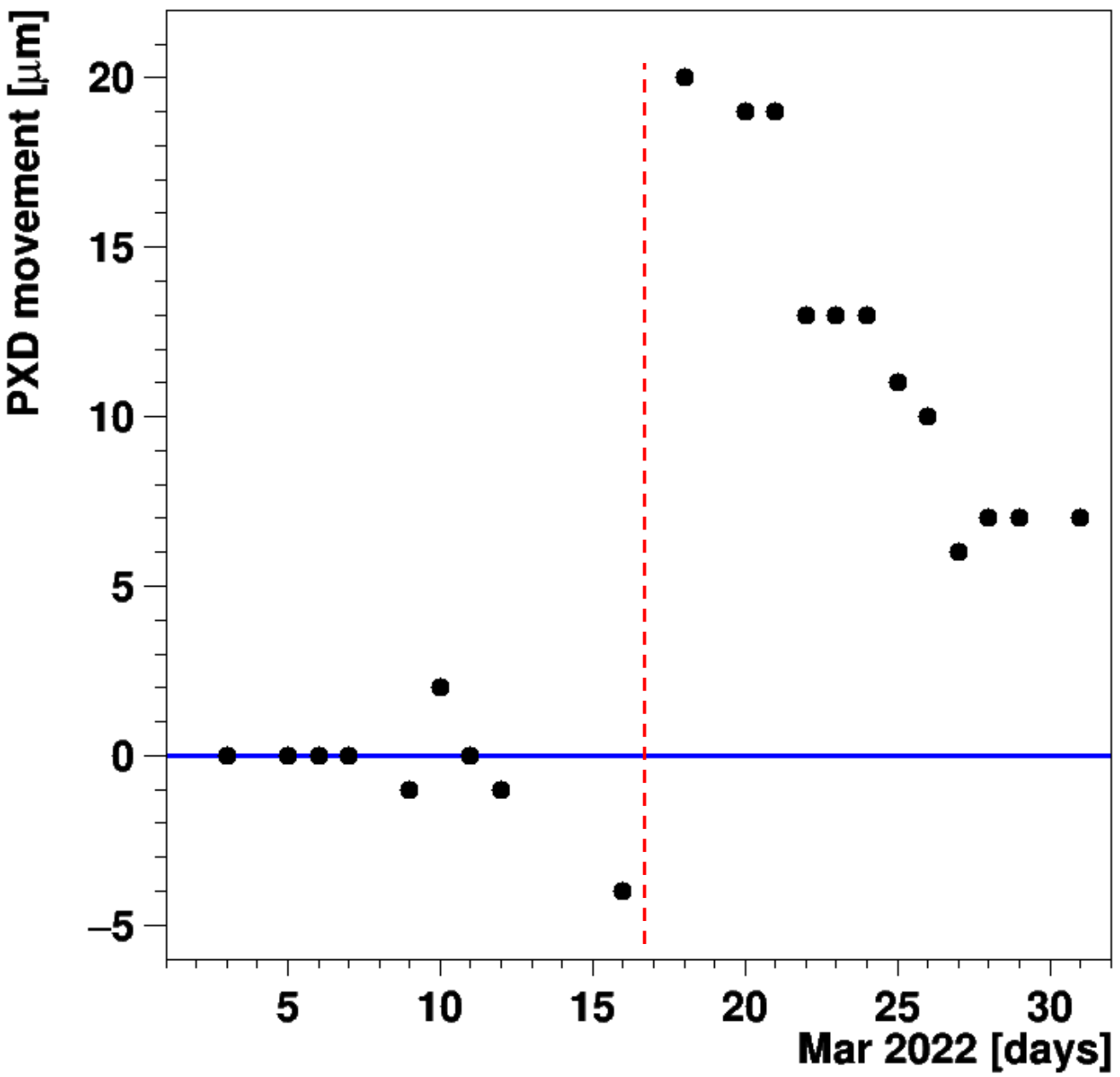
27.3.2022 run 1303

22.3.2022 run 1211

18.3.2022 run 1149

16.3. earth quake mag 7.3

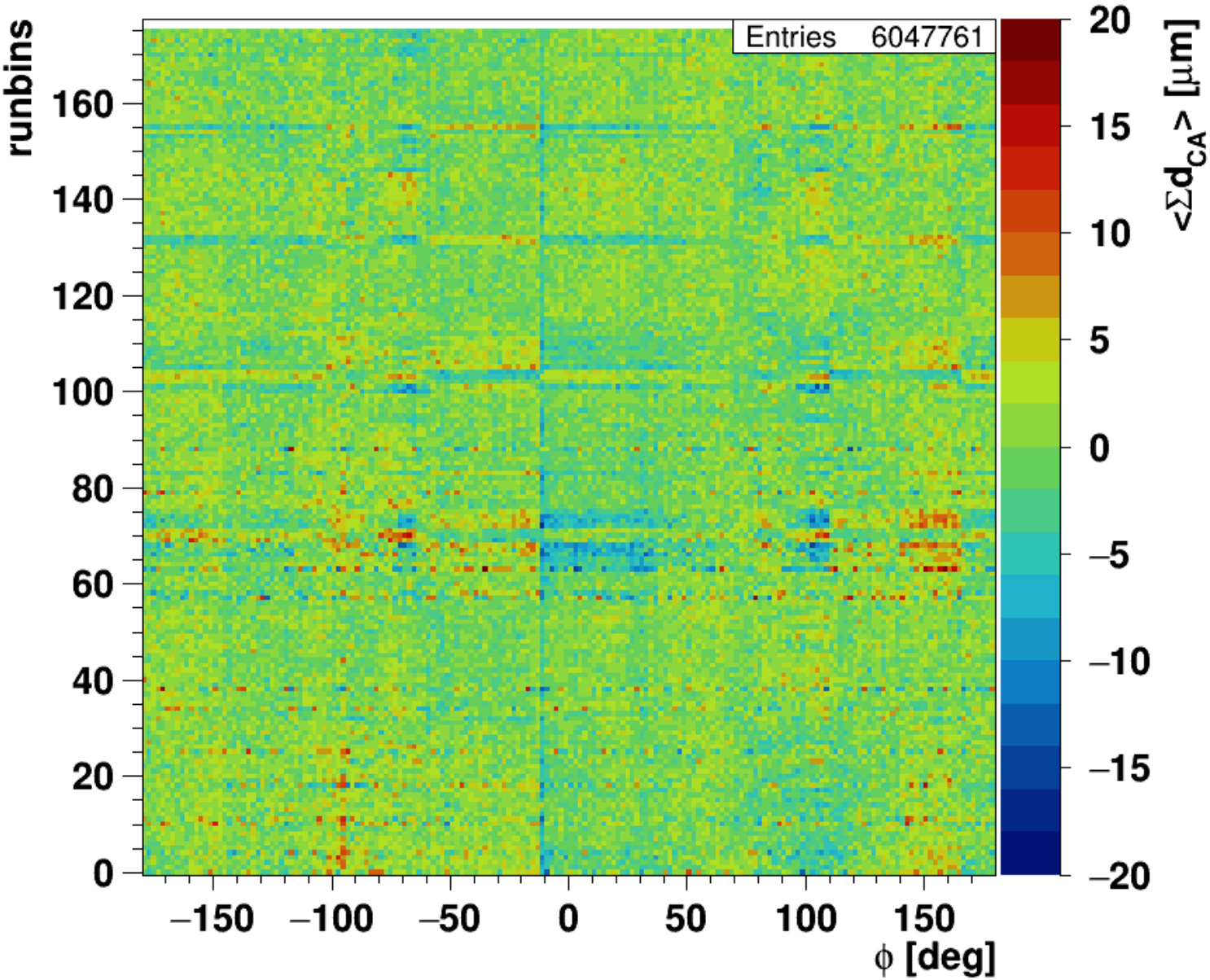
PXD vs time



- 5.3.2022 (run 813)
  - PXD alignment wrt SVD
- 16.3.2022
  - 7.3 earthquake
- 18.3.2022 (run 1149)
  - PXD moved
- 22.3.2022 (run 1211)
  - PXD rebound starts
- cured on mdst by time-dependent alignment?

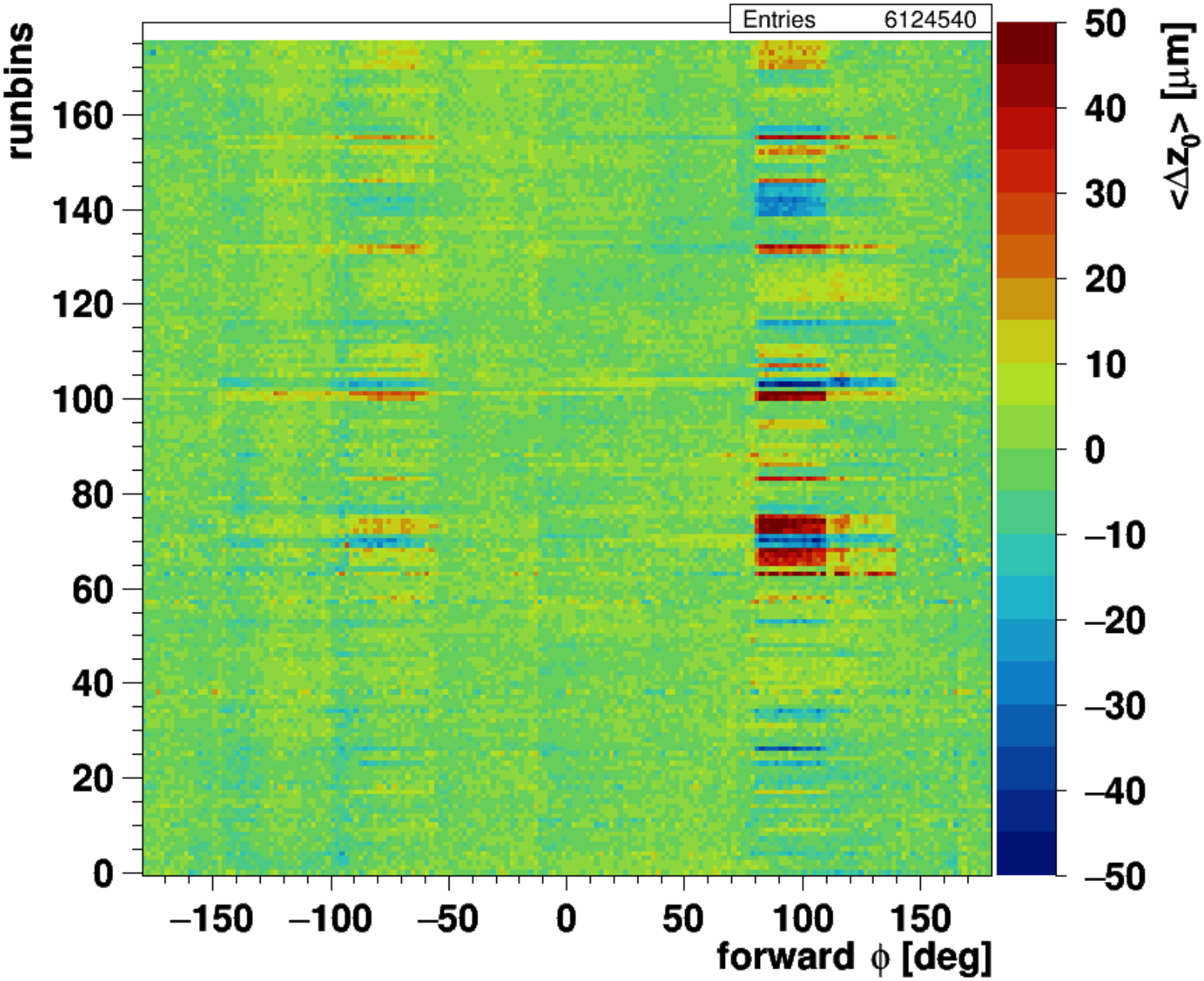
mdst: dca match

- high p track pairs on mdst:
  - Bhabhas and di-muons
  - buckets 30 and 31 (Mar 2022)
  - earthquake: runbin 61/62

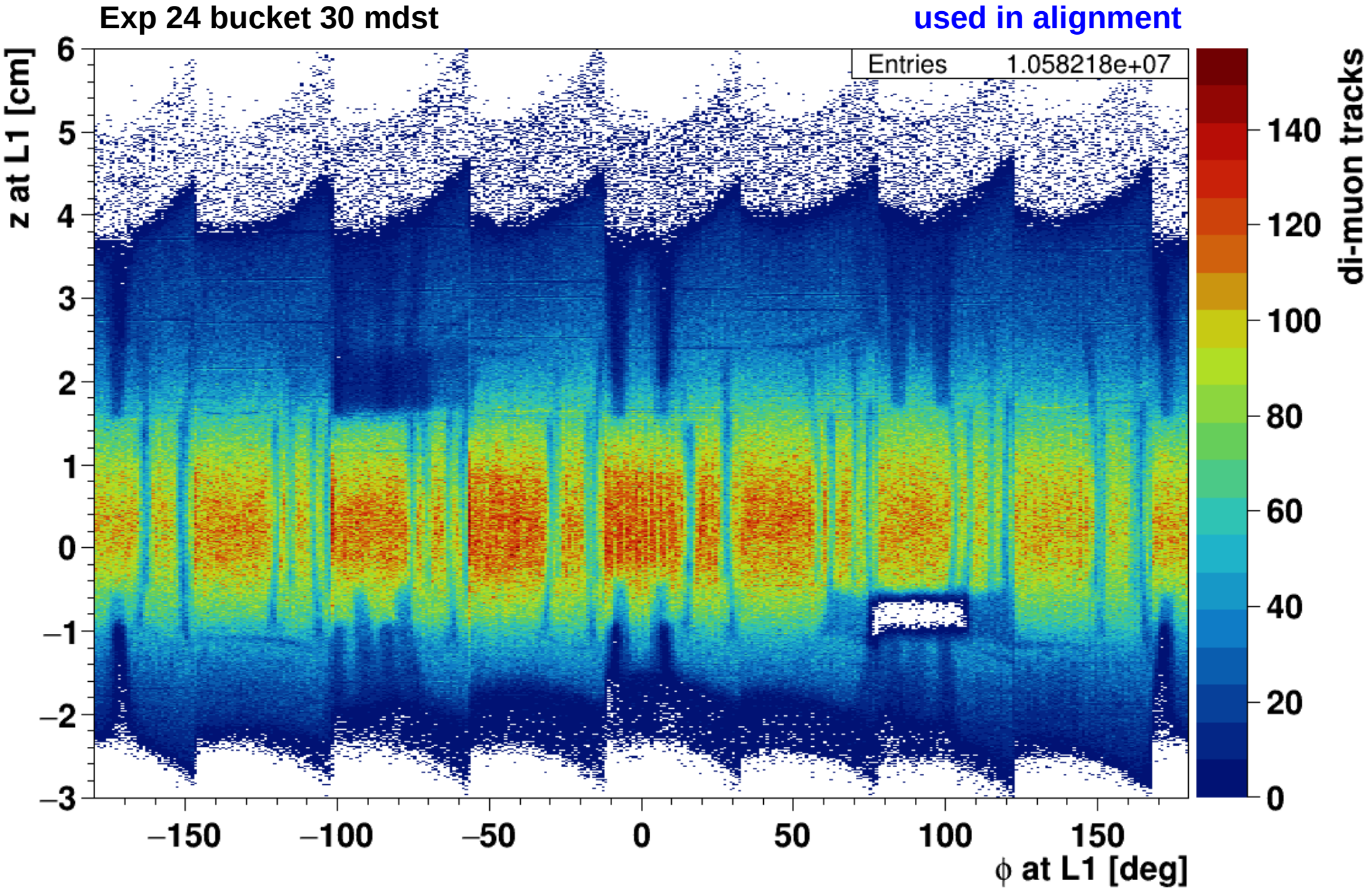


mdst: z0 match

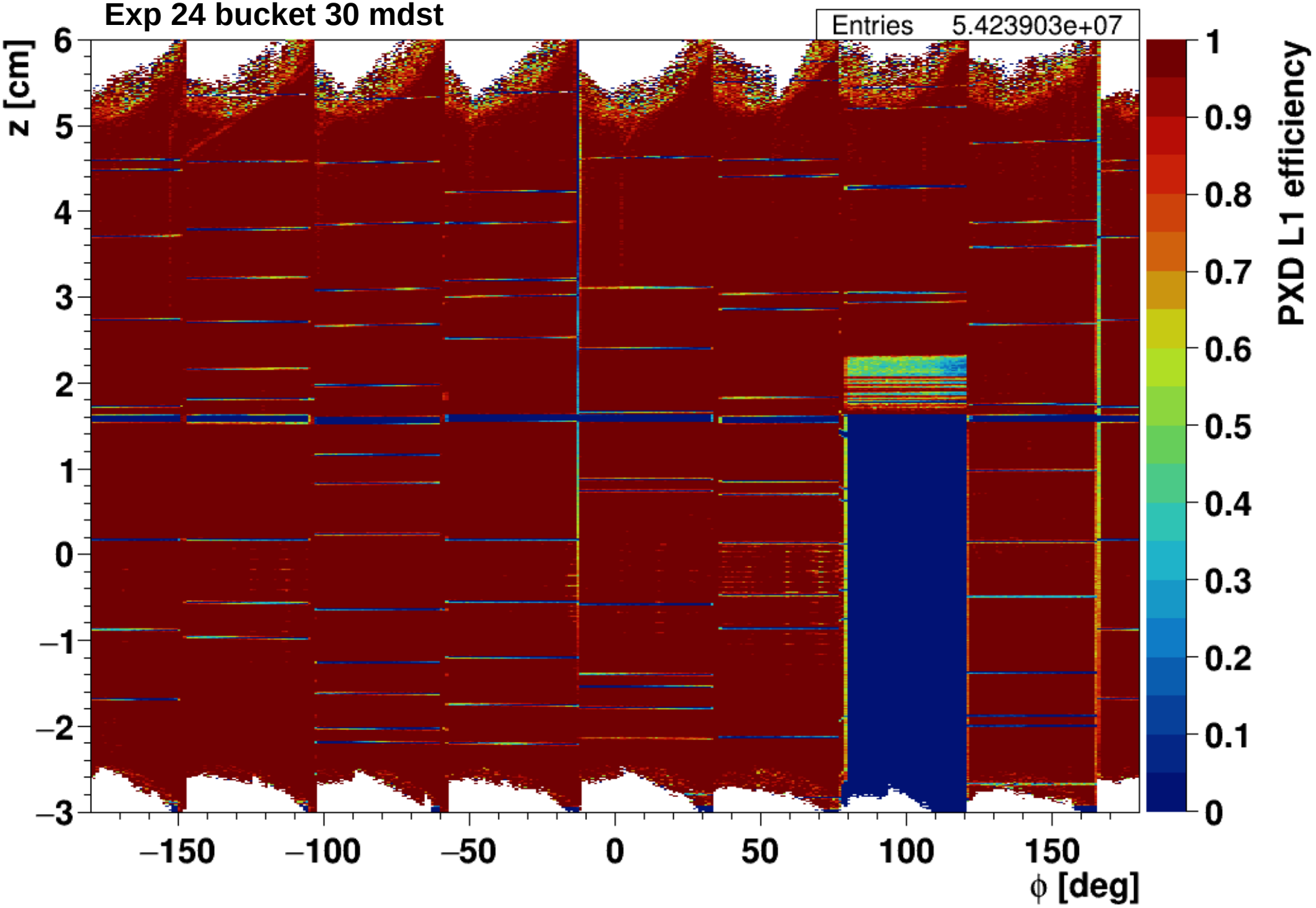
- high p track pairs on mdst:
  - Bhabhas and di-muons
  - buckets 30 and 31 (Mar 2022)
  - z_0 (mis)-match
  - earthquake: runbin 61/62
- PXD 1.3.1 affected after the earthquake
- periodic:
  - alignment blocks?



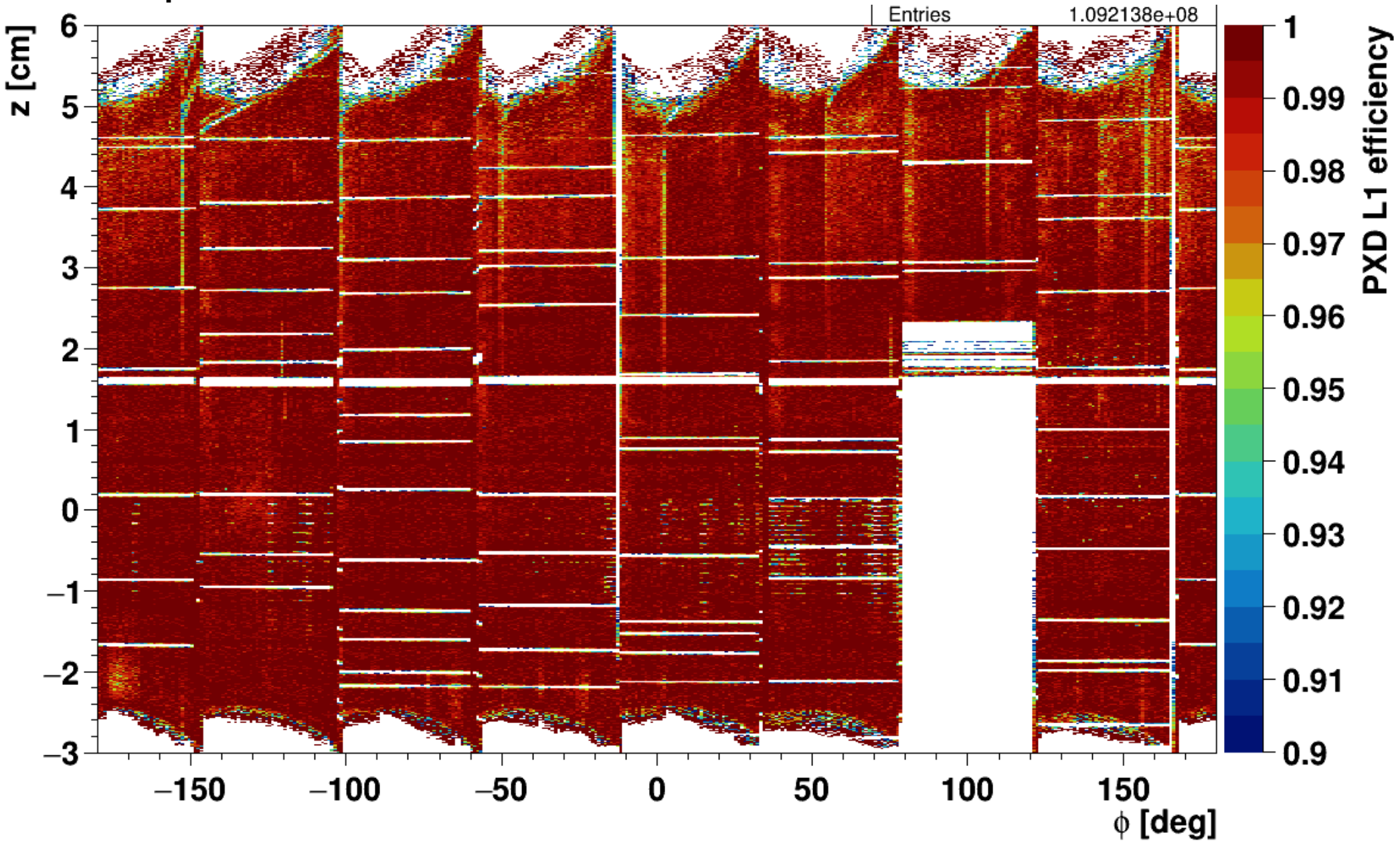
di-muons at PXD



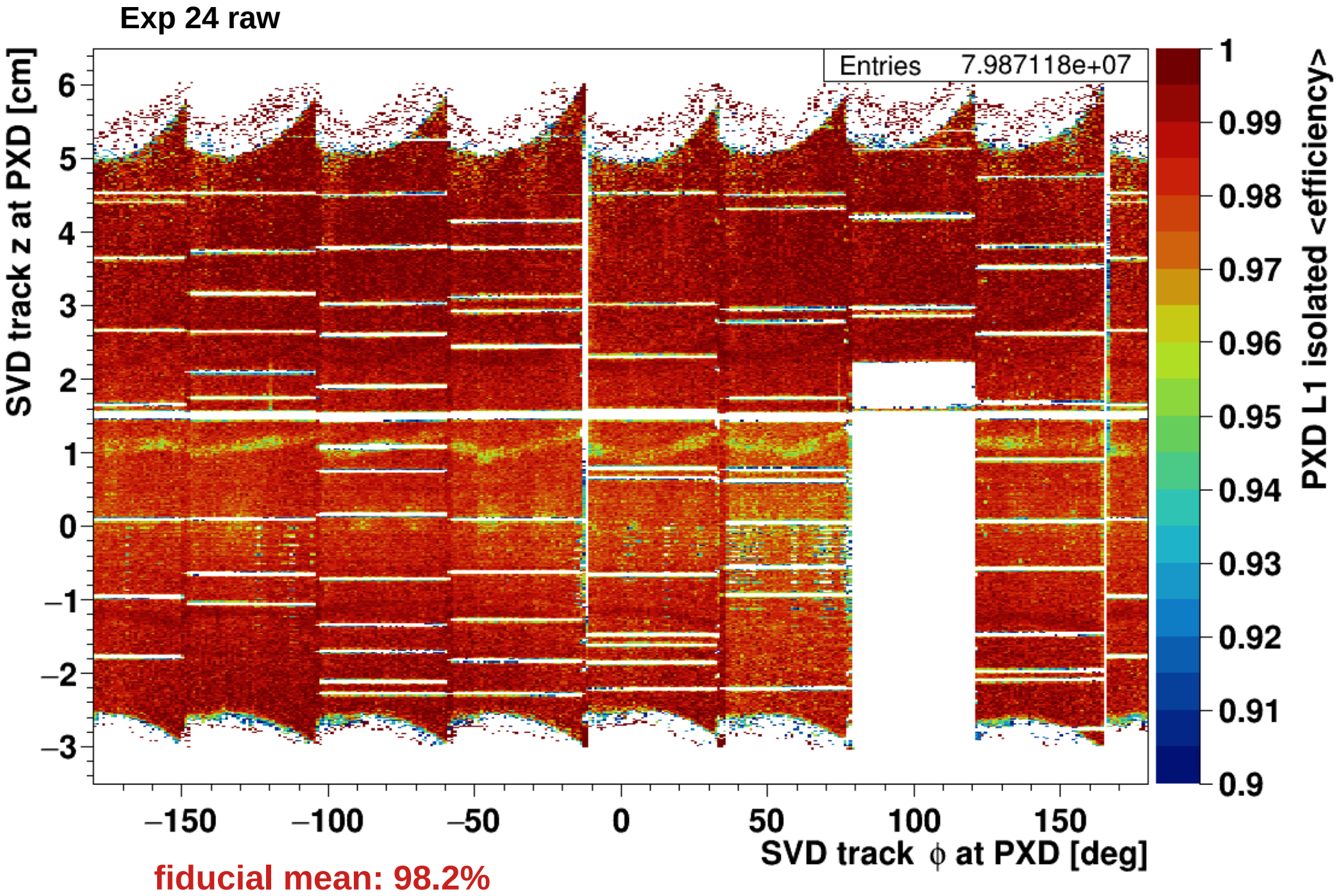
PXD L1 efficiency map on mdst



PXD L1 efficiency map on mdst



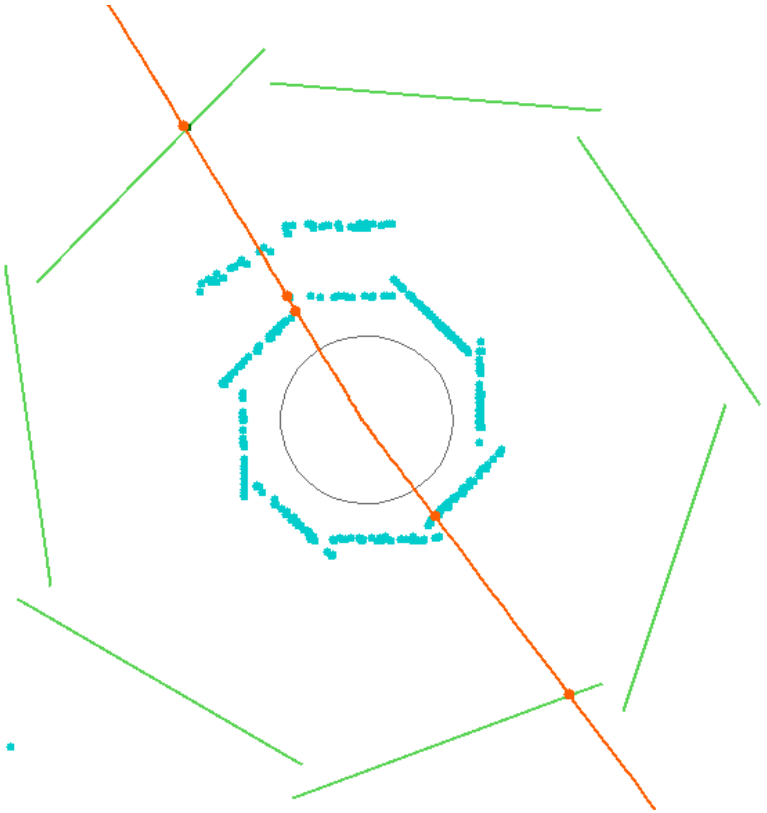
PXD L1 efficiency map on raw



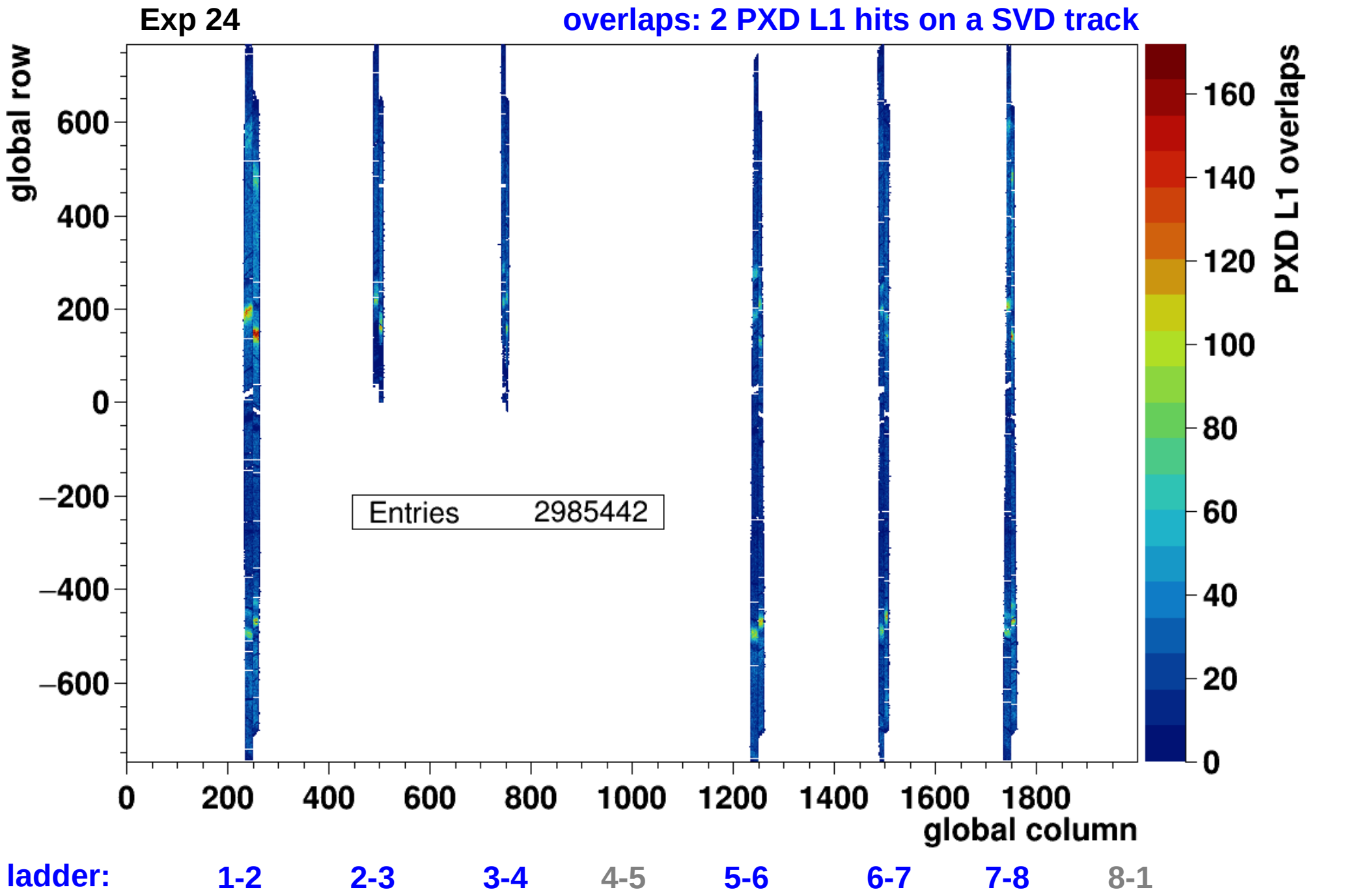
fiducial mean: 98.2%

PXD L1 overlaps

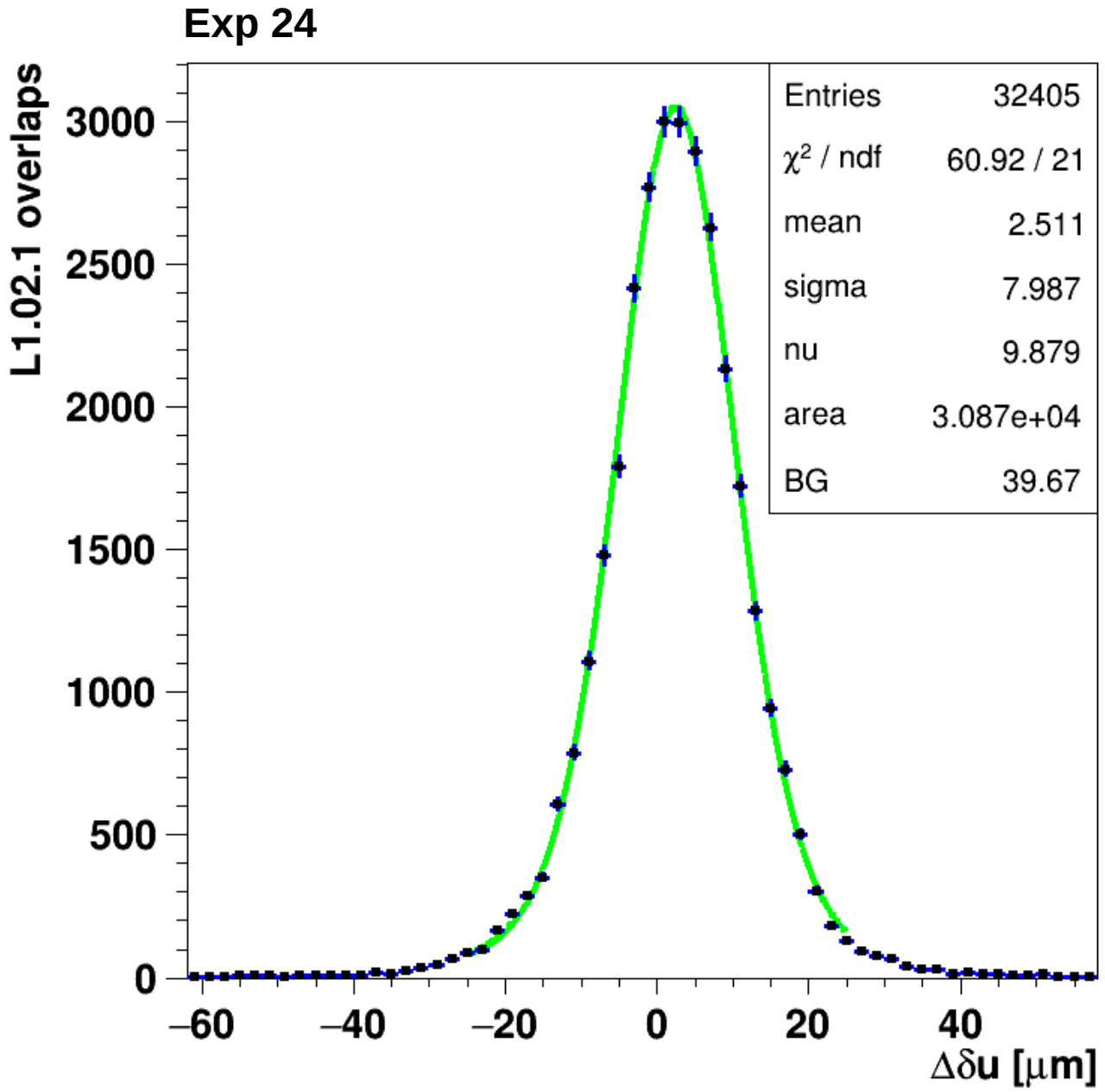
overlaps: 2 PXD L1 hits on a SVD track



PXD L1 overlaps

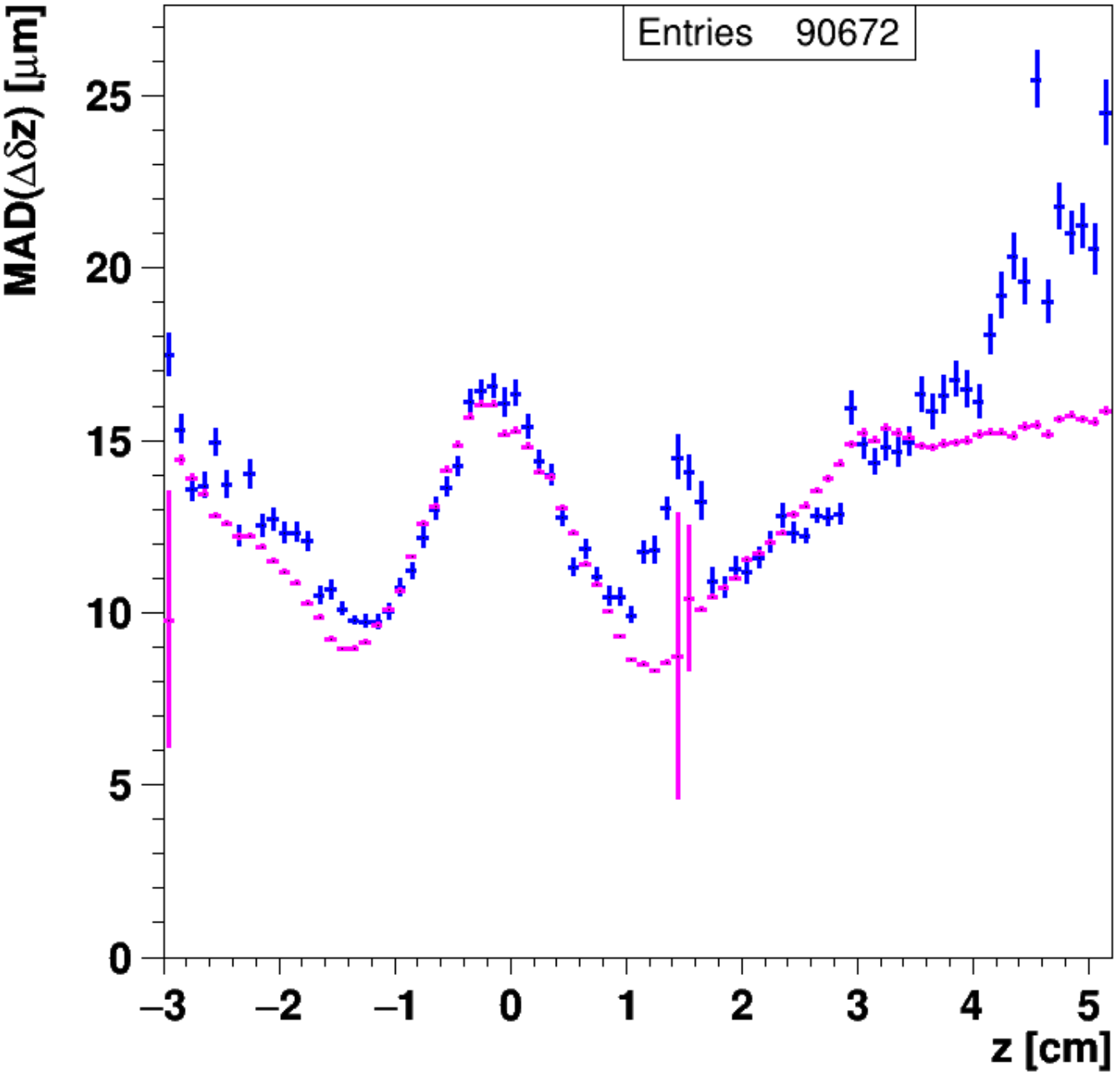


PXD L1 overlap residuals



- **overlap residuals:**
  - single: δ = hit - track
  - **double: $\Delta = \delta_1 - \delta_2$**
  - (correlated track contribution cancels out)
  - **width 8.0 µm**
  - (Student's *t* fit)
  - (similar to Exp 18)

PXD L1 overlaps: *z* residual width vs z

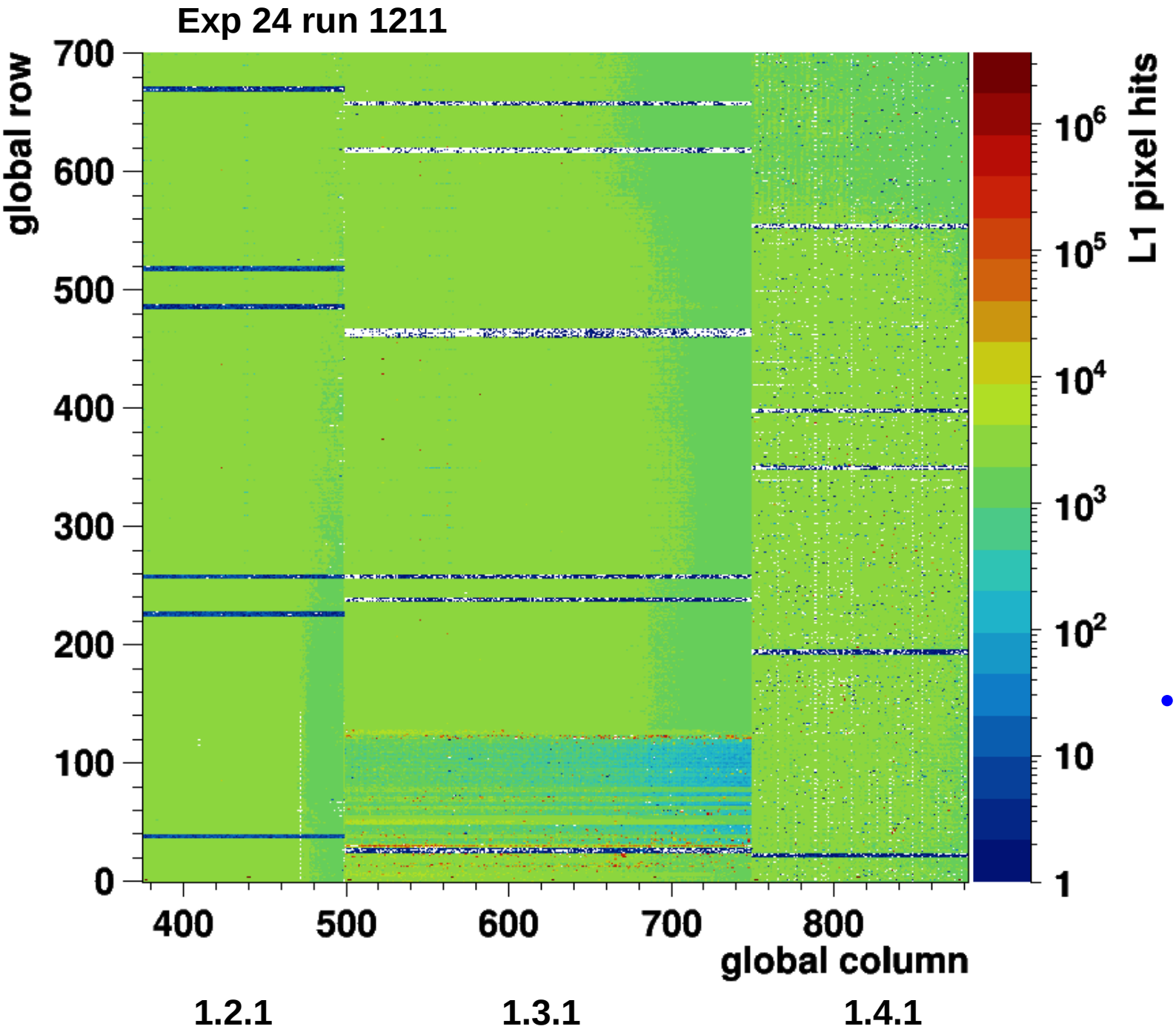


- optimal charge sharing at
  - λ = atan(pitch / thickness)
  - **z = -1.1 cm**
  - **z = +1.0 cm**
- resolution degrades at large angles:
  - (too) long clusters
- simulation follows data trends
  - except at z-gap: 1.5 cm
  - except in forward region: z > 3 cm (λ > 65°)

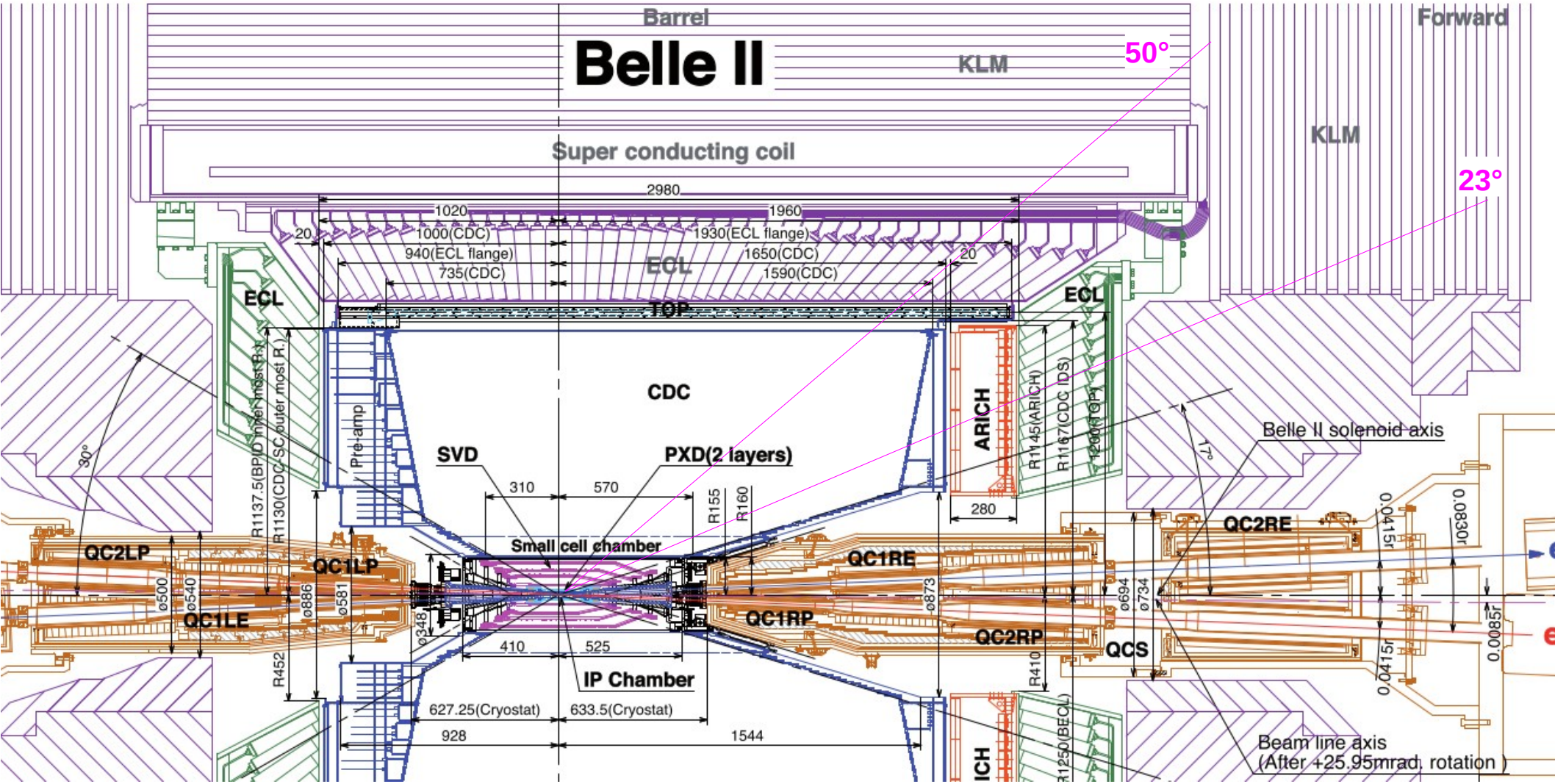
summary

- Mar 2022:
  - 25 µm movement after earthquake
  - relaxation over 10 days
- PromptReco mdst after time dependent PXD alignment:
  - *z* shift on module 1.3.1 (with sick switcher)
  - limited coverage by di-muons used in alignment?
  - (add Bhabhas?)
- Efficiency map:
  - depends on tracking
- Hit resolution from overlaps:
  - rφ (u) direction: 8 µm like last year
  - *z* direction: closer to simulation up to z = 3.5 cm

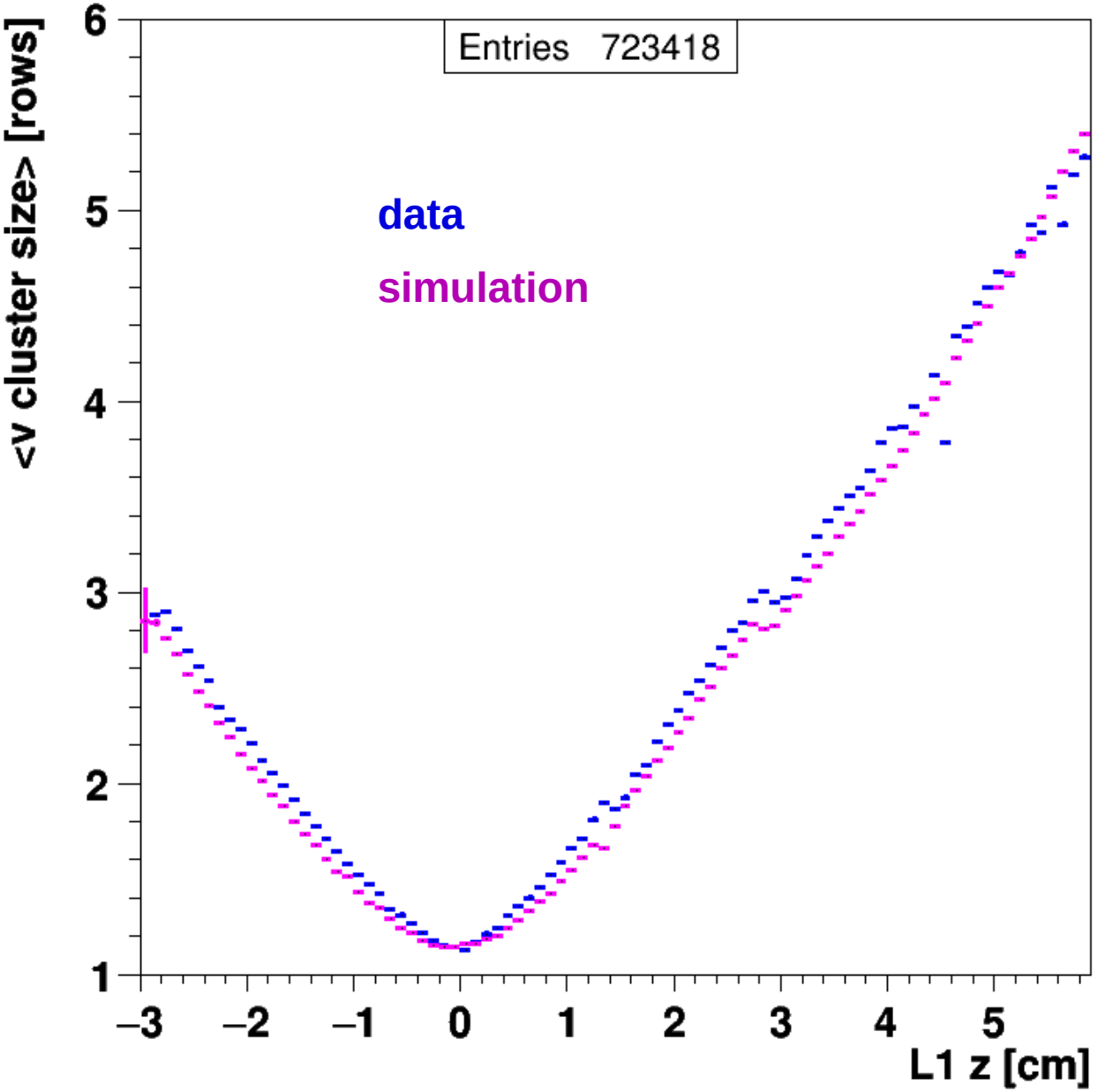
PXD hit map



- sick switcher on 1.3.1
  - hot pixels


Barrel
Belle II
KLM
Forward
50°
23°
Super conducting coil
2980
1020
1960
20
1000(CDC)
940(ECL flange)
735(CDC)
1930(ECL flange)
1650(CDC)
1590(CDC)
20
ECL
ECL
ECL
TOP
CDC
ARICH
SVD
PXD(2 layers)
Pre-amp
310
570
280
R155
R160
R1145(ARICH)
R1167(CDC IDS)
R1200(TOP)
R1137.5(BP/D inner most R.)
R1130(CDC/SC outer most R.)
30°
17°
Belle II solenoid axis
QC2LP
QC1LP
QC1LE
QC1RE
QC1RP
QC2RP
QC2RE
QCS
Small cell chamber
IP Chamber
ø500
ø540
ø886
ø581
ø348
ø873
ø694
ø734
0.0415r
0.0830r
0.0085r
R452
R410
410
525
627.25(Cryostat)
633.5(Cryostat)
928
1544
R1250(BECL)
Beam line axis
(After +25.95mrad. rotation)

PXD L1 overlaps: *z* cluster size



- 2 entries per overlap
- **v** cluster size increases with **z**:
  - dip angle λ increases
- (quite) well described by simulation
  - with threshold steps