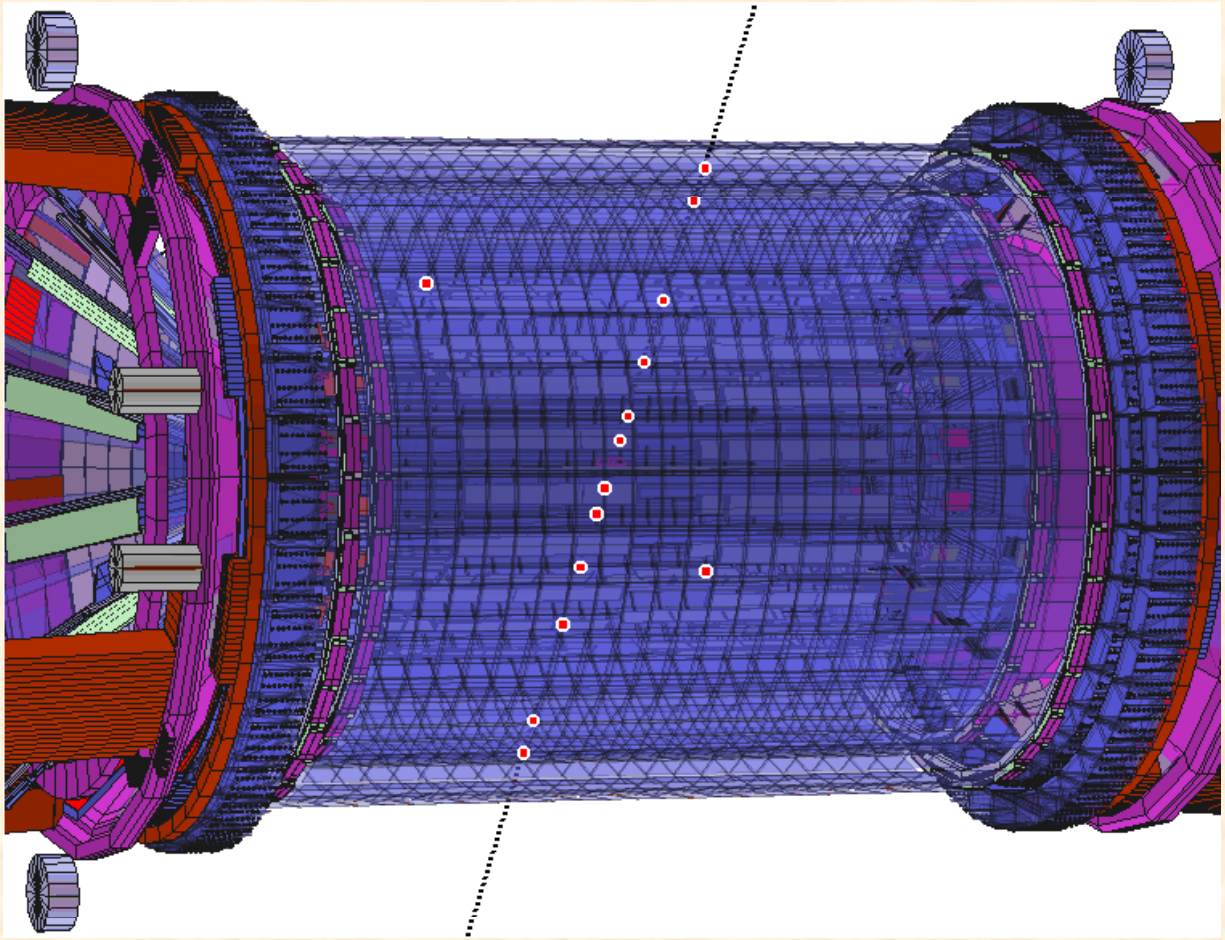
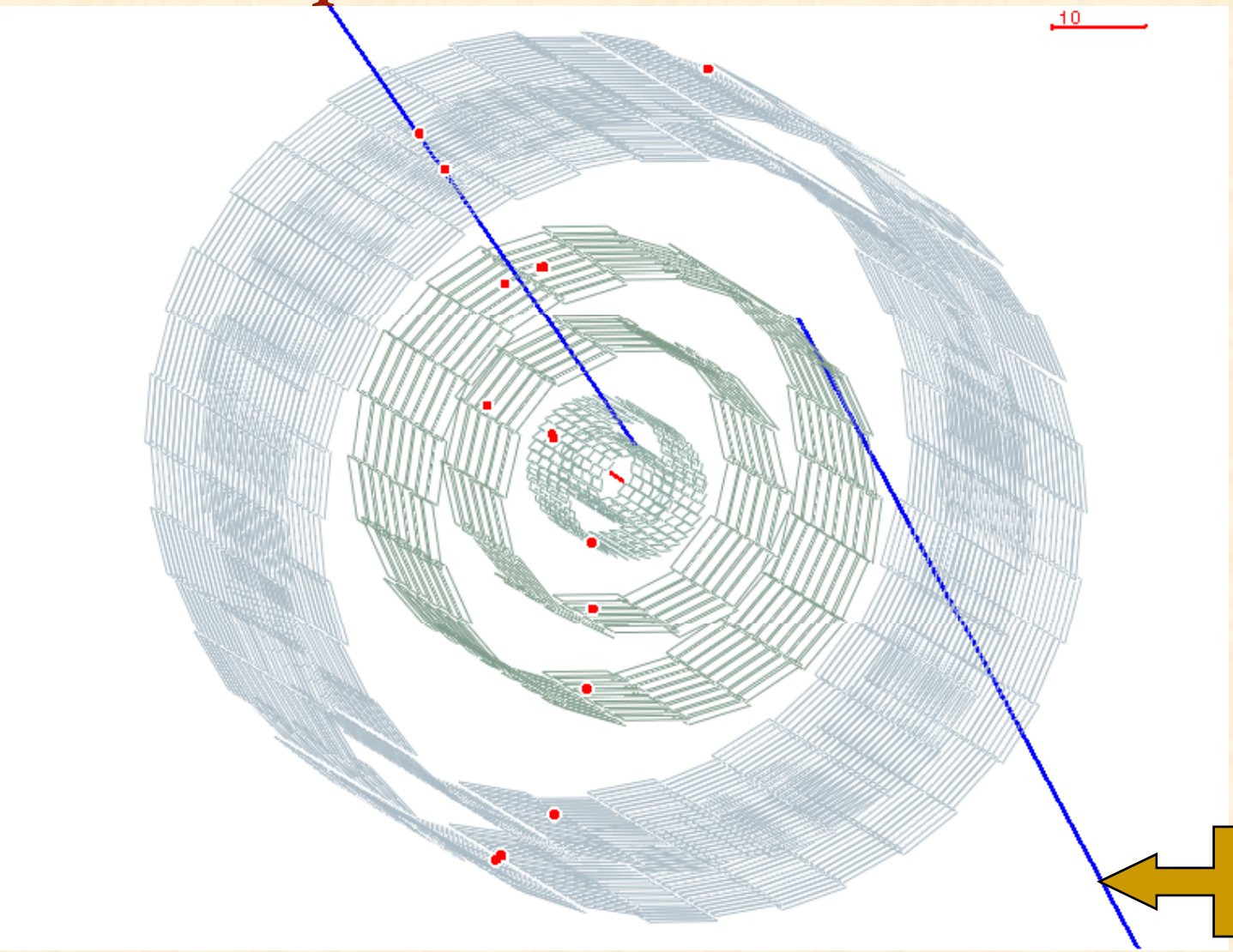
Visualisation and ITS alignment



Introduction

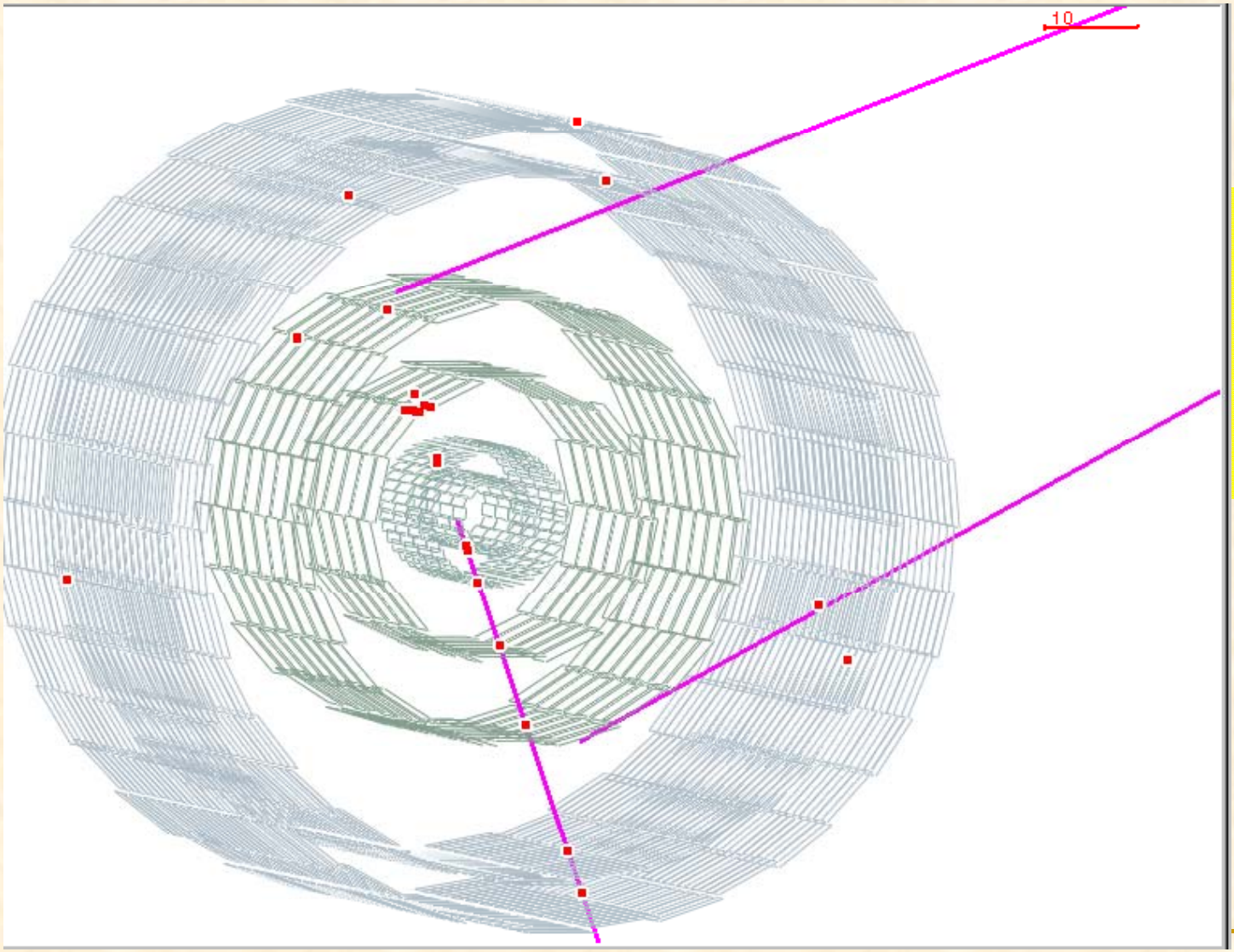
- ITS alignment – need of *good* quality tracks in order to avoid biases ➔ display, complementary to the statistical tools
  - clusters isolation
  - assignment ambiguities
  - tracking or geometry (potential) bugs
- Scale of the misalignment effects: tens- hundreds of microns ➔ zooming → precision geometry representation
- Playing with different re-alignments ➔ interactivity
- Simple direct *measurements*, QA type plots
- Few simple examples of practical use ➔ next slides

Evident problem: RUN 61418 event 44



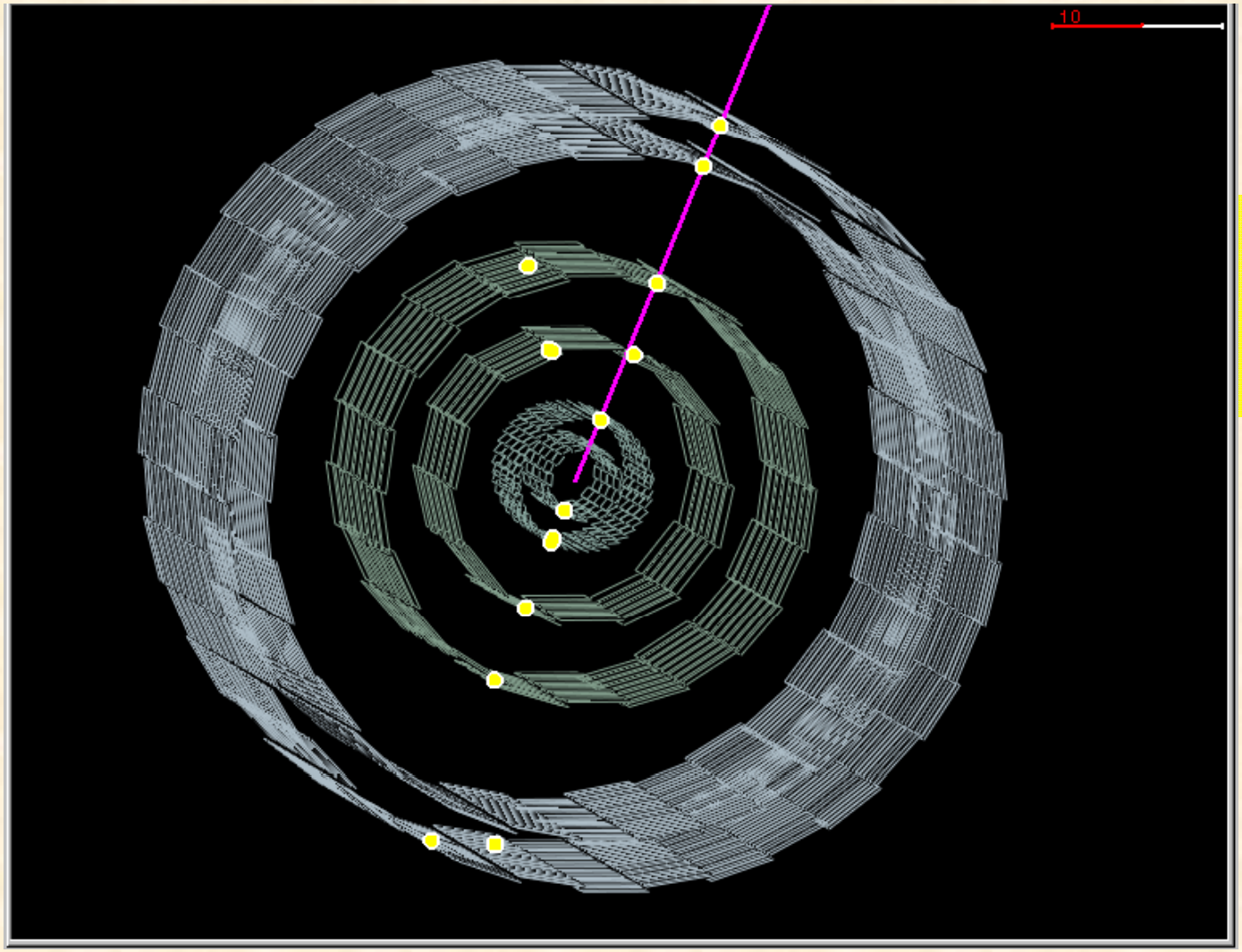
No clear clusters – track assignment

Another example - RUN 61418 event 88



Problem of cleaning ESD ? Fake tracks have only 2 SSD assigned clusters (each)

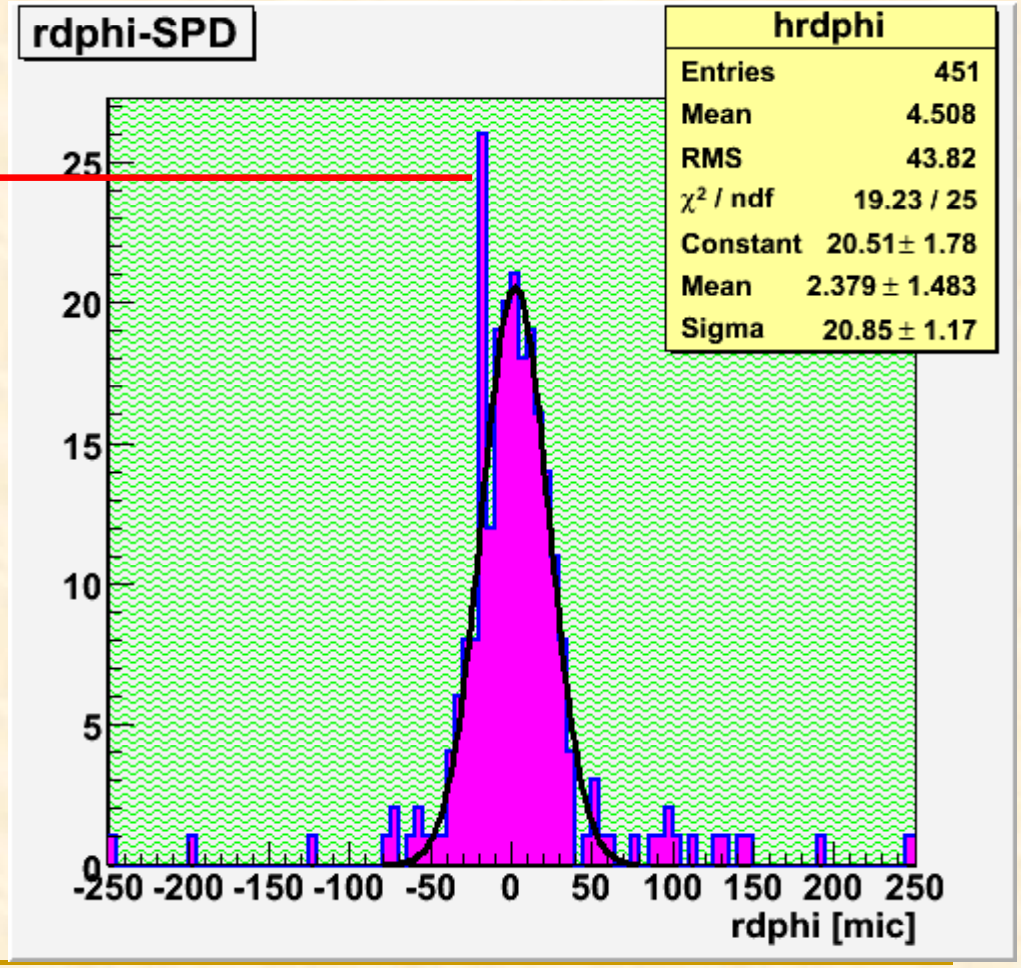
Another example - RUN 62276 ev 958



Evident track with
3 (yes) SPD clusters
Plus SSD, but
not reconstructed

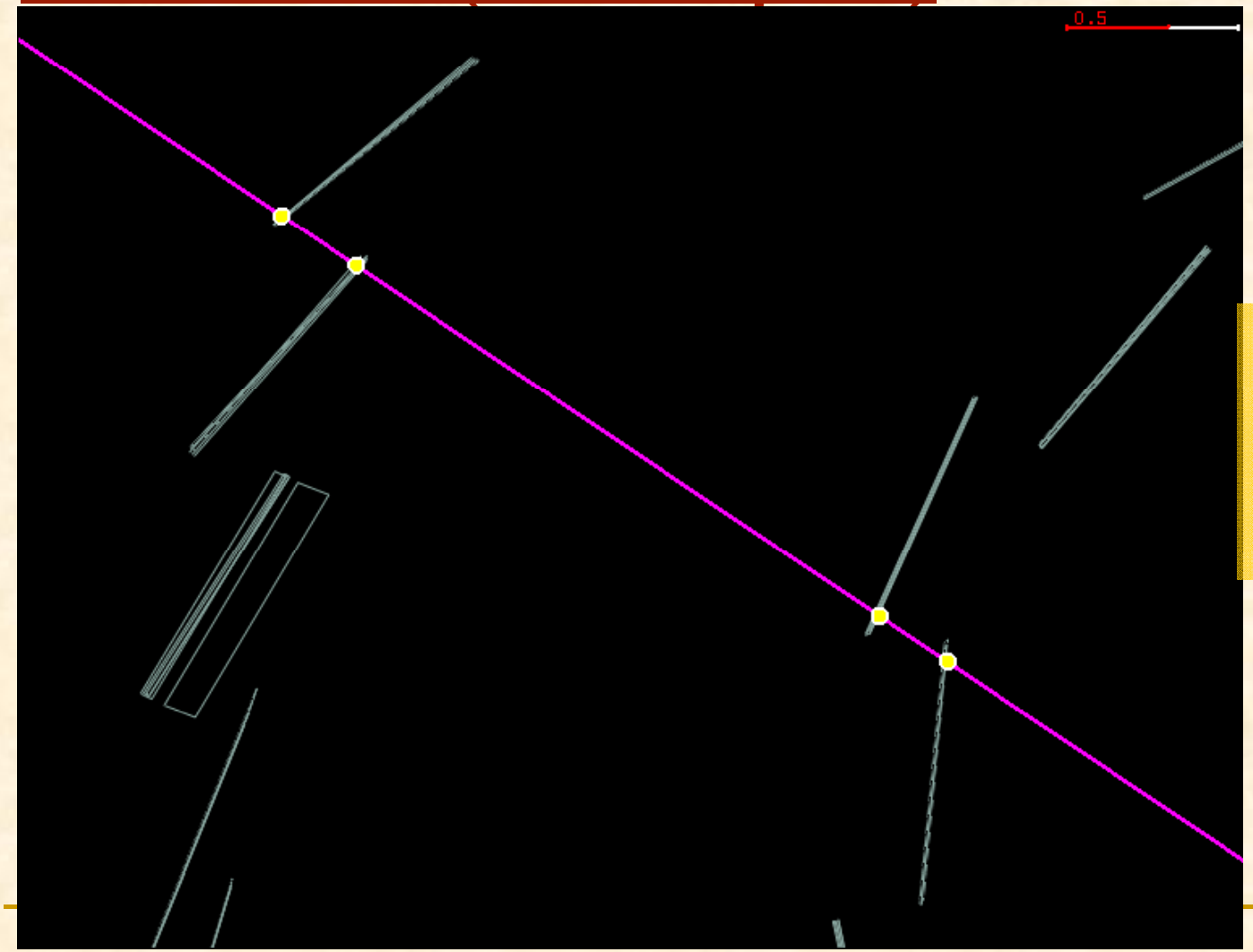
Case study – hunting ghost clusters in SPD

Rdphi distance of the overlap clusters after re-alignment



All events contributing to this peak scanned with AliEve
→No apparent anomaly found !
Numerical arte-fact of alignment procedure (?)
Goes away with change of alignment

Run 61418 event 1143 – double contributor (to the spike)



Simple alieve: user's geometry and alignment.
All 4 SPD clusters used in tracking

ReadESDfriend information

(out of AliEve)

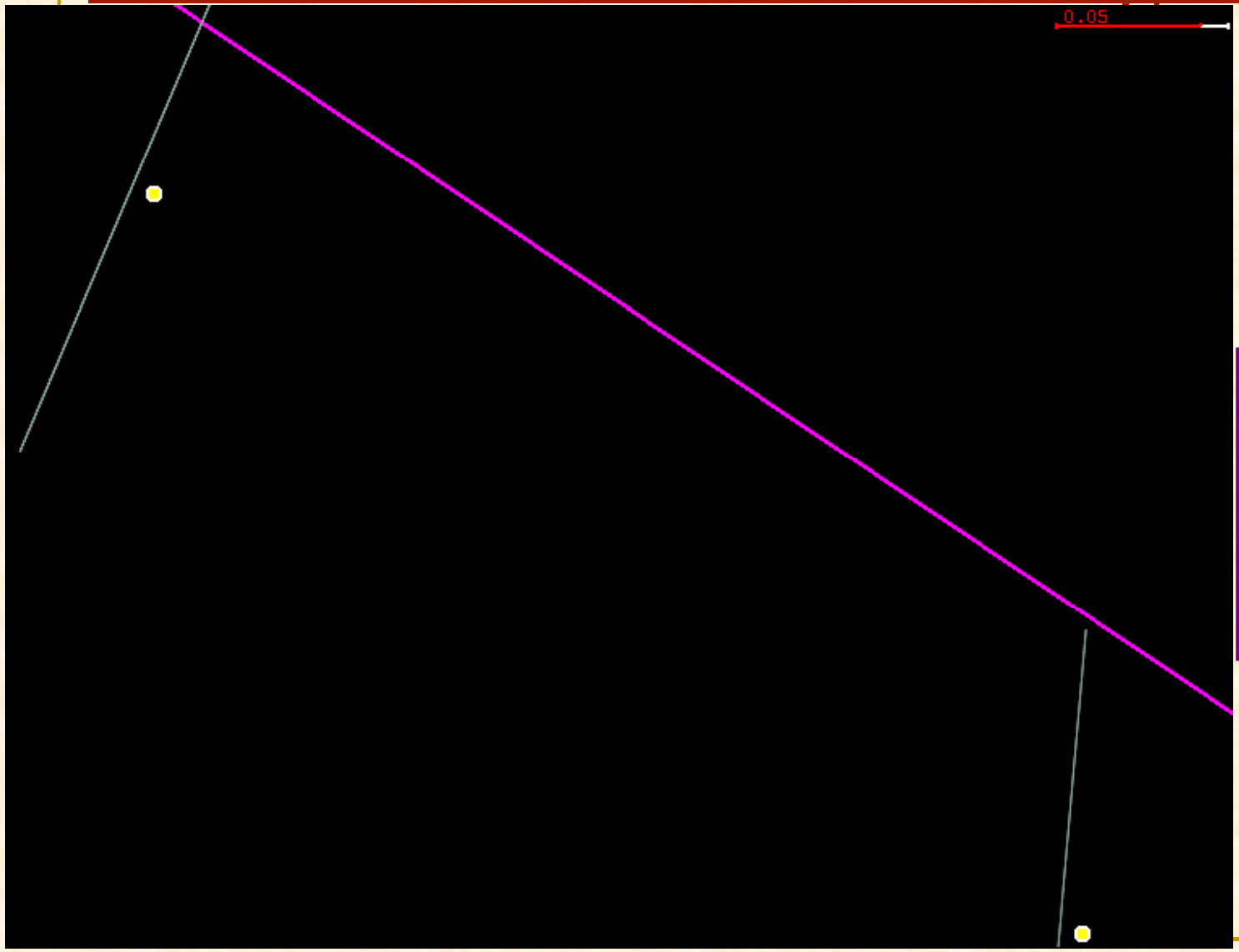
```
Event number: 1143
Number of tracks: 2
Number of friend tracks: 2
Track number 0
   Number of TPC clusters: 2
   Index of the 1st TPC cluster: -1270338736
   ITS cluster map (from SPDs to SSDs):
 Bit 0: 1
 Bit 1: 1
 Bit 2: 0
 Bit 3: 0
 Bit 4: 1
 Bit 5: 1
   Number of track points: 6
   X coordinate of the 1st track point: -36.3034
   Y coordinate of the 1st track point: 22.8503
   Z coordinate of the 1st track point: -26.8642
   R of the 1st track point:50.6138
volID1-6: 12682 10543 4163 2083 2087 4167
Number of friend tracks: 2
Track number 1
   Number of TPC clusters: 6
   Index of the 1st TPC cluster: -1270338736
   ITS cluster map (from SPDs to SSDs):
 Bit 0: 1
 Bit 1: 1
 Bit 2: 0
 Bit 3: 0
 Bit 4: 1
 Bit 5: 1
   Number of track points: 4
   X coordinate of the 1st track point: 35.432
   Y coordinate of the 1st track point: -25.3048
   Z coordinate of the 1st track point: 3.94276
   R of the 1st track point:43.7184
volID1-6: 13149 10910 4235 2115 16 0
```

SPD and SSD clusters used in the track fit (ITS map)

6 clusters, 2 doubles!

??

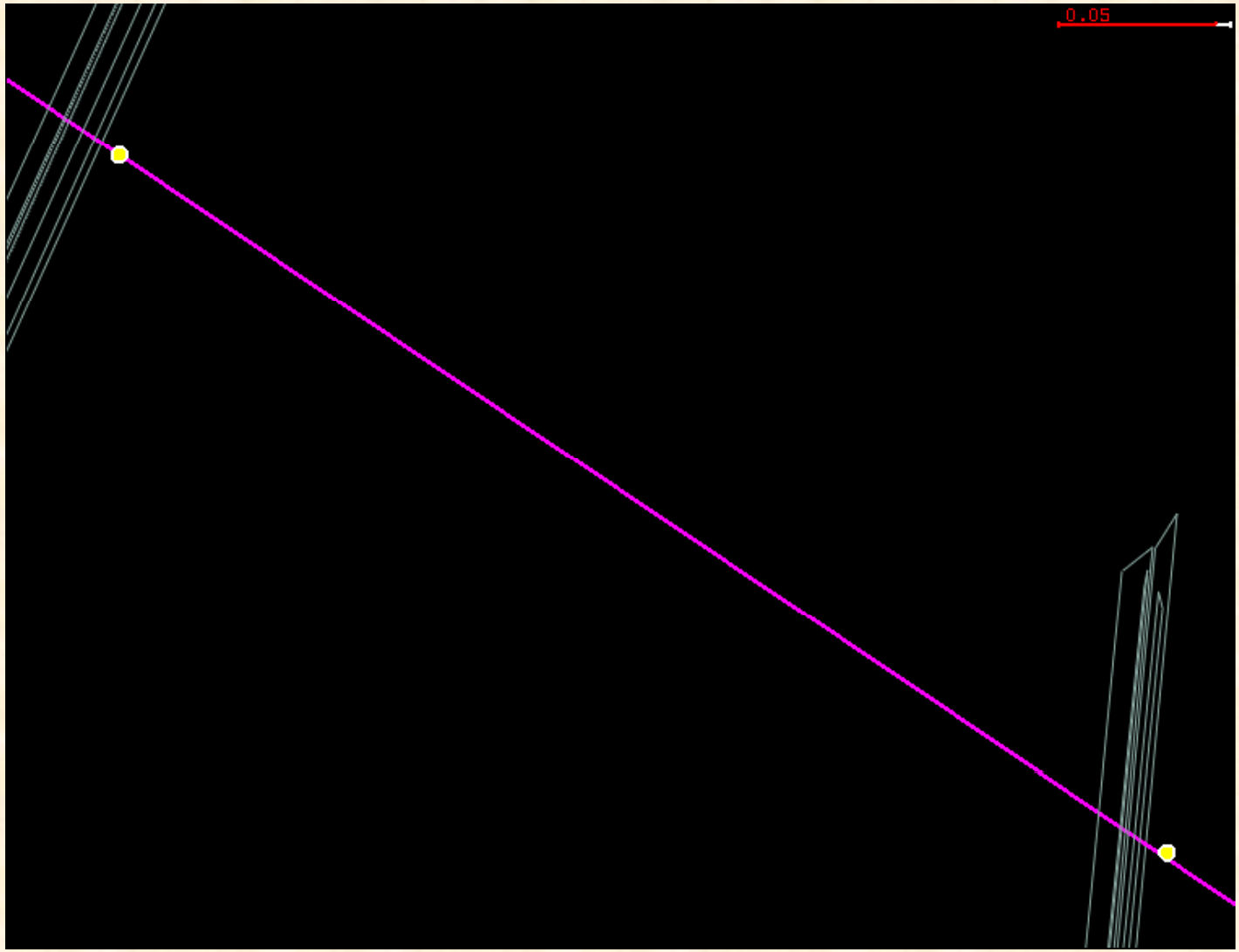
Run 61418 event 1143 – no realignment



Zoom of one of the 2 overlaps

NOTE: track reconstructed with the aligned geometry, clusters not aligned

Run 61418 event 1143 – with realignment



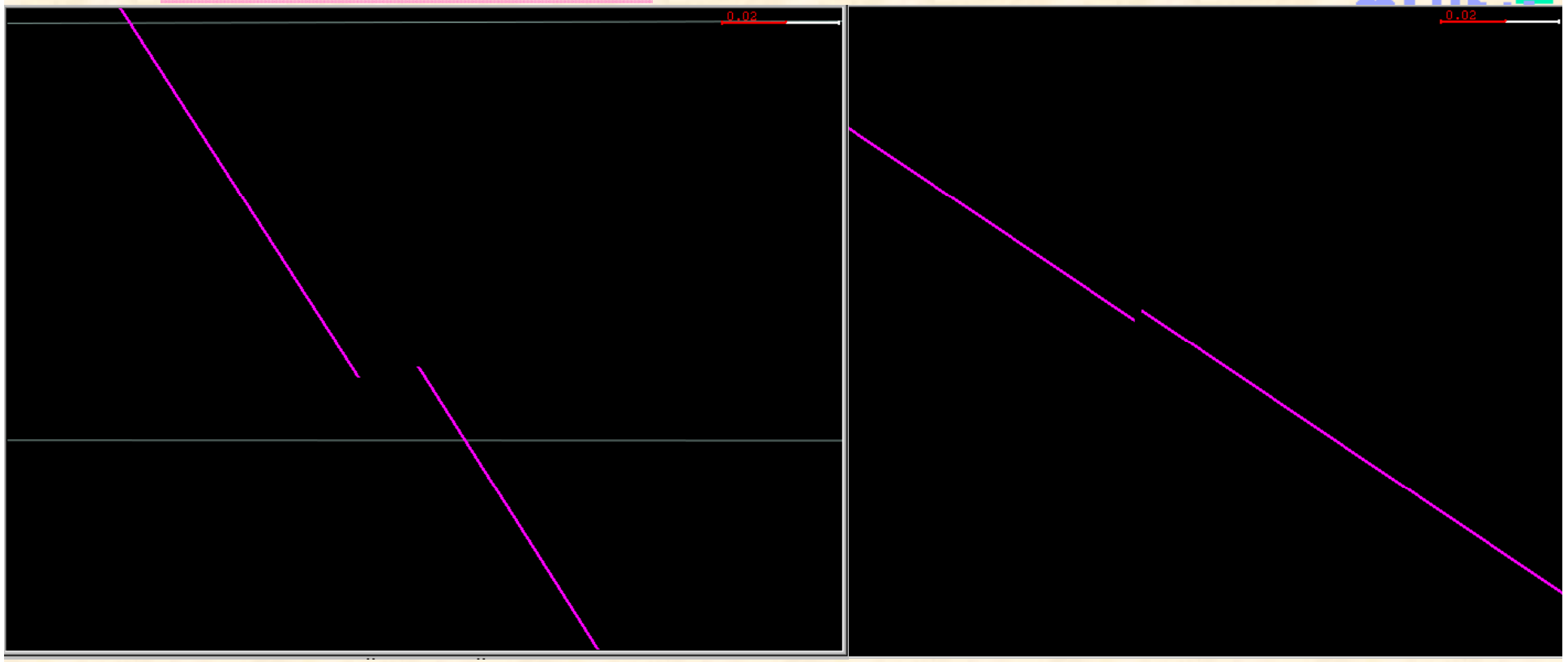
NOTE: strange drawing of modules by its_digits.C macro

- TGeo overlaps created when realigning

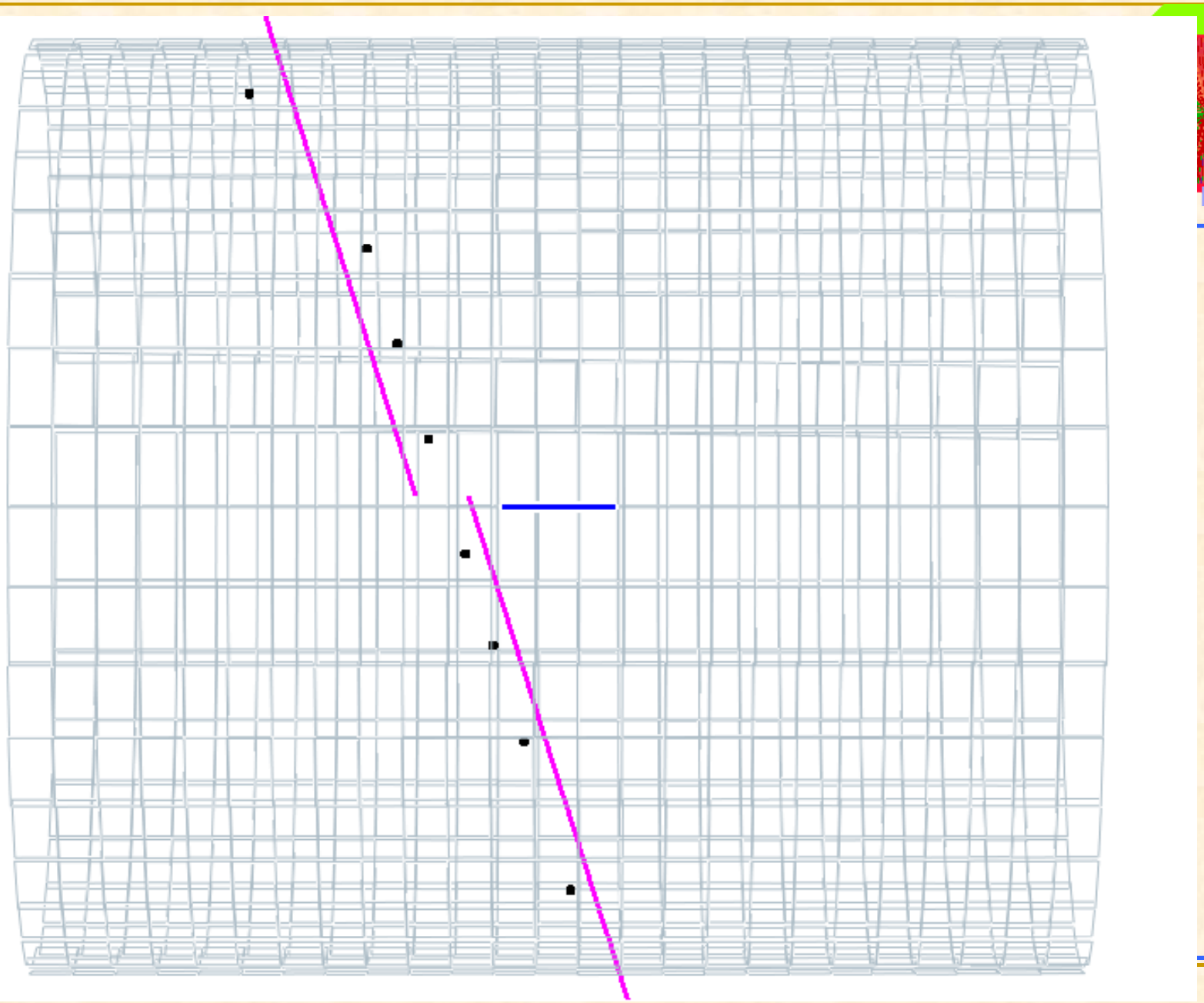
Run 61418 event 1143 – alieve_init zoom

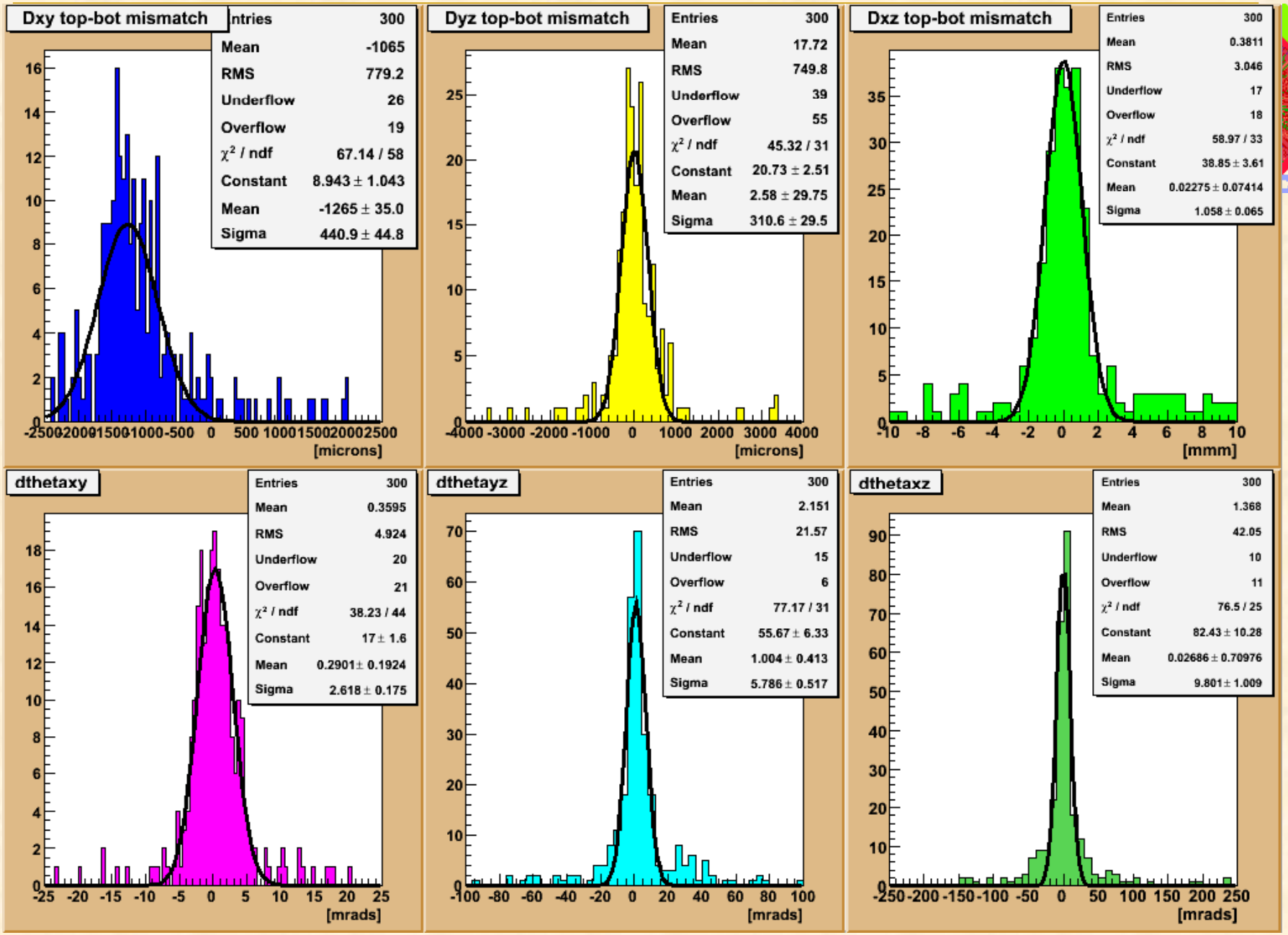
Max zoom in YZ projection

Max zoom in XY projection

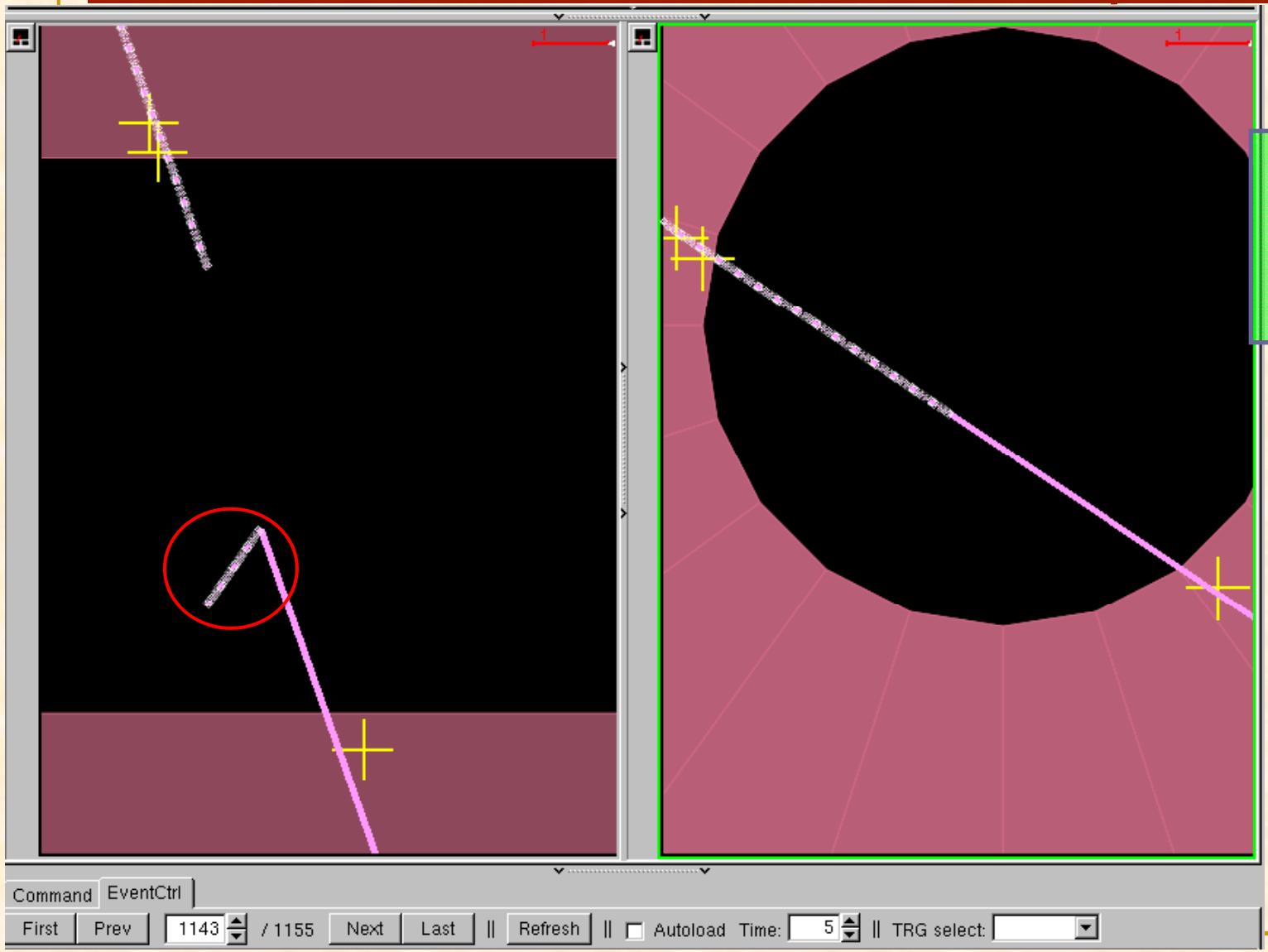


alieve_init → more flexibility in selecting geometry/alignment but less info from reco (no cosmic vertex found AliRoot-v4-16-Rev-01 → needs Andrea's patch)



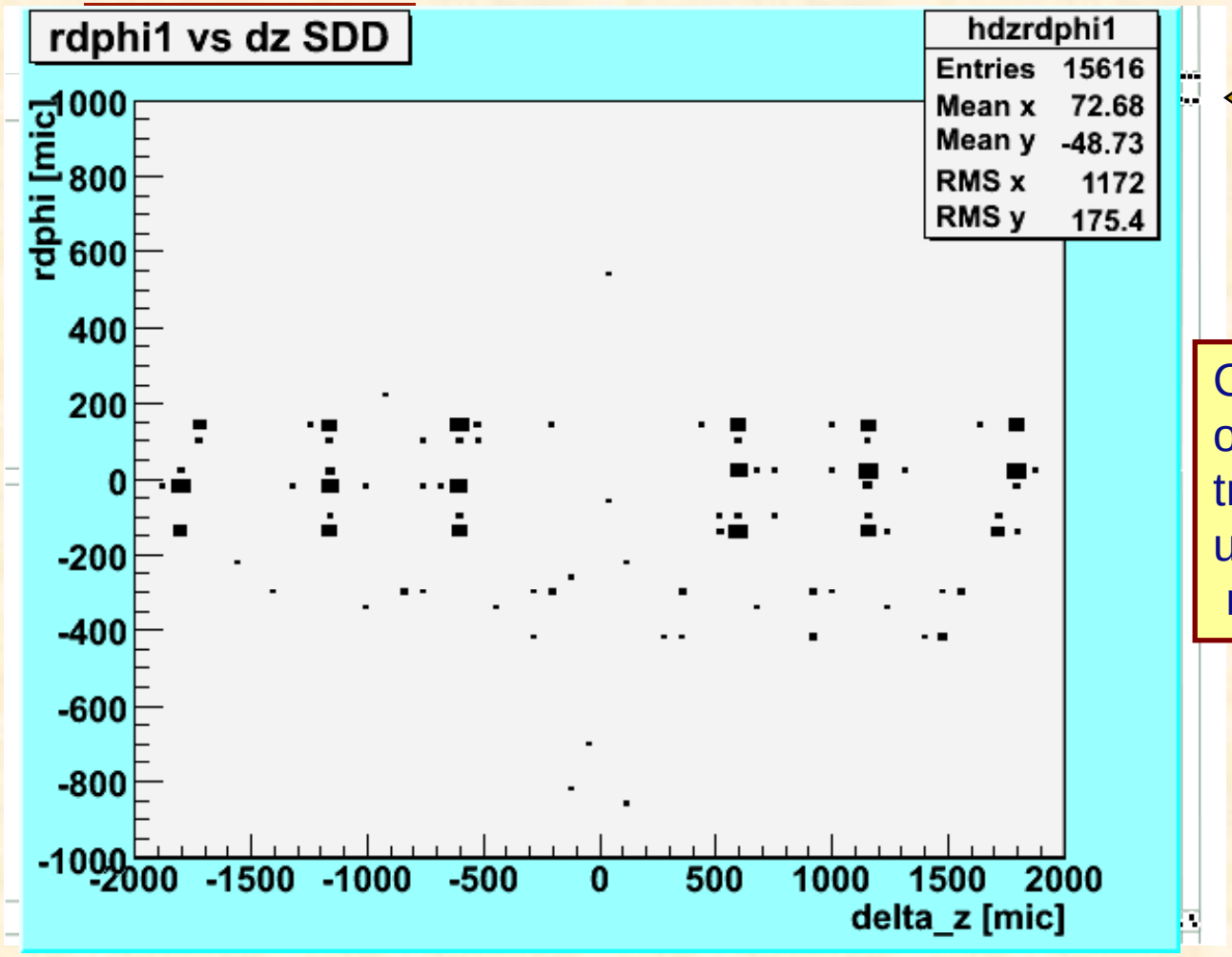

Dxy top-bot mismatch
Entries 300
Mean -1065
RMS 779.2
Underflow 26
Overflow 19
χ² / ndf 67.14 / 58
Constant 8.943 ± 1.043
Mean -1265 ± 35.0
Sigma 440.9 ± 44.8
[microns]
Dyz top-bot mismatch
Entries 300
Mean 17.72
RMS 749.8
Underflow 39
Overflow 55
χ² / ndf 45.32 / 31
Constant 20.73 ± 2.51
Mean 2.58 ± 29.75
Sigma 310.6 ± 29.5
[microns]
Dxz top-bot mismatch
Entries 300
Mean 0.3811
RMS 3.046
Underflow 17
Overflow 18
χ² / ndf 58.97 / 33
Constant 38.85 ± 3.61
Mean 0.02275 ± 0.07414
Sigma 1.058 ± 0.065
[mmm]
dthetaxy
Entries 300
Mean 0.3595
RMS 4.924
Underflow 20
Overflow 21
χ² / ndf 38.23 / 44
Constant 17 ± 1.6
Mean 0.2901 ± 0.1924
Sigma 2.618 ± 0.175
[mrads]
dthetayz
Entries 300
Mean 2.151
RMS 21.57
Underflow 15
Overflow 6
χ² / ndf 77.17 / 31
Constant 55.67 ± 6.33
Mean 1.004 ± 0.413
Sigma 5.786 ± 0.517
[mrads]
dthetaxz
Entries 300
Mean 1.368
RMS 42.05
Underflow 10
Overflow 11
χ² / ndf 76.5 / 25
Constant 82.43 ± 10.28
Mean 0.02686 ± 0.70976
Sigma 9.801 ± 1.009
[mrads]

Run 61418 event 1143 – visscan/zoom



Forced OCDB geometry,
gap in YZ,
extra segment ?

Case study – hunting correlated noise in SDD2

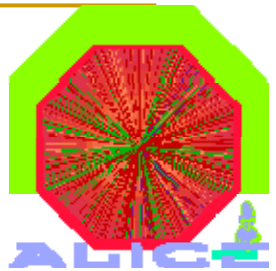


Rphi overlap ladders 4-5, modules 0

Correlated noise in the overlap regions – masking true overlap clusters used for (residual) misalignment estimate

Rphi overlap

Still another practical problem

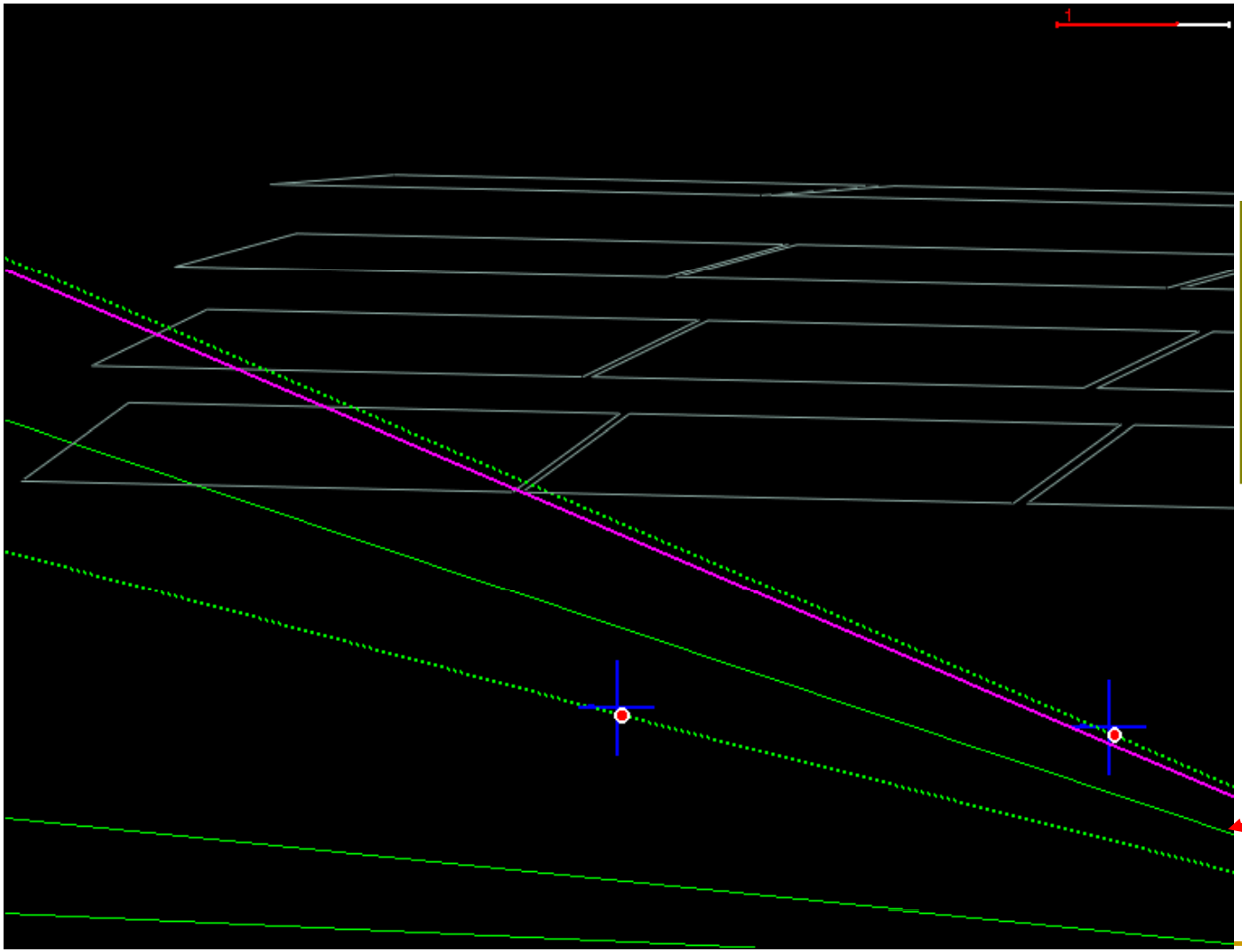


How to find an intersection point between a track and a (transparent) sensor plane ?

➔Trying to find a rotation making a track practically point-like (in the range of interest), so ⊥ to the projection plane.

Complication - tracks are not straight in case of B ON

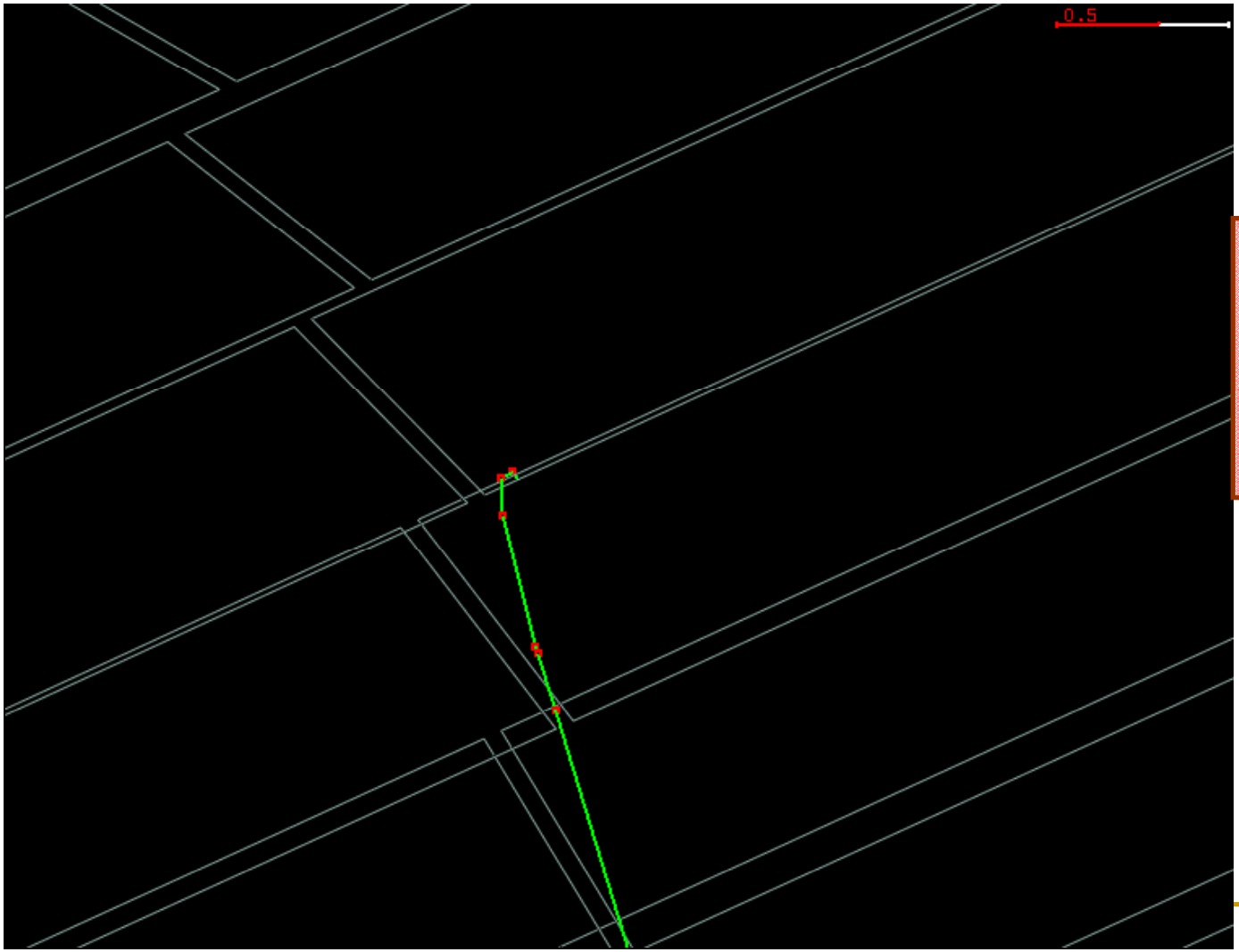
Event # 24_3Dbis – missing hit



Only sector 3 shown here.
Is particle passing through the dead Z-zone ?

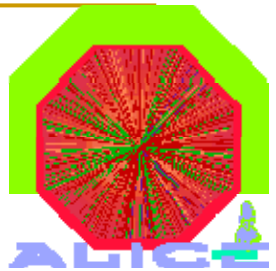
Tracks from kinematics

Looking along a track → localizing intersection point with a sensor plane



SPD1 is between the first 2 red points (SPD0 and SDD3) →Intersection in the R-phi overlap zone !?

Few final comments



- Alignment – part of the QA, needs detailed geometry in the display
- Need to switch easily between different geometries and alignments
- Aligners typically need highly zoomed events and possibility to do simple measurements (scale, coordinates needed)
- Visscan vs simple alieve – plus and contras
  - Track refit only with visscan (?)
  - Free choice of geometry-alignment only with alieve_init
- AliEve already a powerful tool, can do better…

ALICE coordinates

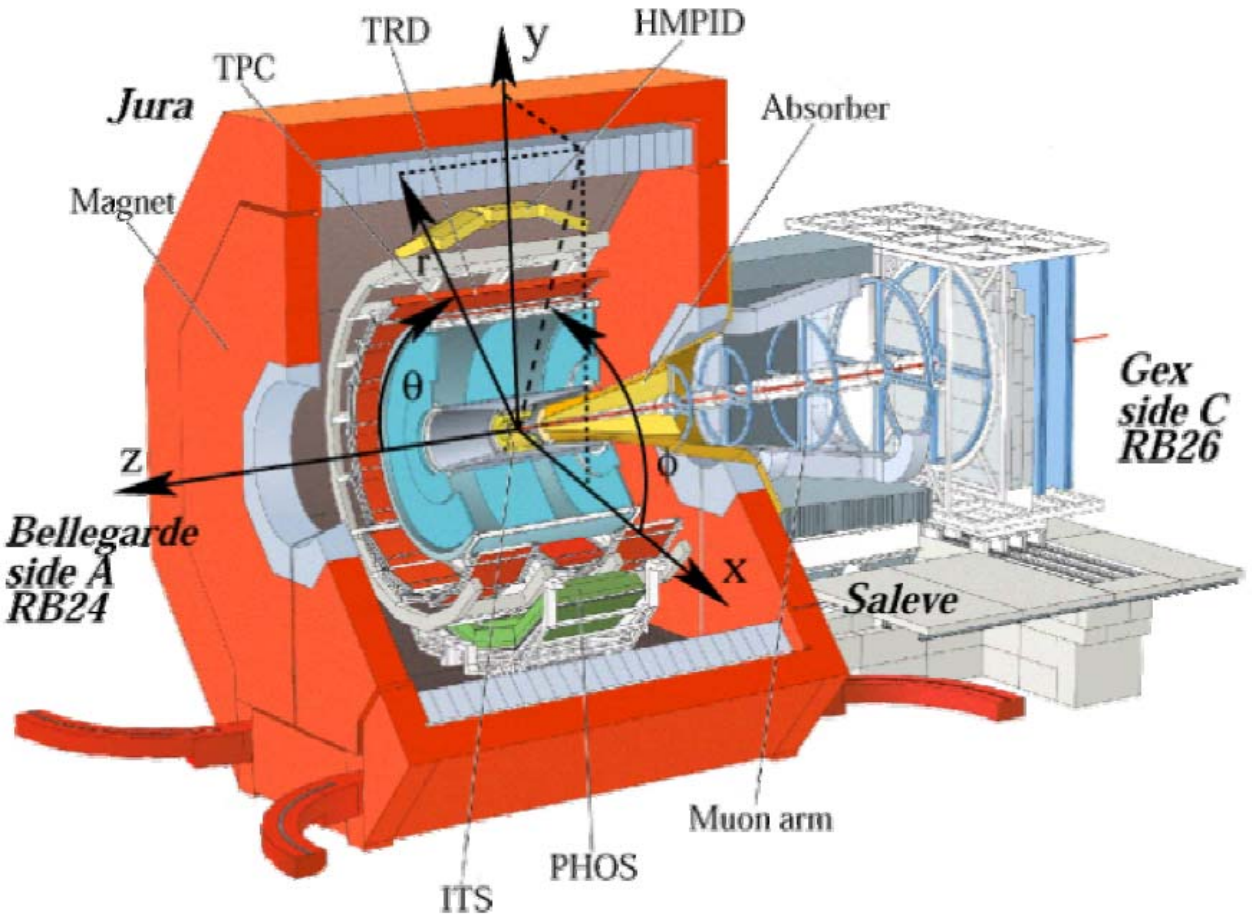


Fig1. Definition of the ALICE coordinate system axis, angles and detector sides.