Tracker Meeting: simulation of the first station calibration in a vertical position

Sara Gamba, University of Pisa
Pavel Murat, FNAL

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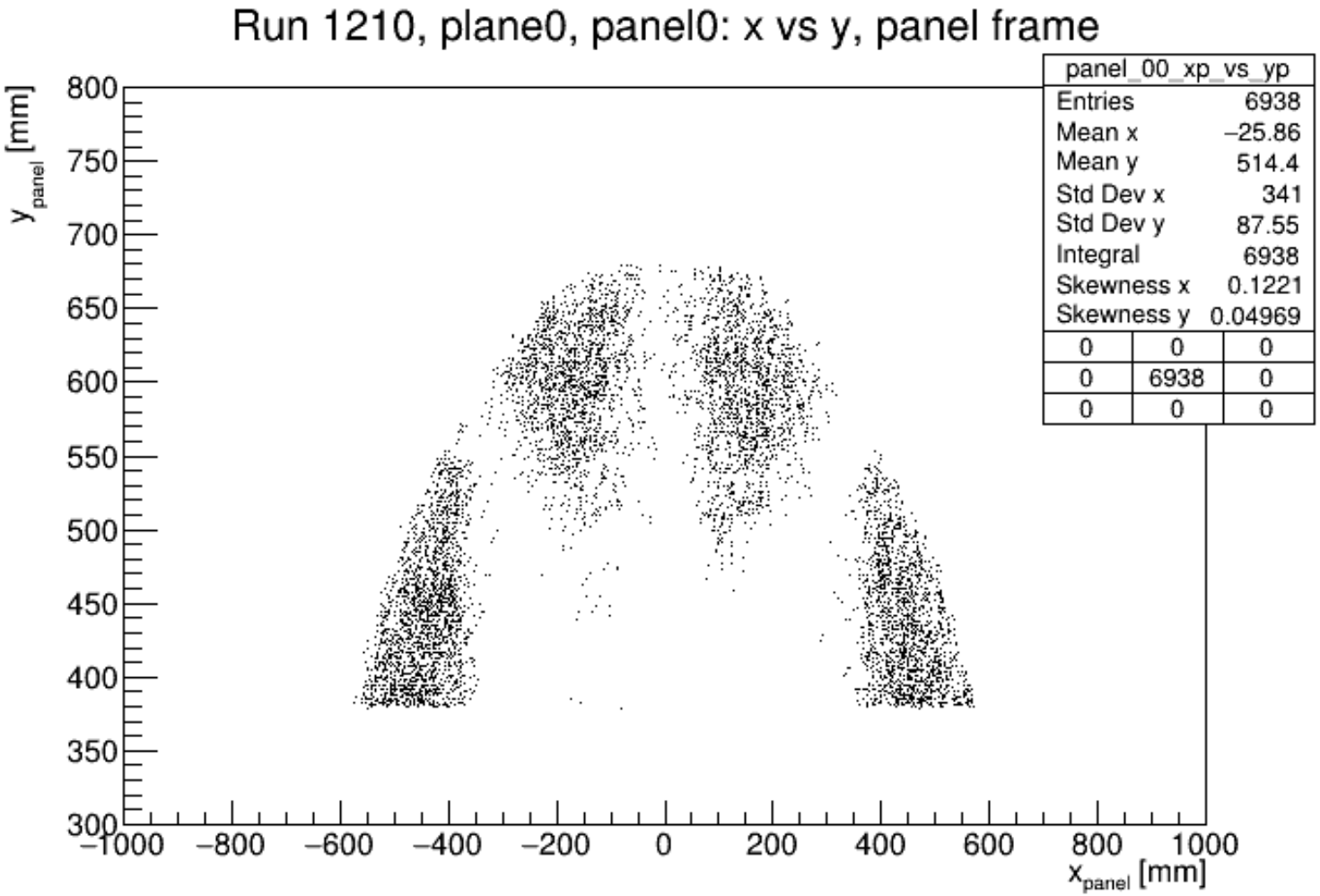
Fermilab

figures/pdf/cherubi

Cosmics simulation and selection criteria

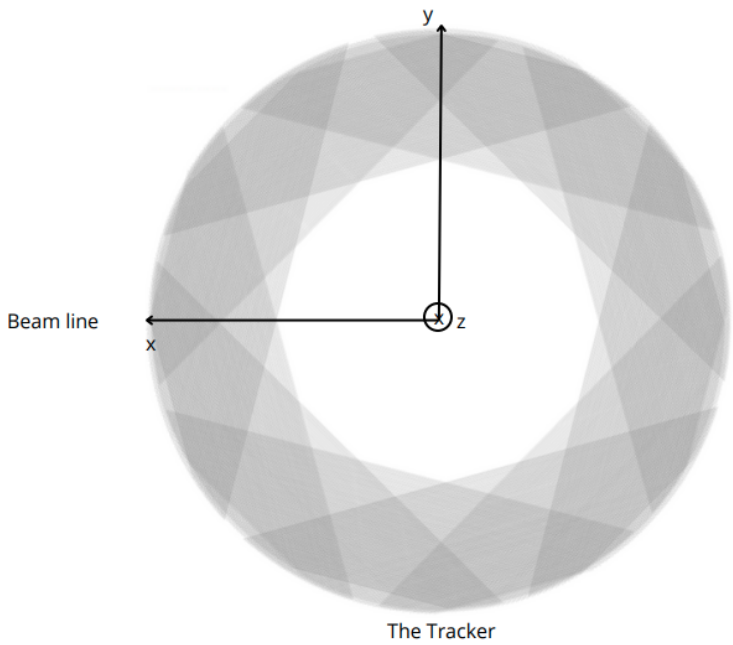
- A simulation has been performed to reconstruct cosmics for the calibration of the station, which is vertically oriented, aiming to understand possible biases in determining longitudinal position caused by the non-uniform illumination of a panel;
- Selection of the first station;
- Vertical and extracted position;
- No magnetic field;
- To reconstruct a straight line in 3D, at least 4 hits at different z are needed: tracks selected with $nhits_{face_i} \geq 1$;
- To improve the resolution, $nhits_{panel_i} \leq 3$ were selected.

Panel illumination



Reconstruction of Cosmic tracks

- The station is not yet calibrated: whether a straw has been hit or not is the only info we have;
- The reconstruction of the hit position is performed using:
  - the straw direction;
  - the straw midpoints (x, y);
  - the straw z coordinate.
- The intersection of two straw in two different faces, in the same plane, is considered to be the hit point;
- Two intersection points are found $\rightarrow$ reconstructed line.



Combo, Stereo Hits and Reconstructed line

1. Geometrical Combo Hits

Determination of a unique straw in a panel:

- mean of straws midpoint (x_m, y_m, z_m);
- straws direction (D_x, D_y).

2. Geometrical Stereo Hits

Determination of the hit point in a plane:

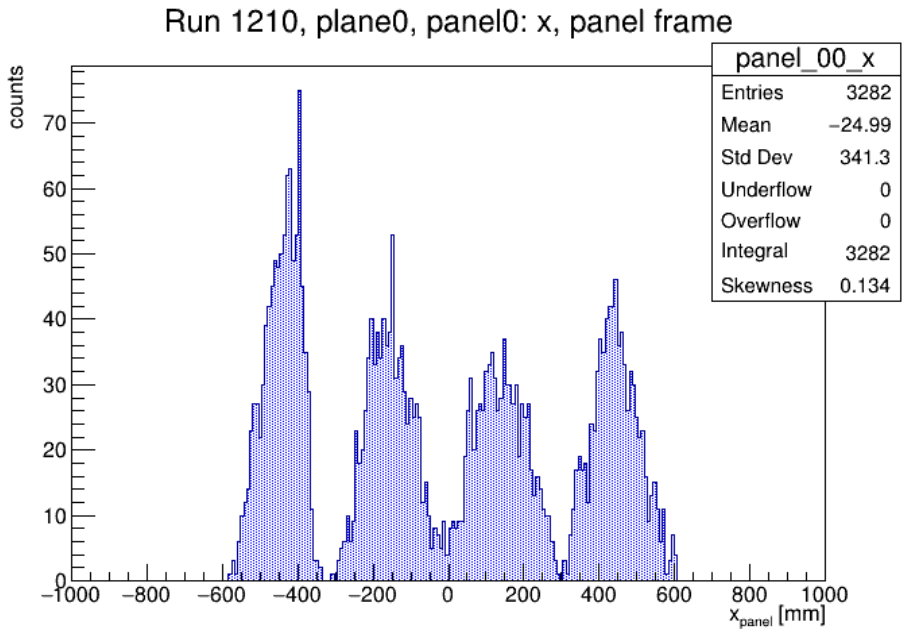
- intersection point (x, y) using the two straws directions and midpoints;
- mean of z coordinate between the two faces.

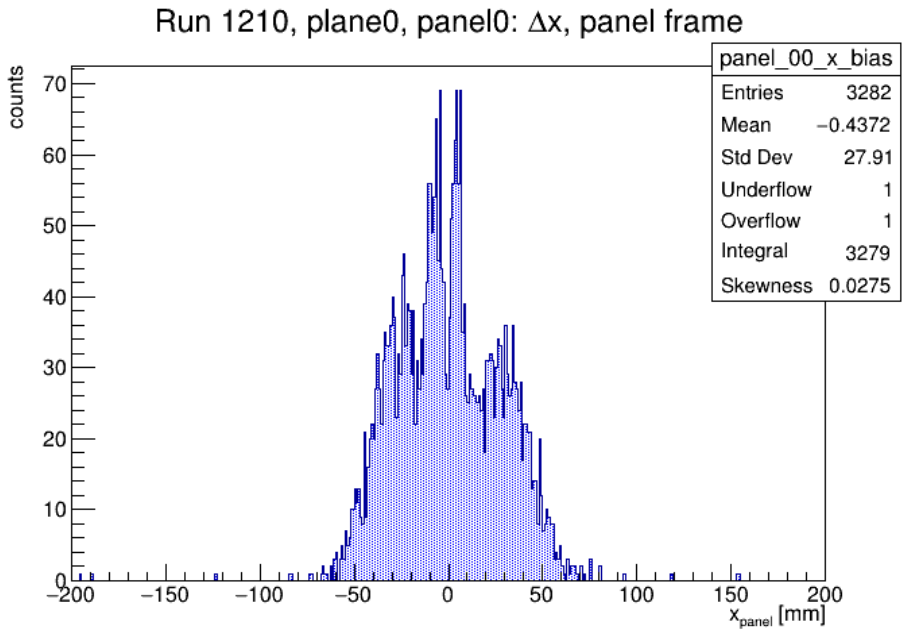
3. Reconstructed Line

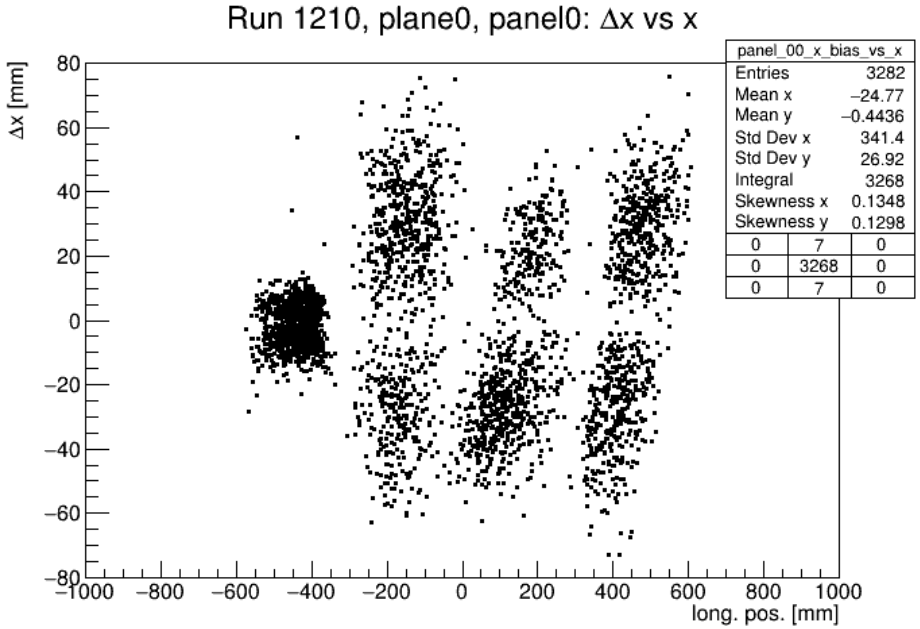
Determination of a unique reconstructed track:

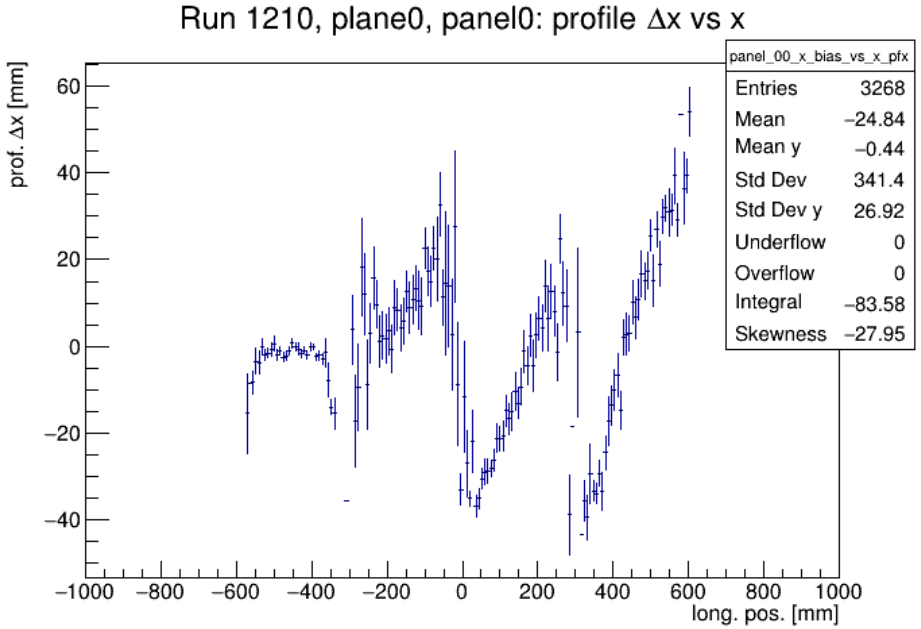
- one stereo hit per plane: one line reconstructed geometrically;
- the intersection point of the line with panels is found knowing the z_m coordinate.

Results

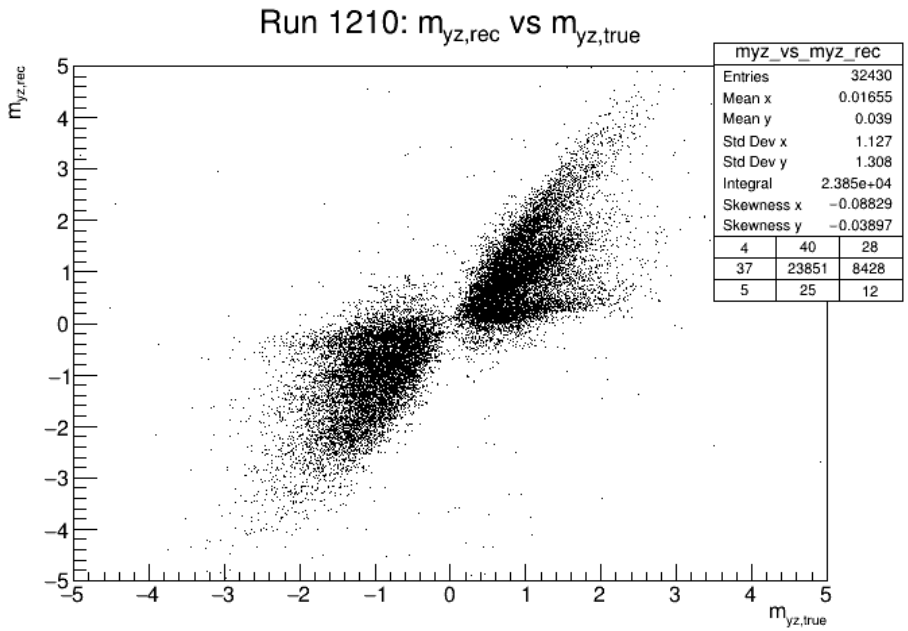

Run 1210, plane0, panel0: x, panel frame
panel_00_x
Entries 3282
Mean −24.99
Std Dev 341.3
Underflow 0
Overflow 0
Integral 3282
Skewness 0.134
counts
x_panel [mm]

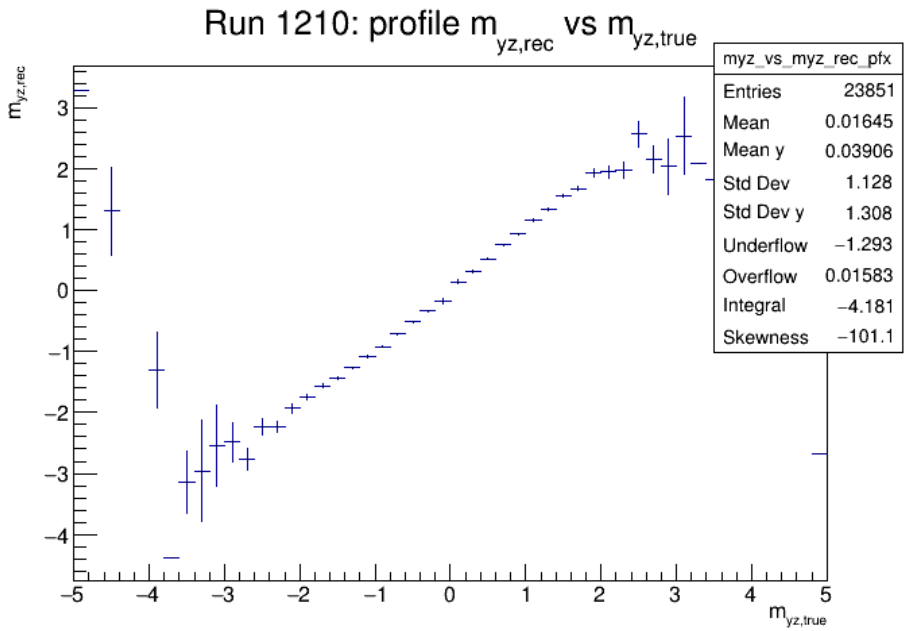

Run 1210, plane0, panel0: Δx, panel frame
panel_00_x_bias
Entries 3282
Mean −0.4372
Std Dev 27.91
Underflow 1
Overflow 1
Integral 3279
Skewness 0.0275
counts
x_panel [mm]


Run 1210, plane0, panel0: Δx vs x
panel_00_x_bias_vs_x
Entries 3282
Mean x −24.77
Mean y −0.4436
Std Dev x 341.4
Std Dev y 26.92
Integral 3268
Skewness x 0.1348
Skewness y 0.1298
0 7 0
0 3268 0
0 7 0
Δx [mm]
long. pos. [mm]


Run 1210, plane0, panel0: profile Δx vs x
panel_00_x_bias_vs_x_pfx
Entries 3268
Mean −24.84
Mean y −0.44
Std Dev 341.4
Std Dev y 26.92
Underflow 0
Overflow 0
Integral −83.58
Skewness −27.95
prof. Δx [mm]
long. pos. [mm]

Results


Run 1210: $m_{yz,rec}$ vs $m_{yz,true}$
myz_vs_myz_rec
Entries 32430
Mean x 0.01655
Mean y 0.039
Std Dev x 1.127
Std Dev y 1.308
Integral 2.385e+04
Skewness x −0.08829
Skewness y −0.03897
4 40 28
37 23851 8428
5 25 12
$m_{yz,rec}$
$m_{yz,true}$


Run 1210: profile $m_{yz,rec}$ vs $m_{yz,true}$
myz_vs_myz_rec_pfx
Entries 23851
Mean 0.01645
Mean y 0.03906
Std Dev 1.128
Std Dev y 1.308
Underflow −1.293
Overflow 0.01583
Integral −4.181
Skewness −101.1
$m_{yz,rec}$
$m_{yz,true}$

Conclusions

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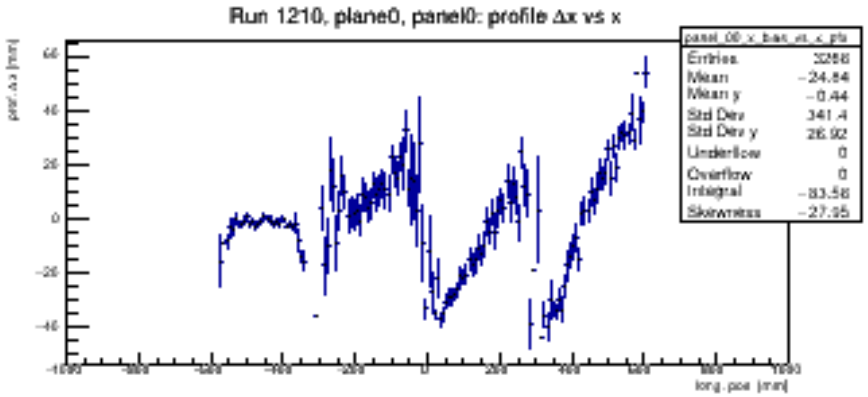

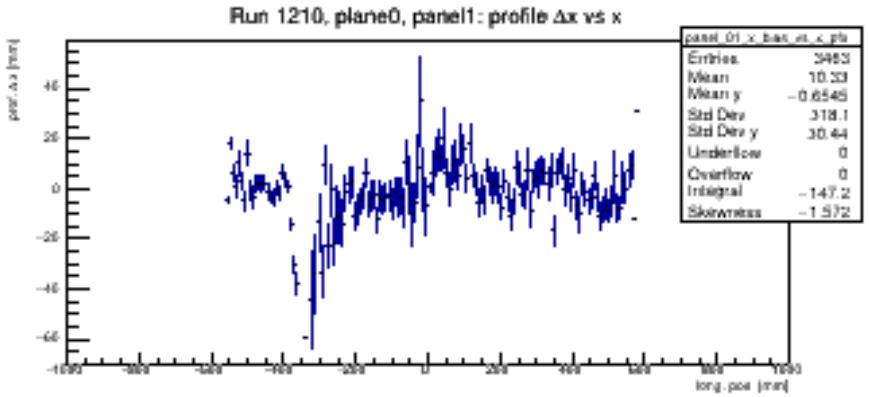

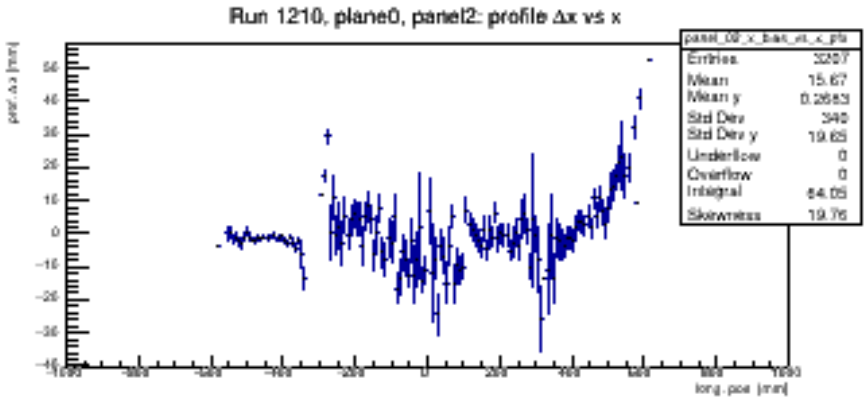

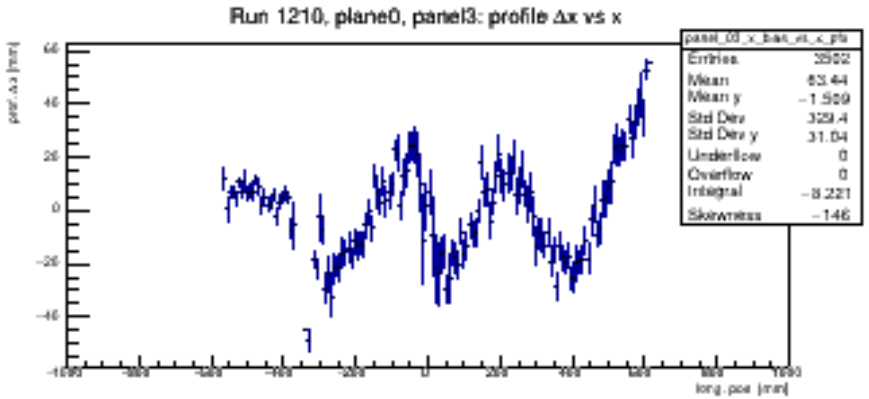

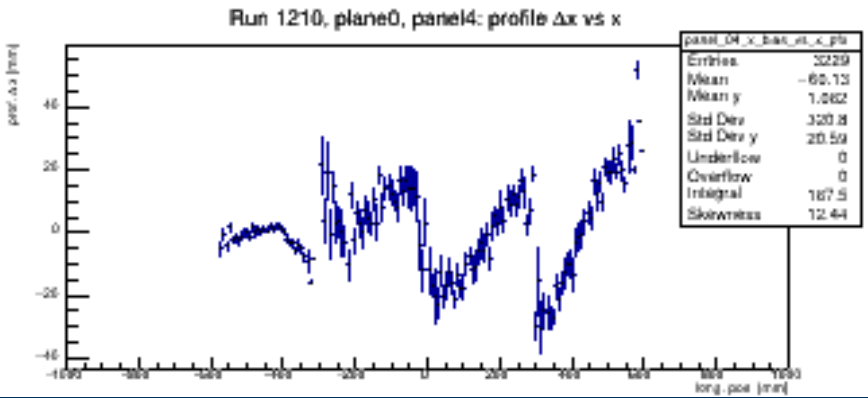

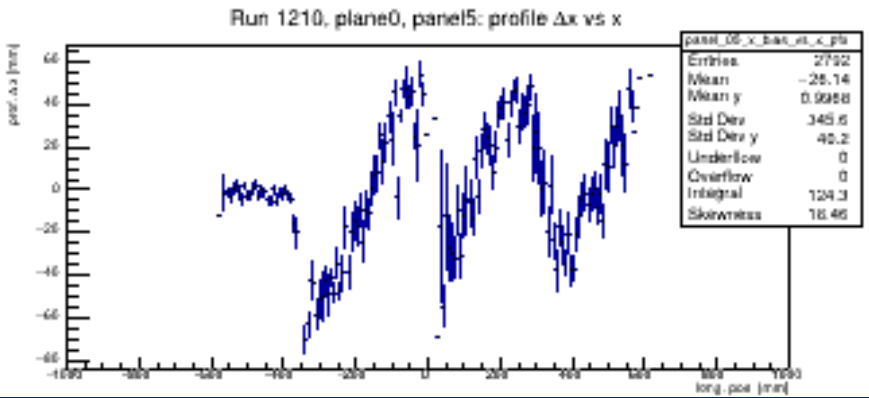

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