

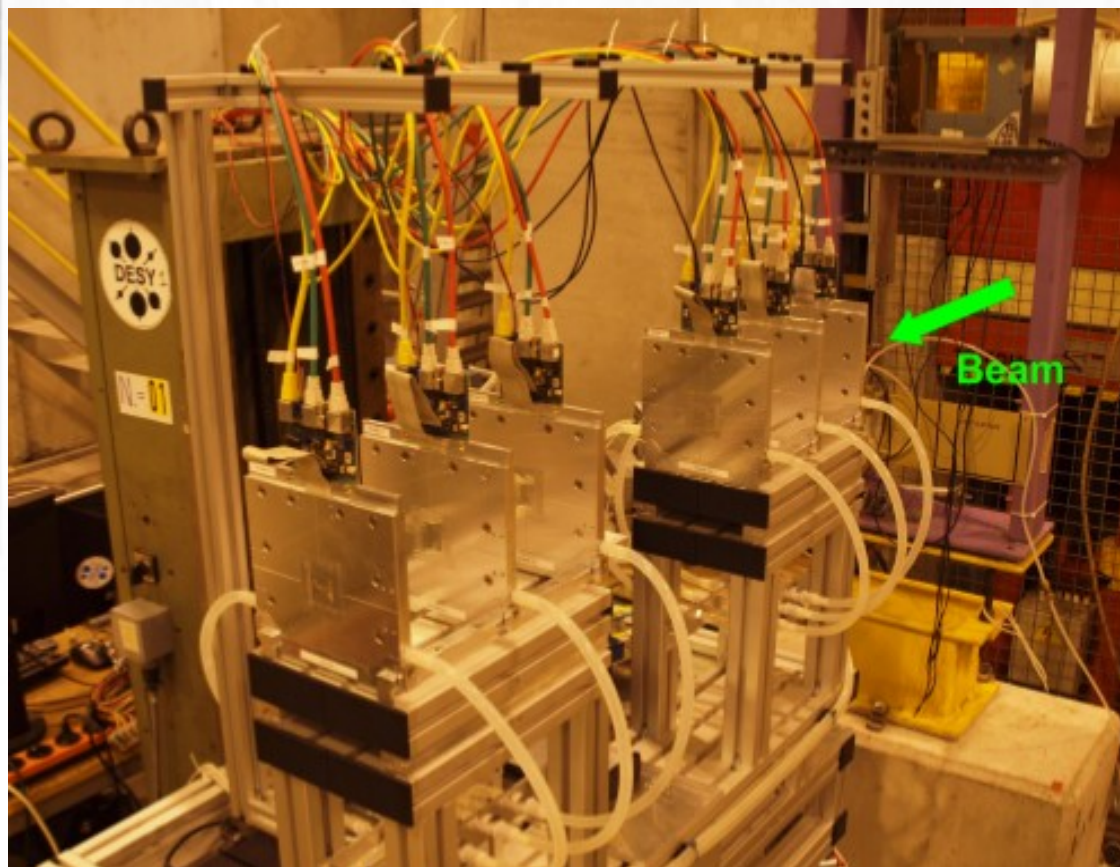


Current status of Test Beam data analysis

Olena Karacheban, CMS weekly meeting,
27 Nov. 2013, DESY-Zeuthen

EUDET Telescope -

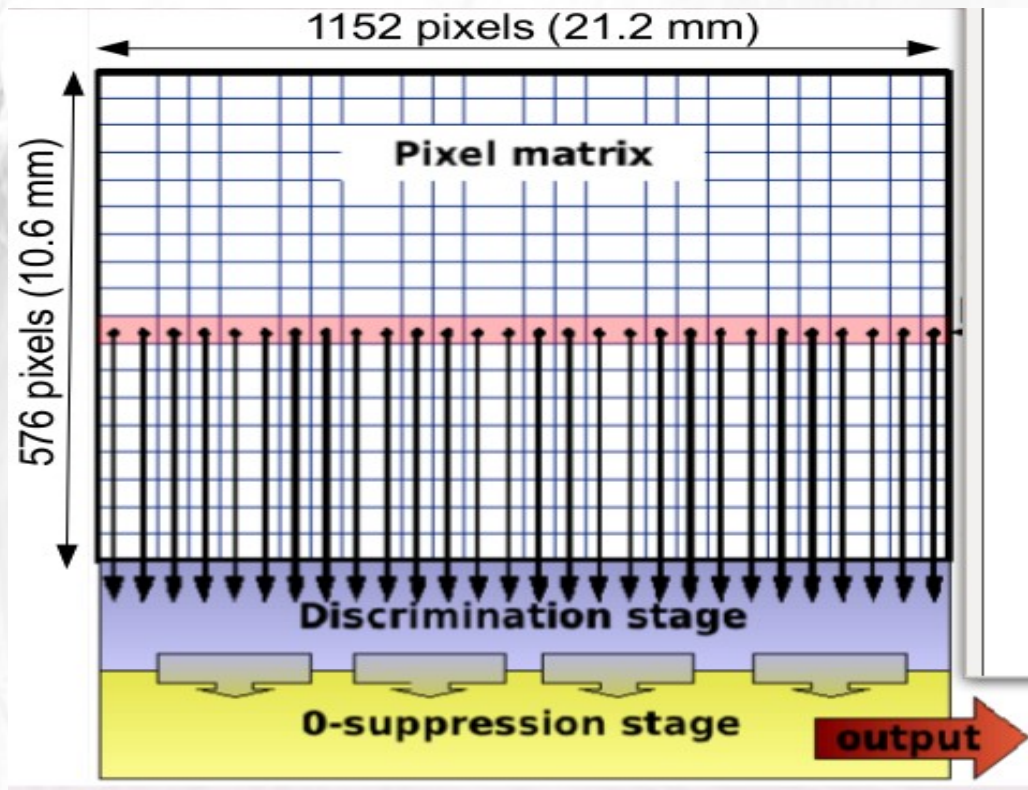
tracking device designed for detector prototypes characterisation at the test beam.



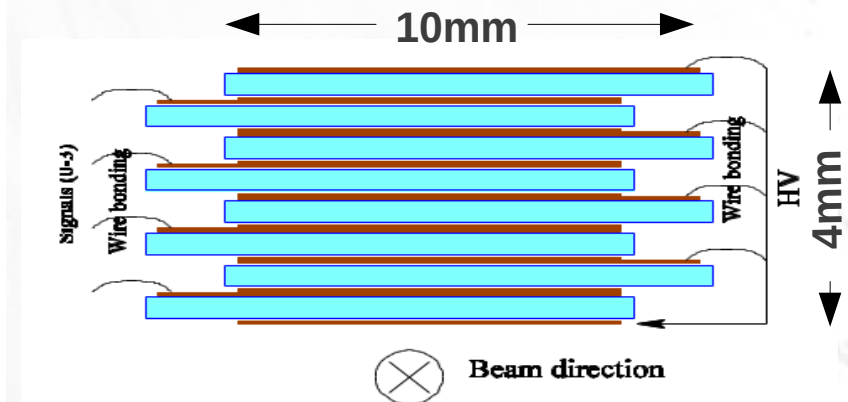
- The active area of the telescope consists of six Mimosa26 pixel sensors.
- Six measurement points per track.
- Geometry can be changed by user.

Mimosa26 Sensors (21.2mmx10.6mm)

Sapphire detector (DUT)

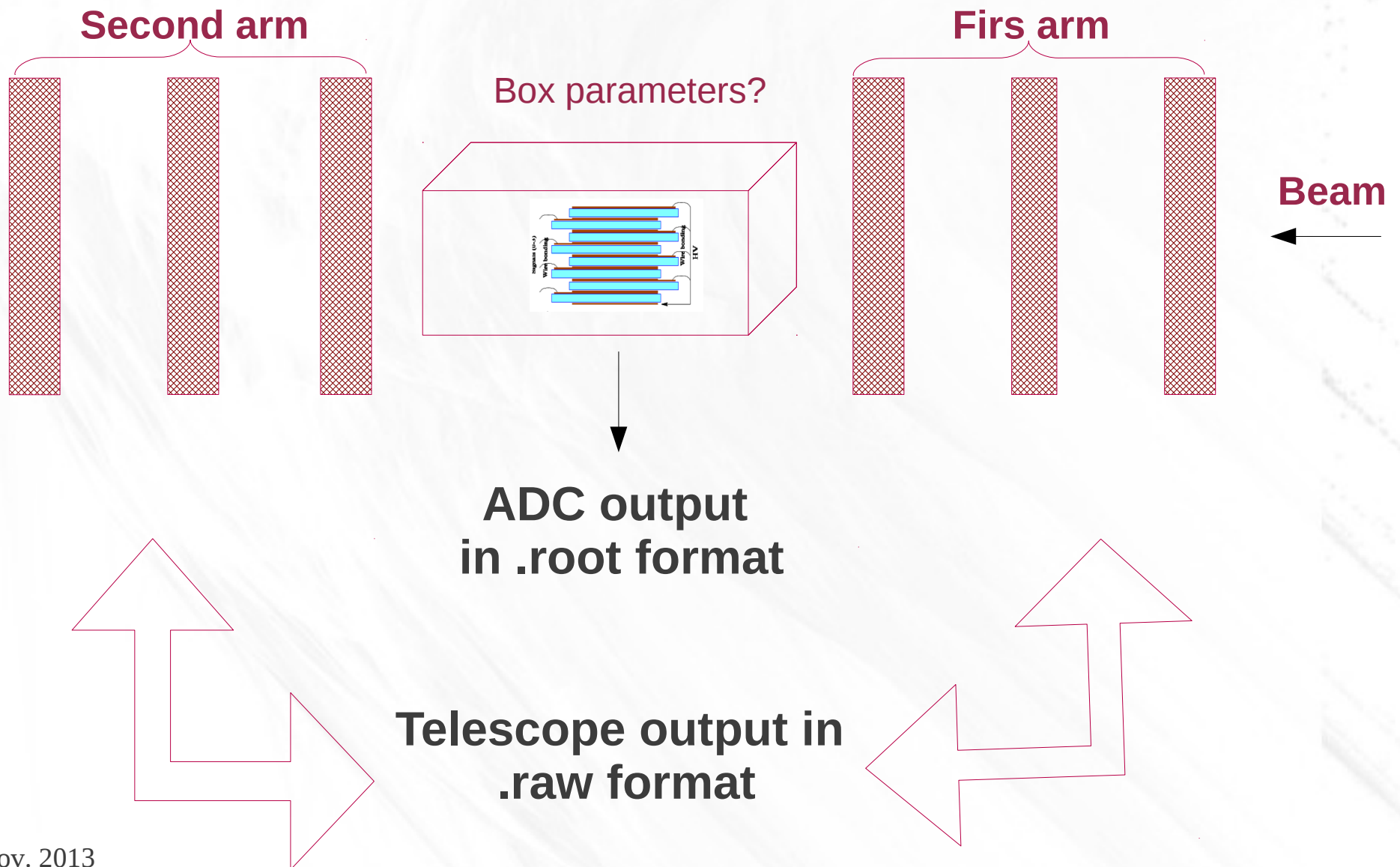


- Pixel size 18.4 μm
- MAX Track pointing resolution $\sim 2 \mu\text{m}$.



- 8 individual sapphire plates 10 x 10 x 0.5 mm.
- Al-Pt-Au metallization from both sides 9 x 9 mm.
- 4 readout channels.
- Beam energy 5 GeV.

TB geometry



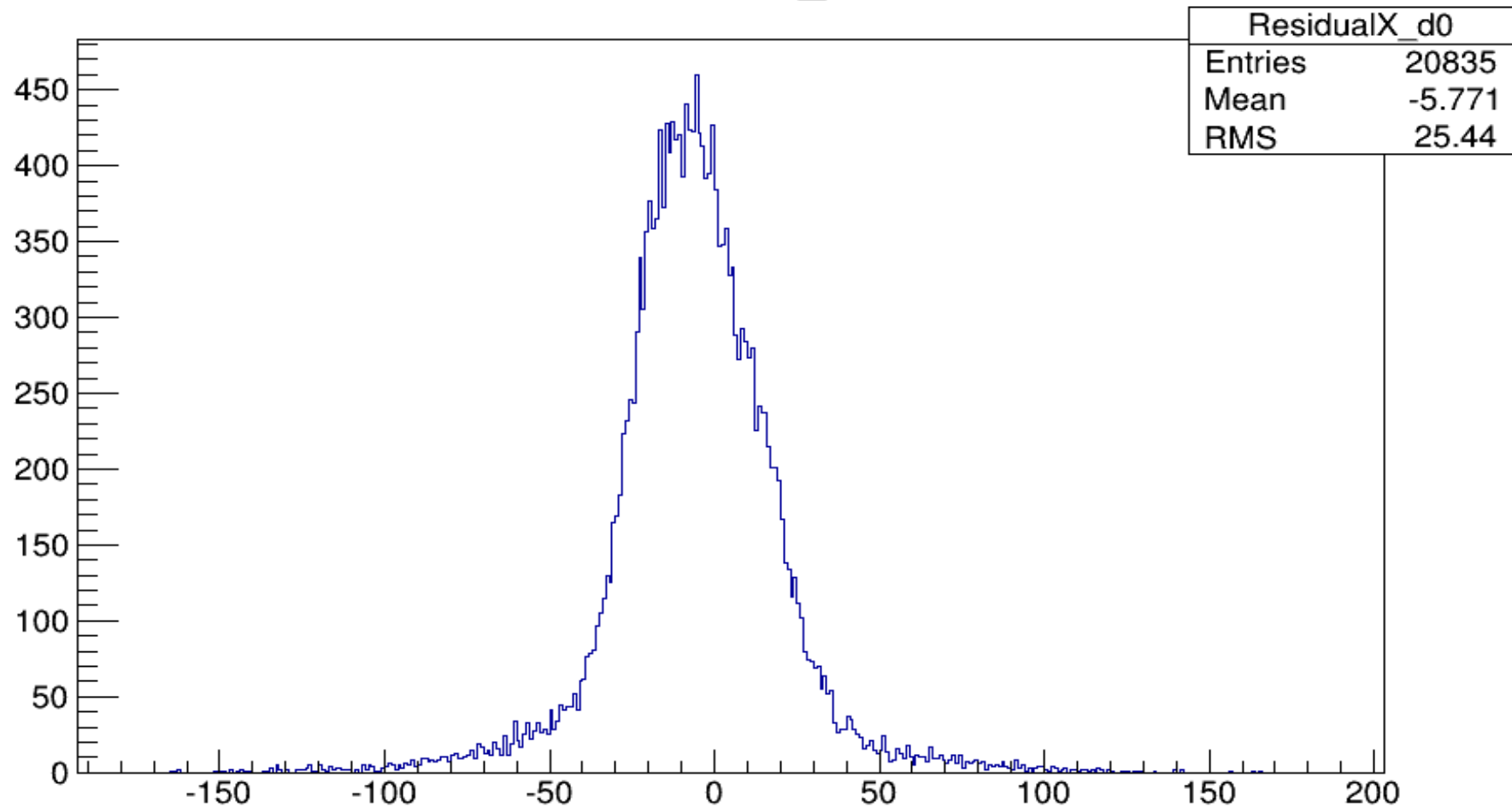
EUTelescope software

Offline analysis includes few steps:

- **converter** → format from raw to lcio, create HopPixel;
- **clustering** → use HotPixel to create SensorOffset;
- **filter** → minimise clusters;
- **hitmaker** → use SensorOffset to do PreAlignment;
- **align** → precise alignment;
- **fitter** → build final tracks → DUT **analysis**.

We want **one alignment for all files**.
Alignment parameters were calculated from
run without DUT **#288**.

XResidual_d0

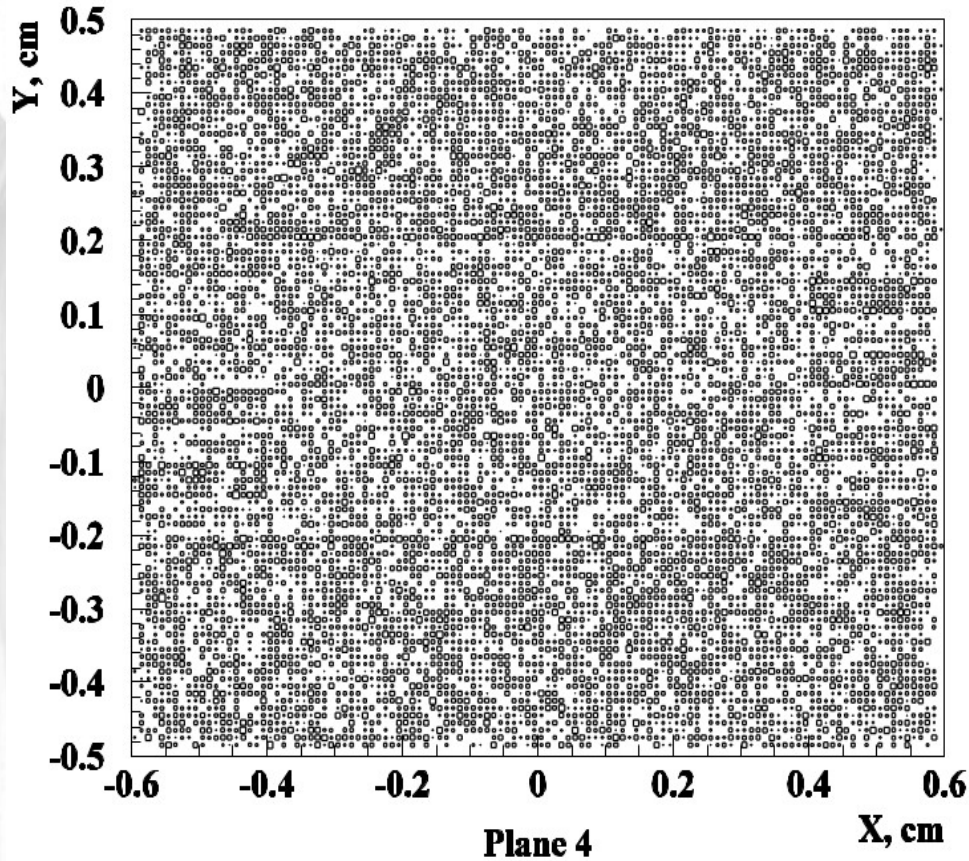


Residual values. X and Y

EU Telescope sensor number	Residual X (um)		Residual Y (um)	
	mean	RMS	mean	RMS
Plane 1	-5.77	25.44	-17.5	31.09
Plane 2	-1.2	15.48	3.96	18.6
Plane 3	4.35	23.99	-11.04	27.7
Plane 4	-12.53	26.13	-12.07	31.4
Plane 5	46.01	31.95	131.8	42.6
Plane 6	-30.86	34.14	-95.17	39.89

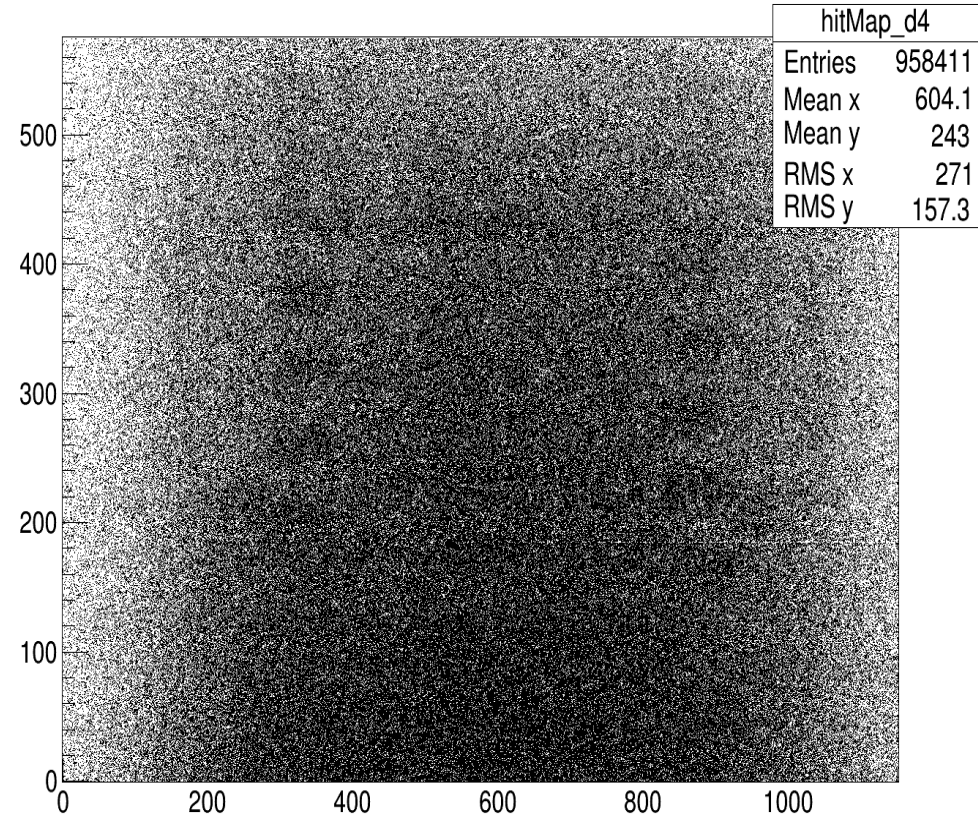
Expected and measured hit distribution at 4-th telescope plane

Telescope plane downstream DUT



Monte Carlo GEANT3, 1 million events generated.

Hit map



Deviation of the electron track from the straight line inside the sensor is within 10 m

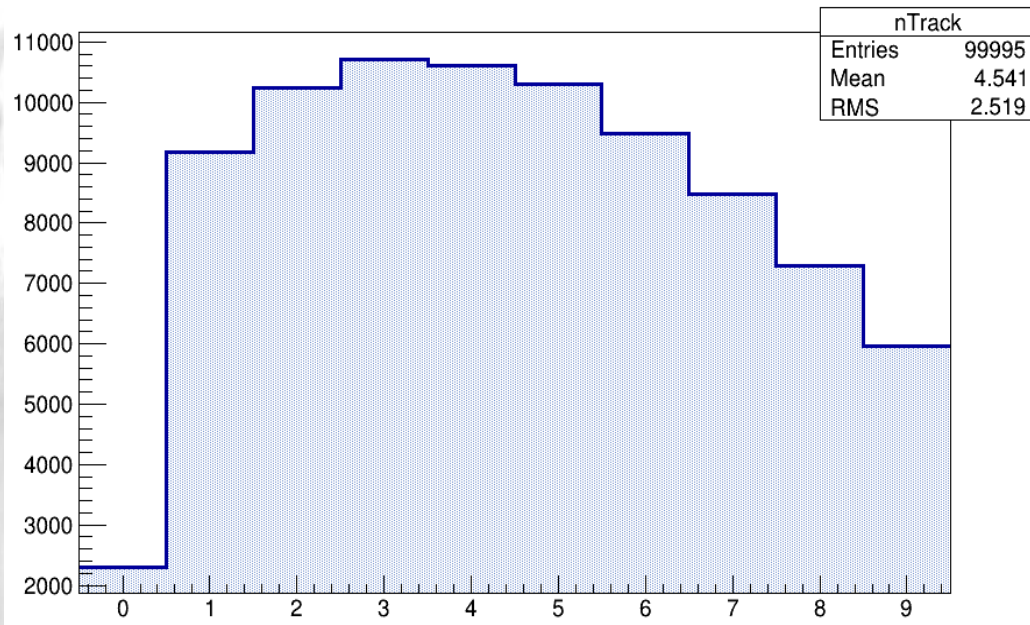
Run #268 - run with DUT, 500V

Analysis steps:

- **converter** → **clustering** → **filter** → **hitmaker** — *standard steps, applied w/o changes;*
- **alignment** *applied from run #288;*
- **fitter** *modified to produce ROOT files with hits coordinates;*
- *hits coordinates are used in* **analysis program.**

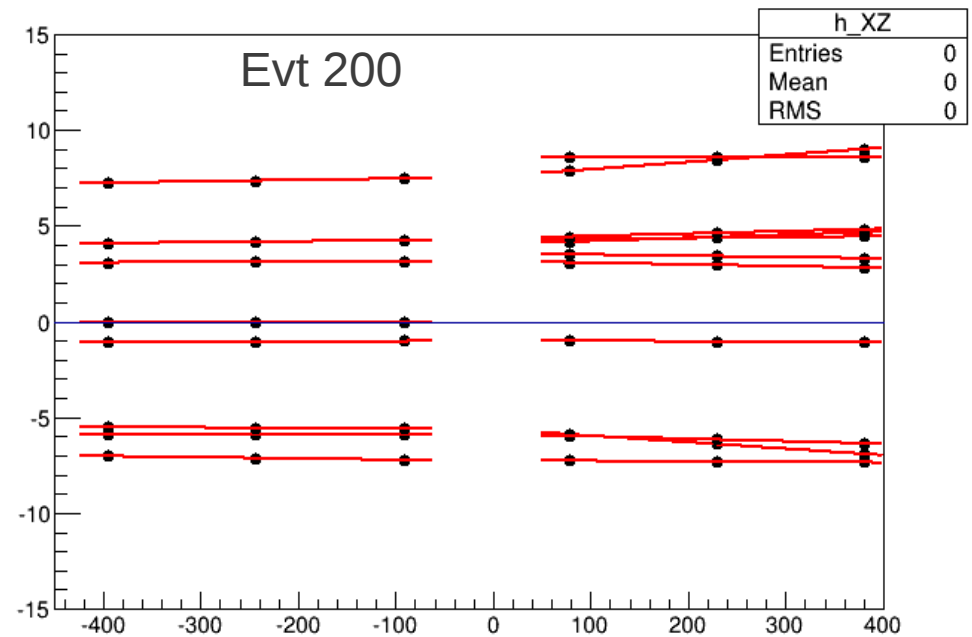
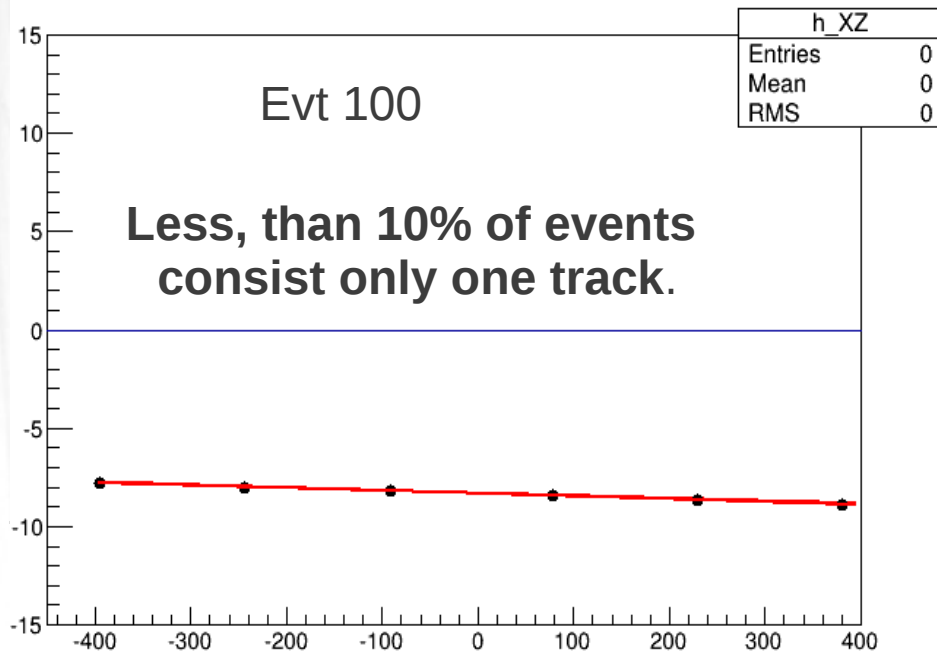
Fitted tracks for run #268

Number of reconstructed tracks in an event



For next TB we should take care about track multiplicity per event immediately.

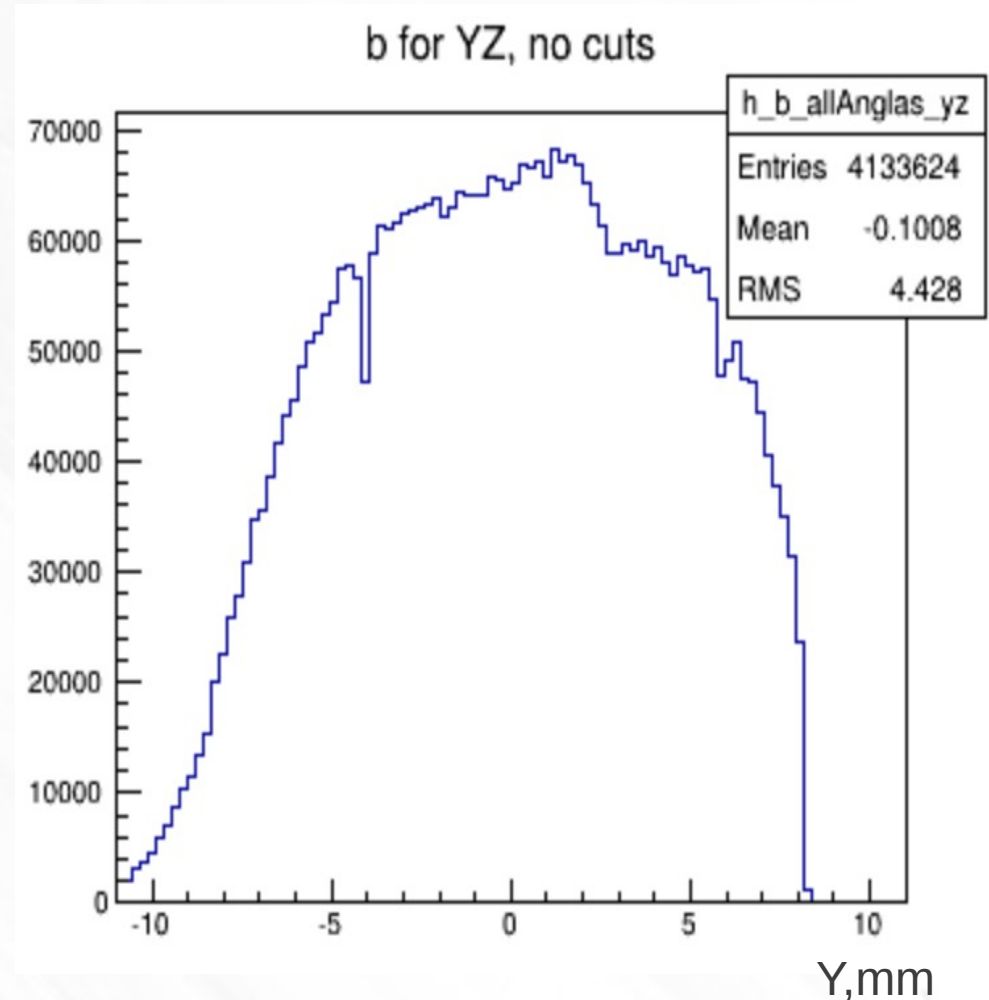
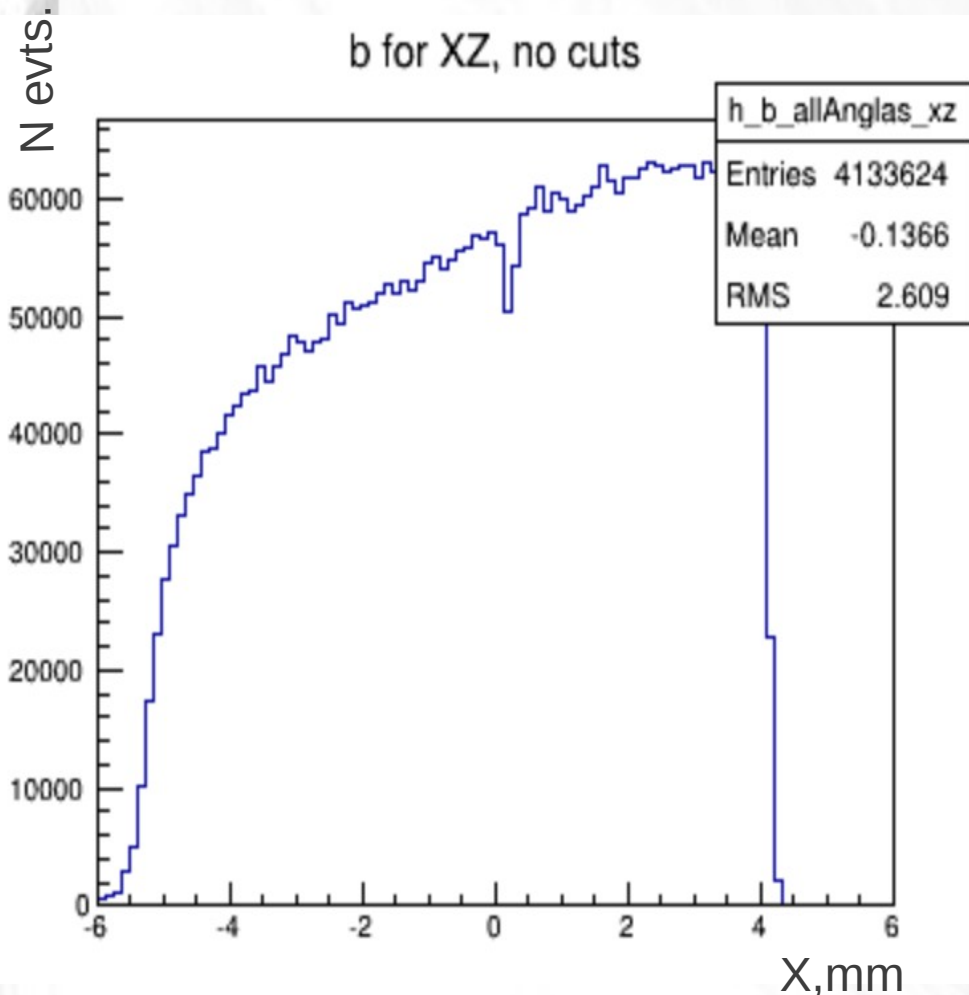
For this analysis: shall we cut all events with high multiplicity?



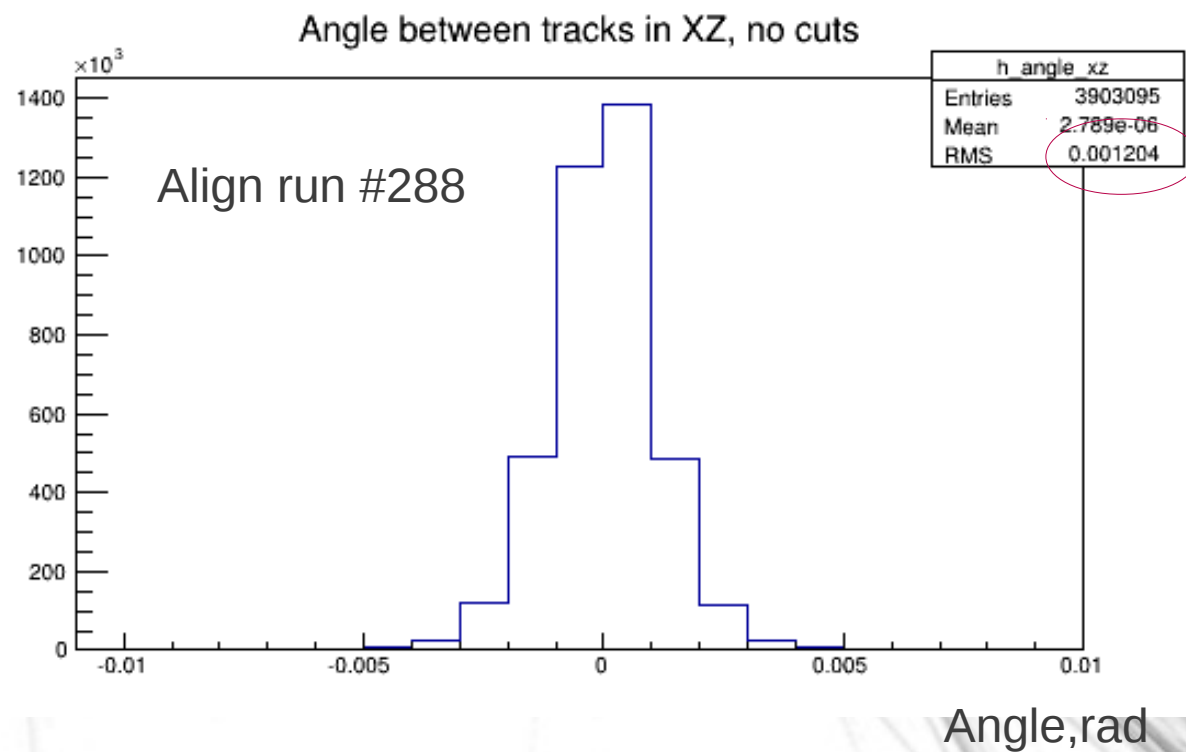
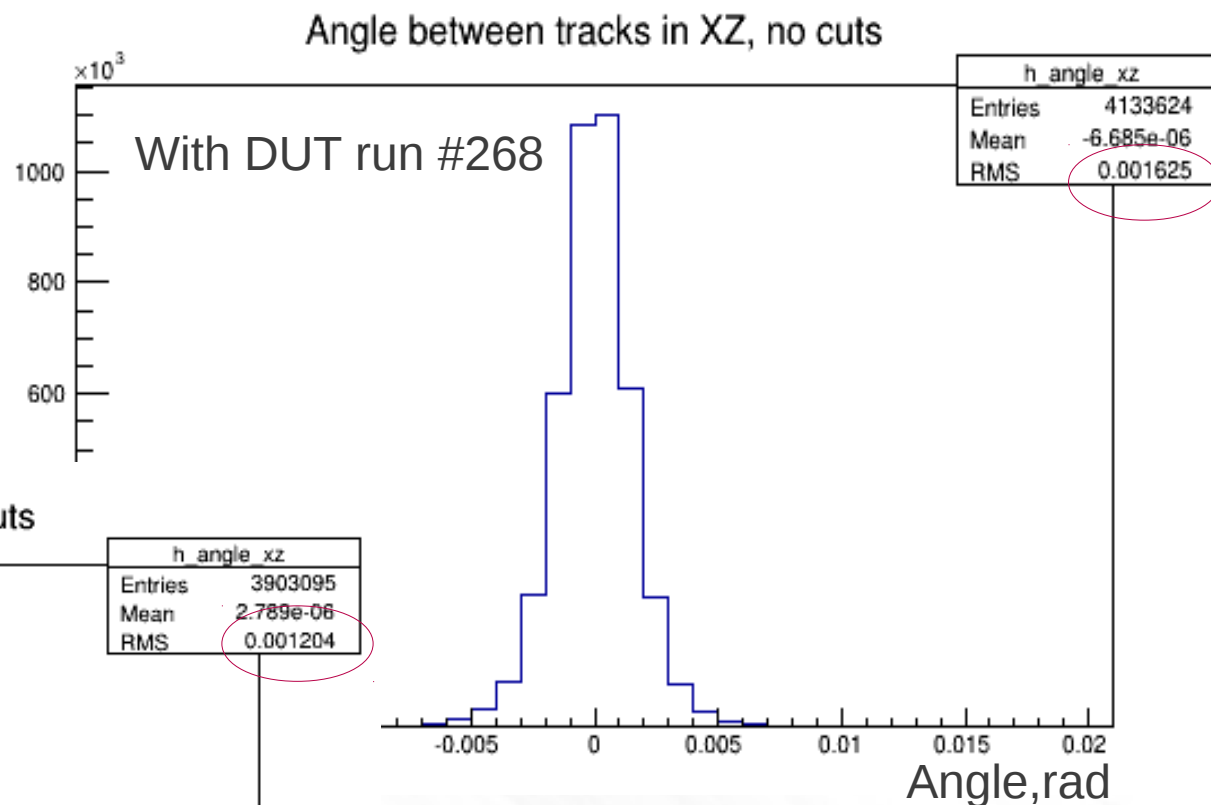
Tracks from two arms were fitted separately.

$y = a*z + b$ in YZ projection and

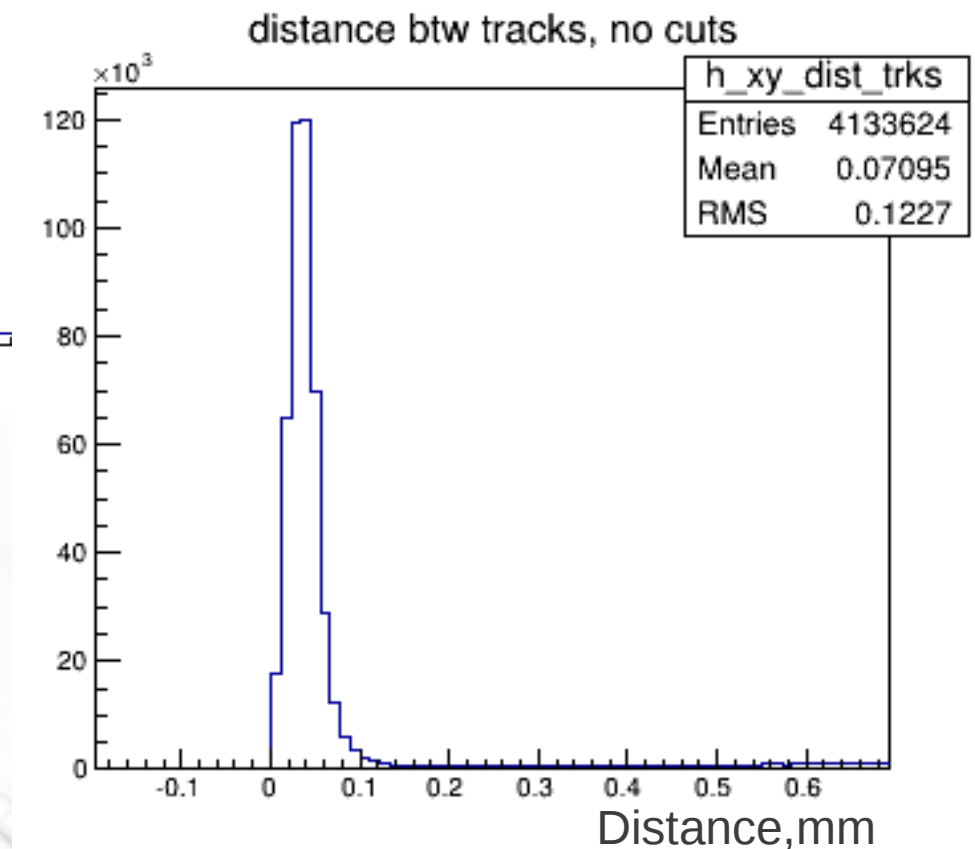
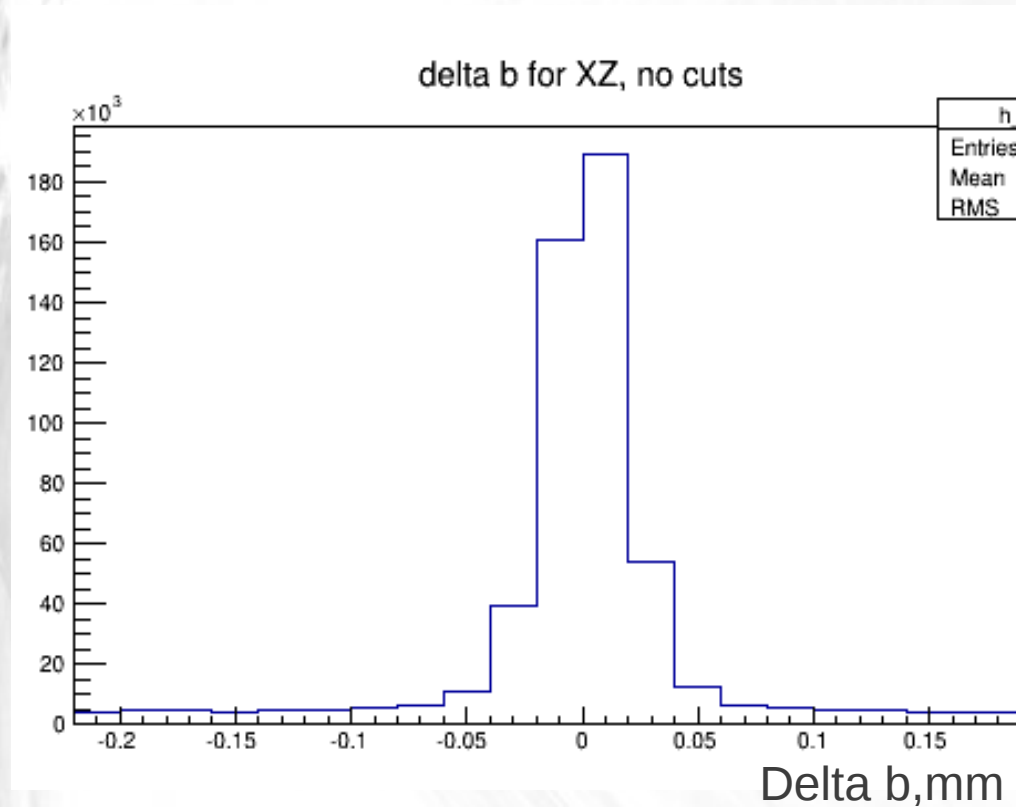
$x = a*z + b$ in XZ projection.



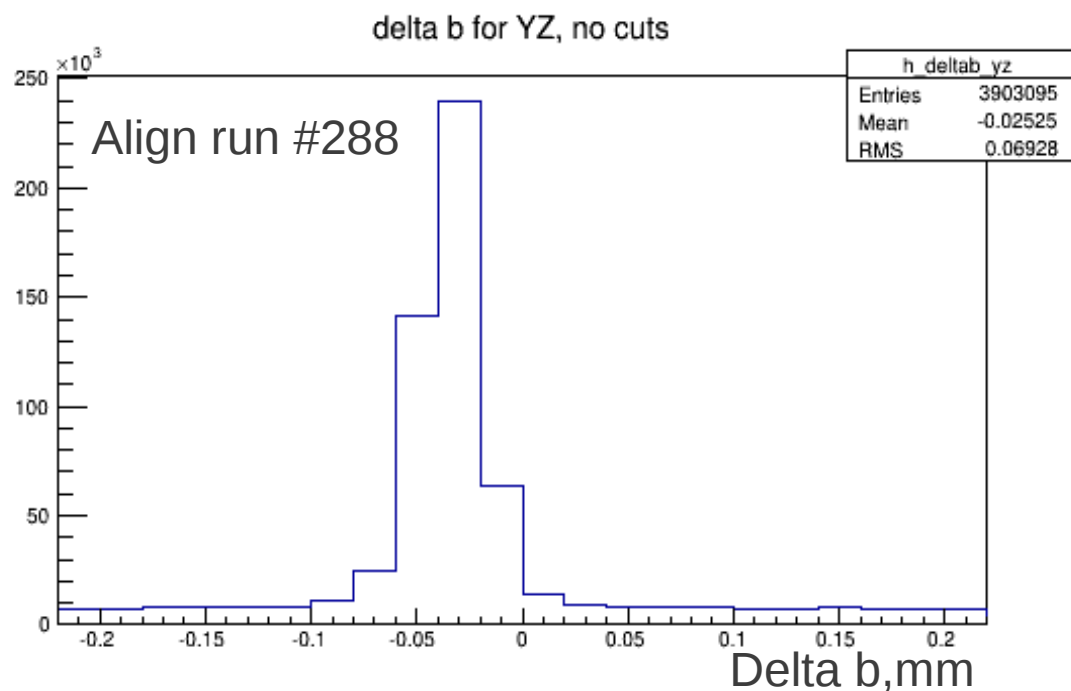
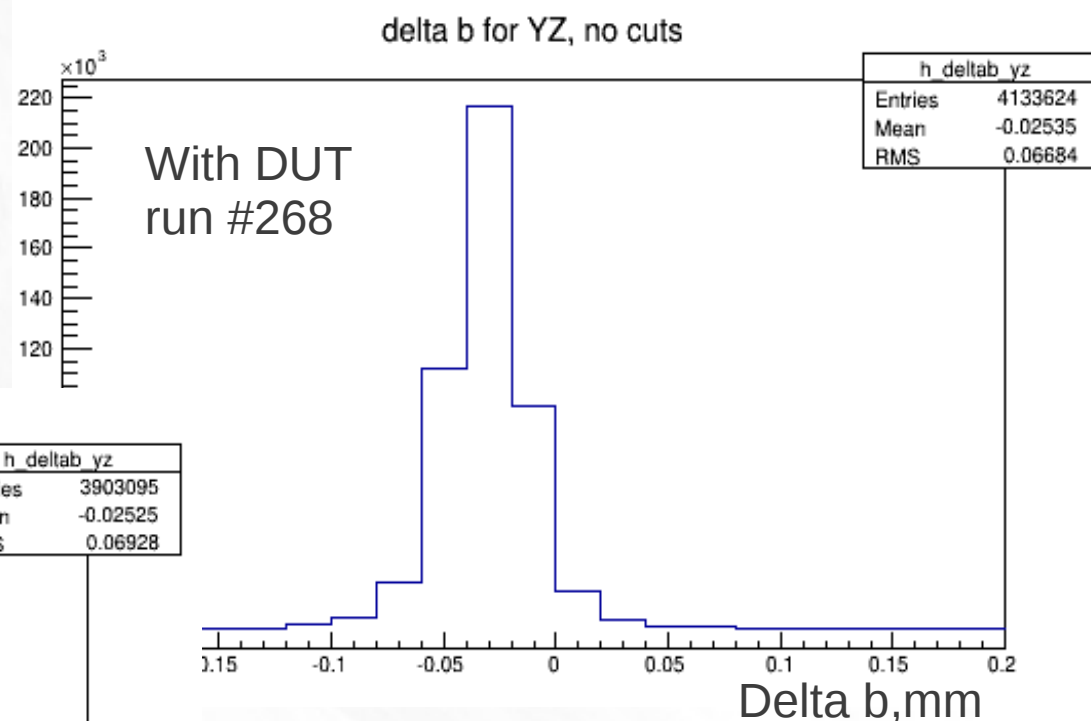
Angle between tracks in XZ for align run #288 and run #268 with DUT



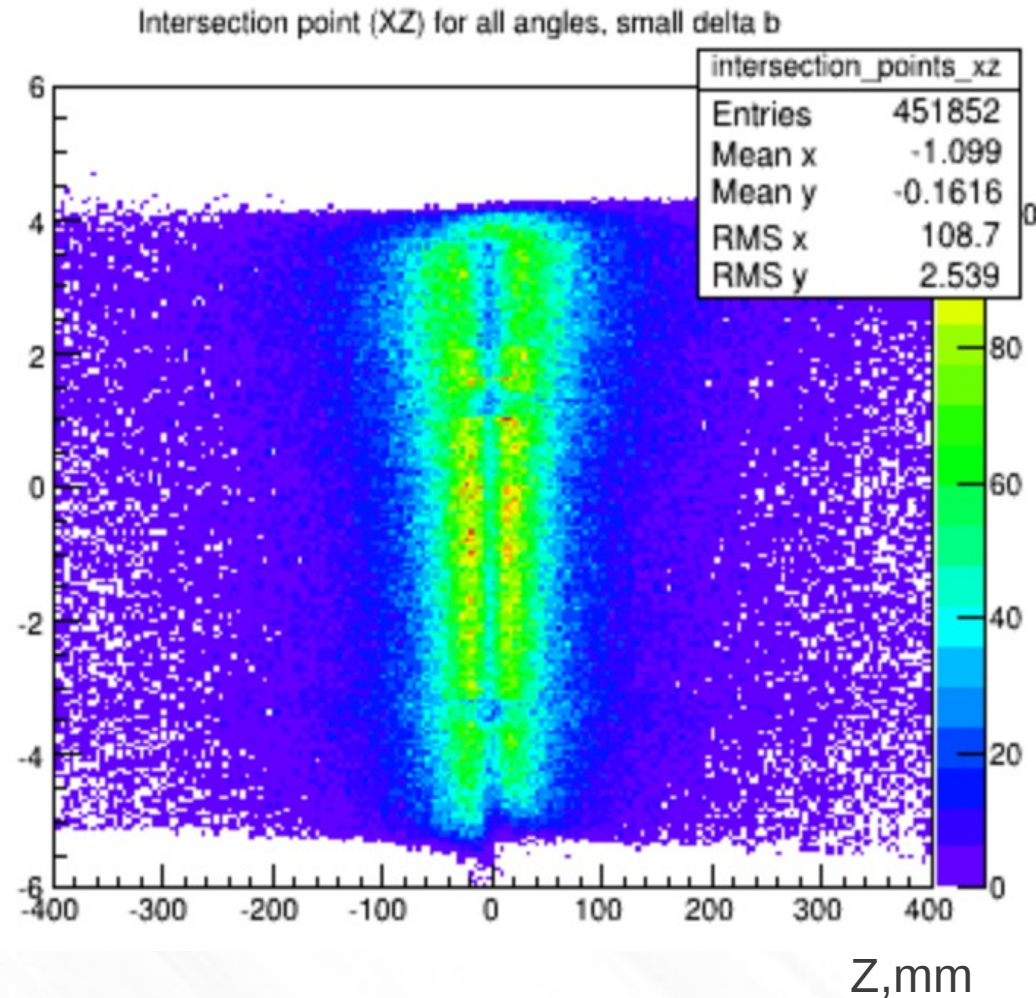
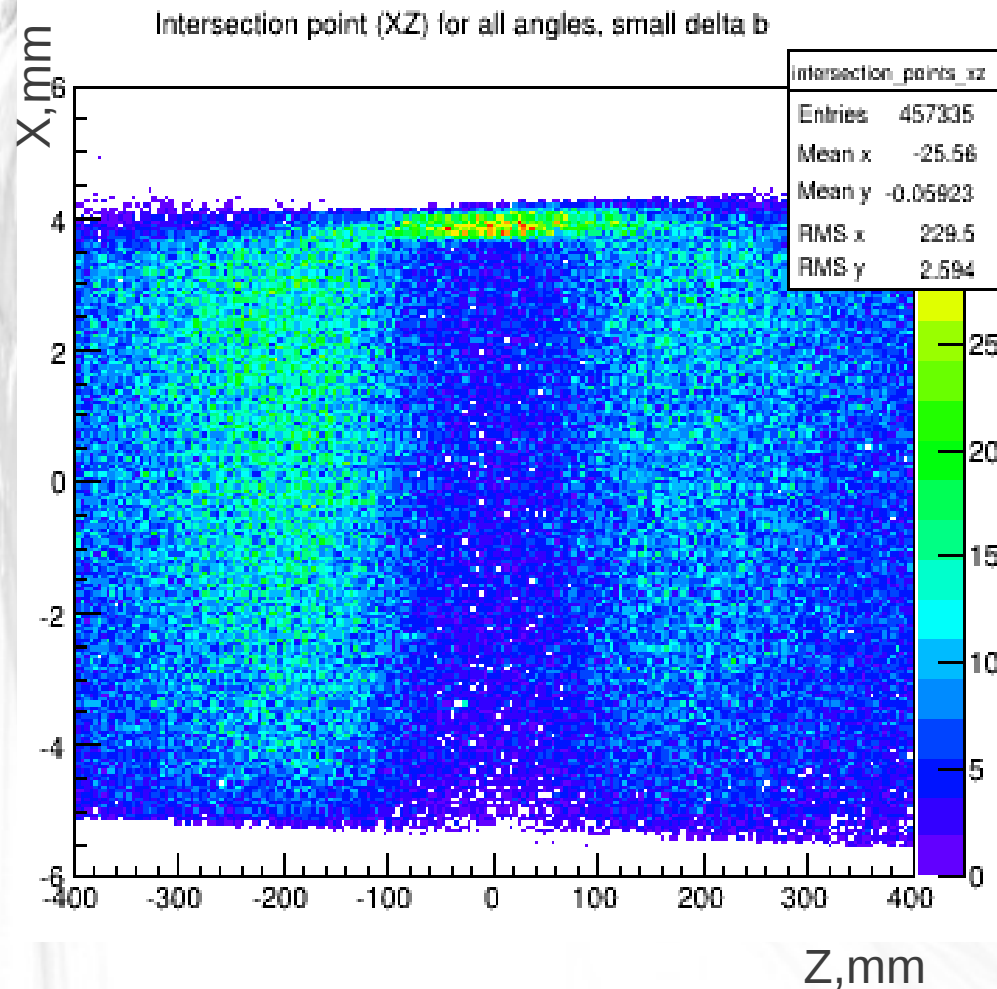
Impact parameter - delta b in XZ and distance between tracks distribution, Z=0



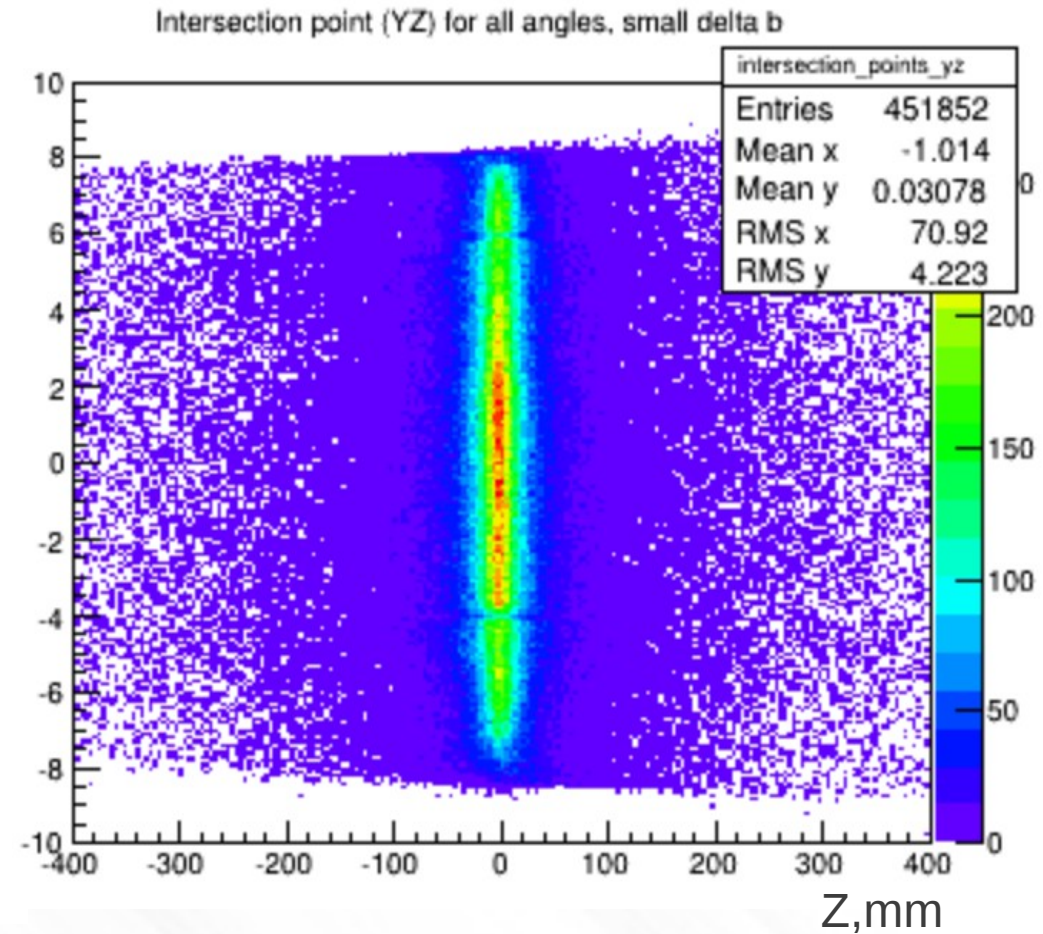
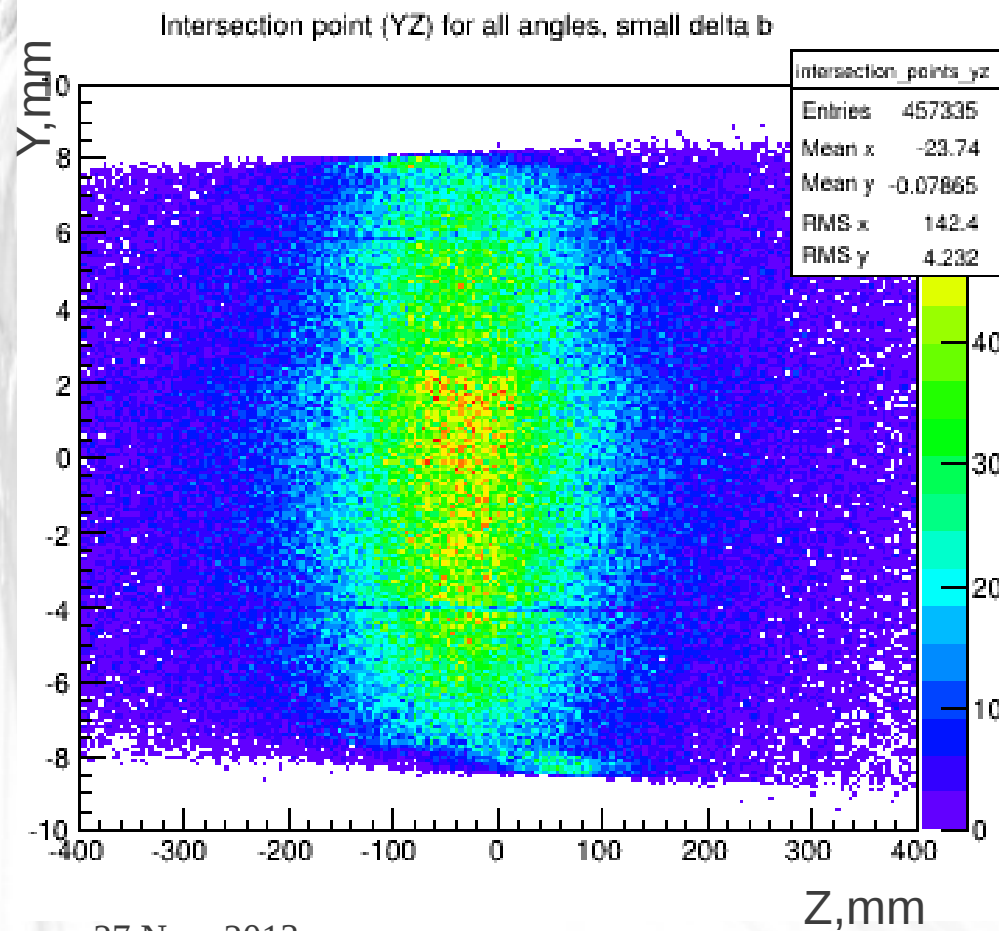
delta b in YZ is asymmetric for both align run and for run with DUT



Intersection point in XZ for tracks with small impact parameter for align run and run with DUT

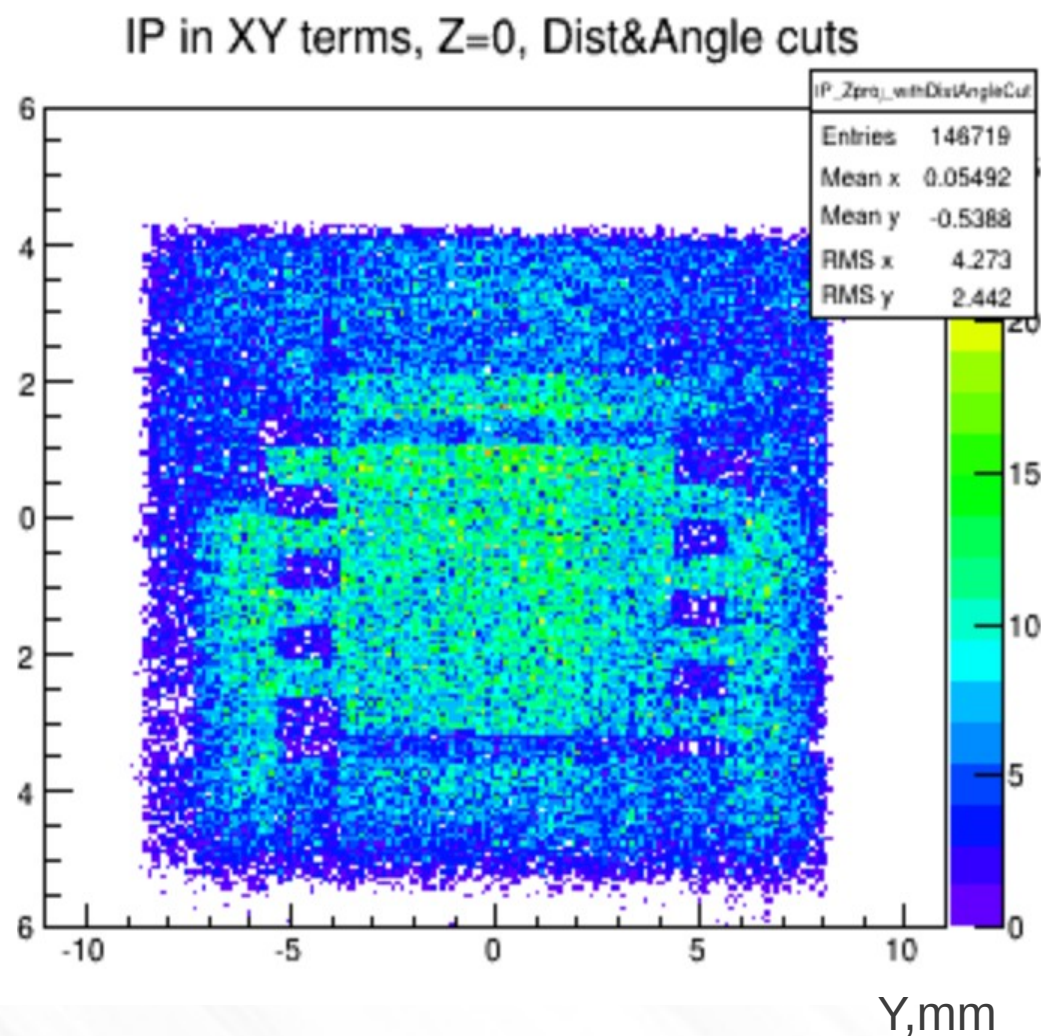
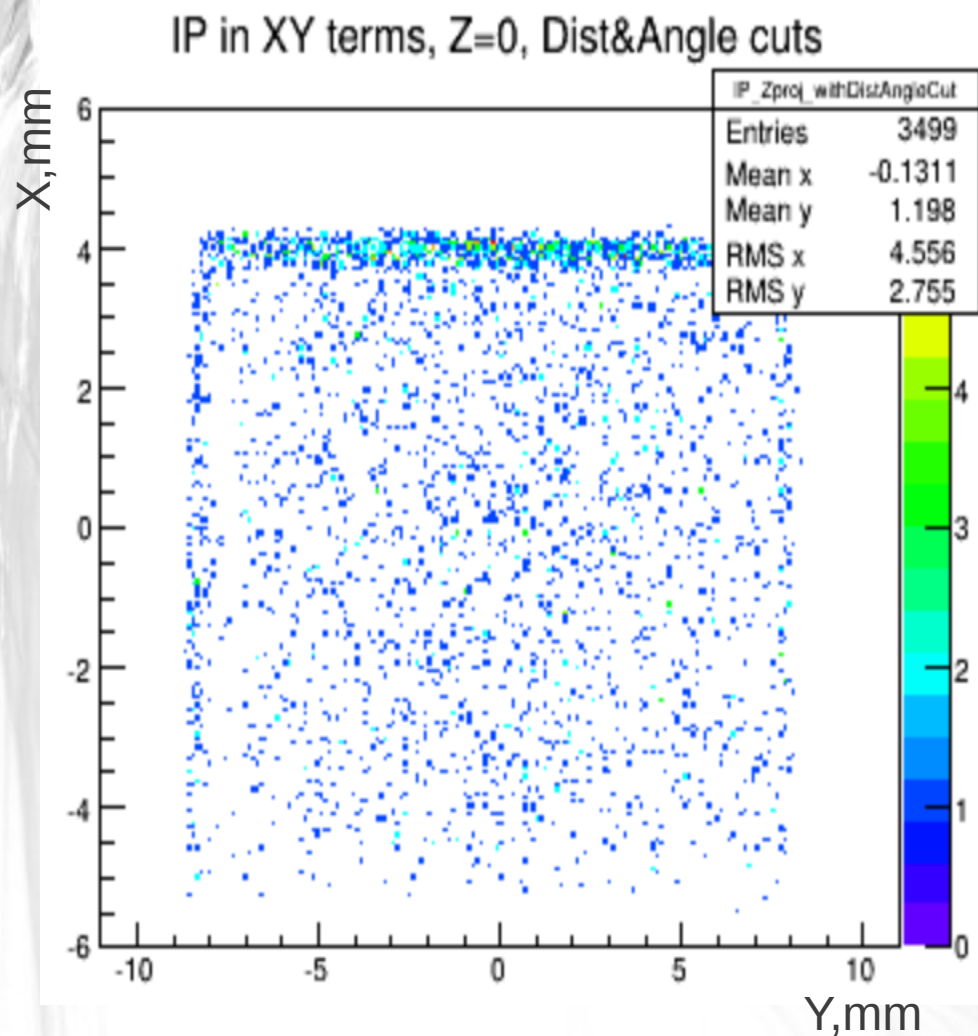


Intersection point in YZ for tracks with small impact parameter for align run and run with DUT



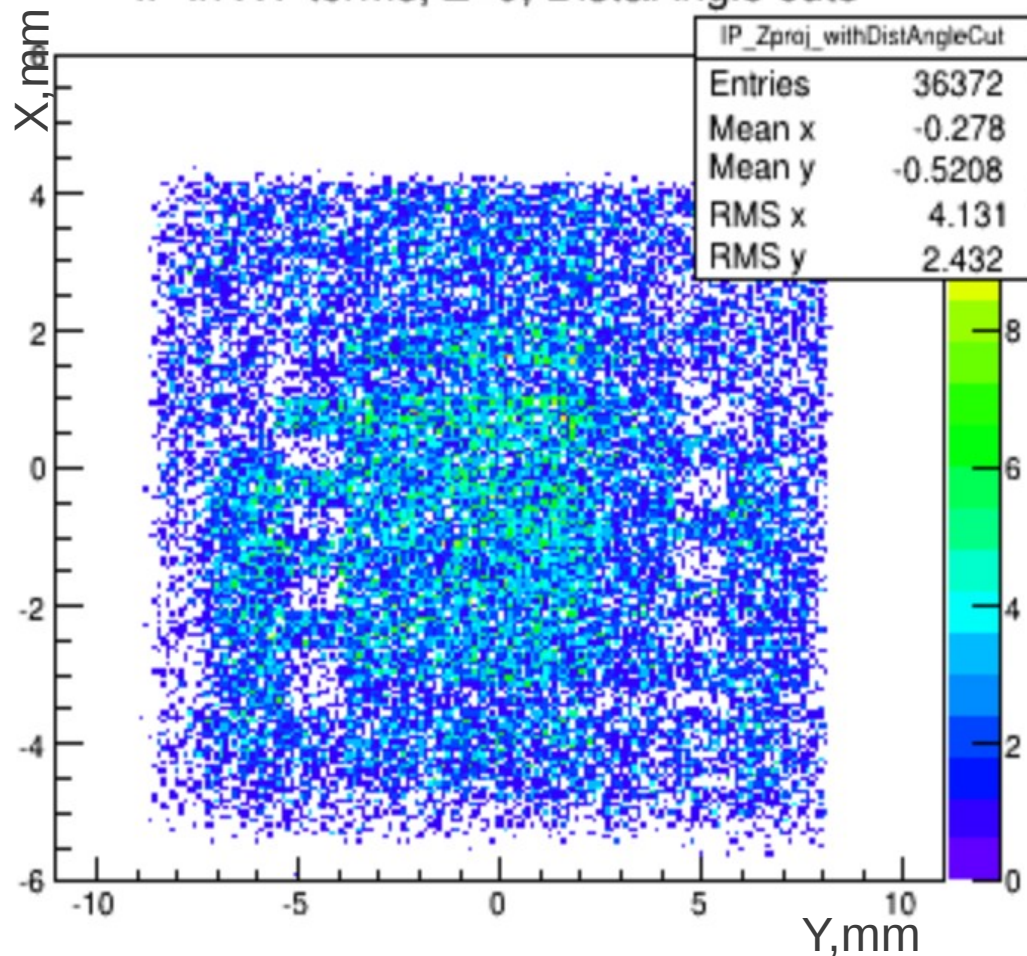
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Intersection point (X,Y,0) for tracks with small distance & big angle for align run and run with DUT

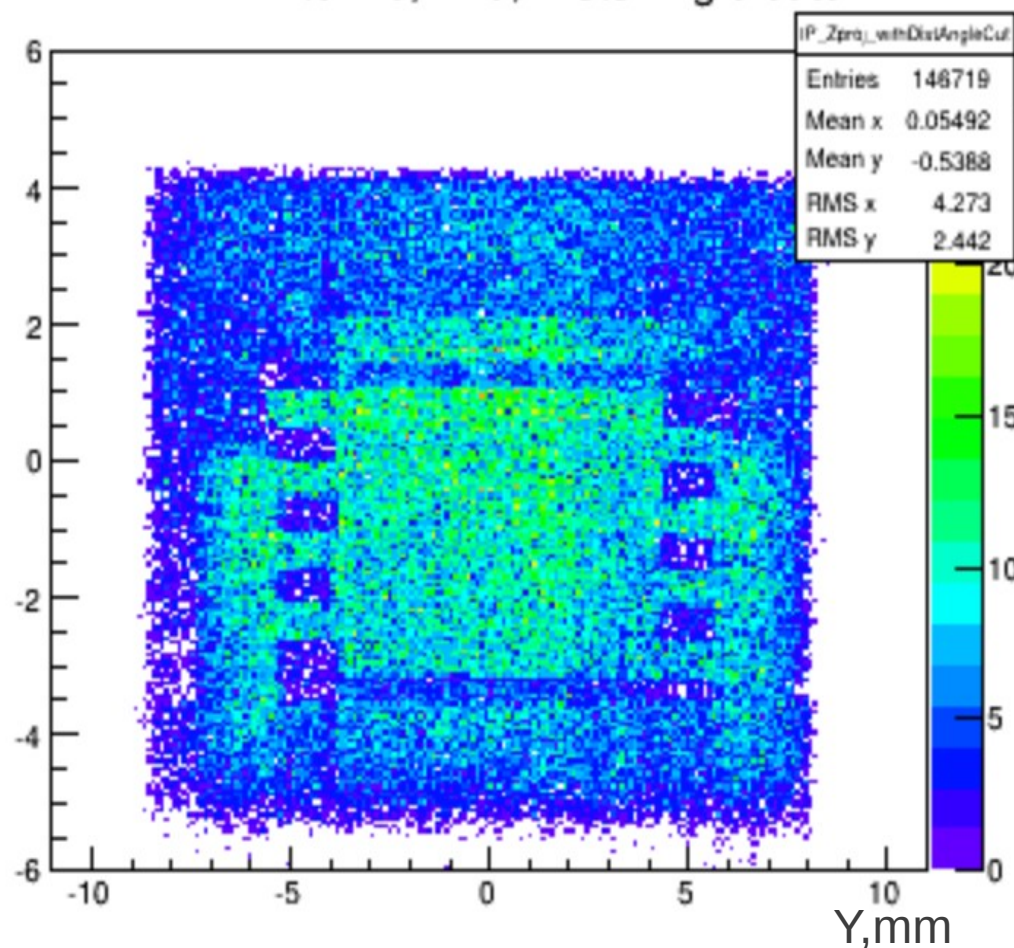


Intersection point (X,Y,0) for events with 4 or less tracks per events and for full run with DUT

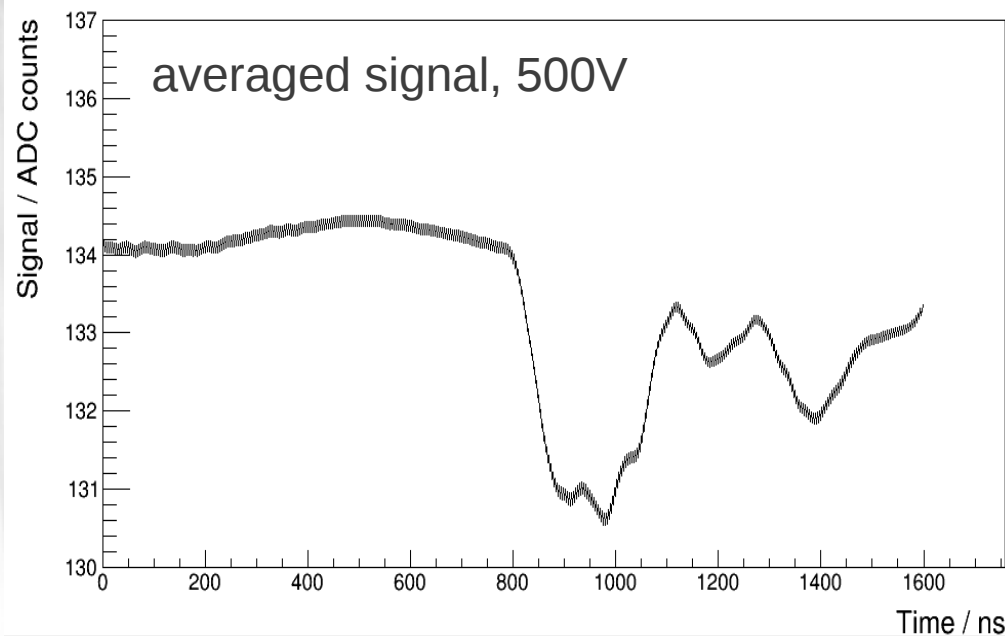
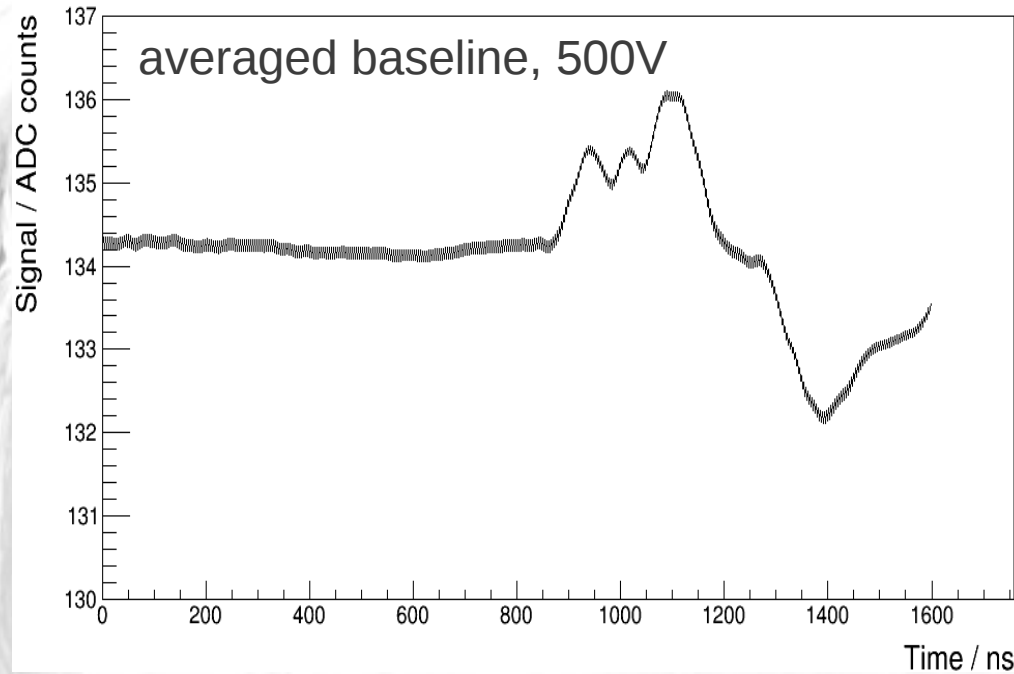
IP in XY terms, Z=0, Dist&Angle cuts



IP in XY terms, Z=0, Dist&Angle cuts

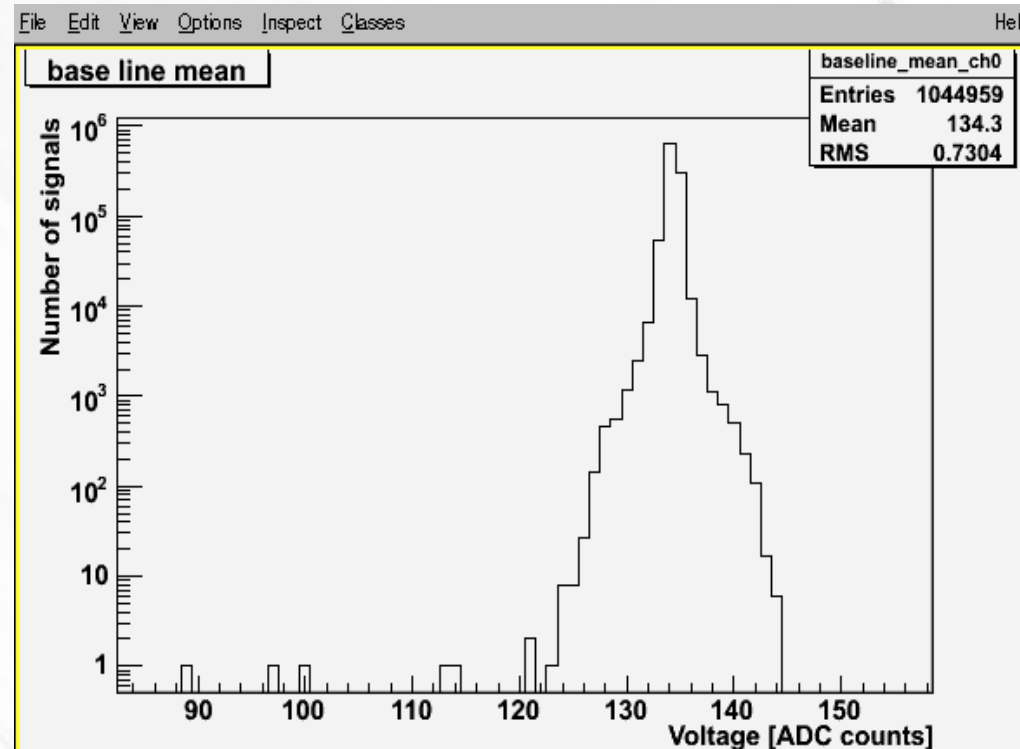


ADC signal

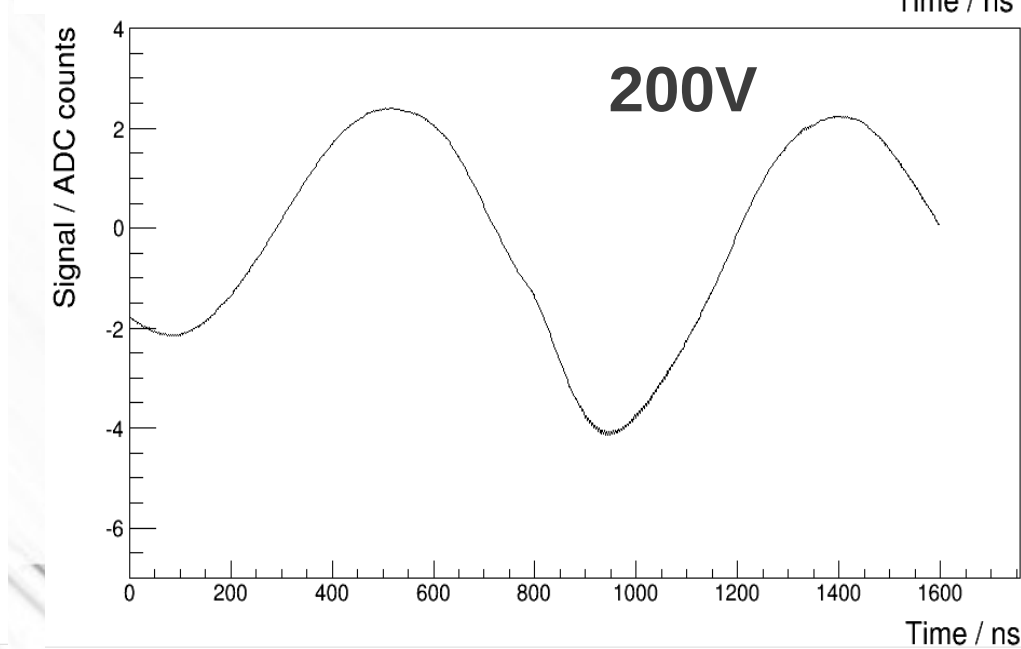
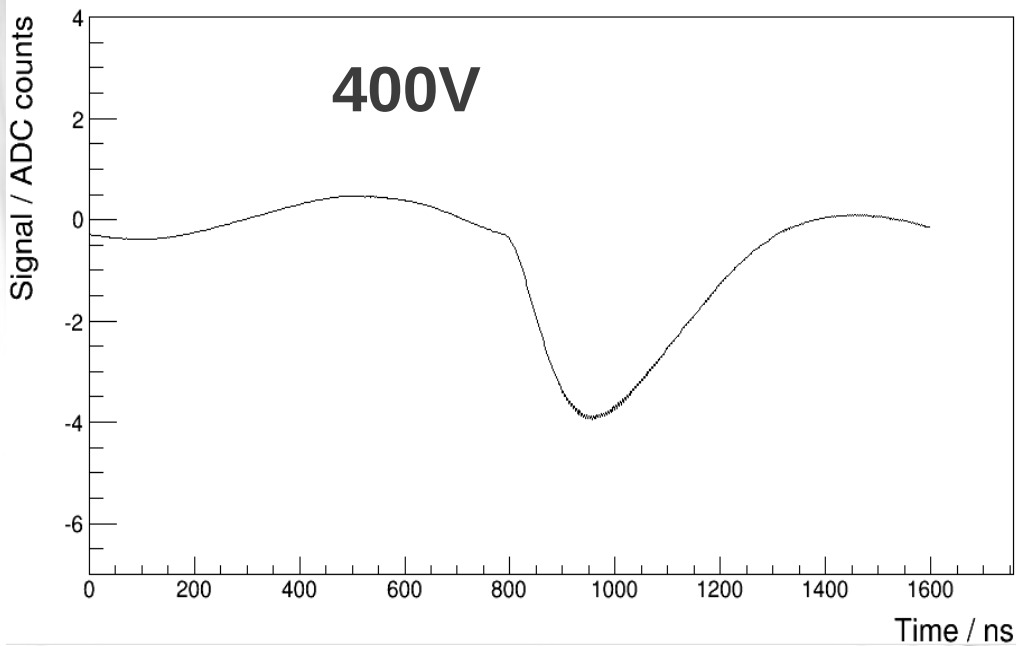
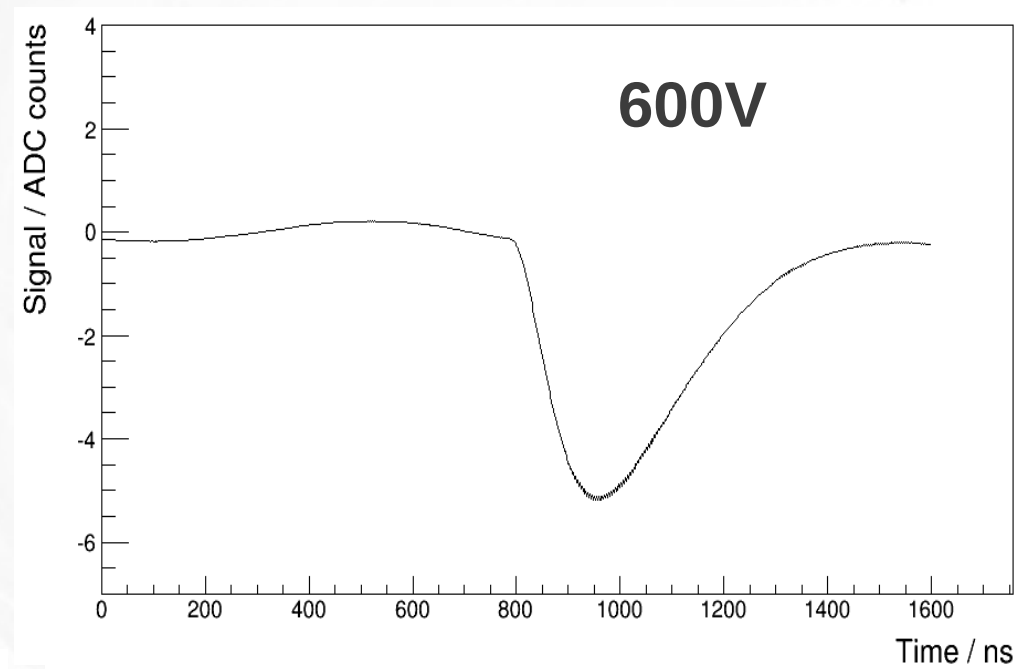
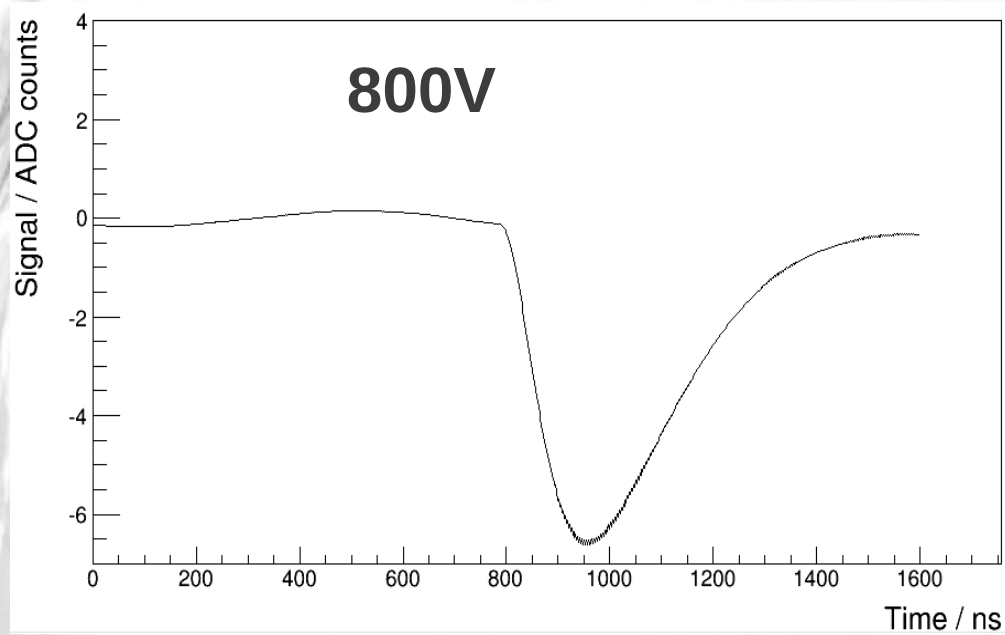


Sampling ADC v1721,
255 channels was used.

For ~96% events baseline is
In range 134-135.
Rest of events are baseline
fluctuations.



Signal from sapphire after subtraction on baseline



Conclusion

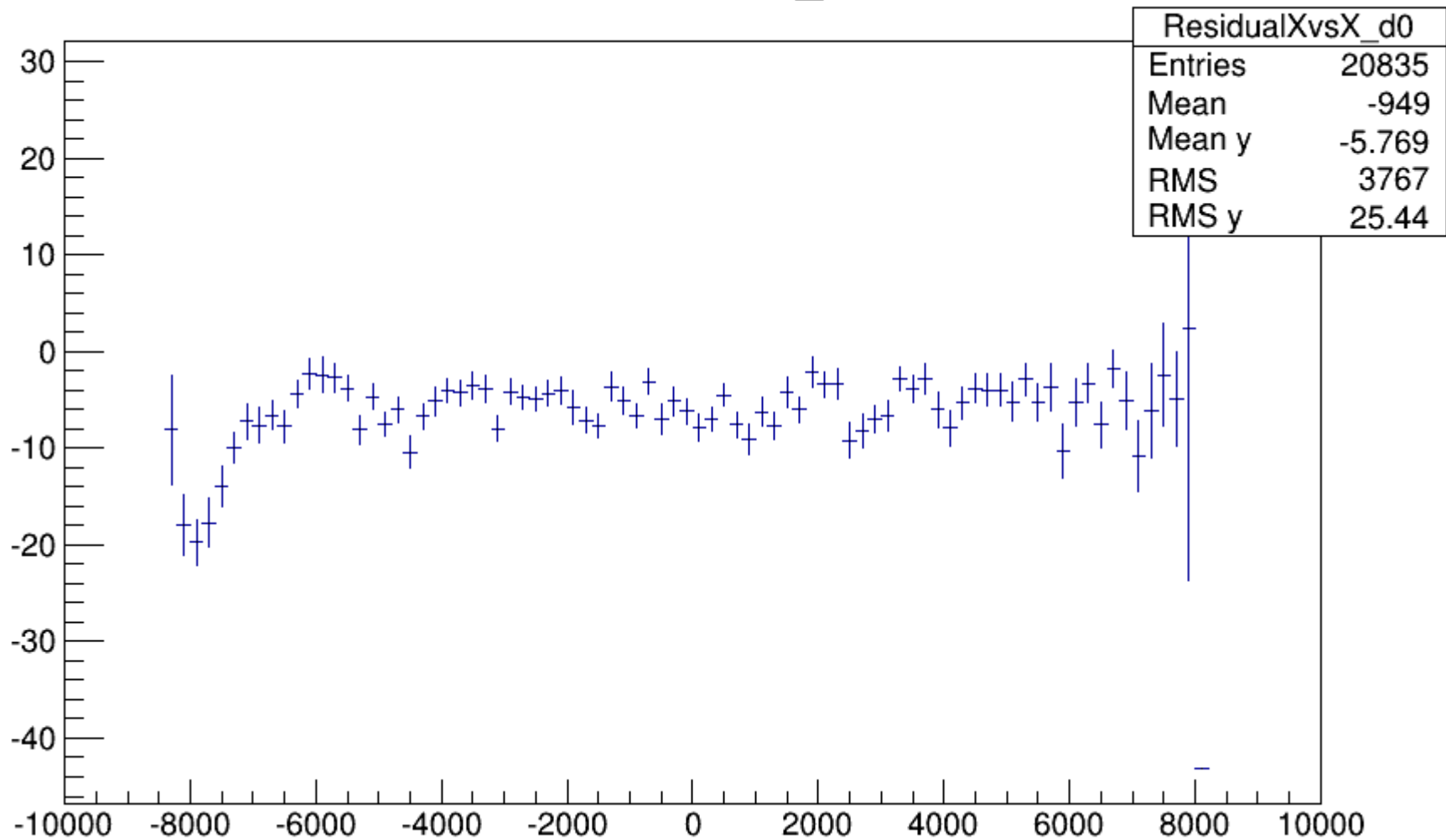
- Tracks are reconstructed using UETelescope software.
 - Alignment from run #288 applied.
 - We can see detector position.
-
- Averaged signal from detector is 6.5 ADC channels for 800V.

Plans

- We want to go from projections to 3D.
- Last step is synchronisation of ADC signal and track position.

Backup

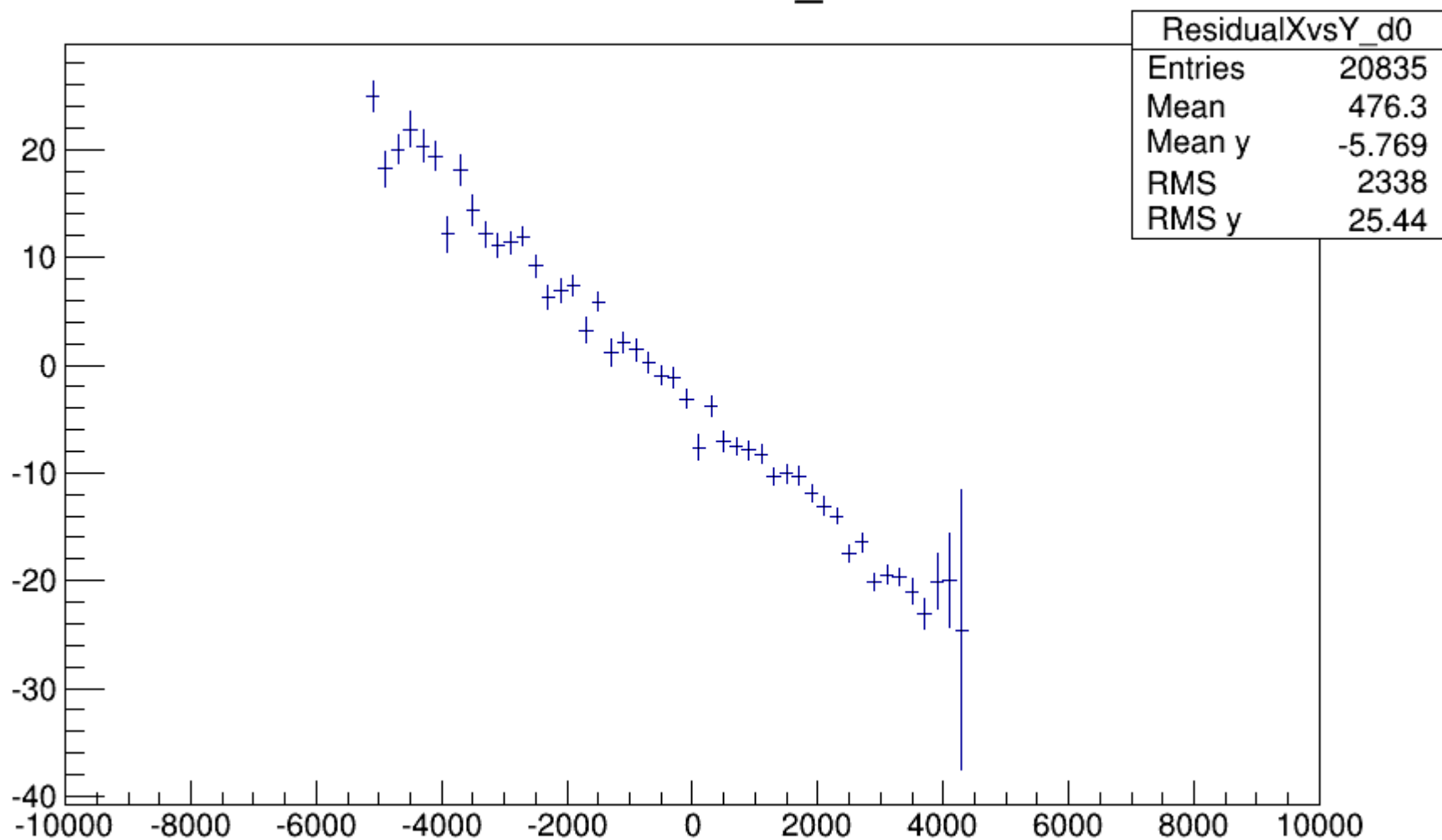
XvsXResidual_d0



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Backup

XvsYResidual_d0

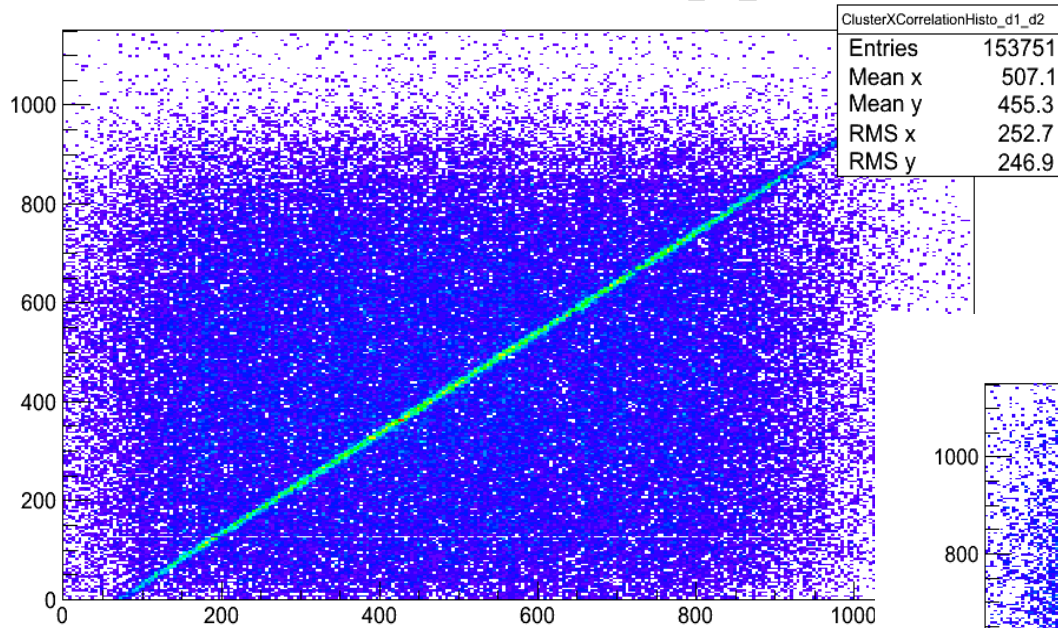


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Backup

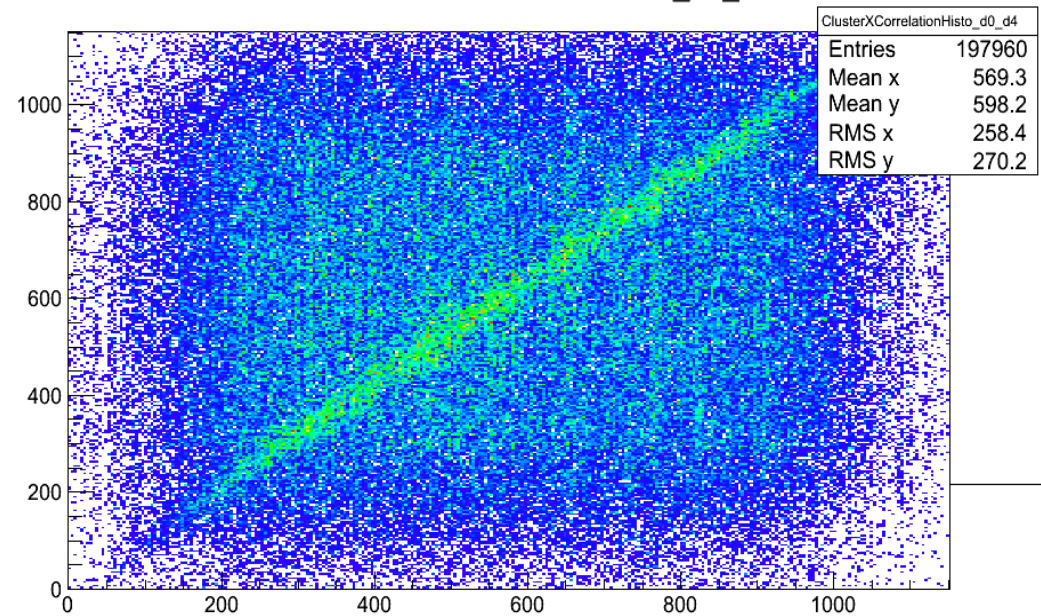
Correlation between the number of hits in neighbouring telescope planes.

ClusterX/ClusterXCorrelationHisto_d1_d2



← One of the planes is shifted by over 100 pixels.

ClusterX/ClusterXCorrelationHisto_d0_d4



Correlation becomes wider →
for not neighborhood sensors.

Thanks a lot for help to Sergej Schuwalow,
Olga Novgorodova, Vladyslav Libov, Itamar
Levy, Hanno Perrey, Konstantin Afanaciev
and Wolfgang Lohmann!