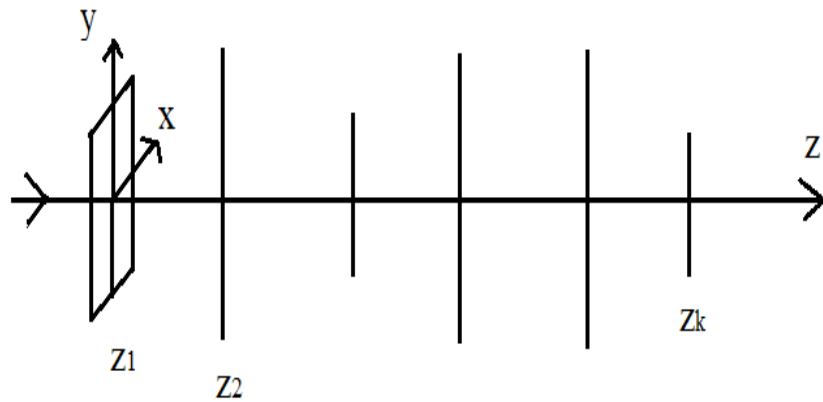


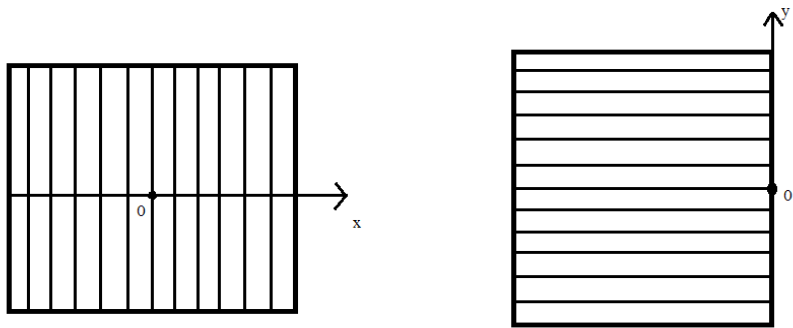
Alignment solution for silicon detectors of MiniSPD setup

Barlykov N. on behalf of Group 1

What is *alignment*? Purpose and execution.

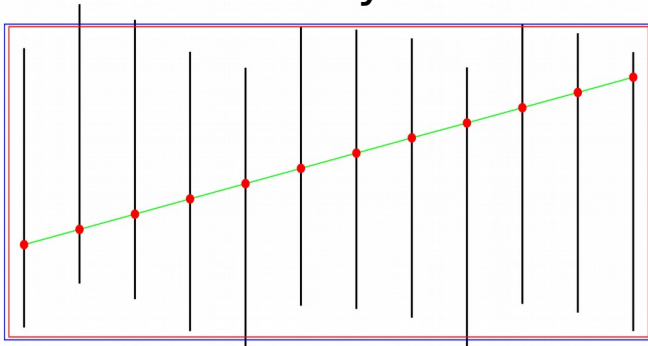


Beam direction (z).
Silicon detectors can define x, y or other coordinate. It depends on strip positions: vertical, horizontal, other angle.
It's impossible to set detectors ideally (zero position of coordinate sets in the center of detector).

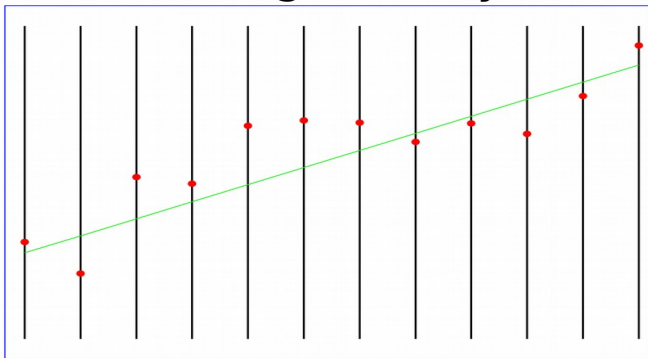


Misalignment

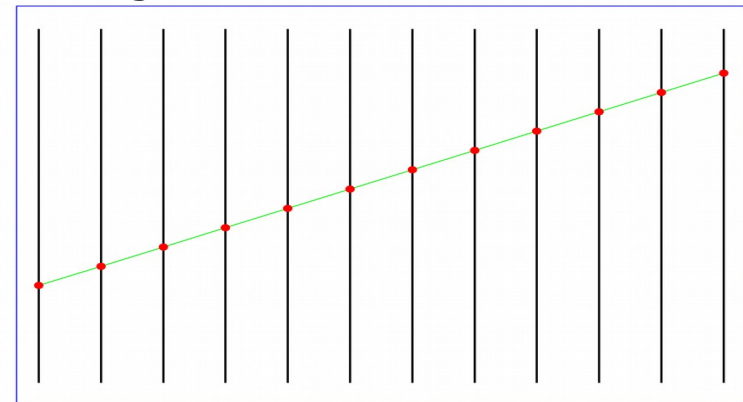
Reality



Nominal geometry



Aligned detectors



Functional minimization

Alignment is minimization of residuals of functional:

$$F = \sum_{events} \sum_{tracks} \sum_{hits} \left(\frac{d_i^2}{\sigma_{d_i}^2} \right)$$

$$d_i = u_{fit} - u_{mes}$$

Large number of parameters: track parameters (4 * number of tracks) and shifts (numbers of detectors), number of hits >> parameters.

$$u_{fit} \rightarrow u_j(z_i) = (x_0 + t_x z_i) \cos(\alpha_i) + (y_0 + t_y z_i) \sin(\alpha_i) + \Delta u_i$$

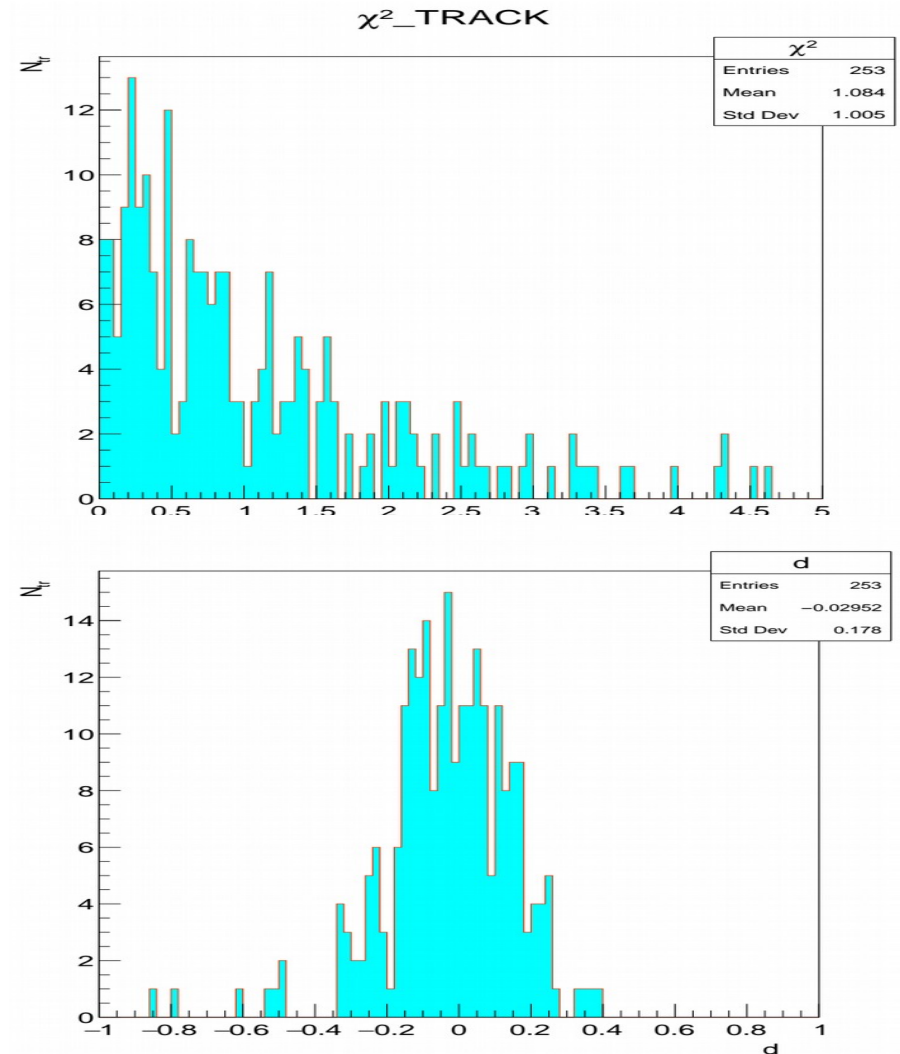
Monte-Carlo tracks without shift

Result of fit for global parameters

=====			
I	initial	final	differ

1	0.00000	0.00000	0.00000
2	0.00000	0.00000	0.00000
3	0.00000	-0.00917	-0.00917
4	0.00000	-0.02422	-0.02422
5	0.00000	0.00000	0.00000
6	0.00000	0.00000	0.00000

Total 252 local fits, 67 rejected.

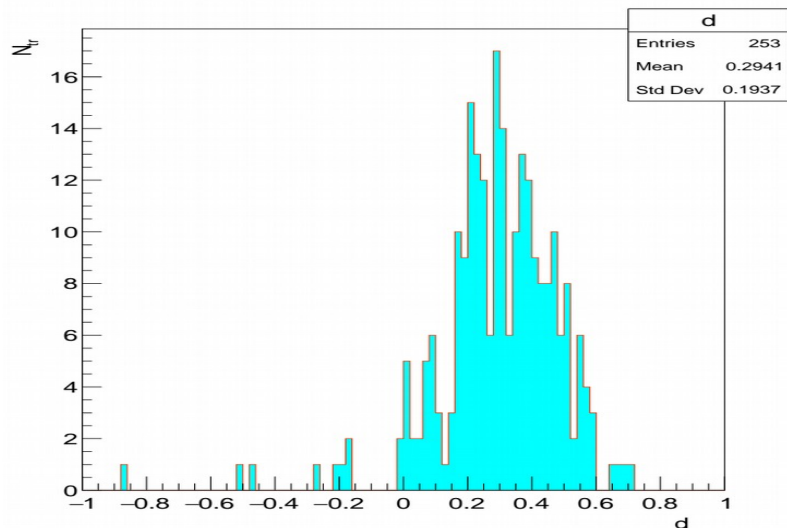


Monte-Carlo tracks with shift (III plate)

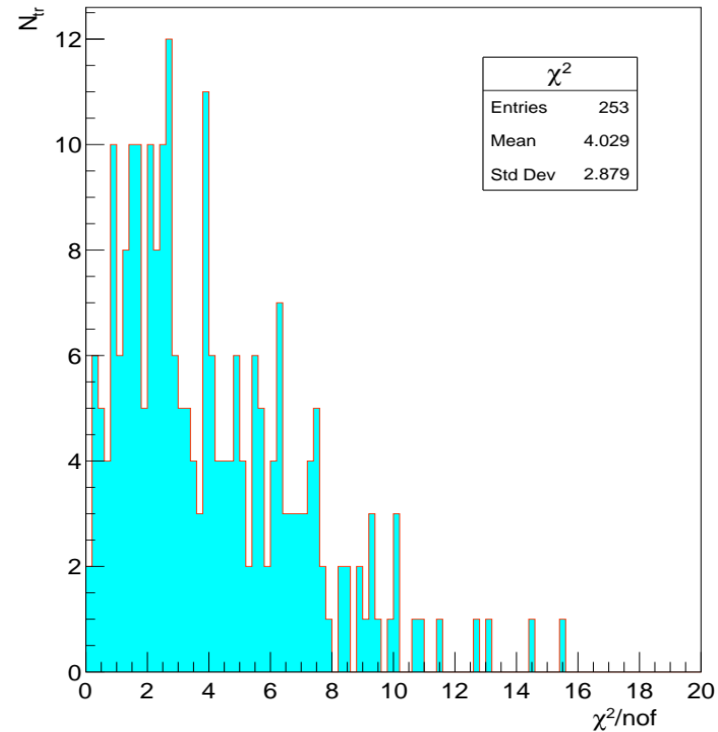
Result of fit for global parameters

	initial	final	differ
1	0.00000	0.00000	0.00000
2	0.00000	0.00000	0.00000
3	0.00000	0.49083	0.49083
4	0.00000	-0.02422	-0.02422
5	0.00000	0.00000	0.00000
6	0.00000	0.00000	0.00000

Total 252 local fits, 67 rejected.
Shift = 0,5 mm



χ^2_{TRACK}



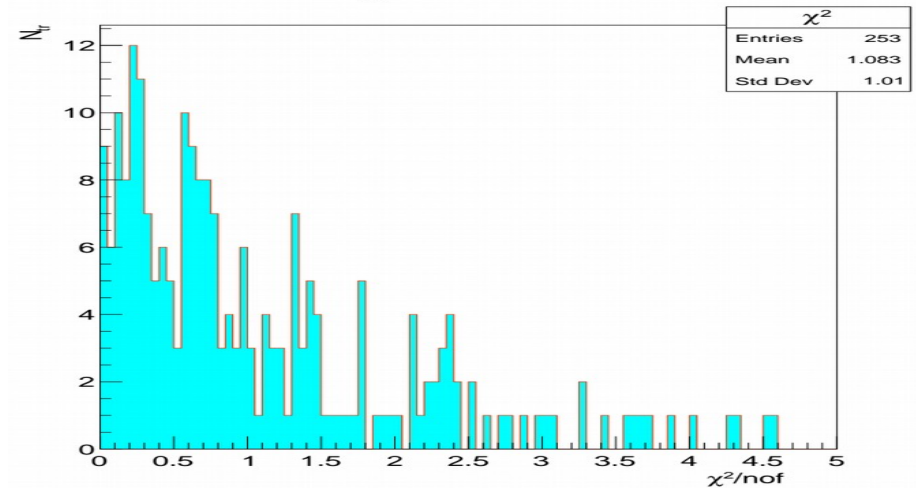
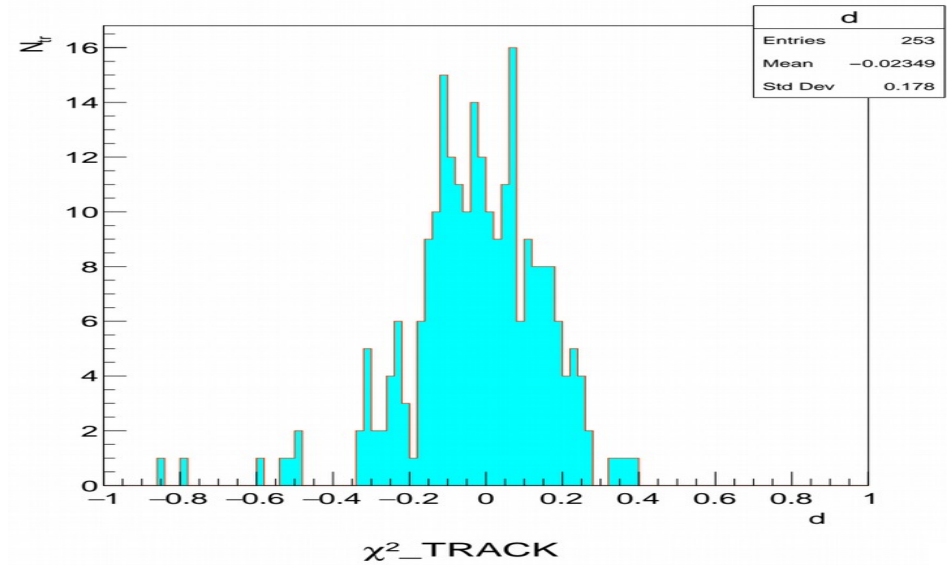
After iteration

Result of fit for global parameters

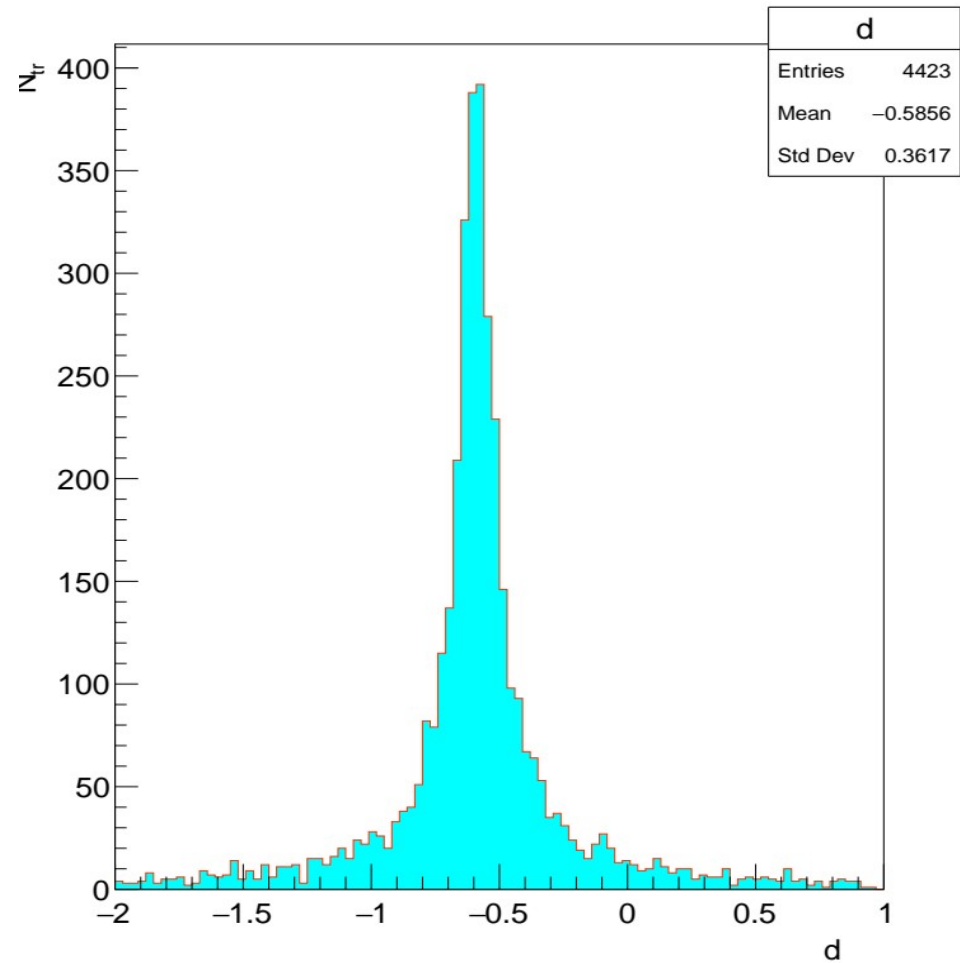
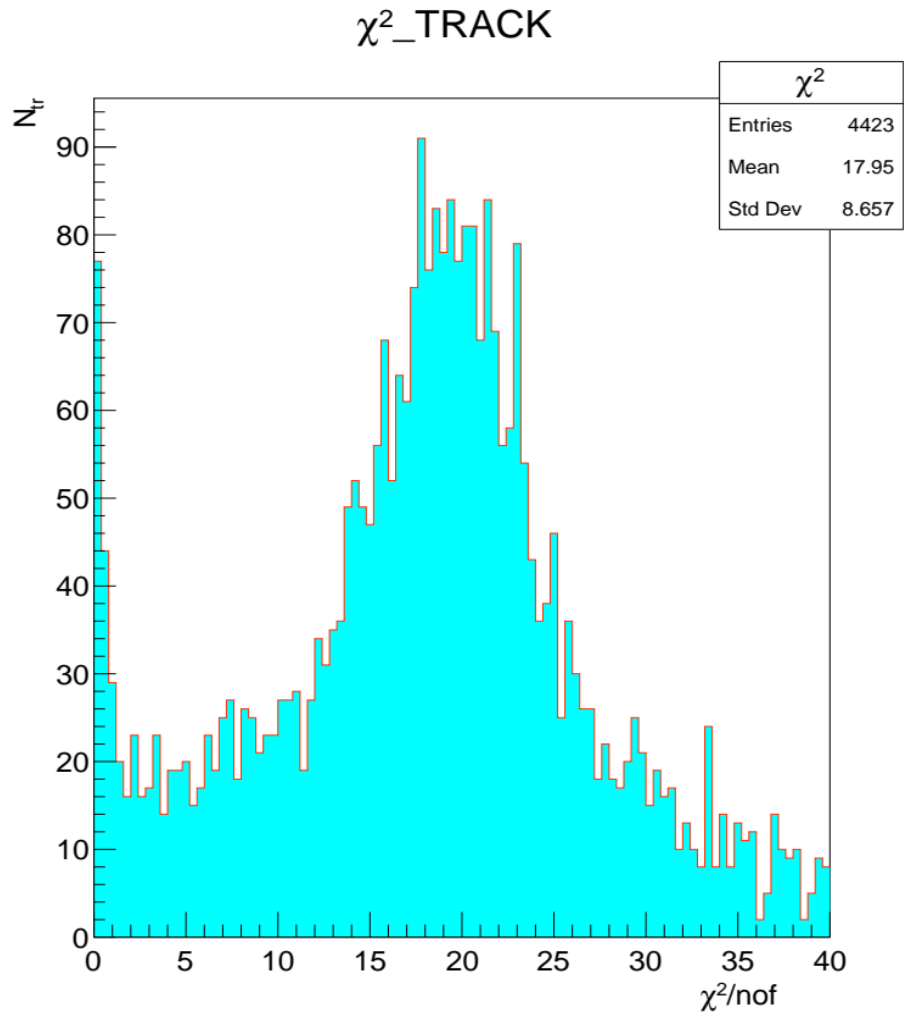
=====			
I	initial	final	differ

1	0.00000	0.00000	0.00000
2	0.00000	0.00000	0.00000
3	0.99083	0.99083	-0.00000
4	-0.02422	-0.02422	0.00000
5	0.00000	0.00000	0.00000
6	0.00000	0.00000	0.00000

Total 252 local fits, 67 rejected.
Shift = 0,5 mm

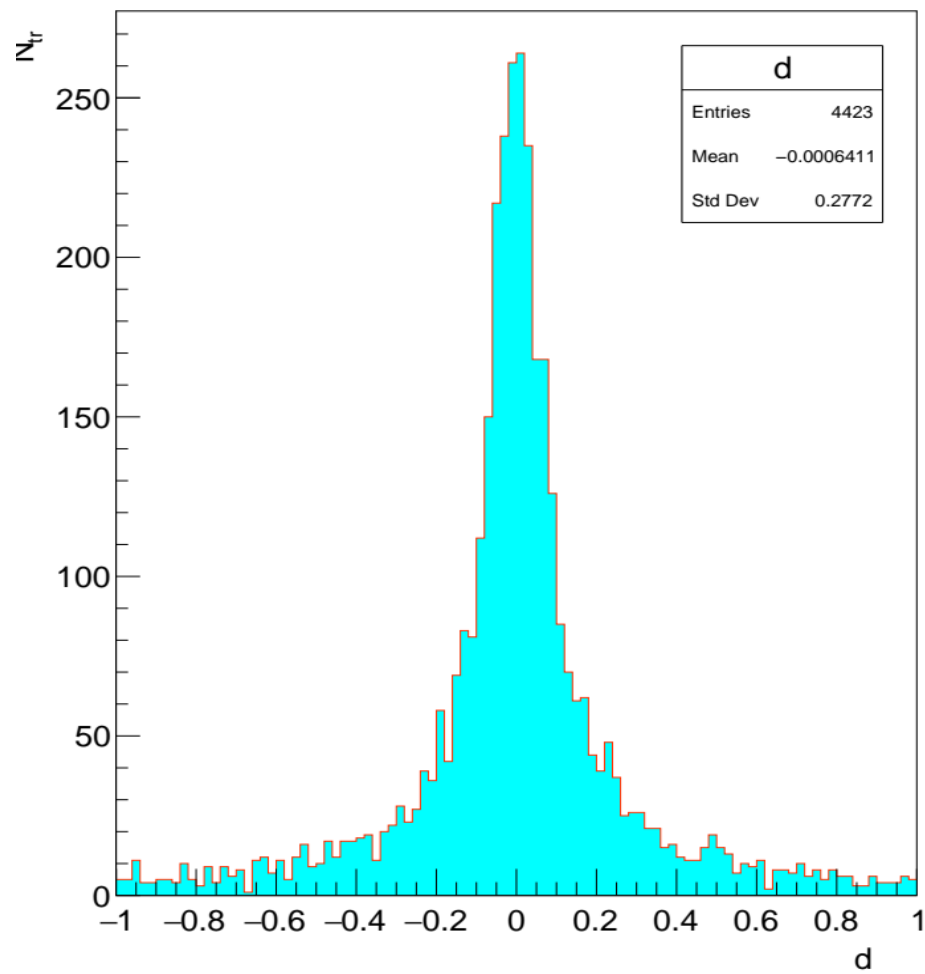
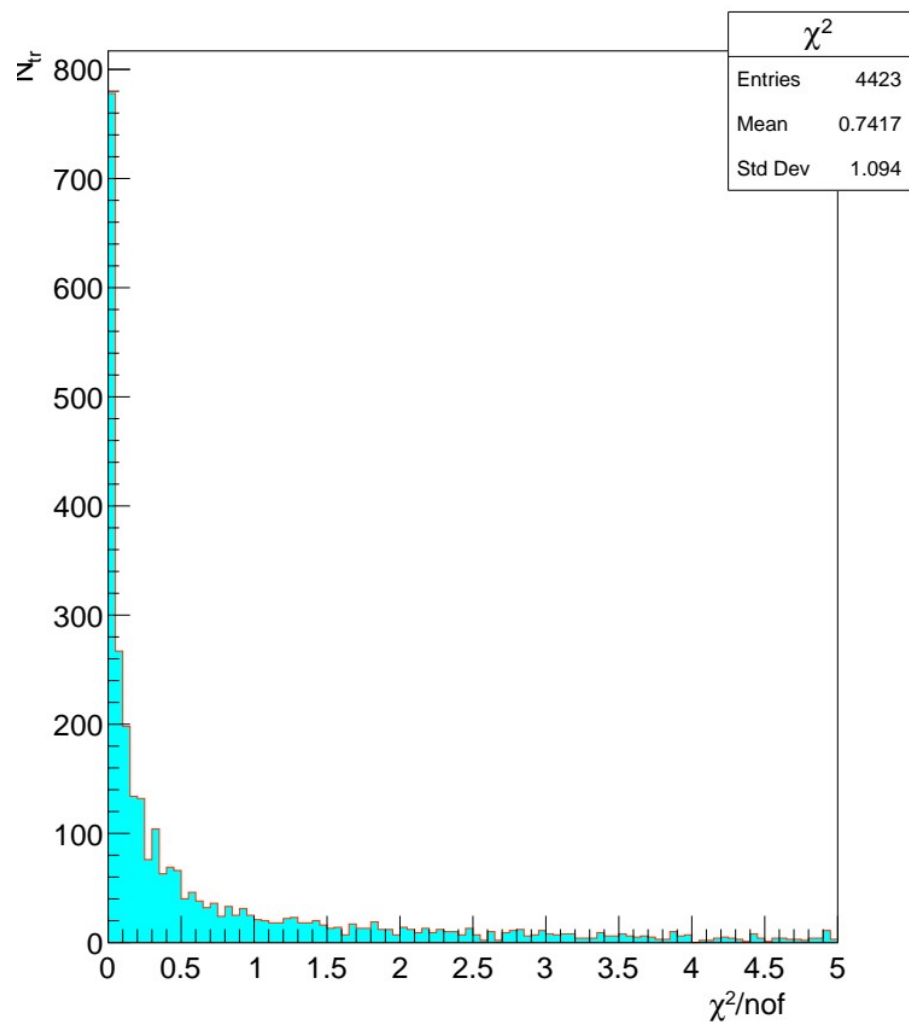


Shift=0,9 mm (II plate)



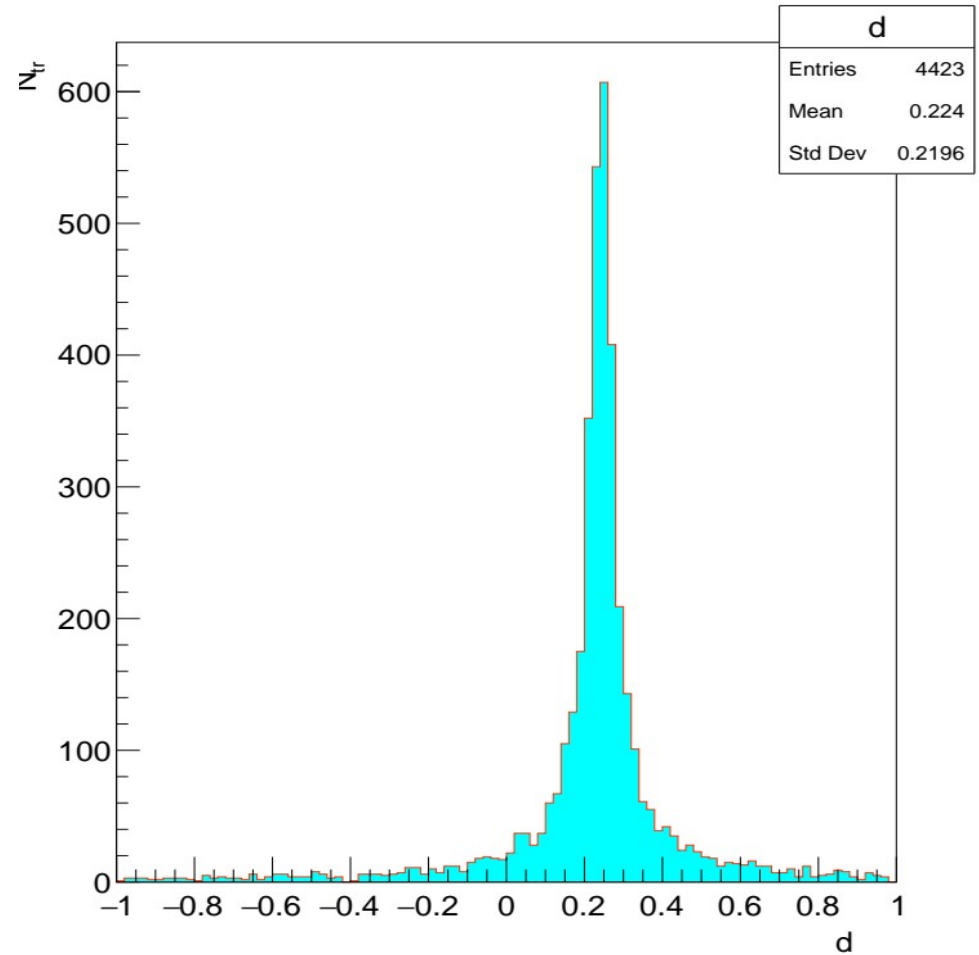
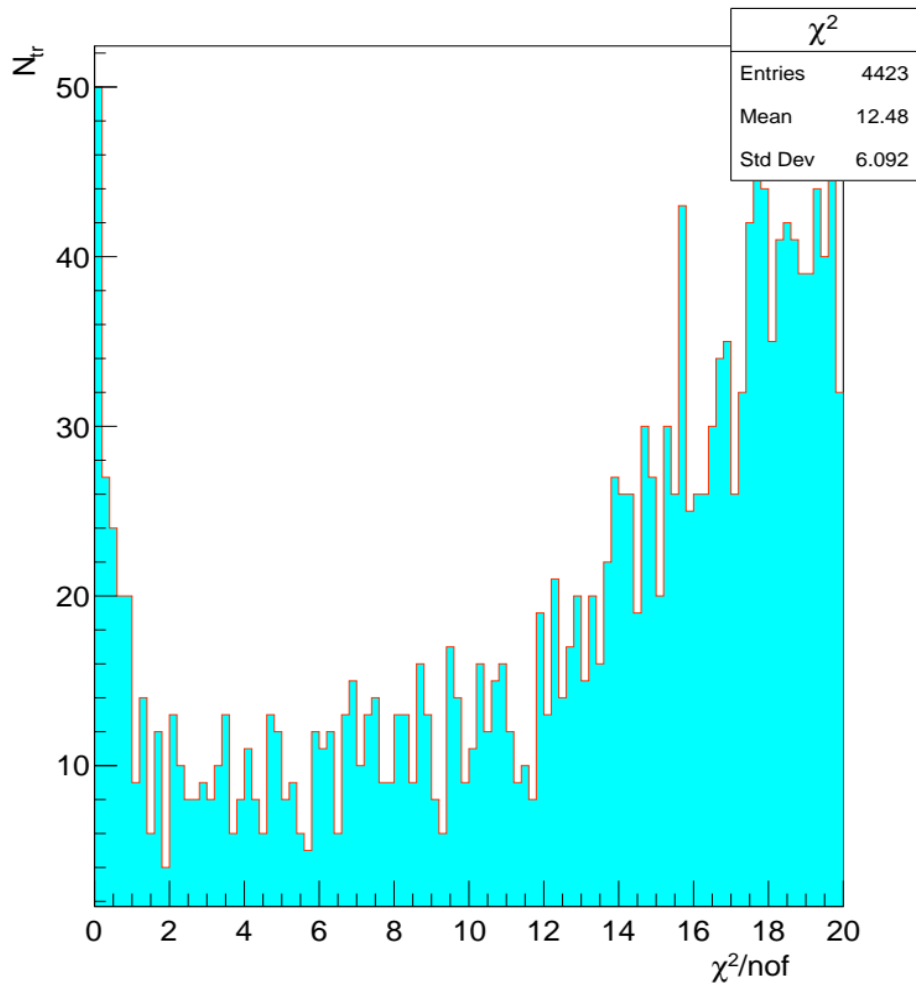
After iteration (II plate)

χ^2_{TRACK}

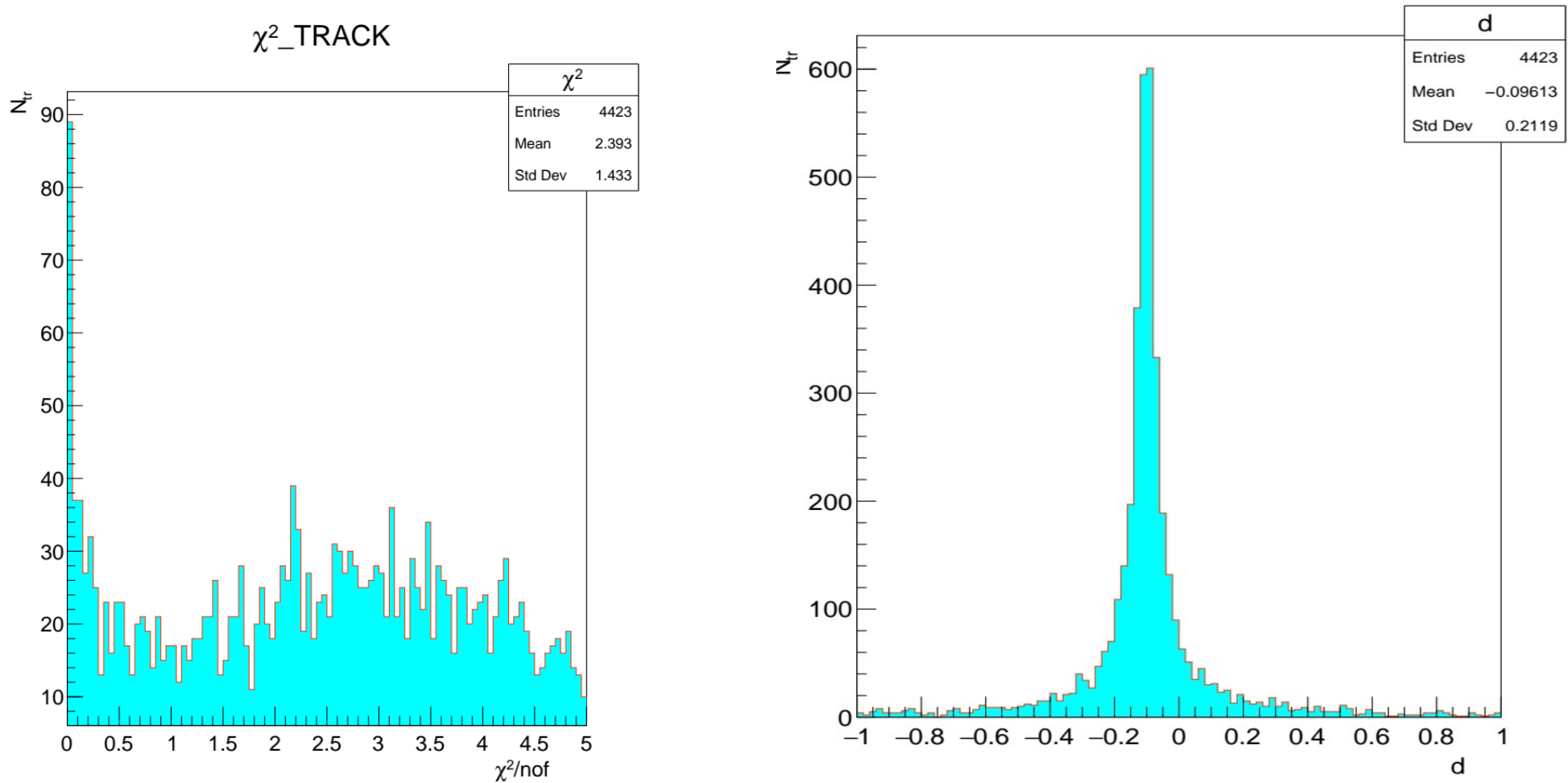


Shift=0,9 mm (III plate)

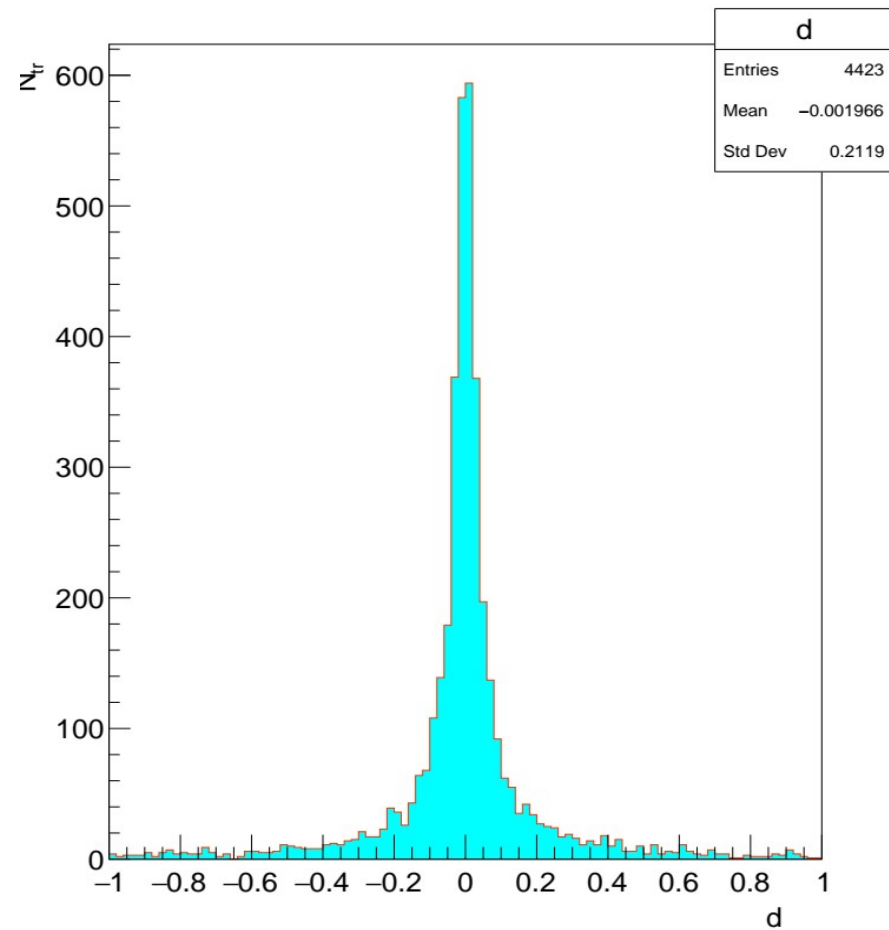
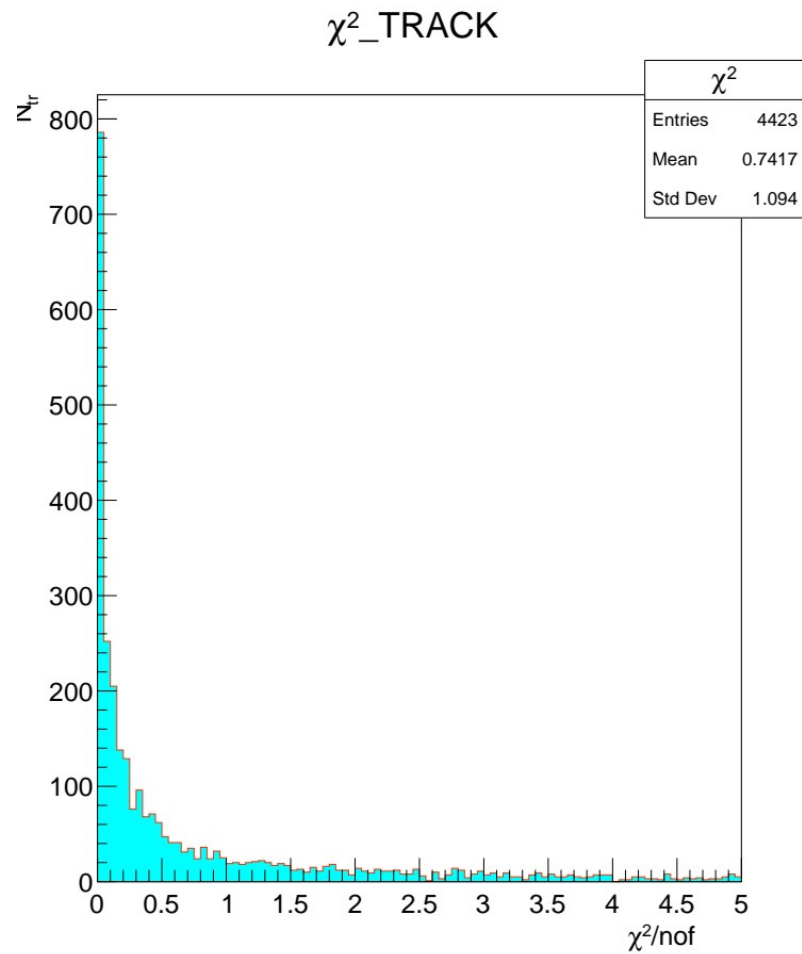
χ^2_{TRACK}



Before alignment (with shift)



After alignment (with shift)



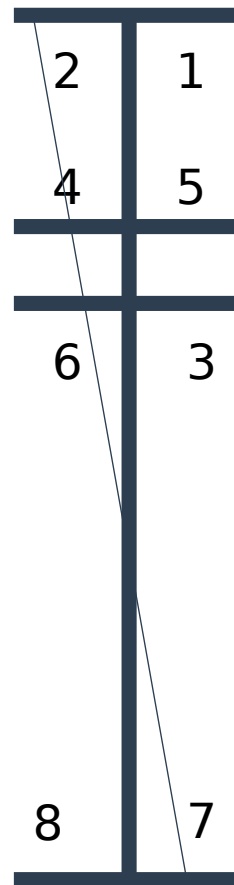
Analysis of experimental data

	Nfile	Comb.	Ntracks
I	268	<i>LLL</i>	4422
	248	<i>LLL</i>	2853
	157	<i>RRR</i>	2588
	137	<i>RRR</i>	1683
II	158	<i>RLL</i>	2233
	267	<i>LLR</i>	2039
	247	<i>LLR</i>	1713
	138	<i>RRL</i>	419
III	257	<i>LRR</i>	1540
	148	<i>RLL</i>	1334
	168	<i>RLL</i>	1032
	237	<i>LRR</i>	79
IV	258	<i>LRL</i>	188
	167	<i>RLR</i>	134
	147	<i>RLR</i>	124
	238	<i>LRL</i>	52

Vertical tracks

Oblique tracks

Noise



File 247(267)

“Good” modules: 2,5,6,8.
 “Bad” module: 3.
 Noise level < 2%

Conclusions

- 1. It was mastered the alignment task solution (Millepede of Blobel) based on Monte-Carlo simulation tracks, SVD data for application at MiniSPD stand.**
- 2. MC simulation of tracks for 3(4 with fiction plate) two-side silicon plates of MiniSPD setup.**
- 3. Included misalignment parameters are determined uniquely for 6 and more plates.**
- 4. For single x-coordinate of 3 silicon plates misalignment parameters are found with certain accuracy (depending on sigma).**
- 5. Analysis of hit data from MiniSPD setup was carried out. It was estimated all 8 modules.**