Tracker Alignment update

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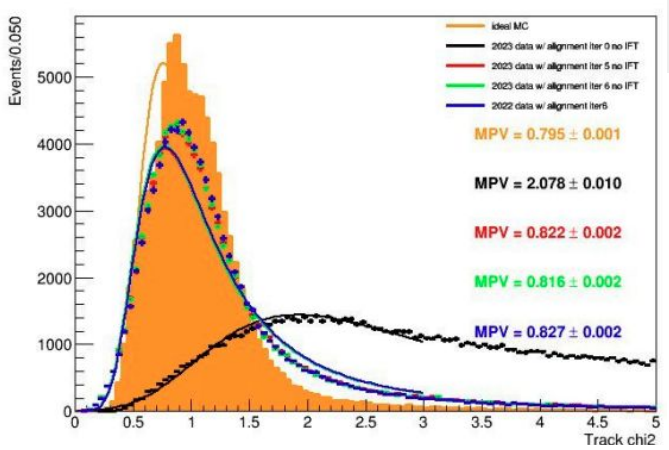
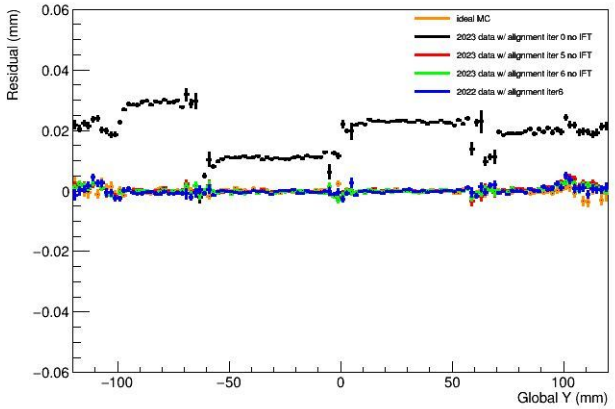
07/07/2023

FASER alignment meeting

Recap

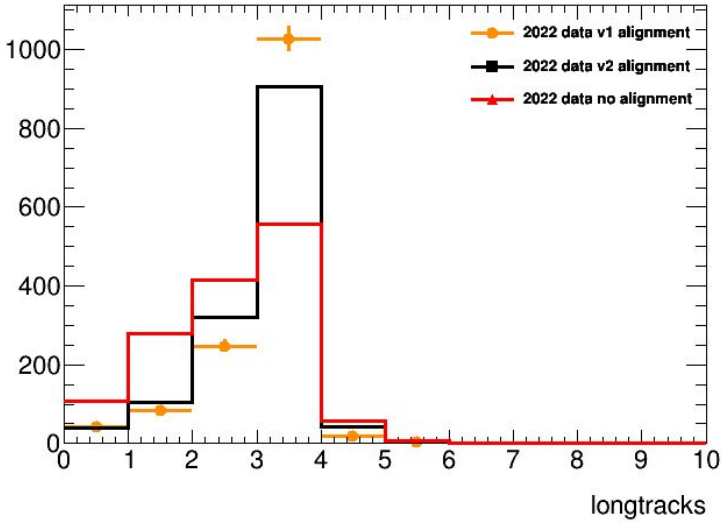
- More details in [slides]
- Updated the alignment (station 1/2/3)
  - 6 DoFs for layers
  - Works well for mis-aligned MC
  - Tested the 2022 and 2023 data
- Updates:
  - Remove Z shift for layers
    - No obvious difference is observed
  - Photon conversion events
    - Analyzing the ntuple

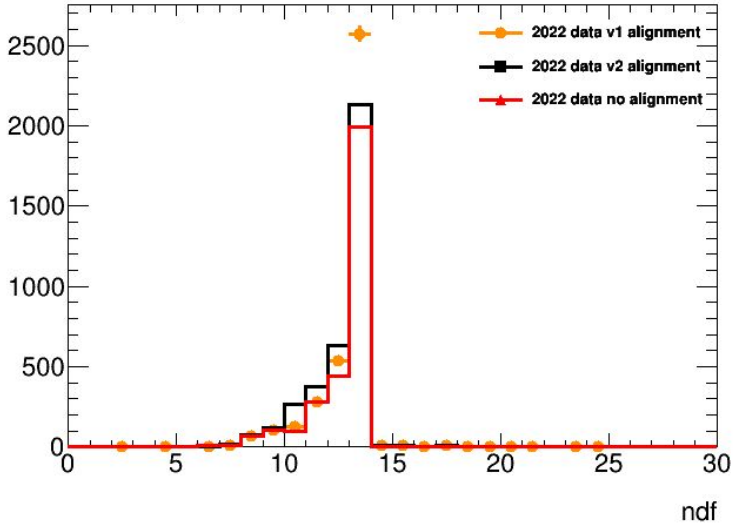




Photon-conversion candidates

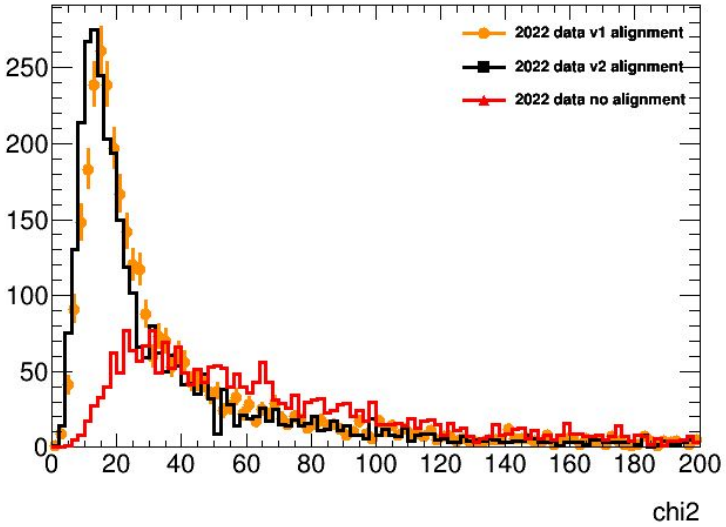
- The sample is made based on previous alignment (v1) results
- Difference between v1 and v2 (new alignment with 5DoFs for layers) maybe reasonable

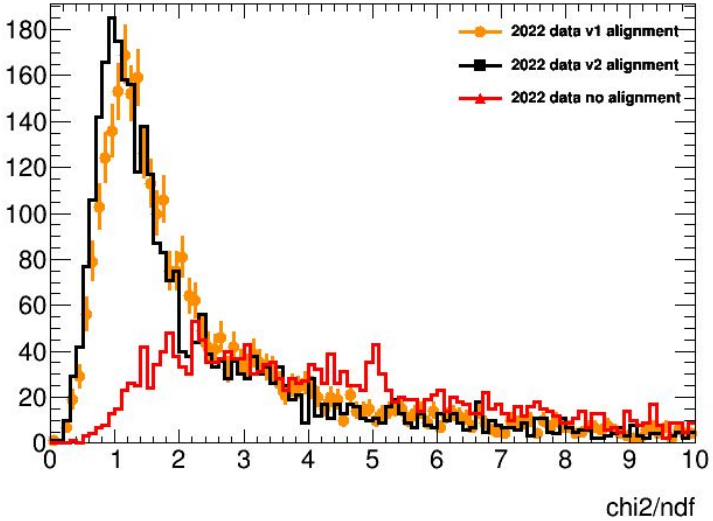




Track chi2

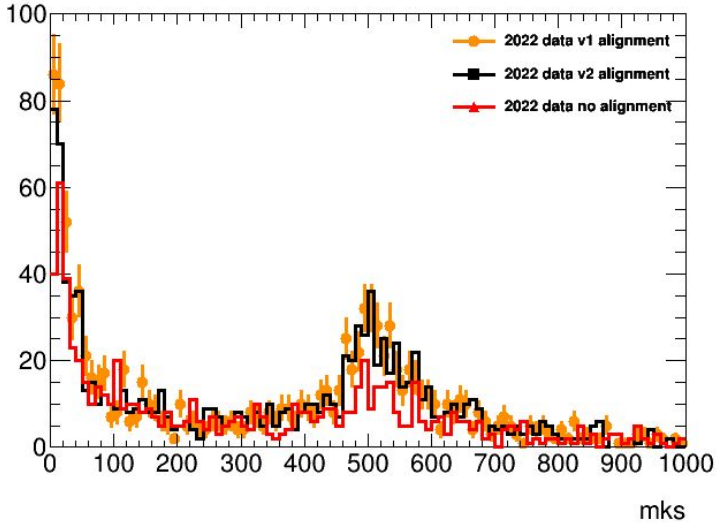
- New alignment can give a better track chi2

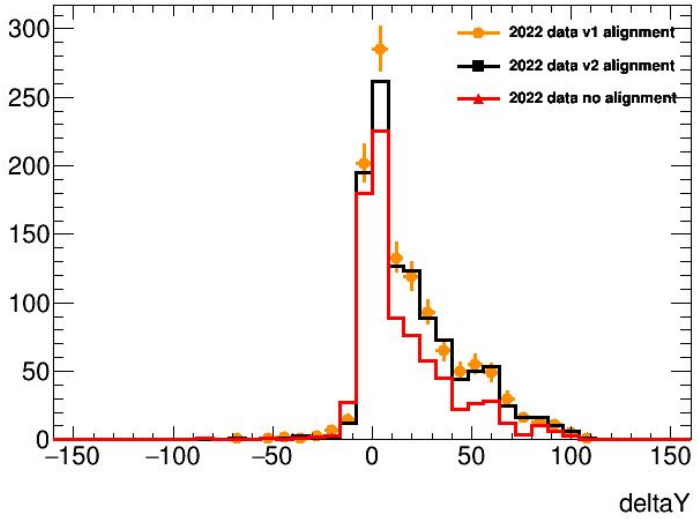




Photon conversion candidates

- Invariant mass and delta Y (positive track - negative track) at VetoNu





back-up

Alignment corrections for each layer

2022

ID	X(mm)	Y(mm)	Z(mm)	RX(radd)	RY(rad)	RZ(rad)
10	0.119144	0.0111326	1.32238	0.00065216	0.00561539	0.000474007
11	0.0085454	0.0304299	1.12894	0.00210669	0.00550491	8.6017e-05
12	0.122165	-0.0152098	1.23478	0.0046594	0.00595661	-0.000369556
20	-0.186554	-0.0266273	0.132216	0.00121587	-0.00176494	-5.292e-05
21	-0.194432	0.0075434	0.463694	-0.00013745	-0.00238039	0.000161293
22	-0.114603	0.01089	0.930678	-0.00145978	-0.00213376	-6.46612e-05
30	0.057152	0.00604144	0.0675279	-0.0022229	0.000564984	6.7815e-05
31	0.0510277	-0.00523817	0.14844	-0.00160965	0.00087576	8.1768e-05
32	0.0382598	-0.0141762	0.247553	-0.0015126	0.000755932	-0.000146812

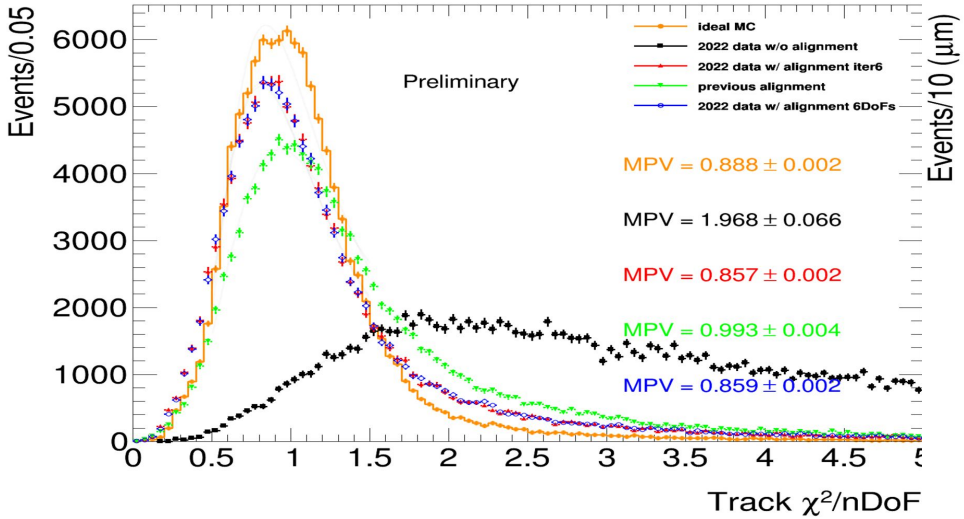
2023

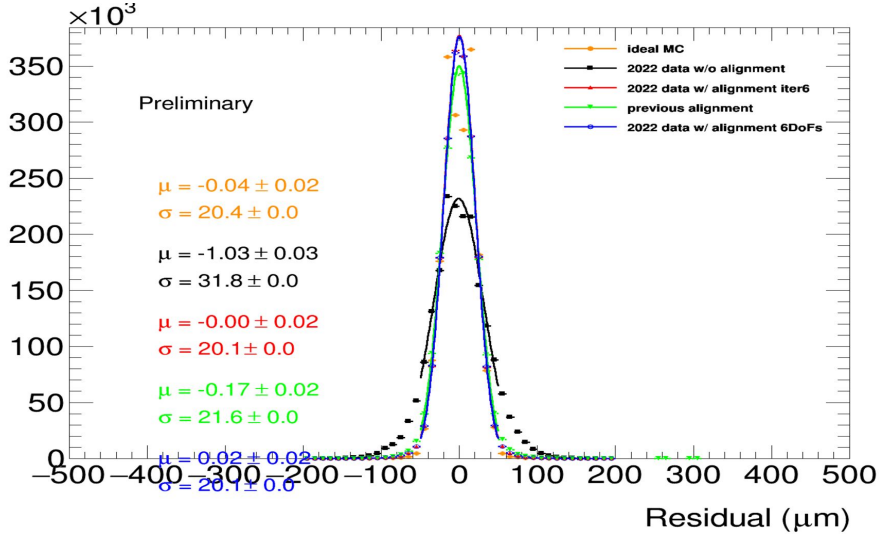
Stat error:
X: ~0.002
Y: ~0.00005
Z: ~0.01
RX: ~0.0002
RY: ~0.0002
RZ: ~0.000002

10	0.10735	0.0148554	1.28615	-0.00084861	0.0041021	0.000490135
11	0.0303527	0.0307255	0.975724	0.00240821	0.0030191	9.05834e-05
12	0.167147	-0.0165872	0.791797	0.00670819	0.00278465	-0.000375675
20	-0.127957	-0.023316	-0.552692	0.00480414	-0.00134031	-5.78142e-05
21	-0.154644	0.0142313	-0.094753	0.00208042	-0.00106082	0.000155322
22	-0.103397	0.0195984	0.460754	-0.00022848	-0.00074377	-7.29485e-05
30	0.035353	0.0109744	0.133643	-0.0015663	1.8848e-05	3.15117e-05
31	0.05423	-0.0019338	0.163719	-0.000329376	0.000698177	4.13136e-05
32	0.0495251	-0.012313	0.267923	0.00028863	0.00106679	-0.00018631

2022 data

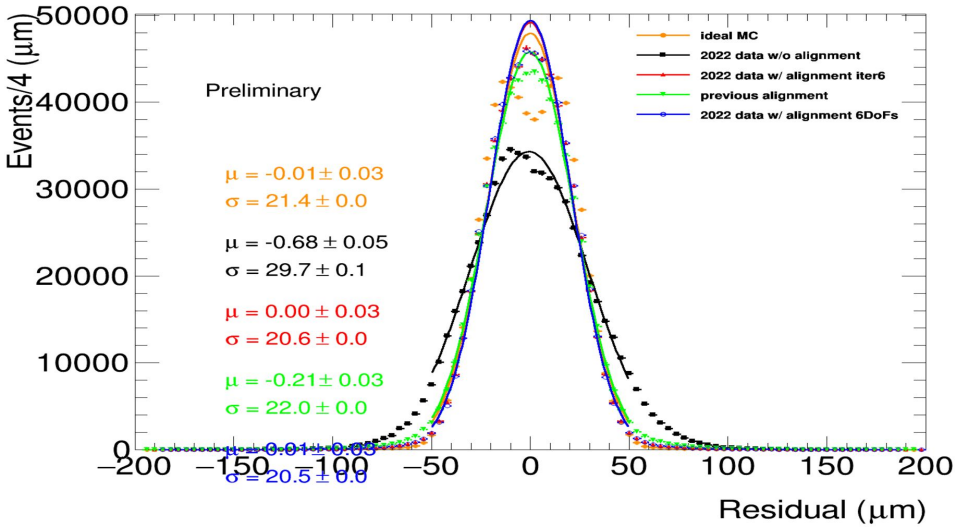
- Same conclusion with before
- Almost no difference to the alignment with 6DoFs
- As expected, most tracks are perpendicular to modules

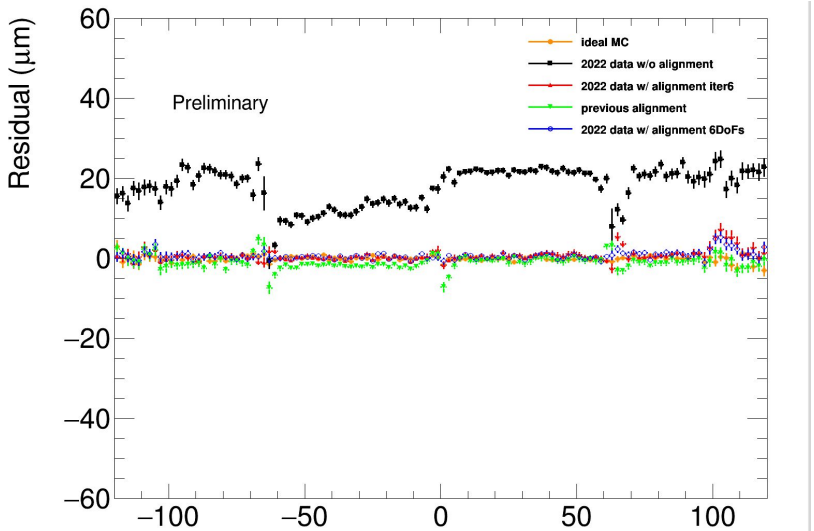




2022 data

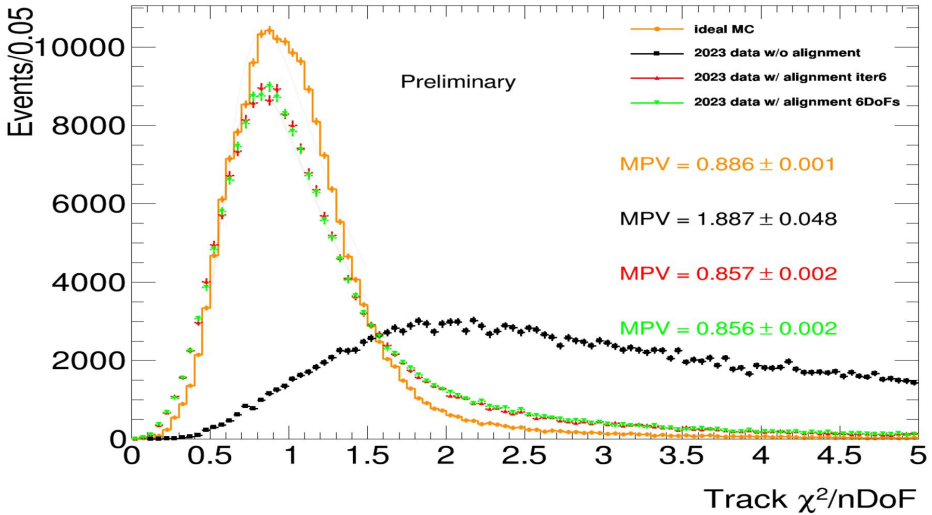
- Residual is around 20um after alignment
  - Consist with MC
  - Better than previous alignment (used for Moriond results)

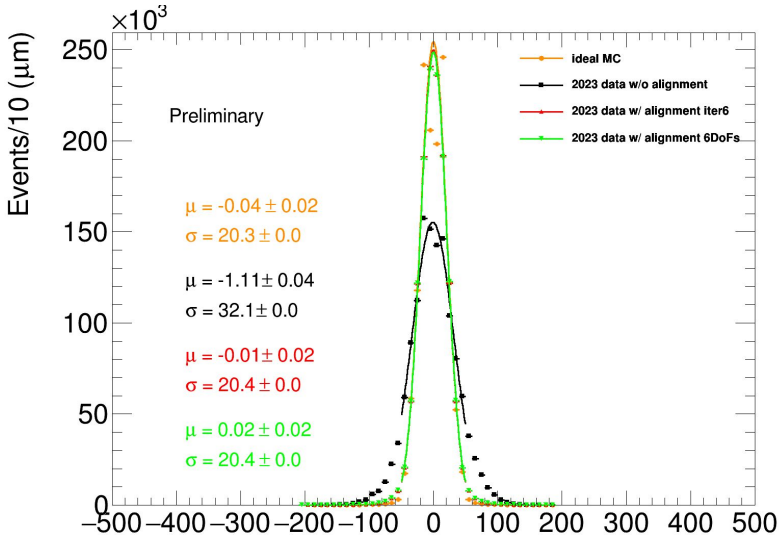




2023 data

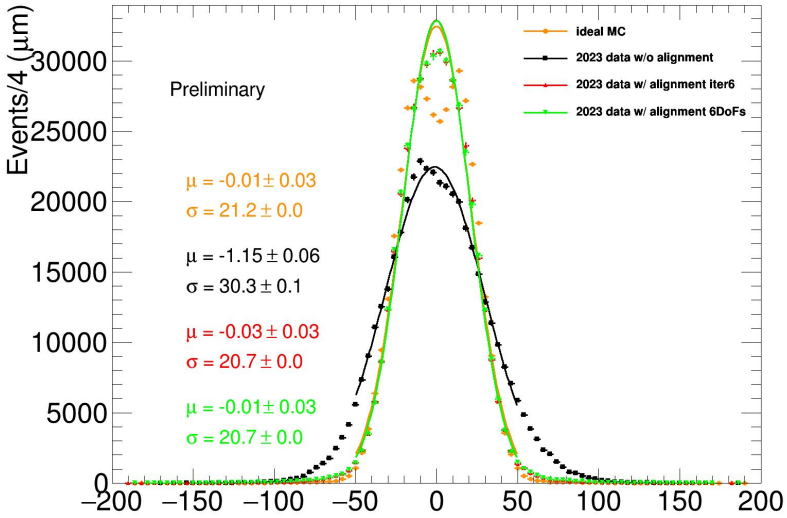
- Same conclusion with before
- Almost no difference to the alignment with 6DoFs
- Consist with 2022 data

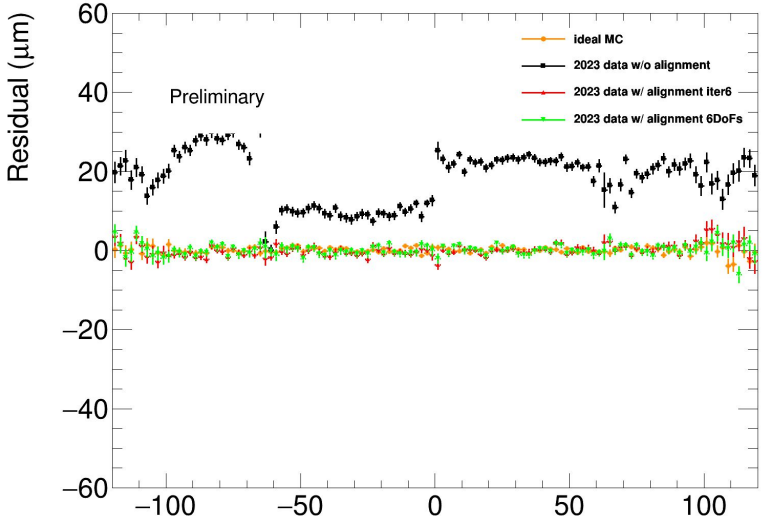




2023 data

- Same conclusion with 2022 data





Data 2022 vs data 2023

- In general all the distributions including track parameters and residuals are consist
  - Slightly difference in q/p around the peak