Primary Vertexing with Machine Backgrounds and Λ_c/D^0 Ratio

Shyam Kumar*, Annalisa Mastroserio, Domenico Elia

INFN Bari, Italy

Primary Vertexing with Machine Backgrounds

Reconstruction of D^0 meson

Primary Vertex Reconstruction:

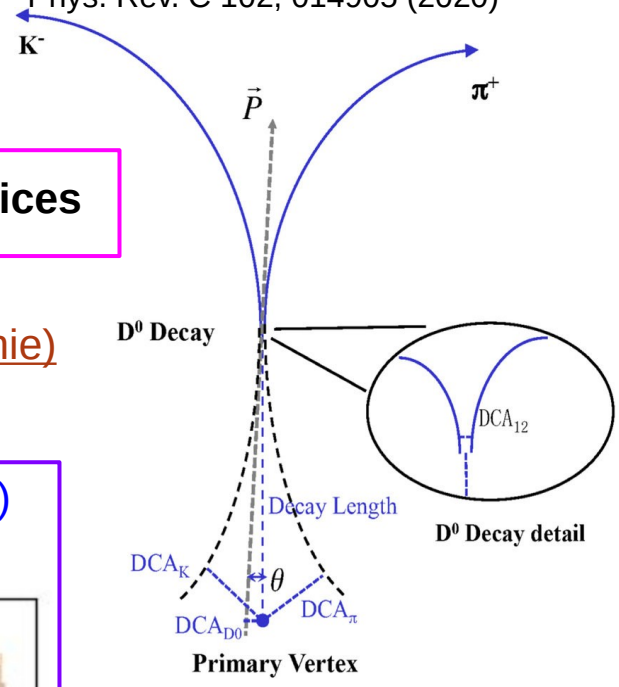
Reconstructed Tracks → **CentralTrackVertices** → **PrimaryVertices**

Seed Vertices indices (0,1,2,...)

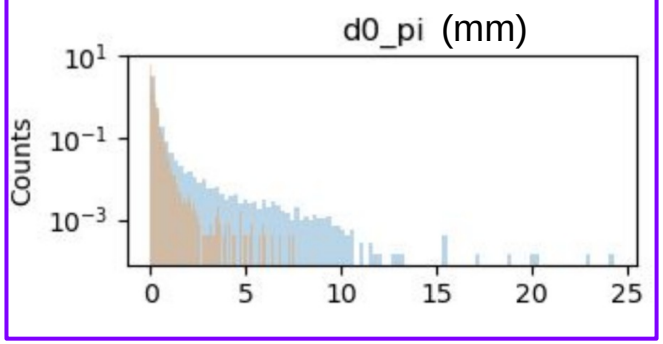
Slides (connie)

10x100 ep, $Q^2 > 1$

Phys. Rev. C 102, 014905 (2020)

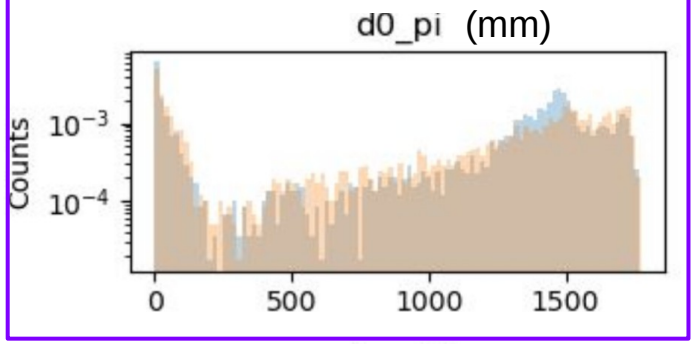


w/o Machine bkg



Signal (D^0 sample)

w Machine bkg (nhits>3)



Bkg (DIS Sample)

d0_pi = DCA_π (plot)

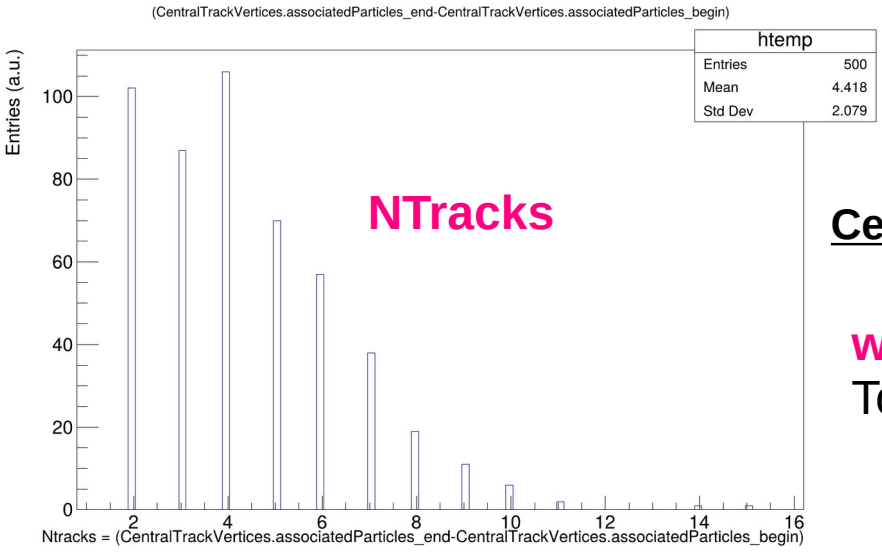
Primary vertexing: S. Kumar

Broadening of d0_pi distribution points some issue in the primary vertex position

Gold coating at beam pipe reduces synchrotron radiation (5μm---->**10μm**)

Shujie's slides

Primary Vertex w/o and w Machine Backgrounds

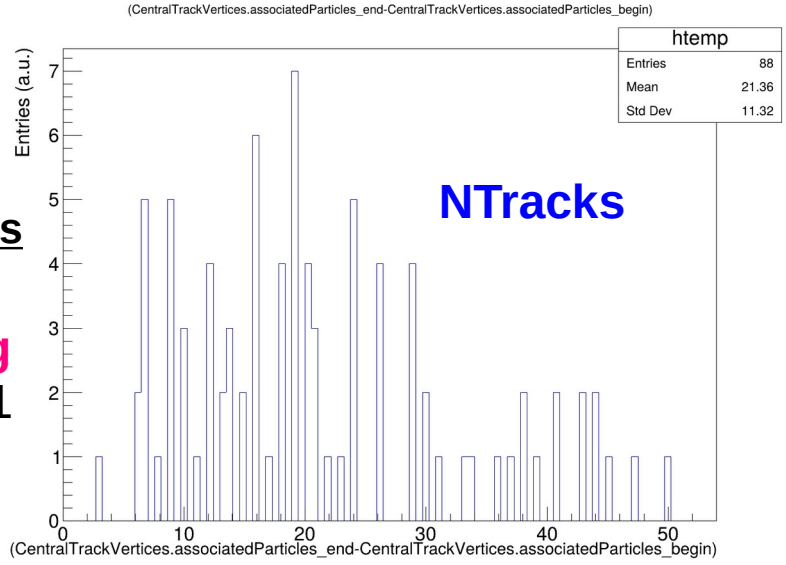


NTracks

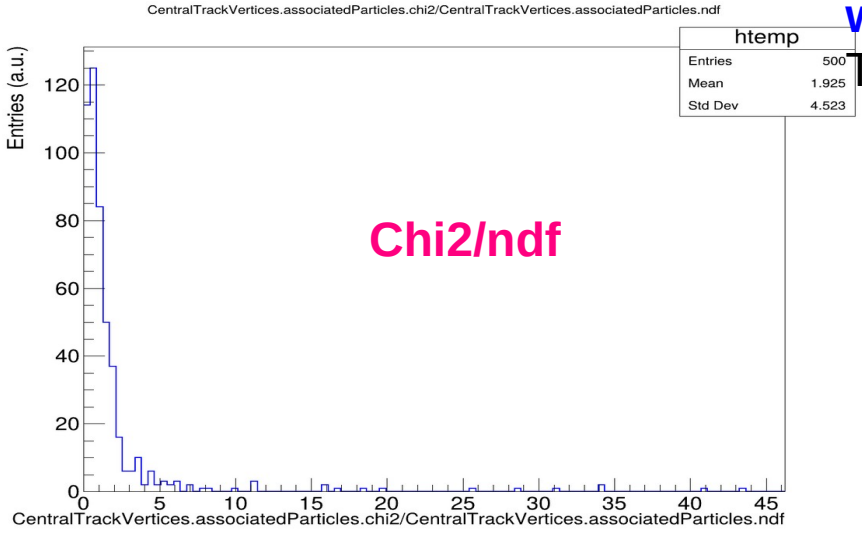
CentralTrackVertices

w/o Machine Bkg

Total events = 591



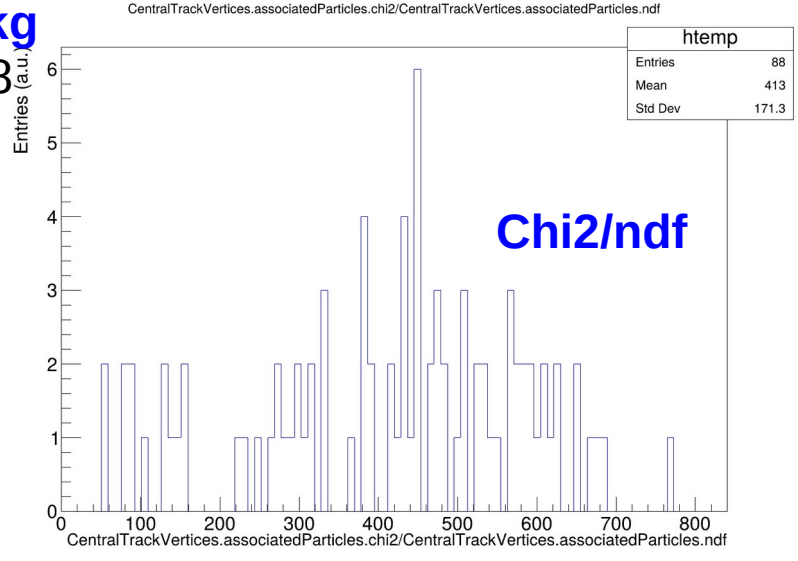
NTracks



Chi2/ndf

w/o Machine Bkg

Total events = 48



Chi2/ndf

Primary Vertexing w/o Machine Bkg

pythia8NCDIS_10x100_minQ2=1_beamEffects_xAngle=-0.025_hiDiv_1.0028.eicrecon.edm4eic.root (**October Campaign**)

Event No.	PV Index	NTracks	Chi2/ndf	PrimaryVertices_objIdx
0	0			
1	0	5	0.4640202	0
2	0	4	0.6208505	0
3	0	3	0.0603734	0
4	0	4	0.7479300	0
5	0	2	0.0040856	0
6	0	6	0.4292482	0
7	0	8	0.5839211	0
8	0	6	19.762019	0
9	0	4	0.5270119	0
10	0			
11	0	3	2.6528356	0
12	0	5	0.5054881	0
13	0	7	0.7177379	0
14	0	3	1.6701340	0
15	0	3	0.2214768	0
16	0	5	0.9580778	0
17	0	5	4.6595538	0
18	0	4	2.3536362	0
19	0	2	0.0345881	0
20	0	5	0.9021016	0
21	0	5	1.4837184	0
22	0			
23	0	3	1.0161910	0
24	0	6	0.5528225	0
368	**0**	**6**	**1.9358595**	**0**
368	**1**	**2**	**1.1153685**	**1**

CentralTrackVertices=>PV Index

PrimaryVerticesObject Index

Primary Vertexing w Machine Bkg

pythia8NCDIS_10x100_minQ2\=1_beamEffects_xAngle\=-0.025_hiDiv_1.0000.eicrecon.edm4eic.root (**October Campaign**)

Event No.	PV Index	NTracks	Chi2/ndf	PrimaryVertices_objIdx
0	0			
1	0	31	539.29178	
1	1	23	292.77243	
2	0			
3	0	39	584.74253	
4	0			
5	0			
6	0			
7	0	44	481.72695	
8	0			
9	0	6	577.55178	
9	1	9	620.27252	
9	2	18	565.71274	
9	3	19	629.04087	
10	0			
11	**0**	**50**	**448.03825**	**2**
11	**1**	**12**	**480.89699**	**4**
11	**2**	**9**	**152.54224**	
11	**3**	**26**	**512.24833**	
11	**4**	**8**	**58.614722**	
12	0			
13	0			
14	0	37	607.38990	
15	0	19	682.86222	
15	1	33	672.35738	
16	0			
17	0			

CentralTrackVertices=>PV Index

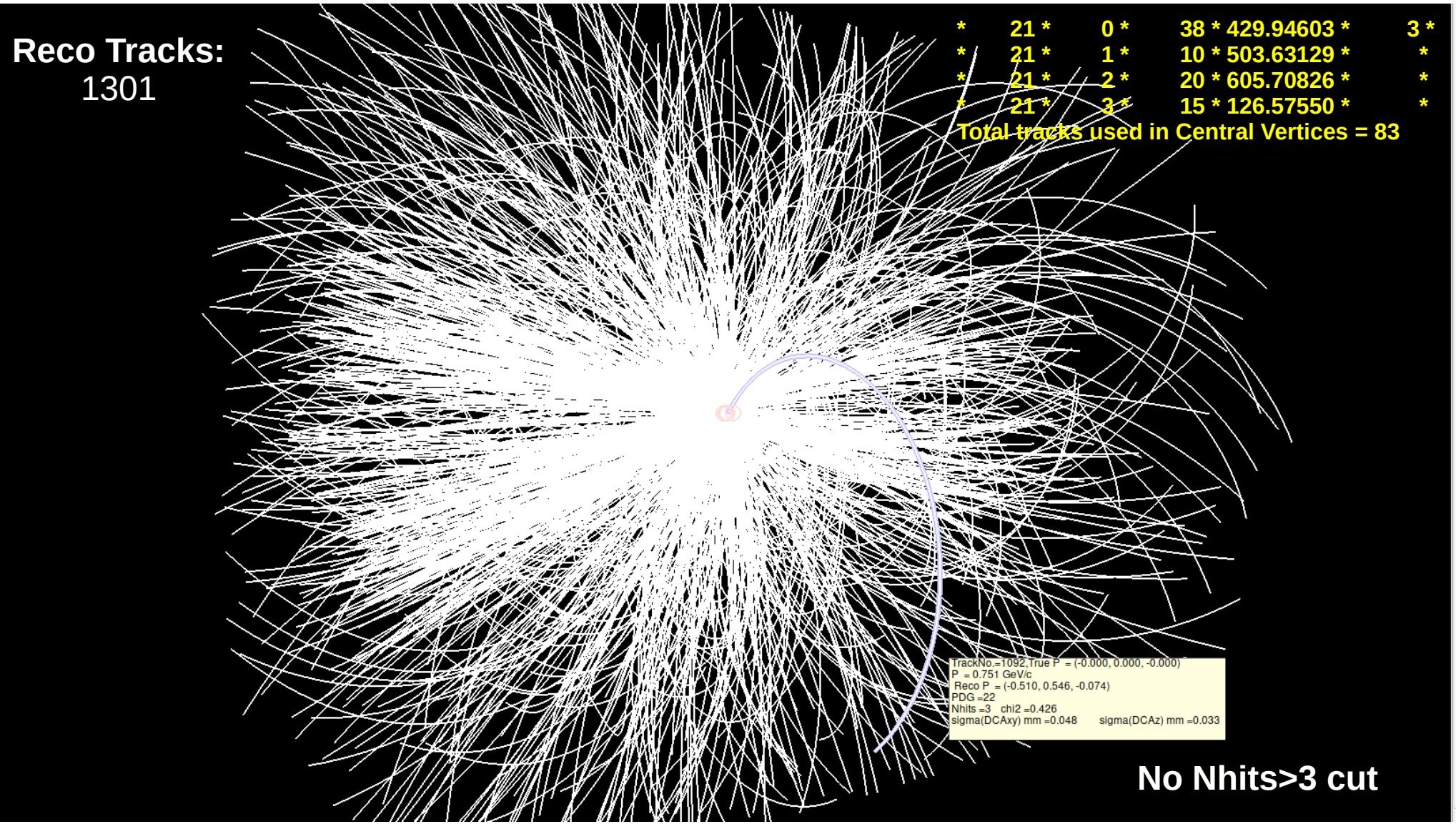
PrimaryVerticesObject Index

18	**0**	**9**	**379.36446**	**4**
18	**1**	**10**	**392.97017**	**7**
18	**2**	**21**	**274.24365**	**8**
18	**3**	**7**	**453.12216**	
18	**4**	**7**	**330.76023**	
18	**5**	**18**	**275.12411**	
18	**6**	**30**	**265.17989**	
18	**7**	**7**	**53.231102**	
18	**8**	**6**	**135.97923**	
19	0	43	312.29966	
19	1	12	449.01896	
20	0	19	571.17828	
20	1	24	621.67578	
21	**0**	**38**	**429.94603**	**3**
21	**1**	**10**	**503.63129**	
21	**2**	**20**	**605.70826**	
21	**3**	**15**	**126.57550**	
22	0			
23	**0**	**10**	**296.17238**	**3**
23	**1**	**14**	**381.56041**	
23	**2**	**24**	**446.24783**	
23	**3**	**18**	**150.51314**	
23	**4**	**20**	**278.59998**	

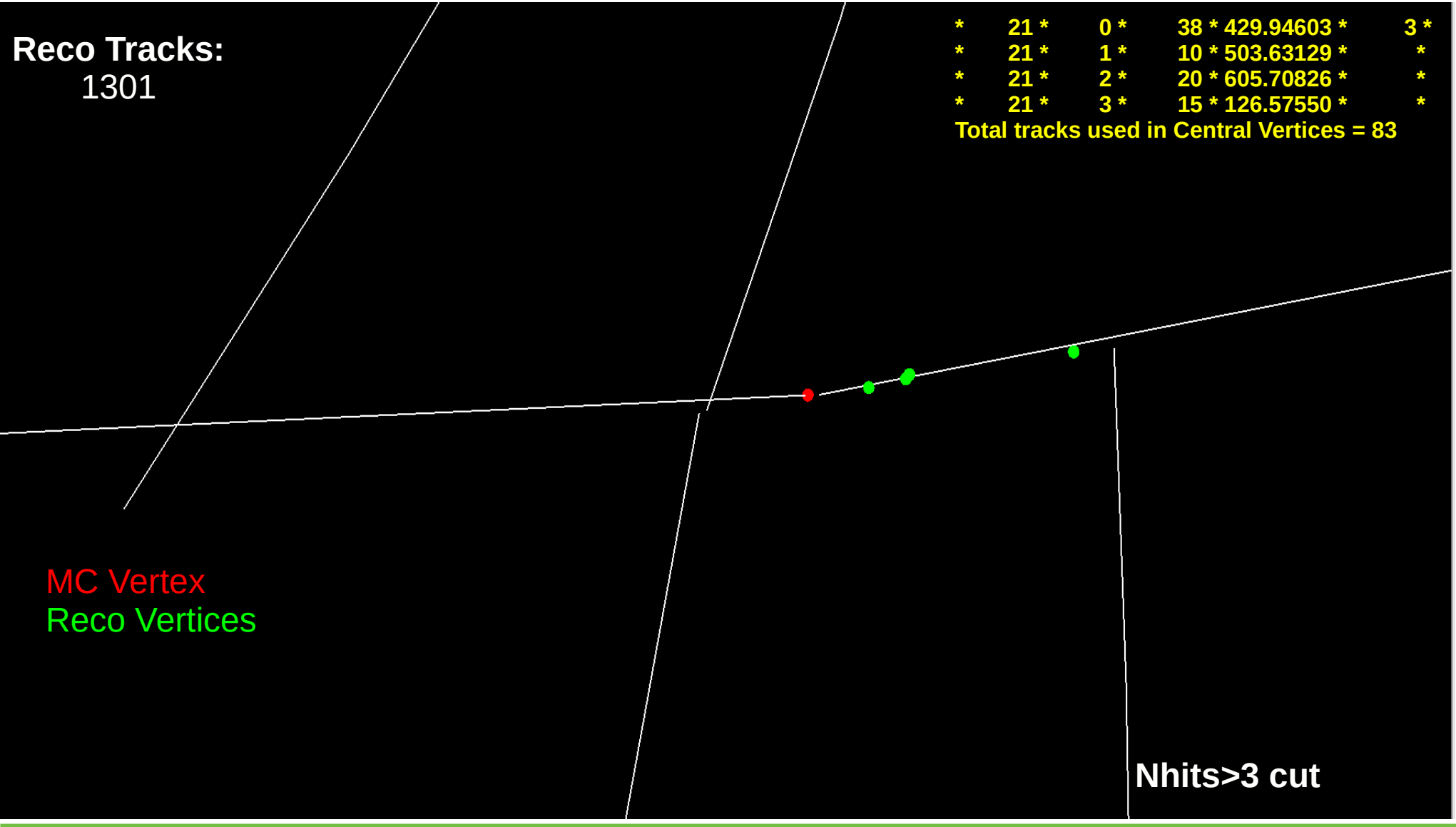
New Branch: CentralTrack4HitCutVertices, Primary4HitCutVertices

Pull request #2527 merged

Event display (Event 21)

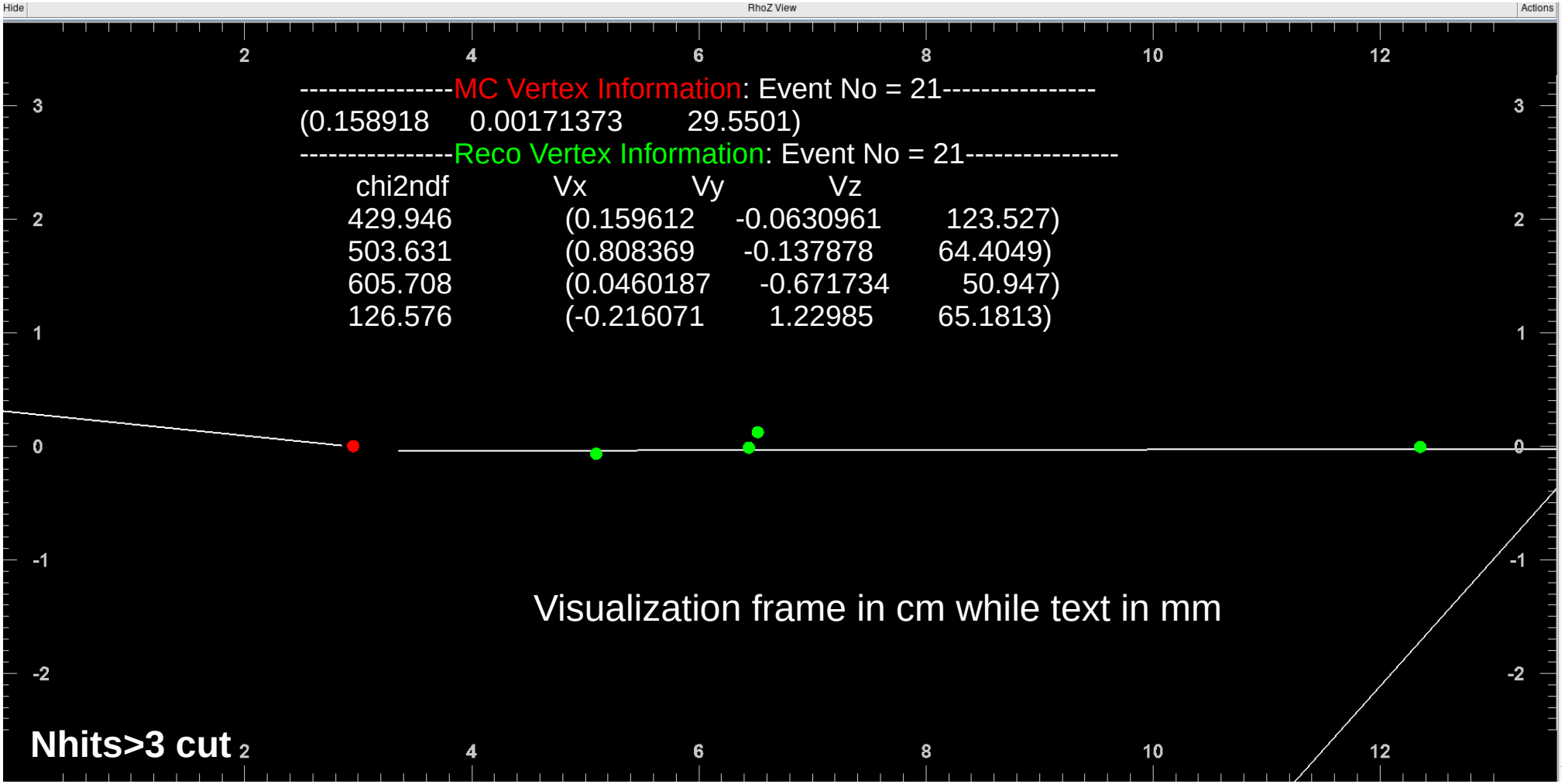


Event display (Event 21)



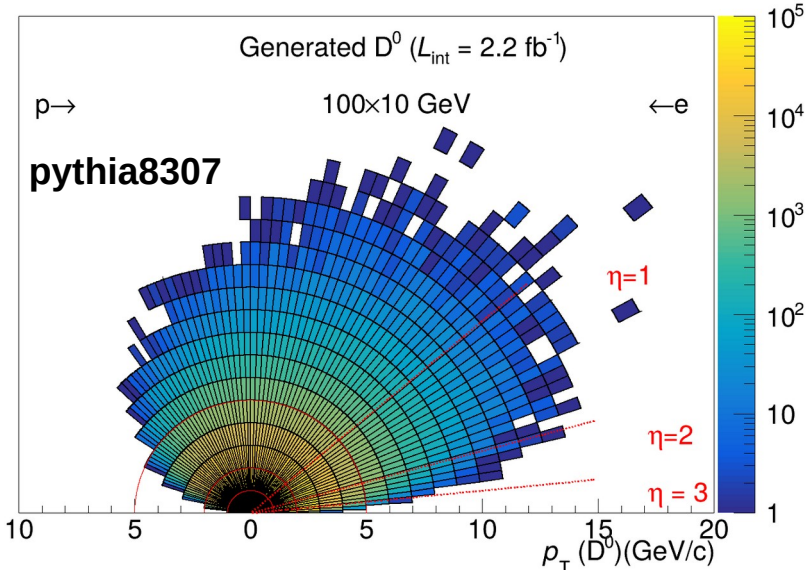
Event display (Event 21)

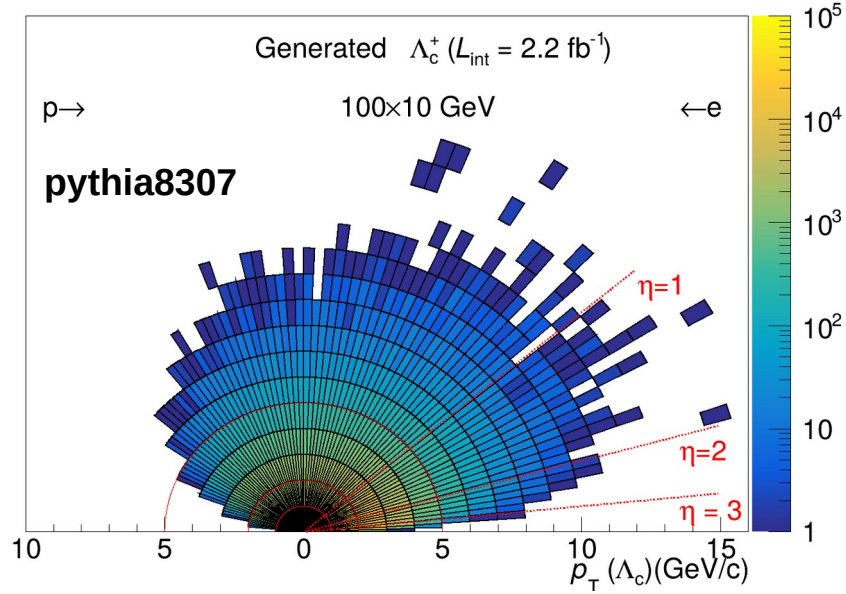
RZ view



Status of Λ_c/D^0 Ratio

PYTHIA8 Simulation

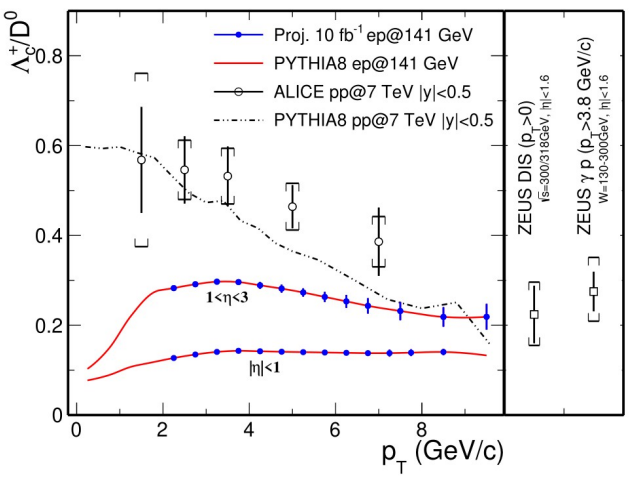




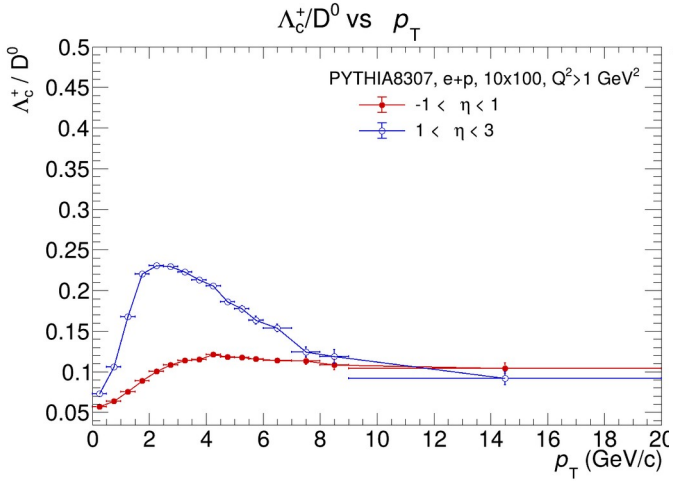
Events = 1B

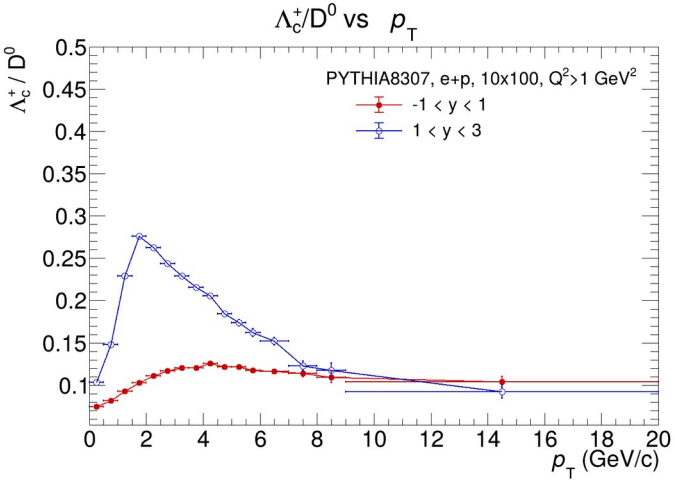
D⁰ Sample
$\sigma = 4.633 \times 10^5$ pb

Λ_c Sample
$\sigma = 4.527 \times 10^5$ pb

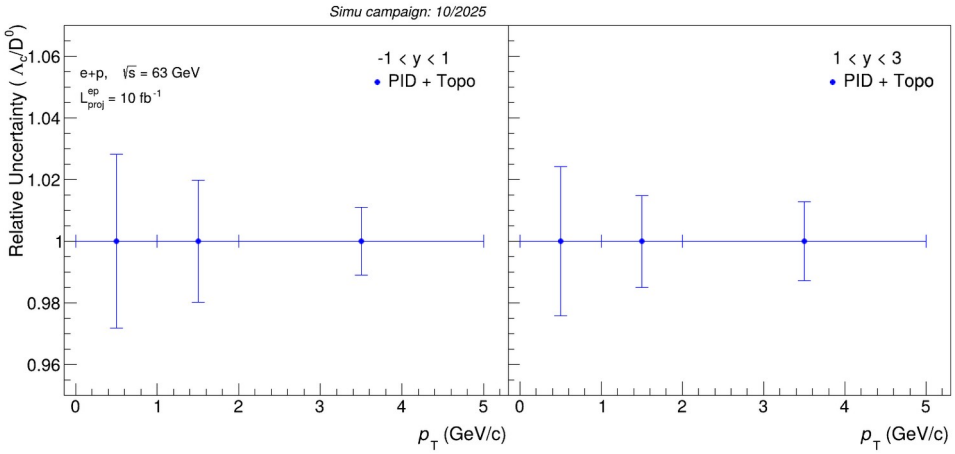


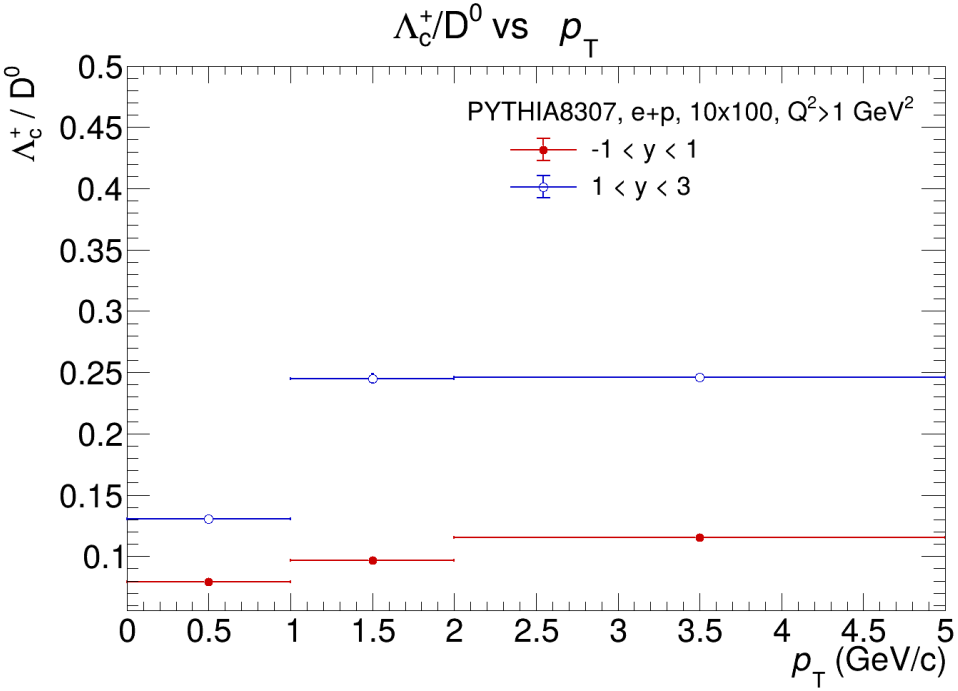
arXiv:2102.08337 [nucl-ex]





Charm Baryon to Meson Ratio (Λ_c/D^0)





Binning must be done finer in p_T and also study differential in η

Summary and Future Plan

- There is more than one reconstructed primary vertices in an event
- The primary vertex has a large Chi2/ndf compared to the case without background
- Primary vertex reconstruction has already been implemented with four hits
- The request to produce background samples has already been submitted
- First look including the prediction for Λc/D0 ratio has already been presented
- Next to do finer binning and run with official campaigns

Thank you for your attention!