Mean $\langle p_T \rangle$ fluctuations for pp collisions

Some issues in the Track Selection

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Few words about the mean p_T fluctuation (scale-independent approach)

- To measure the event-by-event fluctuations, we use the dynamical fluctuation $\sigma^2_{p_{\mathrm{T}},\mathrm{dyn}}$ defined as:

$$\sigma^2_{p_{\mathrm{T}},\mathrm{dyn}} = \left\langle \left(M(p_{\mathrm{T}}) - \mu_{M(p_{\mathrm{T}})} \right)^2 \right\rangle - \frac{\left\langle (p_{\mathrm{T}} - \mu_{p_{\mathrm{T}}})^2 \right\rangle}{\langle N_{\mathrm{ch}} \rangle}$$

which is derived from:

  - variance of the inclusive single particle p_{T} distribution $\left\langle \left(p_{\mathrm{T}} - \mu_{p_{\mathrm{T}}} \right)^2 \right\rangle$,
  - variance of the event-by-event mean transverse momentum distribution $\left\langle \left(M(p_{\mathrm{T}}) - \mu_{M(p_{\mathrm{T}})} \right)^2 \right\rangle$ and
  - the average number of charged particles per event $\langle N_{\mathrm{ch}} \rangle$

- By definition $\sigma^2_{p_{\mathrm{T}},\mathrm{dyn}}$ is zero if all fluctuations are purely statistical

Few words about the mean p_T fluctuation (scale-dependent approach)

- In a scale-dependent approach we measure the event-by-event mean p_T with the two-particle correlator:

$$C_m = \frac{1}{\sum_{k=1}^{n_{ev,m}} N_k^{\text{pairs}}} \sum_{k=1}^{n_{ev,m}} \sum_{i=1}^{N_{\text{acc},k}} \sum_{j=i+1}^{N_{\text{acc},k}} \left(p_{\text{T}}^i - M(p_{\text{T}})_m\right)\left(p_{\text{T}}^j - M(p_{\text{T}})_m\right)$$

- Where $M(p_{\text{T}})_m = \frac{1}{\sum_{k=1}^{n_{ev,m}} N_{\text{acc},k}} \sum_{k=1}^{n_{\text{ev},m}} \sum_{i=1}^{N_{\text{acc},k}} p_{\text{T}}^i$ is the mean transverse momentum of all tra ultiplicity class *m*

- We use the dimensionless ratio $\frac{\sqrt{|C_m|}}{M(p_{\text{T}})_m}$ for the representation of the results in units of the average tr rse momentum

At the last PAG meeting where these results were presented:

https://indico.cern.ch/event/476248/

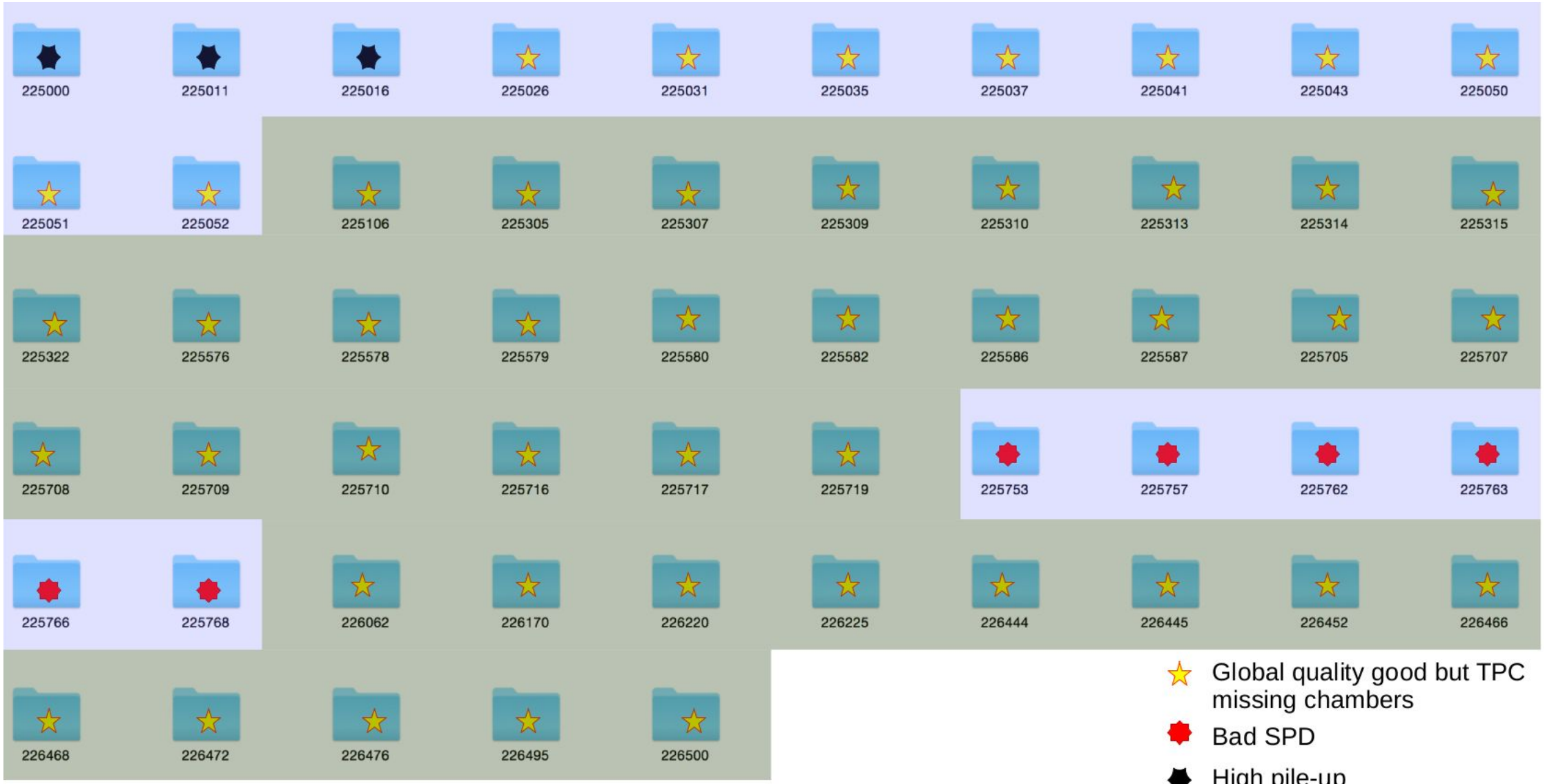
It was suggested to use TPConly track cuts for the measurement of the $\langle p_T \rangle$ fluctuation

- This we will show today

Event selection

- kINT7 trigger
- |vtxz| < 10 cm
- Pile up is removed using SPD (standard cuts)
- Incomplete events from DAQ are excluded

Event selection



Event selection

- Runs:
  225026,225031,225035,225037,225041,225043,225050,225051,
  225052,225106,225305,225307,225309,225310,225313,225314,
  225315,225322,225576,225578,225579,225580,225582,225586,
  225587,225705,225707,225708,225709,225710,225716,225717,
  225719,226062,226170,226220,226225,226444,226445,226452,
  226466,226468,226472,226476,226495,226500
- Period LHC15f pass2
- Number of events: 39,797,362

Standard and TPC only cuts

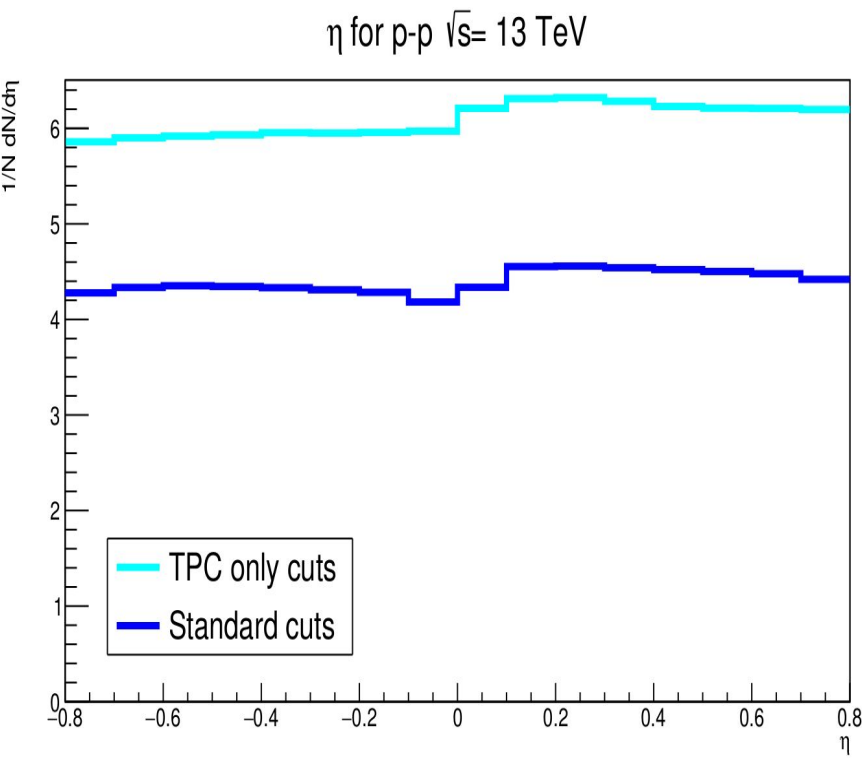
Standard cuts 2011

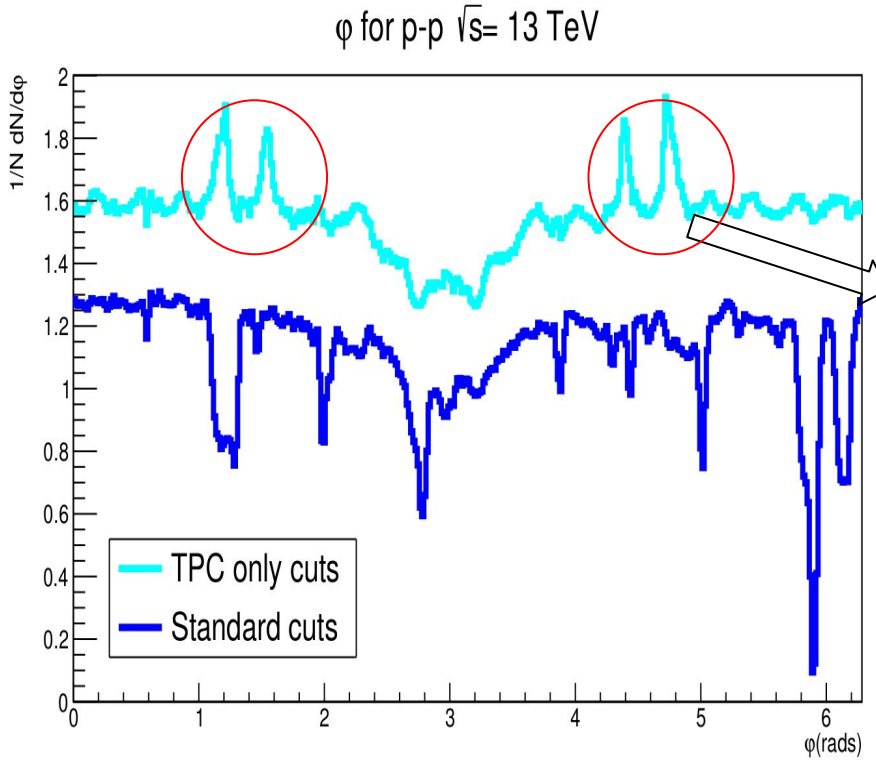
Min. TPC clusters	50
Max. χ^2 per TPS Cls.	4
Reject kink daughters	yes
TPC refit	yes
ITS refit	yes
Require hits in ITS	one(Any)
Max. DCA to vertex xy	$0.0182+0.0350/p_T^{1.1}$ cm
Max DCA to vertex z	2 cm.

TPC only cuts

Min. TPC clusters	70
Max. χ^2 per TPS Cls.	4
Reject kink daughters	yes
TPC refit	no
ITS refit	no
Require hits in ITS	no
Max. DCA to vertex xy	2.4 cm.
Max DCA to vertex z	3.2 cm.

η and φ distributions





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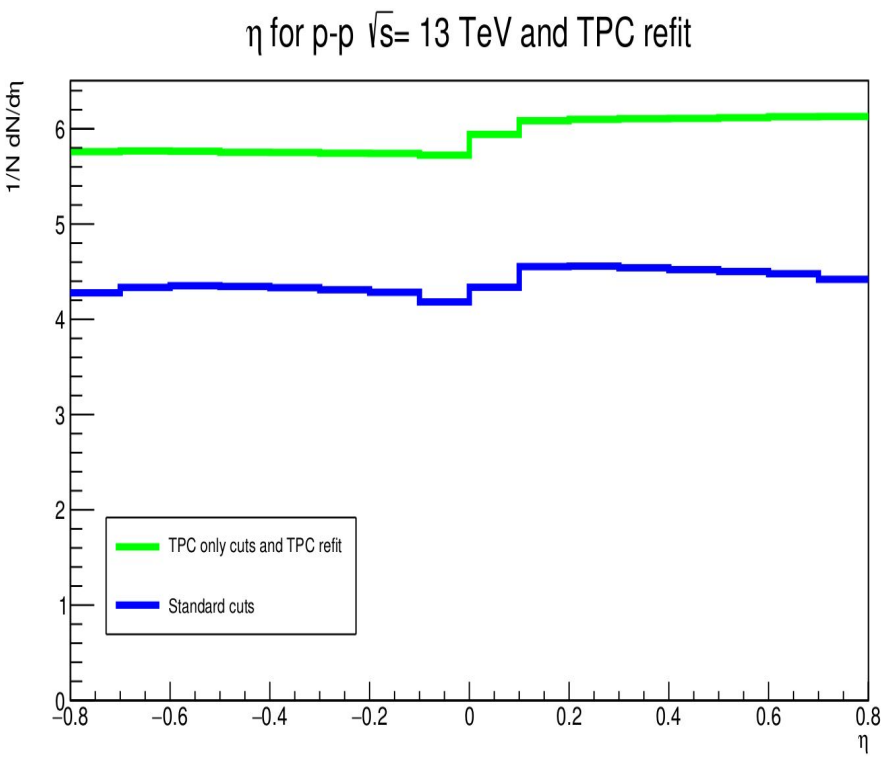
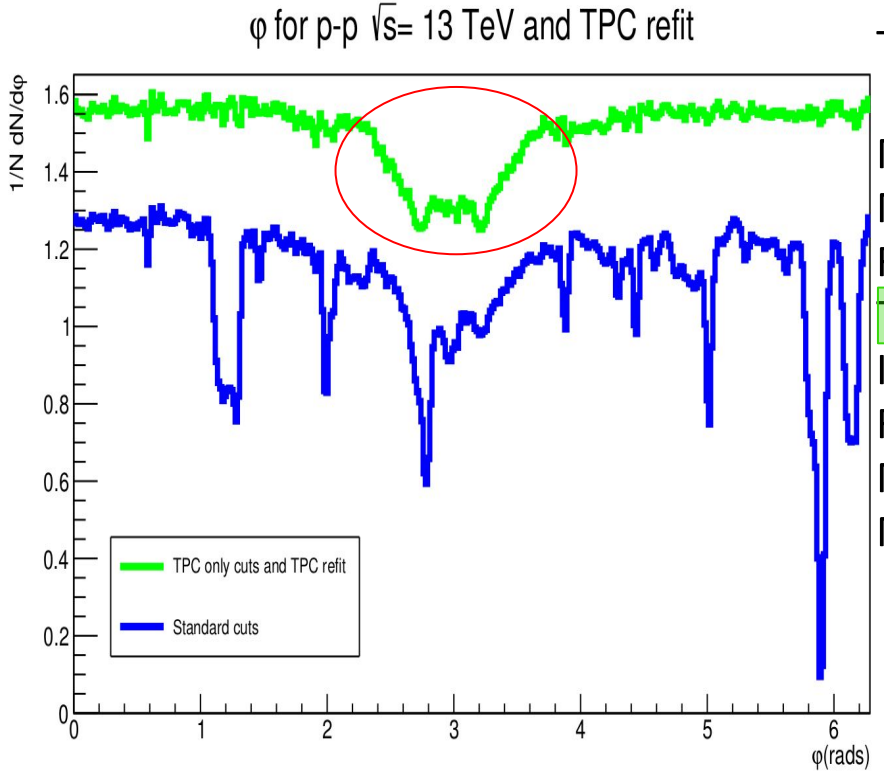
η and φ distributions (implementing TPC refit)





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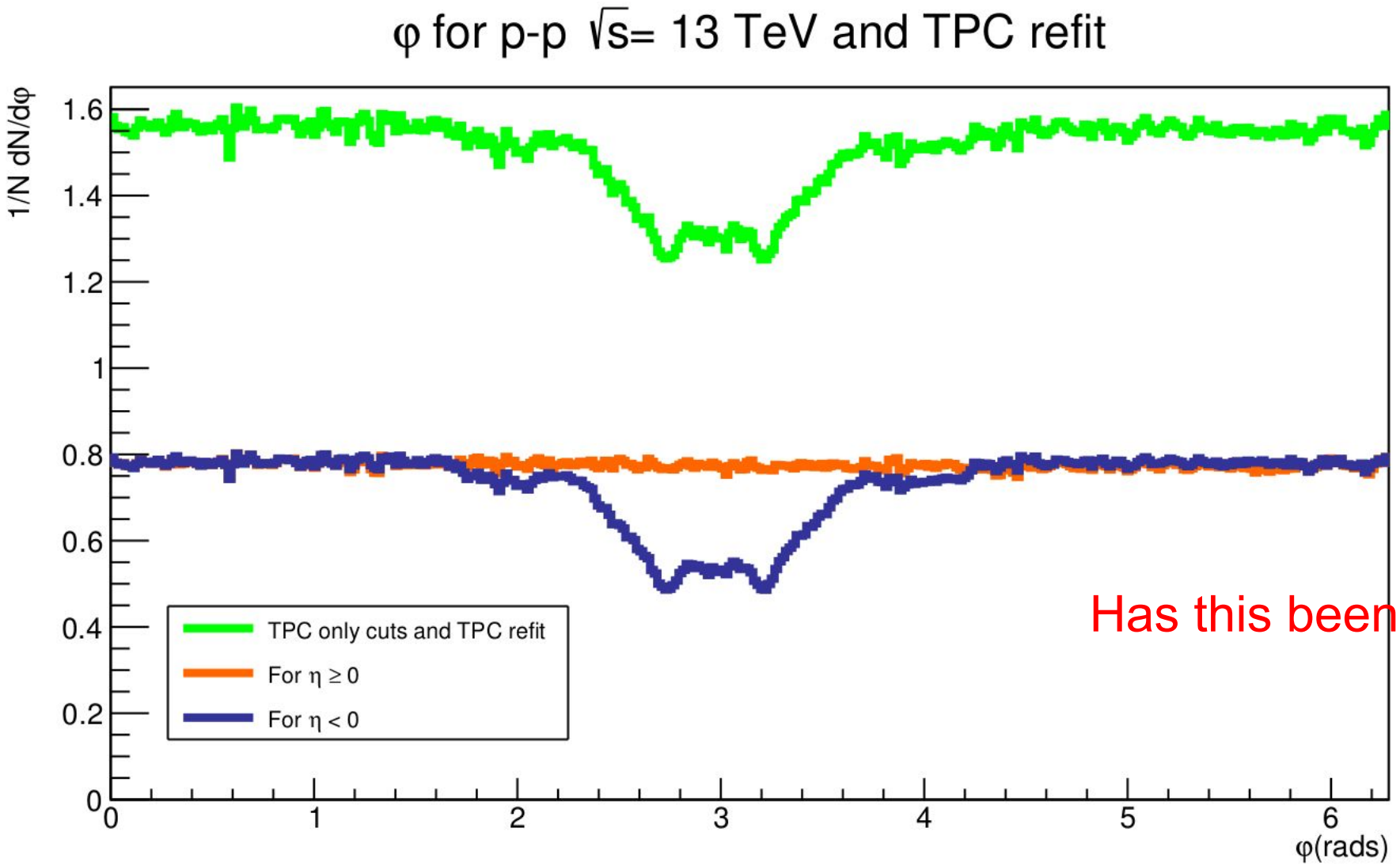
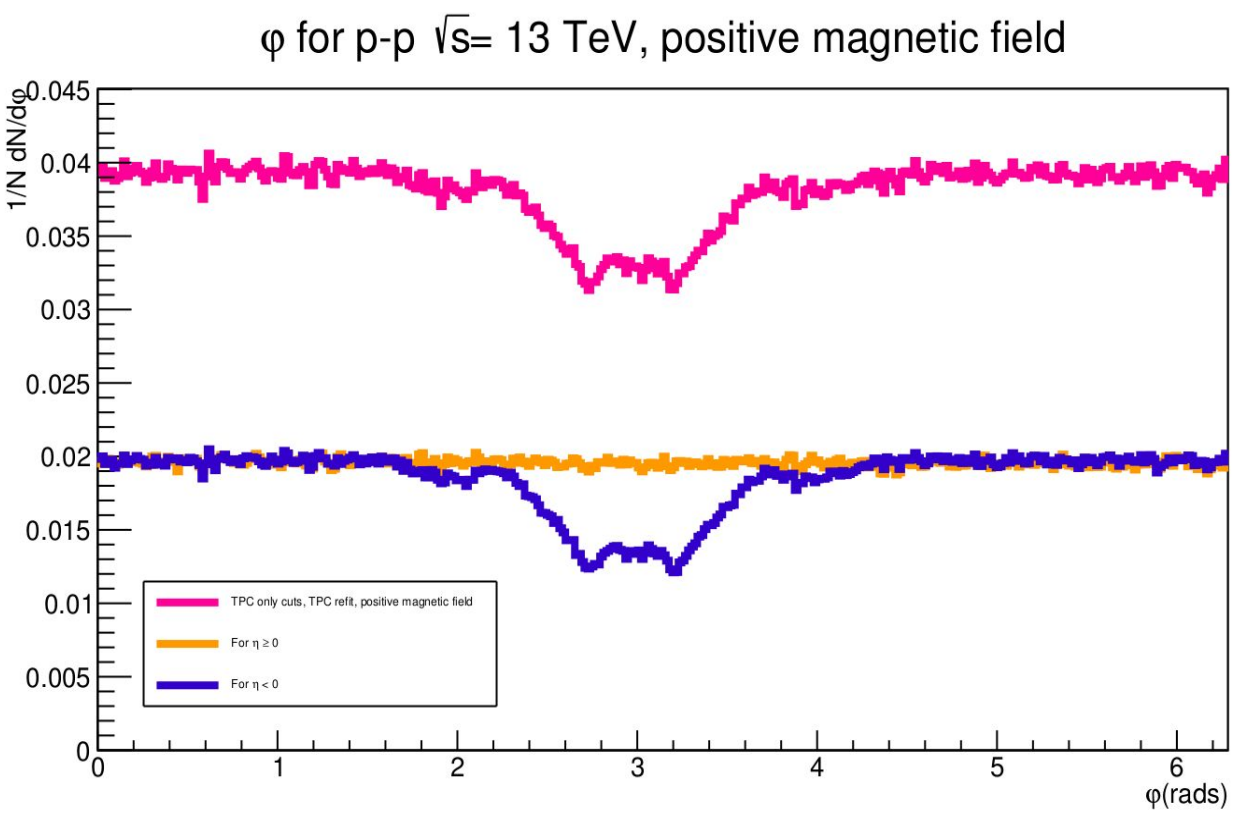
Origin of the dip at φ ~ 3 rad

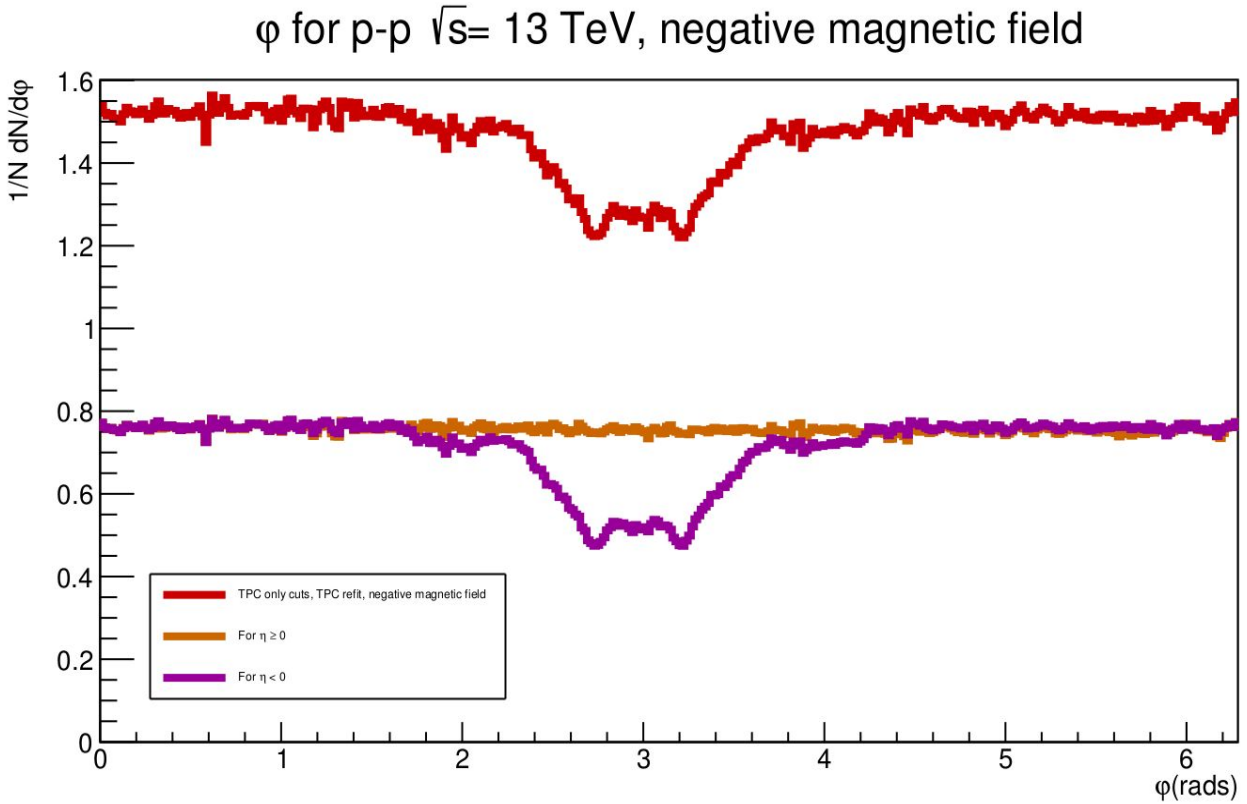


Has this been observed before?

Magnetic Field effects?

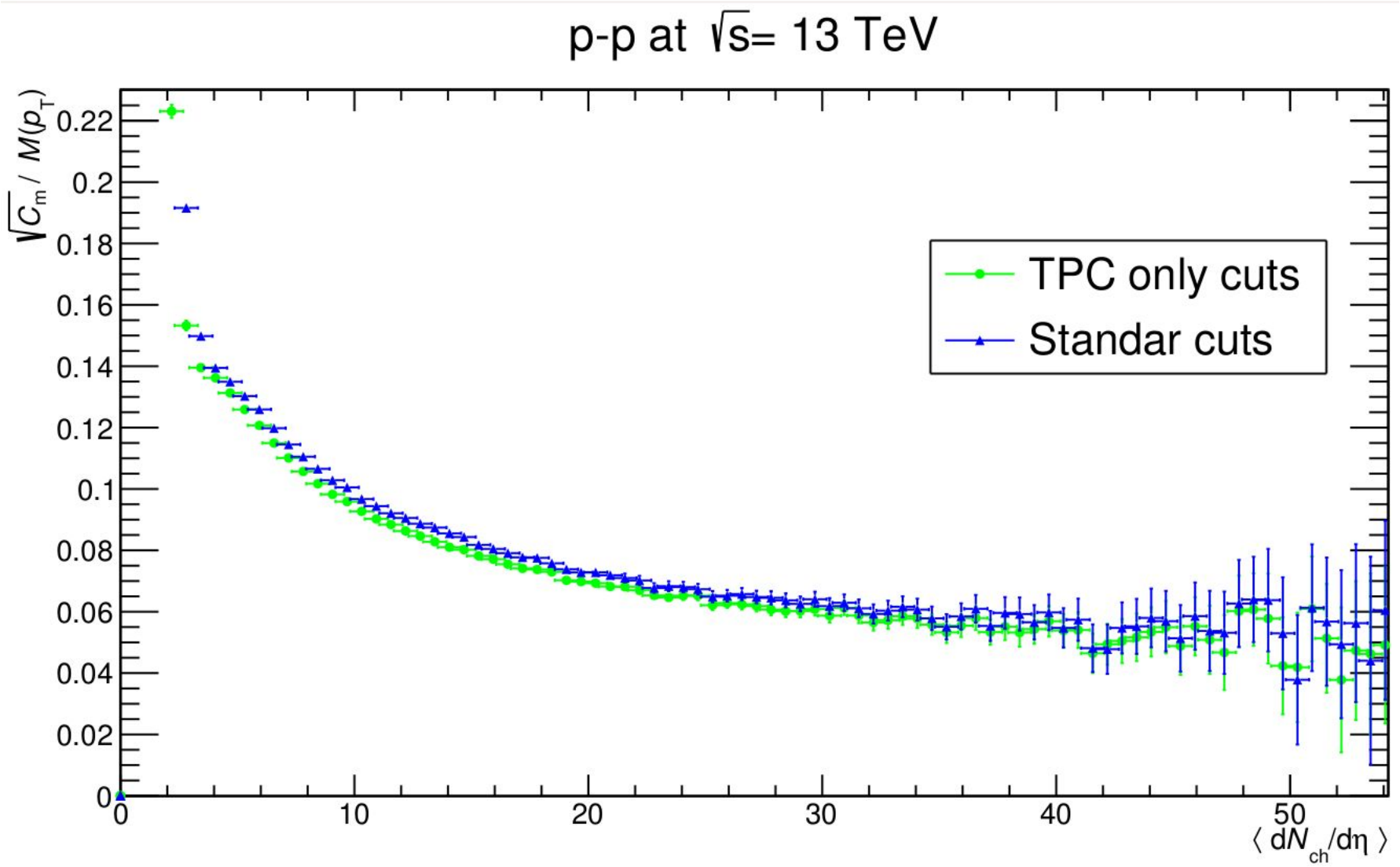


number of events: 917,051



number of events: 35,515,400

Fluctuations vs <Nch> (reference estimator)



To do list

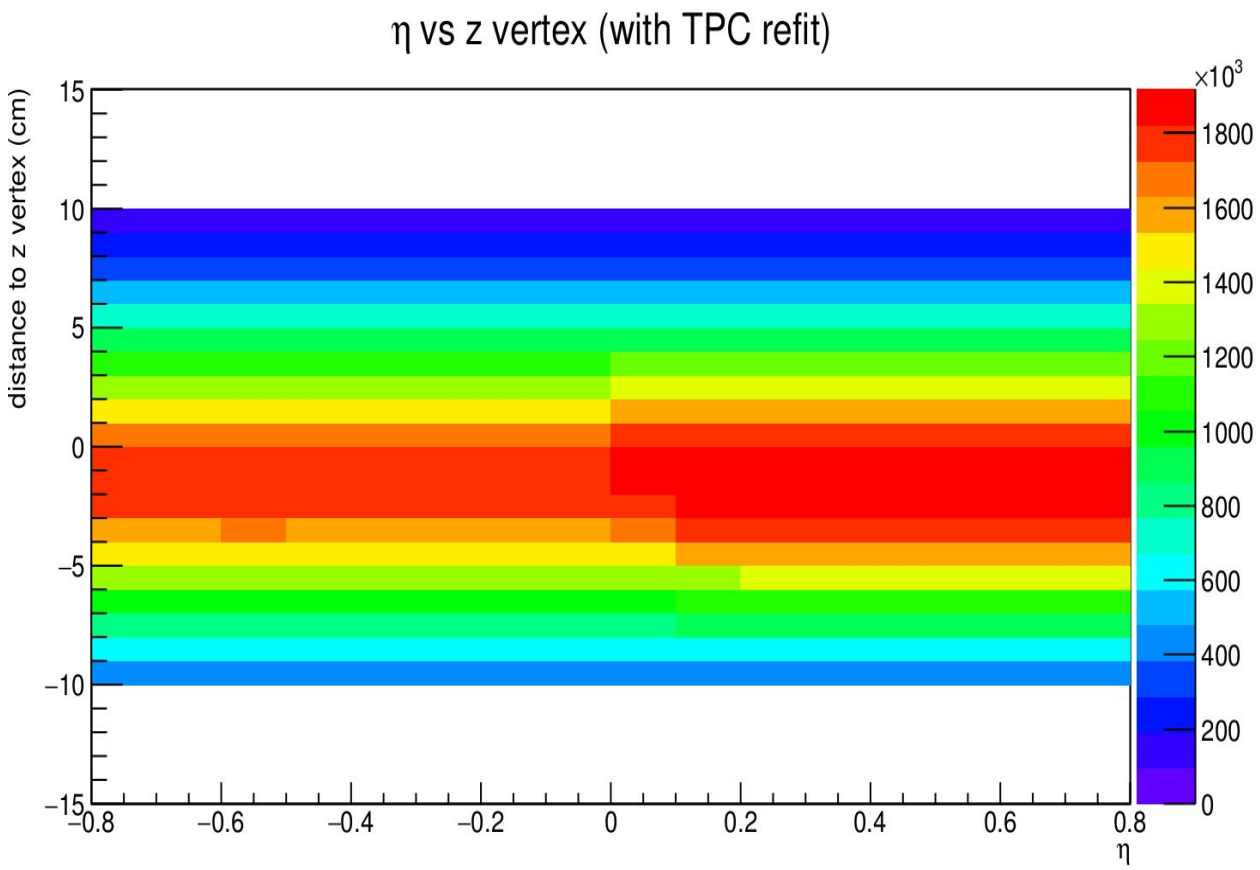
- Check the most recent recommendations concerning the event selection:

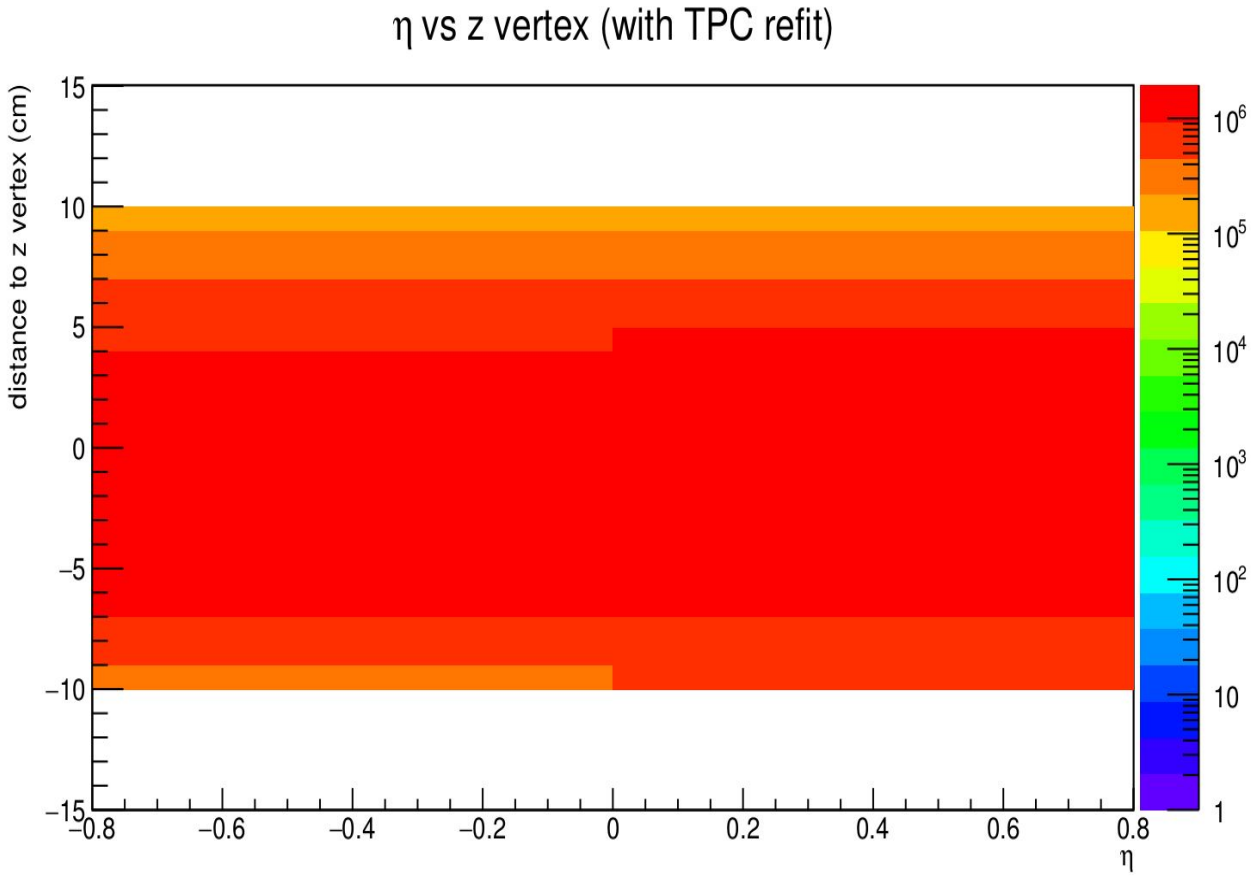
https://twiki.cern.ch/twiki/bin/viewauth/ALICE/AliceHMTFCodeSnippets

- Check with experts the origin of the deep at phi ~ 3 rad for eta <0.
- Implement a selection based on event shapes

Backup

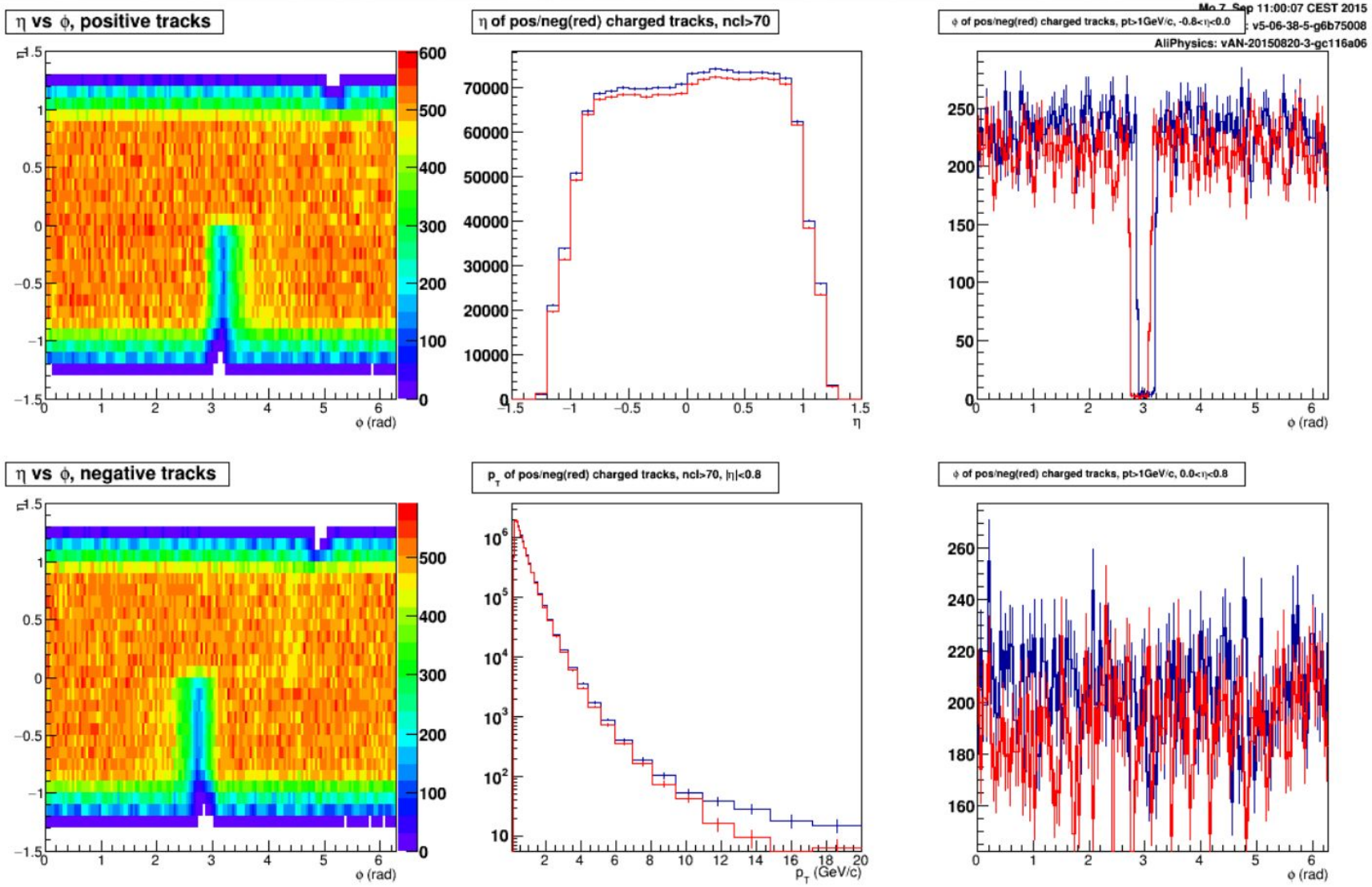
η vs. zvtx





with Logz

Origin of the dip at φ ~ 3 rad



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