3er Congreso de la Red Mexicana Cientifica y tecnologica ALICE LHC
Progreso de la tesis de doctorado

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Red ALICE Mèxico meeting

20 octubre 2016

Outline

- Some results from the last meeting.

- About the analysis in the ALICE colaboration.
  -- The event shape: spherocity
  -- “Spherocity” as a tool to look for jets and isotropic events
  -- Some technical details for this variable.:
  -optimal cuts for the track selection.
  -efficiency study as a function of spherocity.
  -particle yield spectra.

- Conclusions

Some results from last meeting

- 2 proceddings

Jet effects in high-multiplicity pp events. Antonio Ortiz, Gyula Bencédi, Héctor Bello and Satyajit Jena.

https://arxiv.org/pdf/1603.05213.pdf

Proceedings, 7th International Workshop on Multiple Partonic Interactions at the LHC (MPI@LHC 2015) : Miramare, Trieste, Italy, November 23-27, 2015

Review of recent results on heavy-ion physics and astroparticle physics in ALICE at the LHC. Héctor Bello, Arturo Fernandez, Antonio Ortiz

https://arxiv.org/pdf/1609.00692v1.pdf

Joint Proceedings of the XV Mexican Workshop on Particles and Fields & the XXX Annual Meeting of the Division of Particles and Fields of the Mexican Physical Society, JofP:Conf. Series (IoP) 761 (2016) 012033

- 1 paper submitted to a journal

Revealing the Source of the Radial Flow Patterns in Proton-Proton Collisions using Hard Probes. Antonio Ortiz, Gyula Bencédi, Héctor Bello

https://arxiv.org/pdf/1608.04784v1.pdf

Physical Analyisis in ALICE collaboration:

- Transverse Sphericity.

  Is defined in terms of the eigenvalues of

$$\mathbf{S}_{\mathrm{xy}}^{\mathbf{L}} = \frac{1}{\sum_i p_{\mathrm{T}i}} \sum_i \frac{1}{p_{\mathrm{T}i}} \begin{pmatrix} p_{\mathrm{x}i}^2 & p_{\mathrm{x}i}\, p_{\mathrm{y}i} \\ p_{\mathrm{y}i}\, p_{\mathrm{x}i} & p_{\mathrm{y}i}^2 \end{pmatrix}$$

  as: $S_{\mathrm{T}} \equiv \frac{2\lambda_2}{\lambda_2 + \lambda_1}.$

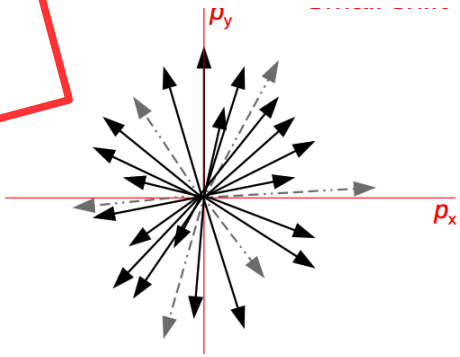
  Where $\lambda_1 >= \lambda_2$.

- Transverse Spherocity

  Transverse spherocity is

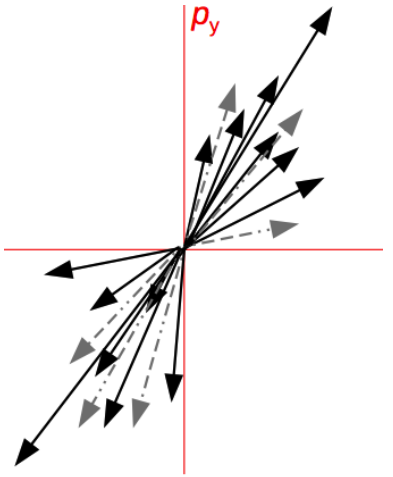
$$S_T^{pherocity} = \frac{\pi^2}{4} \min_{\vec{n}=(n_x,n_y,0)} \left(\frac{\sum_i |\vec{p}_{Ti} \times \vec{n}|}{\sum_i \vec{p}_{Ti}} \right)^2$$

Looking for an ALICE paper with this measurement.



For both cases we have the limits:

$$S_o = S_T^{pherocity} = \begin{cases} 1 \text{ isotropic structure} \\ 0 \text{ dijet structure} \end{cases}$$



Andrea Banfi G. Salam and G. Zanderighi, "Phenomenology of the event shapes at hadron colliders", arXiv:1001.4082

Some technical details for the analysis.

- For the introduction of this variable, some technical details are studied and documented

  Event clasification using transverse spherocity and event multiplicity for the analysis of pp data: https://aliceinfo.cern.ch/Notes/node/529

For this study we take some considerations:

DATASET: data: LHC15f pass2 (good runs acroding RCT)

MC: LHC15g3a3 (Pythia8-Monash2013)

EVENT SELECTION: AliVEvent::kINT7, AnalysisUtils::IsSPDClusterVsTrackletBG()

IsPileupFromSPDInMultBins(), IsIncompleteDAQ()

VERTEX: SPD and Track vertices reconstructed, separation along z <5mm

For Spherocity we take more than 2 tracks with pT>0.15 GeV/c and | eta |<0.8

Three set of cuts tested:

STANDAR cuts:GetStandardITSTPCTrackCuts2011(kTRUE,1)

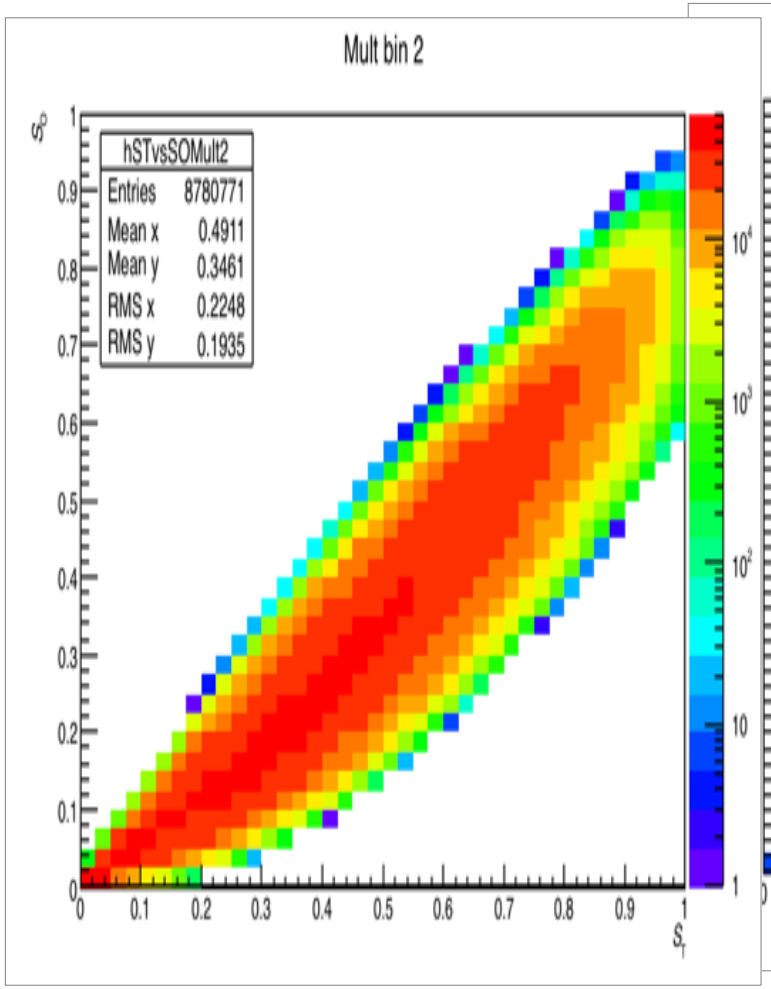
HYBRID:CreateTrackCutsPWGJE(10001008)+CreateTrackCutsPWGJE(10011008)

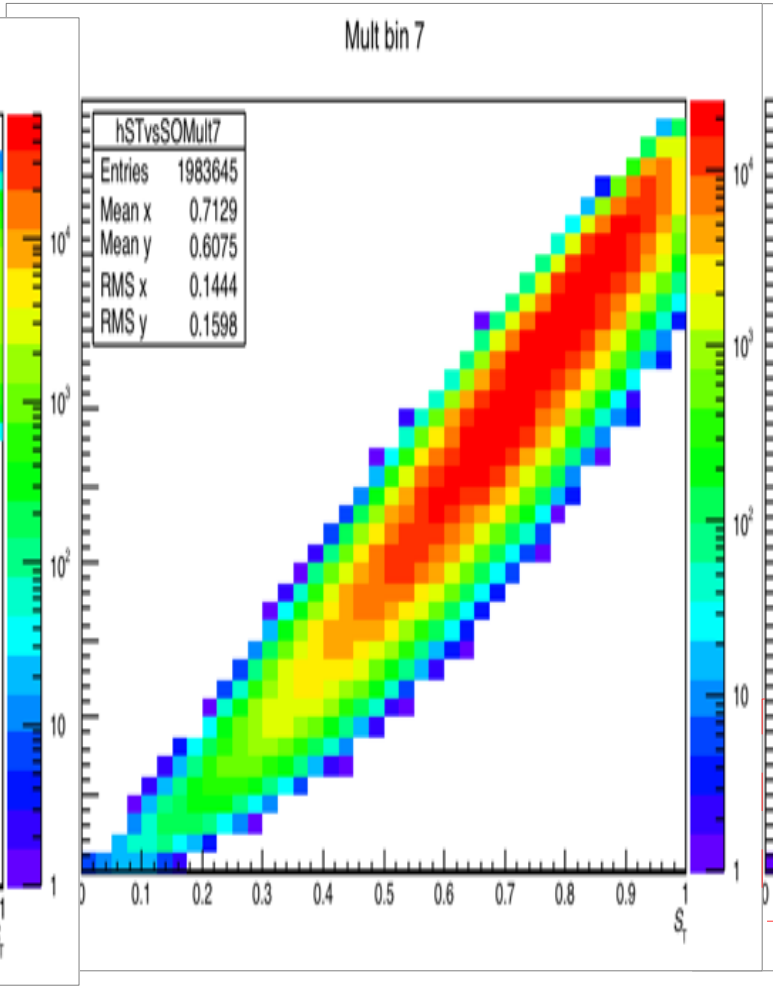
TPC cuts:GetStandardTPCOnlyTrackCuts+TPCrefit

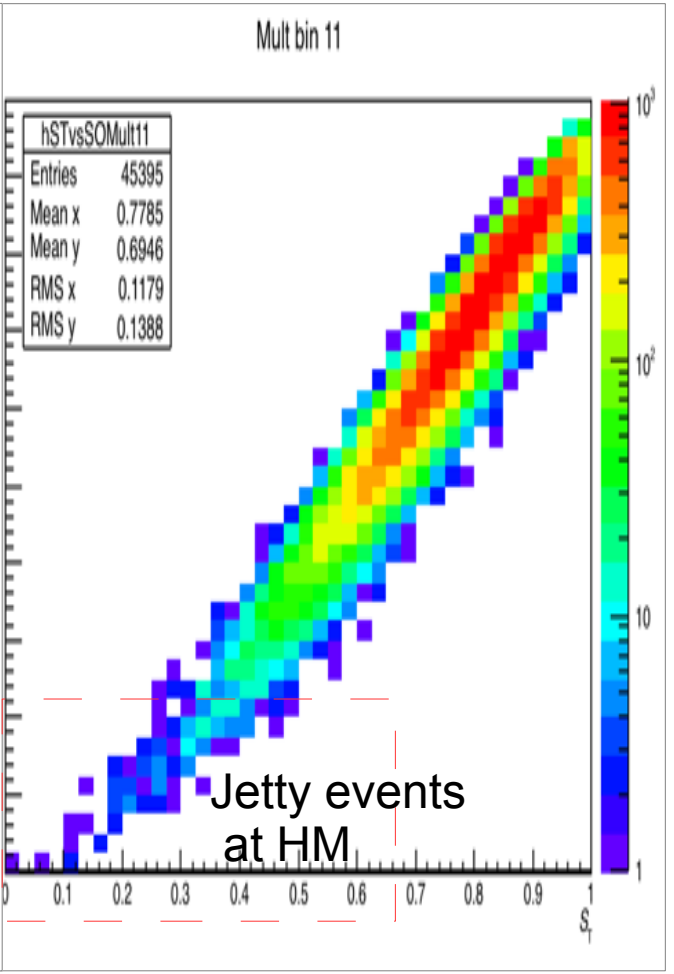
For Multiplicity: GetReferenceMultiplicity(fESD,AliESDTrackCutsITSTPC,0.8)

What is the correlation Spherocity vs Sphericity for diff. Nch bins

We see the correlation and difference at low and high multiplicity



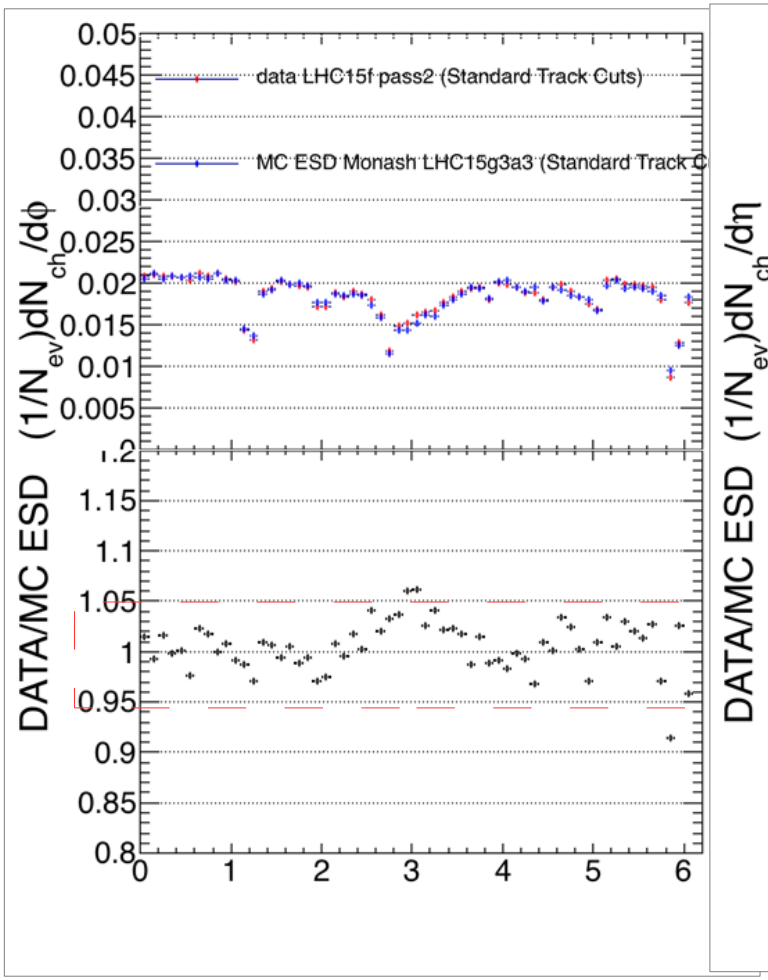


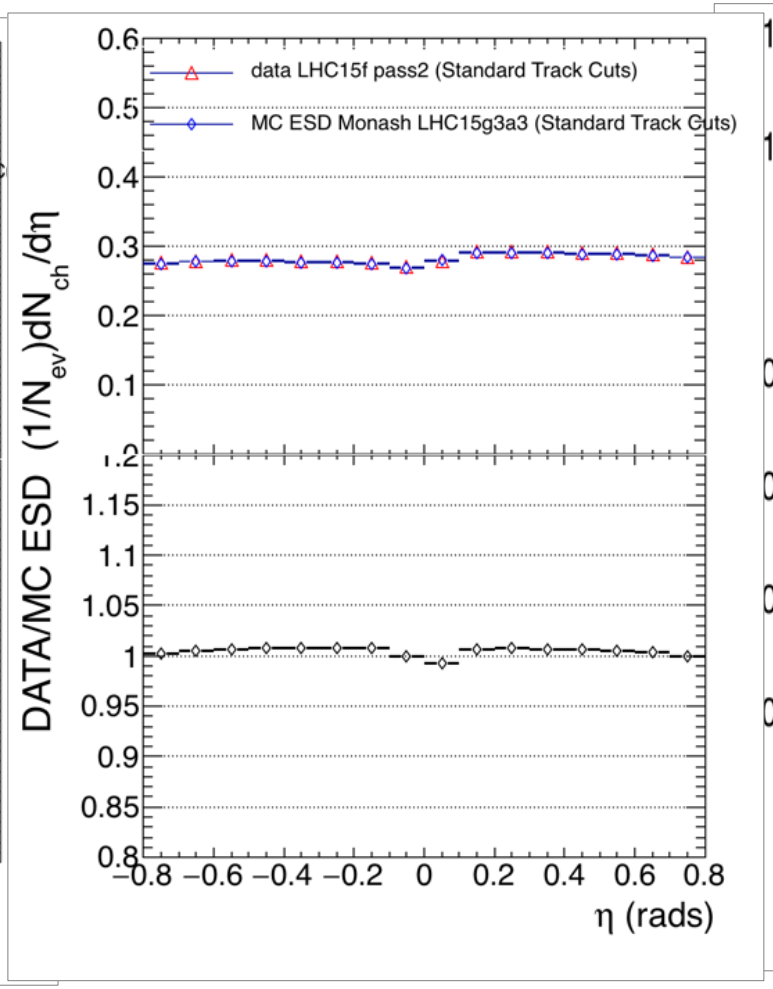


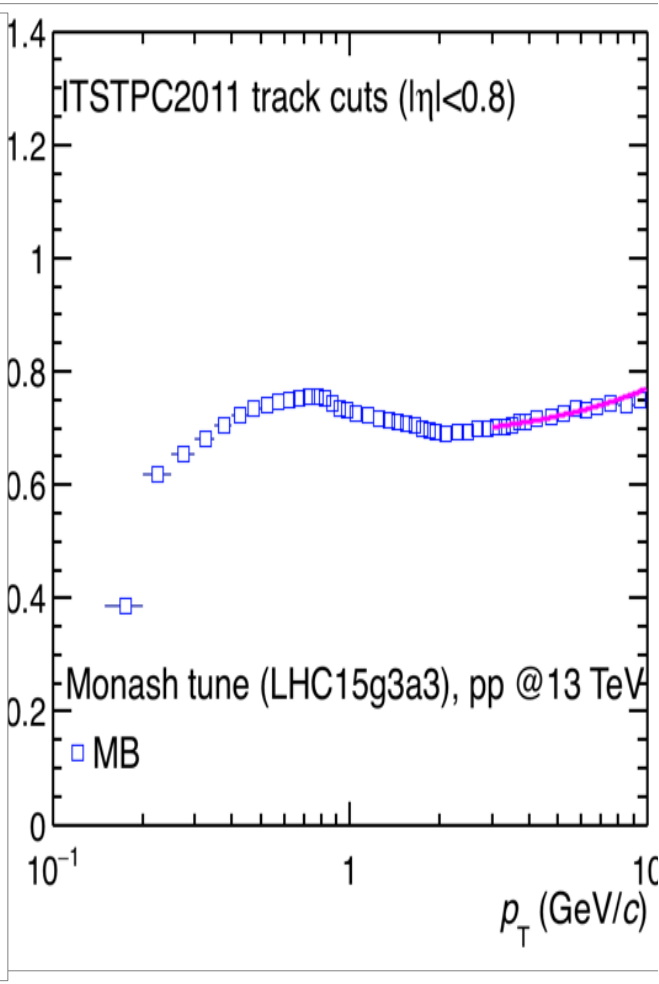
Multbins[14]={0,1, 4, 7,10,15, 20, 25, 30, 40, 50, 60, 70, 140 };

Wich track cuts selection is the optimum?

To study MC/DATA dependence for different cuts: -ITSTPC2011 golden DATA vs MC

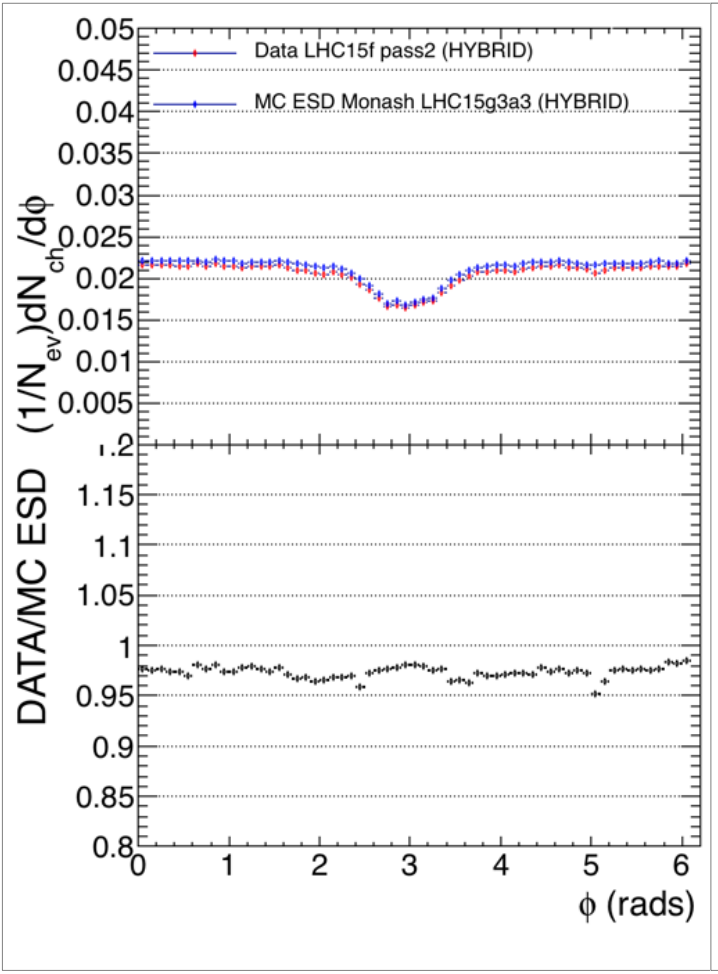


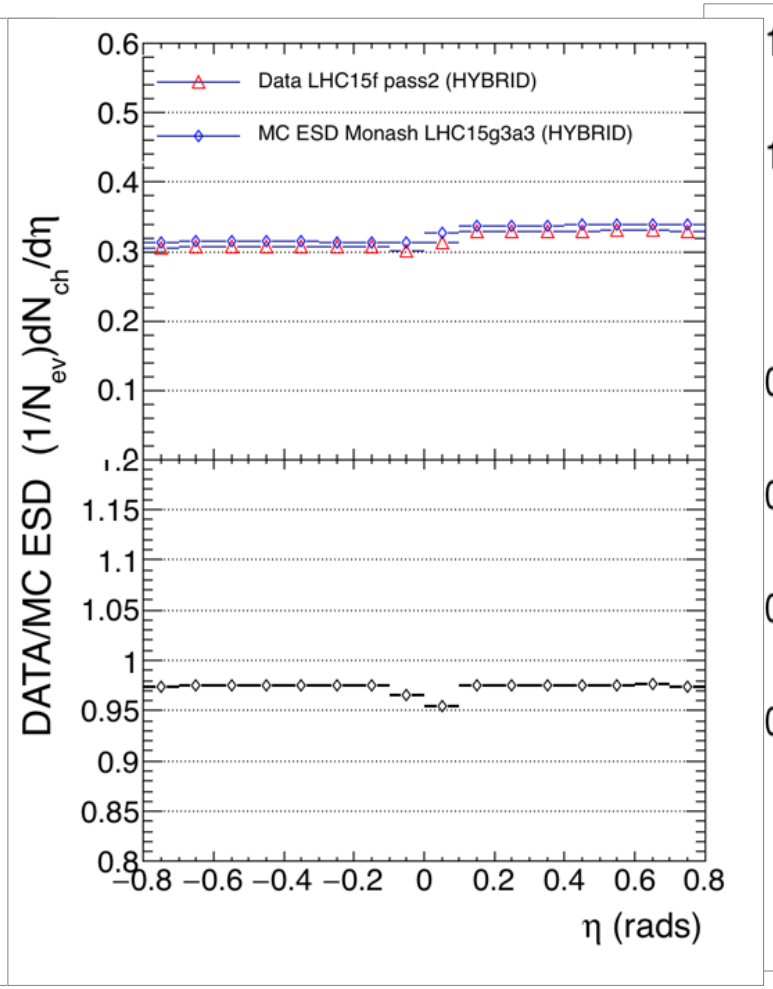


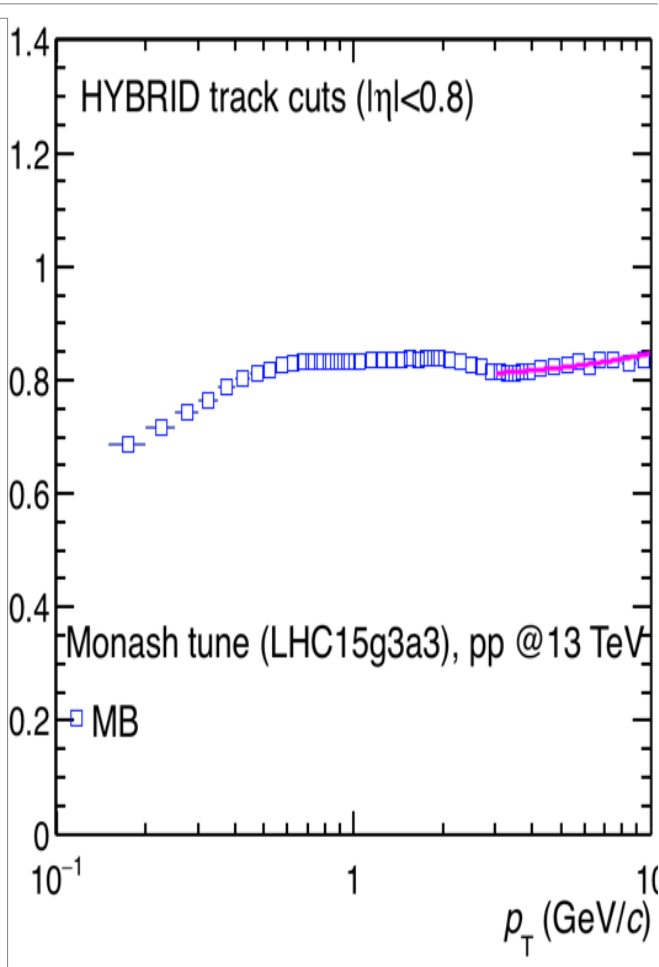


Wich track cuts selection is the optimum?

To study MC/DATA dependence for different cuts: HYBRID track cuts DATA vs MC





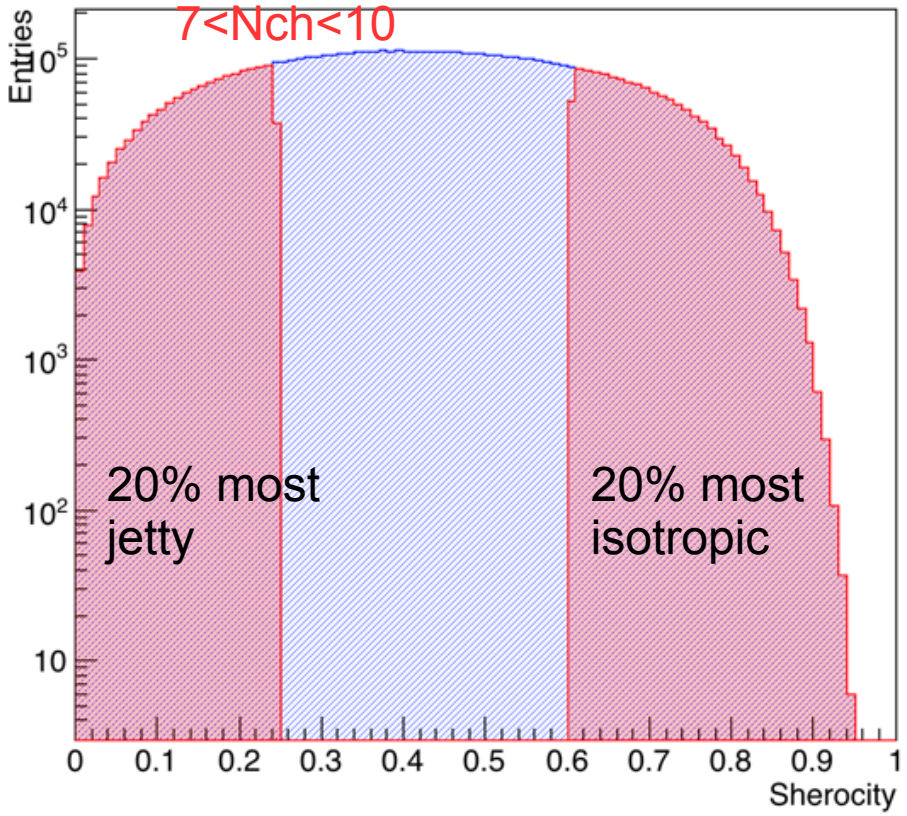


How is affected the efficiency due to the event selection with different topology?

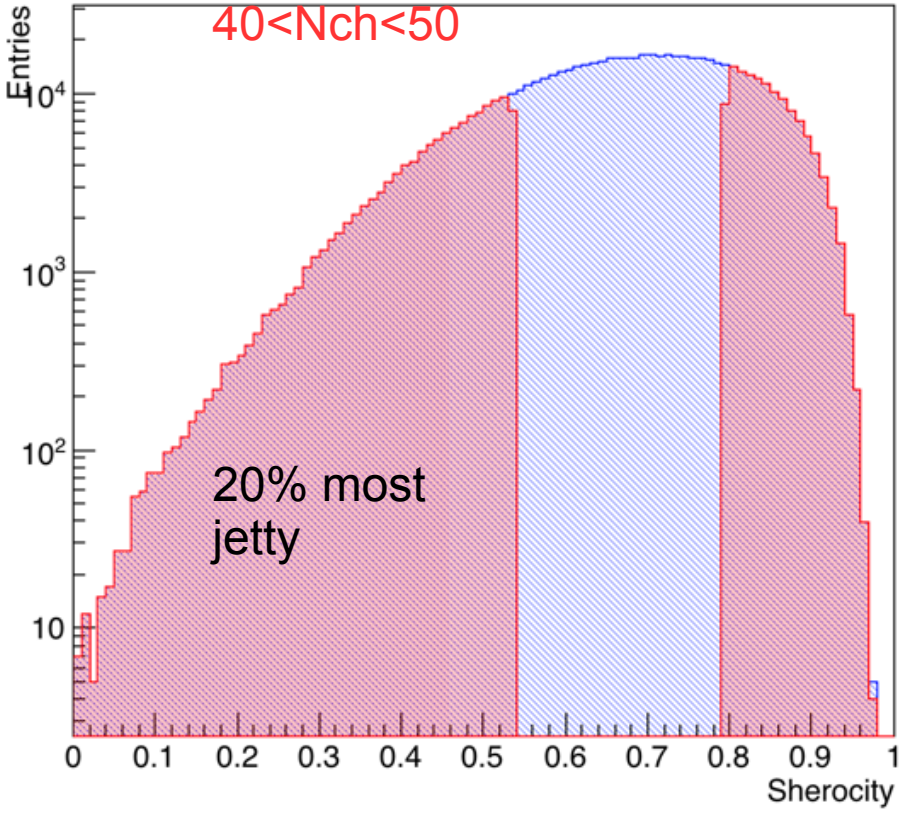
For three different Event Shape binnings and percentiles

- BinA= {0.0,0.1,0.4,0.9,1.0}; BinApc= {0.0,10.0,40.0,90.0,100.0};
- BinB= {0.0,0.2,0.4,0.8,1.0}; BinBpc= {0.0,20.0,40.0,80.0,100.0};
- BinC= {0.0,0.3,0.4,0.7,1.0}; BinCpc= {0.0,30.0,40.0,70.0,100.0};

Spherocity distribution
7<Nch<10

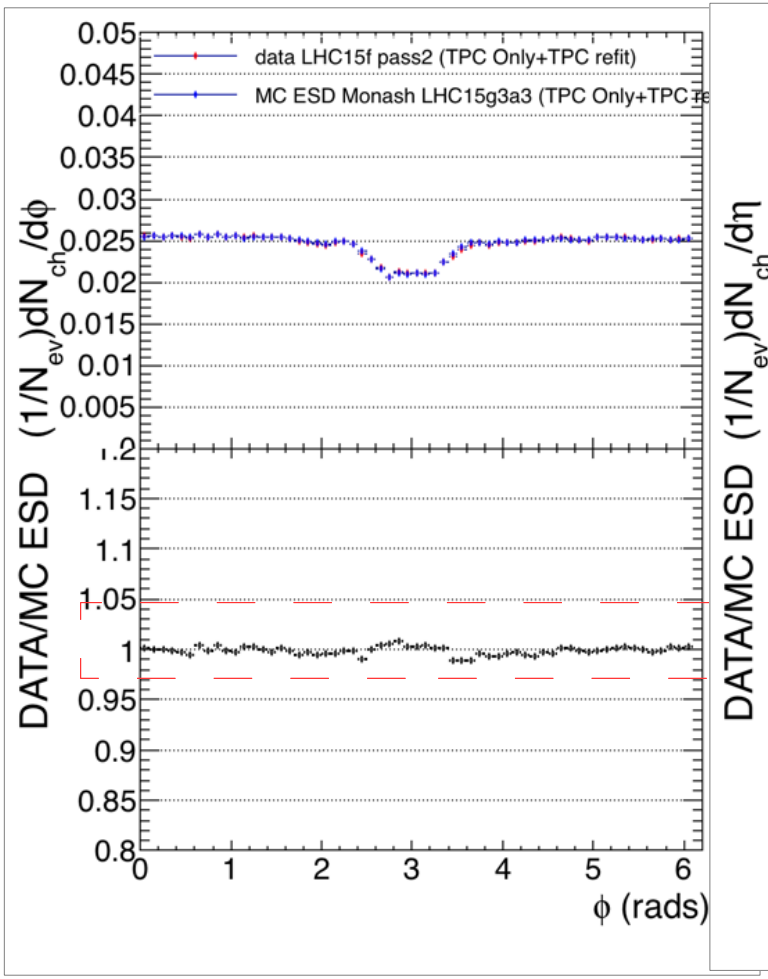


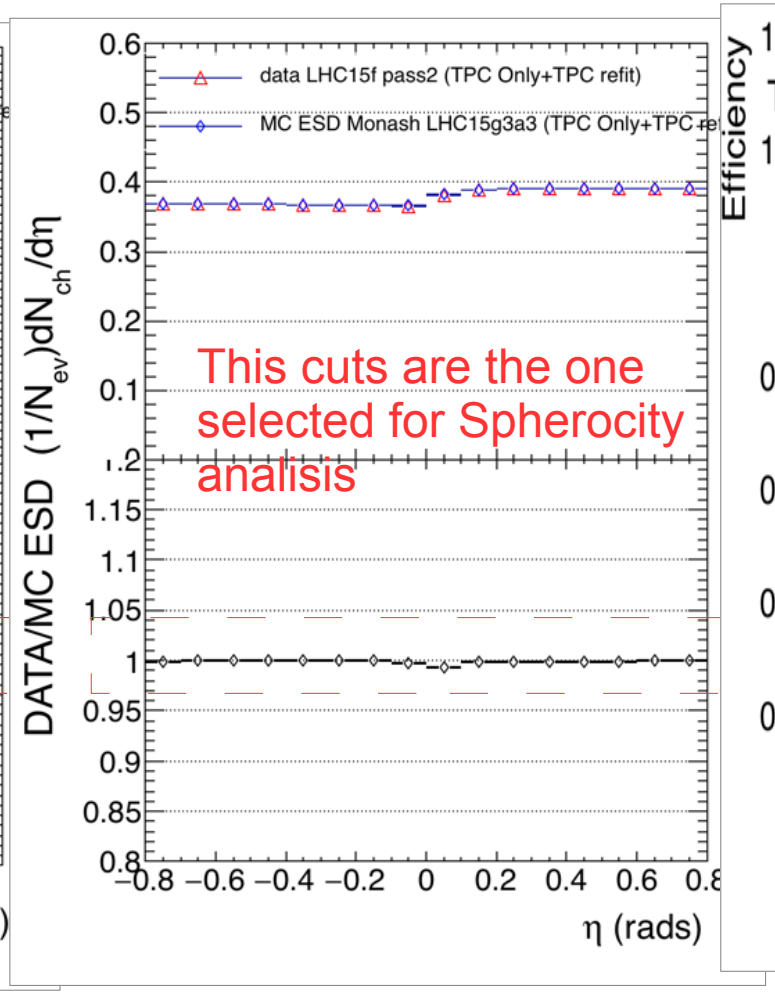
Spherocity distribution
40<Nch<50

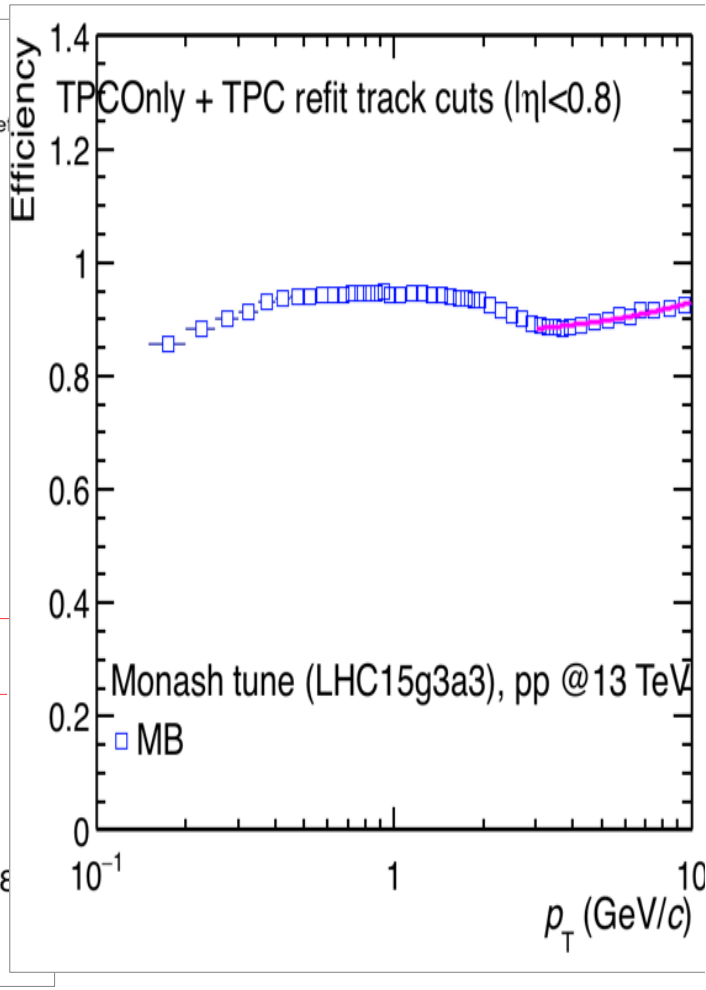


Wich track cuts selection is the optimum?

To study MC/DATA dependence for different cuts: TPC Only+TPC refit DATA vs MC

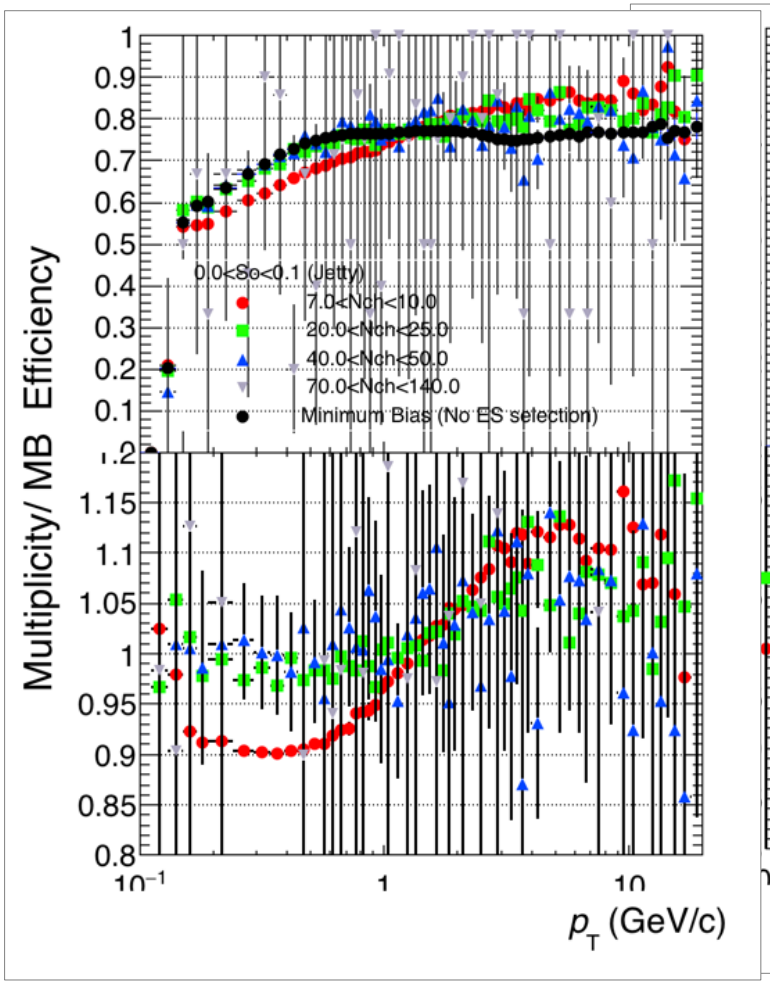


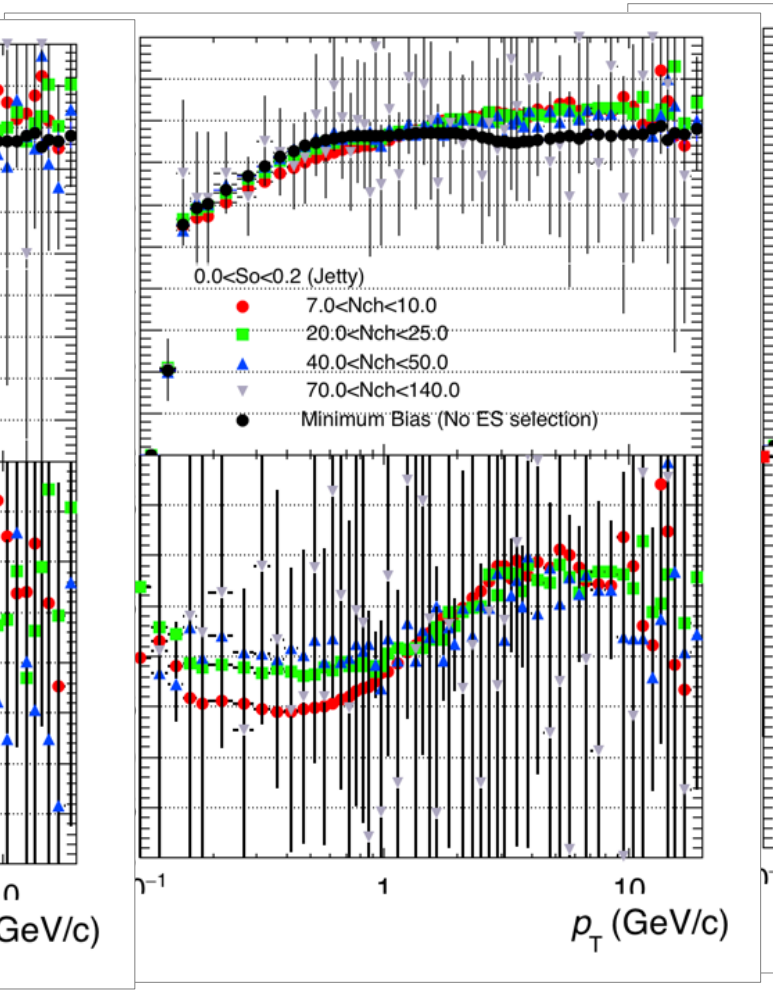


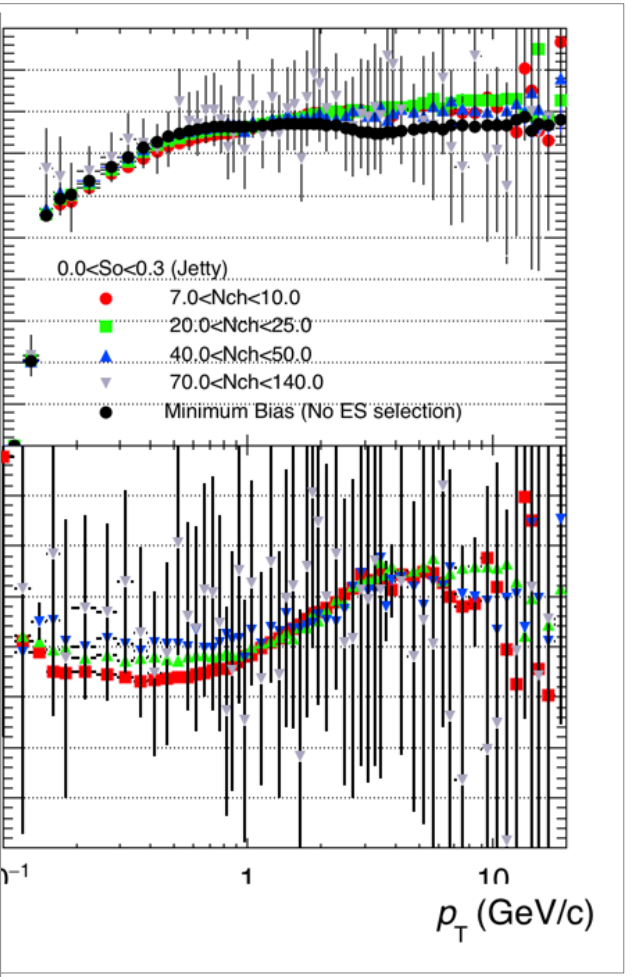


For three different SPHEROCITY binnings for JETTY events

- BinA= {0.0,0.1,0.4,0.9,1.0};
- BinB= {0.0,0.2,0.4,0.8,1.0};
- BinC= {0.0,0.3,0.4,0.7,1.0};



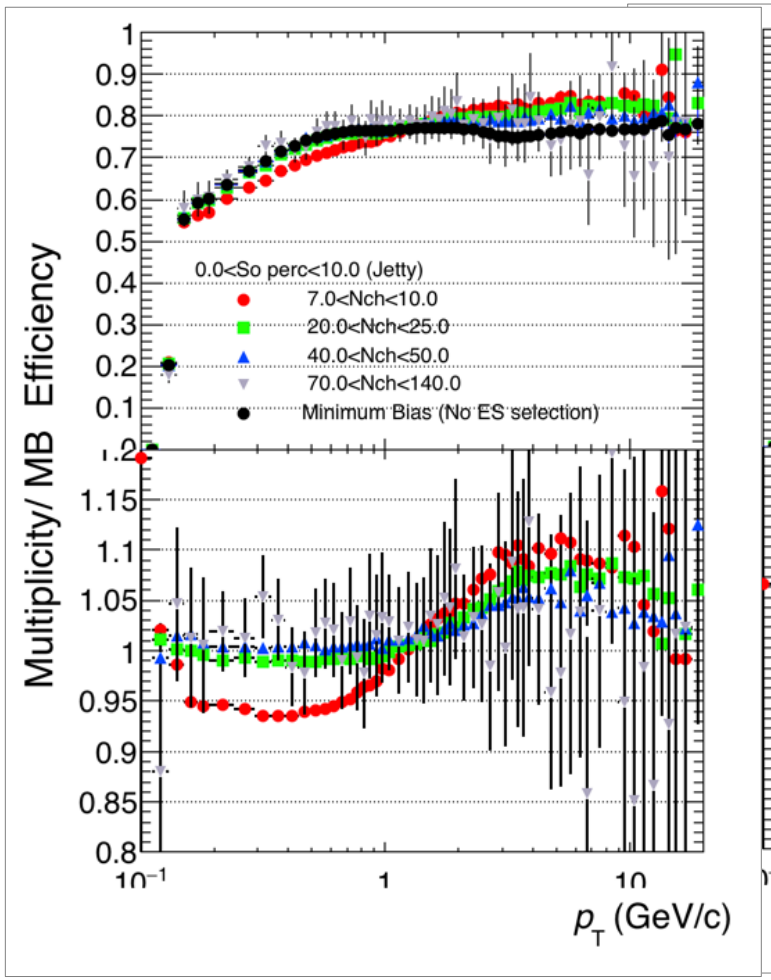


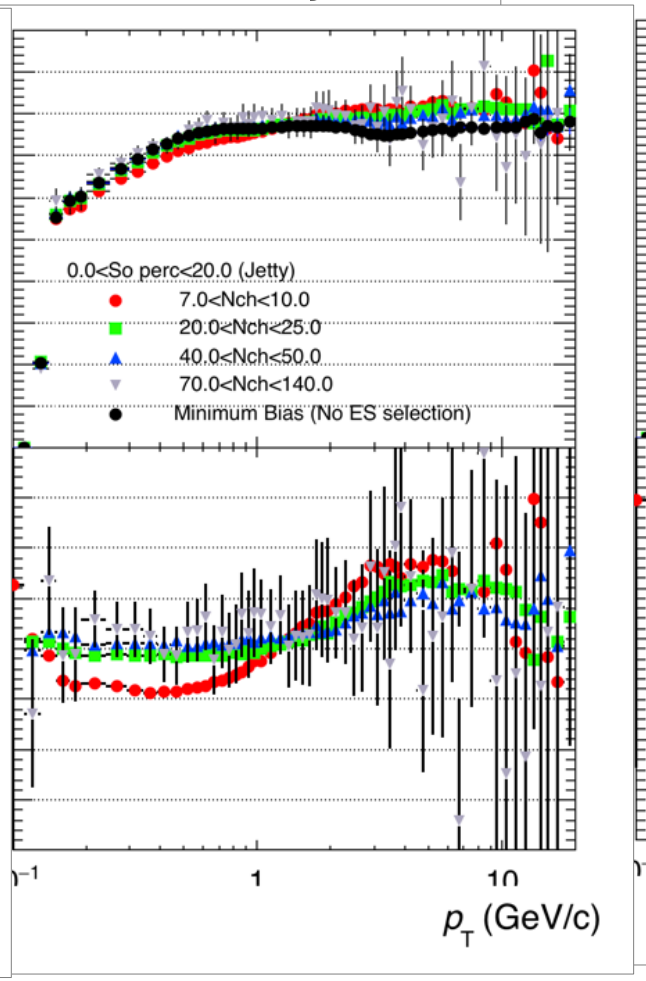


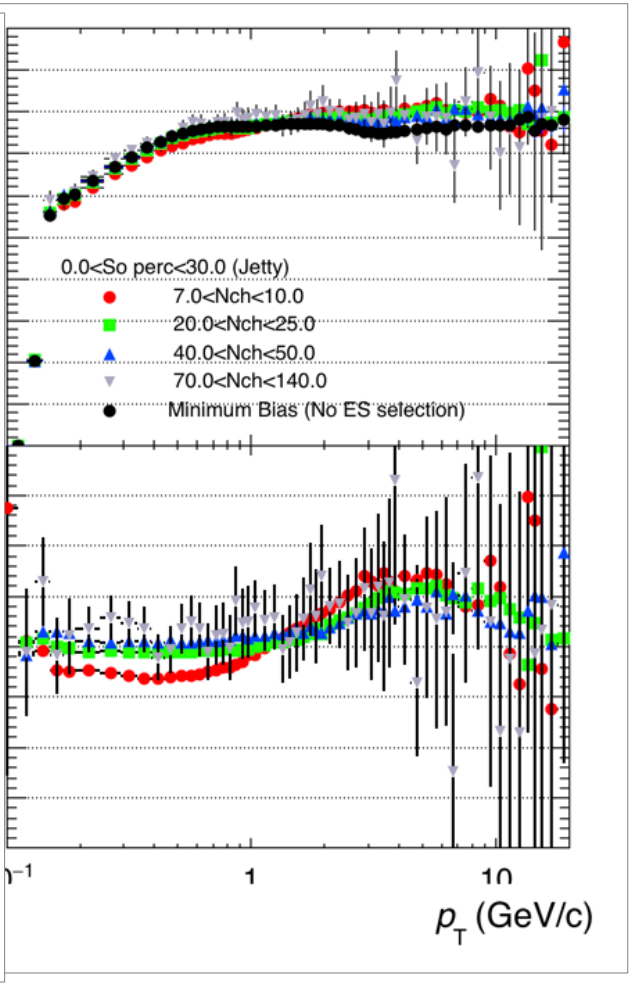
For three different SPHEROCITY percentiles for JETTY events

- BinApc= {0.0,10.0,40.0,90.0,100.0};
- BinBpc= {0.0,20.0,40.0,80.0,100.0};
- BinCpc= {0.0,30.0,40.0,70.0,100.0};

Better statistics for percentiles

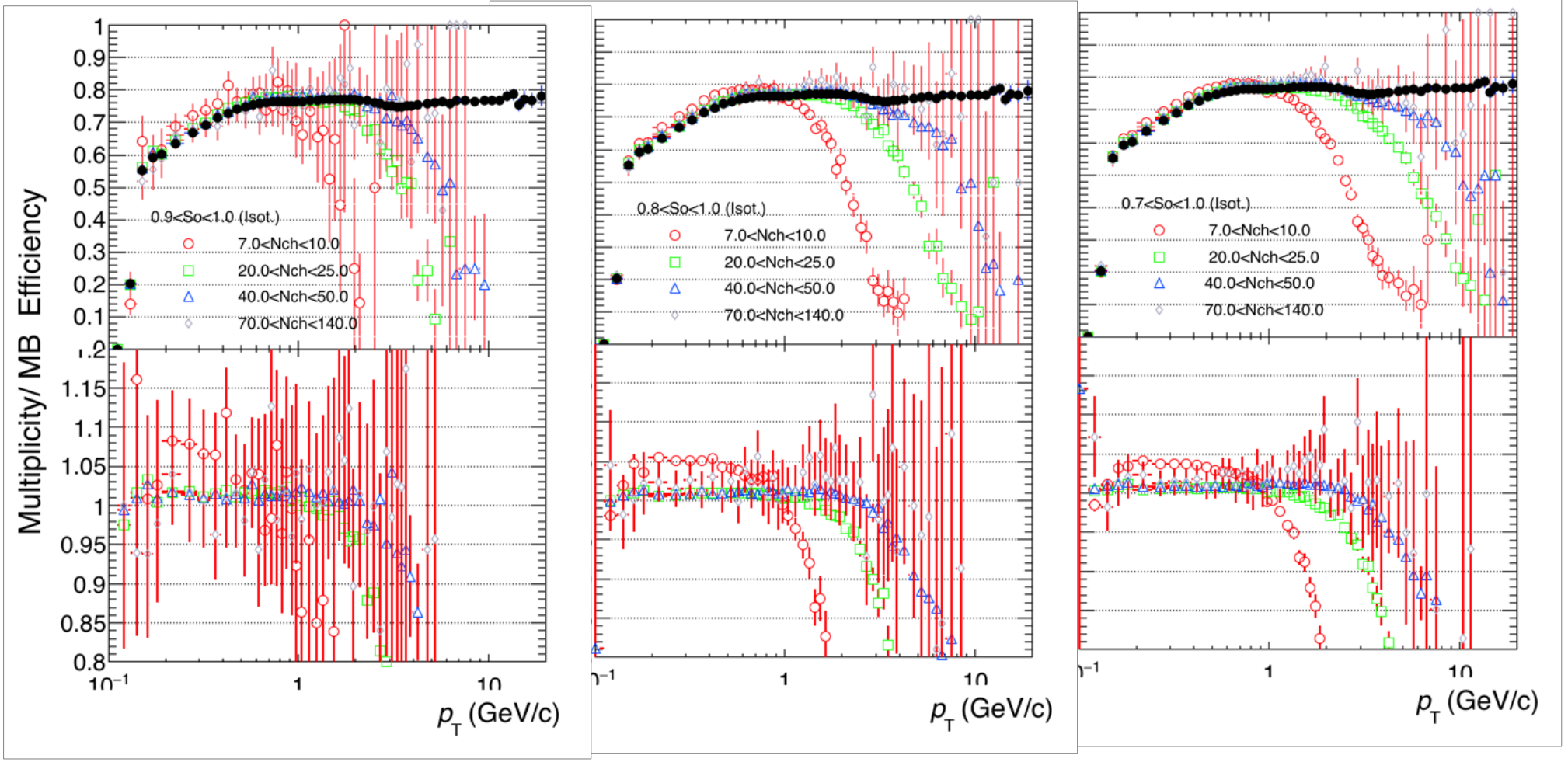






For three different SPHEROCITY binnings for ISOTROPIC events

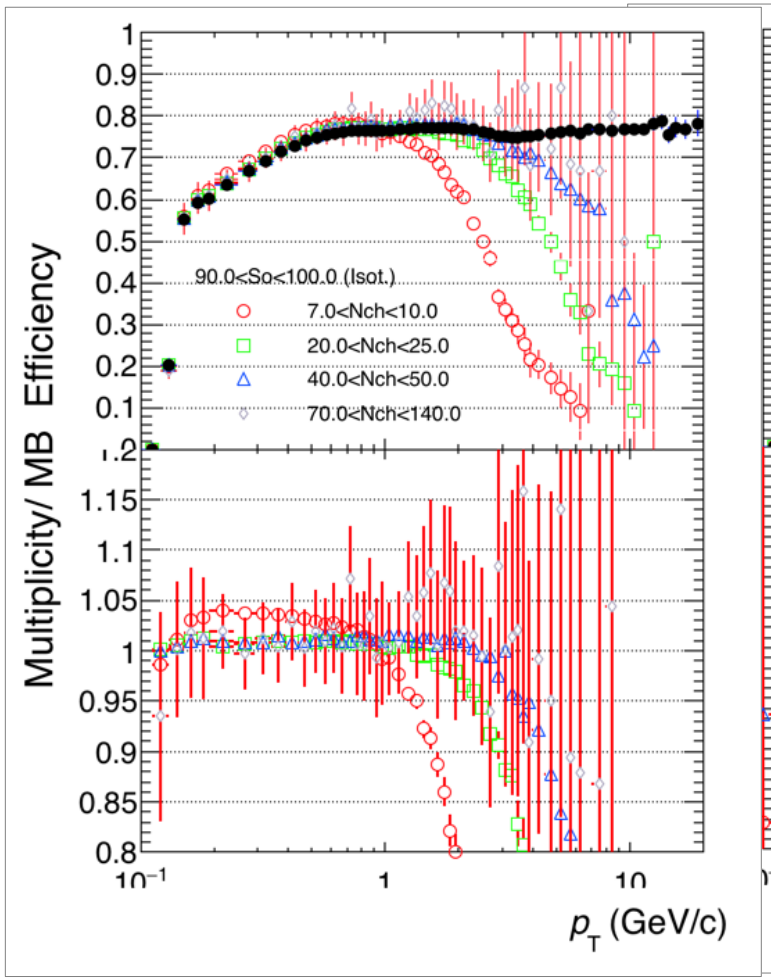
- BinA= {0.0,0.1,0.4,0.9,1.0};
- BinB= {0.0,0.2,0.4,0.8,1.0};
- BinC= {0.0,0.3,0.4,0.7,1.0};

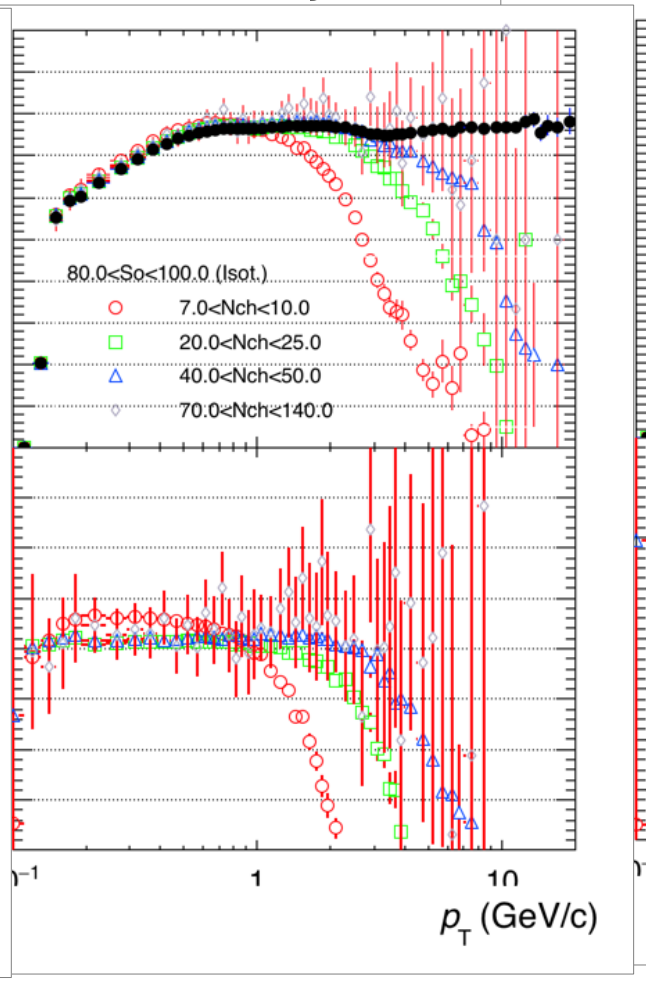


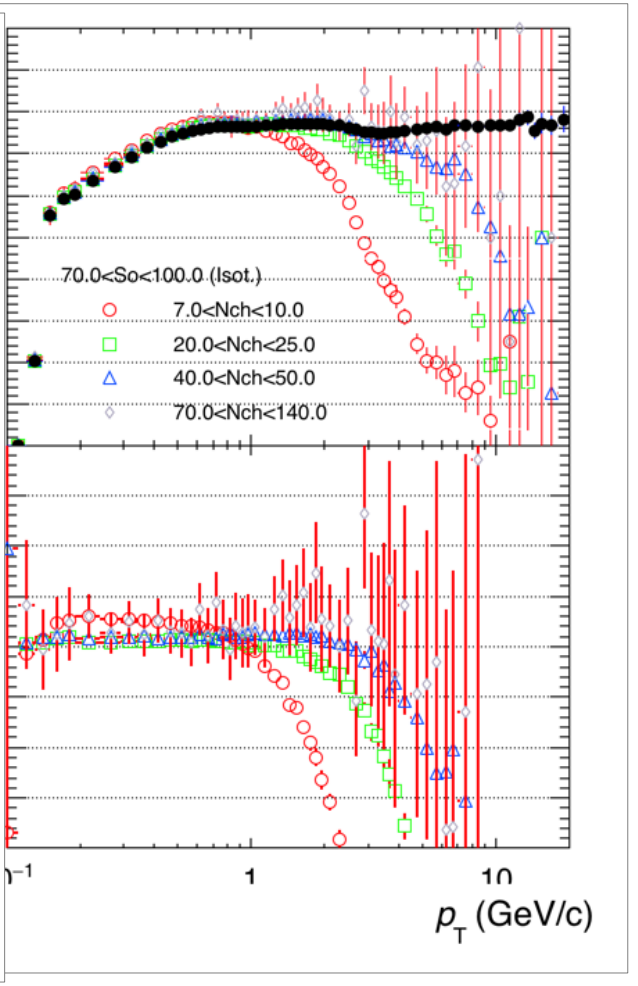
For three different SPHEROCITY percentiles for ISOTROPIC events

- BinApc= {0.0,10.0,40.0,90.0,100.0};
- BinBpc= {0.0,20.0,40.0,80.0,100.0};
- BinCpc= {0.0,30.0,40.0,70.0,100.0};

Better statistics for percentiles

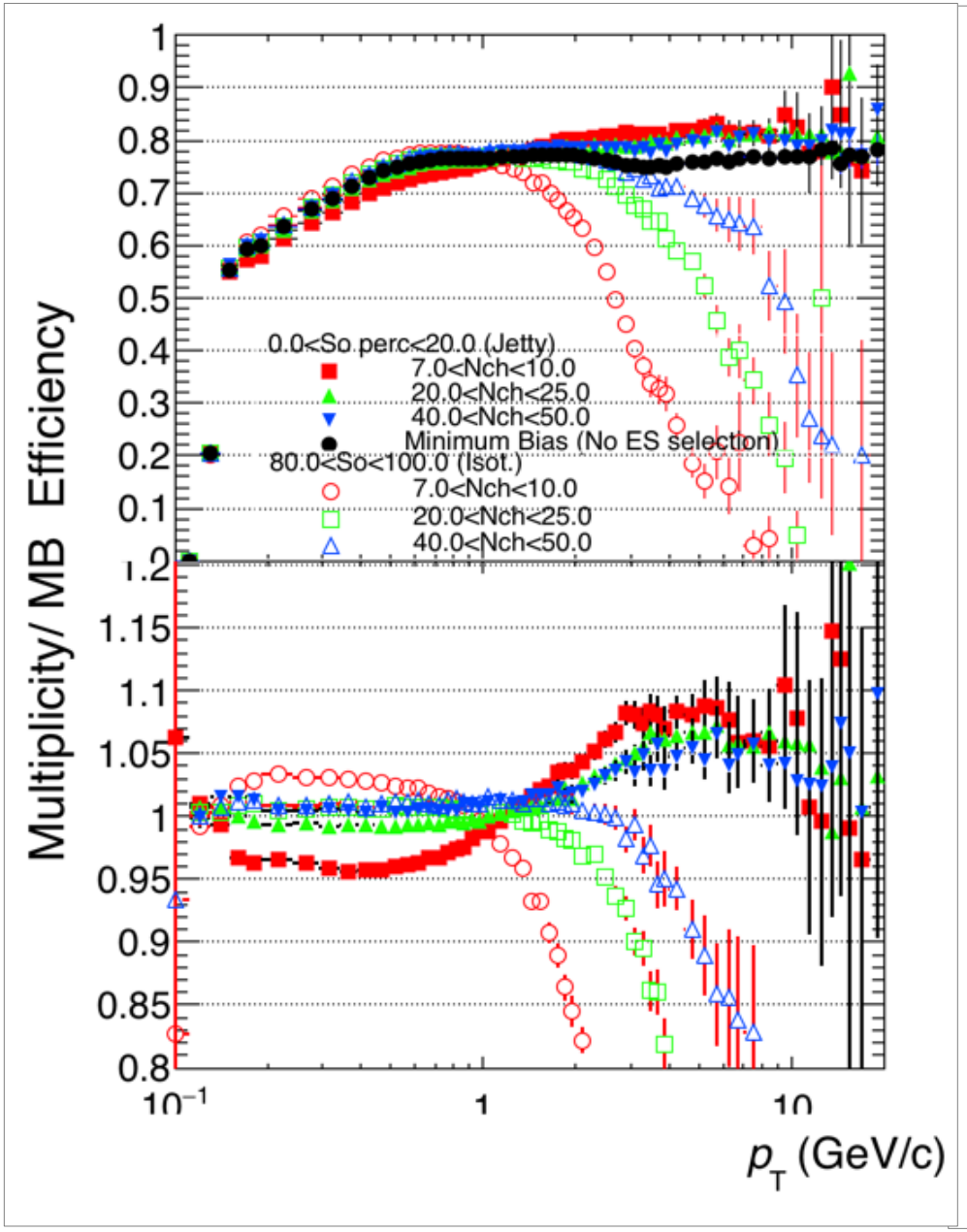




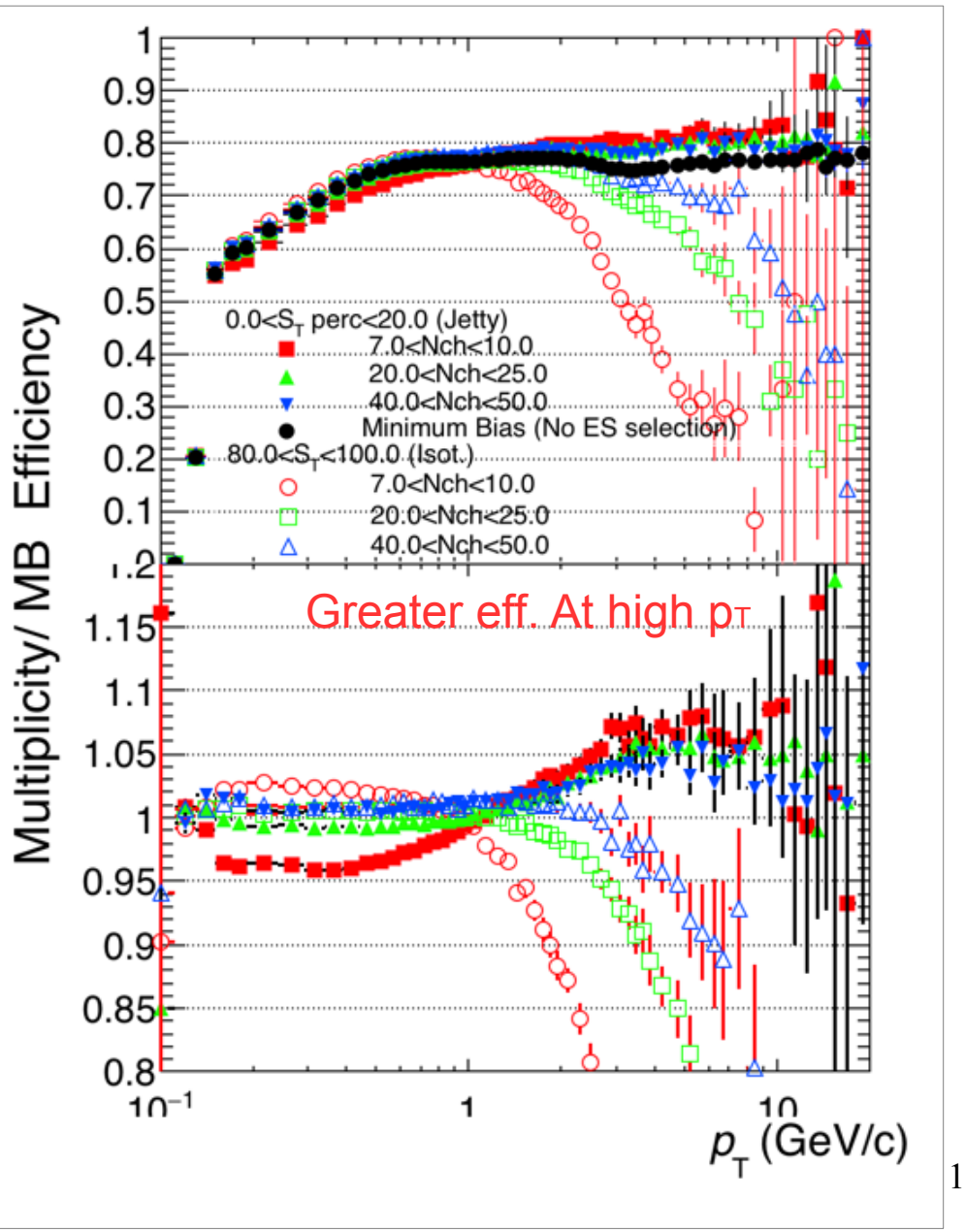


Comparison for percentile bins with best statistics.

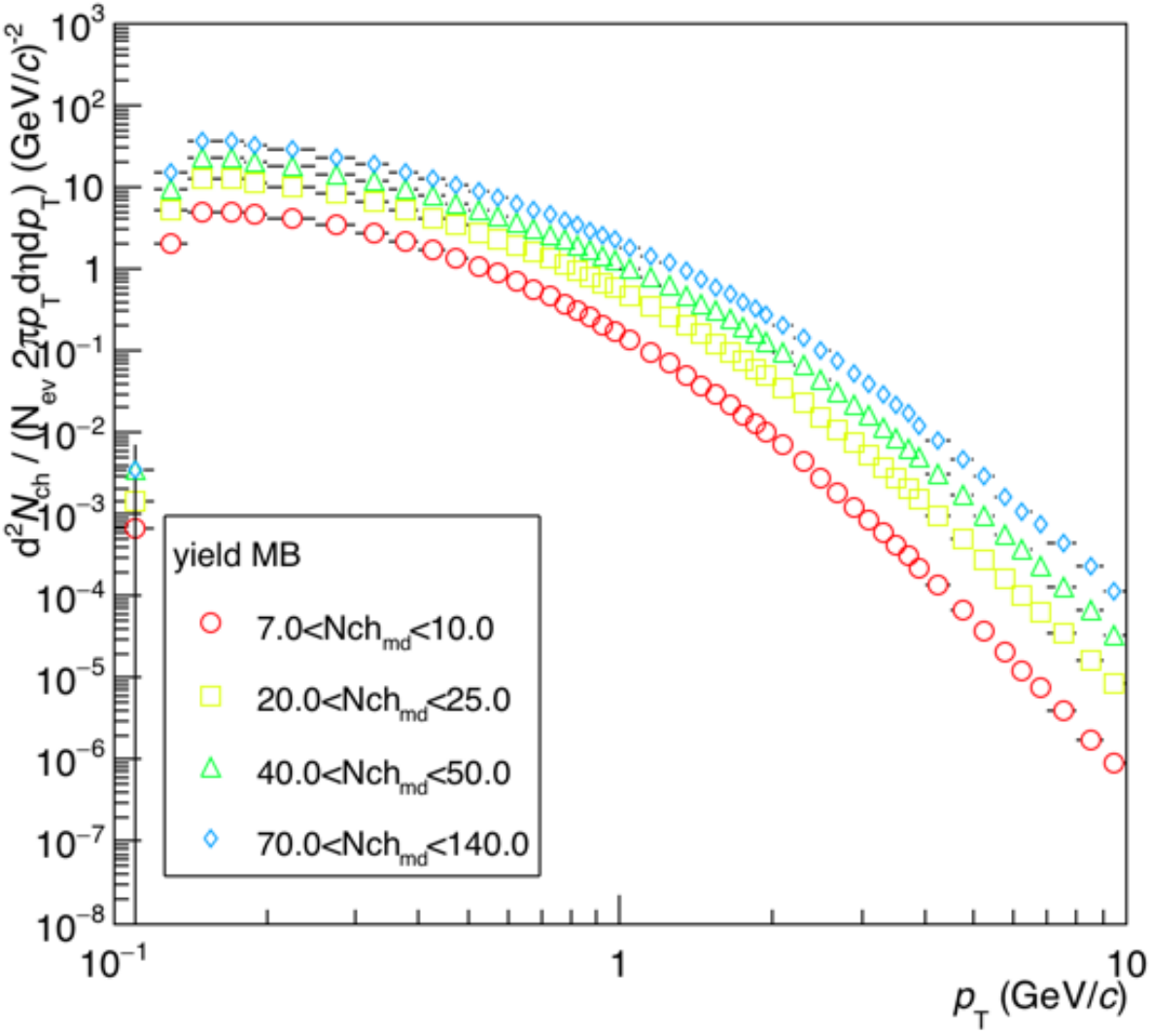
SPHEROCITY



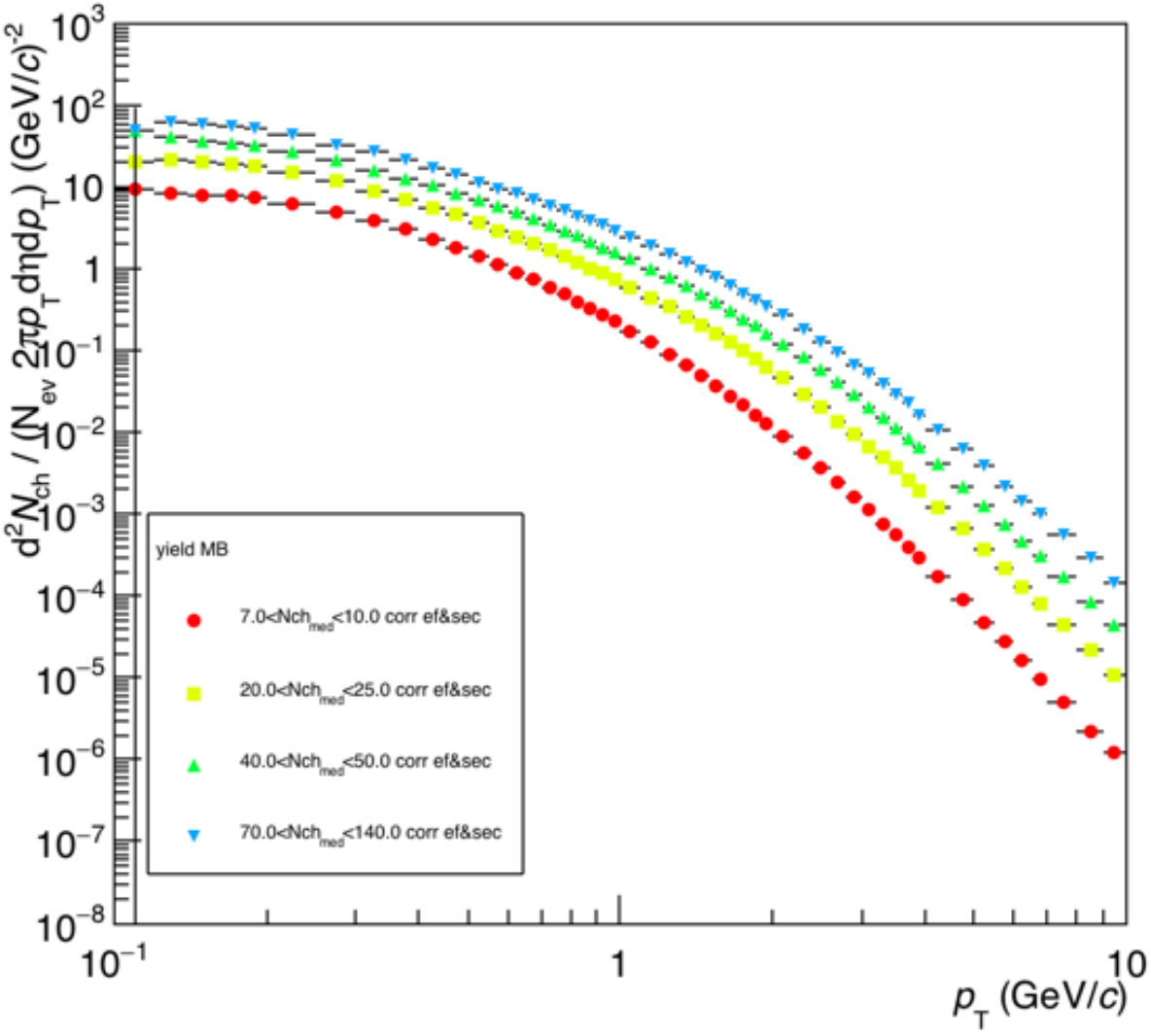
SPHERICITY



The spectra for the charge particles (MC ESD) for MB.

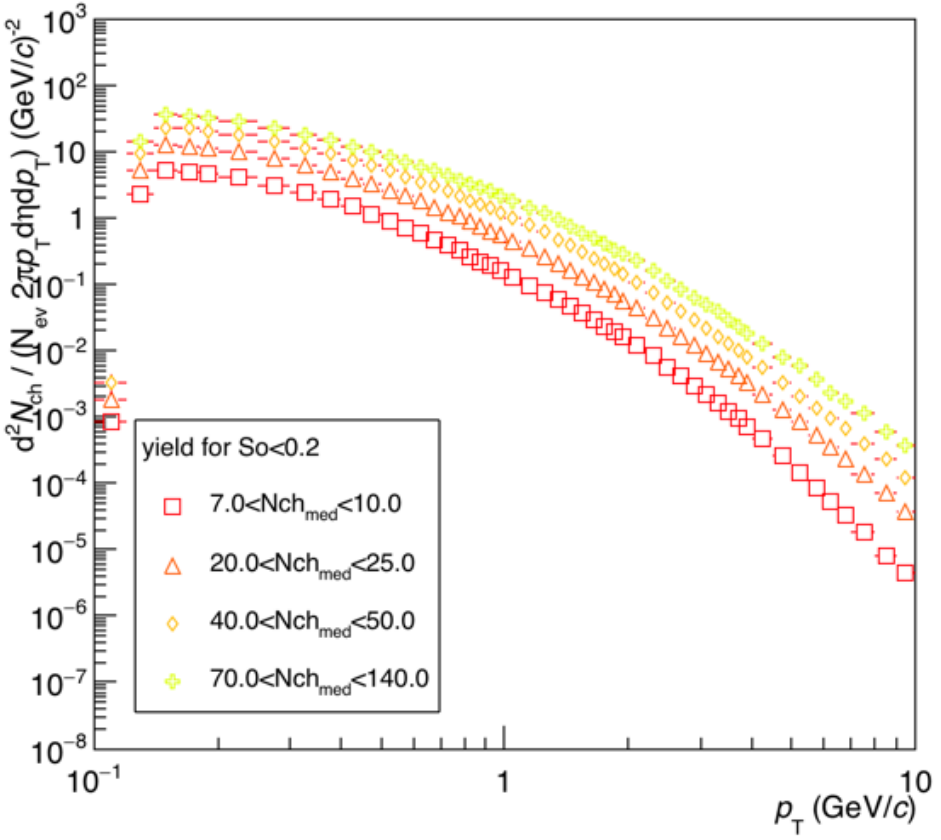


The spectra for the charge particles corrected by efficiency and secondaries for MB.

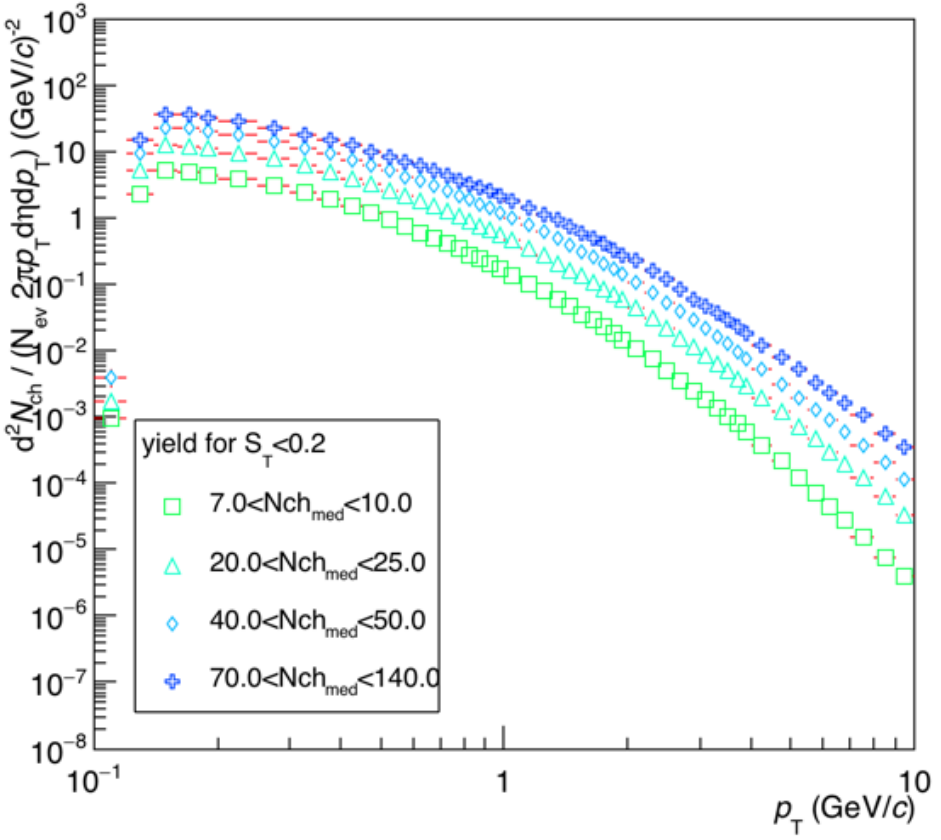


The spectra for jetty charge particles (MC ESD).

- Selected with SPHEROCITY

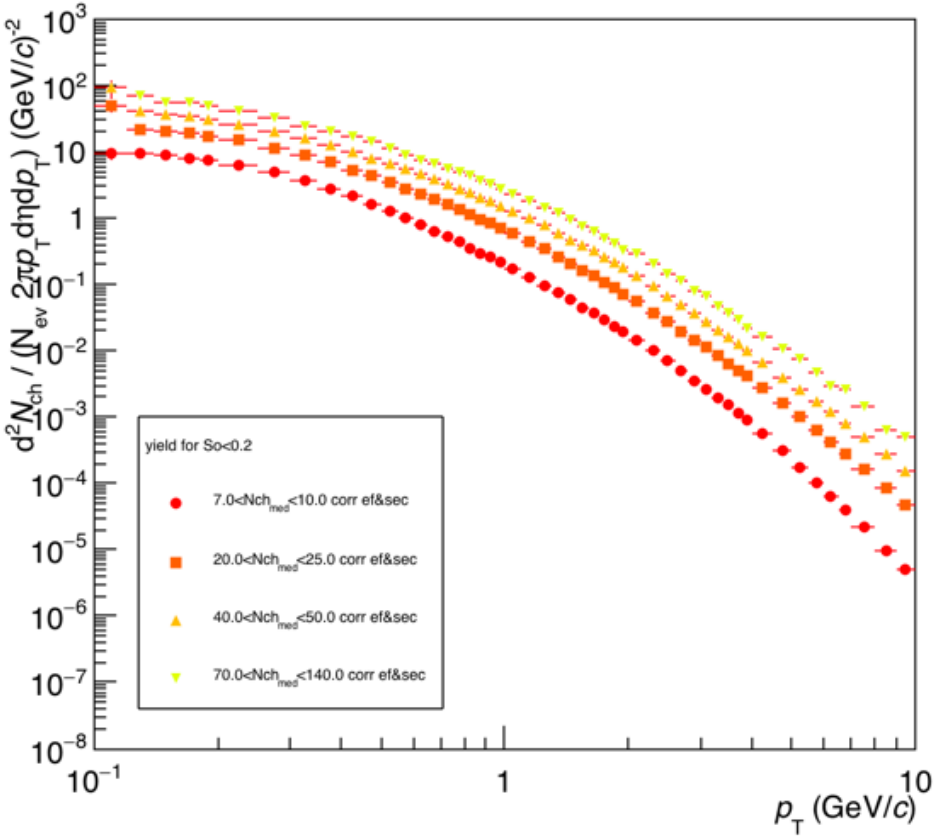


Selected with SPHERICITY

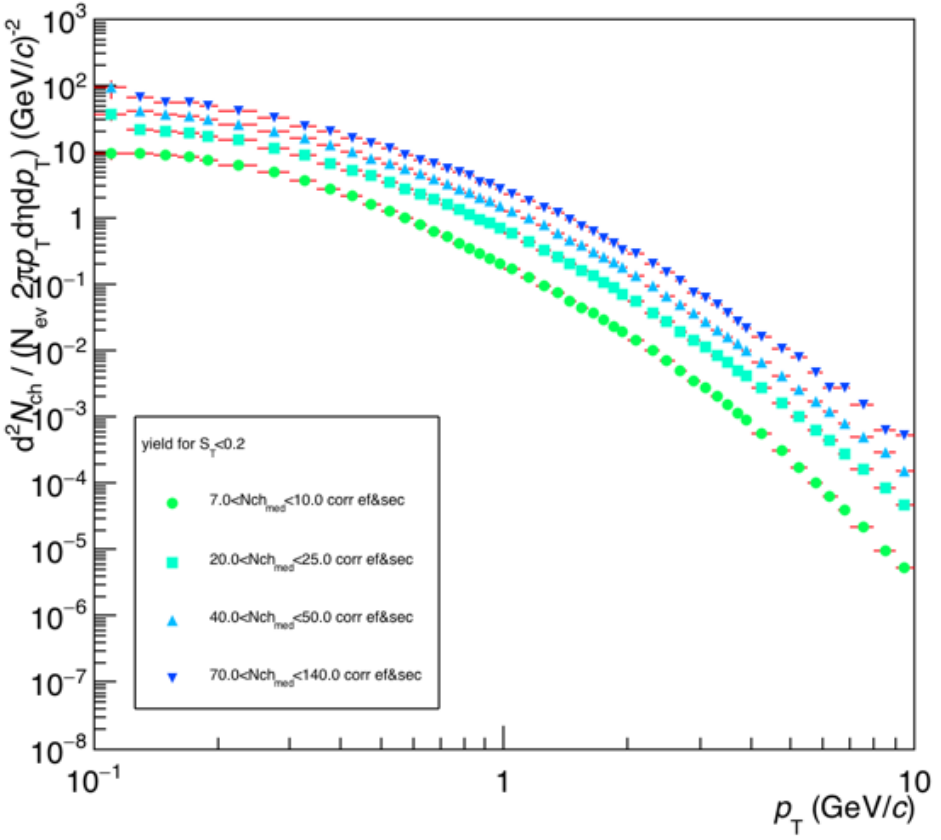


The spectra for jetty charge particles corrected by secondaries and efficiency (jetty efficiency).

- Selected with SPHEROCITY

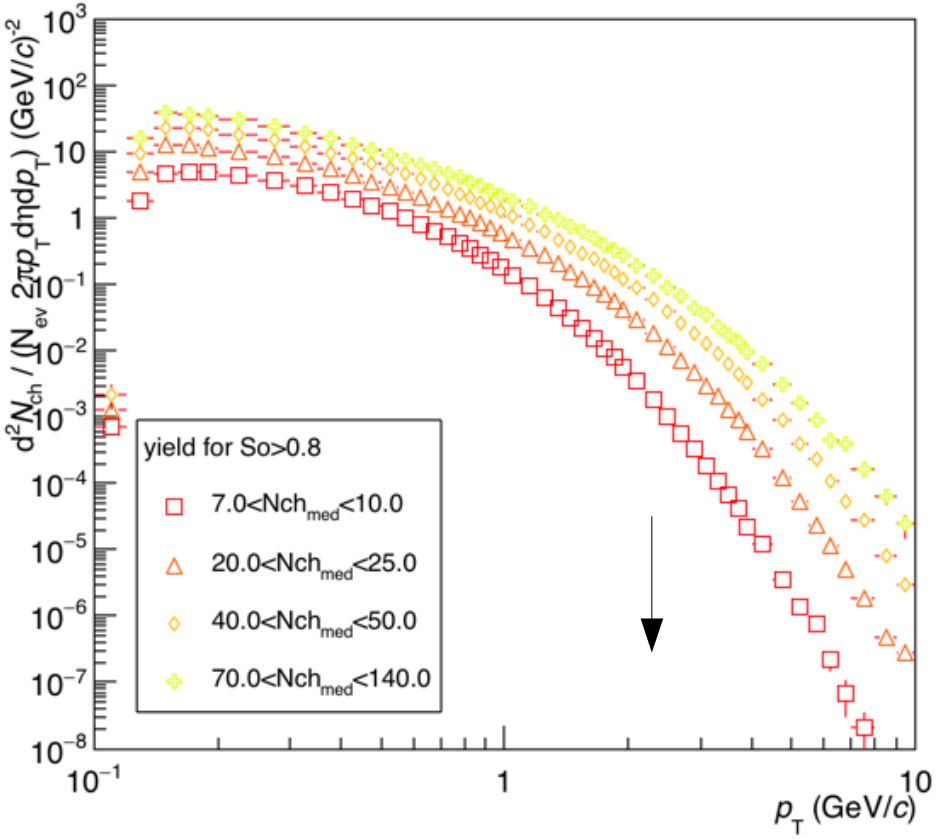


Selected with SPHERICITY

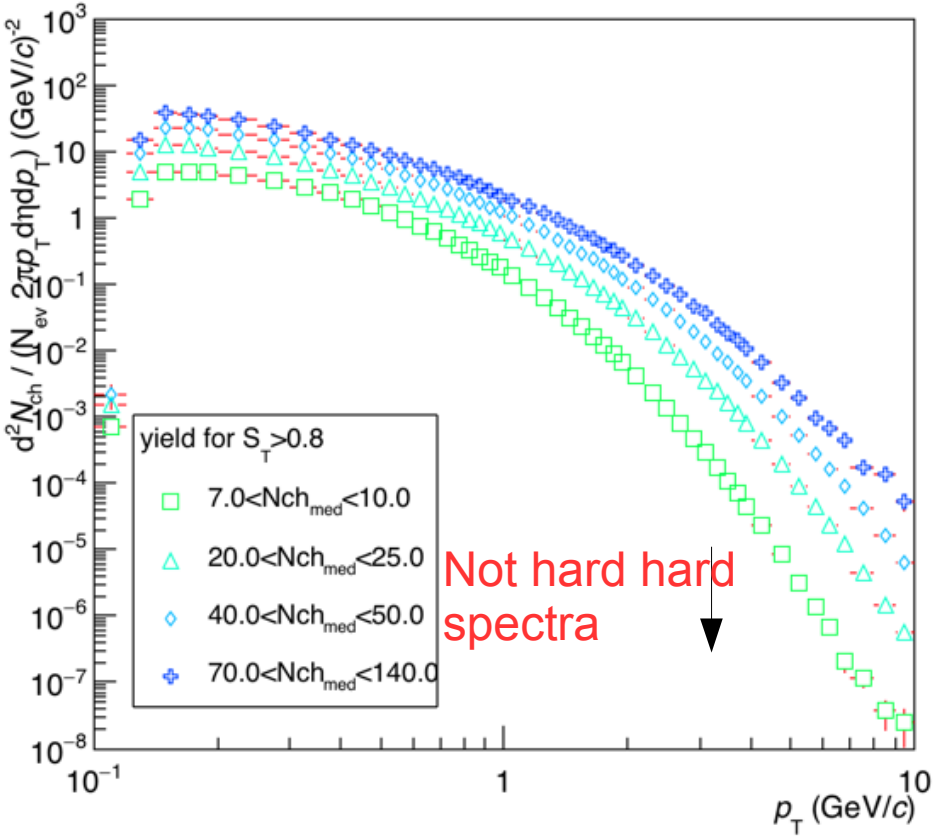


The spectra for isotropic charge particles (MC ESD)

- Selected with SPHEROCITY

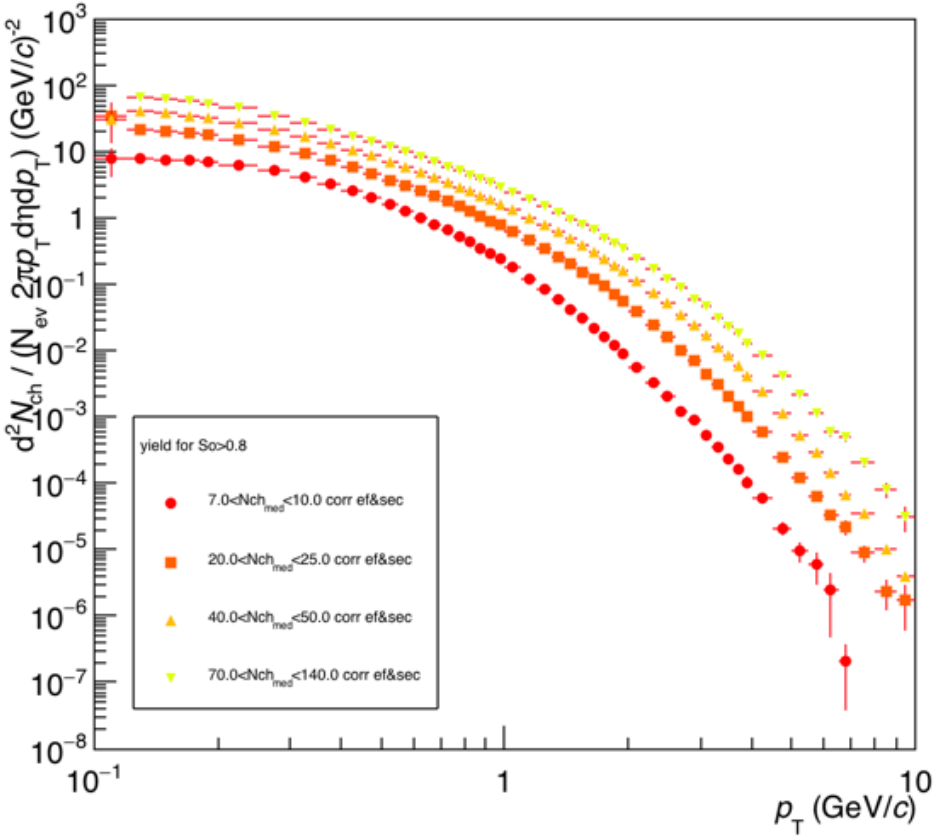


Selected with SPHERICITY

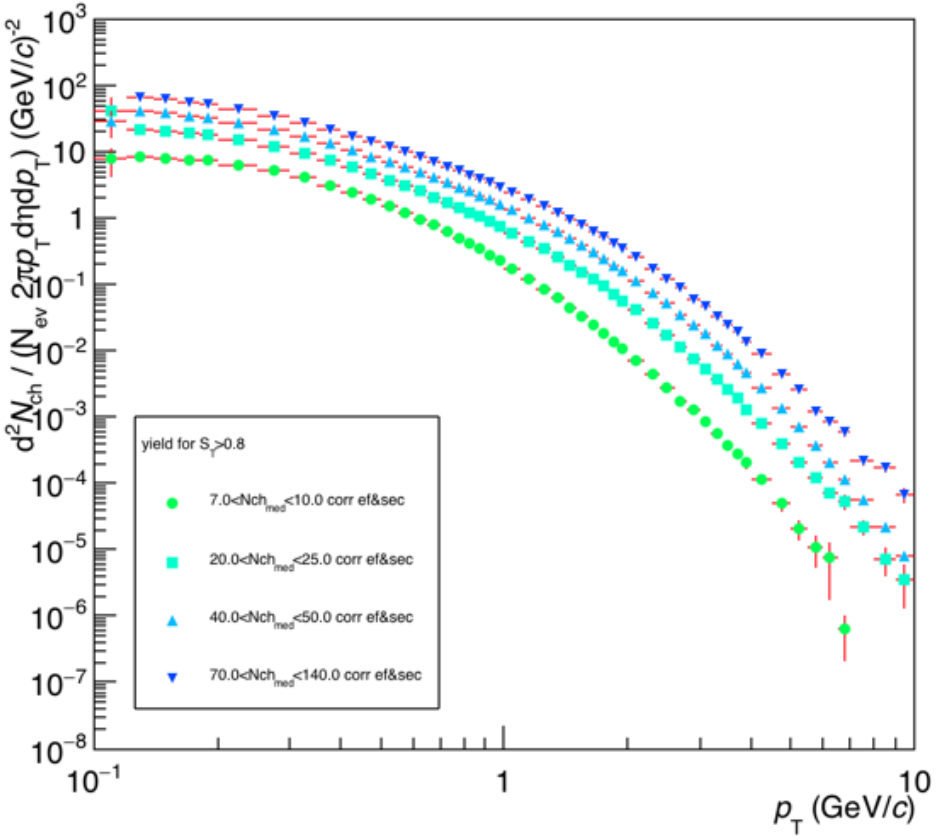


The spectra for isotropic charge particles corrected by secondaries and efficiency (for isotropic cut applied to low dN/deta<25).

- Selected with SPHEROCITY



Selected with SPHERICITY



Conclusions

- Spherocity is a tool for selecting different event shape, we are introducing this analysis at ALICE

  --Some technical considerations are needed:

- TPC+TPCrefit are the selected track cuts.
- Efficiency for jetty events is better than for isotropic ones.
- Jetty events efficiency different than MB sample, but no mult dependence.
- For Isotropic and dN/deta >31 and pt<3 GeVs there' s no multiplicity dependence.
- selecting in percentage is less noisy by statistics.

Conclusions

To do:

- First cross-PWG (LF-CF-HF) meeting to discuss the use of sphero(i)city in data: 28/10/2016 (16:00 hrs GVA)

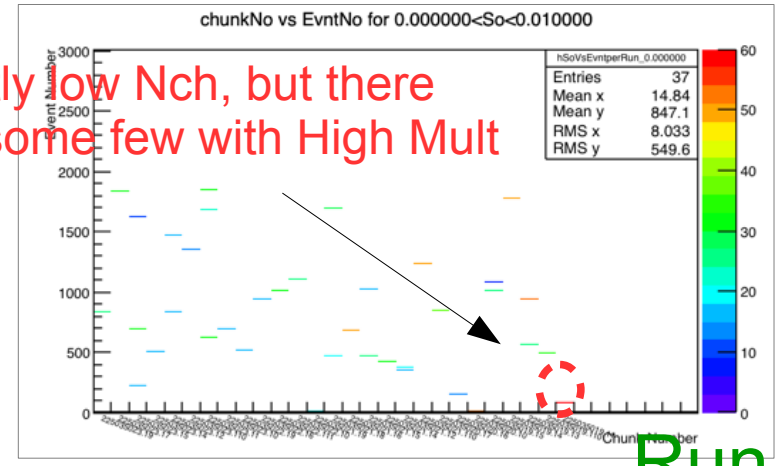
  Aim: Physics of this observable, set the track cuts, show first results
- Get results with LHC15f pass2 data.
- Continue with the analysis.

Thank you!

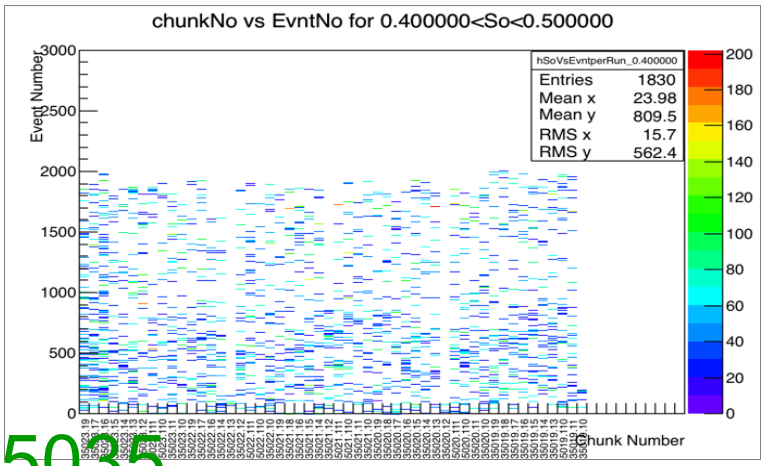
Thank you!.
To organizers and participants

Spherocity as a tool for searching dijets and isotropic events with high multiplicity.

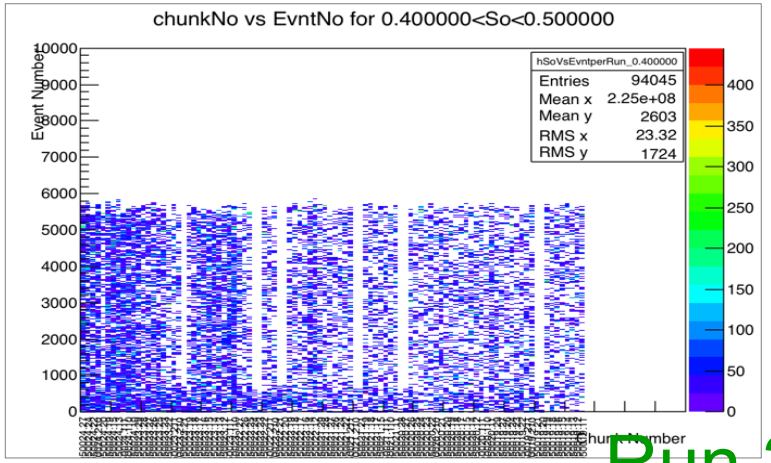
Using So we can find interesting events with specific shape and high multiplicity.

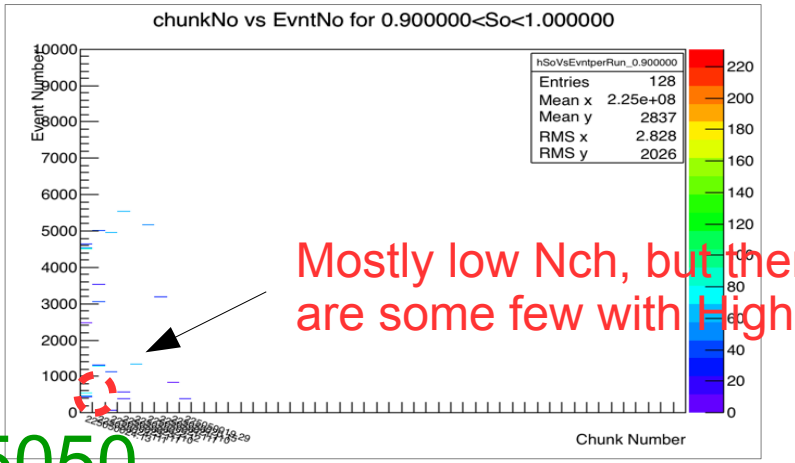


Mostly low Nch, but there are some few with High Mult



Run 225035



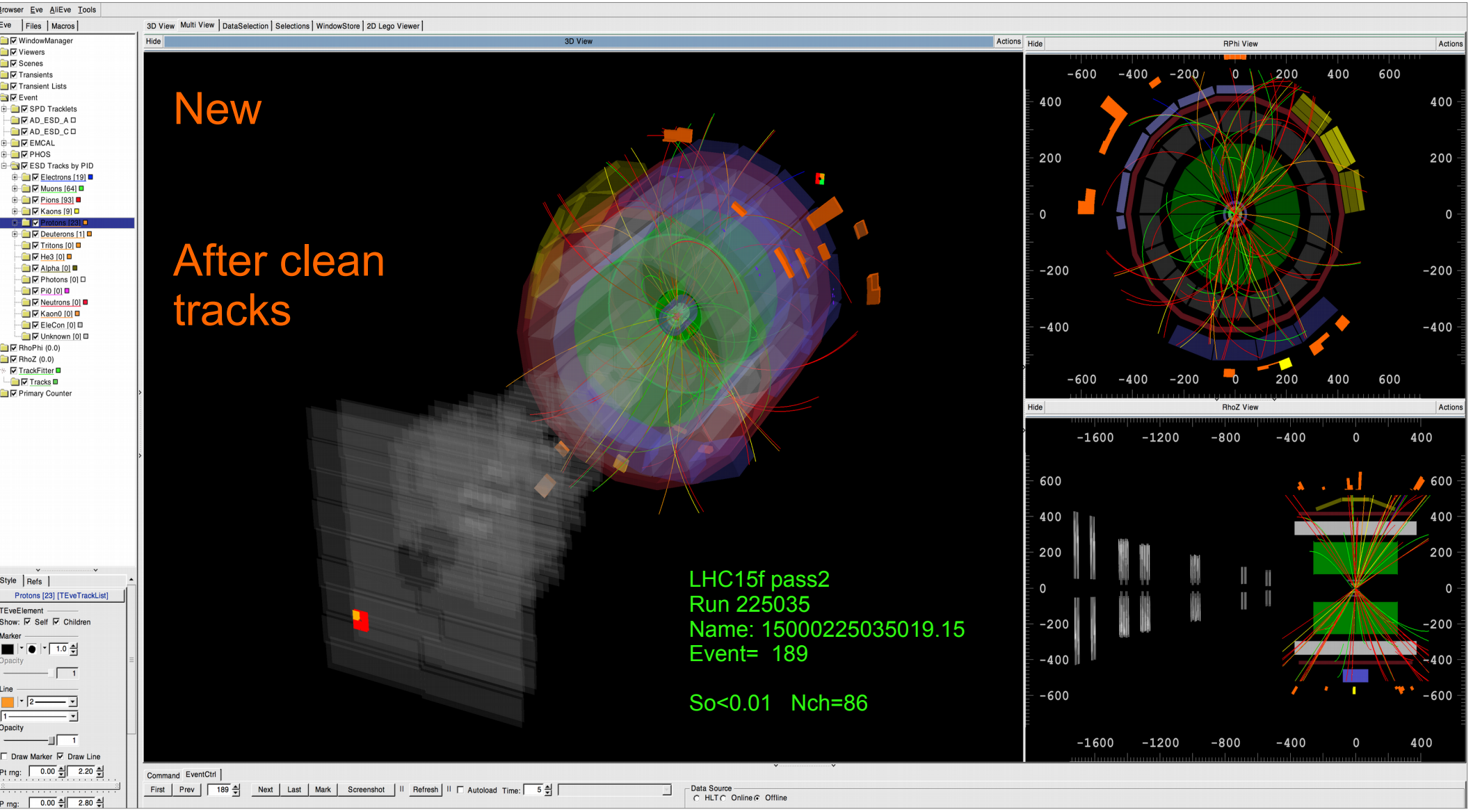


Mostly low Nch, but there are some few with High Mult

Run 225050

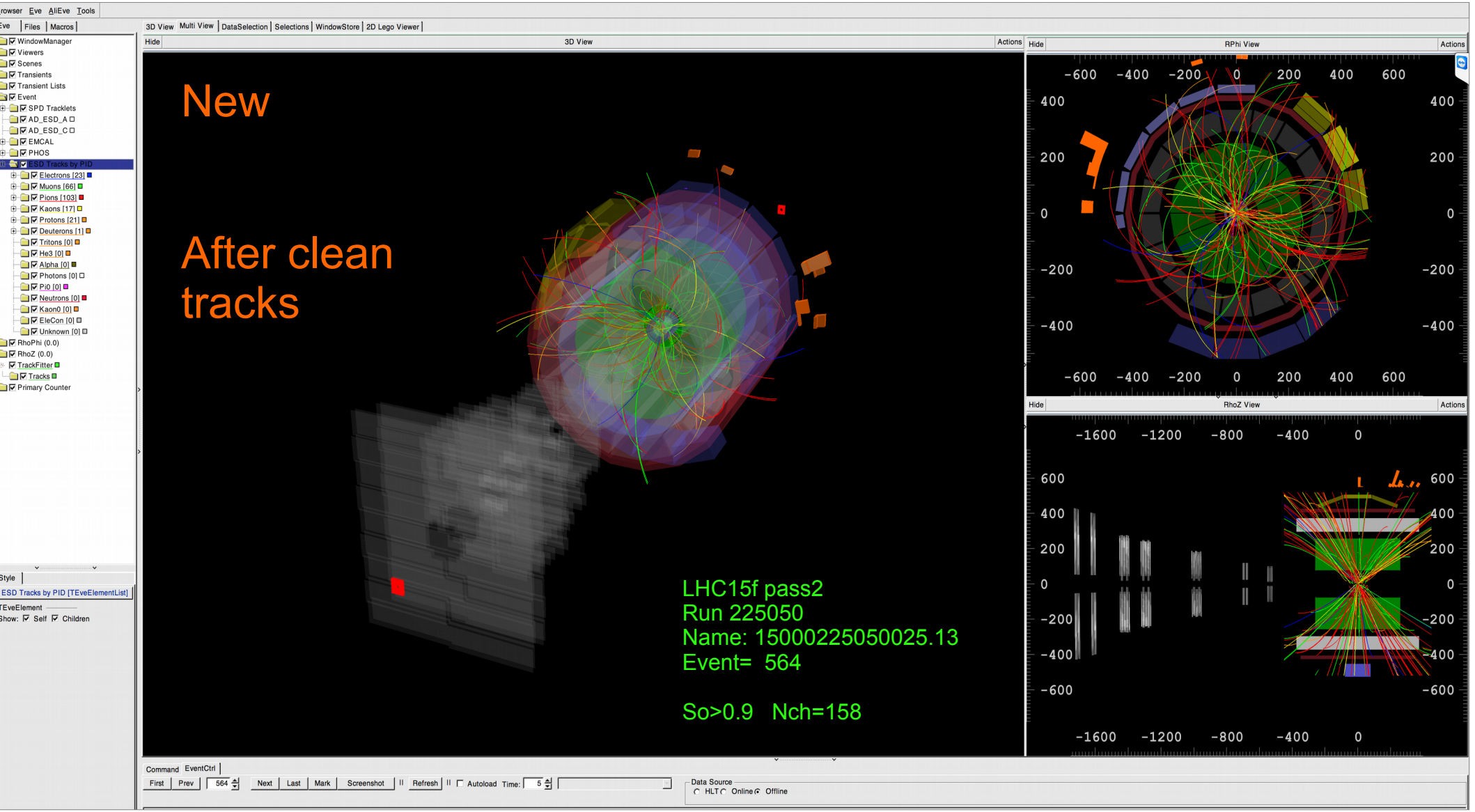
Visualization for events selected with Spherocity R 225035

JETTY EVENT So<0.01 (HM event)

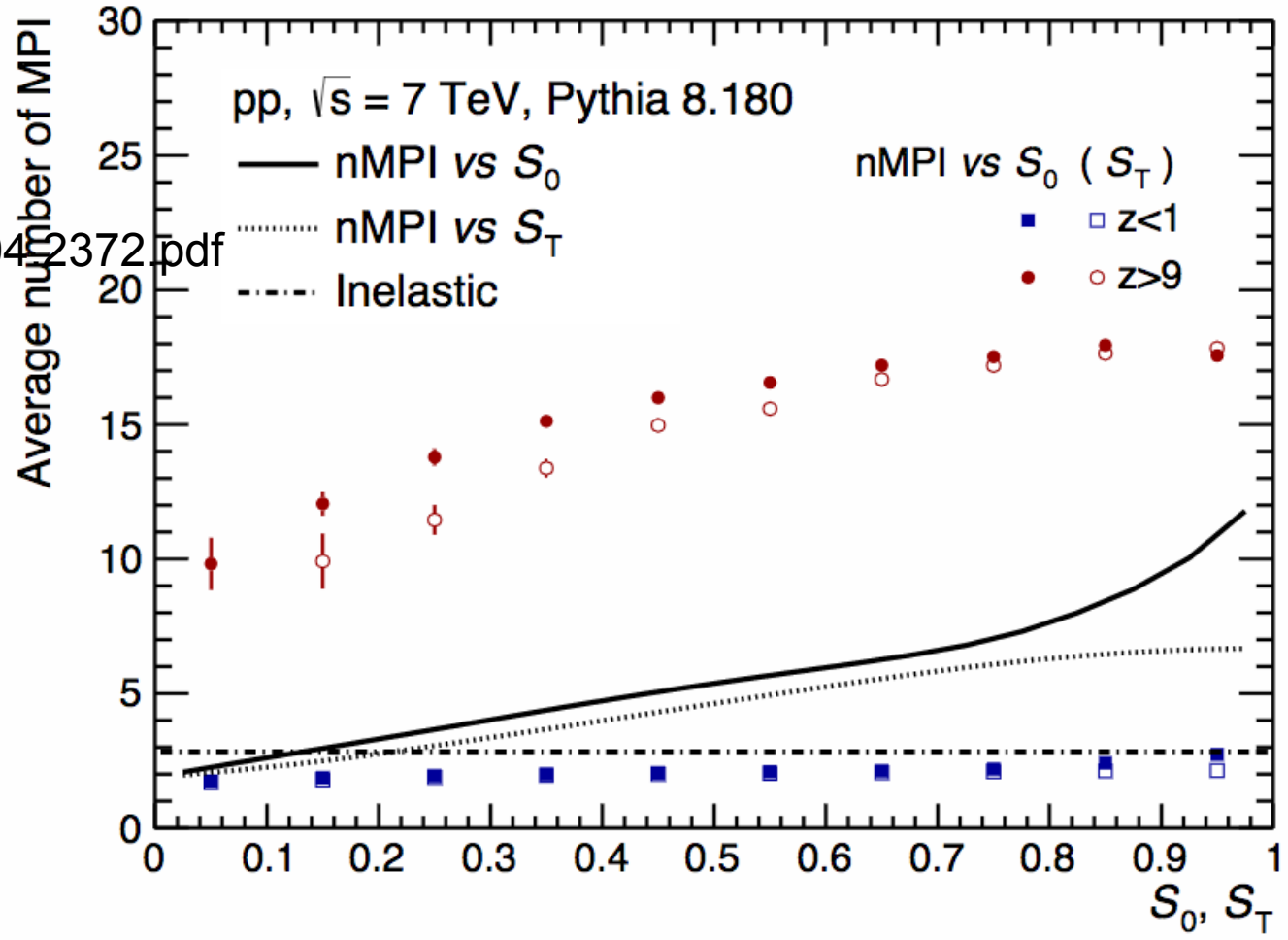


Visualization for events selected with Spherocity R 225050

ISOTROPIC So>0.9 (HM event)

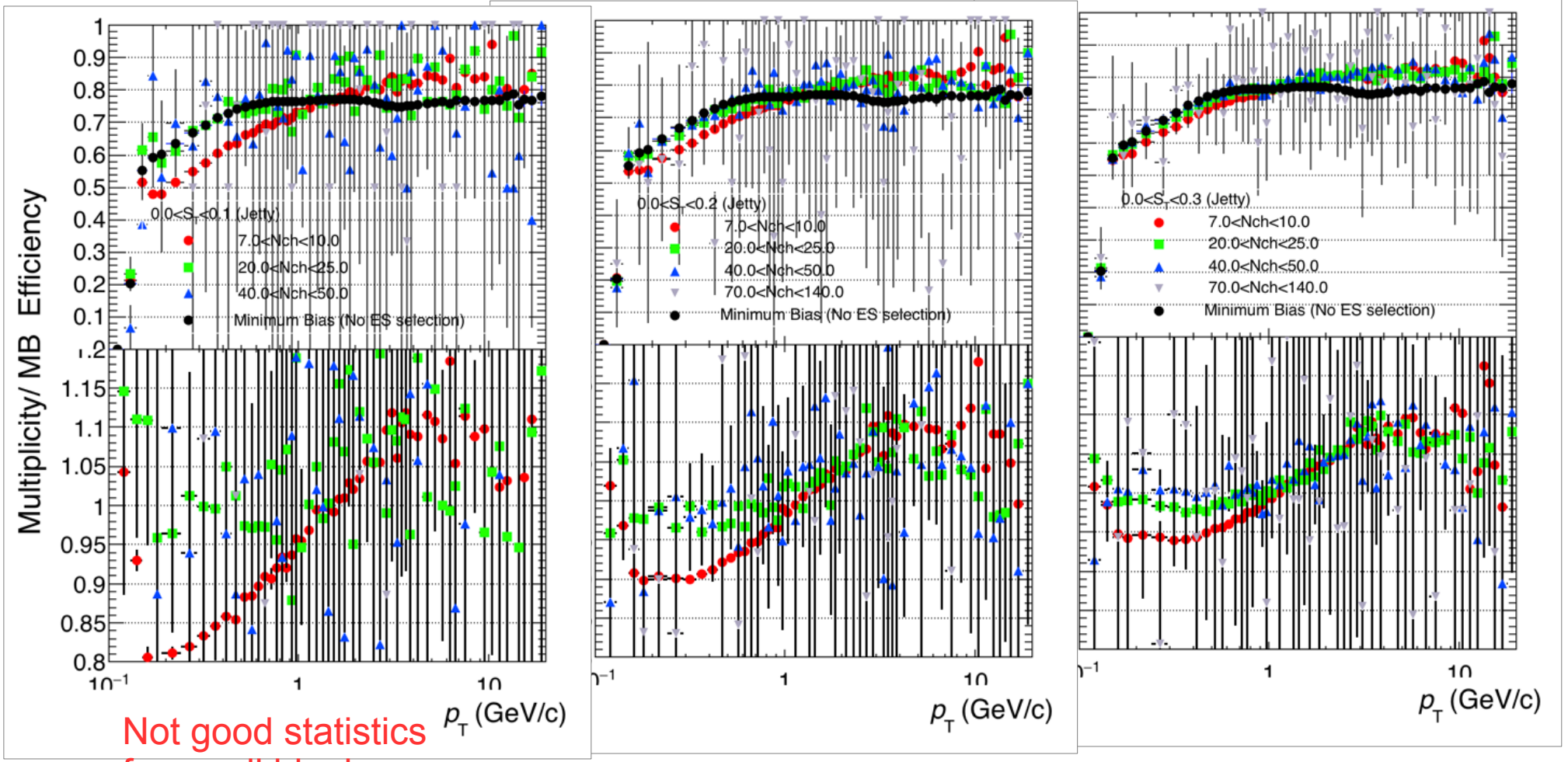


Eleazar et All
https://arxiv.org/pdf/1404.2372.pdf



For three different SPHERICITY binnings for JETTY events

- BinA= {0.0,0.1,0.4,0.9,1.0};
- BinB= {0.0,0.2,0.4,0.8,1.0};
- BinC= {0.0,0.3,0.4,0.7,1.0};

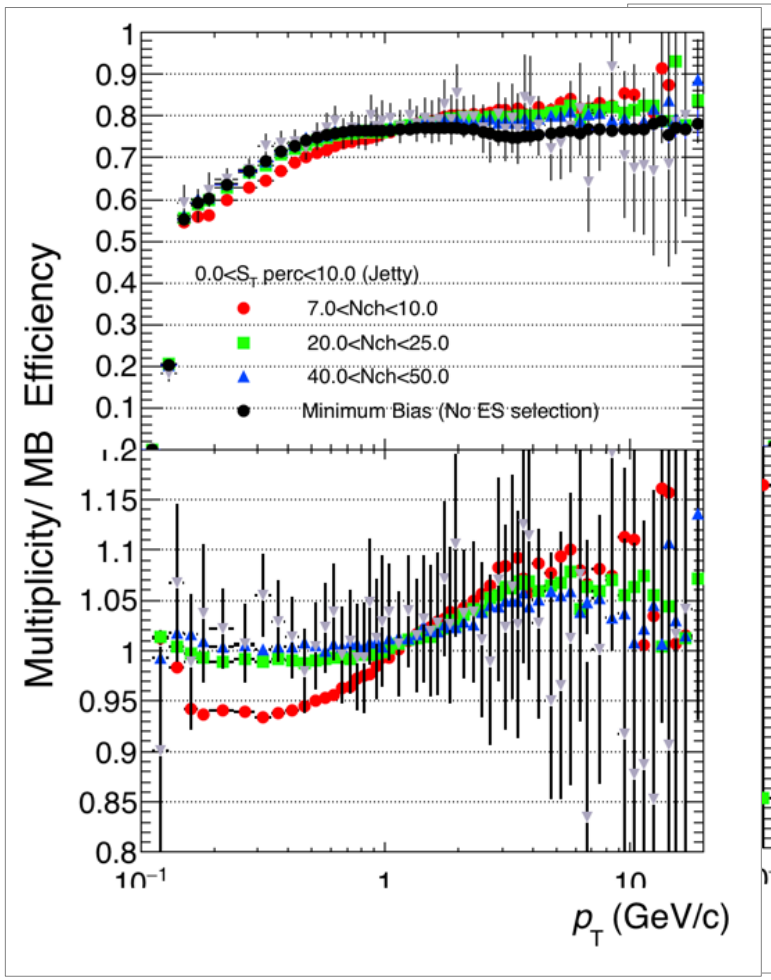


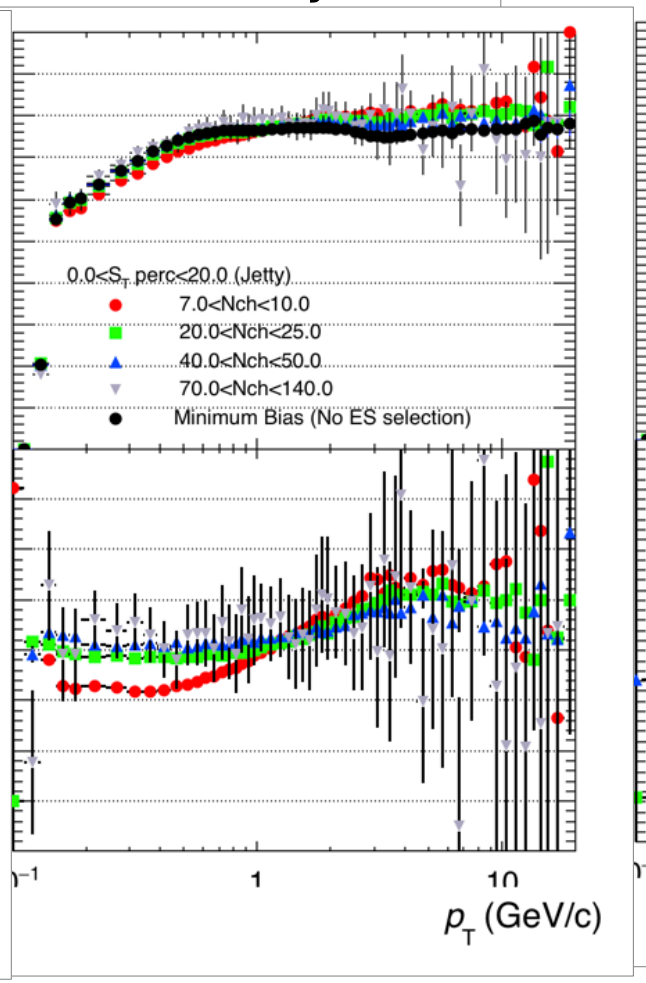
Not good statistics for small binning

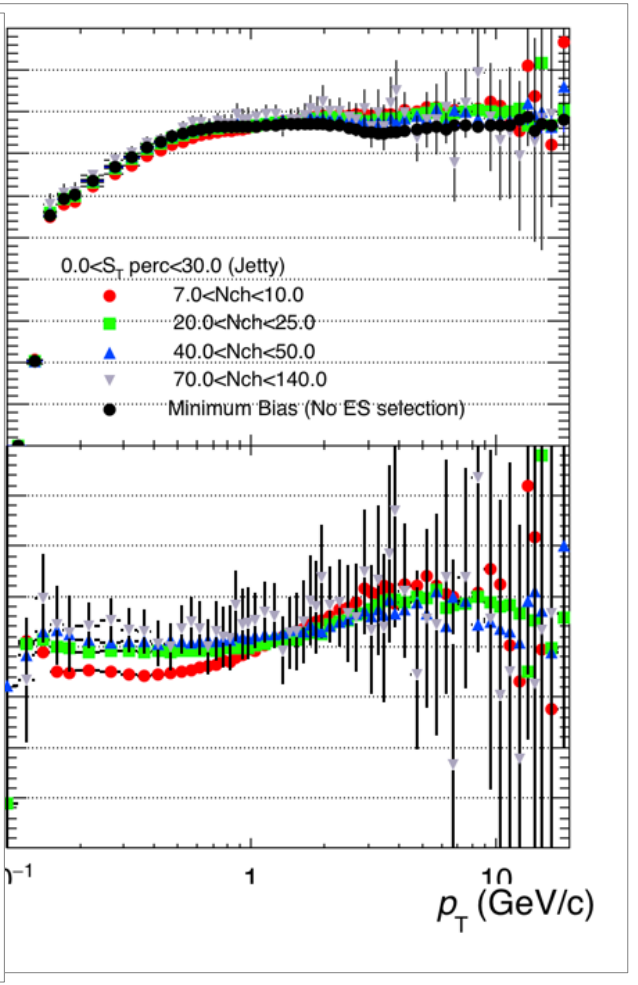
For three different SPHERICITY percentiles for JETTY events

- BinApc= {0.0,10.0,40.0,90.0,100.0};
- BinBpc= {0.0,20.0,40.0,80.0,100.0};
- BinCpc= {0.0,30.0,40.0,70.0,100.0};

Better statistics for percentiles

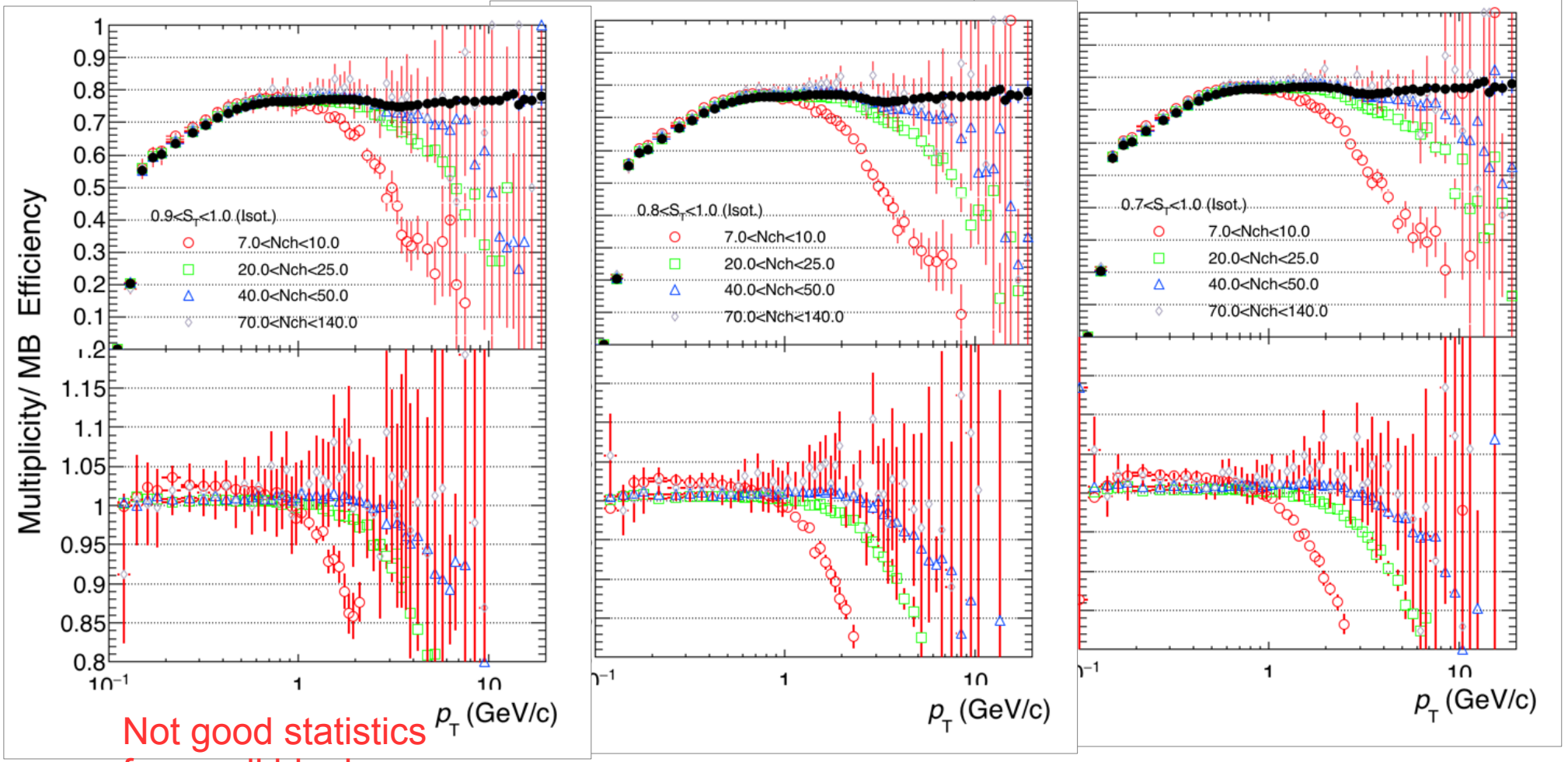






For three different SPHERICITY binnings for ISOTROPIC events

- BinA= {0.0,0.1,0.4,0.9,1.0};
- BinB= {0.0,0.2,0.4,0.8,1.0};
- BinC= {0.0,0.3,0.4,0.7,1.0};



Not good statistics for small binning

For three different SPHERICITY percentiles for ISOTROPIC events

- BinApc= {0.0,10.0,40.0,90.0,100.0};
- BinBpc= {0.0,20.0,40.0,80.0,100.0};
- BinCpc= {0.0,30.0,40.0,70.0,100.0};

Better statistics for percentiles