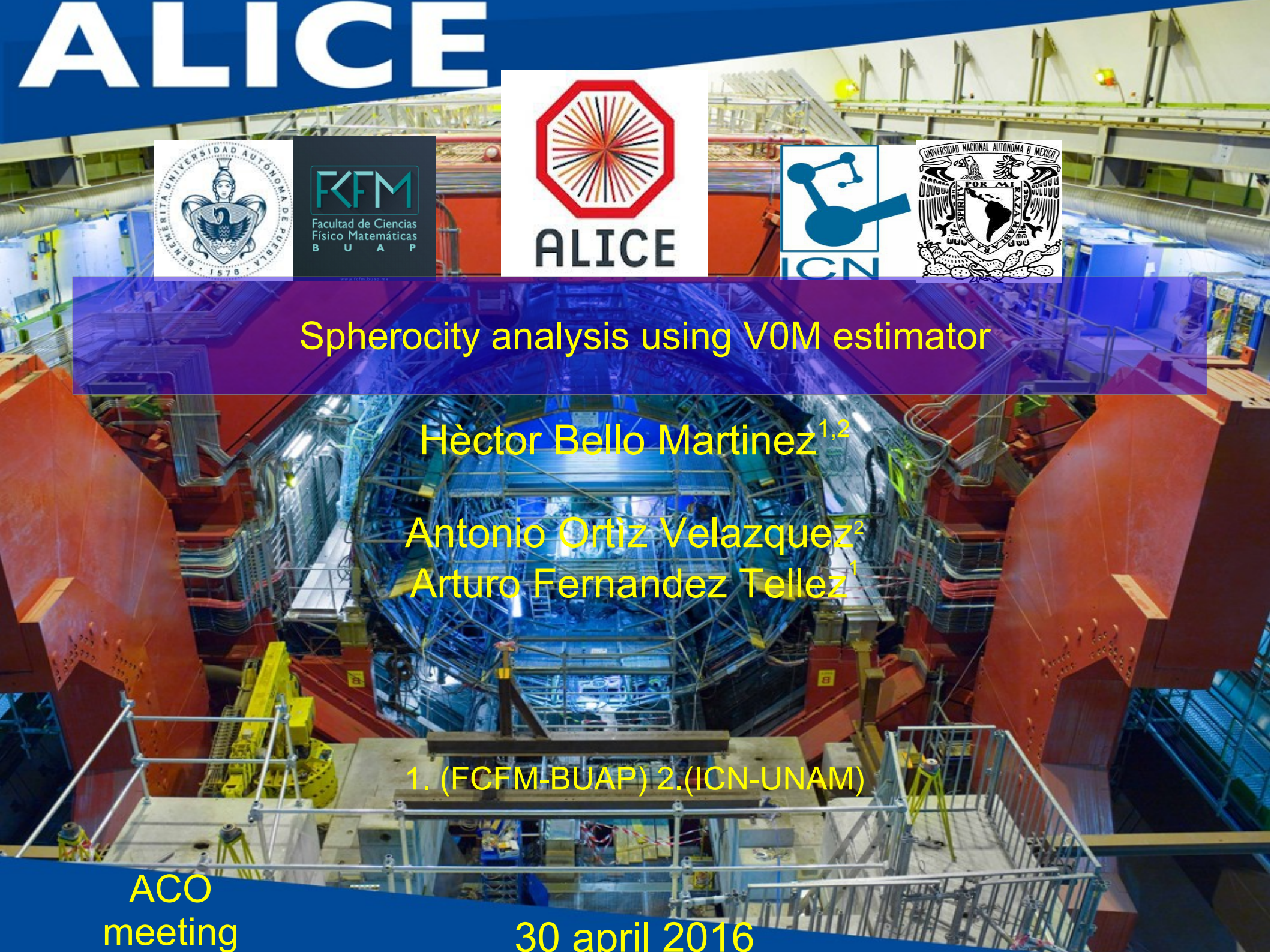

Spherocity analysis using V0M estimator

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Antonio Ortiz Velazquez[2]

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1. (FCFM-BUAP) 2.(ICN-UNAM)

ACO meeting

30 april 2016

Outline

I`ll show:

- Results in data LHC15f:
  --Mean transverse momentum for Spherocity bins with V0M and reference estimator
  --Spectra for V0M and reference
  --Ratio V0M to REF for spectra for different So bins
- Results in ESD MC LHC15g3a3 (Monash)
  --Some behaviour with the mean values for V0M

- Conclusions.

Analysis and run selection

Software: Aliroot:`v5-07-20` Aliphysics:`vAN-20160204`
Event shape classes: (PWGLF/SPECTRA/Spherocity)
Analysis macros: `AddTransverseEventShapeTask.C`
`AliAnaTransverseEventShapeTask.cxx`
`AliAnaTransverseEventShapeTask.h`

LHC15f pass2: (55 mill of evts) (after all ev selection)
LHC15g3a3 Monash Tune (52 mill of evts) (after all ev selection)
good runs*:
226500, 226495, 226483, 226476, 226472, 226468, 226466,
226452, 226445, 226444, 226225, 226220, 226170, 226062,
225768, 225766, 225763, 225762, 225757, 225753, 225719,
225717, 225716, 225710, 225709, 225708, 225707, 225705,
225587, 225586, 225579, 225578, 225576, 225322, 225315,
225314, 225313, 225310, 225309, 225307, 225305, 225106,
225052, 225051, 225050, 225043, 225041, 225037, 225035,
225031, 225026

(*) http://twiki.cern.ch/twiki/bin/viewauth/ALICE/PWGLF13TeVanalysis

Event, track and physics selection

Event Selection

Trigger: KINT7 (*Thanks to Gyula*)
Rejection of AliESDEvent::IsIncompleteDAQ
Vertex selection
SPD Pile-up rejection
Background rejection
Multivertex Pile-up rejection
low diagonal cut OFO &V0M applied
No PF protection should be applied for LHC15f **
https://twiki.cern.ch/twiki/bin/view/ALICE/PWGPPEvSelRun2pp
**https://twiki.cern.ch/twiki/bin/view/ALICE/AliceHMTFCodeSnippets#Physics_Selection

Physics Selection

- MinNCrossedRowsTPC = 120; *
- MinRatioCrossedRowsOverFindableClustersTPC=0.8;
- MaxFractionSharedTPCCluster = 0.4;
- Maxchi2perTPCcl=4.;
- Max dcaz ITSTPC=2.0;
- SetDCAToVertex2D(kFALSE);
- SetRequireSigmaToVertex(kFALSE);
- RequireTPCRefit(kTRUE);
- RequireITSRefit(kTRUE);
- AcceptKinkDaughters(kFALSE);
- MaxDCAToVertexXYPtDep("0.0182+0.0350/pt^1.01"); *
- SetMaxChi2TPCConstrainedGlobal(36.);

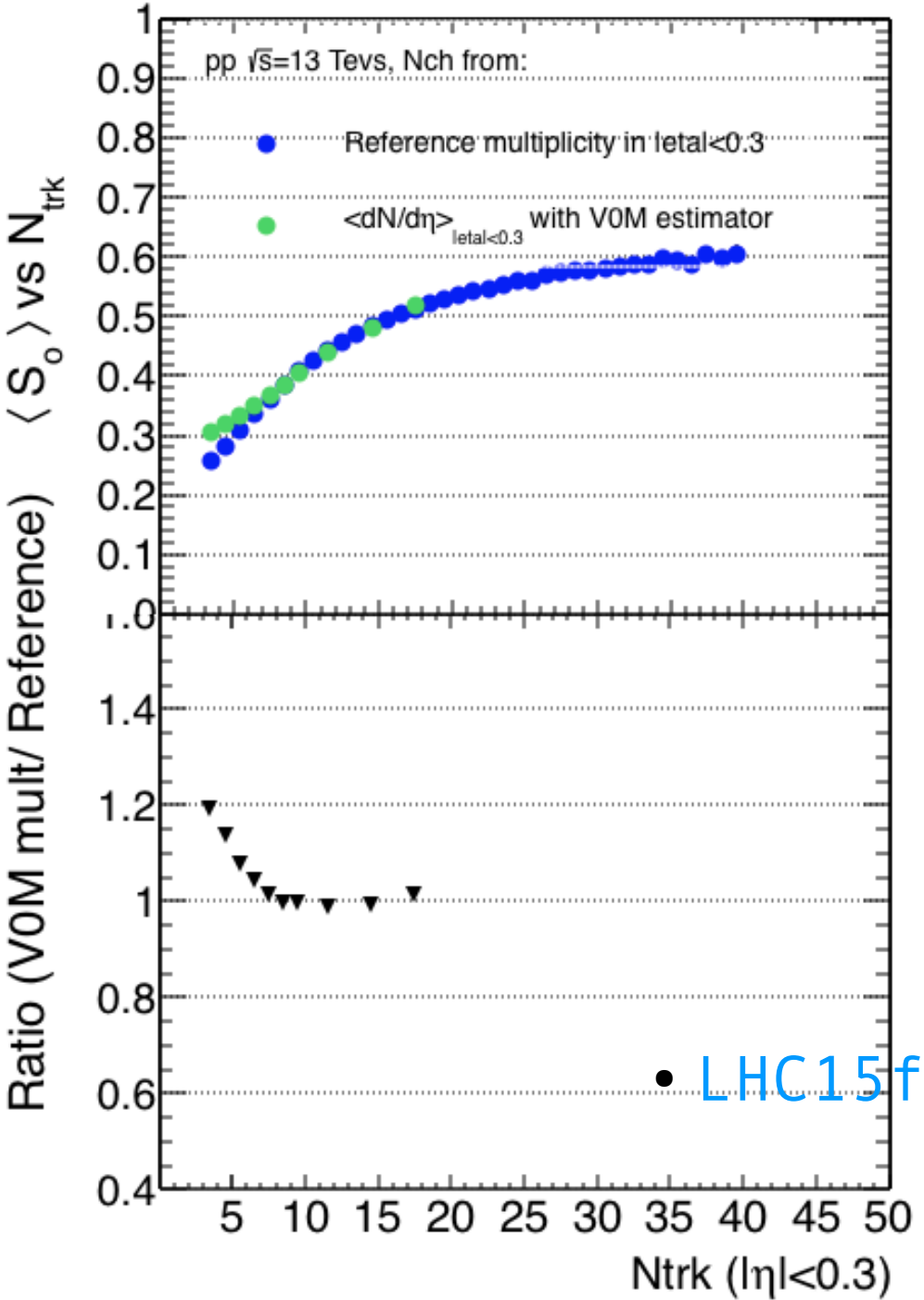
Track selection taken for each analysis:

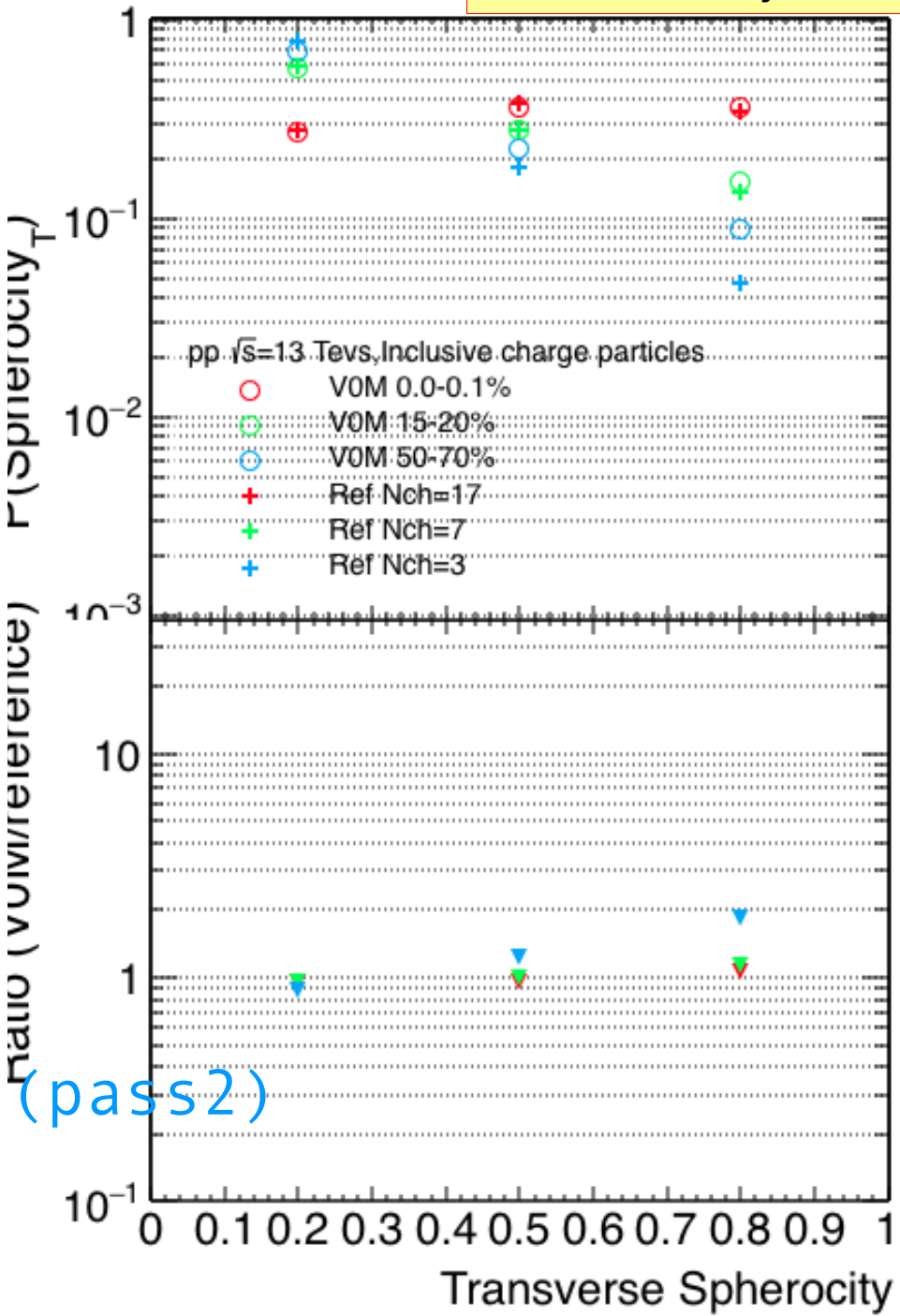
- So Analysis, Hybrid-track cuts for primary charged particles with $|\eta|<0.3$ and $0.15<p_T<10$ GeV/c.
- $\langle p_T \rangle$ Analysis, Golden-track cuts with $|\eta|<0.3$ and $0.15<p_T<10$ GeV/c.
- Multiplicity:
  - Reference multiplicity selection with $|\eta|<0.3$
  - V0M percentil selection

Spherocity Analysis for V0M and Ref | eta| <0.3

Without efficiency corrections

With All PU rejections



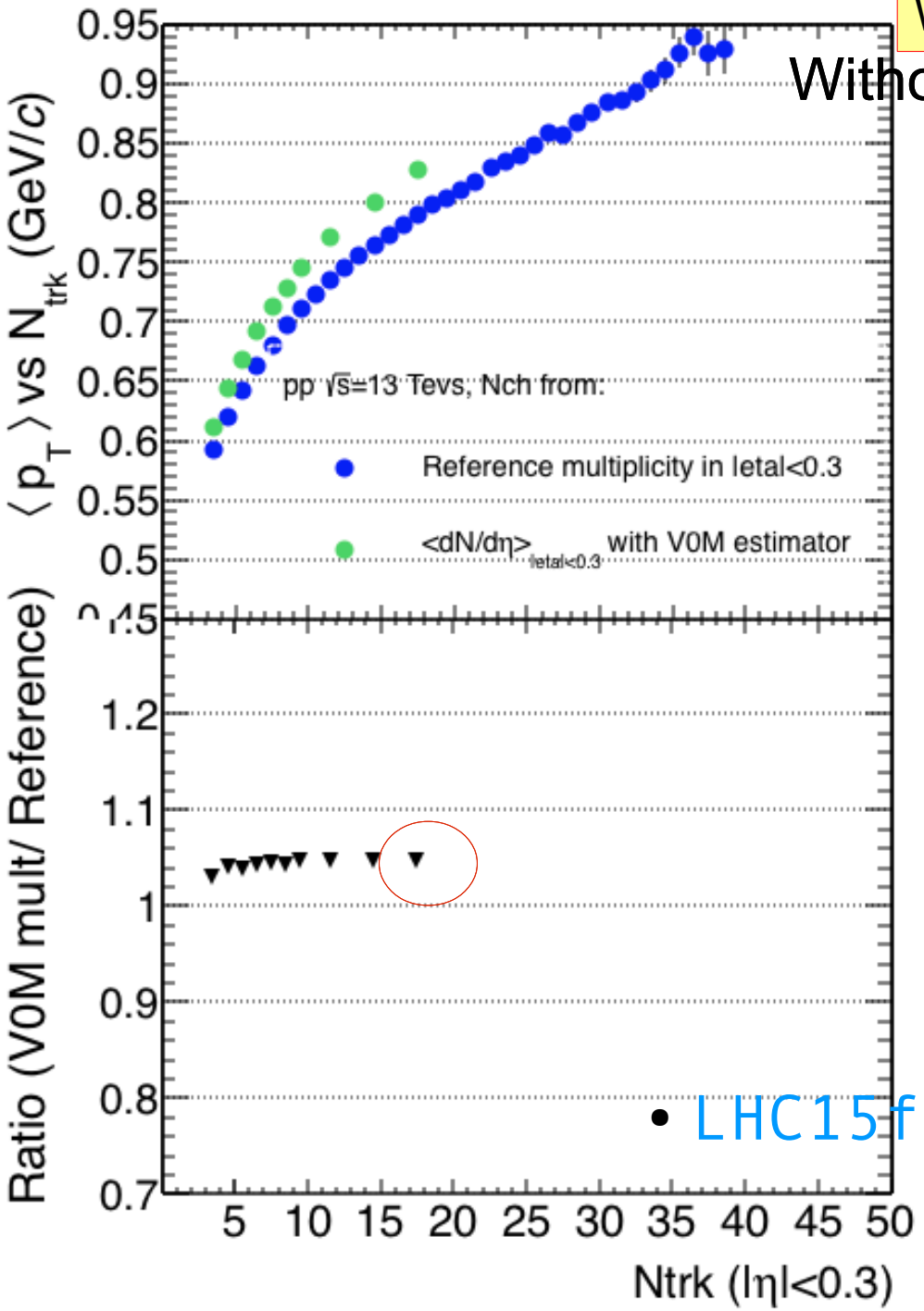


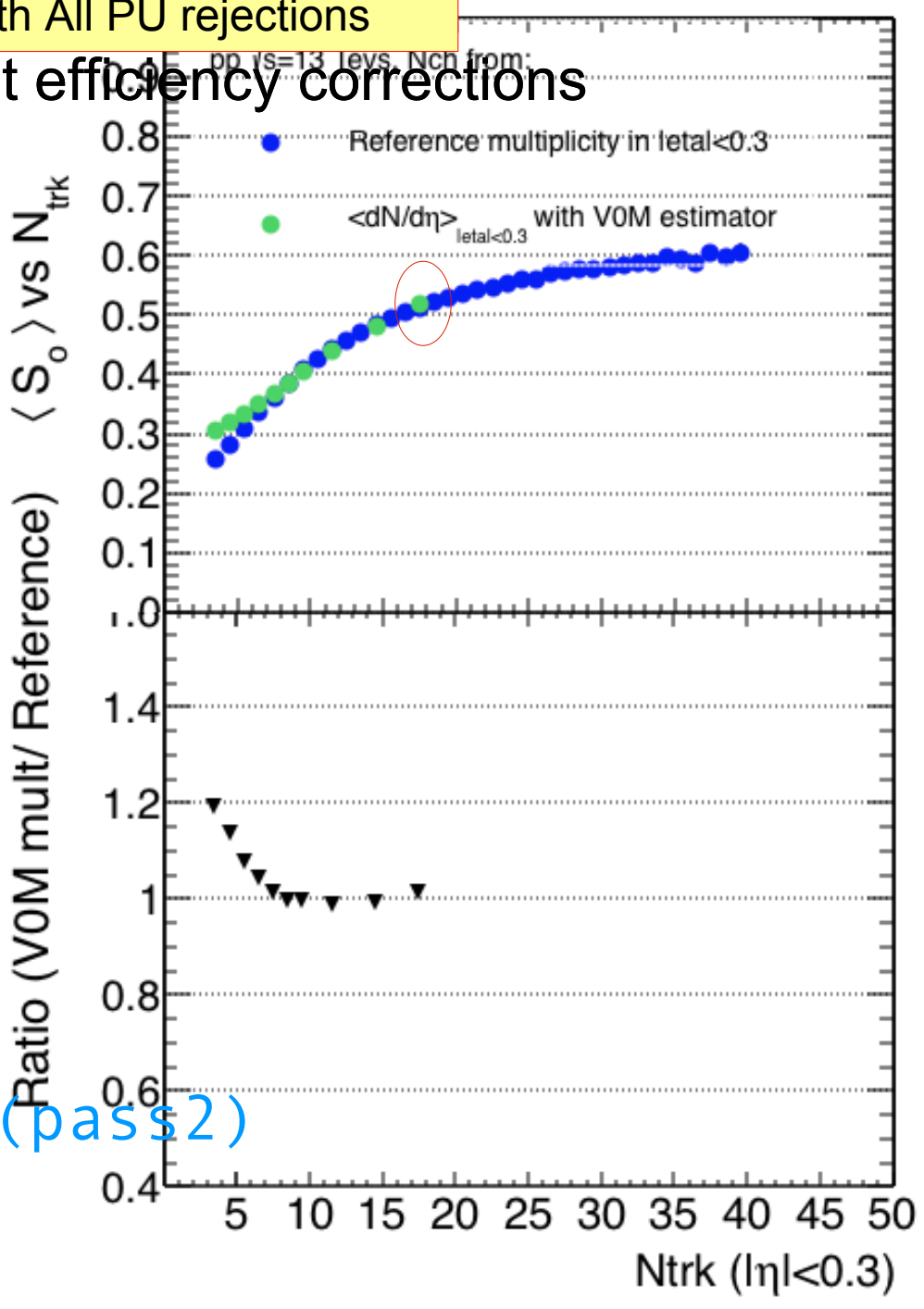
- LHC15f (pass2)

<P_T> and So for V0M and Ref |eta| <0.3

With All PU rejections

Without efficiency corrections

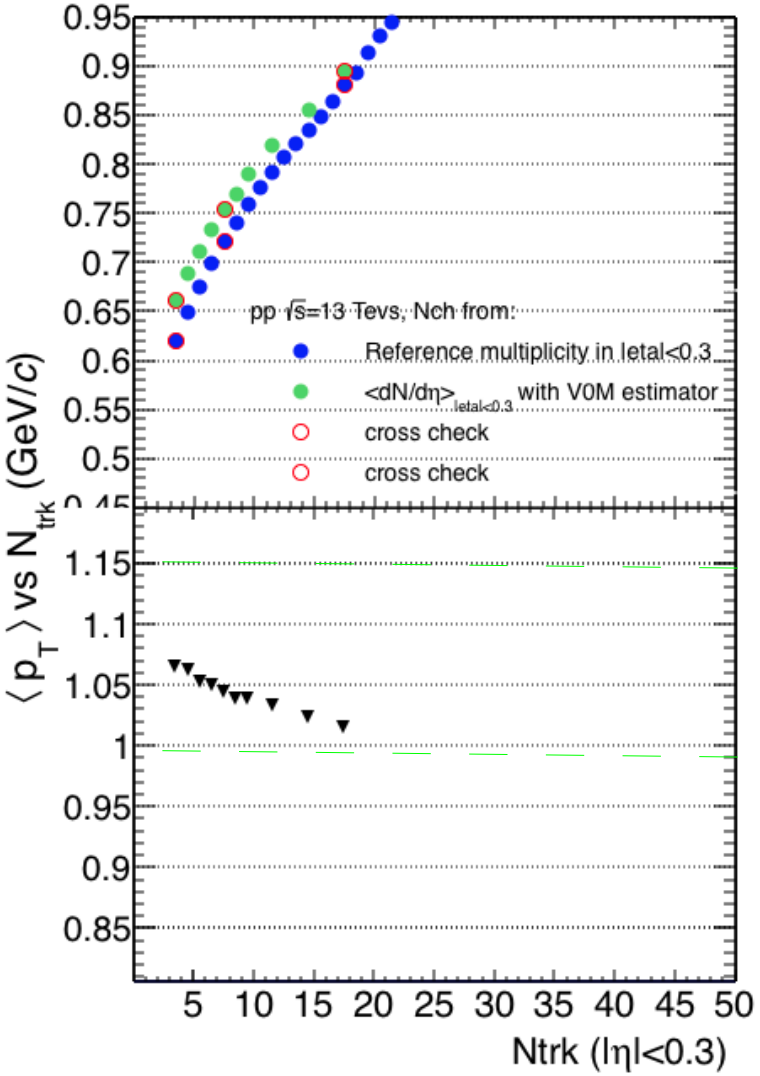




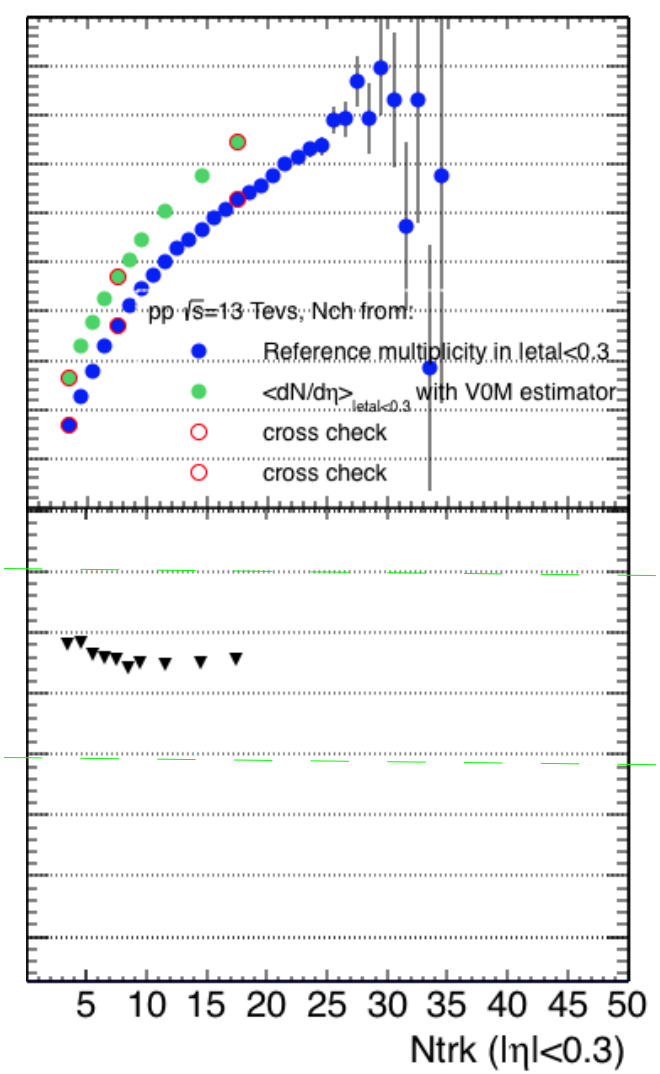
- LHC15f (pass2)

Comparing estimators V0M and Ref | eta| <0.3 For Spherocity bins

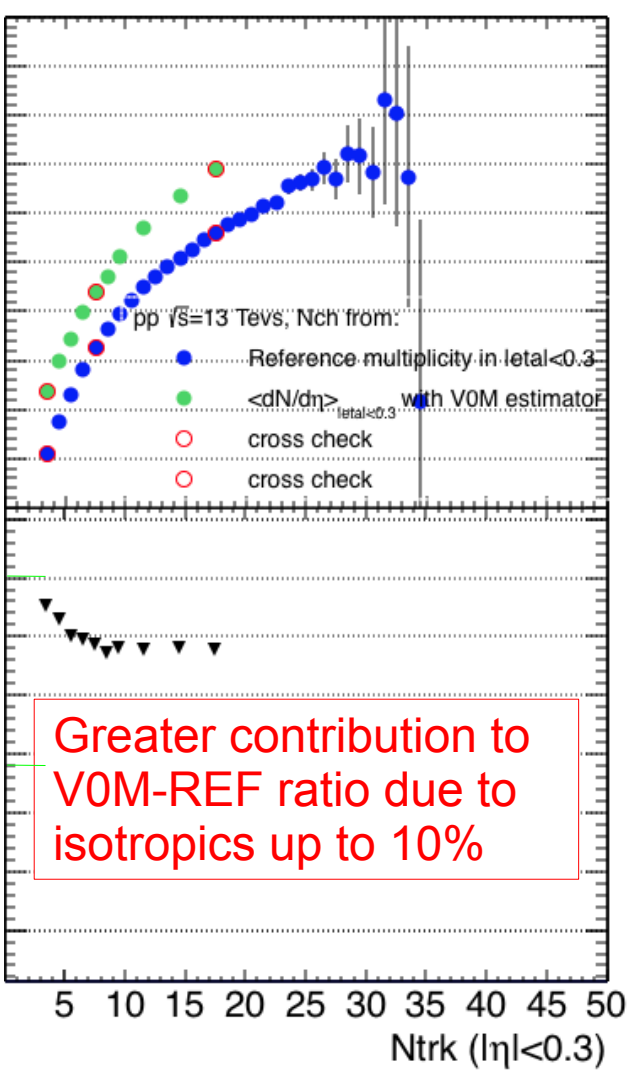
Without efficiency corrections



0<So<0.4



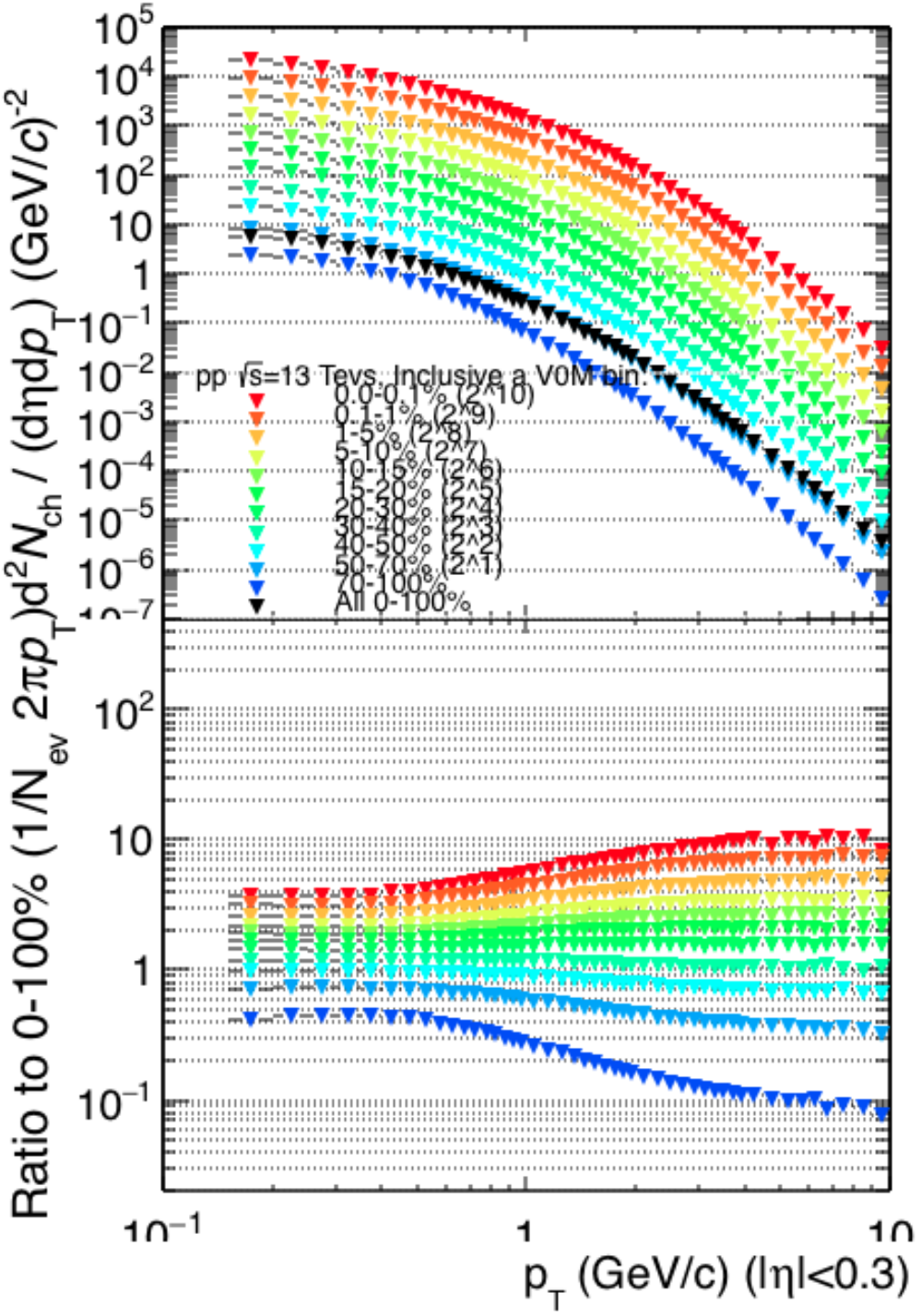
0.4<So<0.6



0.6<So<1

Greater contribution to V0M-REF ratio due to isotropics up to 10%

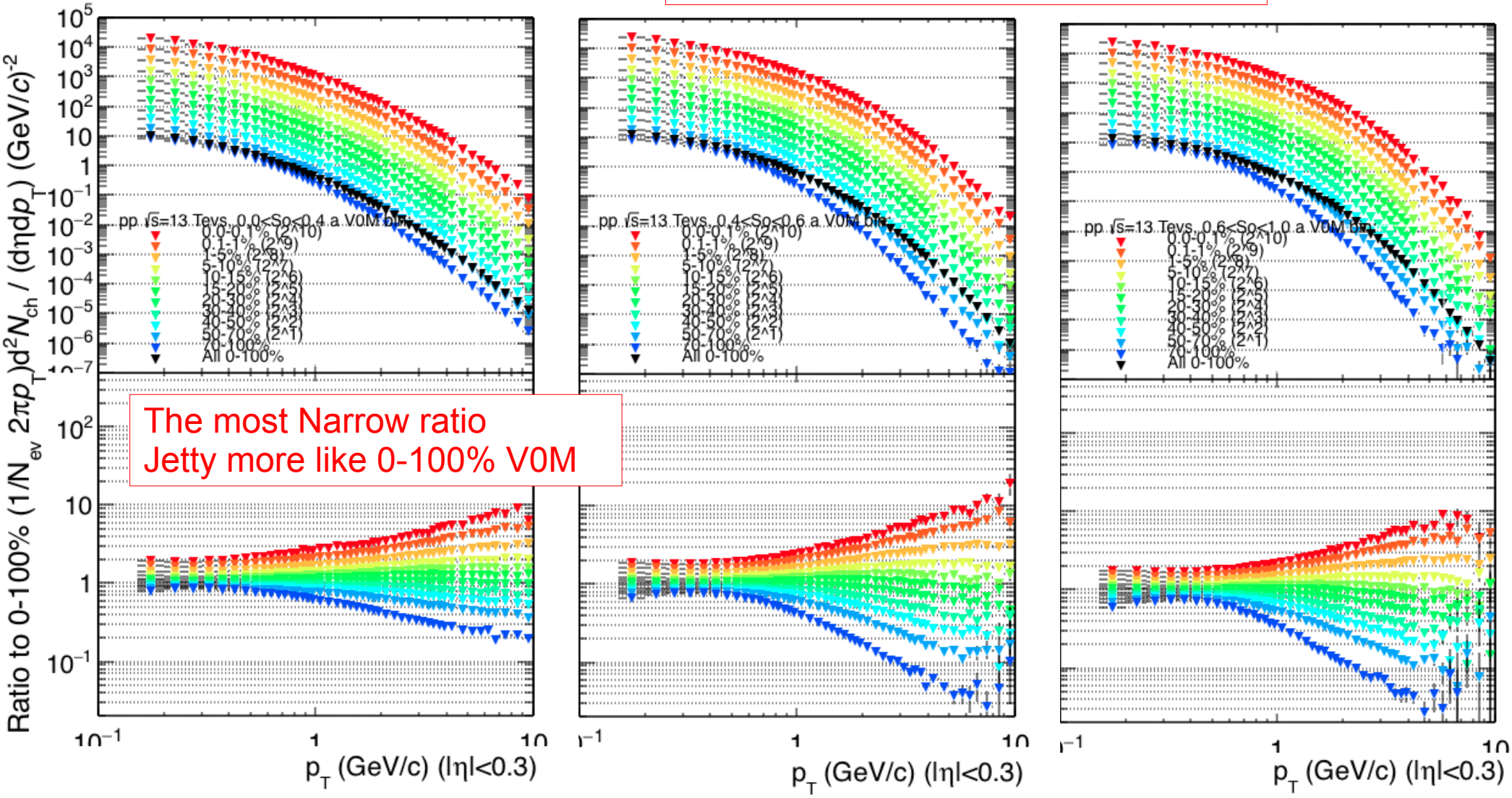
Comparing for V0M percentils and N_{ch} for its <dN/deta>



With All PU rejection cuts

Comparing for V0M percentils and N_{ch} for its <dN/deta>
For Spherocity bins

Normalization was done with events for each shape and V0M classes

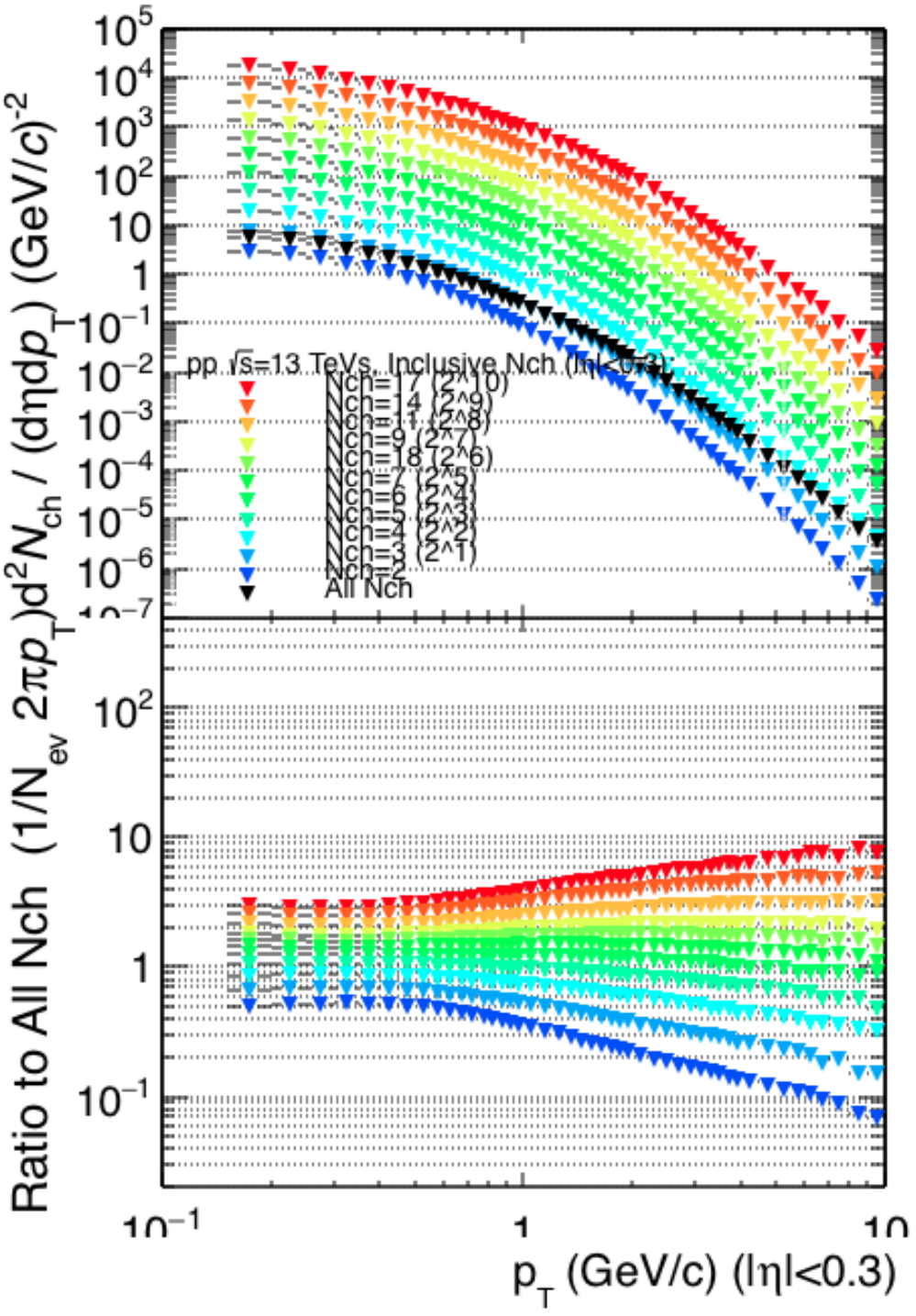


0<So<0.4

0.4<So<0.6

0.6<So<1

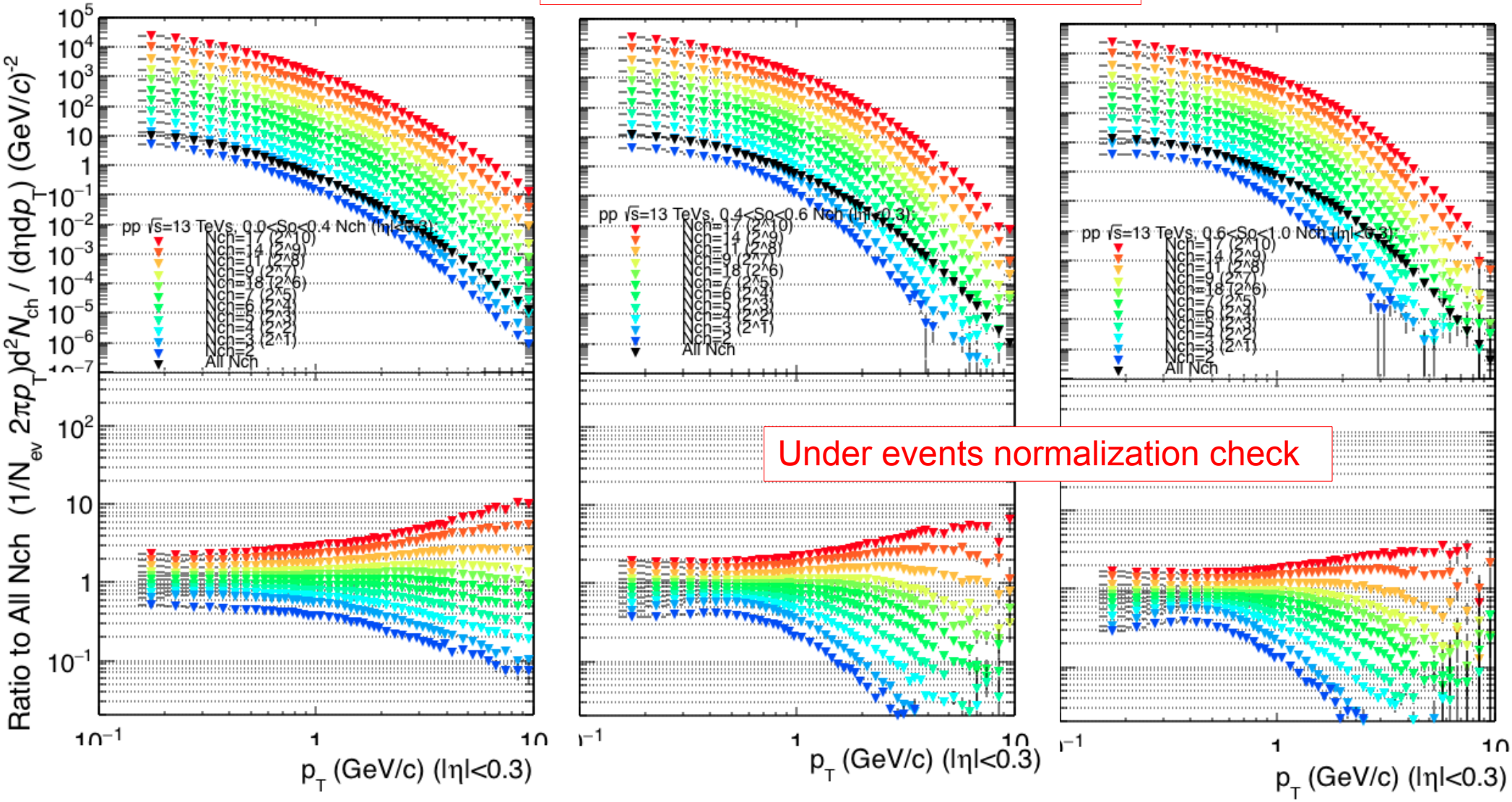
Comparing for REF estimator | eta| <0.3



With All PU rejection cuts

Comparing for REF estimator | eta| <0.3 For Spherocity bins

Normalization was done with events for each shape and Nch classes



Under events normalization check

0<So<0.4

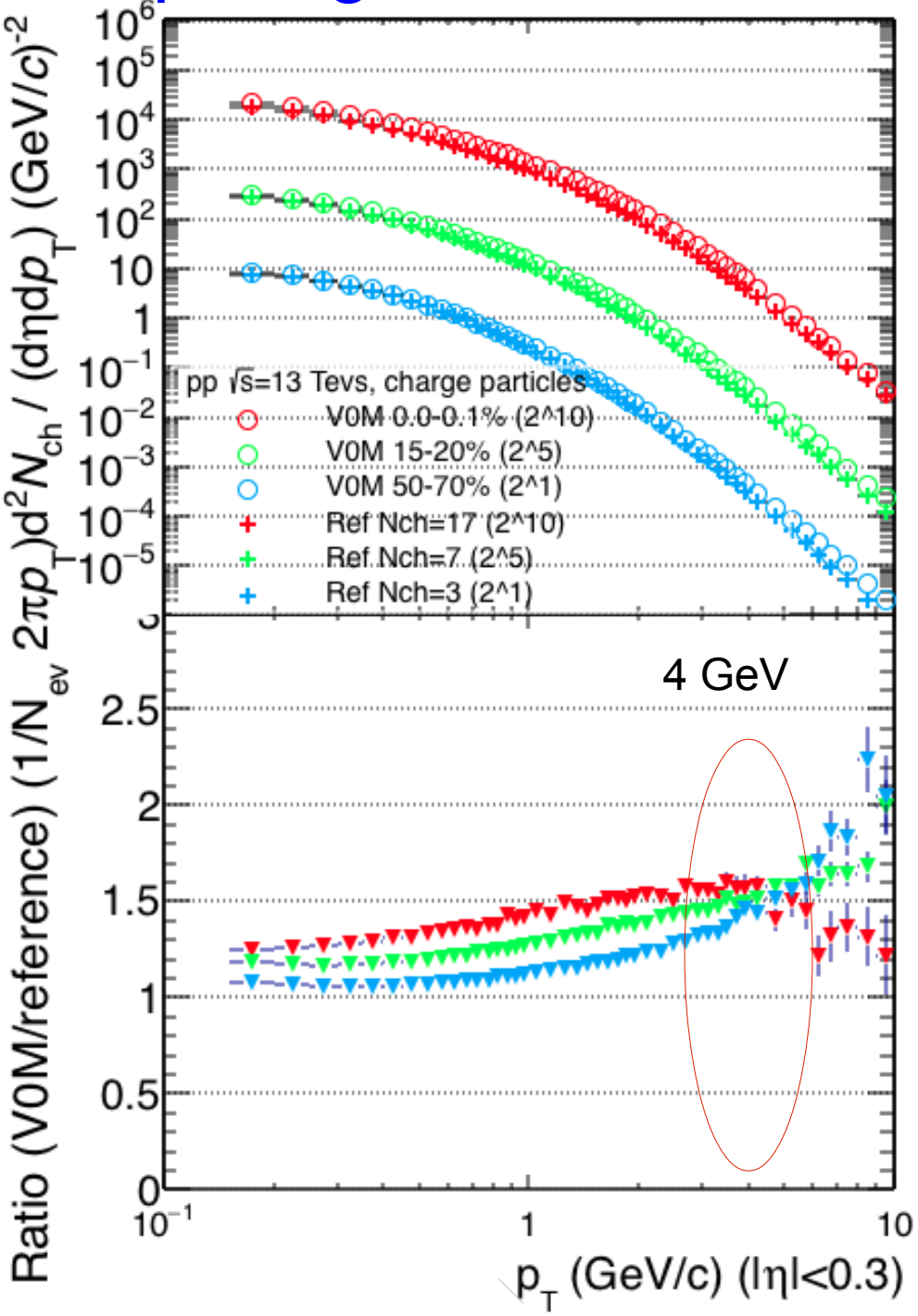
0.4<So<0.6

0.6<So<1

Comparing with V0M mult for Nch:

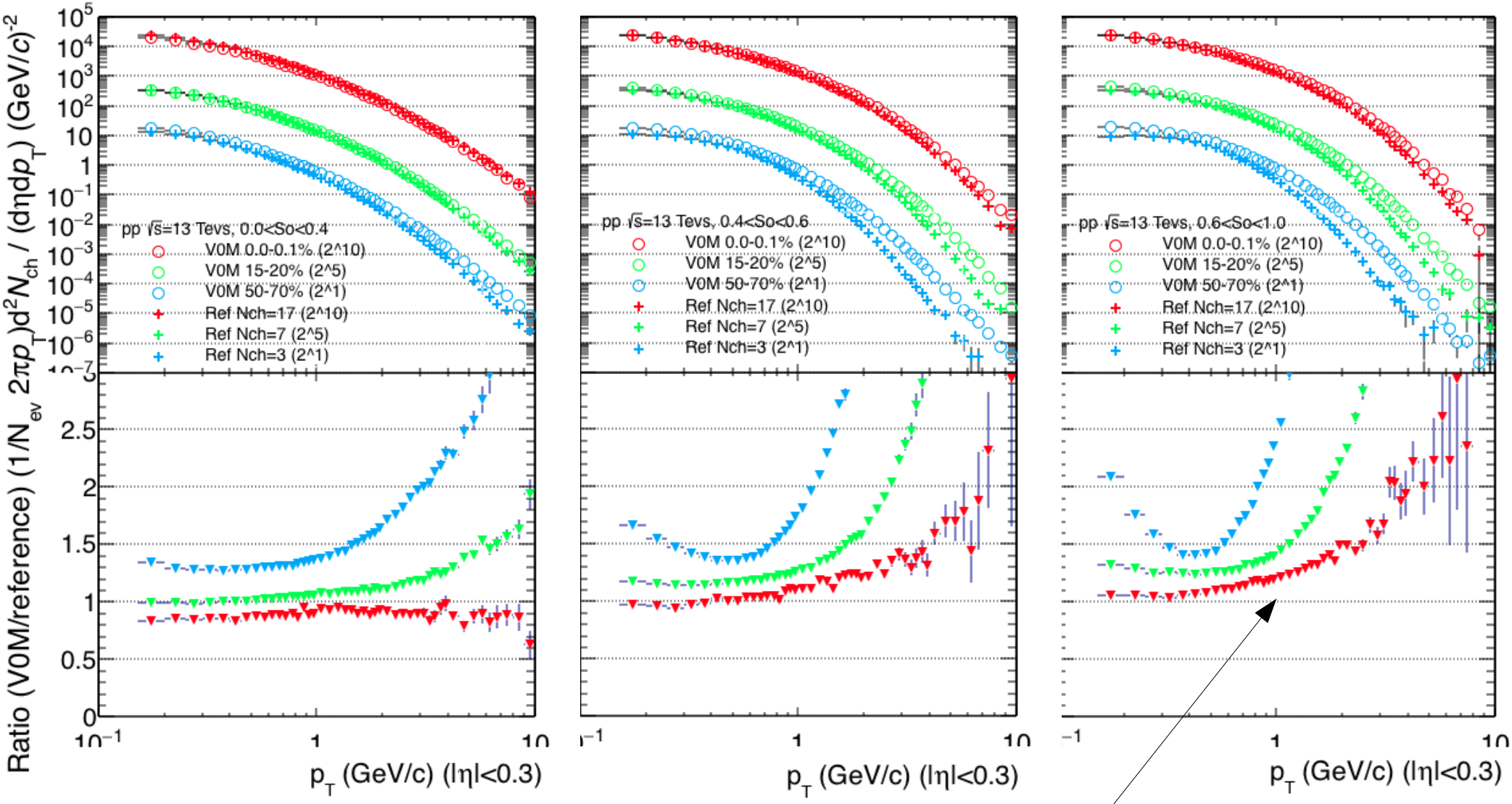
With All PU rejection

V0M$_{Nch}$ vs REF$_{|eta|<0.3}$



Comparing with V0M mult for Nch: For Spherocity bins

Under events normalization check for REF



0<So<0.4

0.4<So<0.6

0.6<So<1

Structure seems broken, but big ratio still for isotropic as in <pT>

Analysis from ESD MC LHC15g3a3 (Pythia8 Monash)

- For MC the way to proced for estimators its a little bit different, exchanging emails with David
- Snippets in run.C

```
AliMultSelectionTask *task = AddTaskMultSelection();
task->SetAddInfo(kTRUE);
task->SetUseDefaultCalib(kTRUE); // data *
task->SetUseDefaultMCCalib(kTRUE); // MC *
task->SetAlternateOADBforEstimators("LHC15f"); **
```

```
* For calibrated runs see:
**This get the V0M percentil boundaries from data this avoid some issue errors like:

E-TFile::TFile: file /Users/hectorbellomartinezImaclab/alice/aliphysics/vAN-
20160418/inst/OADB/COMMON/MULTIPLICITY/data/OADB-LHC15g3a3.root does not exist
F-AliMultSelectionTask::SetupRun: Couldn't find requested alternate calibration! Quitting!
```

- Snippets to get V0M percentil (as usual)

```
AliMultSelection *MultSelection = (AliMultSelection*) lVEvent->FindListObject("MultSelection")
Float_t lMultiplicityPercentile = MultSelection->GetMultiplicityPercentile("V0M");
```

Multiplicity Task in:

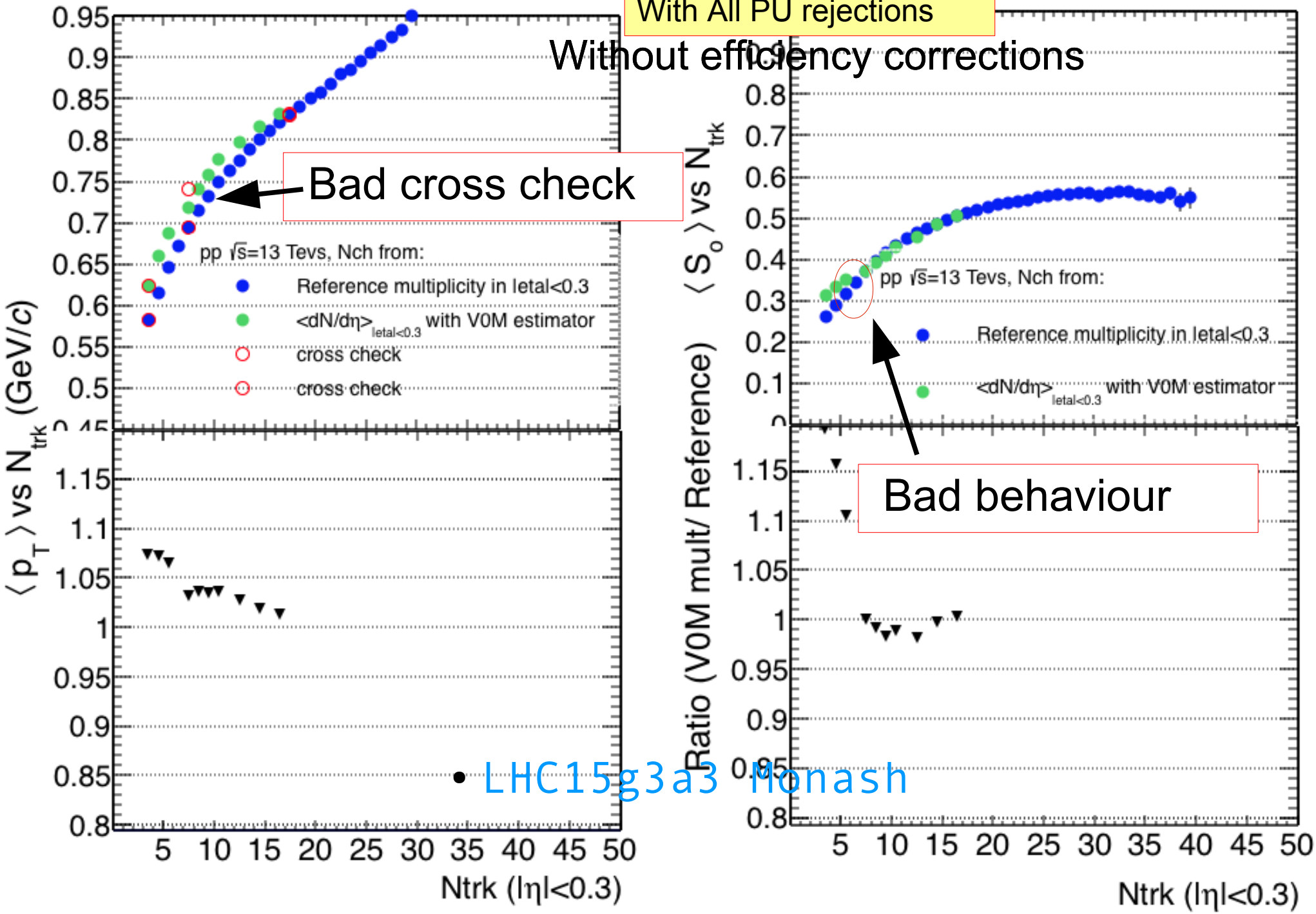
$ALICE_PHYSICS/OADB/COMMON/MULTIPLICITY/AliMultSelectionTask.cxx

$ALICE_PHYSICS/OADB/COMMON/MULTIPLICITY/macros/AddTaskMultSelection.

Monash Tune ESD <P_T> and So for V0M and Ref

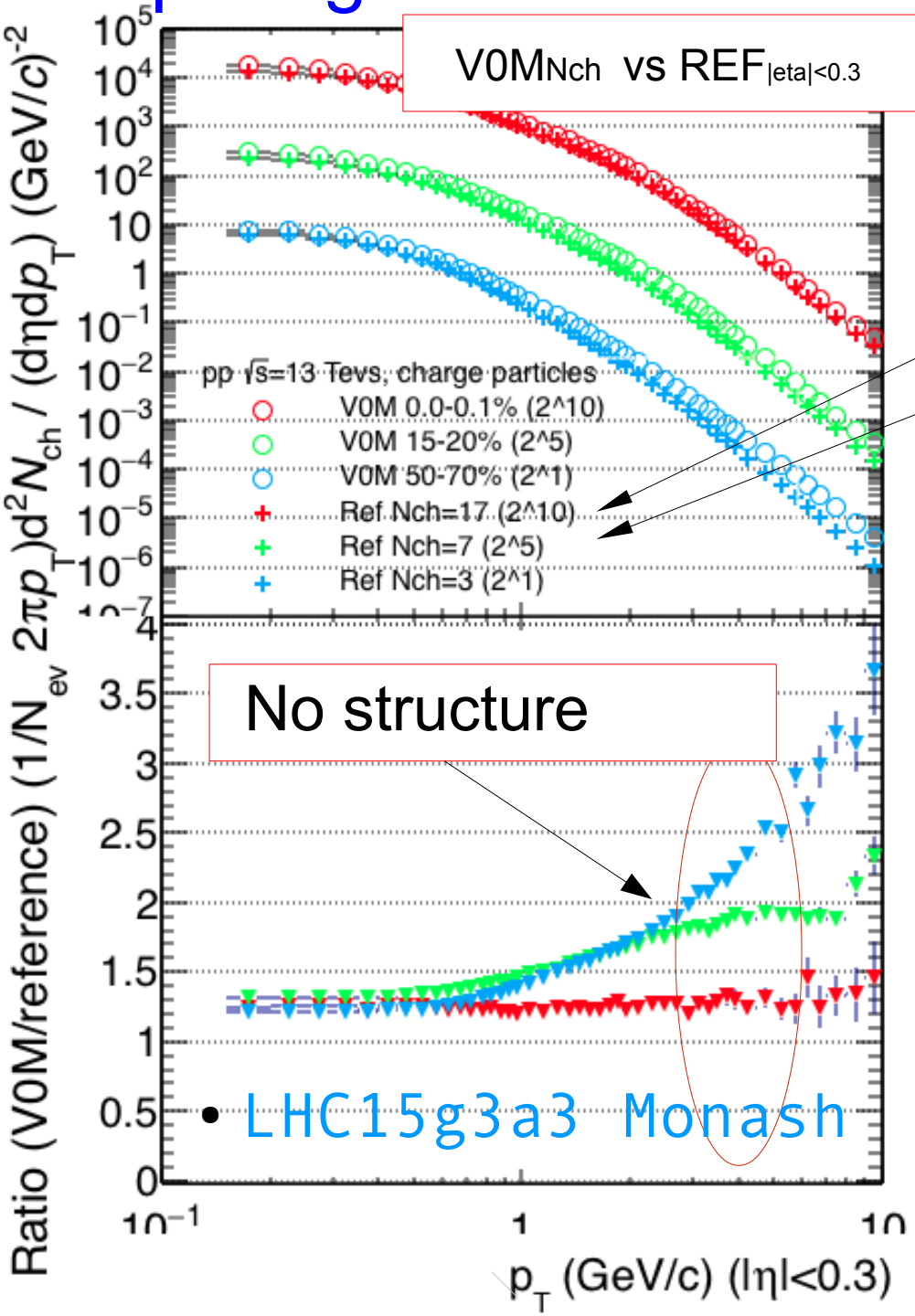
With All PU rejections

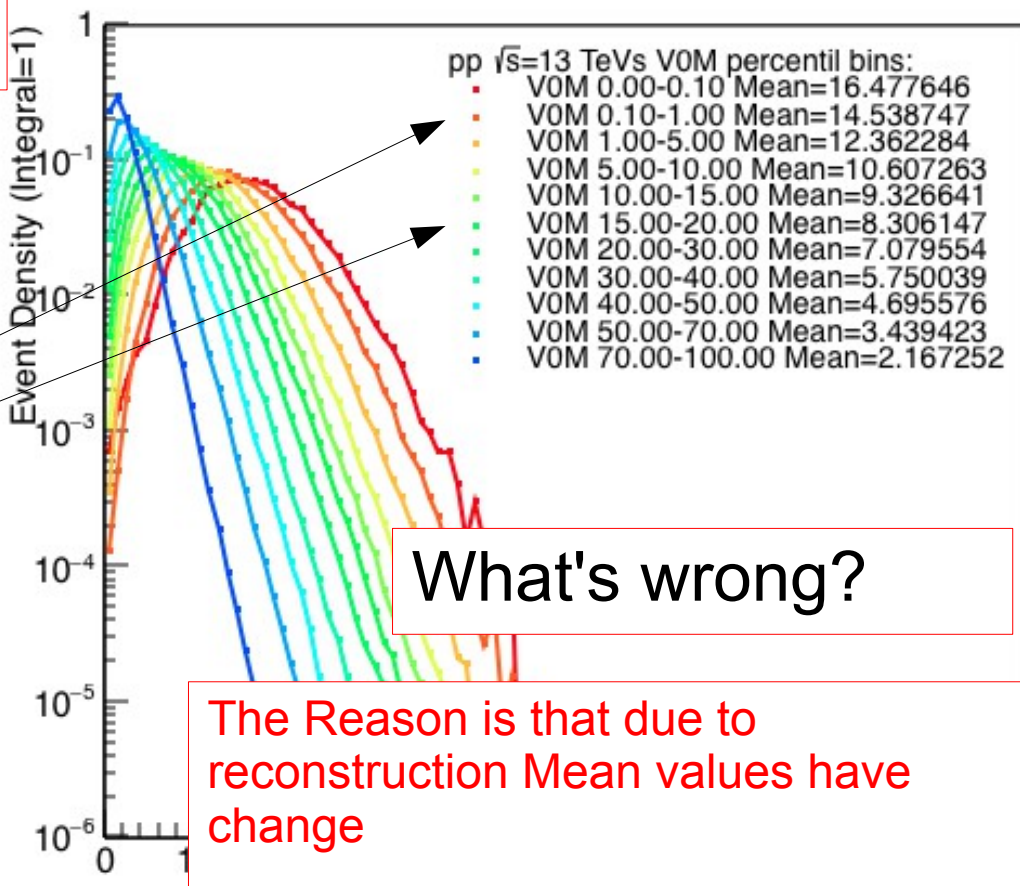
Without efficiency corrections



Comparing with V0M mult for Nch:

With All PU rejection





What's wrong?

The Reason is that due to reconstruction Mean values have change

V0M	Mean in data	Mean ESDMC
50-70%	17	16
15-20%	7	8

Need to rerun with the new mean values

Summary

For data:

- The contribution to greater $<P_T>$ for V0M comes from isotropic events (0.6<So<1) >10%
- The V0M spectra ratio to MB seems narrow for jetty events (0<So<0.4)
- The contribution to greater V0M-REF ratio seems due to isotropic events (0.6<So<1) as seen in the $<P_T>$
  (under check REF events normalization)

For MC:

- The contributi

To be done:

- Check in data normalization for REF in So bins.
- To check ESDMC pythia reruning with the new mean.
- Continue with So analysis.

Thank you!

Back Up

Events in V0M Multiplicity clases

With BG rejection:

if(fNofITSClusters0+ fNofITSClusters1
> 65+4*fNofTracklets) return;

With MV pileup rejection:

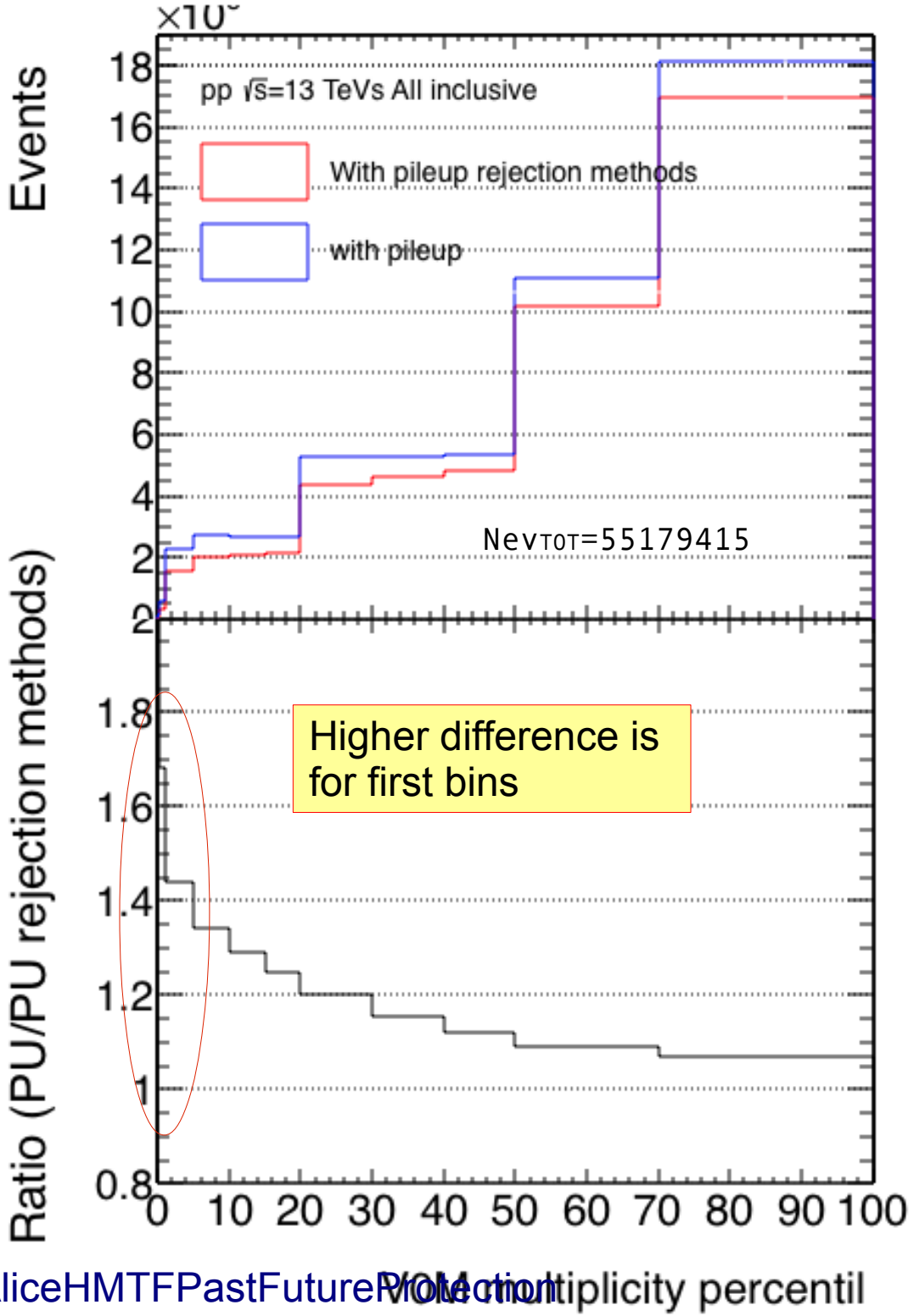
SetMinPlpContribMV=5,
SetMaxPlpChi2MV(5.0),
SetMinWDistMV(15.0), S
SetCheckPlpFromDifferentBCMV=kFALSE.

With low diagonal cut SPD & V0M Off-Online FastOR:

onlineSPD >= -20.589 + 0.73664*offlineSPD

&& onlineV0M >= -100.+7.*offlineV0M

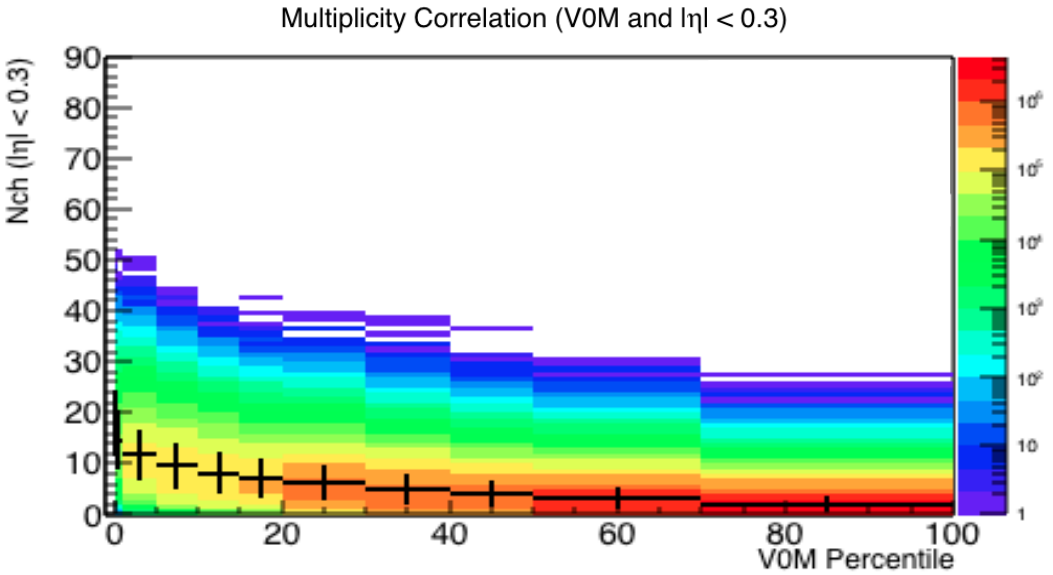
Snippets (thanks to Yihye Song)



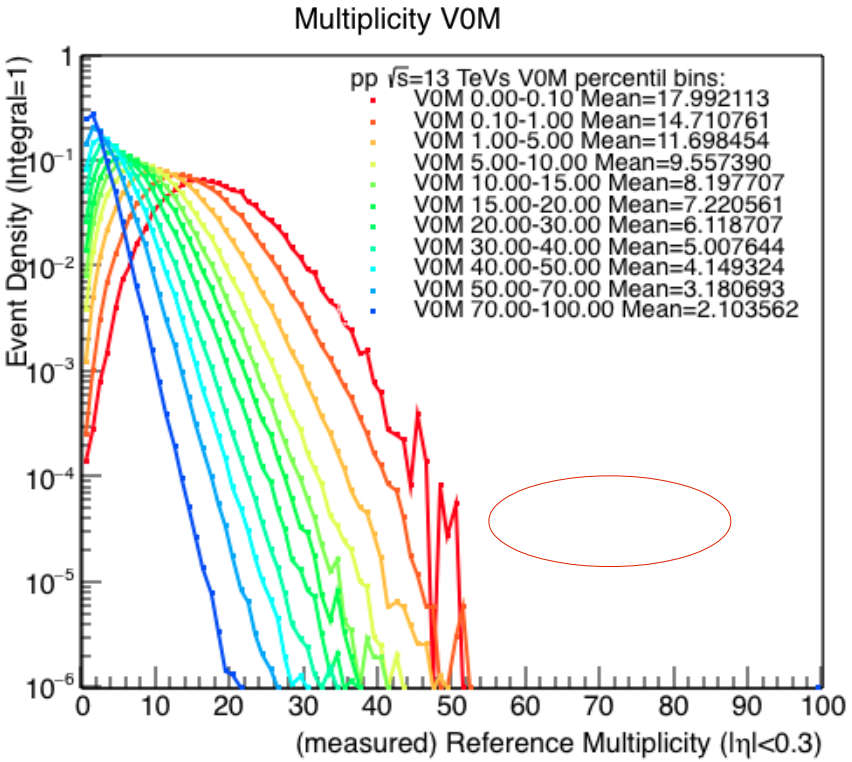
https://twiki.cern.ch/twiki/bin/view/ALICE/AliceHMTFPastFutureProtection

Some usefull plots for V0M Analysis

With All PU rejection cuts



I reproduce the proyections in order to ensure the value of <d*N*/deta>



V0M percentil	<d*N*/deta> |eta|<0.3
0.0-0.1,	17.99
0.1-1,	14.71
1-5,	11.69
5-10,	9.55
10-15,	8.19
15-20,	7.22
20-30,	6.11
30-40,	5.00
40-50,	4.14
50-70,	3.18
70-100	2.10

The number of events where taken from each multiplicity class for normalization

Useful tools

- Used libraries

  $ALICE_PHYSICS/OADB/COMMON/MULTIPLICITY/AliMultSelectionTask.cxx
  $ALICE_PHYSICS/OADB/COMMON/MULTIPLICITY/macros/AddTaskMultSelection.C

- Snippets

```
AliMultSelection *MultSelection = (AliMultSelection*) lVEvent->FindListObject("MultSelection");
Float_t lMultiplicityPercentile = MultSelection->GetMultiplicityPercentile("V0M");
```

  AliPPVsMultUtils class from AliPhysics>=vAN-20151019-1 obsolete

- More:

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

- For pileup rejection codes in HMTF

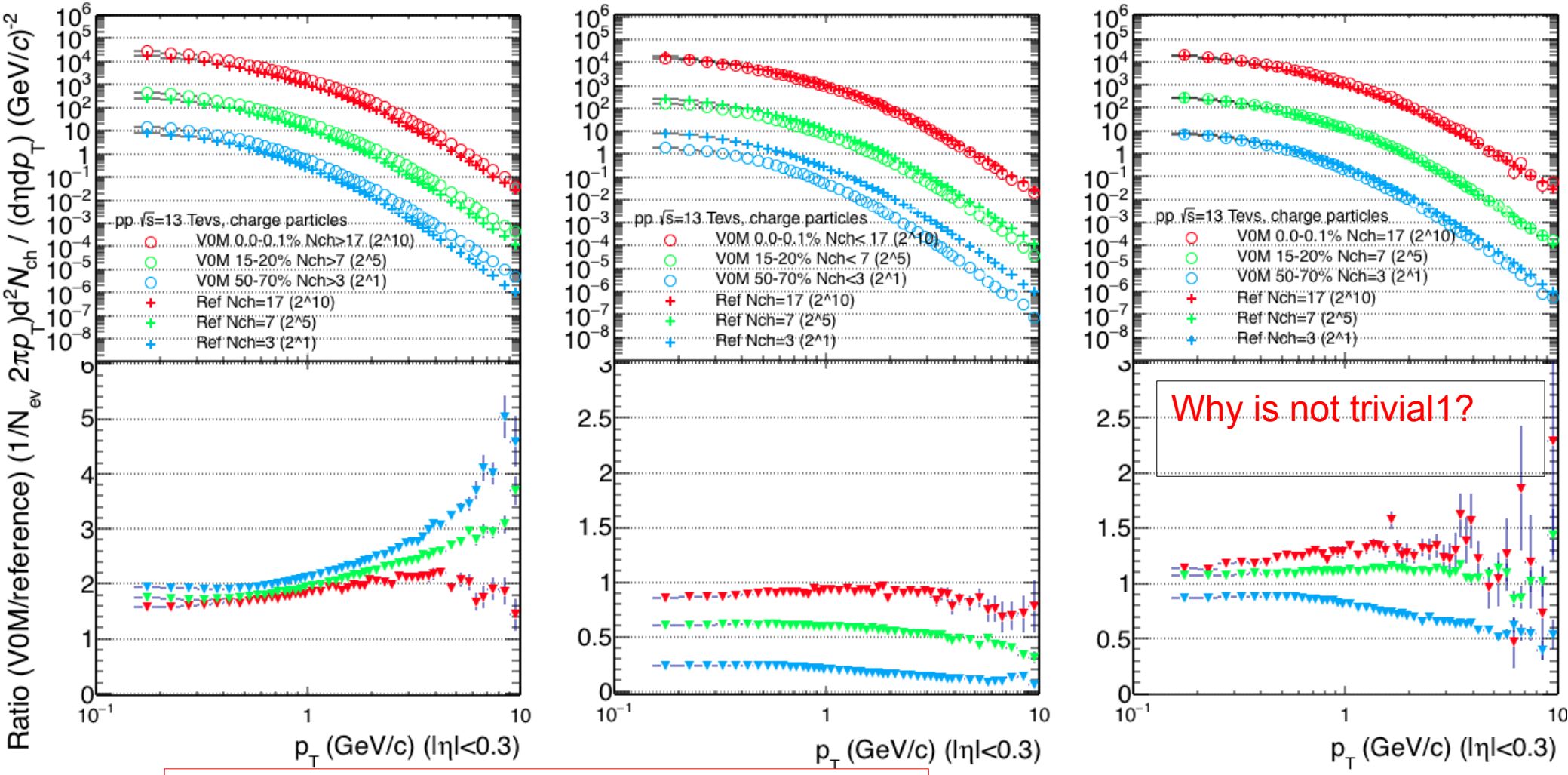
  https://twiki.cern.ch/twiki/bin/view/ALICE/AliceHMTFPastFutureProtection

```
AliVVZERO* vzero = fInputEvent->GetVZEROData();

fMTotV0A = vzero->GetMTotV0A();   fMTotV0C  = vzero->GetMTotV0C();

fTriggerChargeA = vzero->GetTriggerChargeA();

fTriggerChargeC = vzero->GetTriggerChargeC();

 onlineV0M     = fTriggerChargeA+fTriggerChargeC;

offlineV0M    = fMTotV0A+fMTotV0C;
```

- Thanks David for help on AliMultSelection task info.
- Vytautas for provide the binning
- Yihye Song, and Michele Floris for provide the info on the low diagonal cuts on SPD and V0M online-offline

Comparing with V0M mult for Nch: greater, lower and equal to <dN/deta>

With All PU rejection cuts



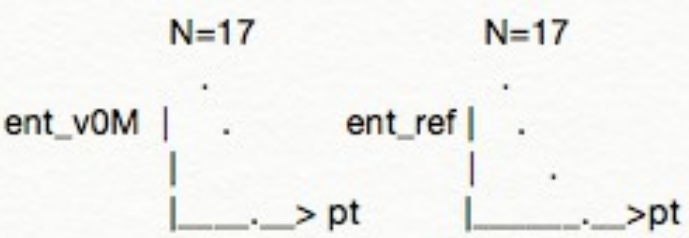
To check the contribution to the ratio,

A crosscheck in number of events has been taken into account

Why V0M mult for Nch equal to <dN/deta> gives ratio different to one:

No necesariamente el ratio debe ser 1 ej

Caso 1 evento mult 17 pero ratio REF/V0M no es 1.

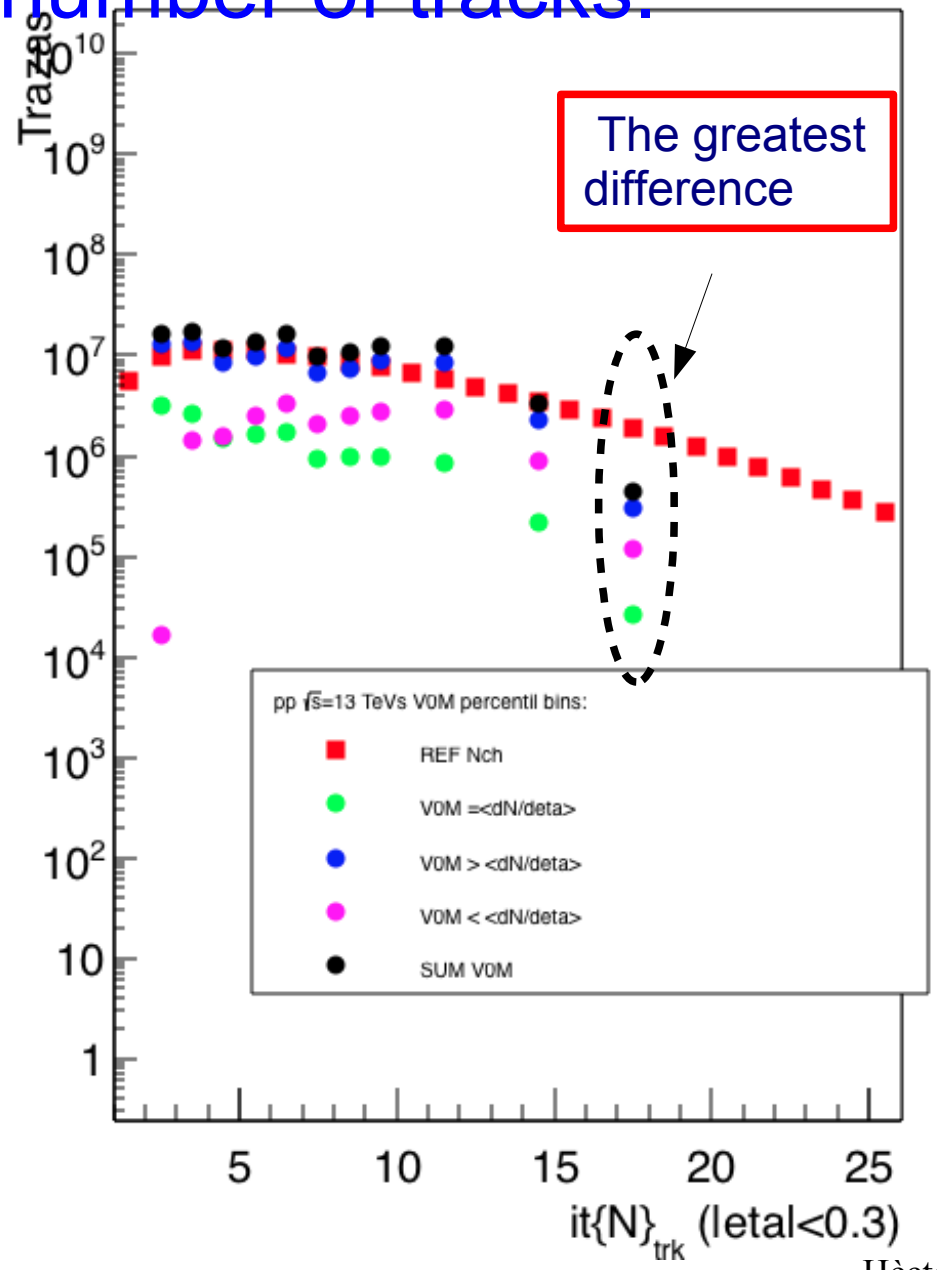


Depends how P_T is distributed for each track

			REF/v0M	Plot
17 trazas-> ej	9 pt=0.5	9 pt=0.5	1	Caso linea azul
	6 pt=1	4 pt =1	4/6=0.66	
	5 pt=2	3 pt =2	3/5=0.6	
	0 pt=3	1 pt=3	0	
17 trazas-> ej	7 pt=0.5	7 pt=0.5	7/7=1	
	5 pt=1	6 pt =1	6/5=1.2	
	2 pt=2	3 pt =2	3/2=1.5	caso linea roja
	3 pt=3	1 pt=3	1/3=0.33	

(1/2pipT_i)(1/Nev_ncref) (dN/detadpTi)=(1/Nev_ncref) (dN_entv0M) Ratio=(1/1)(dN_entv0M)/(dN_entref)
(1/2pipT_i)(1/Nev_ncv0m)(dN/detadpTi)=(1/Nev_ncv0m)(dN_entref)

Also it's true that different estimator gives different number of tracks.



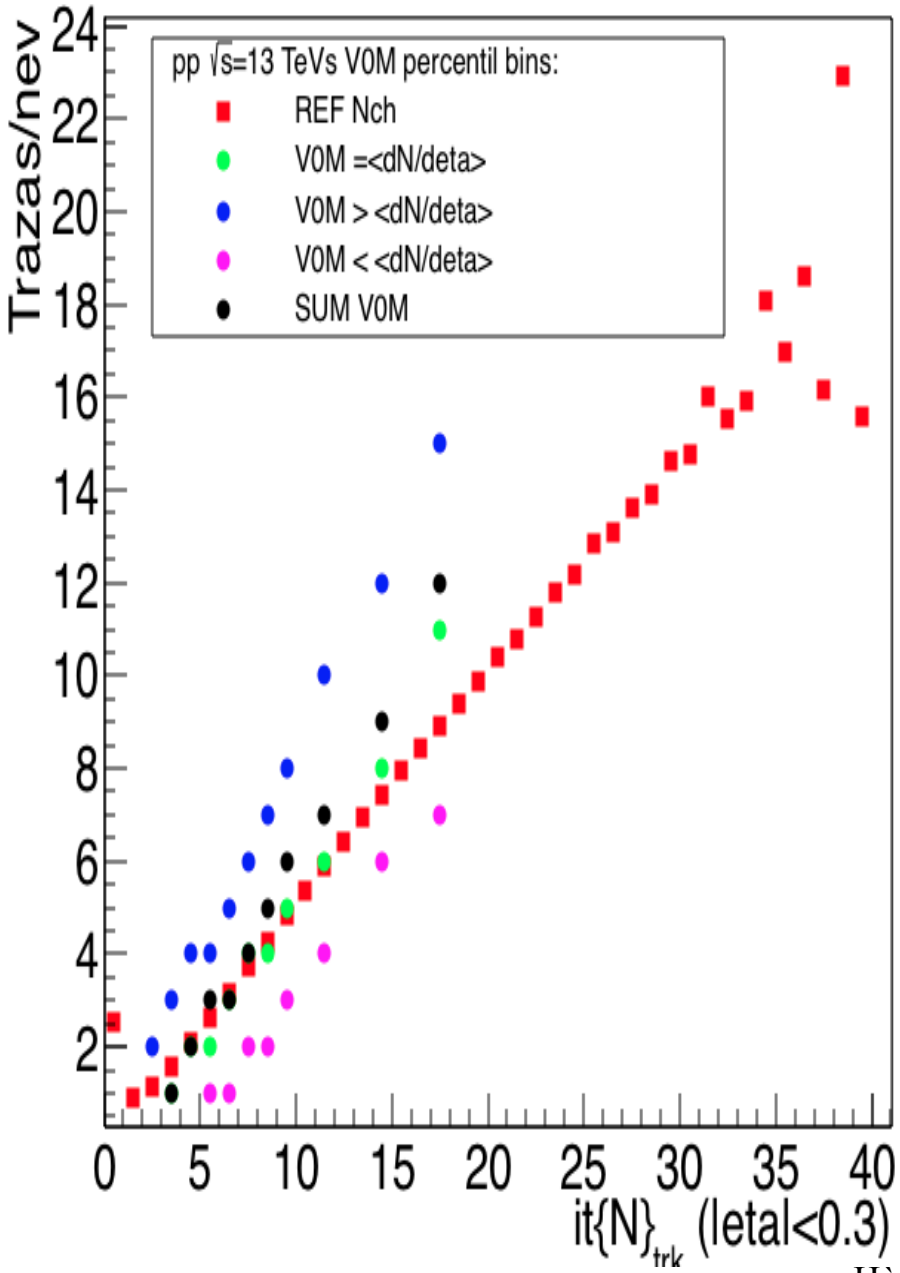
Multiplicity = <dN/deta> in V0M
is less than ITSTPC tracks from REF multiplicityin |eta|<0.3.

particular case:

With V0M 0-01
Trazas TH2D =443 416
Mayor 17: 298 107
Menor 17: 119 662
Igual 17: 25 647
Suma=443, 416

PT ref igual a 17, Nev 281 632
Trazas= 1 929 787

number of tracks per num of events.



Multiplicity = <dN/deta> in V0M
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multiplicityin |eta|<0.3.

particular case:

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Trazas TH2D =443 416
Mayor 17: 298 107
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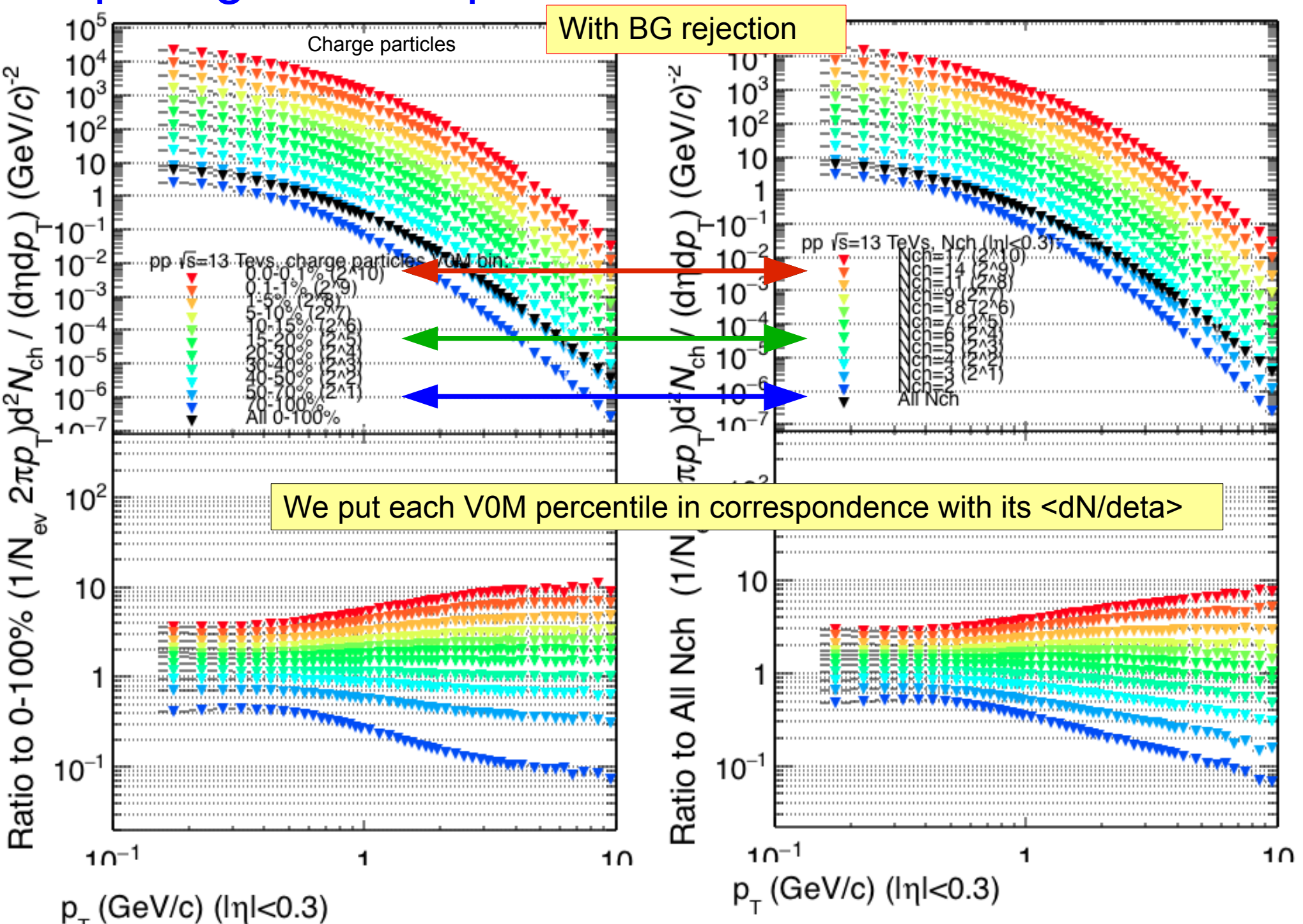
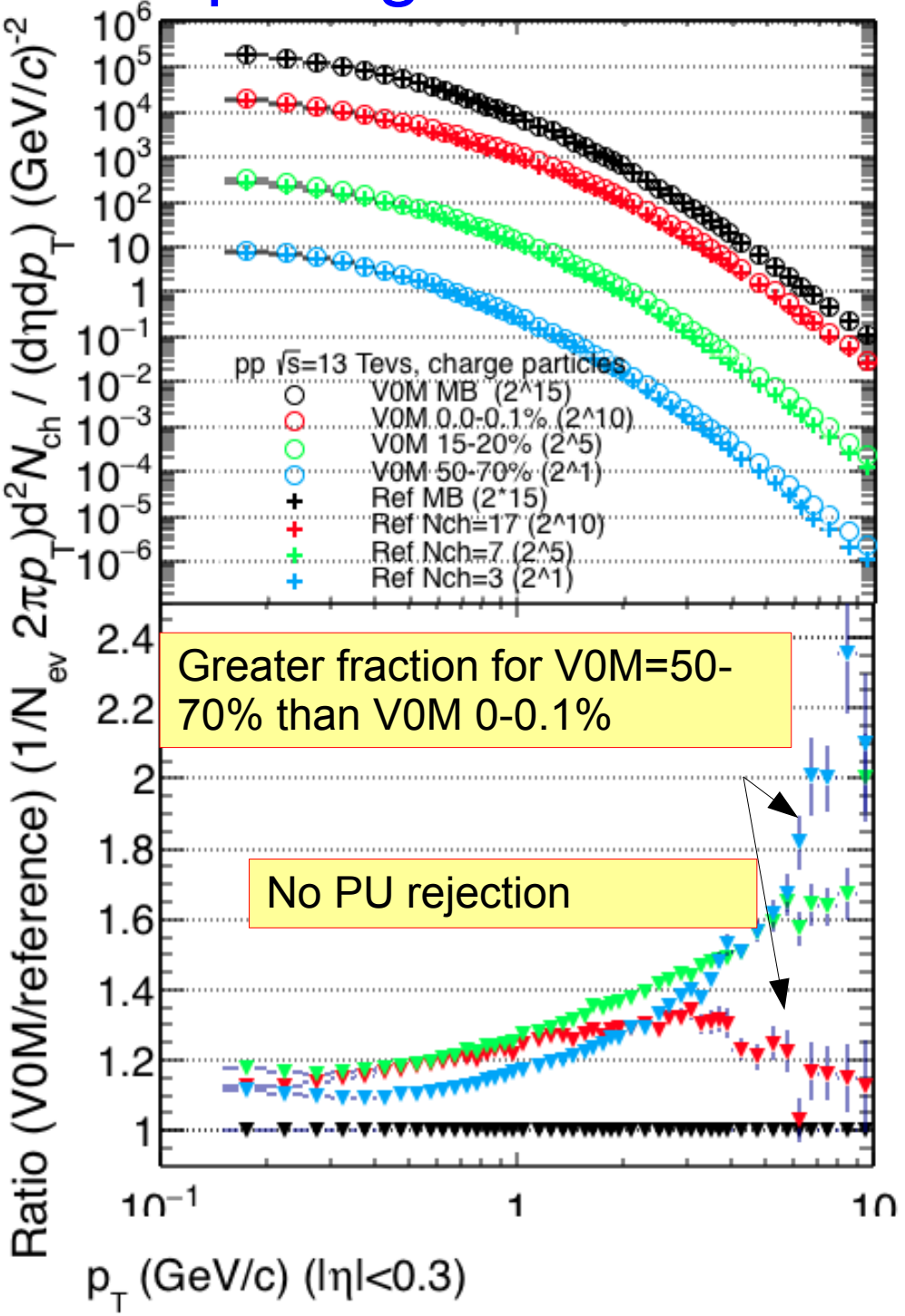
Igual 17: 25 647
Suma=443, 416

PT ref igual a 17, Nev 281 632
Trazas= 1 929 787

Comparing for V0M percentils and N_{ch} for its <dN/deta>

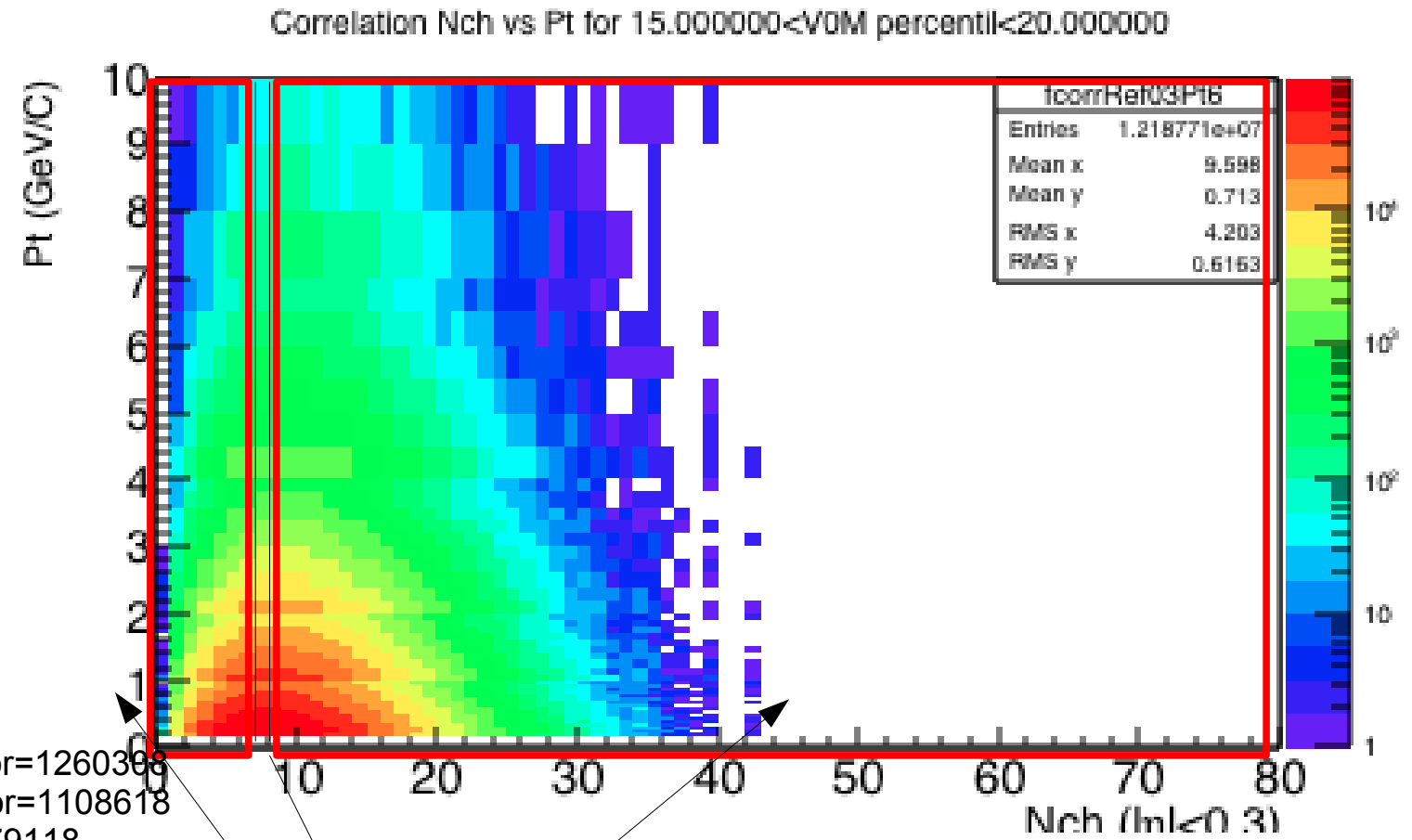


Comparing estimators V0M and Ref | eta| <0.3



To check the compatibility of my program and the information given by the spectra we make another crosscheck.
I take the spectra and calculate <p_T>

Correlation pt vs <dN/deta> |eta|<0.3



Nev=2648044

Nev para mayor=1260308
Nev para menor=1108618
Nev para ig=279118
Suma=2648044

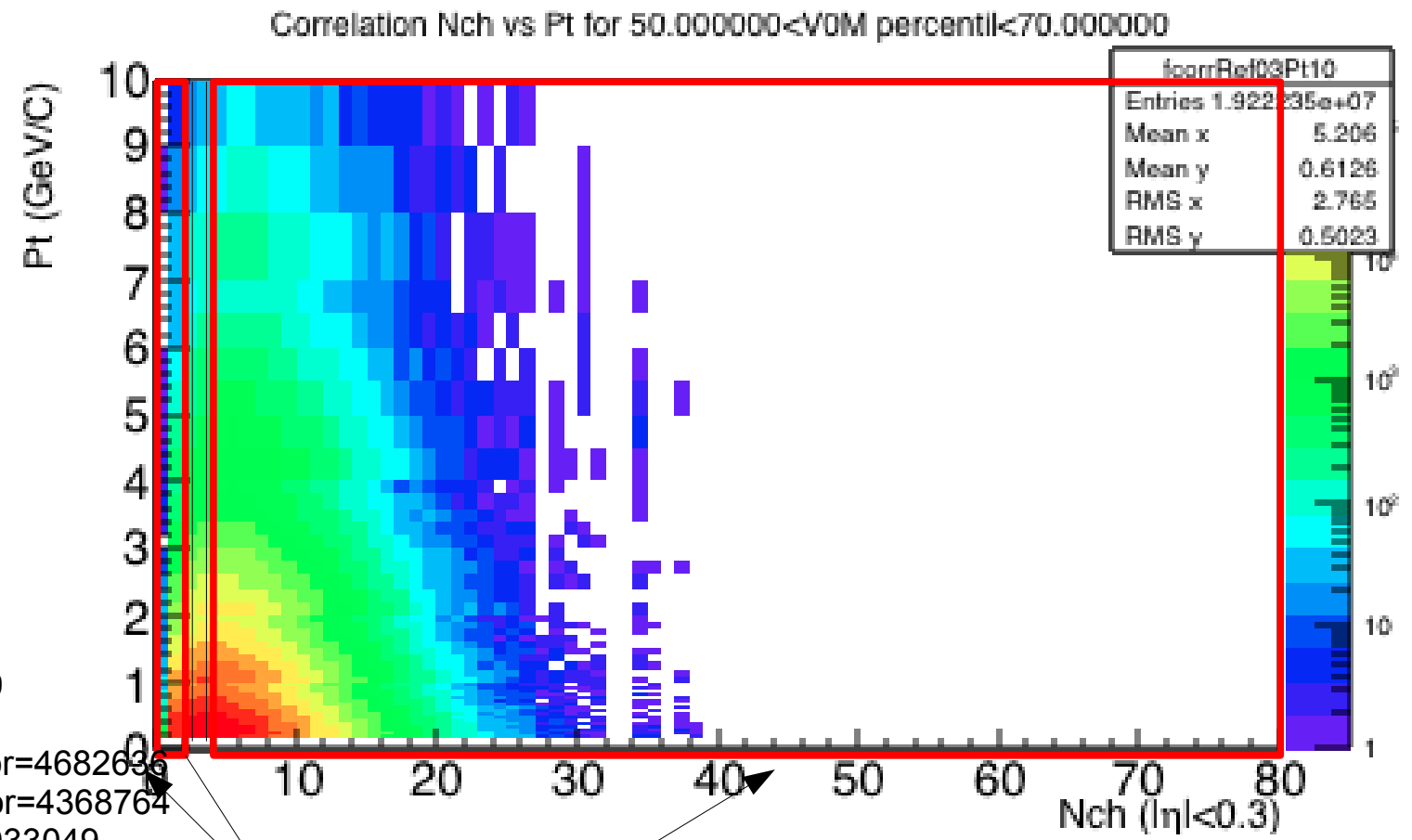
In order to get pt distributions for:

Nch in V0M> <dN/deta>$_{|eta|<0.3}$=7

Nch in V0M< <dN/deta>$_{|eta|<0.3}$=7

Nch in V0M= <dN/deta>$_{|eta|<0.3}$ =7

Correlation pt vs <dN/deta> |eta|<0.3



Nev=11084449

Nev para mayor=4682636
Nev para menor=4368764
Nev para ig=2033049
Suma=11084449

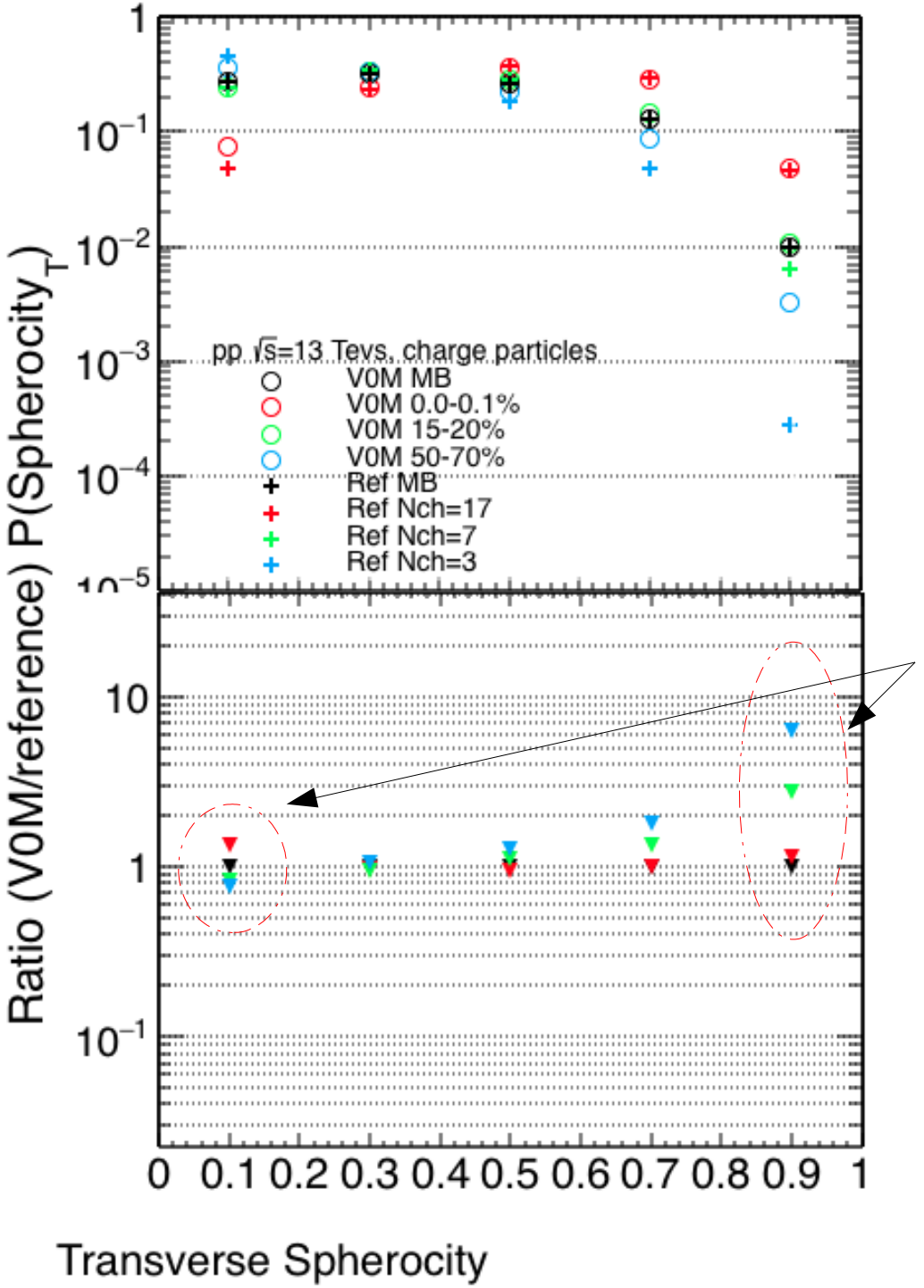
In order to get pt distributions for:

Nch in V0M> <dN/deta>$_{|eta|<0.3}$=3

Nch in V0M< <dN/deta>$_{|eta|<0.3}$=3

Nch in V0M= <dN/deta>$_{|eta|<0.3}$ =3

First Comparison for So with estimators V0M and Ref | eta| <0.3



Greater difference for isotropic events specially for low *N*ch