

ALICE



Spherocity analysis using V0M estimator

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ACO
meeting

14 mayo 2016

Outline

- Resumen para XXX Reunion anual DpyC
- Resumen para avance de tesis
- Results in ESD MC LHC15g3a3 (Monash)
 - Some corrections with the mean values for V0M
- For LHC15f data comparison with eta change.

- Conclusions.

Analysis and run selection

Software: Aliroot:v5-07-20 Aliphysics:vAN-20160204

Event shape classes: (PWGLF/SPECTRA/Sphericity)

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

Analysis from ESD MC LHC15g3a3 (Pythia8 Monash)

- For MC the way to proceed for estimators is 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 gets 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)

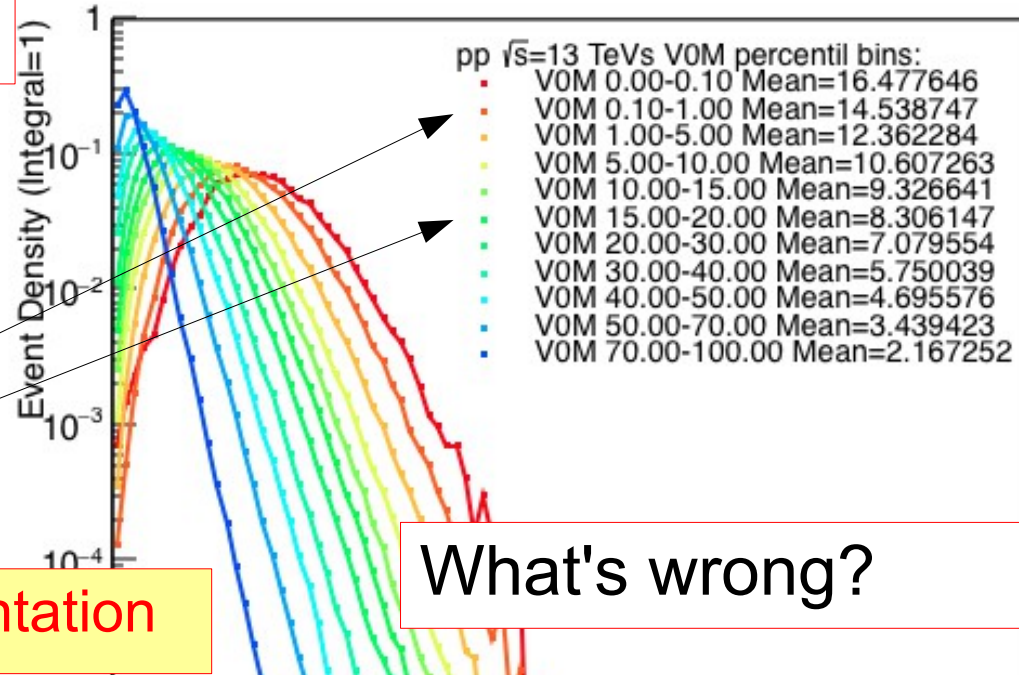
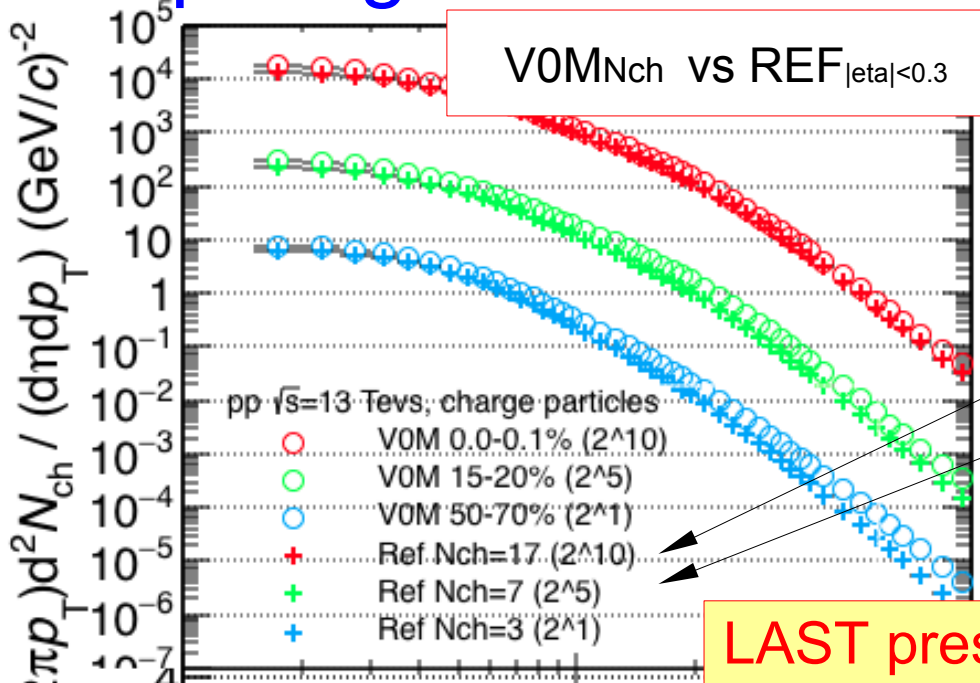
```
AliMultSelection *MultSelection = (AliMultSelection*) lVEvent->FindListObject("MultSelection")
Float_t lMultiplicityPercentile = MultSelection->GetMultiplicityPercentile("V0M");
```

Multiplicity Task in:

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

Comparing with V0M mult for Nch:

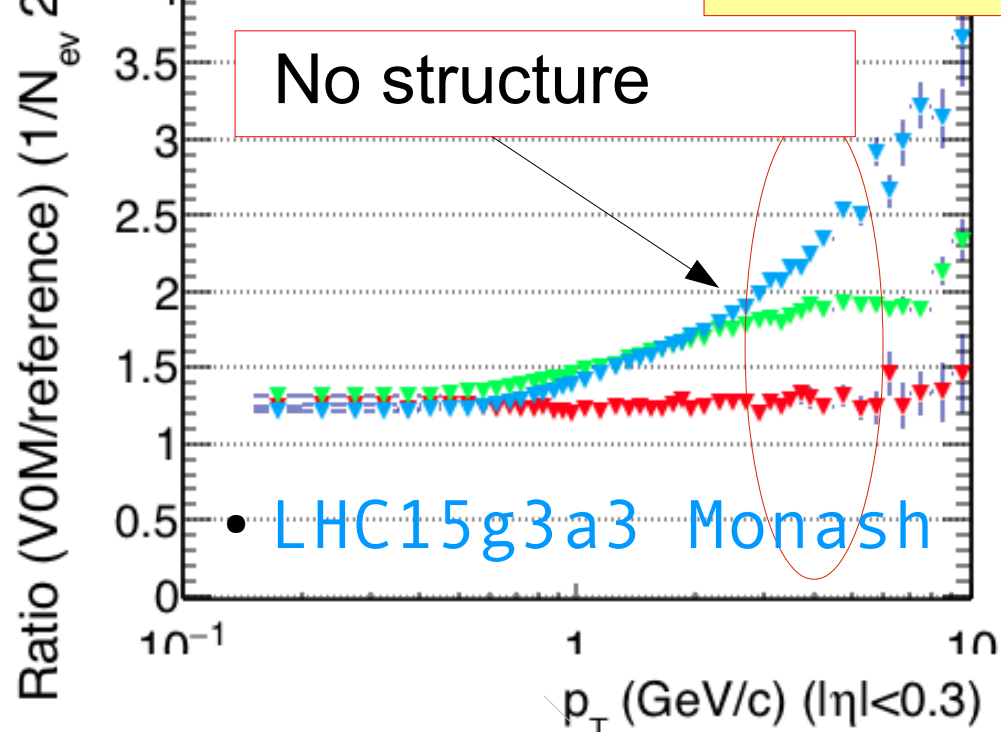
With All PU rejection



LAST presentation

What's wrong?

No structure

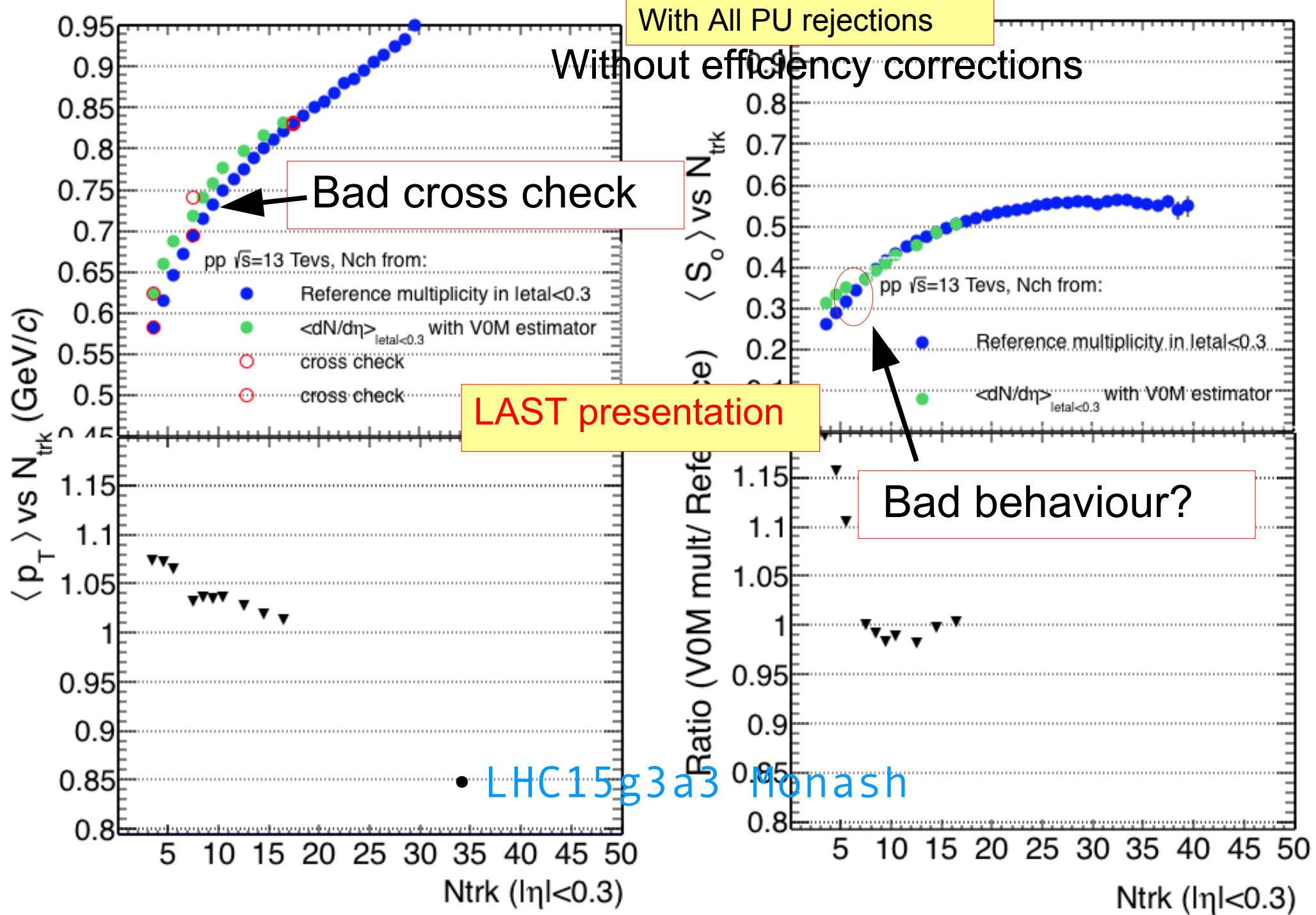


The Reason is that due to reconstruction Mean values have change

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

Need to rerun with the new mean values

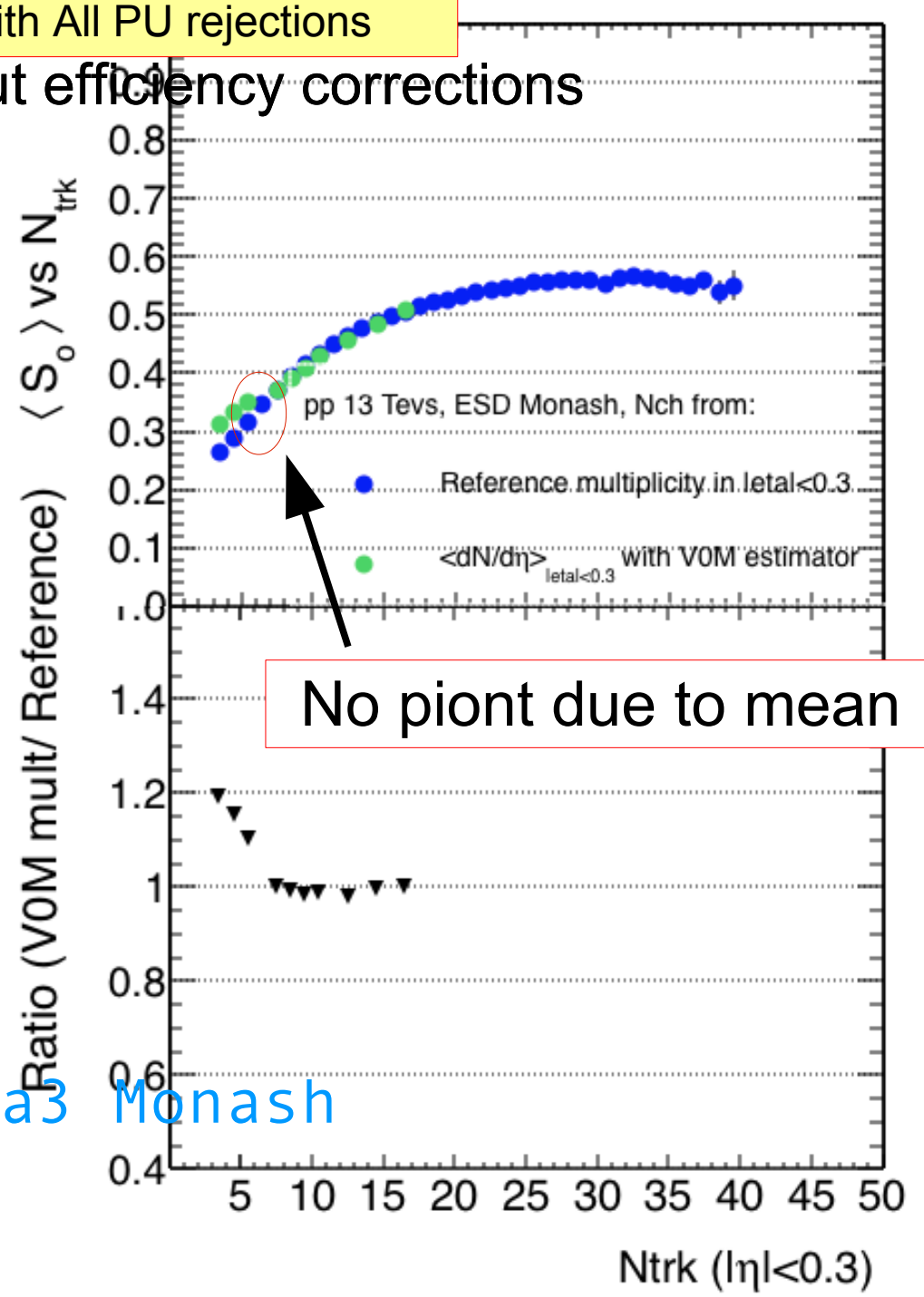
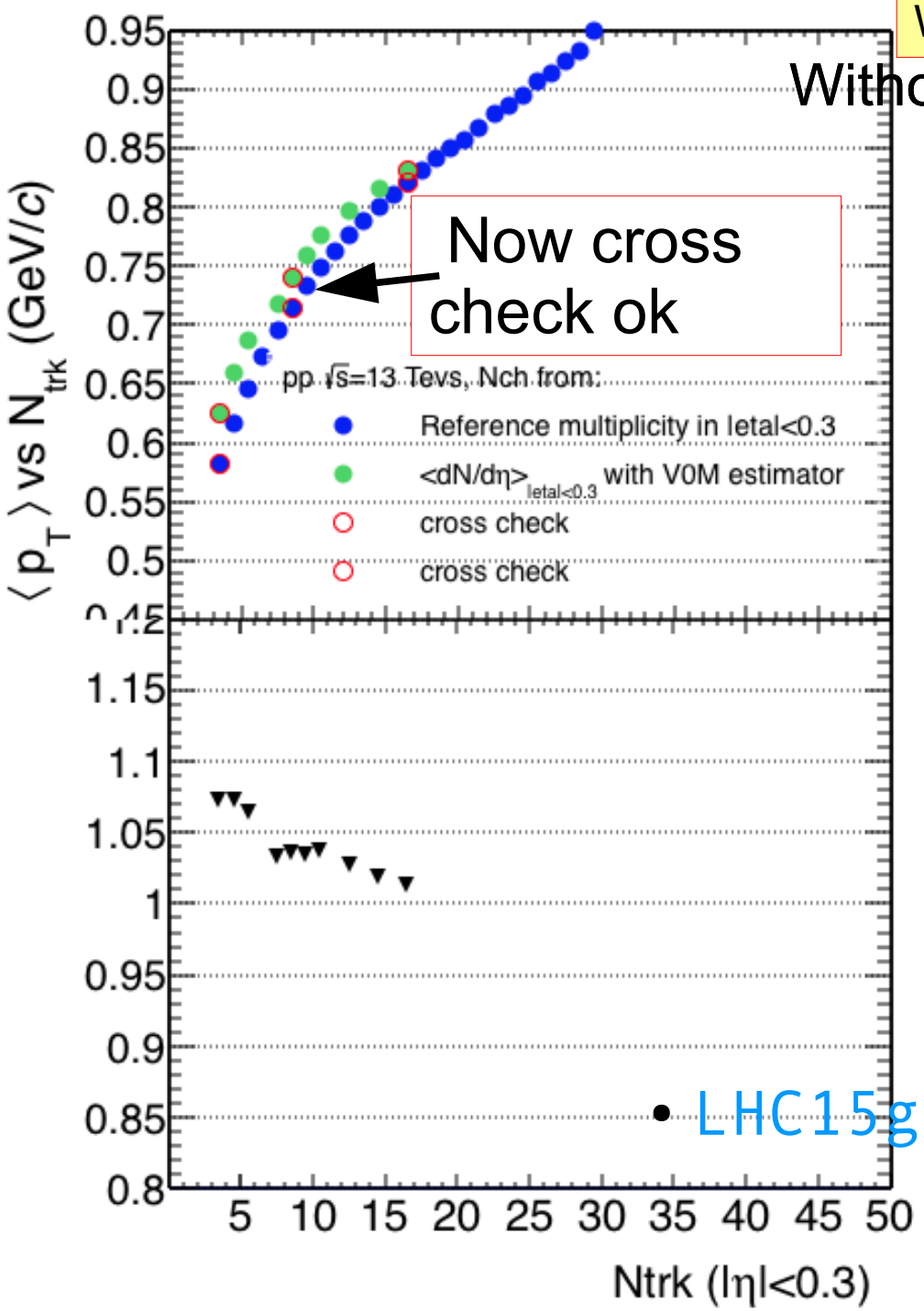
Monash Tune ESD $\langle P_T \rangle$ and S_0 for V0M and Ref



Monash Tune ESD $\langle P_T \rangle$ and S_0 for V0M and Ref

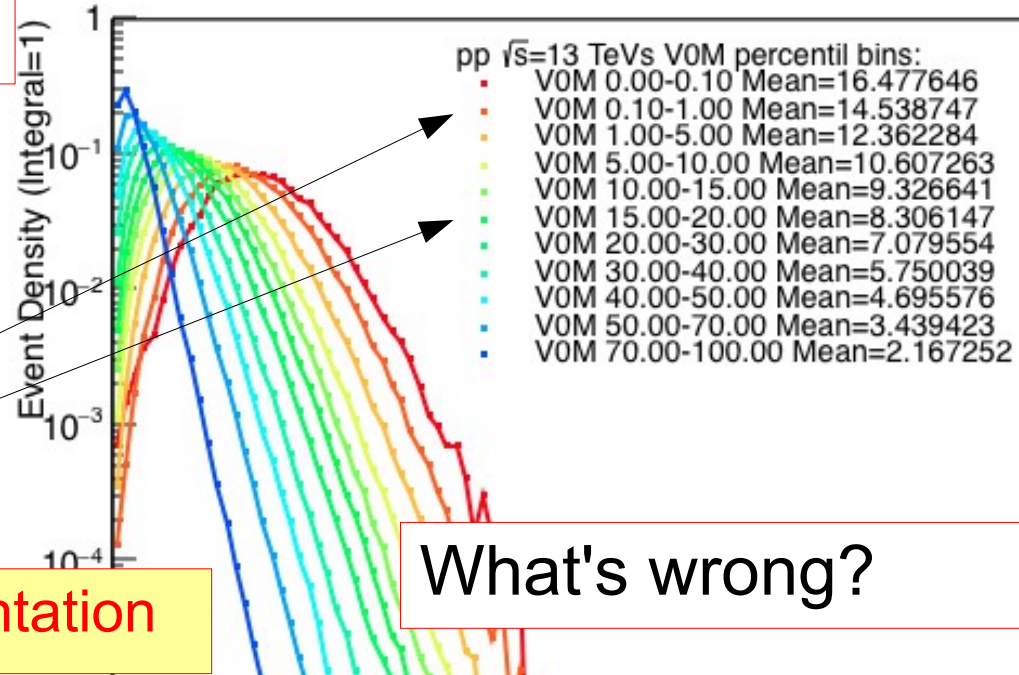
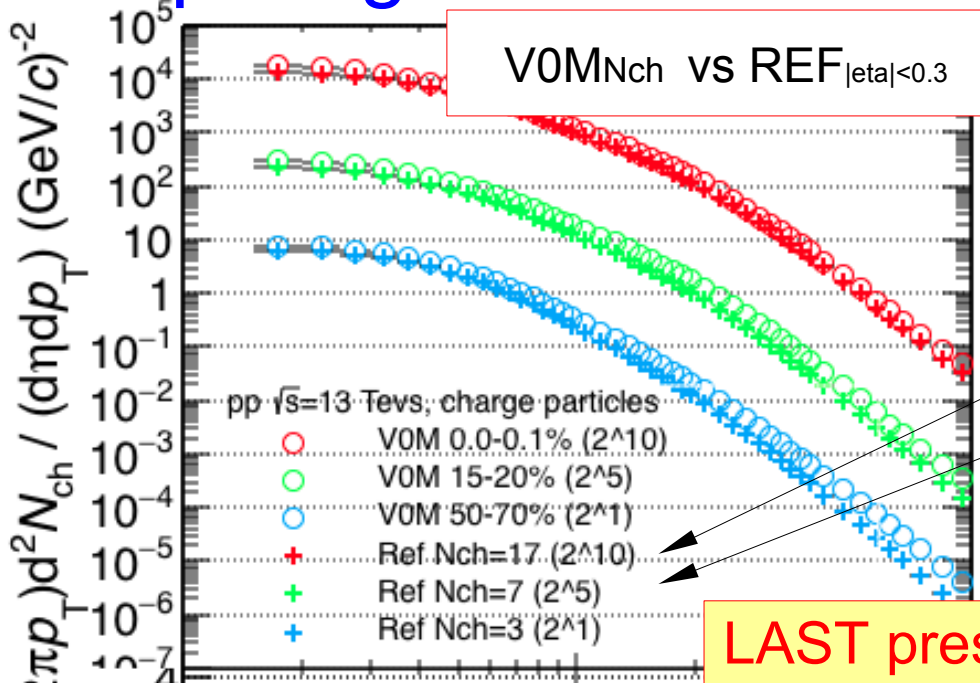
With All PU rejections

Without efficiency corrections



Comparing with V0M mult for Nch:

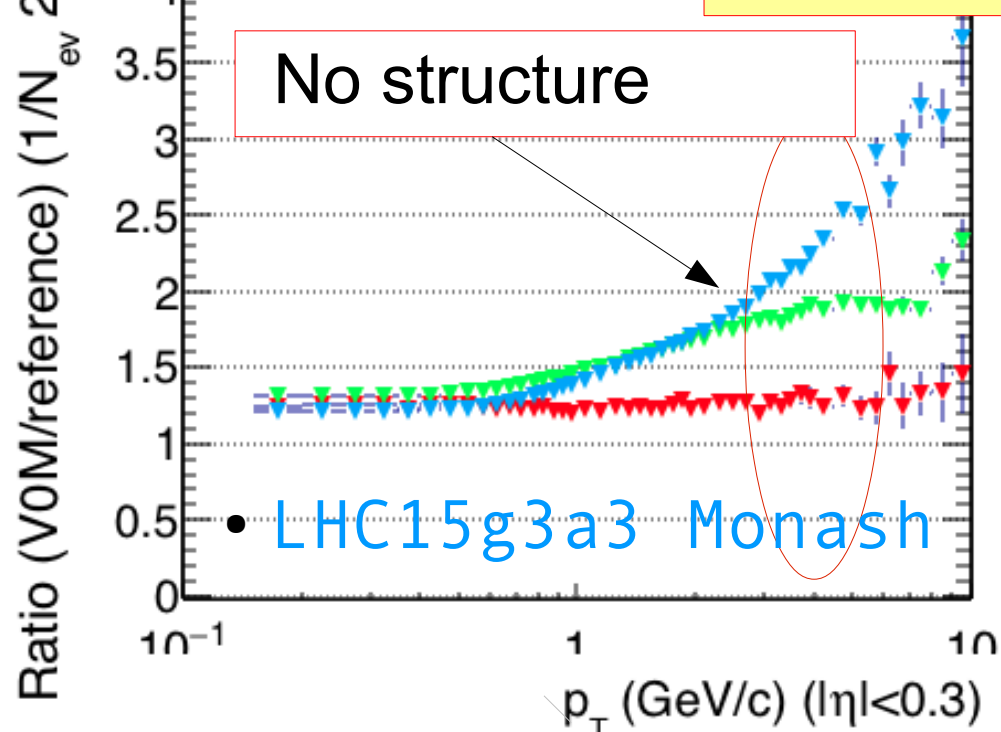
With All PU rejection



LAST presentation

What's wrong?

No structure



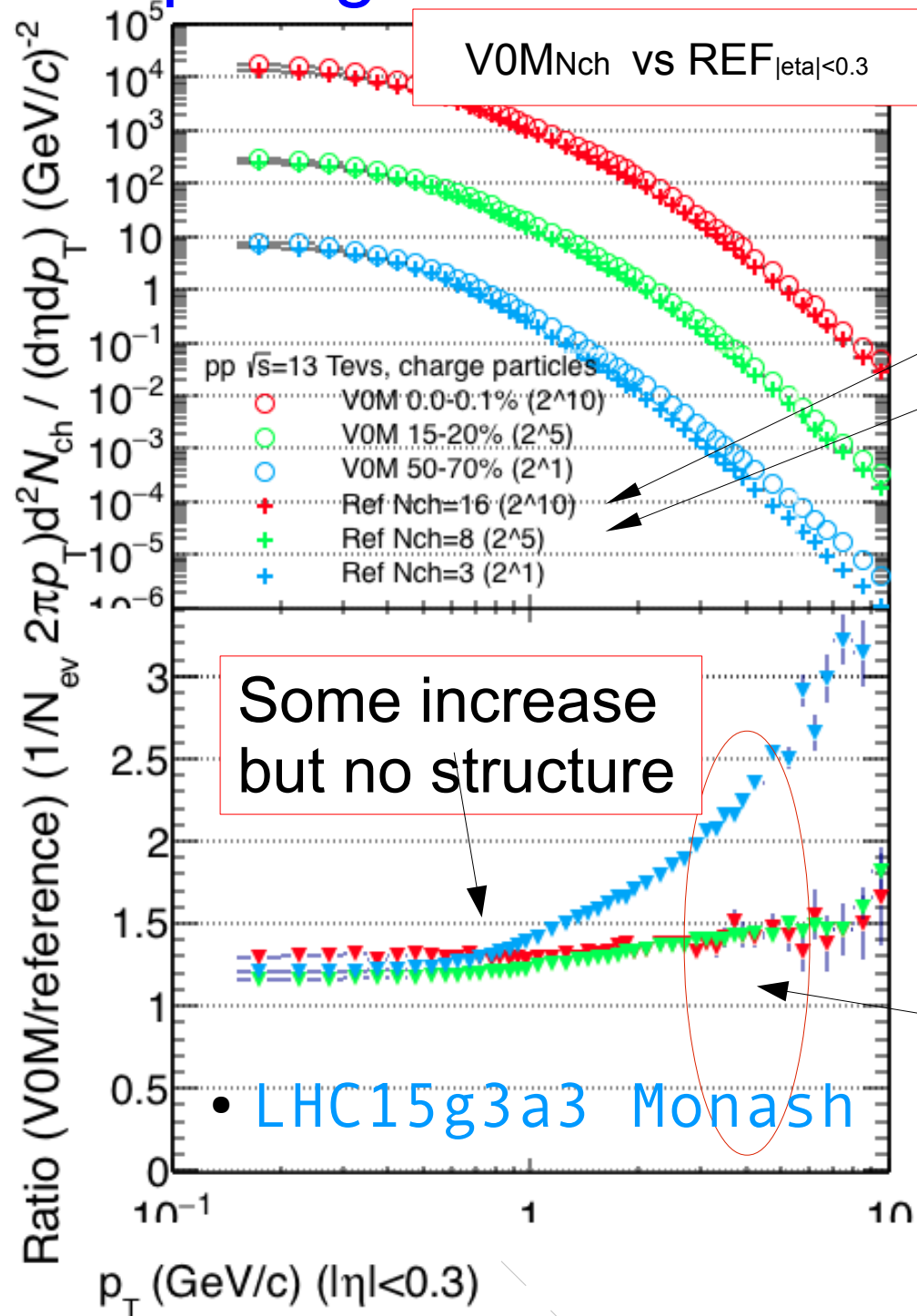
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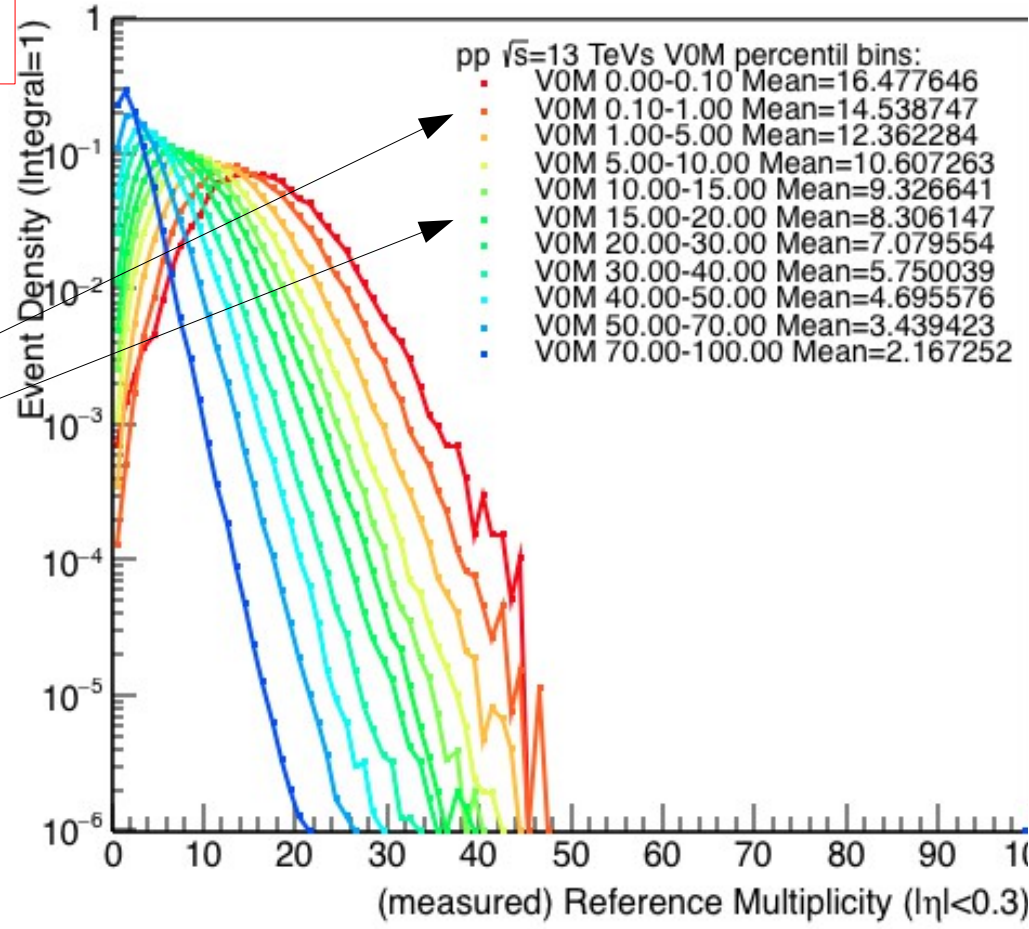
Comparing with V0M mult for Nch:

With All PU rejection



Some increase but no structure

LHC15g3a3 Monash



Maybe its due to MC, we are trying With Per11 (LHC15g3c3)

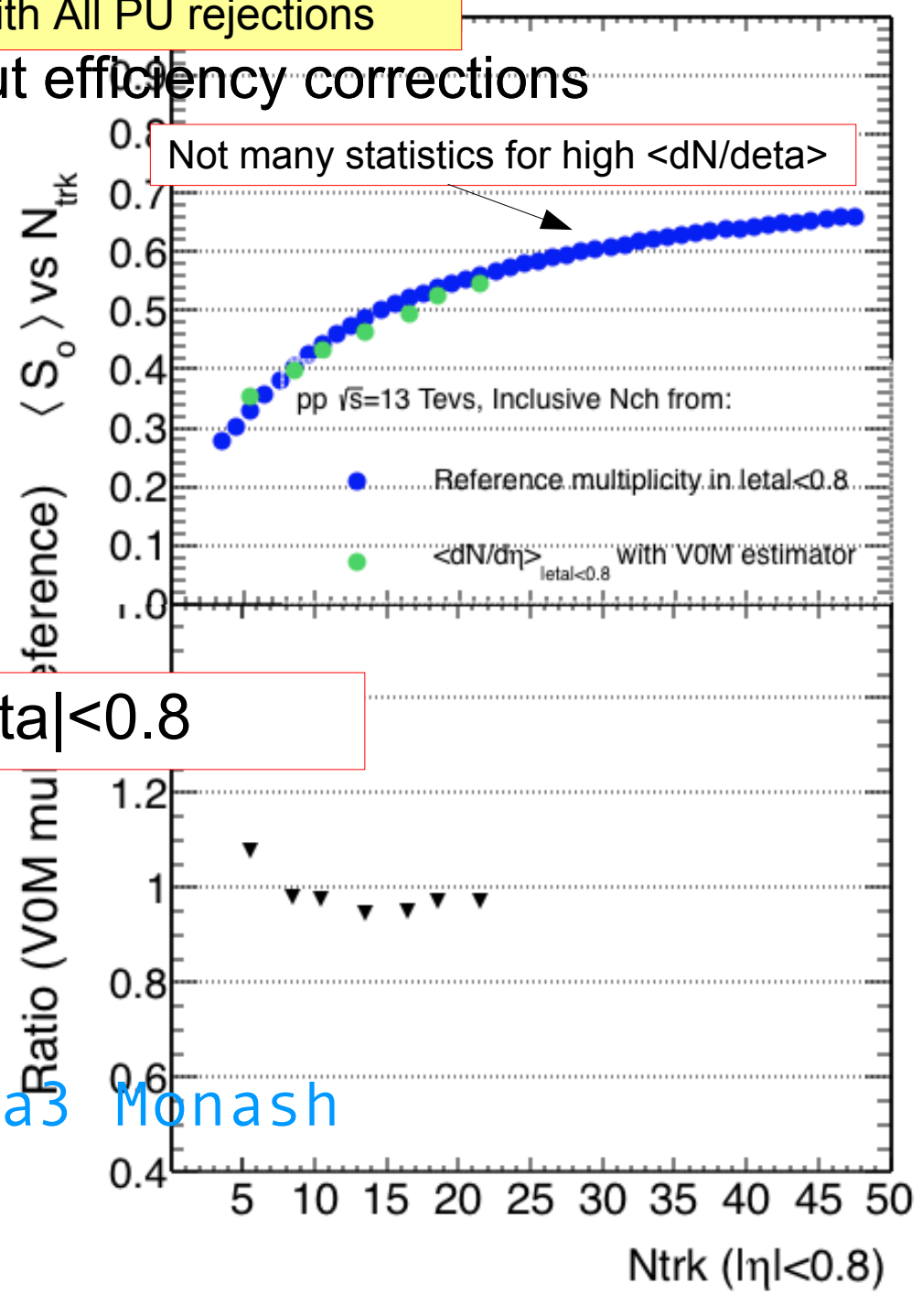
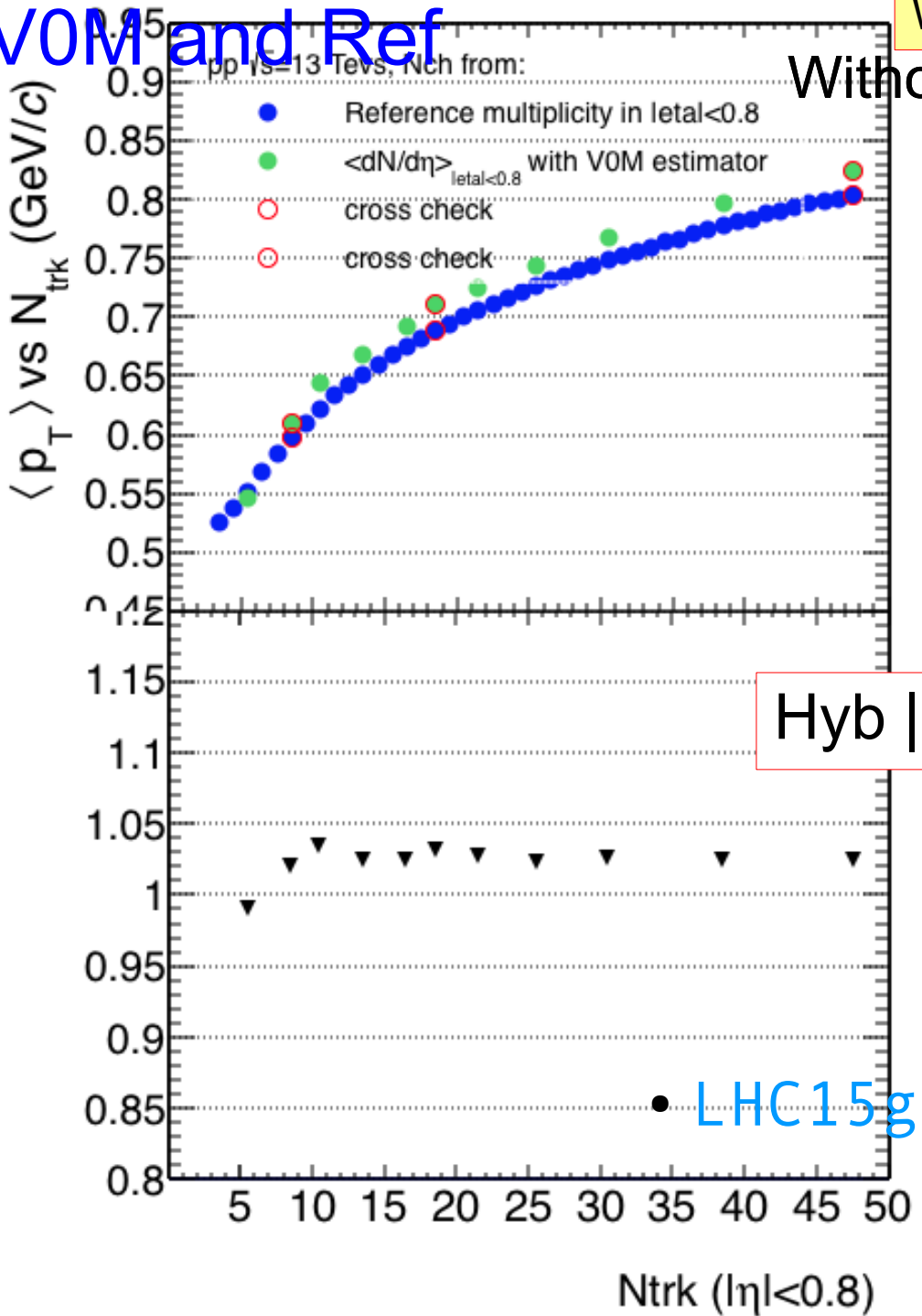
Some test ask for Antonio Monash Tune ESD $\langle P_T \rangle$

VOM and Ref

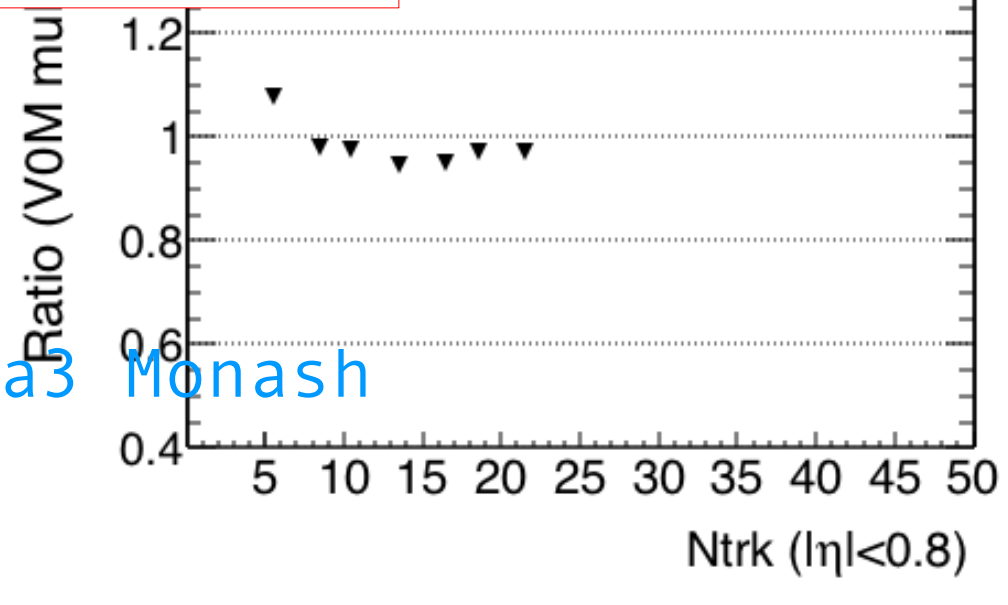
With All PU rejections

Without efficiency corrections

Not many statistics for high $\langle dN/d\eta \rangle$

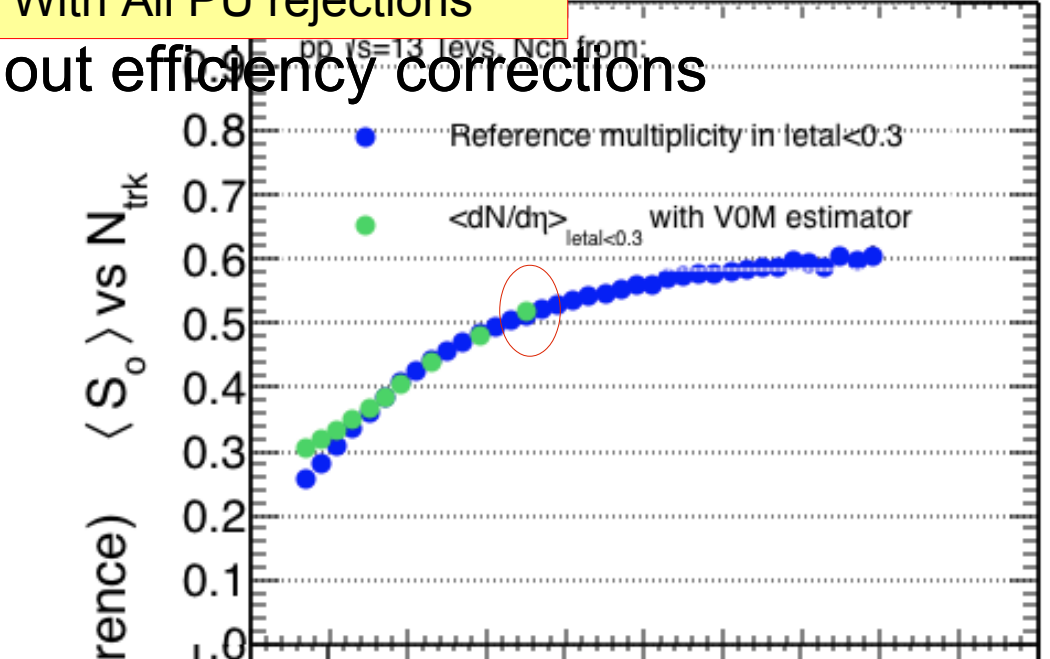
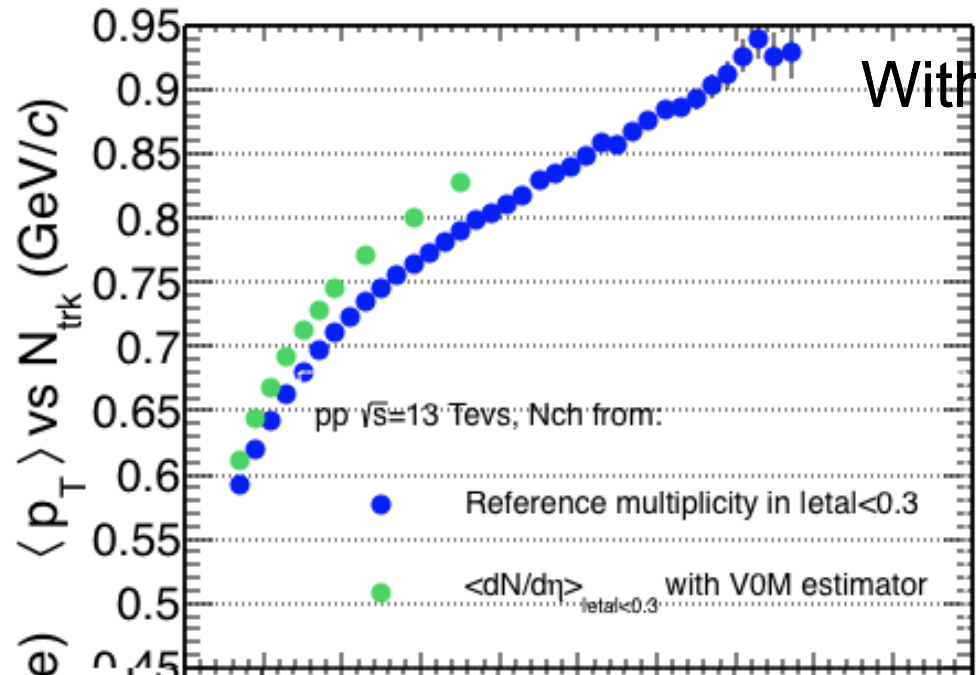


Hyb $|\eta|<0.8$

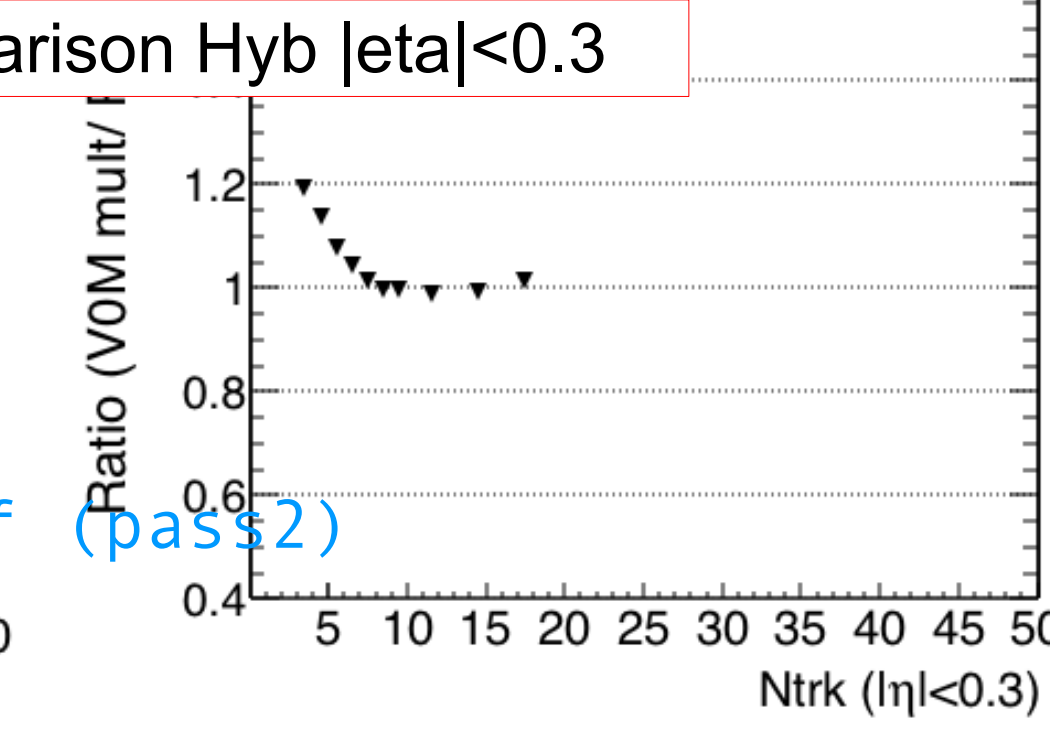
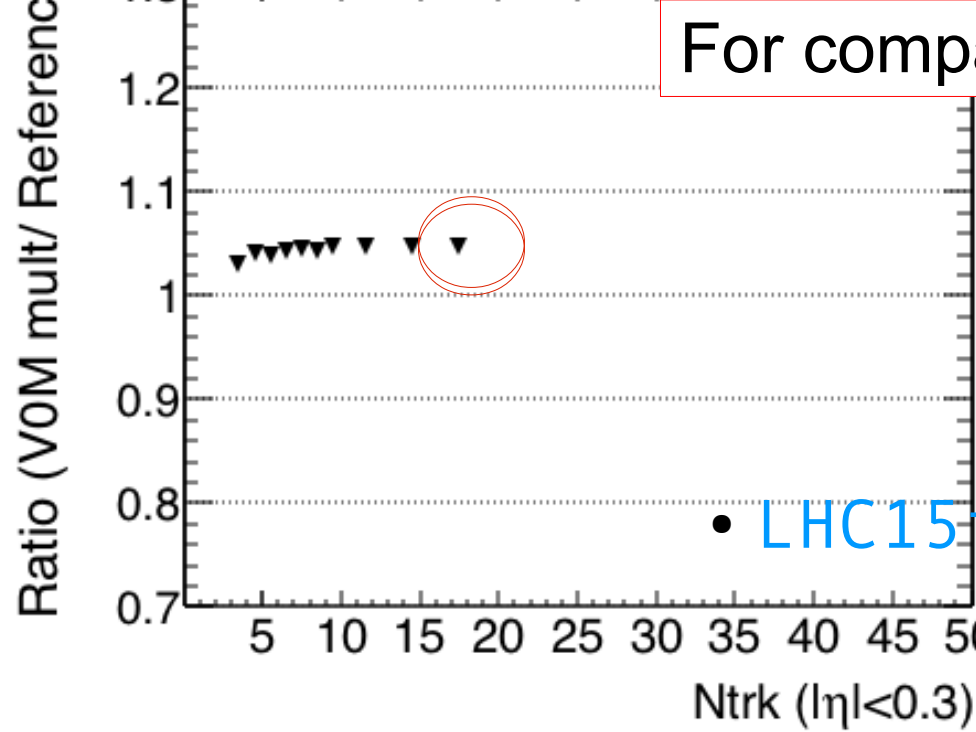


Last $\langle P_T \rangle$ and S_0 for V0M and Ref $|\eta| < 0.3$

With All PU rejections



For comparison Hyb $|\eta| < 0.3$

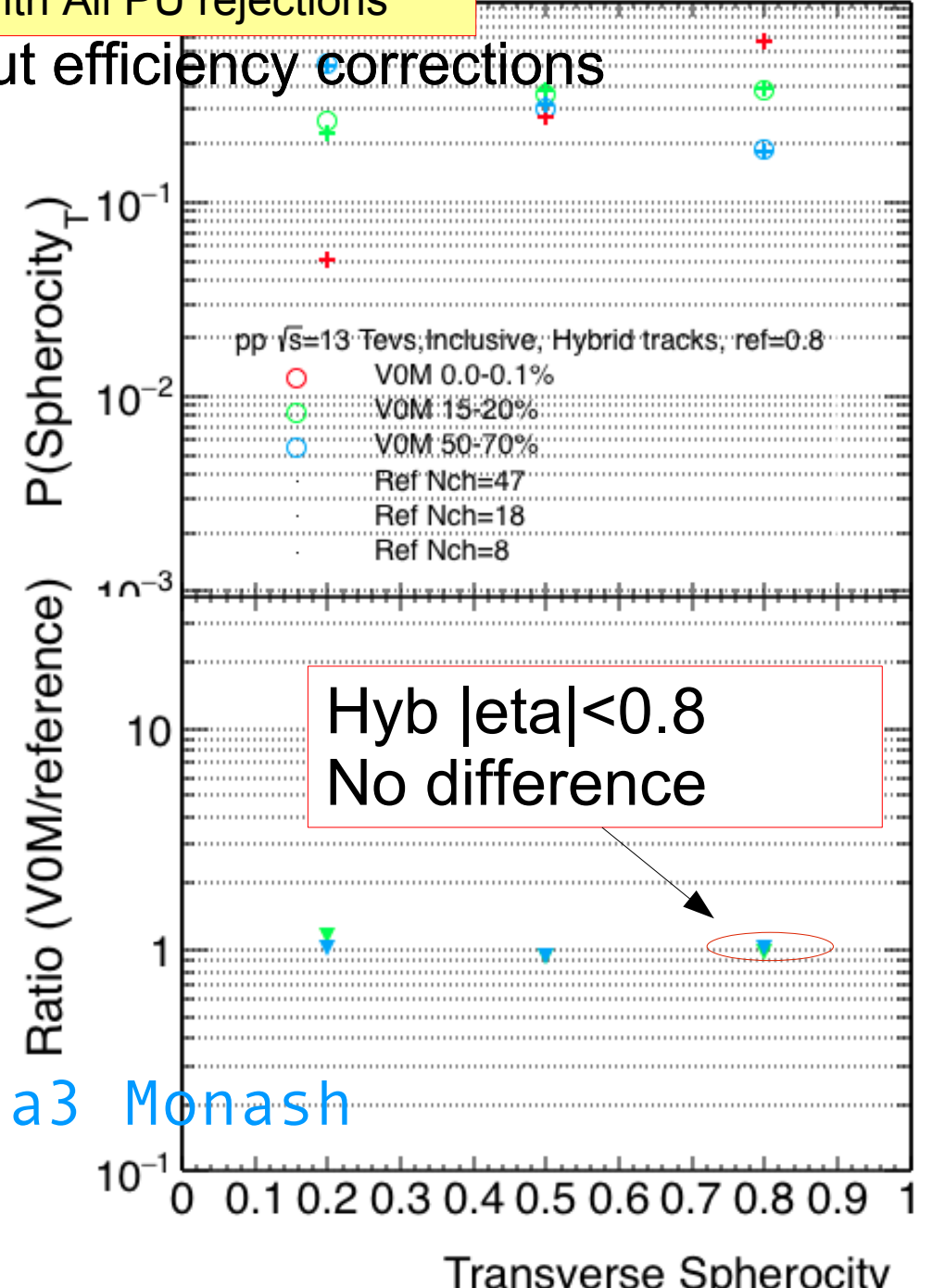
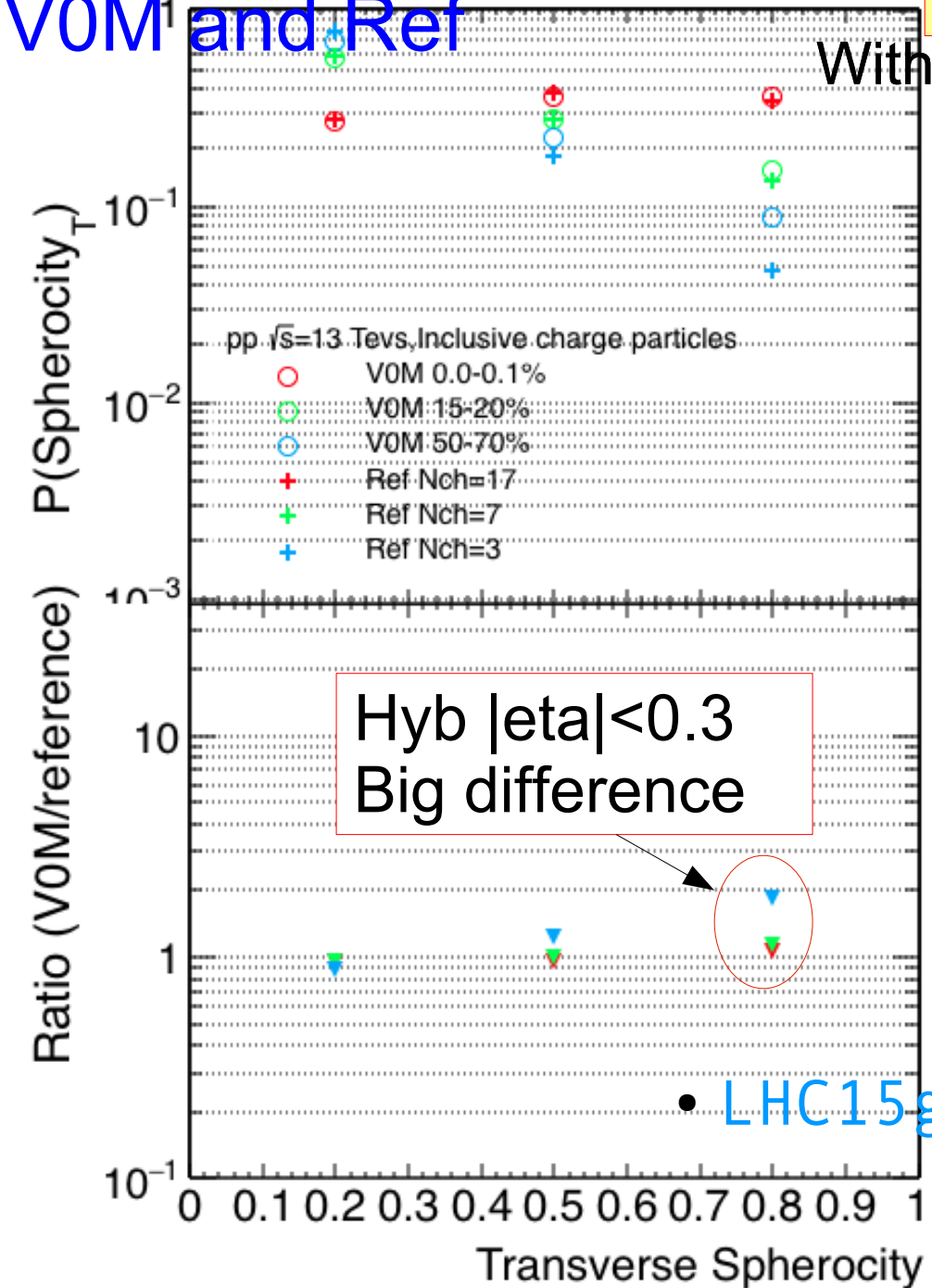


Some test ask for Antonio Monash Tune ESD $\langle P_T \rangle$

VOM and Ref

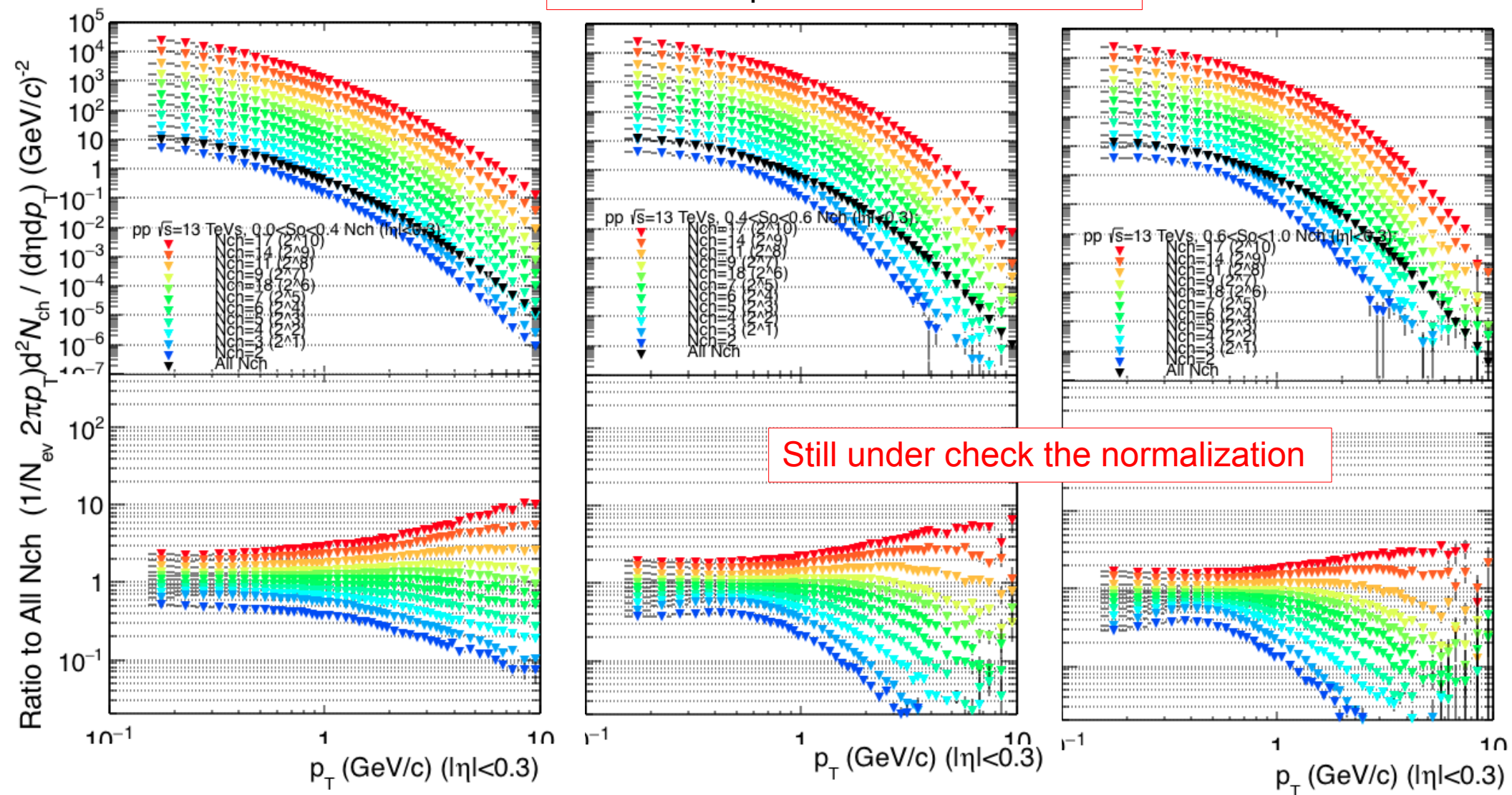
With All PU rejections

Without efficiency corrections



For DATA Comparing for REF estimator $|\eta| < 0.3$ For Sphericity bins

Normalization was done with events for each shape and Nch classes



Still under check the normalization

$0 < S_0 < 0.4$

$0.4 < S_0 < 0.6$

$0.6 < S_0 < 1$

Summary

For MC:

- The correction are done due to the change in the $\langle dN/d\eta \rangle_{|\eta|<0.3}$
- The request of wider region $|\eta|<0.8$, was getted

To be done:

- Check in data normalization for REF in S_0 bins.
- To check now ESDMC pythiaPer11

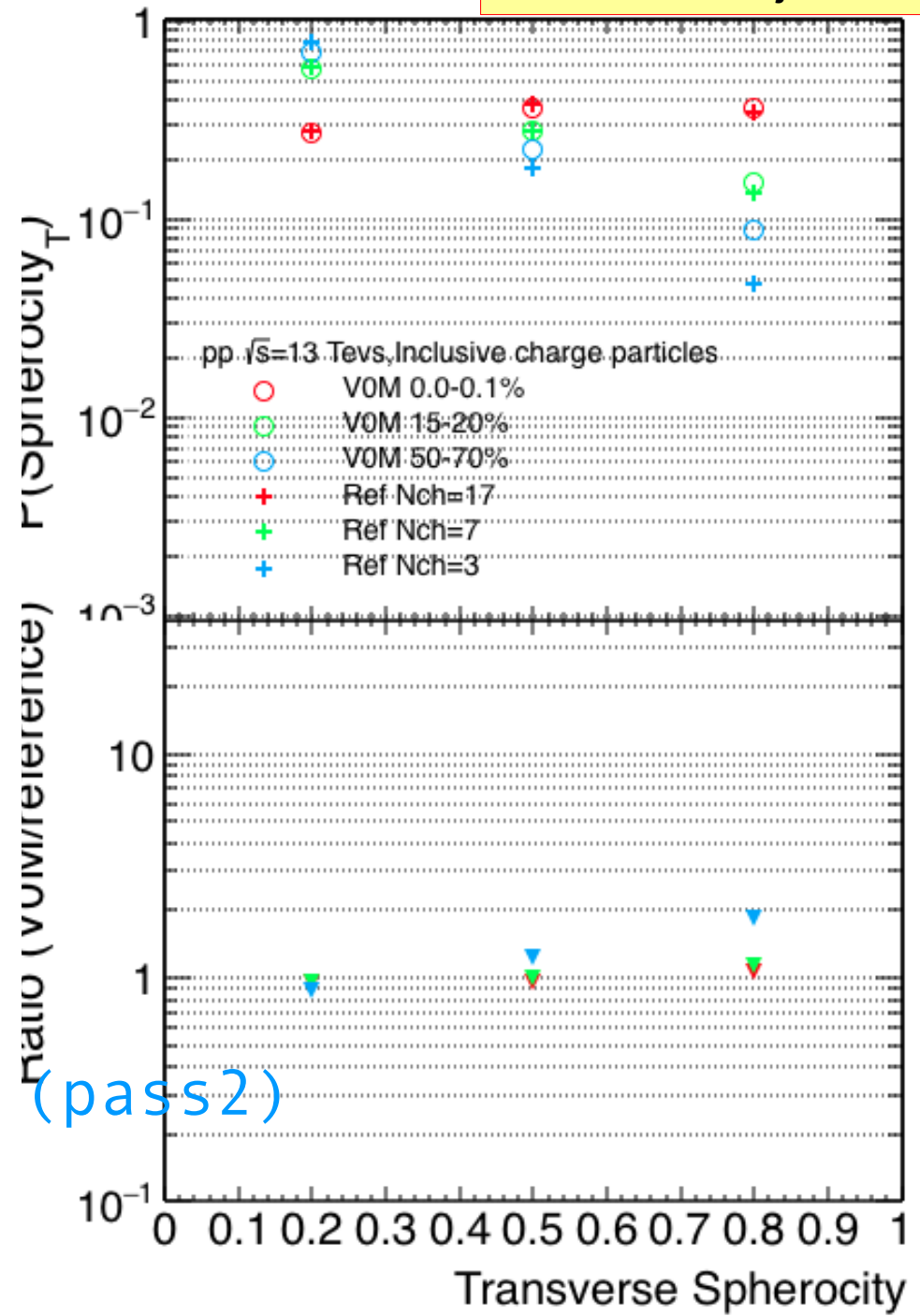
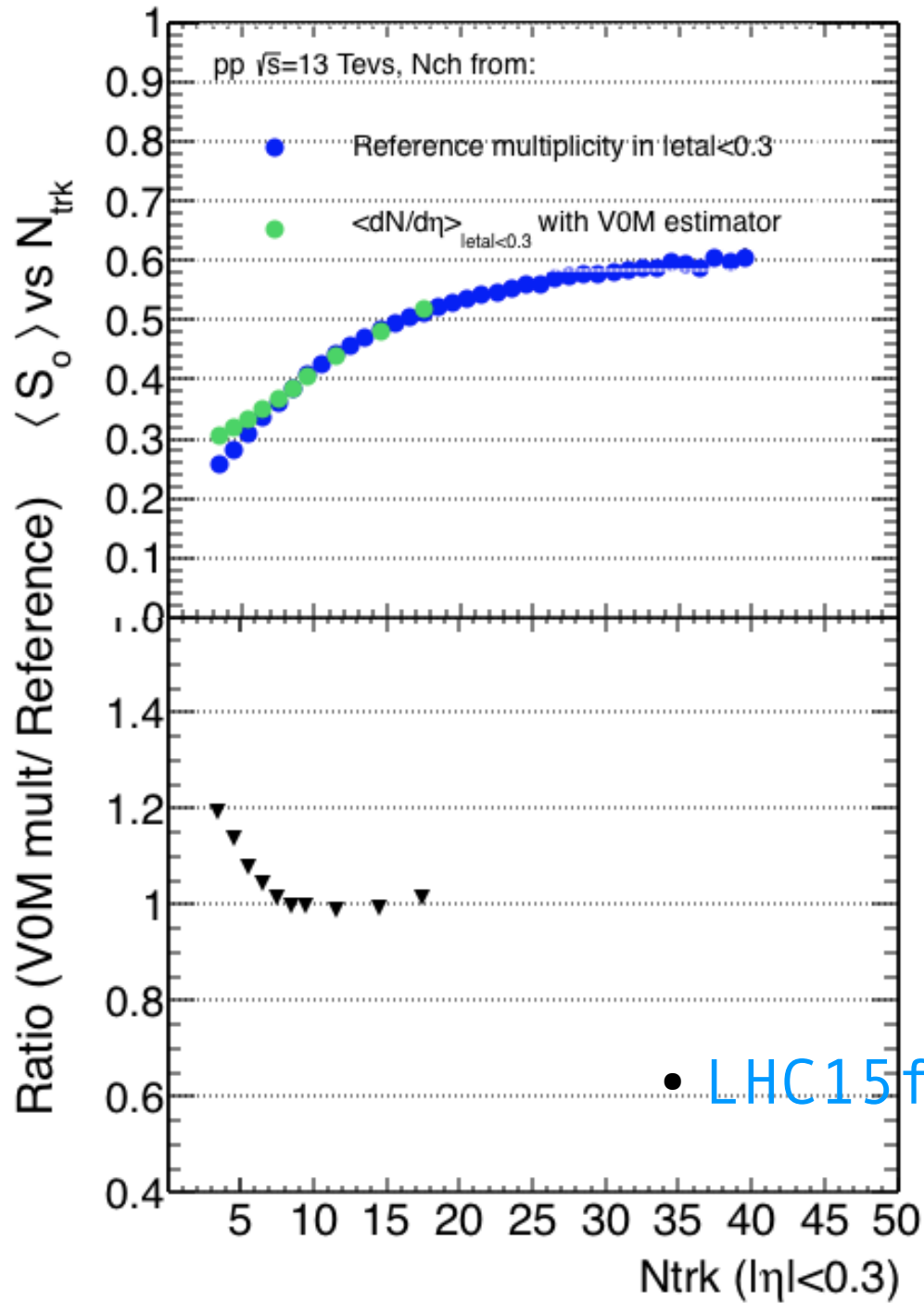
Thank you!

Back Up

Sphericity Analysis for V0M and Ref | $\eta_{\text{trk}} < 0.3$

Without efficiency corrections

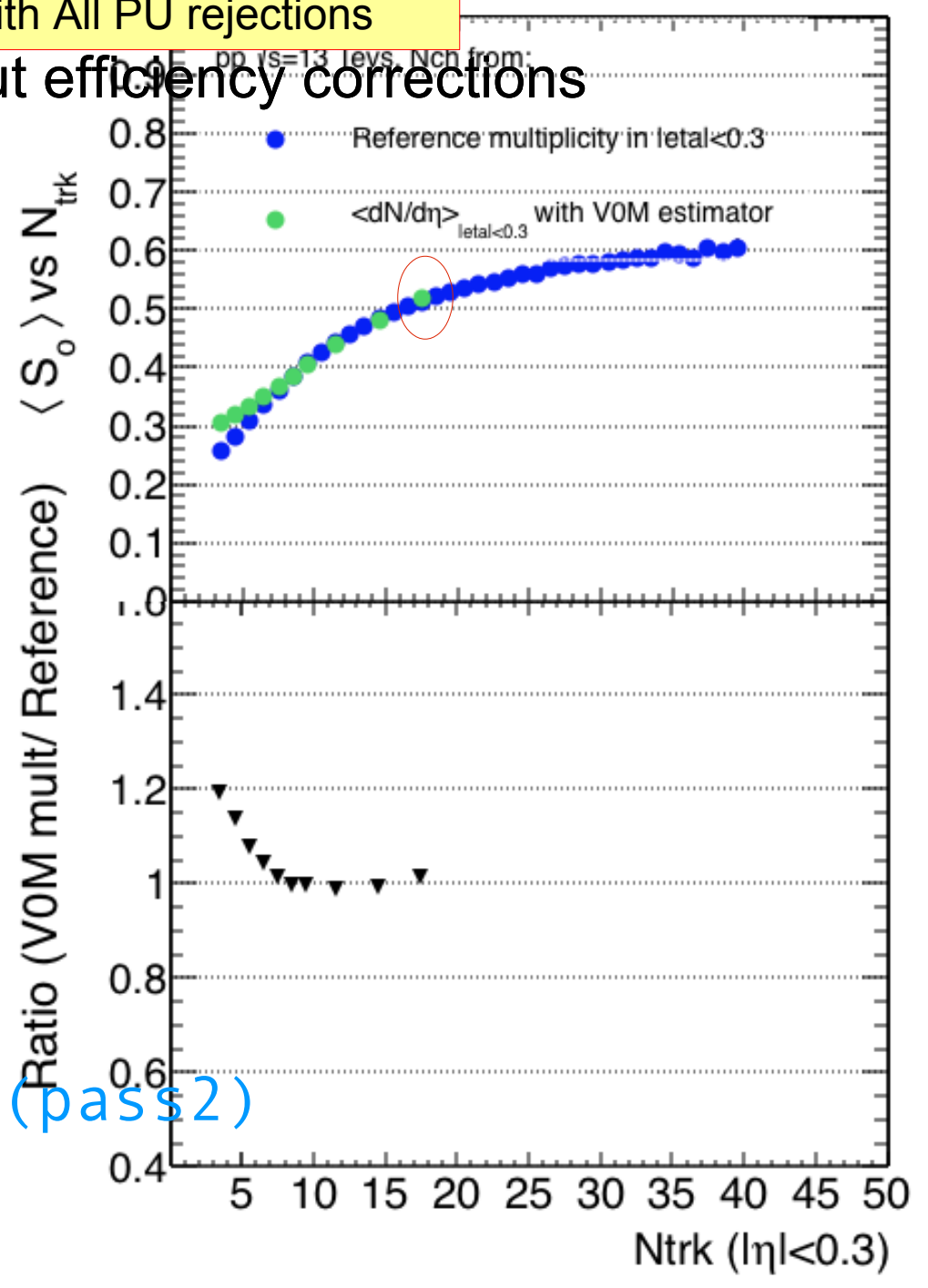
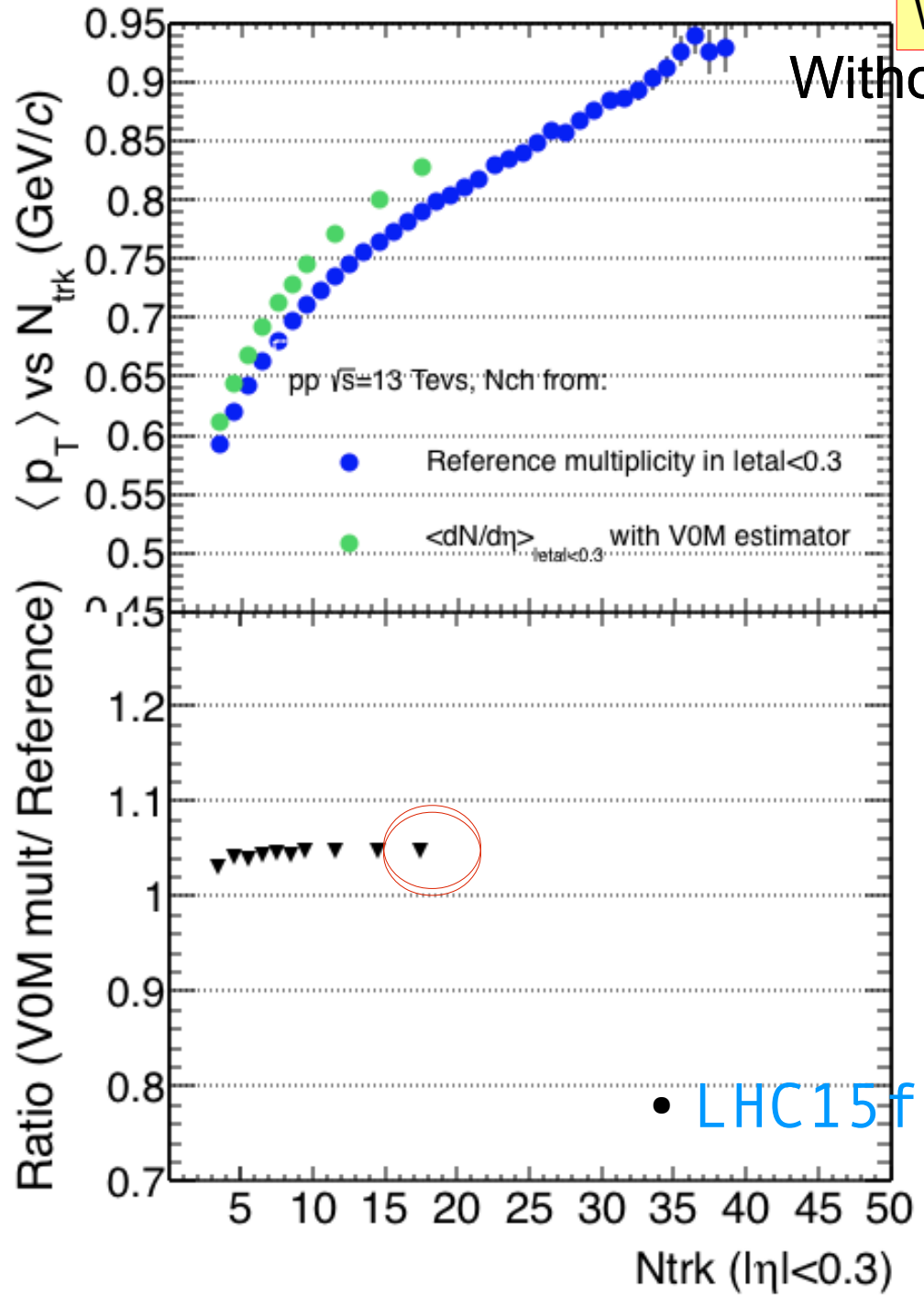
With All PU rejections



$\langle P_T \rangle$ and S_0 for V0M and Ref $|\eta| < 0.3$

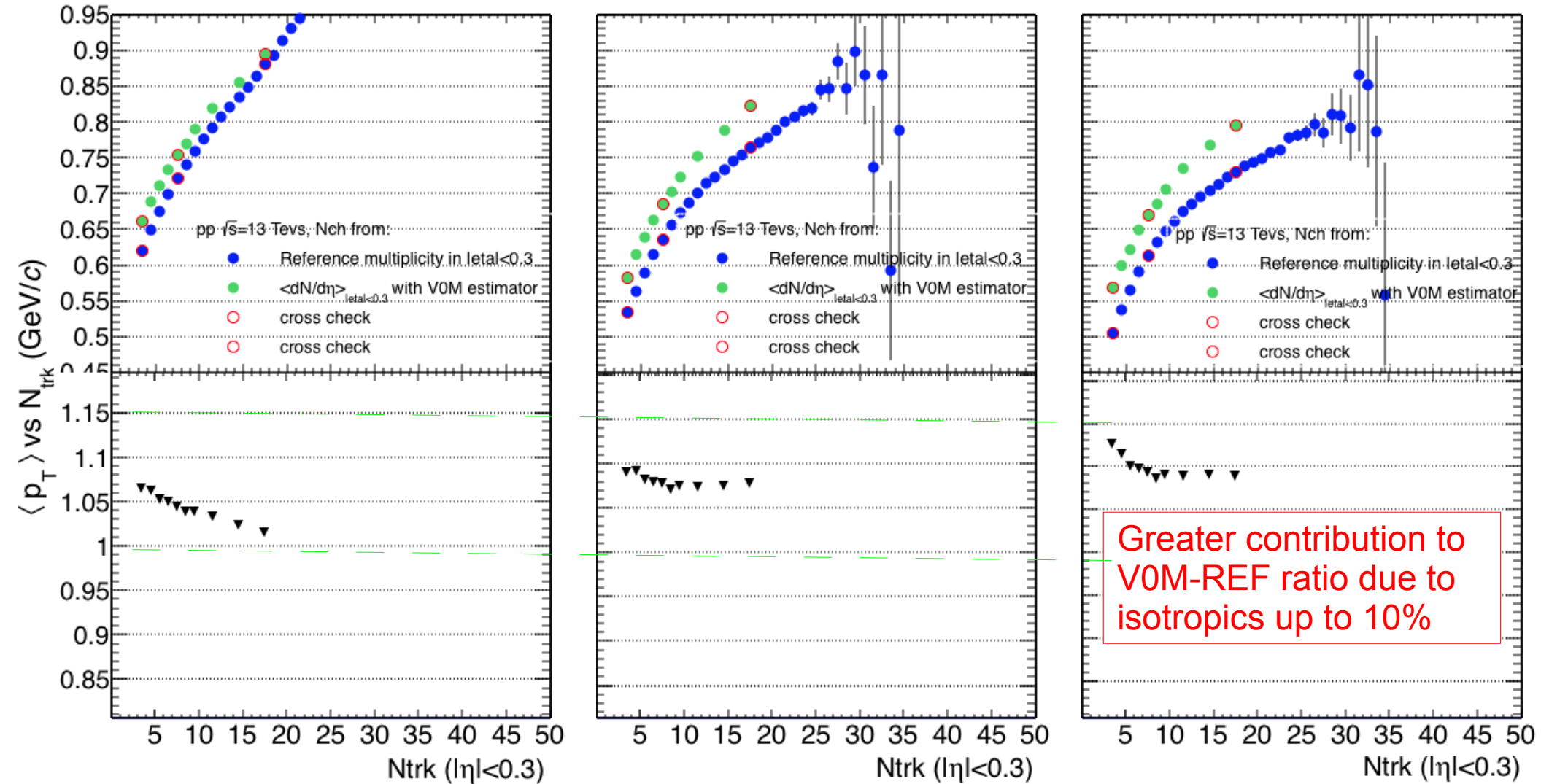
With All PU rejections

Without efficiency corrections



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

Without efficiency corrections



0 < So < 0.4

0.4 < So < 0.6

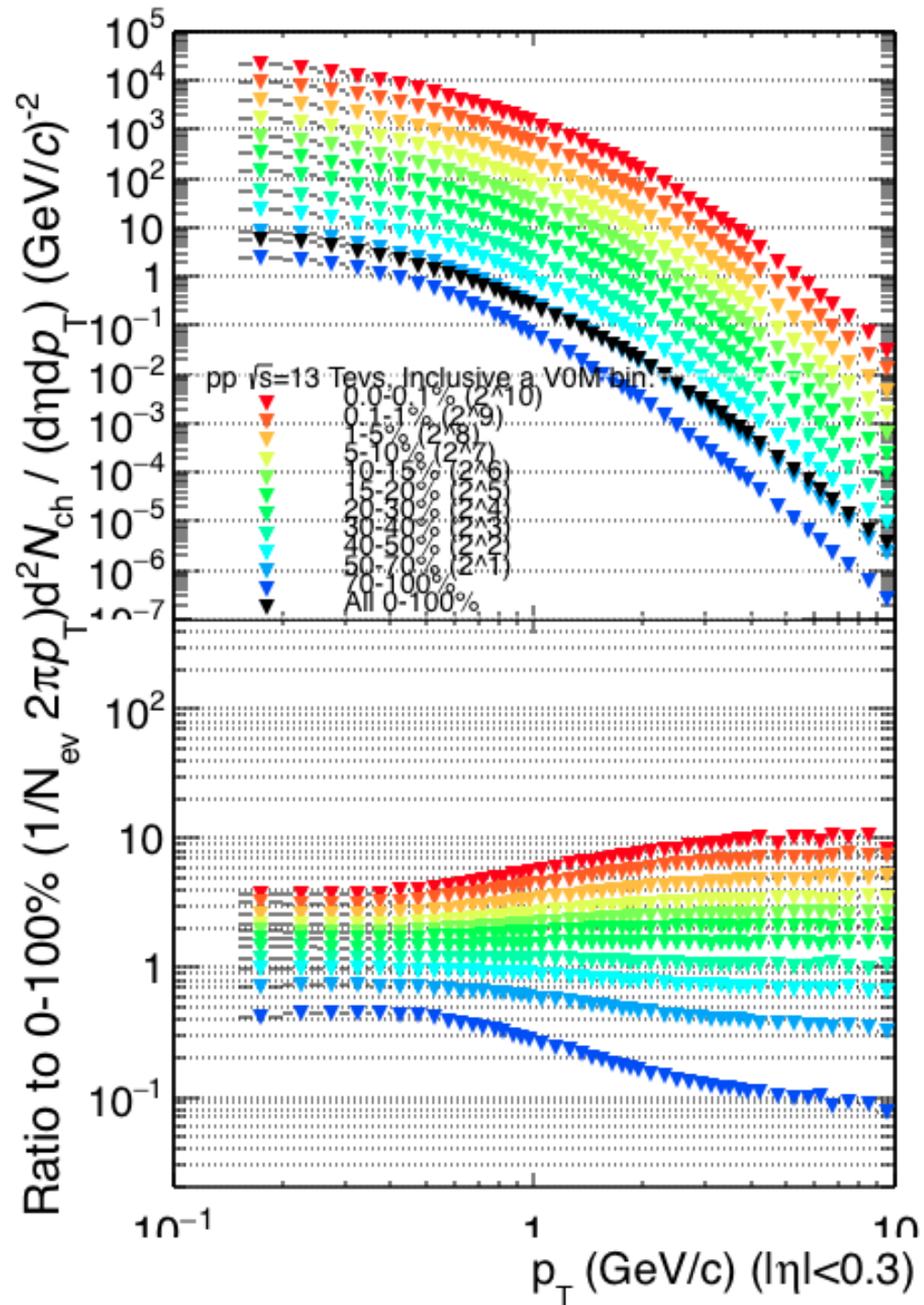
0.6 < So < 1

Hèctor Bello Martínez

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

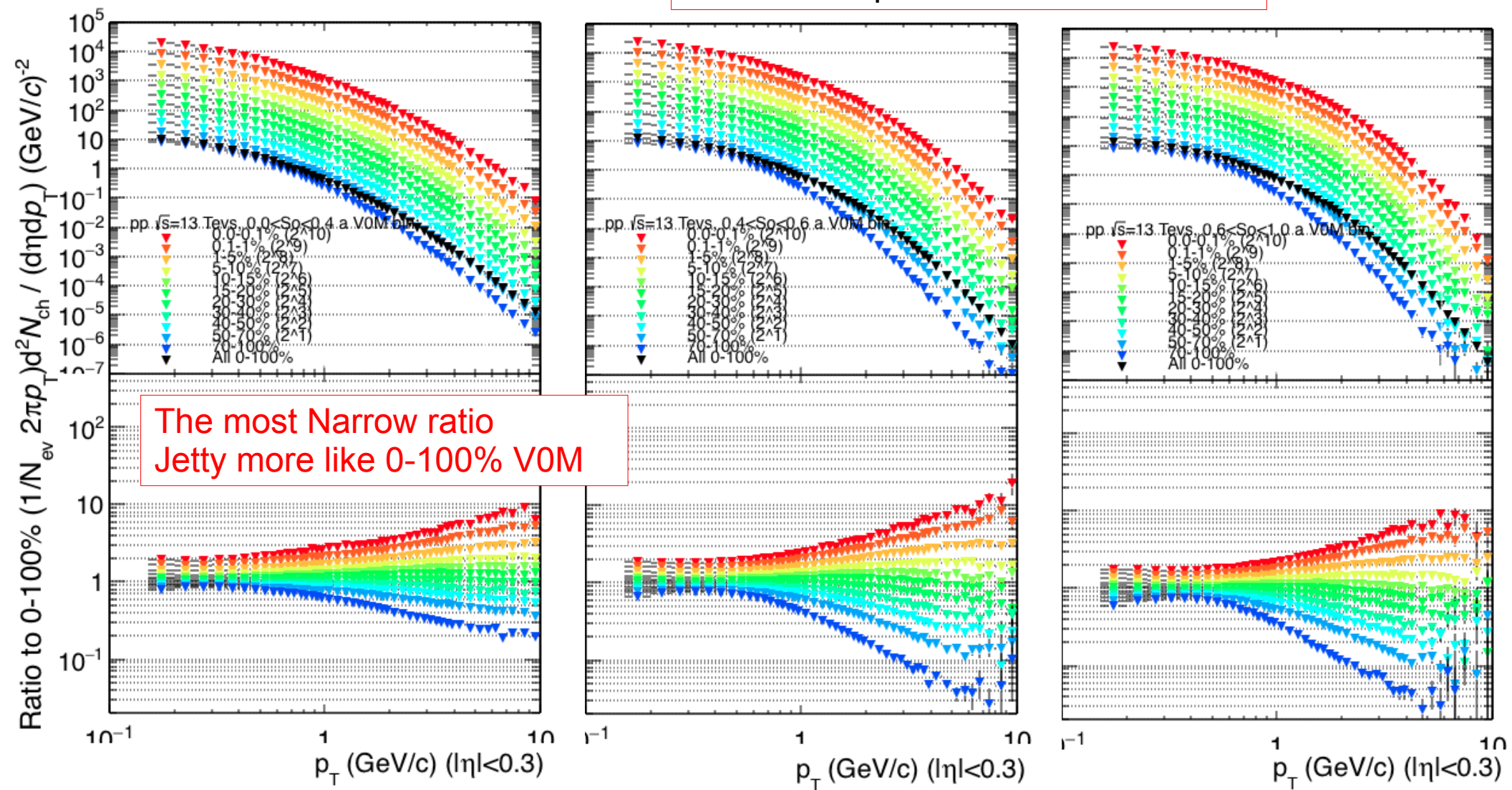
Comparing for V0M percentils and N_{ch} for its $\langle dN/d\eta \rangle$



With All PU rejection cuts

Comparing for V0M percentils and N_{ch} for its $\langle dN/d\eta \rangle$ For Sphericity bins

Normalization was done with events for each shape and V0M classes



The most Narrow ratio
Jetty more like 0-100% V0M

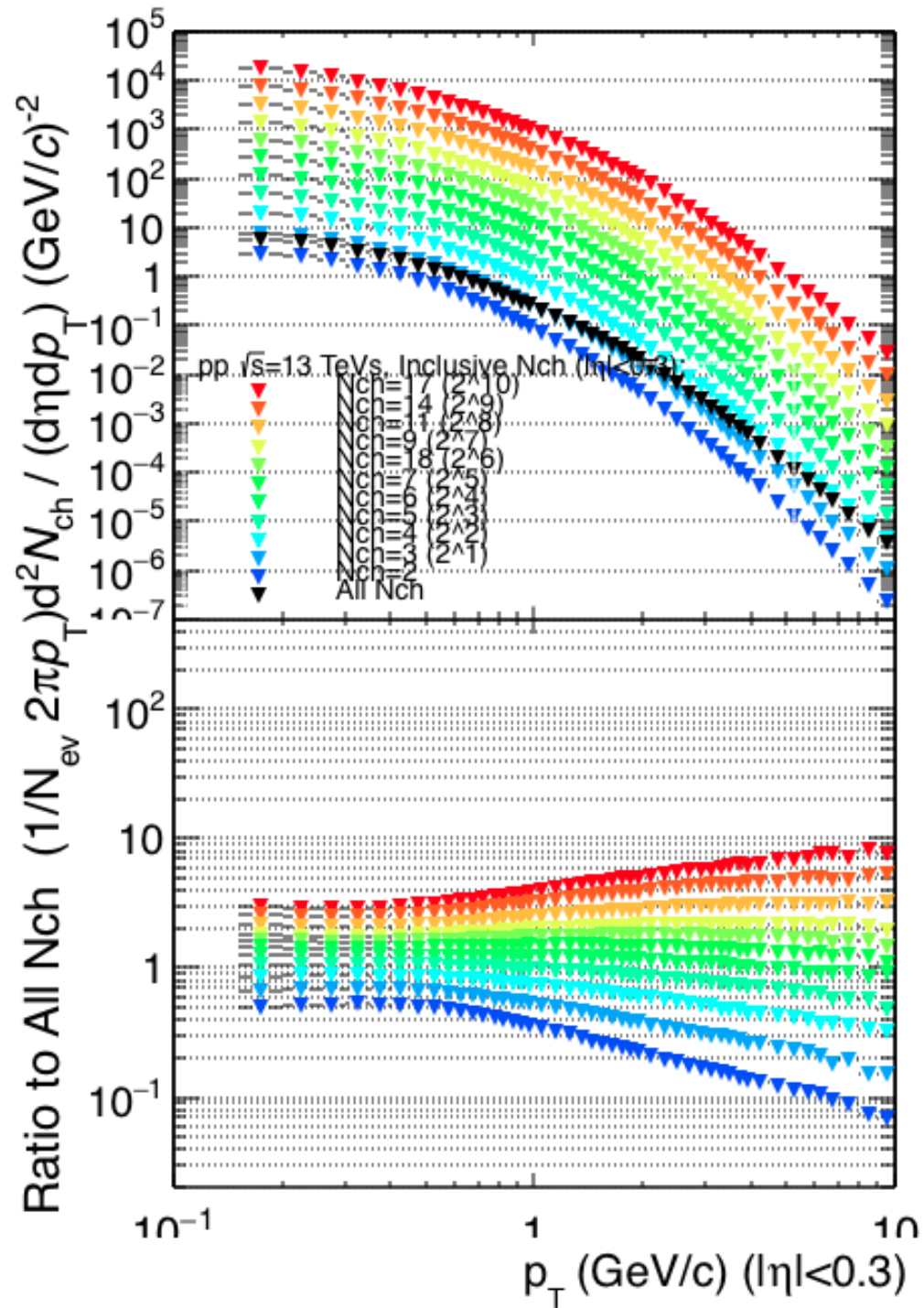
$0 < S_0 < 0.4$

$0.4 < S_0 < 0.6$

$0.6 < S_0 < 1.0$

Comparing for REF estimator $|\eta| < 0.3$

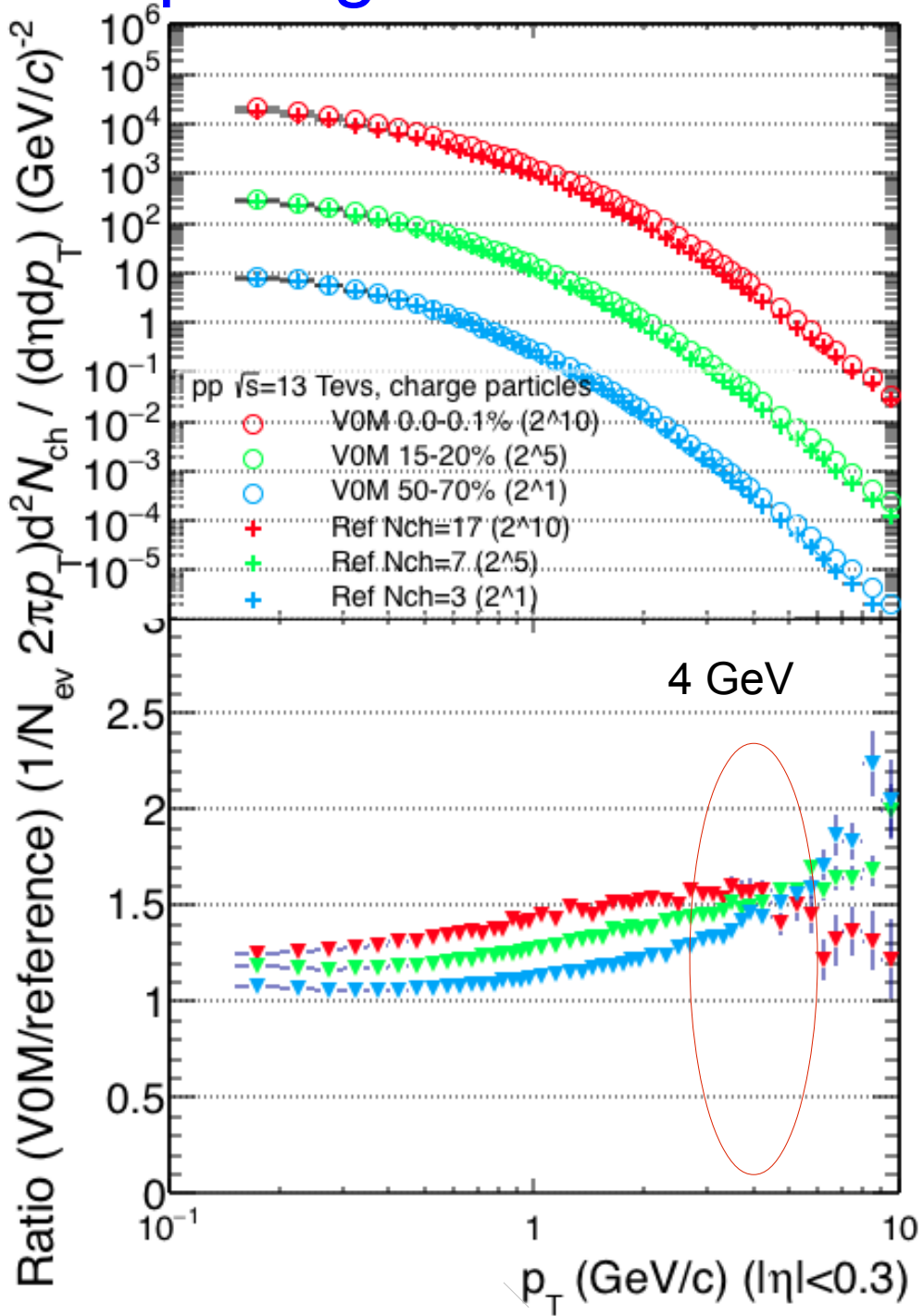
With All PU rejection cuts



Comparing with V0M mult for Nch:

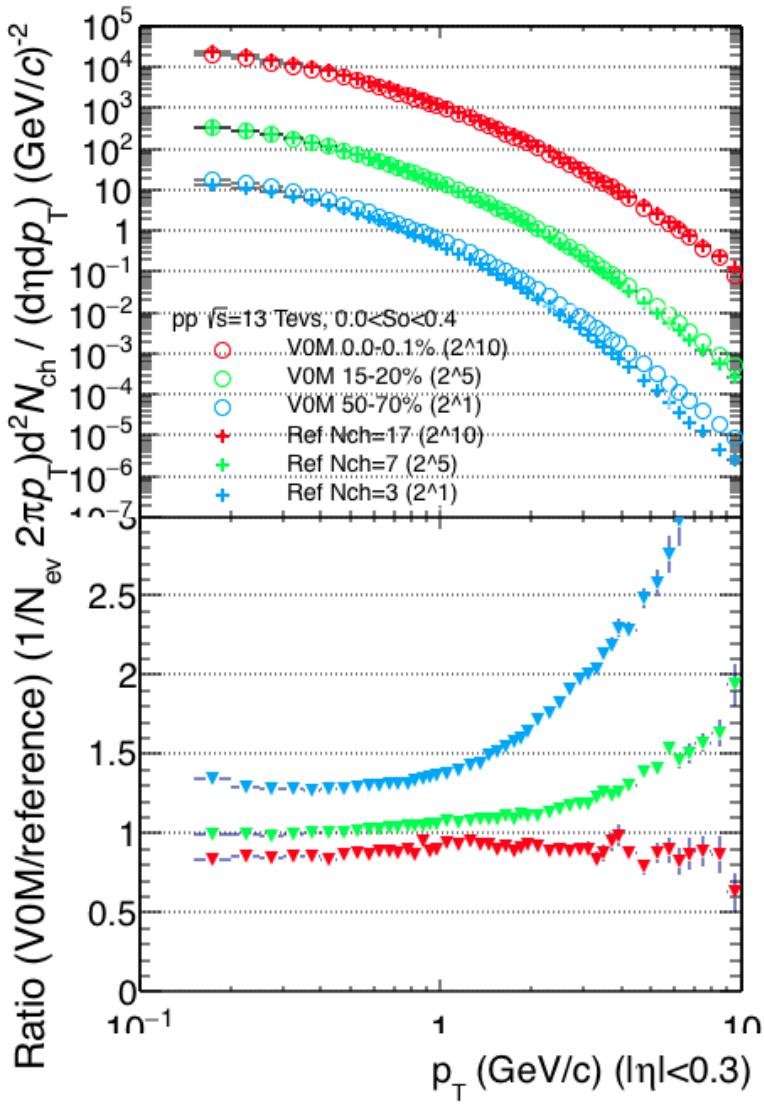
With All PU rejection

V0MNch vs REF_{|eta|<0.3}

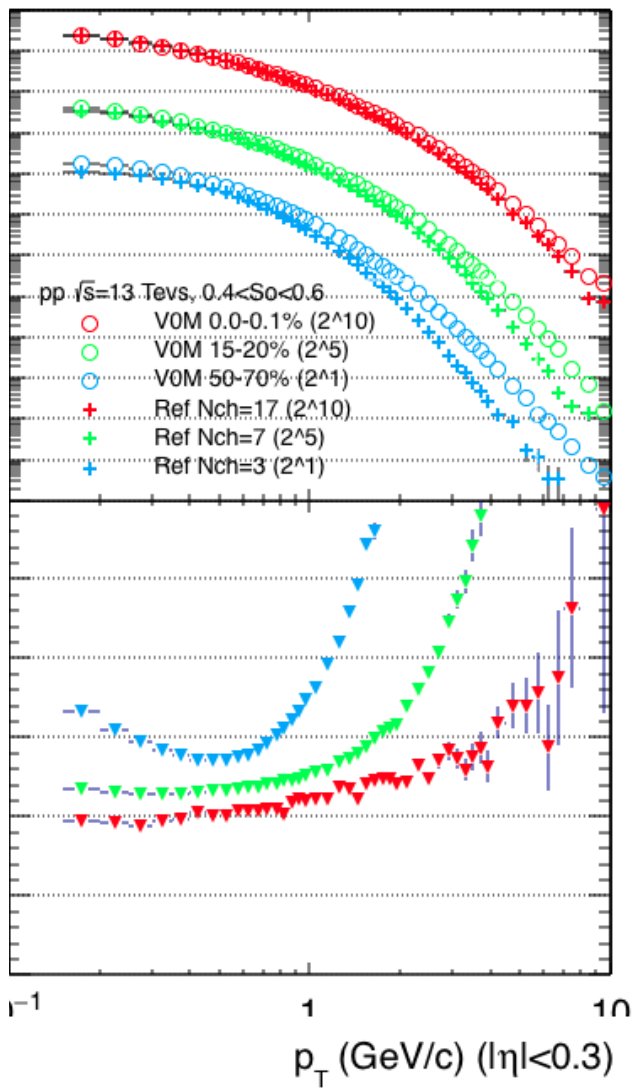


Comparing with V0M mult for Nch: For Sphericity bins

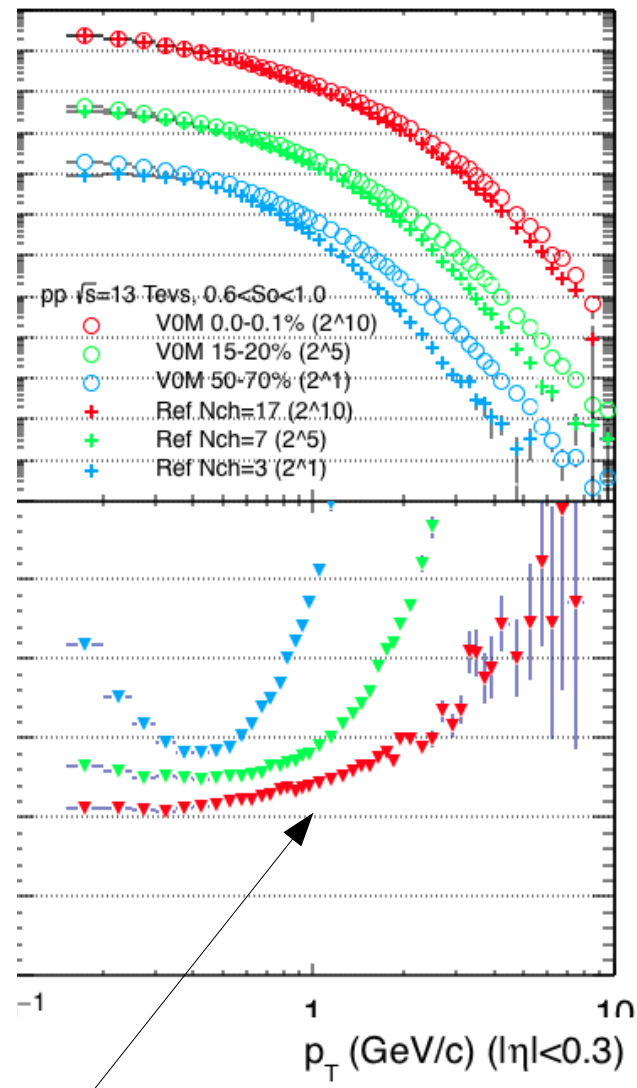
Under events normalization
check for REF



$0 < S_0 < 0.4$



$0.4 < S_0 < 0.6$



$0.6 < S_0 < 1$

Structure seems broken, but big ratio still for isotropic as in $\langle p_T \rangle$

Events in V0M Multiplicity classes

With BG rejection:

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

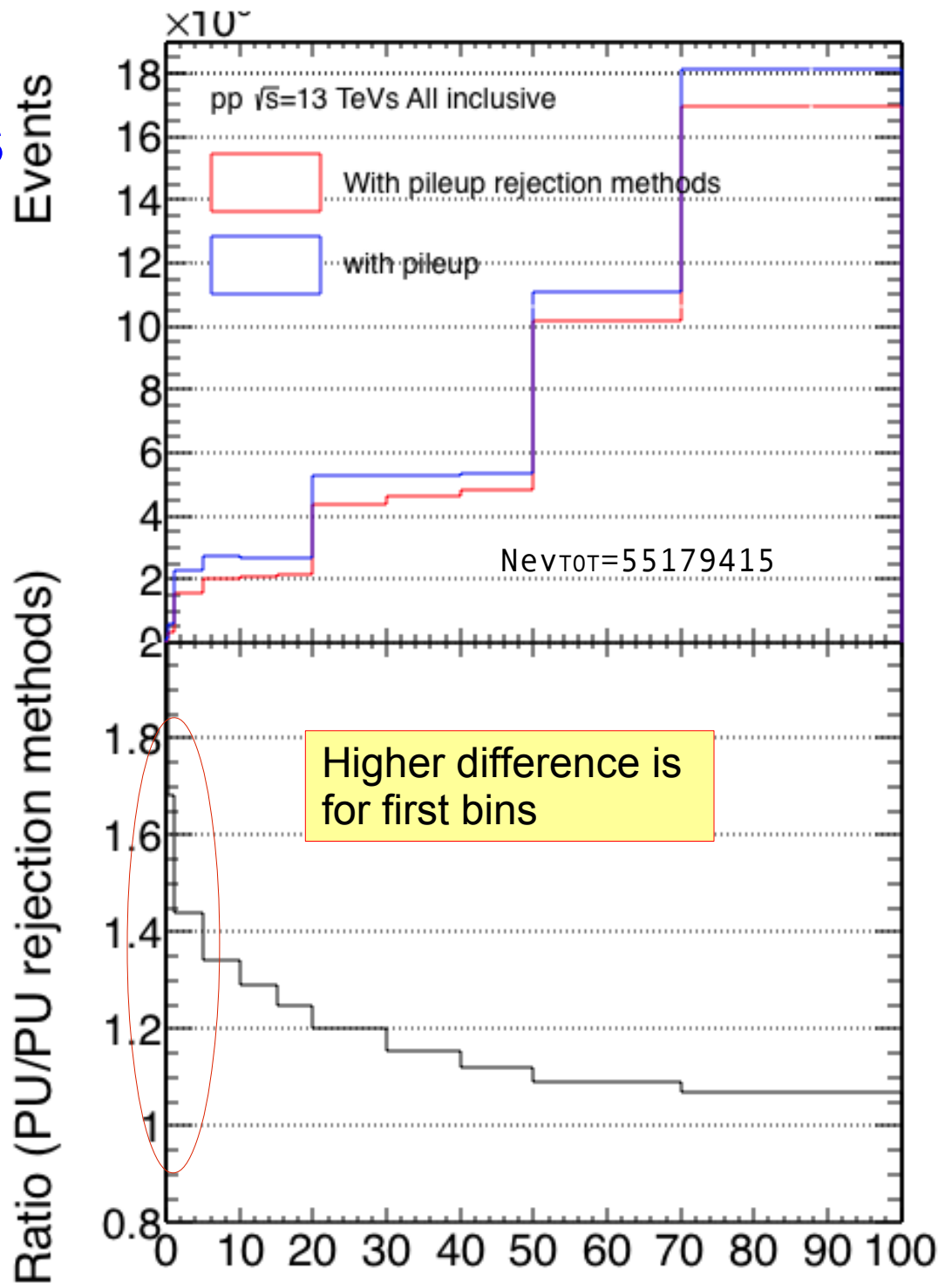
With MV pileup rejection:

```
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
```

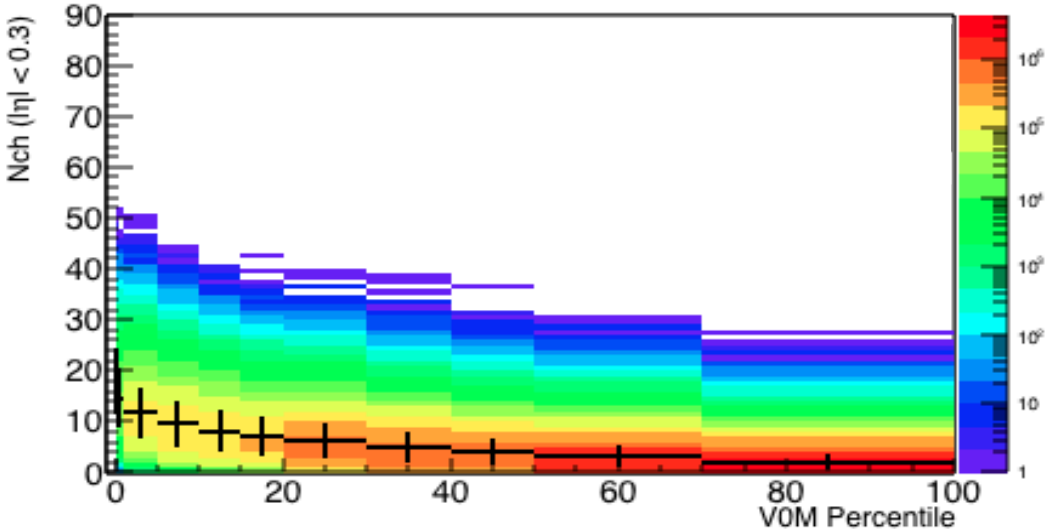
Snippets (thanks to Yihye Song)



Some usefull plots for V0M Analysis

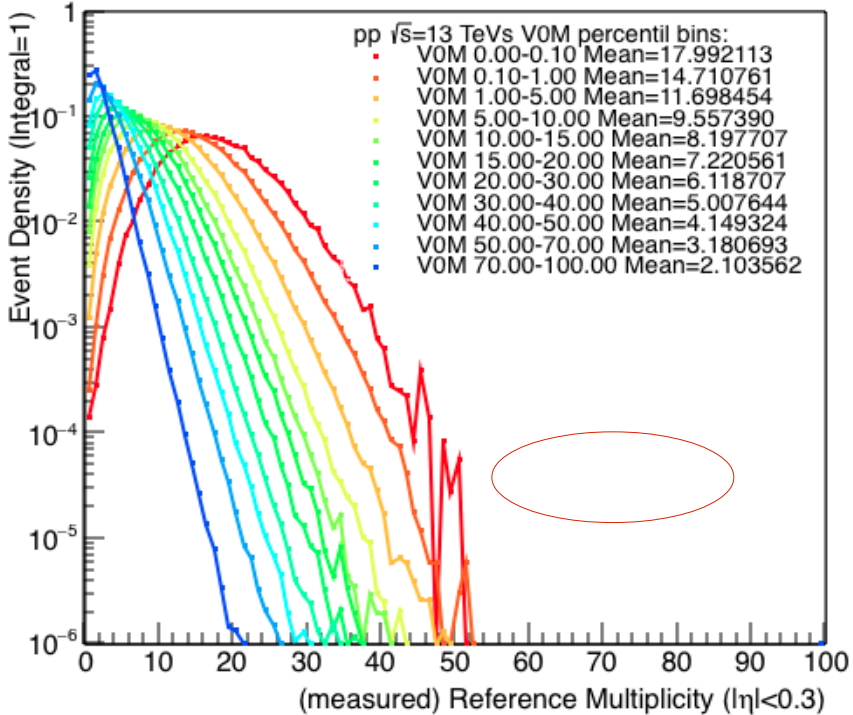
With All PU rejection cuts

Multiplicity Correlation (V0M and $|\eta| < 0.3$)



I reproduce the projections in order to ensure the value of $\langle dN/d\eta \rangle$

Multiplicity V0M



V0M percentil	$\langle dN/d\eta \rangle_{ \eta < 0.3}$
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>

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

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

```
fTriggerChargeA = vzero->GetTriggerChargeA();
```

```
fTriggerChargeC = vzero->GetTriggerChargeC();
```

```
onlineV0M = fTriggerChargeA+fTriggerChargeC;
```

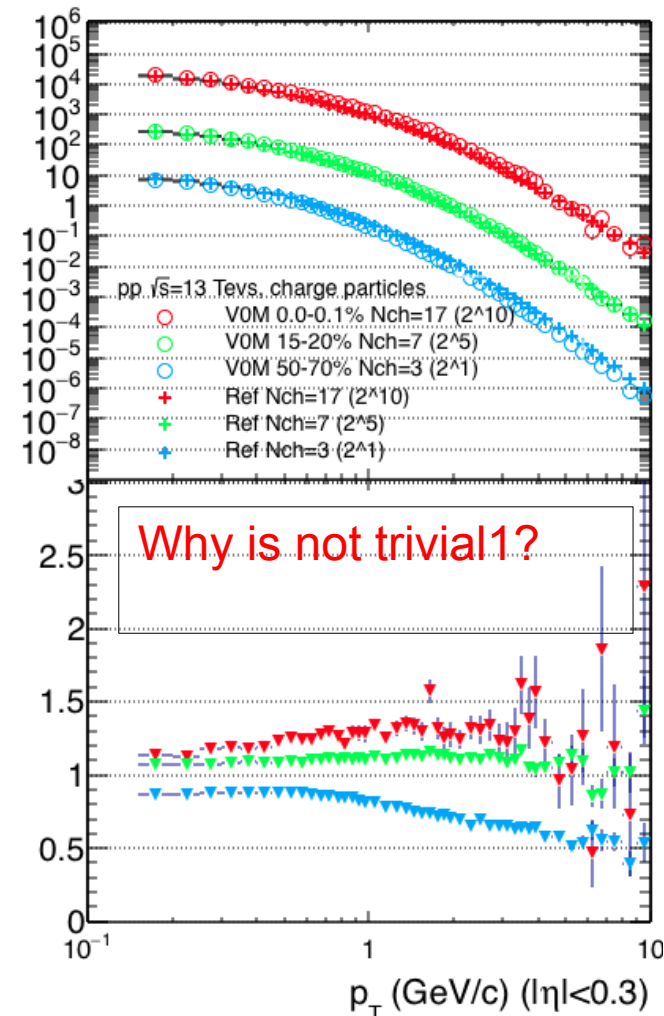
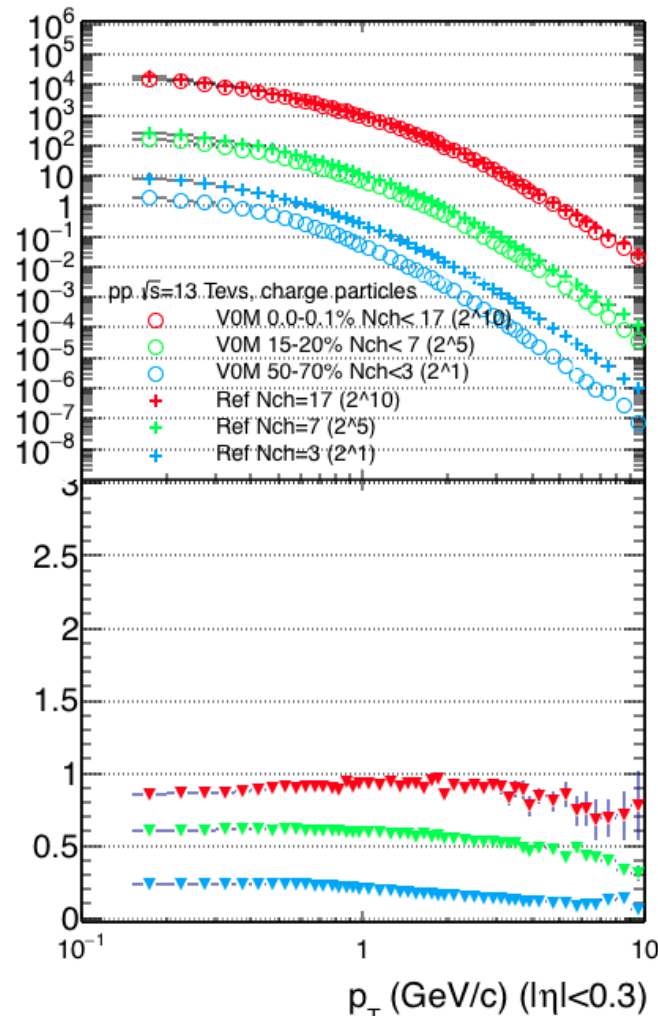
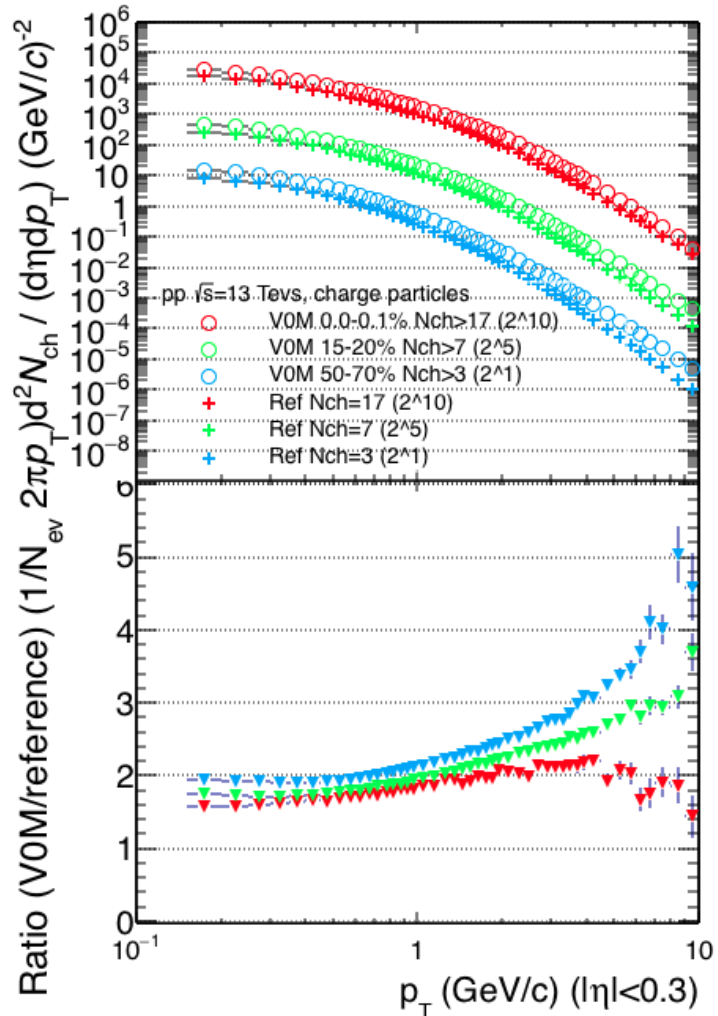
```
offlineV0M = fMTotV0A+fMTotV0C;
```

- 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:

With All PU rejection cuts

greater, lower and equal to $\langle dN/d\eta \rangle$



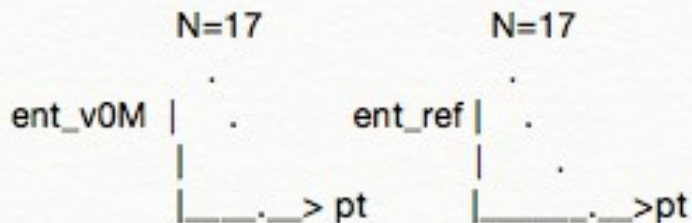
To check the contribution to the ratio,

A crosscheck in number of events has been taken into account

Why V0M mult for Nch equal to $\langle dN/d\eta \rangle$ 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.



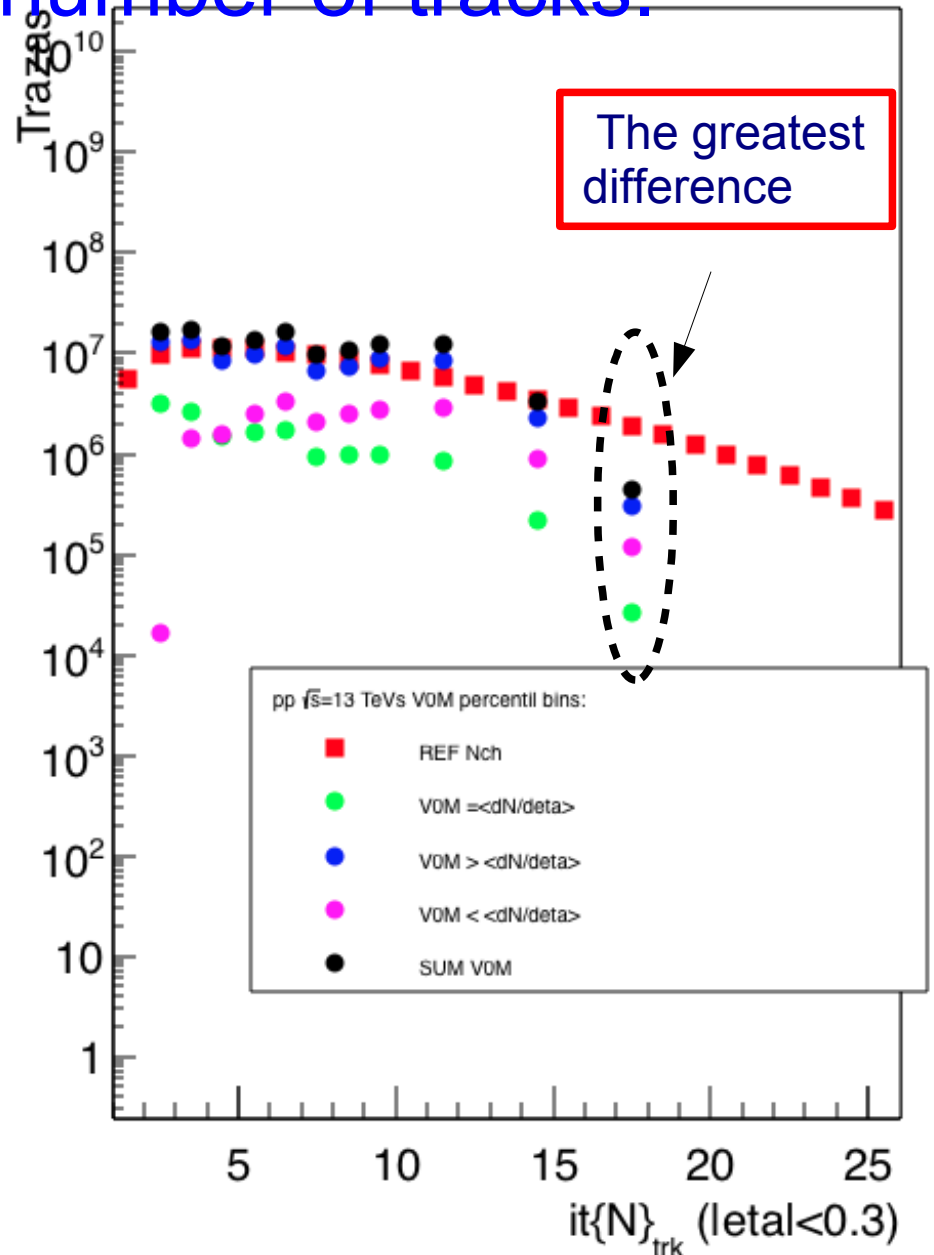
Depends how P_T is distributed for each track

		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	caso linea roja
	5 pt=1	6 pt=1	6/5=1.2	
	2 pt=2	3 pt=2	3/2=1.5	
	3 pt=3	1 pt=3	1/3=0.33	

$$\frac{(1/2\pi p_T) (1/N_{ev_ncref}) (dN/d\eta dp_T)}{(1/2\pi p_T) (1/N_{ev_ncv0m}) (dN/d\eta dp_T)} = \frac{(1/N_{ev_ncref}) (dN_{entv0M})}{(1/N_{ev_ncv0m}) (dN_{entref})}$$

Ratio=(1/1)(dN_entv0M)/(dN_entref)

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



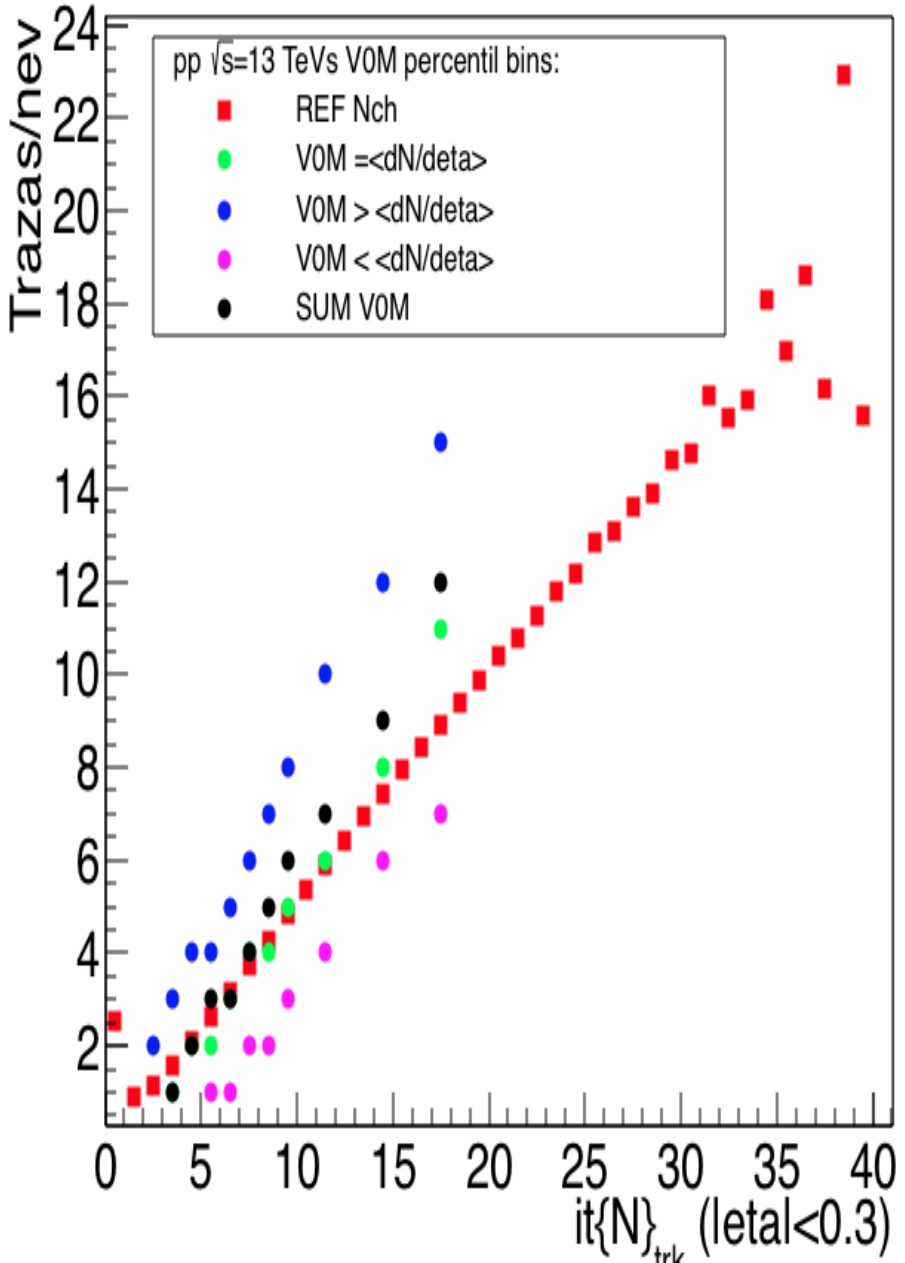
Multiplicity = $\langle dN/d\eta \rangle$ in VOM is less than ITSTPC tracks from REF multiplicity in $|\eta| < 0.3$.

particular case:

With VOM 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.



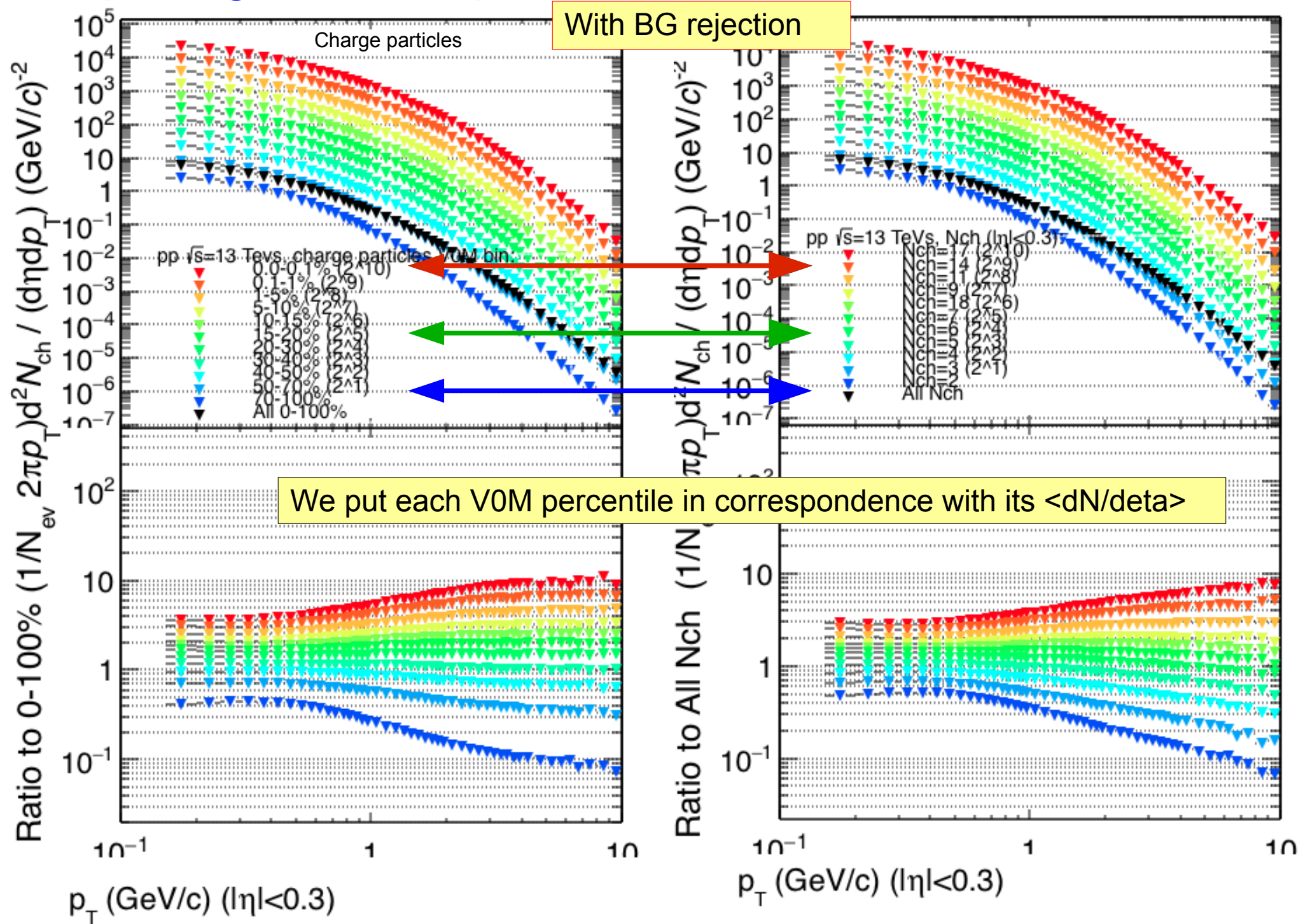
Multiplicity = $\langle dN/d\eta \rangle$ in V0M is less than ITSTPC tracks from REF multiplicity in $|\eta| < 0.3$.

particular case:

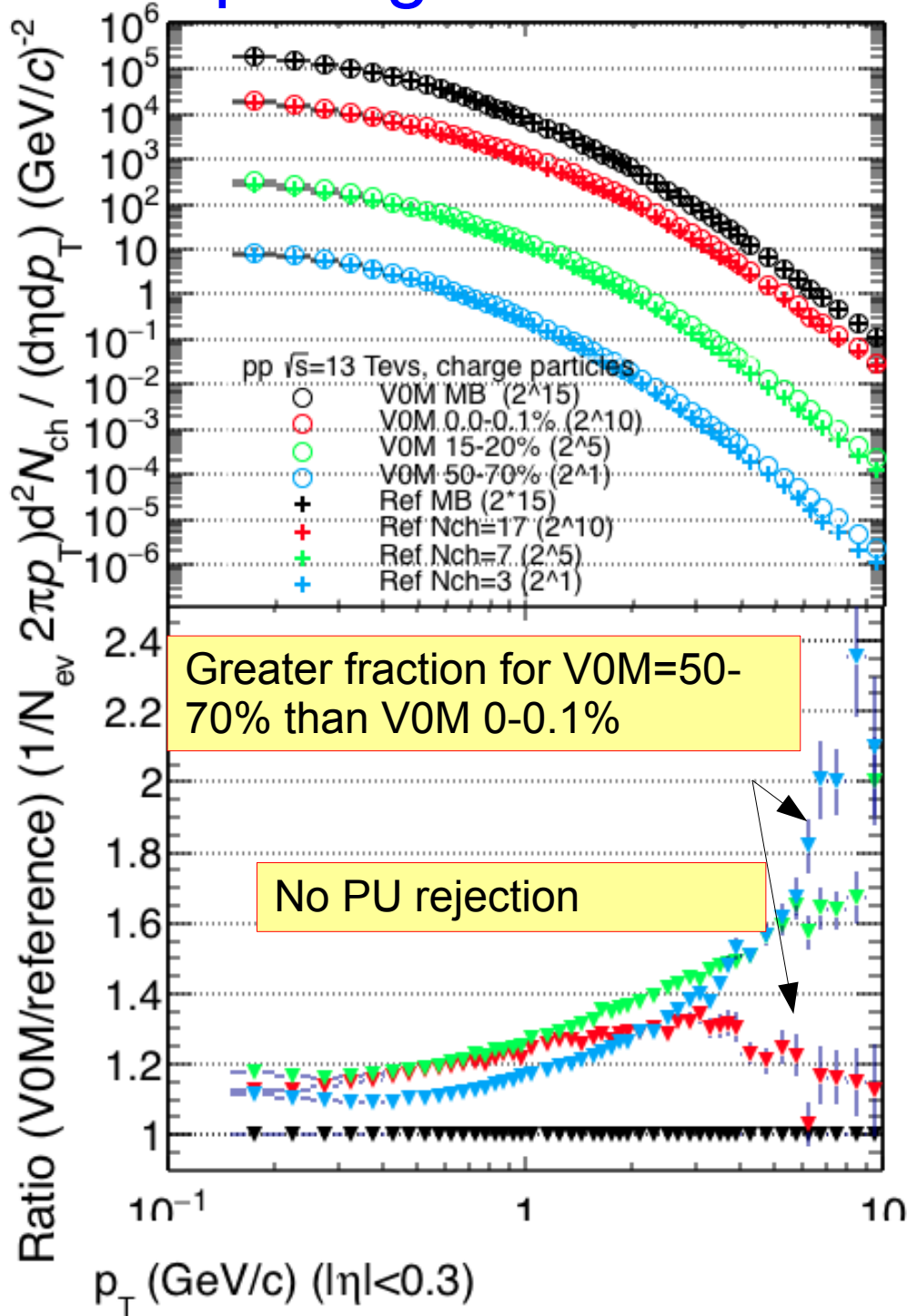
With V0M 0-01
 Trazas TH2D = 443 416
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Comparing for V0M percentils and N_{ch} for its $\langle dN/d\eta \rangle$



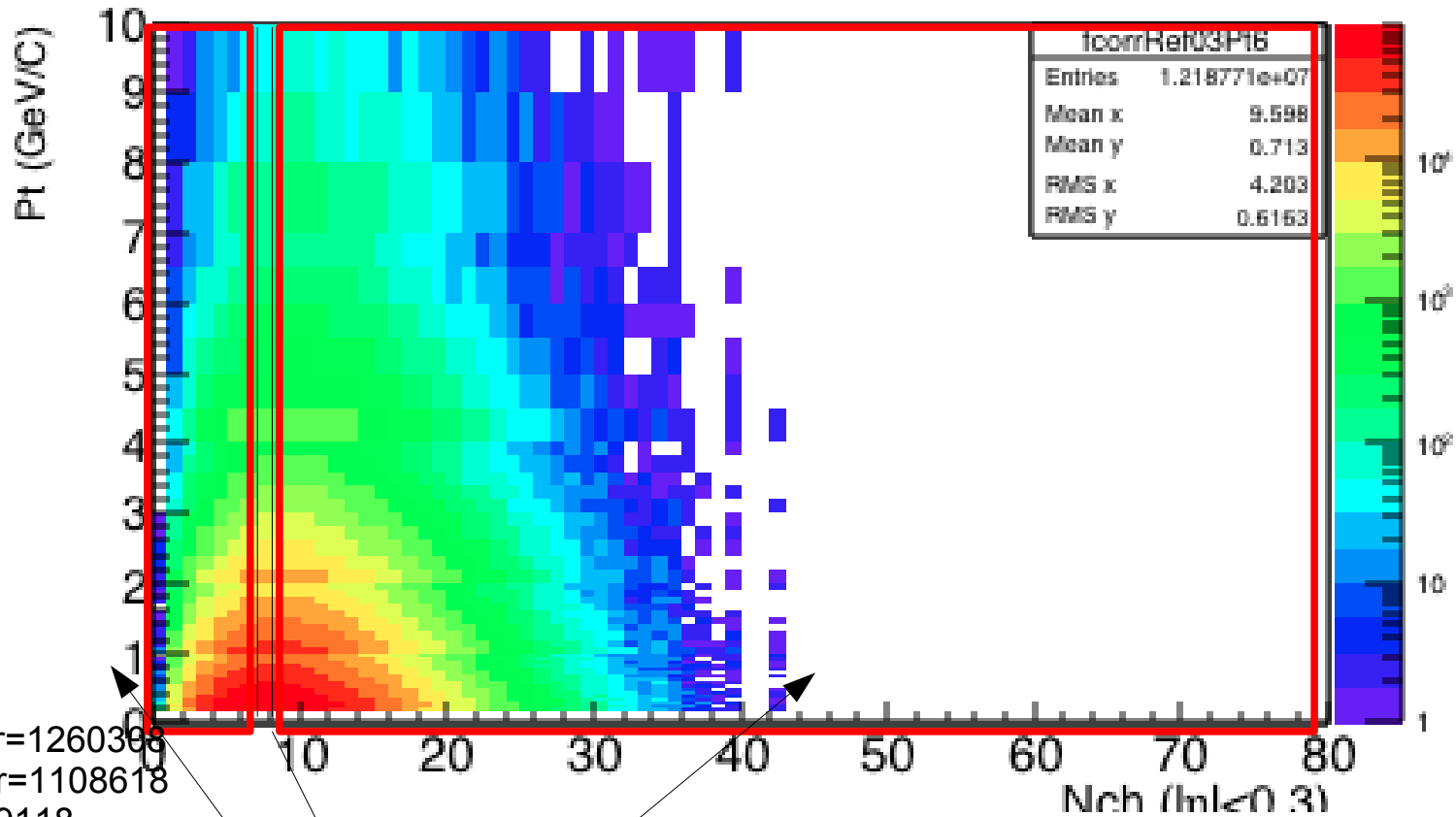
Comparing estimators V0M and Ref $|\eta| < 0.3$



To check the compatibility of my program and the information given by the spectra we make another crosscheck. I take the spectra and calculate $\langle p_T \rangle$

Correlation pt vs $\langle dN/d\eta \rangle_{|\eta|<0.3}$

Correlation Nch vs Pt for $15.000000 < V0M \text{ percentil} < 20.000000$



Nev=2648044

Nev para mayor=1260398

Nev para menor=1108618

Nev para ig=279118

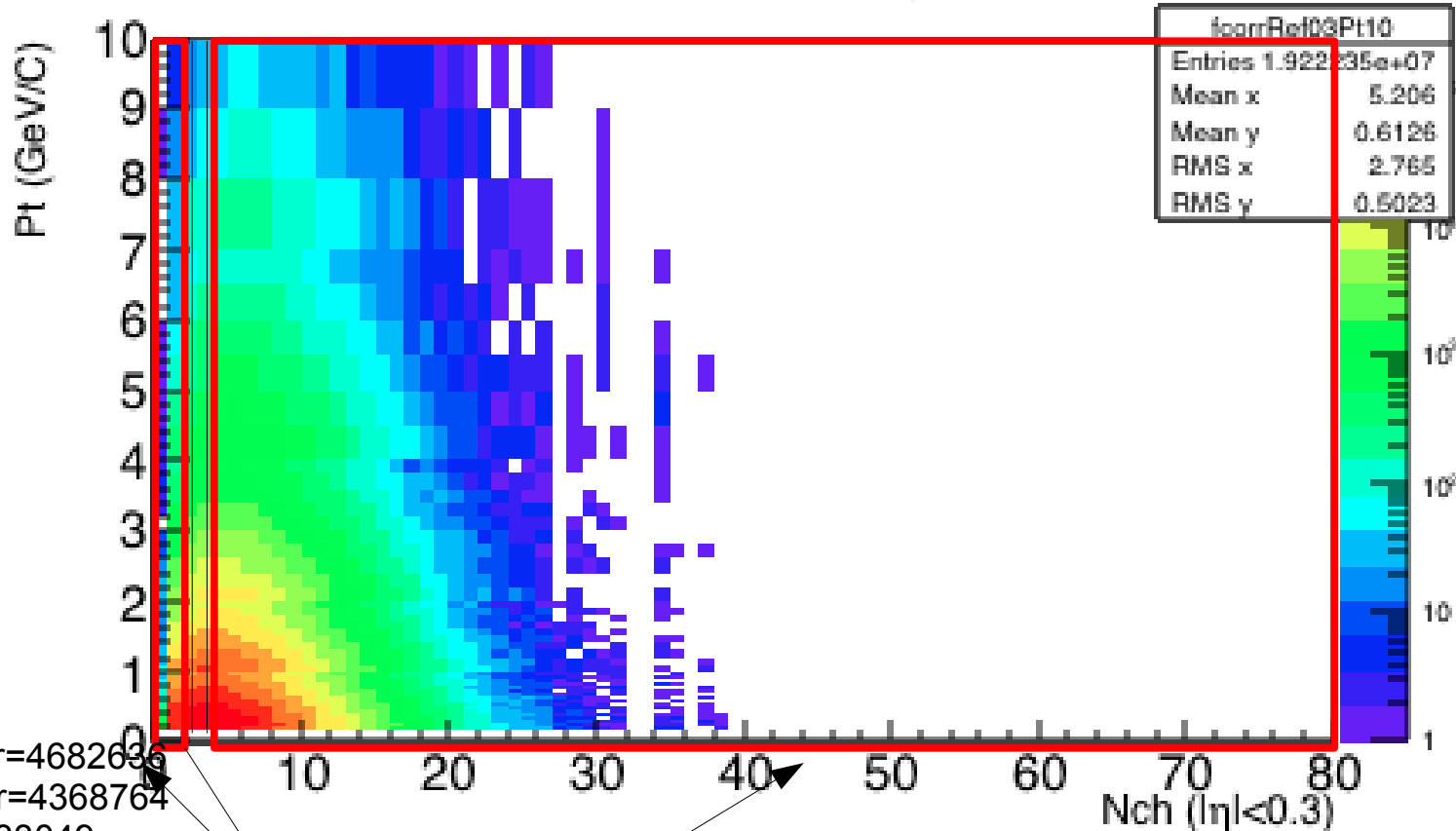
Suma=2648044

In order to get pt distributions for:
 $Nch \text{ in } V0M > \langle dN/d\eta \rangle_{|\eta|<0.3} = 7$
 $Nch \text{ in } V0M < \langle dN/d\eta \rangle_{|\eta|<0.3} = 7$
 $Nch \text{ in } V0M = \langle dN/d\eta \rangle_{|\eta|<0.3} = 7$

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Correlation pt vs $\langle dN/d\eta \rangle_{|\eta|<0.3}$

Correlation Nch vs Pt for $50.000000 < V0M \text{ percentil} < 70.000000$



Nev=11084449

Nev para mayor=4682636

Nev para menor=4368764

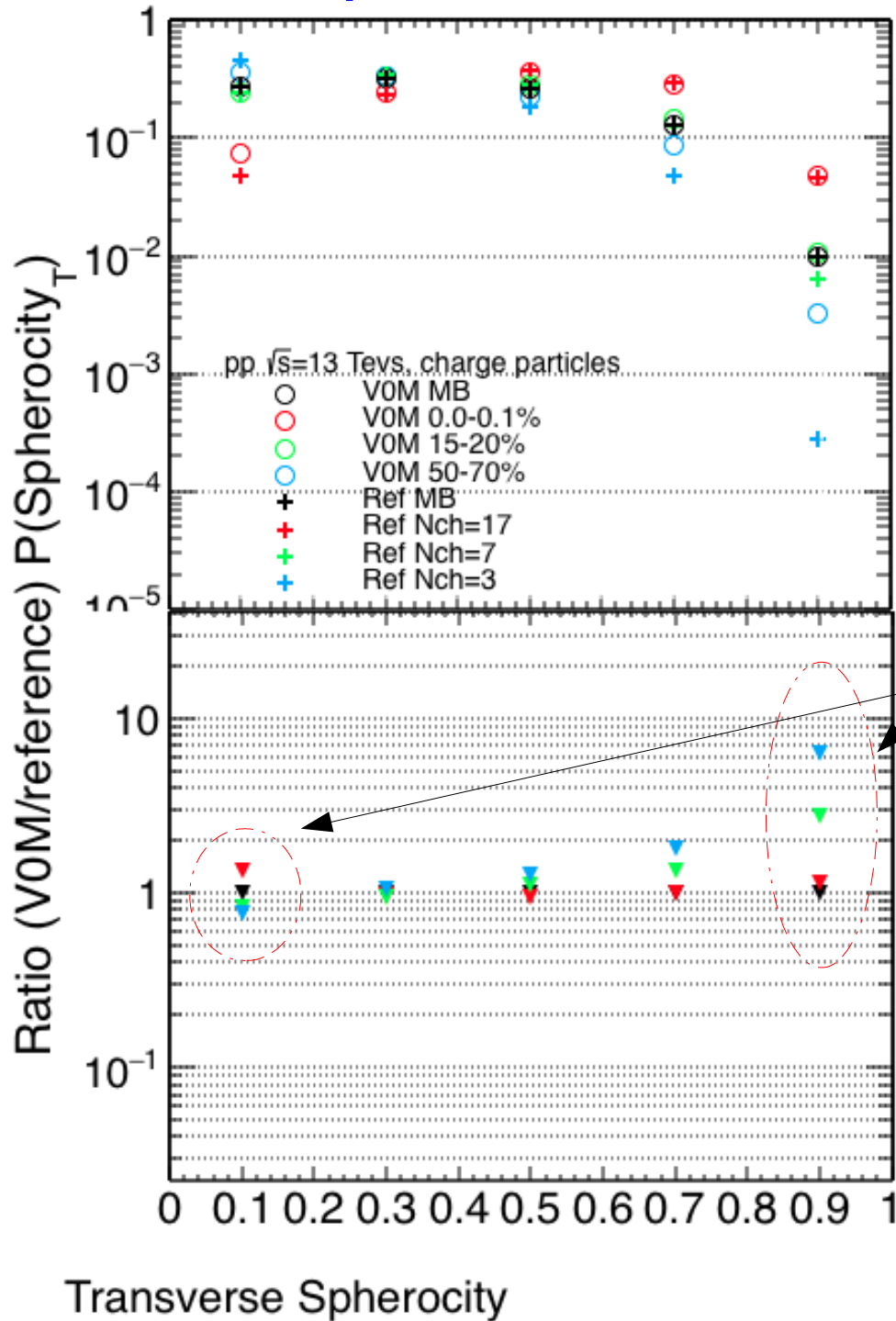
Nev para ig=2033049

Suma=11084449

In order to get pt distributions for:
 $Nch \text{ in } V0M > \langle dN/d\eta \rangle_{|\eta|<0.3} = 3$
 $Nch \text{ in } V0M < \langle dN/d\eta \rangle_{|\eta|<0.3} = 3$
 $Nch \text{ in } V0M = \langle dN/d\eta \rangle_{|\eta|<0.3} = 3$

Héctor Bello Martínez

First Comparison for S_0 with estimators V0M and Ref $|\eta| < 0.3$



Greater difference for isotropic events specially for low N_{ch}