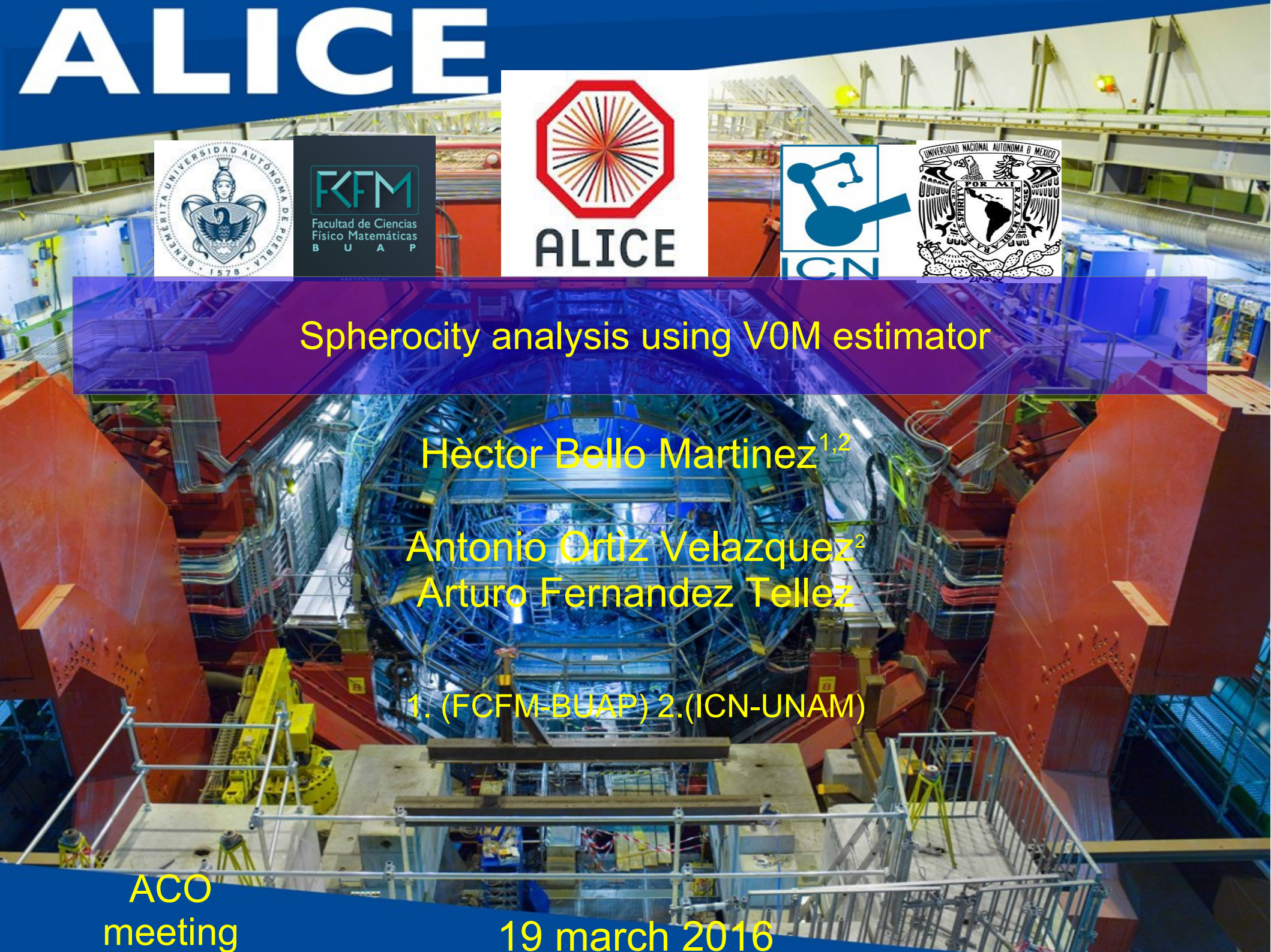


Spherocity analysis using V0M estimator

Hèctor Bello Martinez[1,2]

Antonio Ortìz Velazquez[2]

Arturo Fernandez Tellez

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

ACO meeting

19 march 2016

Outline

- We investigate the 2% of difference in V0M-REF ratio
- We compare the V0M-REF ratio for:
  Nch in V0M> $\langle dN/d\eta \rangle_{|\eta|<0.3}$
  Nch in V0M< $\langle dN/d\eta \rangle_{|\eta|<0.3}$
  Nch in V0M= $\langle dN/d\eta \rangle_{|\eta|<0.3}$

- Conclusions.

Analysis and Event selection

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

Trigger: KINT7 (*Thanks to Gyula*)
Standard Physics selection

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 $|\eta|<0.3$

Pass2
LHC15f pass2: (59 mill of evts)
MC Pythia6 Perugia 2011 **LHC15g3c3** 50 mill.
MC Pythia8 Monash **LHC15g3a3**: 40 mill,
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, 225582, 225580, 225579, 225578, 225576, 225322, 225315, 225314, 225313, 225310, 225309, 225307, 225305, 225106, 225052, 225051, 225050, 225043, 225041, 225037, 225035, 225031, 225026, 225016, 225011, 225000

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

Useful tools for Multiplicity estimators

- 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");
```

- More:

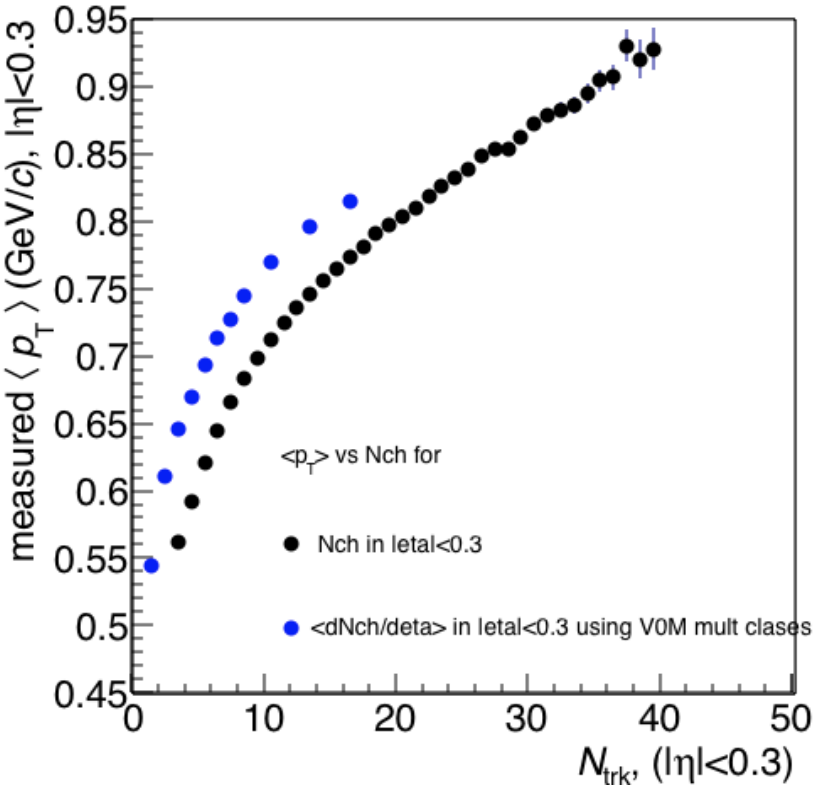
  https://twiki.cern.ch/twiki/bin/viewauth/ALICE/AliceHMTFEstimators

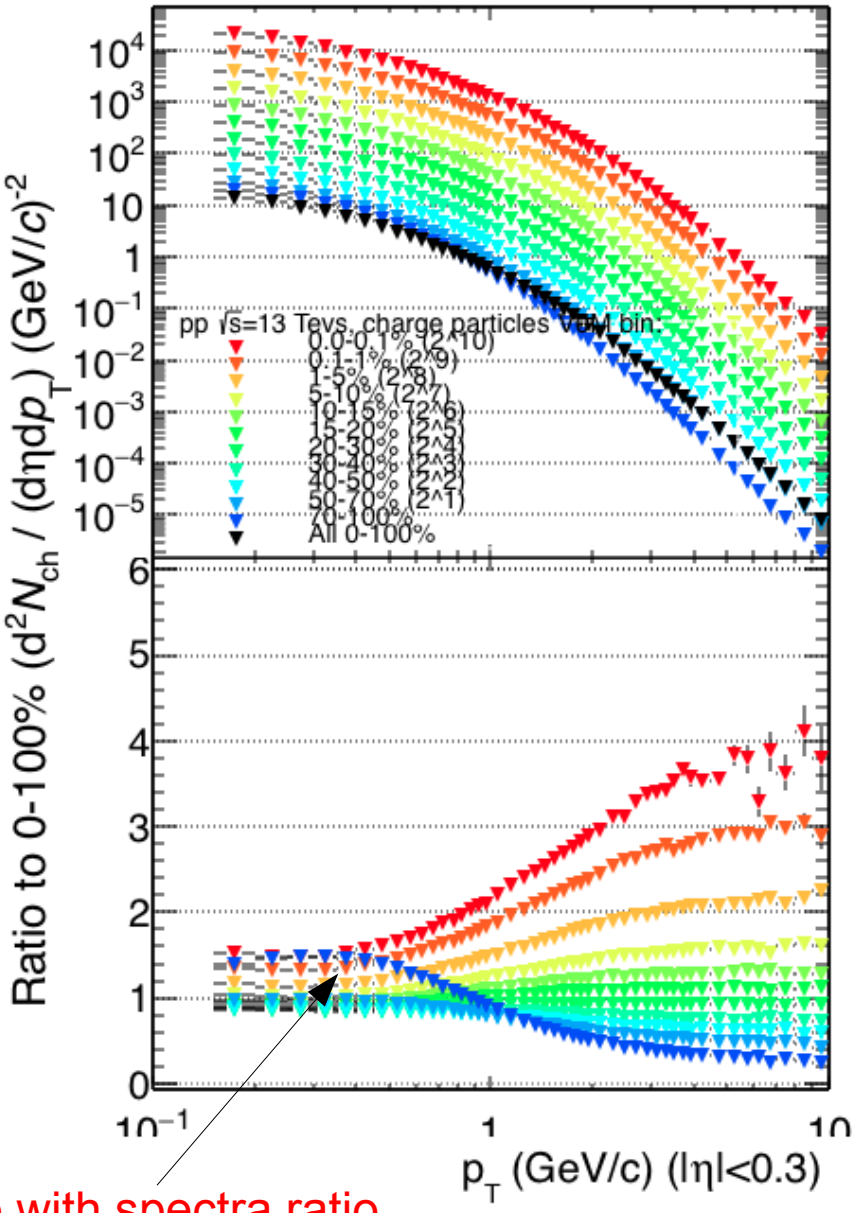
- AliPPVsMultUtils class from AliPhysics>=vAN-20151019-1 obsolete

Thanks David for help.
and Vytautas for provide the binning

Last time presentation ..

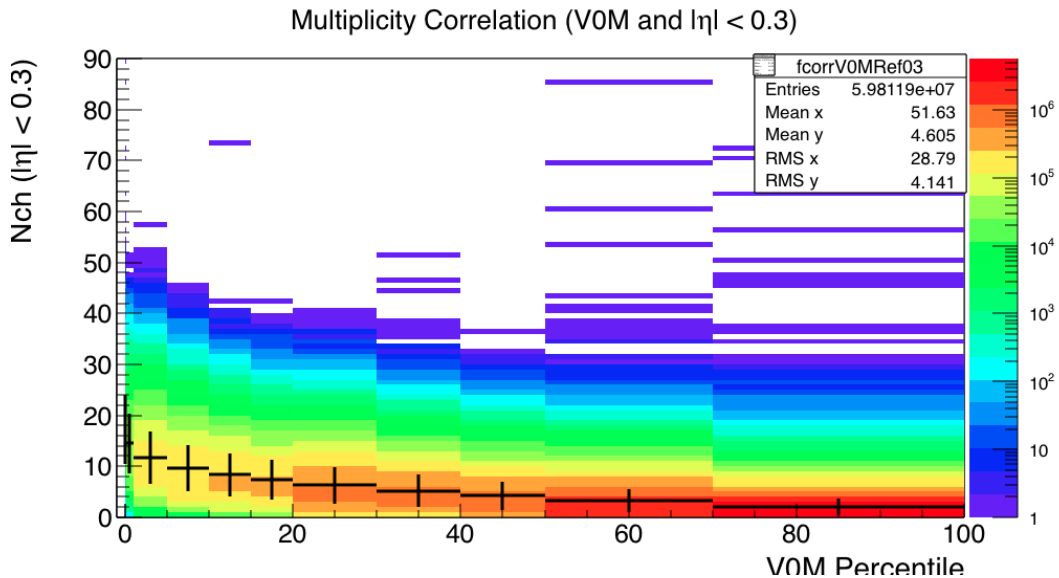
<P$_T$> was wrong becausewas moved to the left

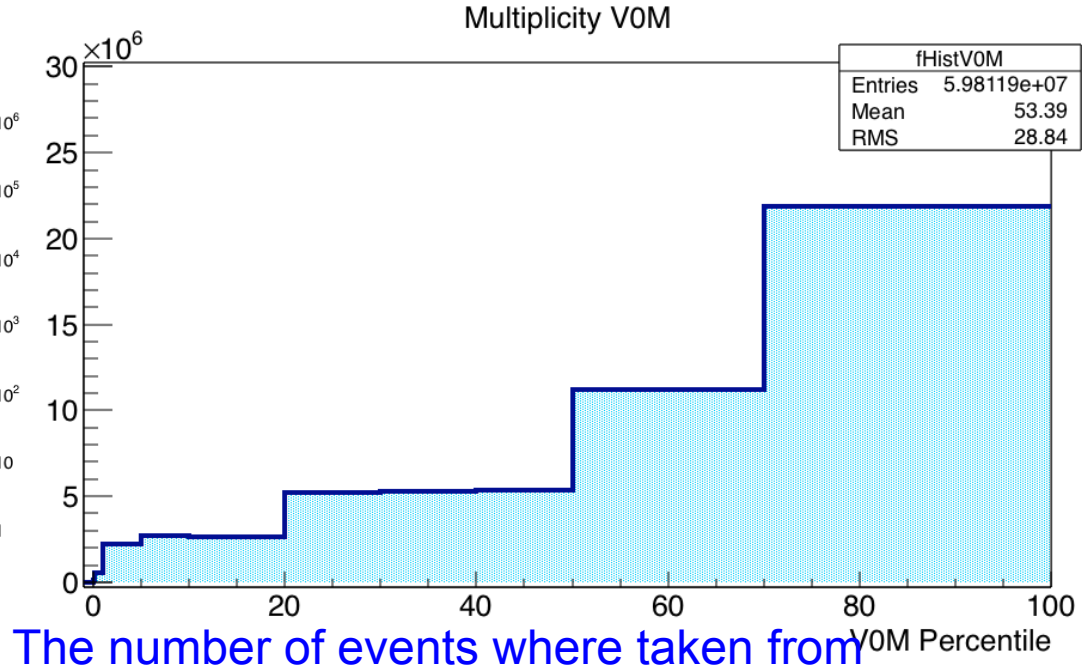




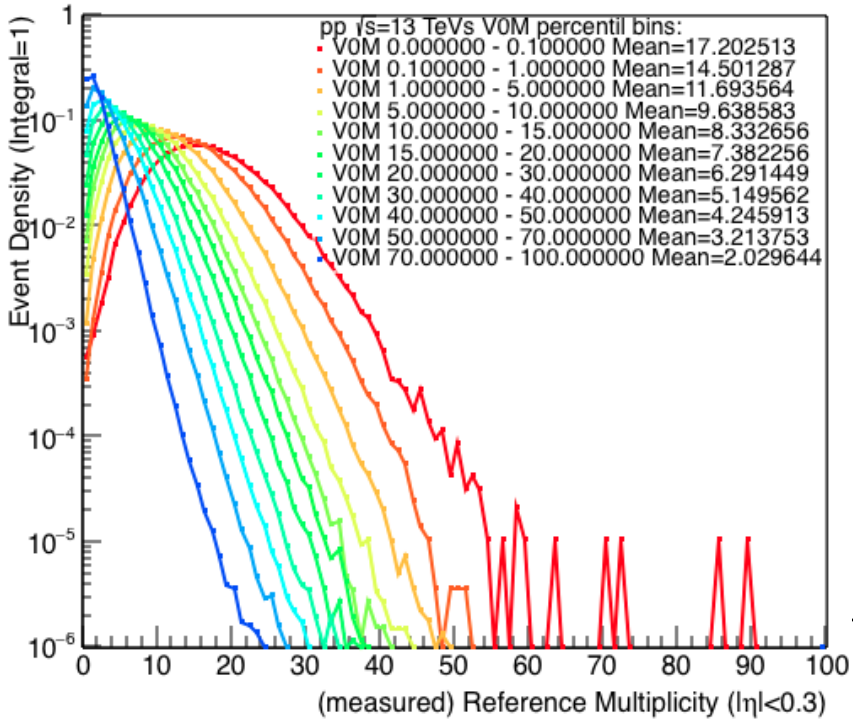
Issue with spectra ratio

How was solved. Cross checks





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

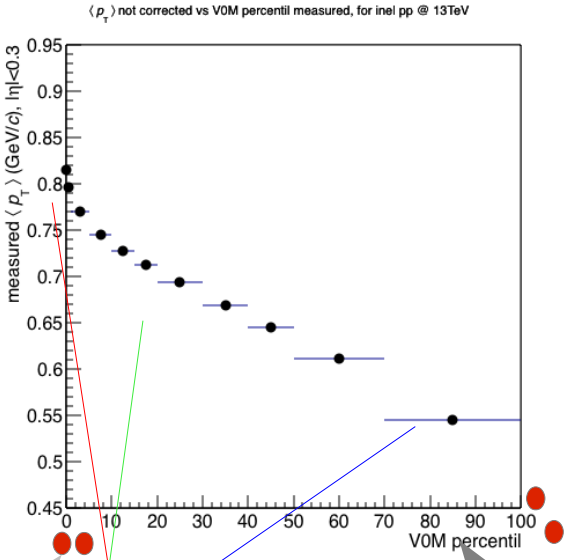


The number of events where taken from each multiplicity class (I was taking from So, this was including some bias)

V0M percentil	<d*N*/deta> |eta|<0.3
0.0-0.1,	17.20,
0.1-1,	14.5
1-5,	11.69
5-10,	9.63
10-15,	8.33
15-20,	7.38
20-30,	6.29
30-40,	5.14
40-50,	4.24
50-70,	3.21
70-100	2.02

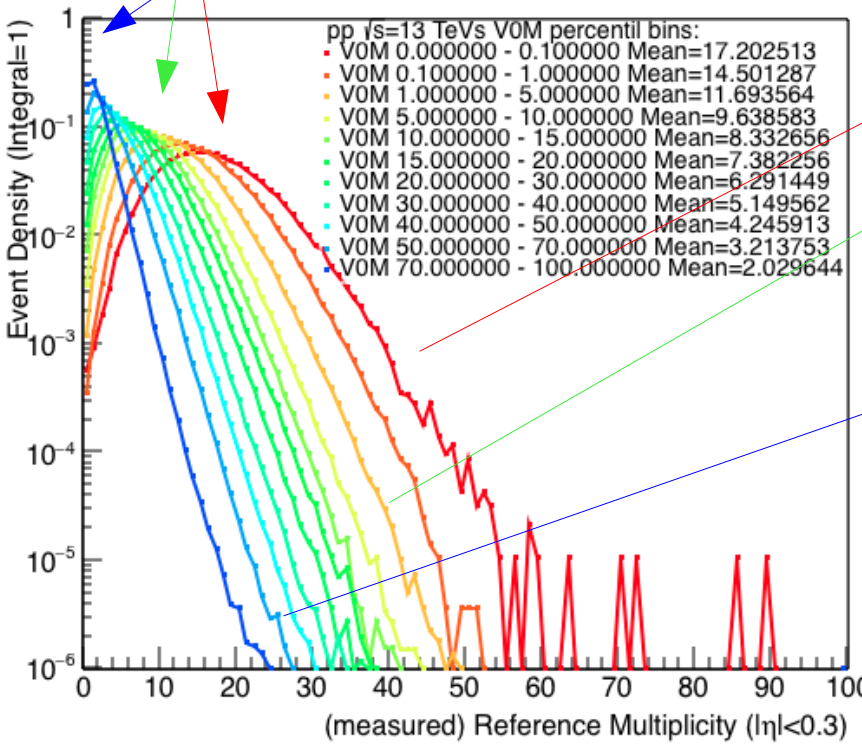
Mean P_T from V0M percentils to <d*N*/deta>$_{|eta|<0.3}$

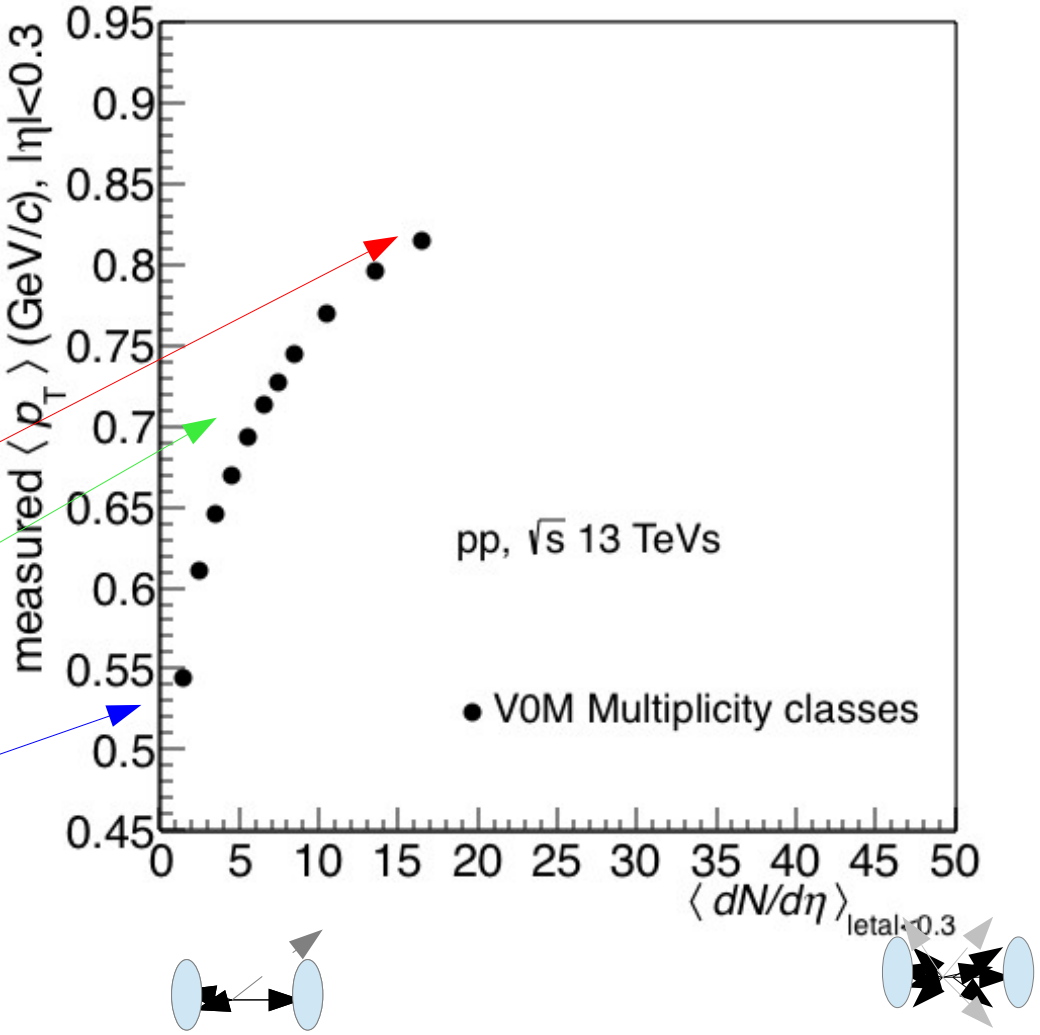
Without efficiency corrections



High P_T

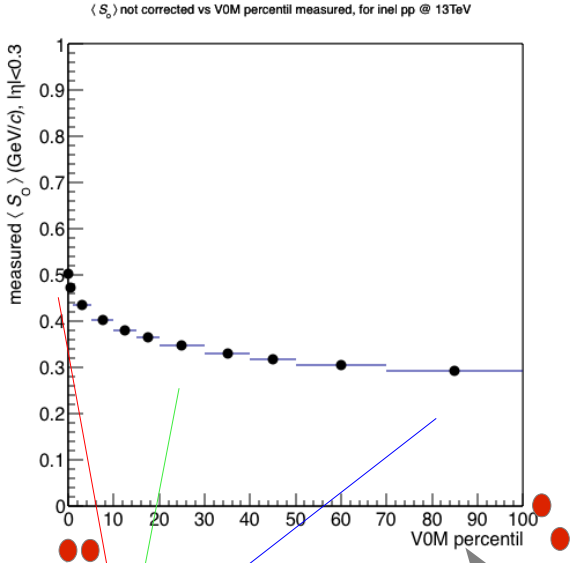
Low P_T





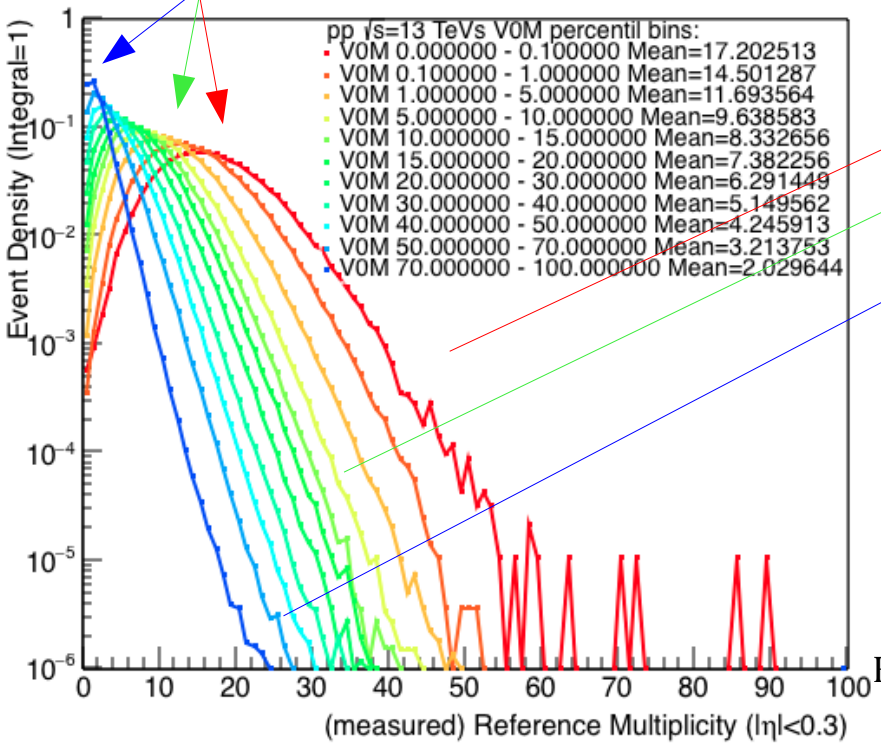
Mean So from V0M percentils to <d*N*/deta>$_{|eta|<0.3}$

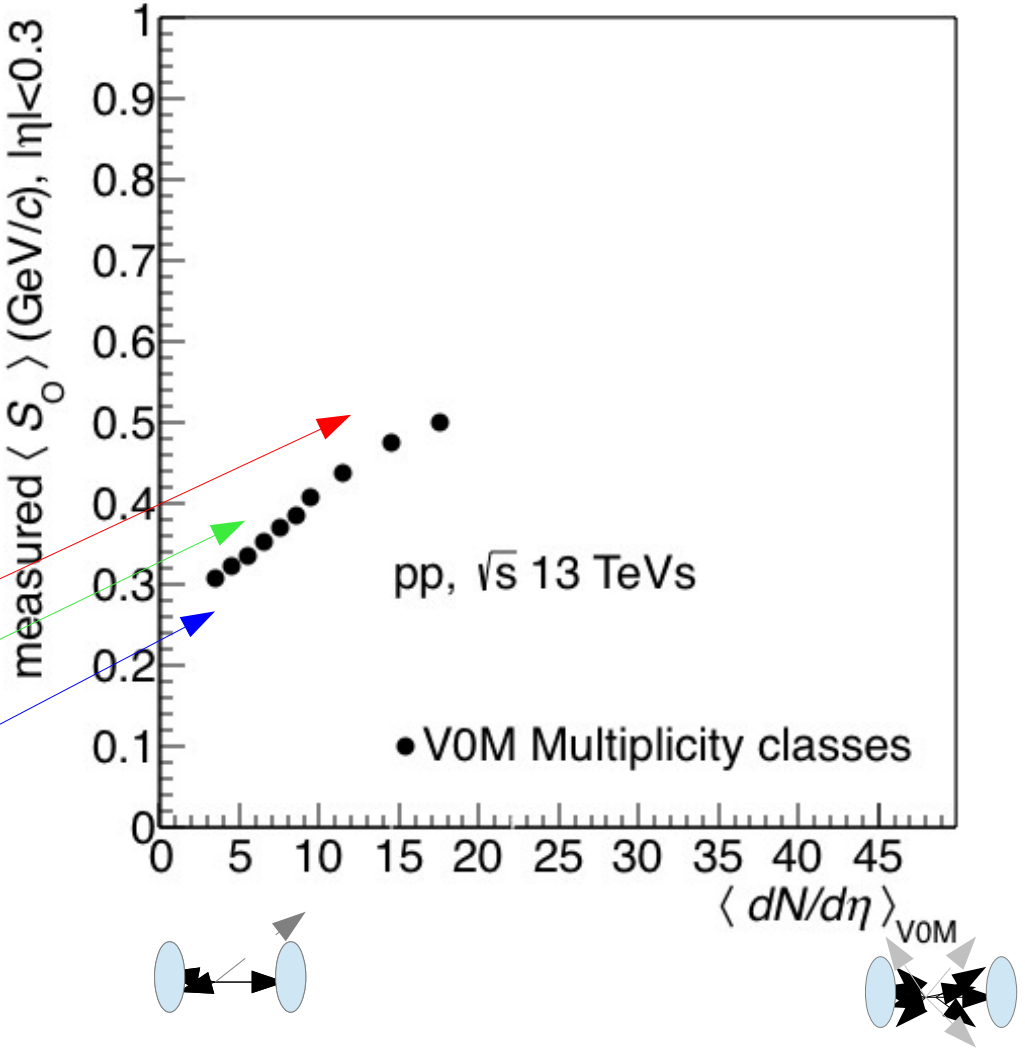
Without efficiency corrections



High So

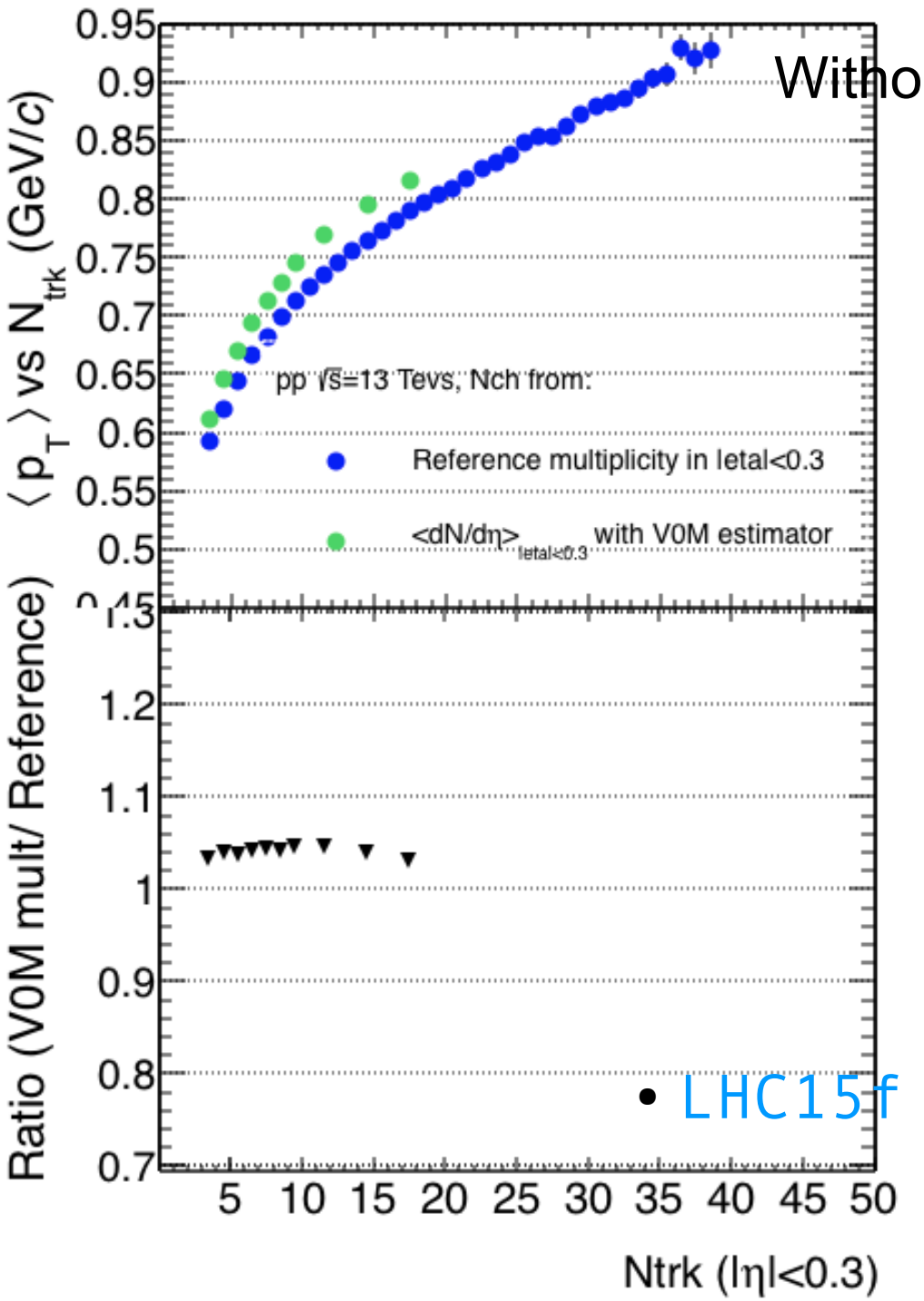
Low So

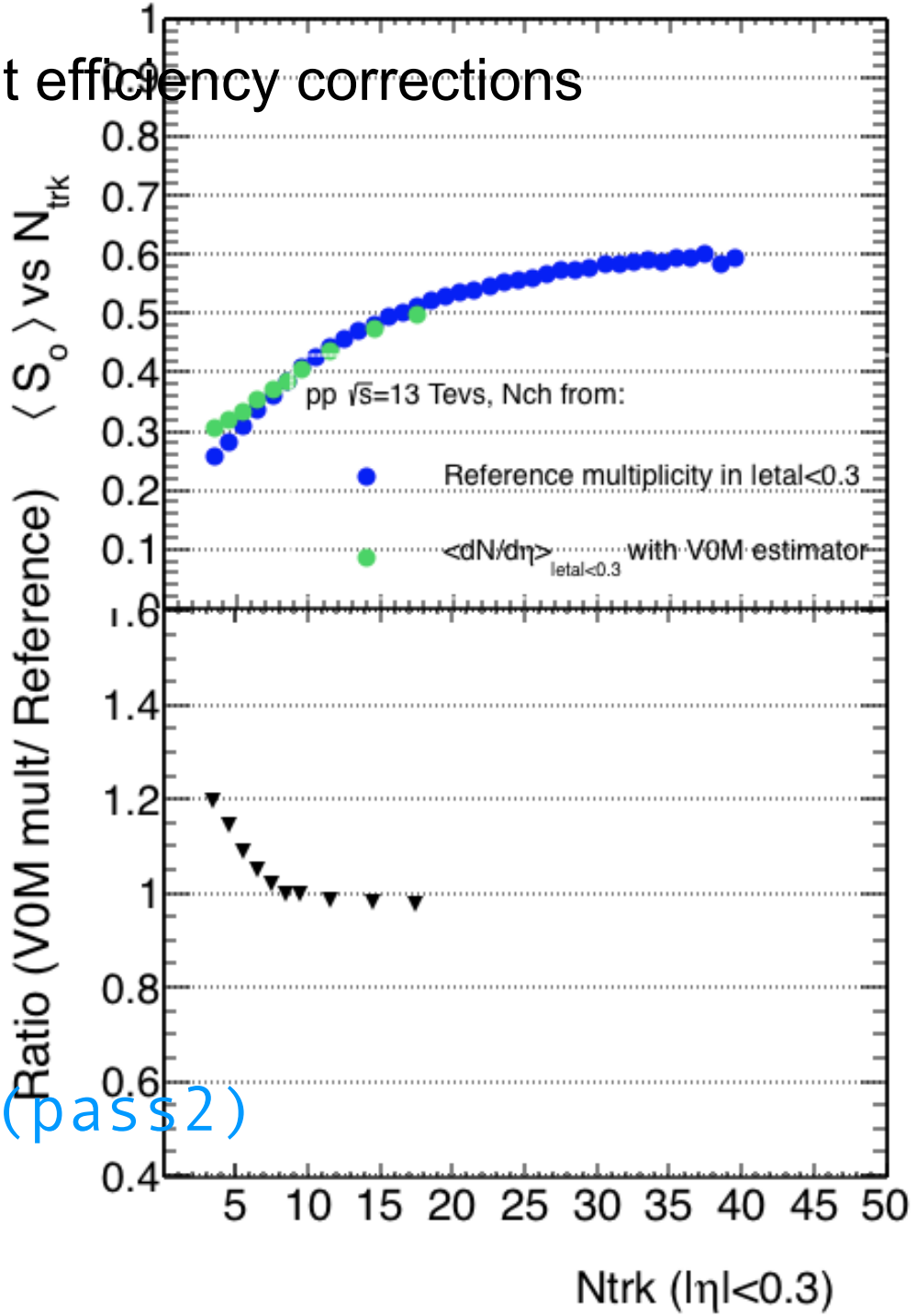




Comparing estimators V0M and Ref | eta| <0.3

Without efficiency corrections



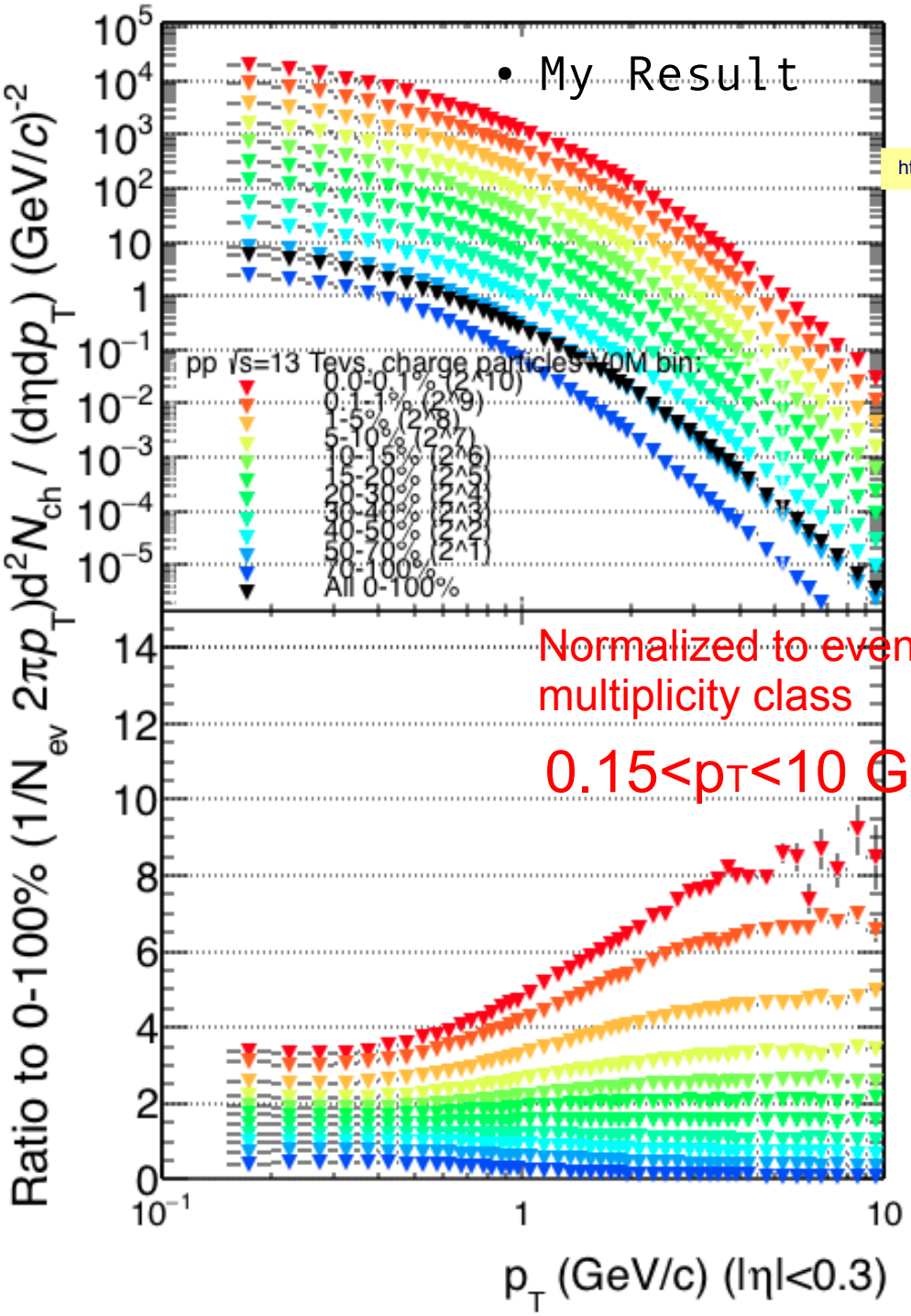


- LHC15f (pass2)

Invariant Yield for V0M percentils

- LHC15f (pass2)

- My Result

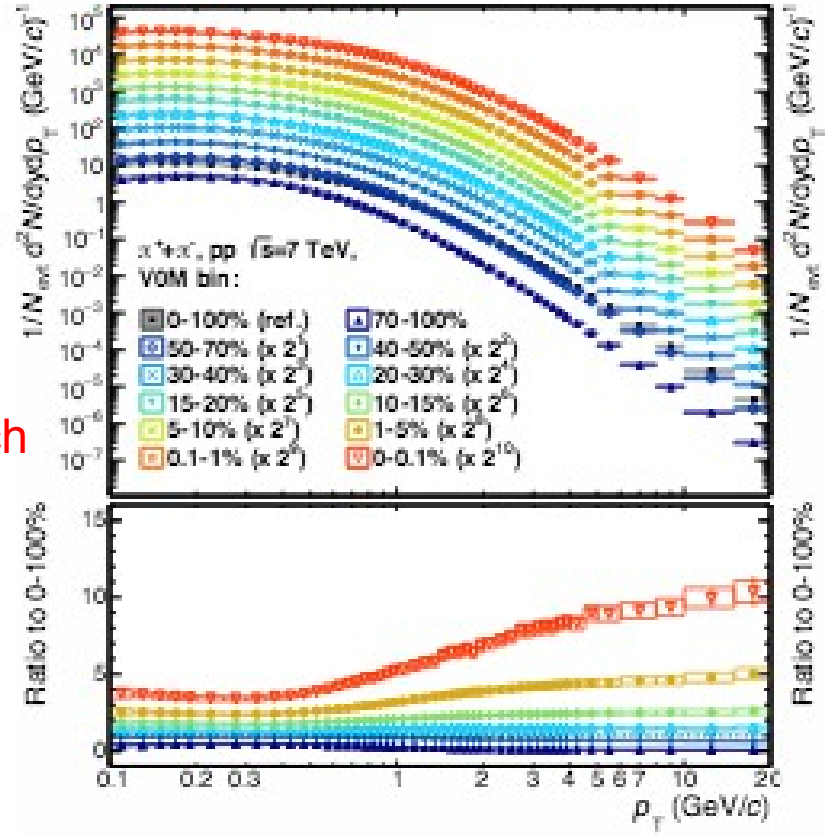


Normalized to events of each multiplicity class

$0.15<p_T<10$ GeV/c

- Vytautas et all Analysis Note

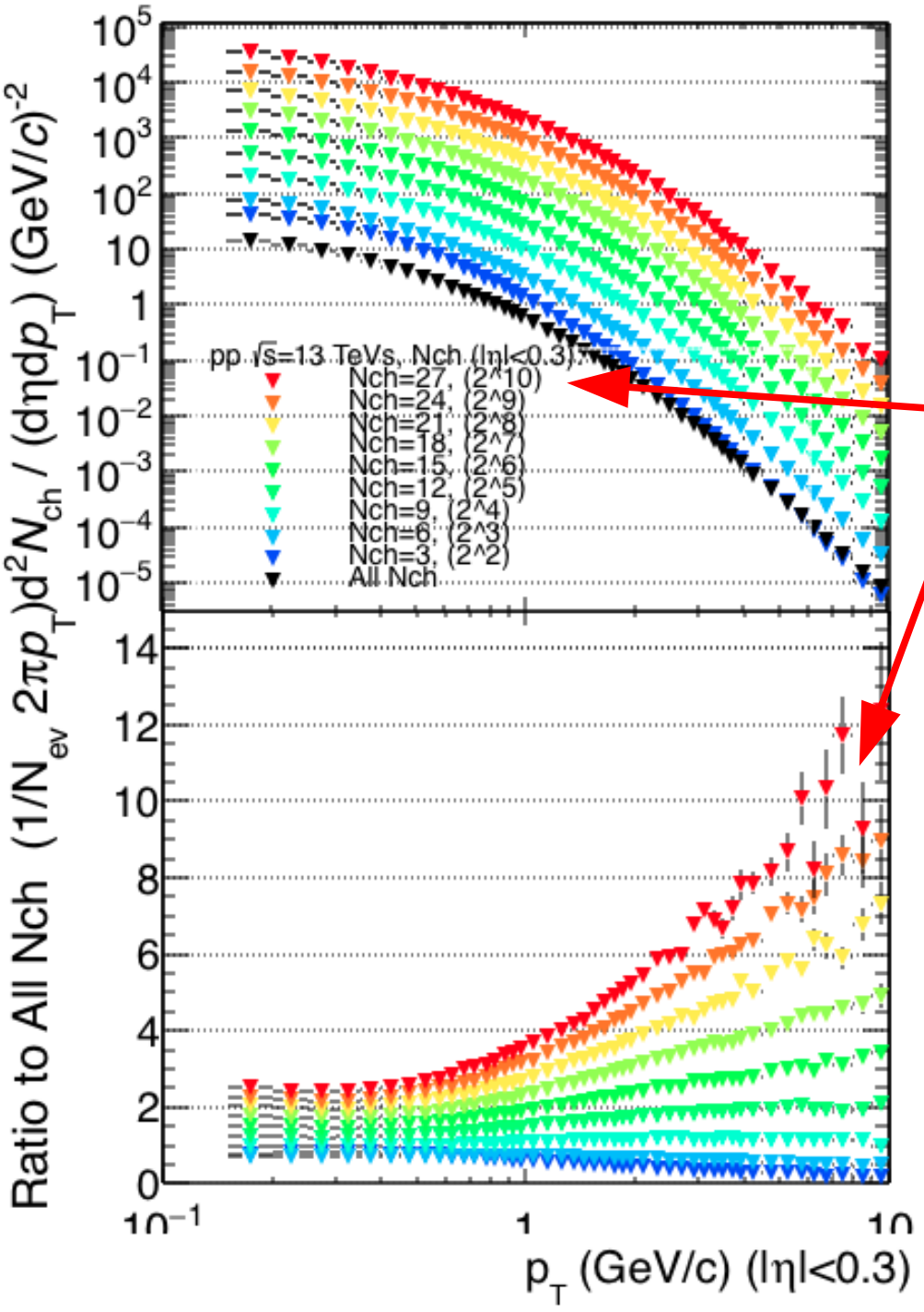
https://aliceinfo.cern.ch/Notes/sites/aliceinfo.cern.ch.Notes/files/notes/analysis/akalweit/2015-Sep-15-analysis_note-A



no (1/2pi*p_T) normalization

$0.15<p_T<20$ GeV/c

Invariant Yield for Reference multiplicity estimator

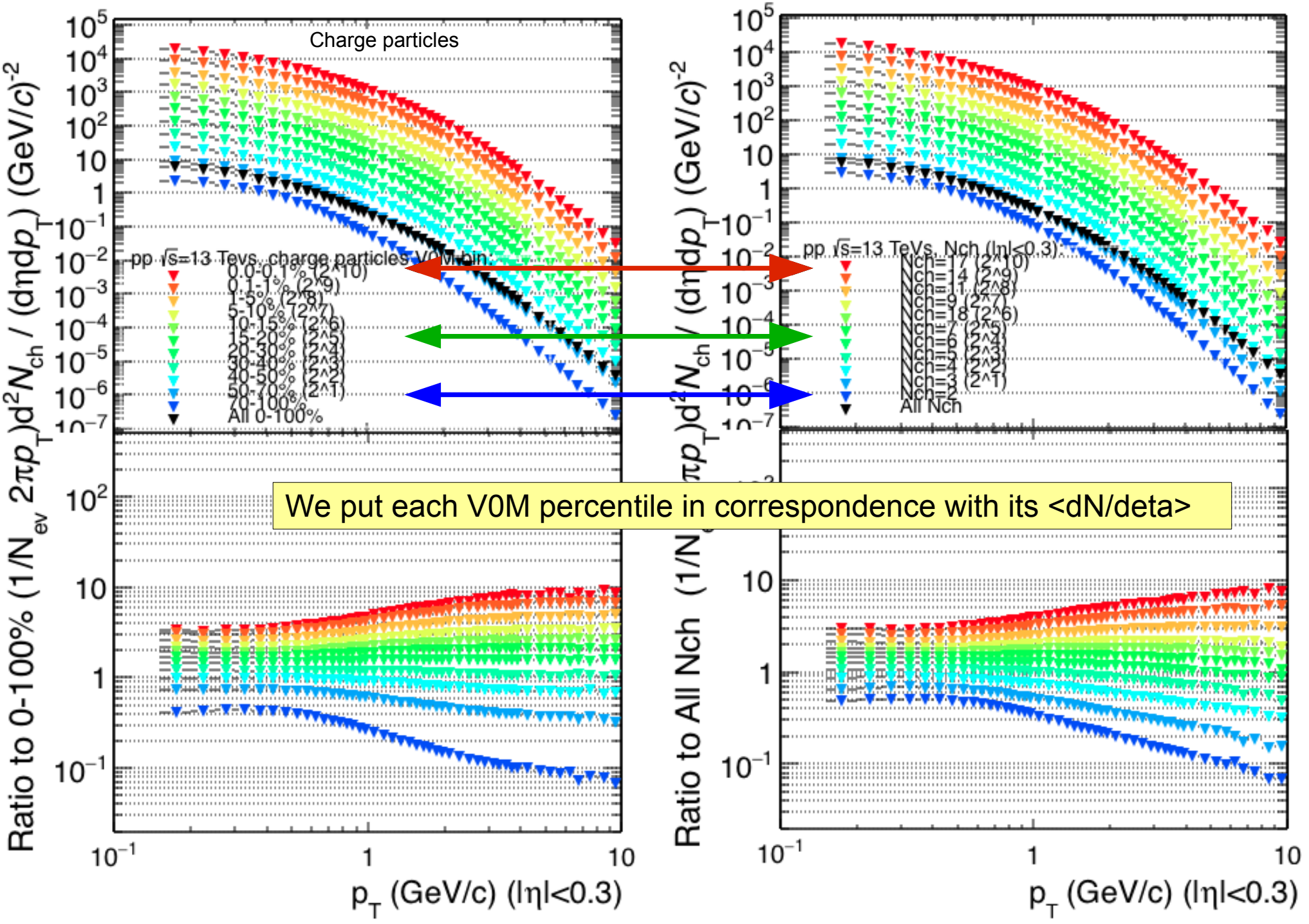


We reach Nch=27

We want to check the spectra behaviour when we take *N*ch= <d*N*/deta>$_{|eta|<0.3}$
For each V0M multiplicity class.

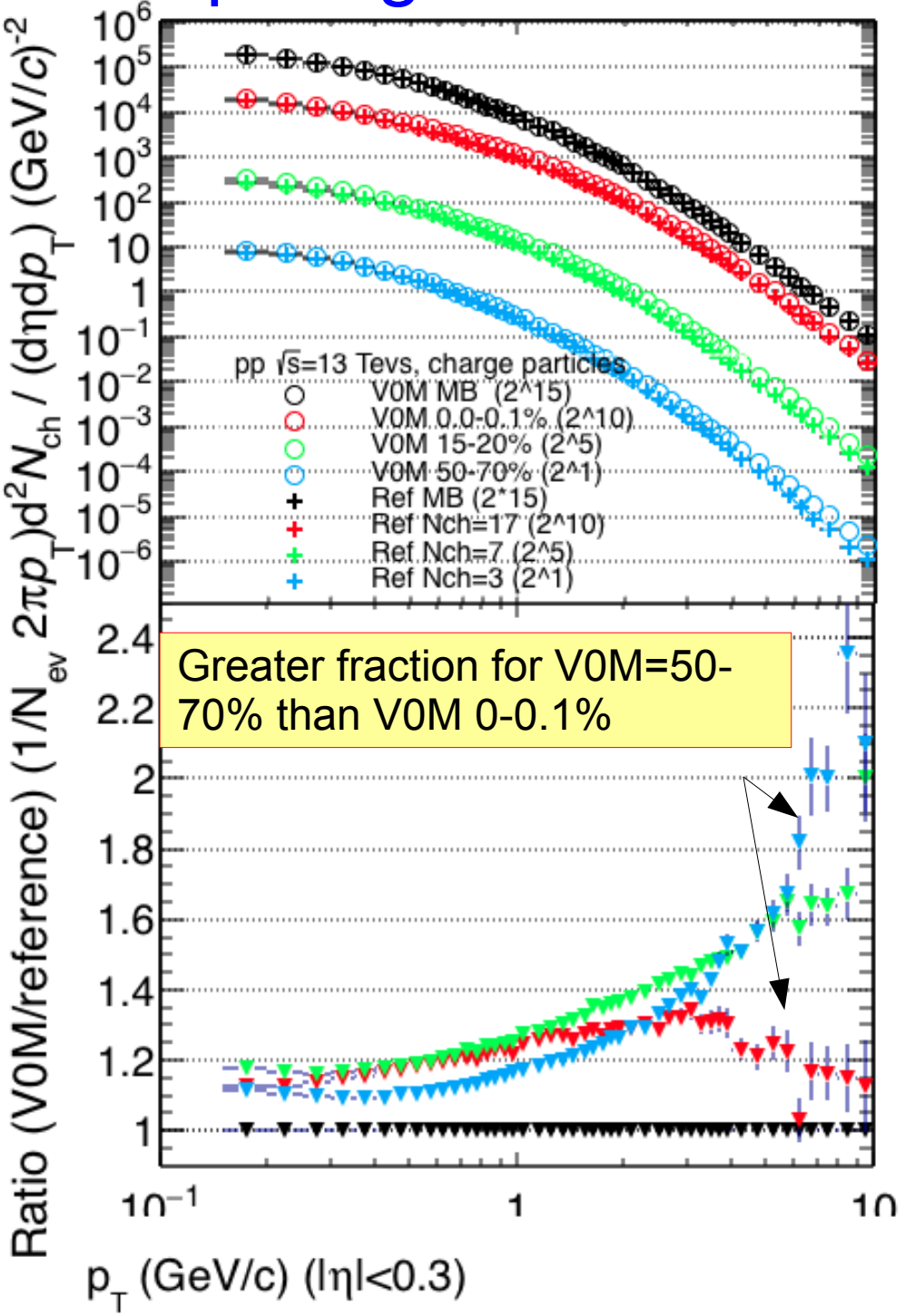
See next slide.

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

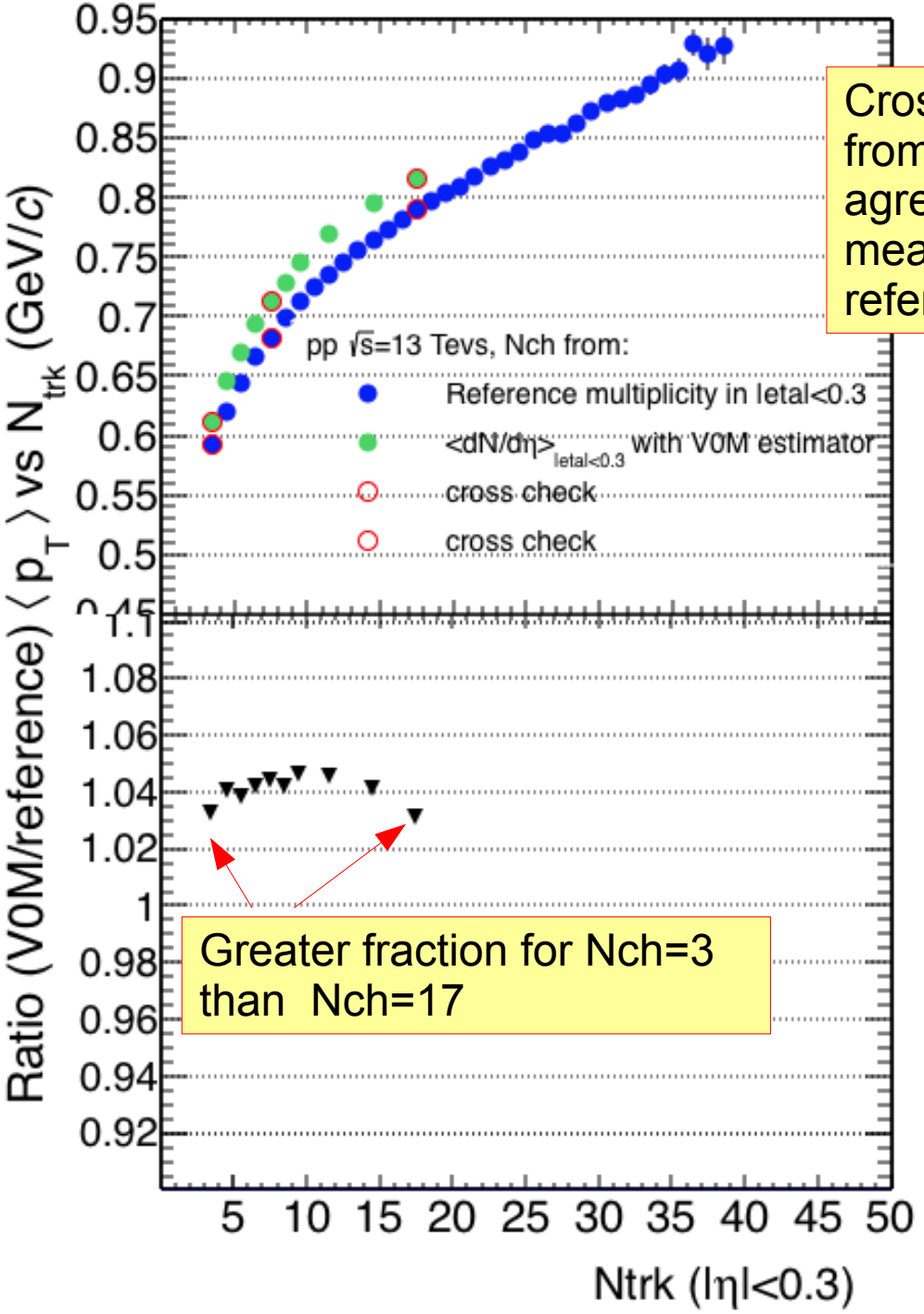


We put each V0M percentile in correspondence with its <dN/deta>

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>



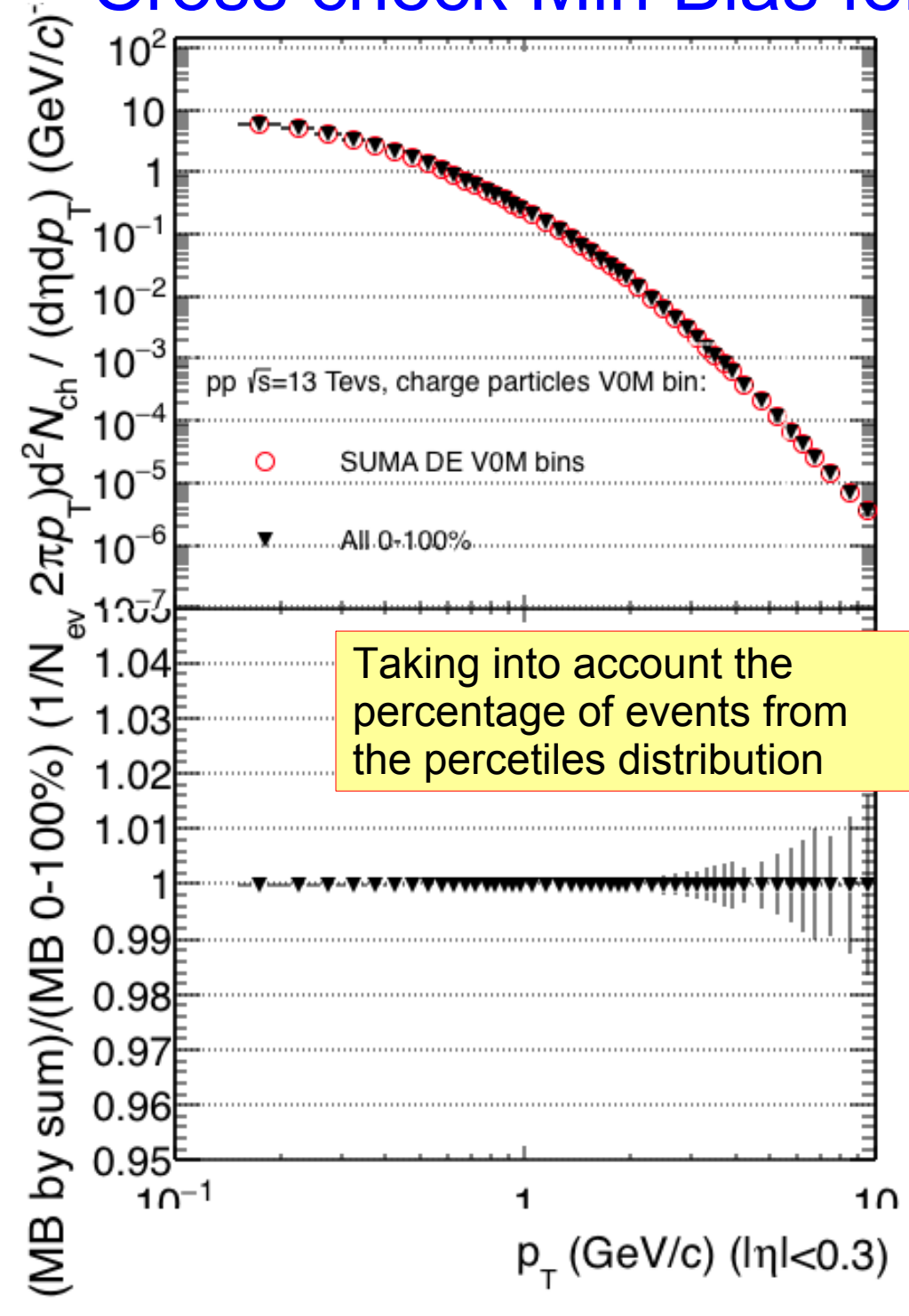
Cross check in <pT> got from the 3 spectra in good agrement with the measurements for V0M and reference estimators

Greater fraction for Nch=3 than Nch=17

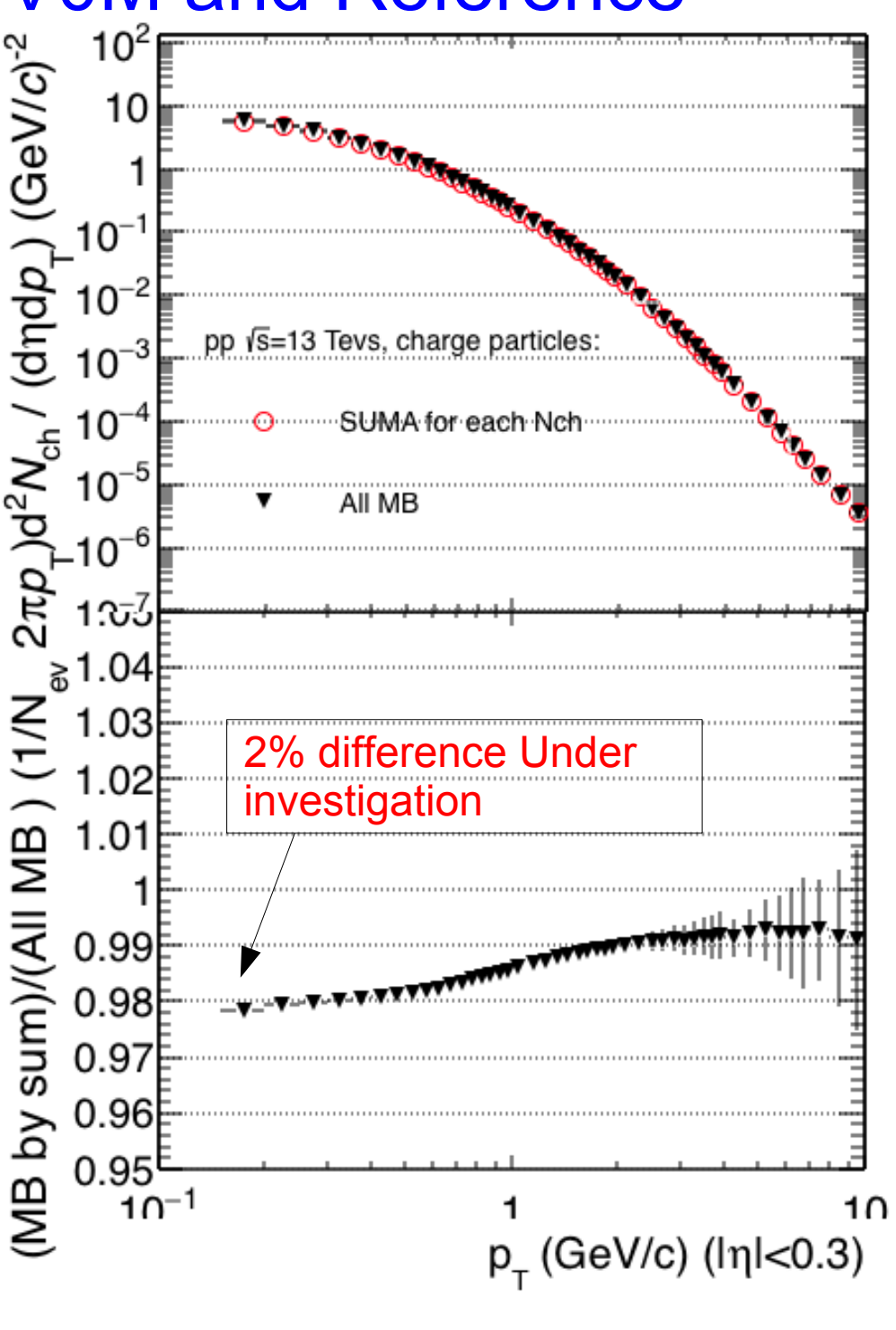
To check the spectra for each V0M multiplicity class is the right one, I made the weighted average in order to get the MB results.

(See next slide)

Cross check Min Bias for V0M and Reference

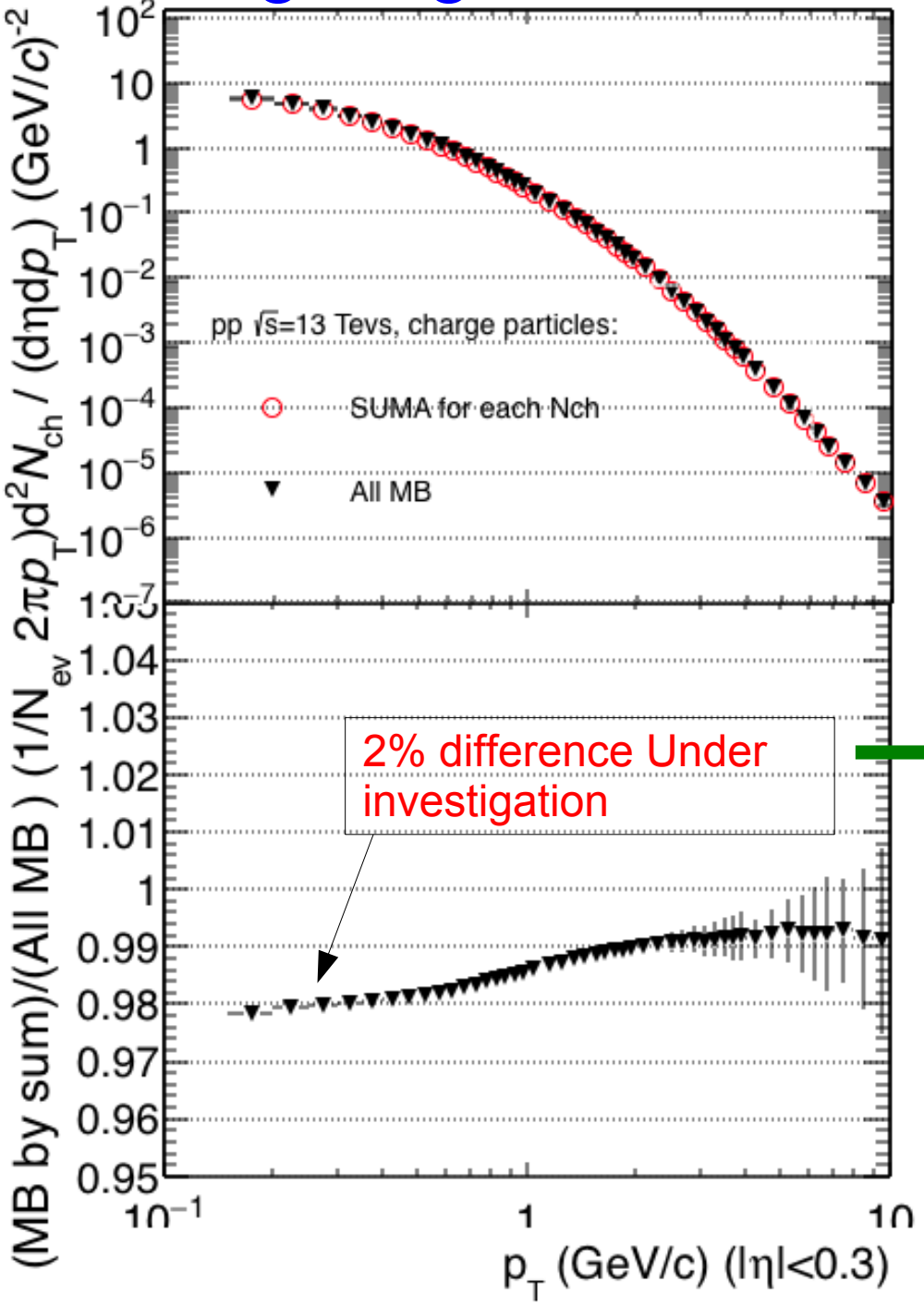


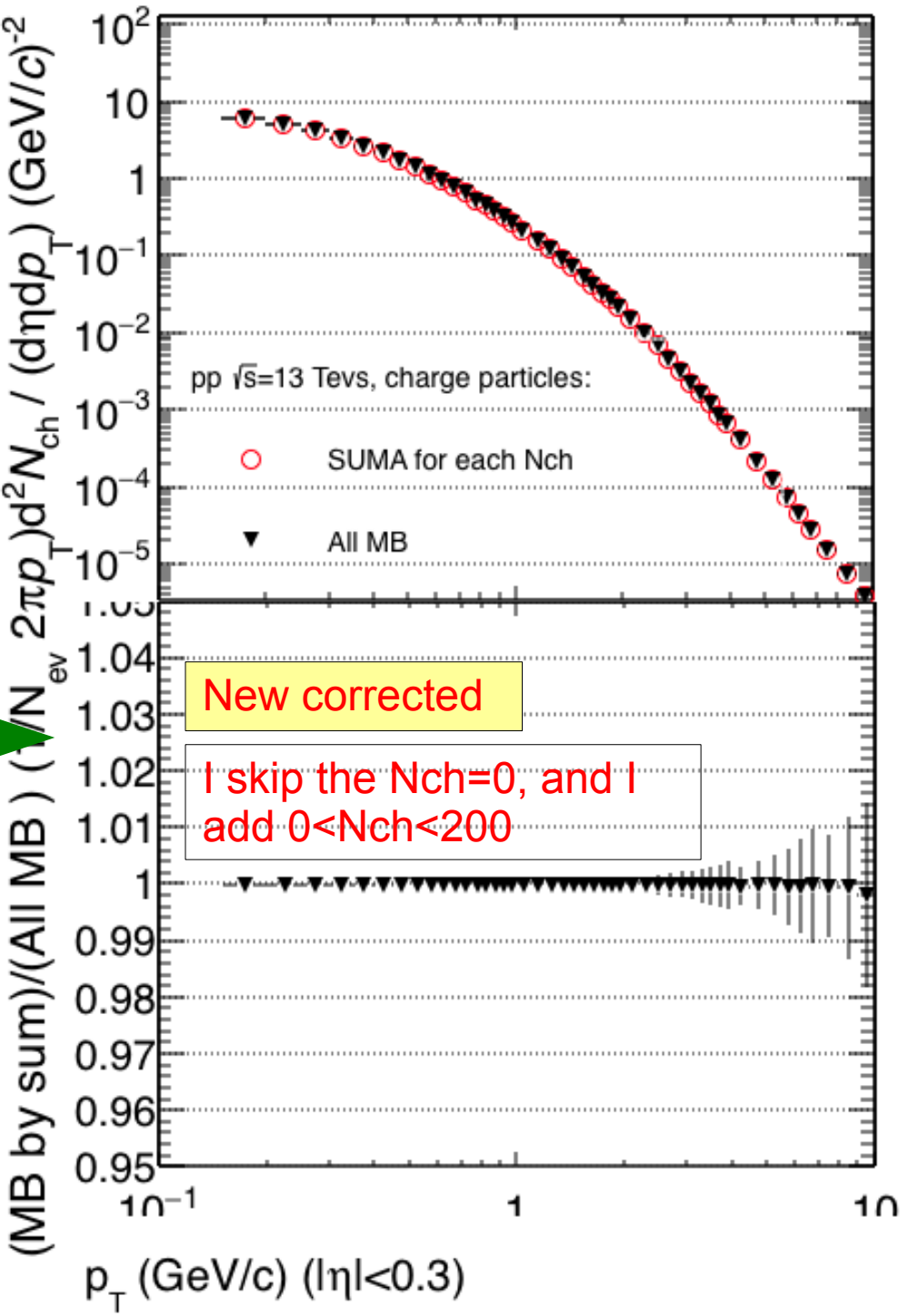
Taking into account the percentage of events from the percetiles distribution



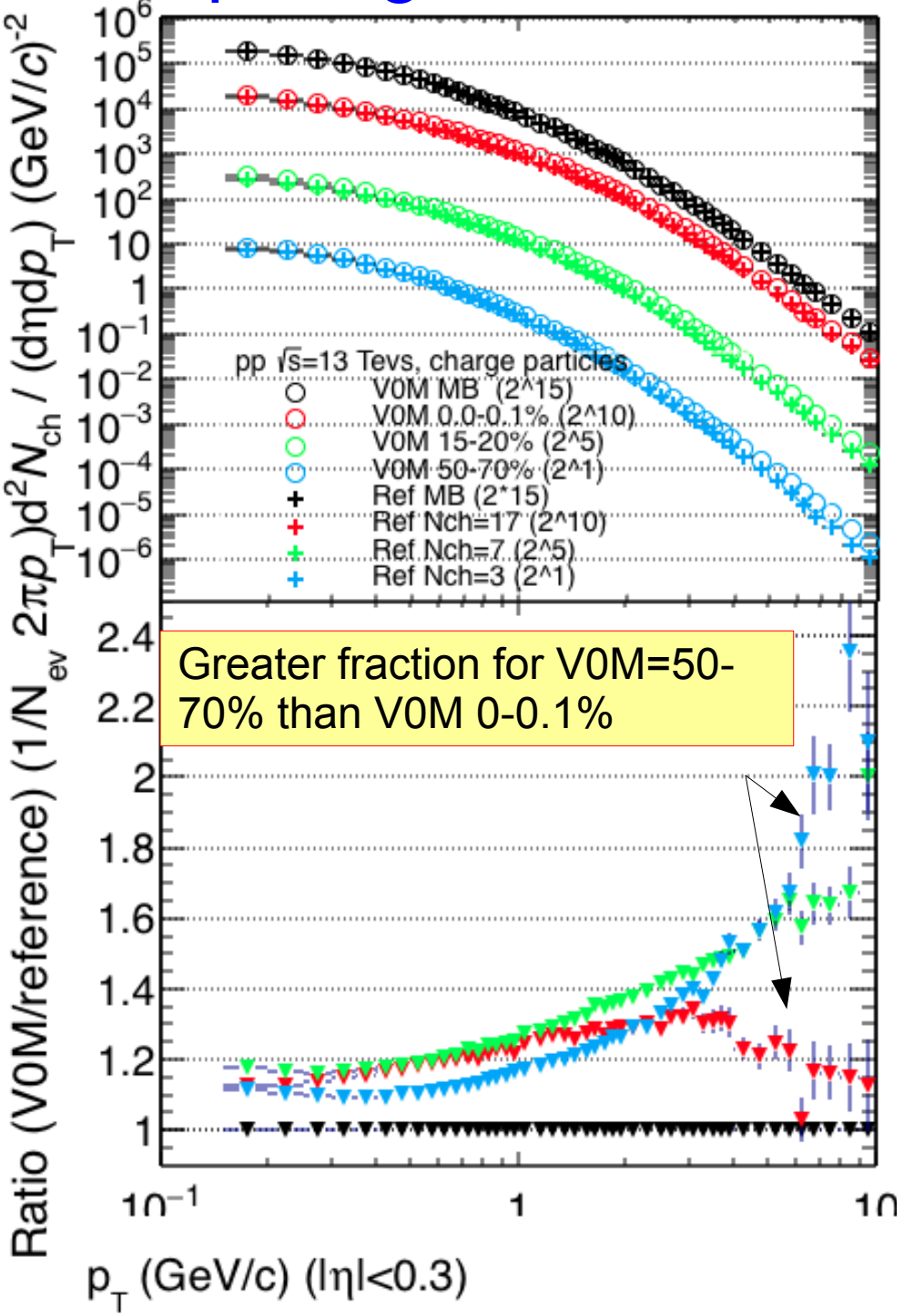
2% difference Under investigation

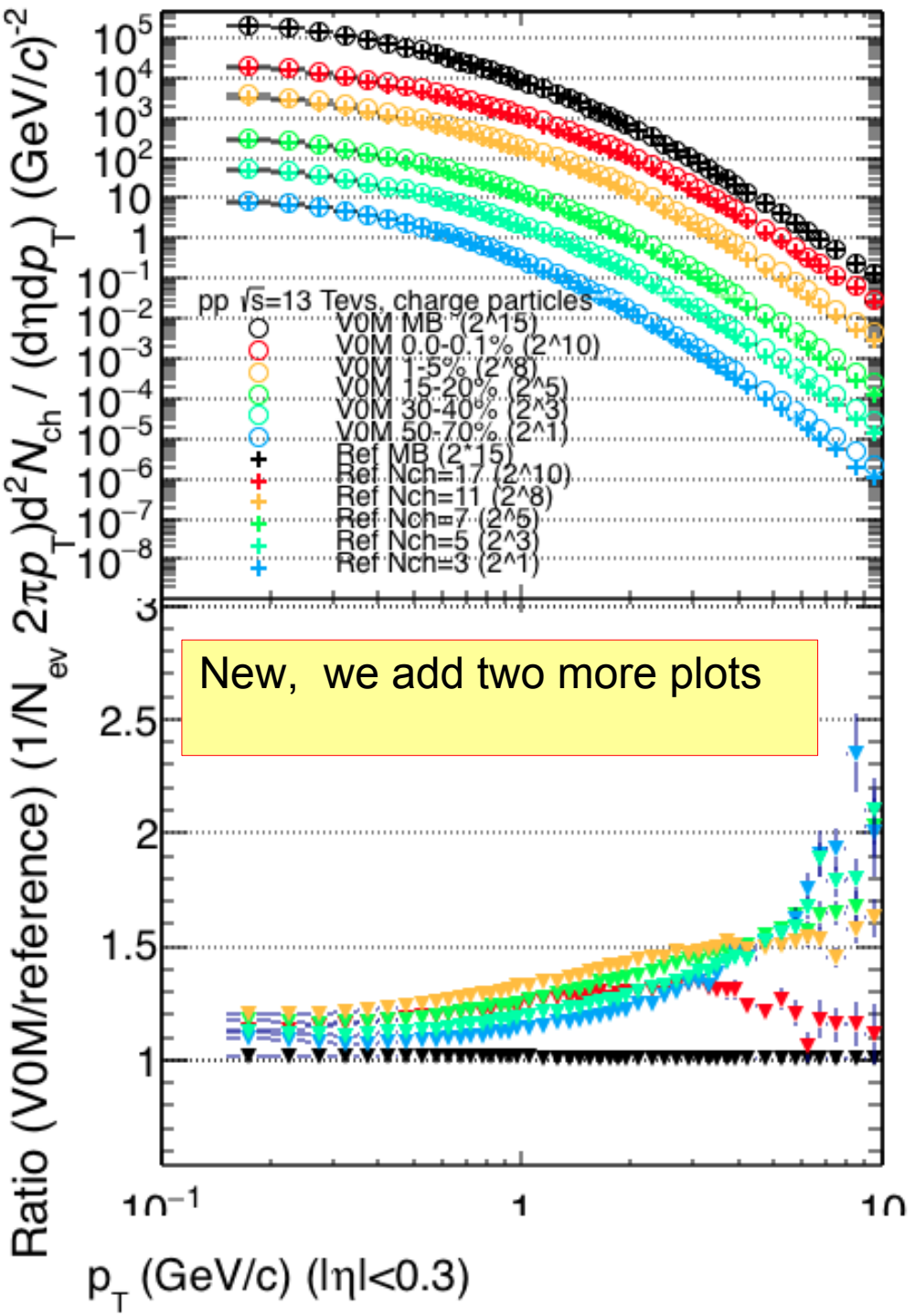
Invetigating Min Bias for Reference



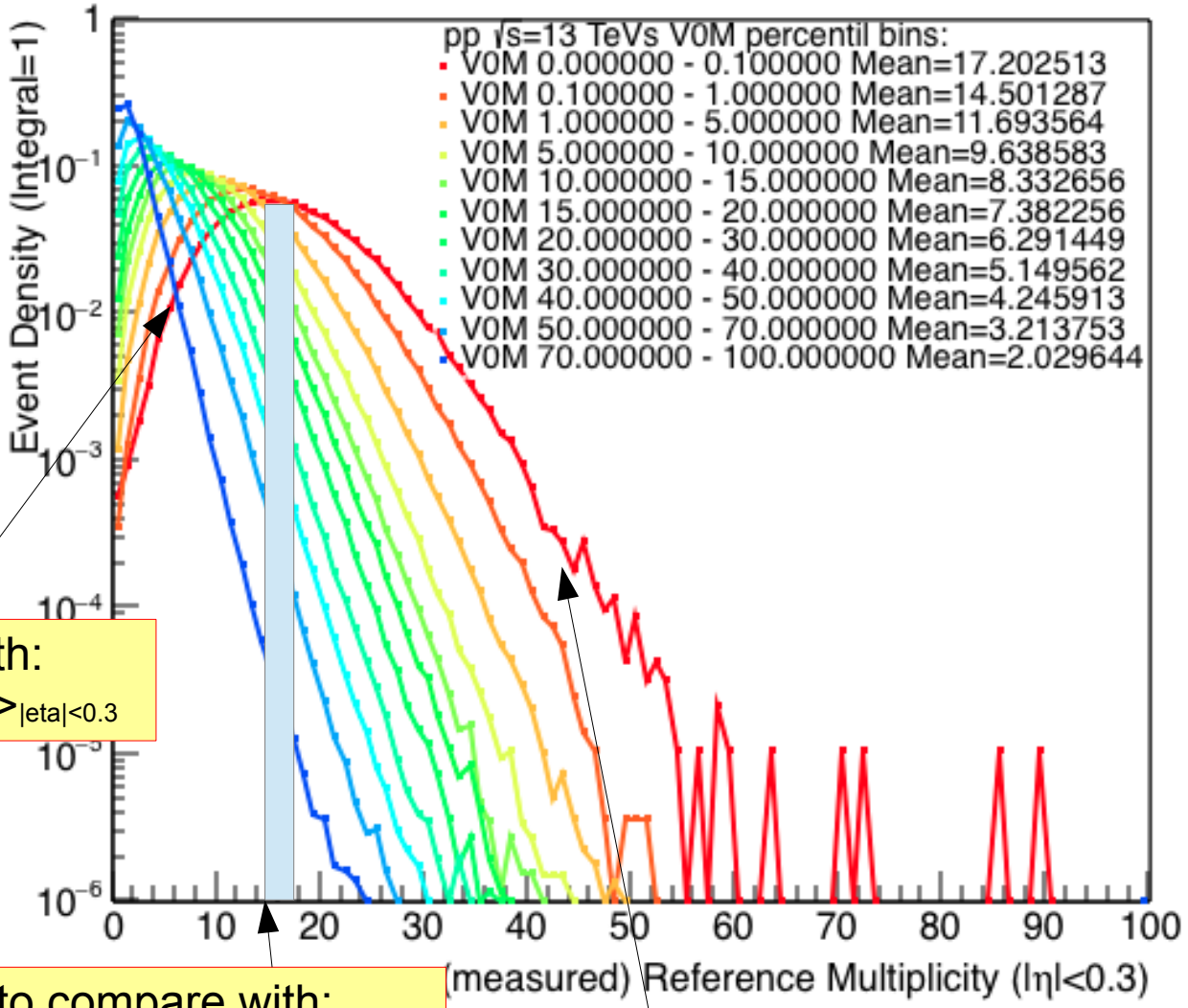


Comparing estimators V0M and Ref I etal <0.3





Who contributes to the greater fraction for V0M?

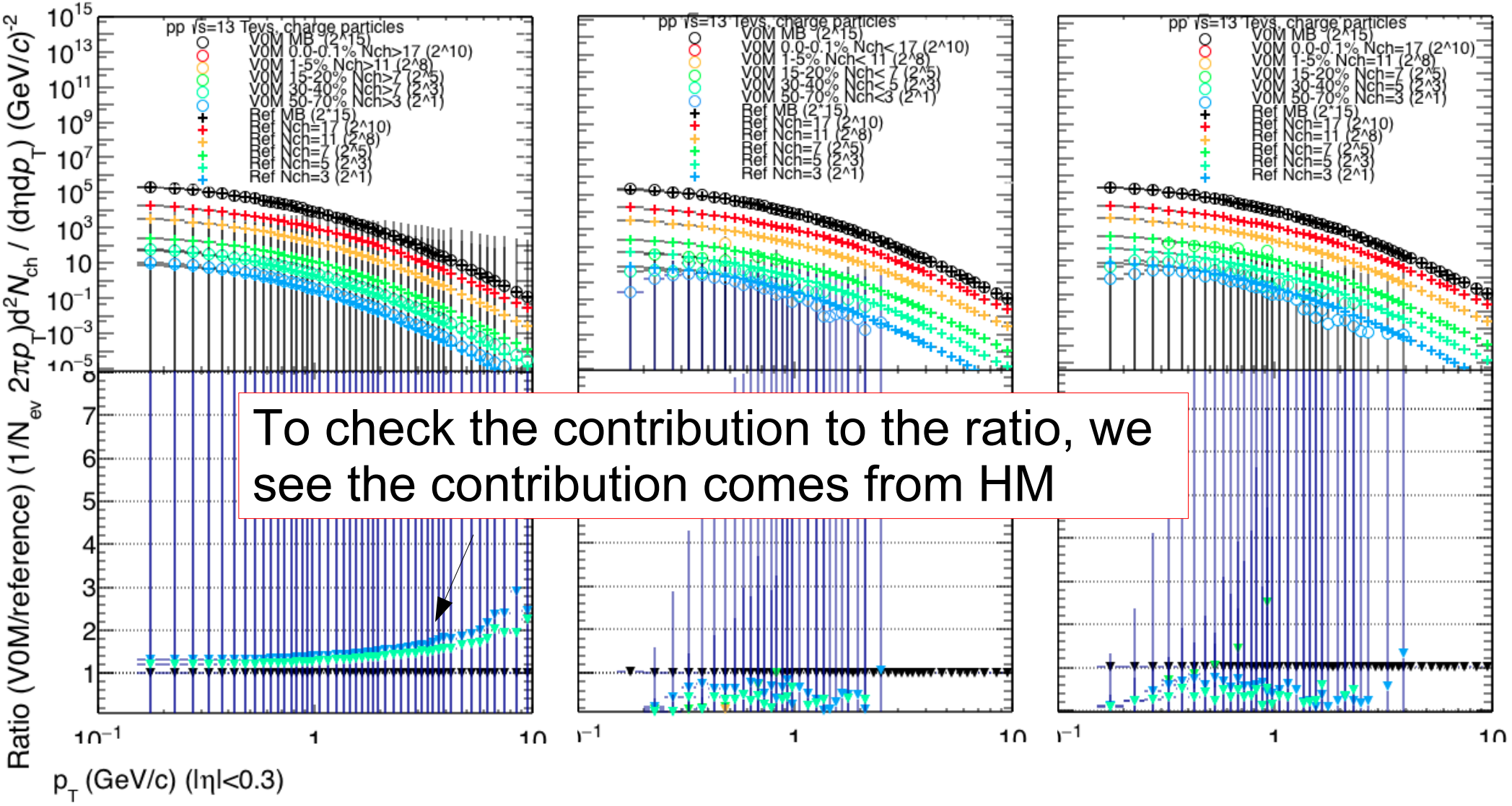


Ned to compare with:
$V0M_{Nch} < \langle dN/d\eta \rangle_{|\eta|<0.3}$

Ned to compare with:
$V0M_{Nch} = \langle dN/d\eta \rangle_{|\eta|<0.3}$

Ned to compare with:
$V0M_{Nch} > \langle dN/d\eta \rangle_{|\eta|<0.3}$

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



To check the contribution to the ratio, we see the contribution comes from HM

News
For Antonio's presentation in ICTP last October

High Energy Physics - Phenomenology

Jet effects in high-multiplicity pp events

Antonio Ortiz, Gyula Bencédi, Héctor Bello, Satyajit Jena

(Submitted on 16 Mar 2016)

The study of the high-multiplicity pp events has become important because we need to understand the origin of the fluid-like features which have been found in such small systems. In this work we concentrate on the radial flow signatures. To this end, the role of jets in high-multiplicity pp collisions is investigated using PYTHIA 8.

Comments: 5 pages, 2 figures. Proceedings of the 7th International Workshop on Multiple Partonic Interactions at the LHC, Trieste, Italy
Subjects: **High Energy Physics - Phenomenology (hep-ph)**
Cite as: arXiv:1603.05213 **[hep-ph]**
(or arXiv:1603.05213v1 **[hep-ph]** for this version)

Submission history

From: Antonio Ortiz [view email]
[v1] Wed, 16 Mar 2016 18:39:02 GMT (386kb,D)

Summary

- We get the MB for Nch from Yields of Charged
- We see the contribution to ratio V0M and Reference comes from HM this is $V0M_{Nch}$ > $\langle dN/deta \rangle_{|eta|<0.3}$
  To be done
- To check what happends for 70-100% and for 0.0-0.1%.

Thank you!.

Summary

- Seems that the spectra are harder when we use V0M multiplicity selection and when we compare with the ones with <d*N*/deta> similar to the reference estimator
- However we need to verify because our MB for charge particles has not been reproduced.
- We get greater <P_T> when we use V0M.
- In MC Antonio see the same effect due to events with more MPIs.

To be done

- To get MB comparison for charge particles.
- To check consistency with standard event selection of the collaboration for run II:
- https://twiki.cern.ch/twiki/bin/view/ALICE/PWGPPEvSelRun2pp

- Thanks to Mario Ivan and the RC meeting for provide the vidyo sesion

Thank you!.

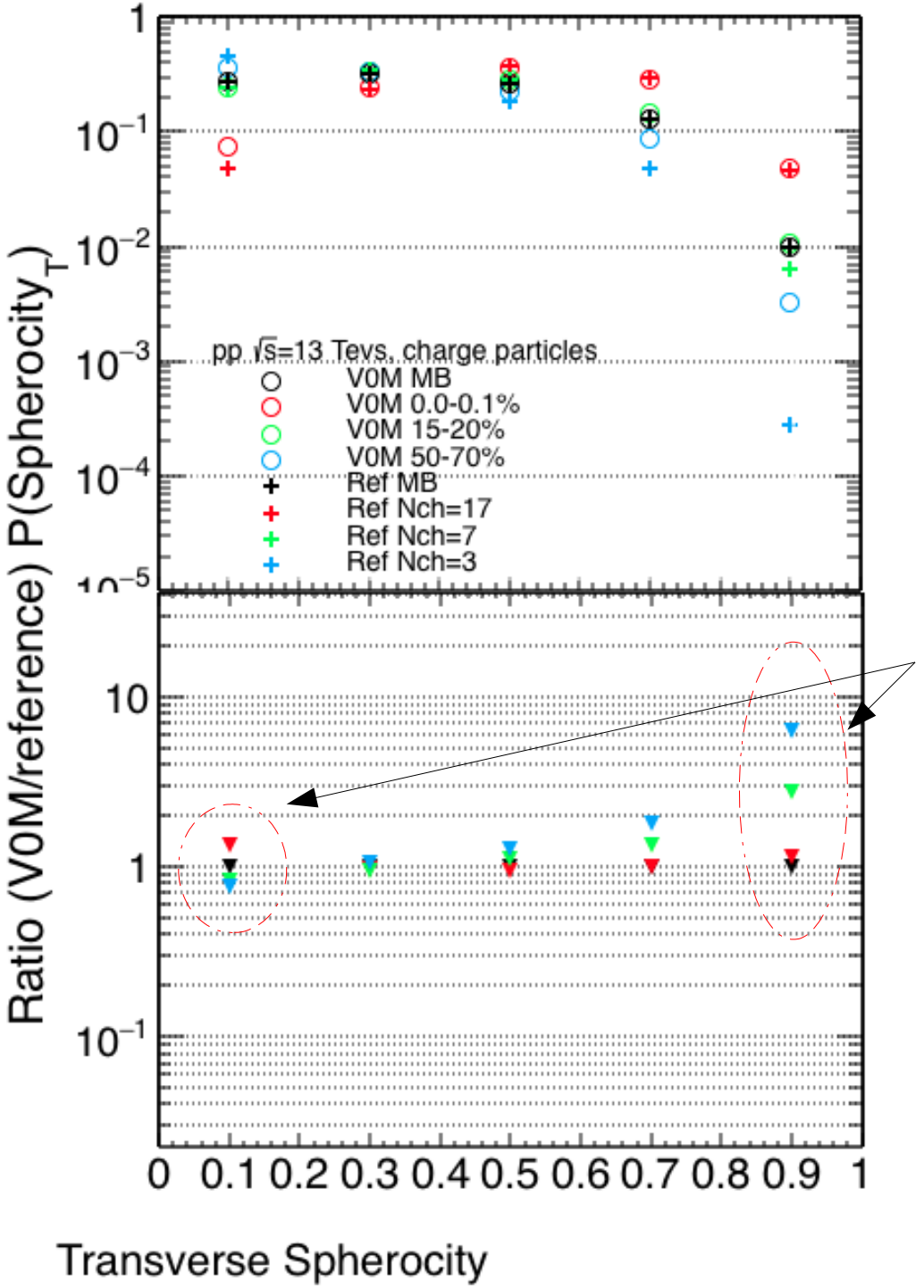
Outline

- Multiplicity correlation V0M vs |eta|<0.3 proyections
- Mean P_T from V0M percentil to <dN_{ch}/deta>
- Mean So from V0M percentil to <dN_{ch}/deta>
- Mean pt and Mean So vs <dN_{ch}/deta> for V0M
- Yield and ratios for V0M and <dN_{ch}/deta>.
- Comparison between methods V0M and reference |eta|<0.3 for spectra, for Mean P_T, for Mean S_O
- Some cross checks

- Conclusions.

Thanks to Mario Ivan and the RC meeting for provide the vidyo sesion

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



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

First Conclusion

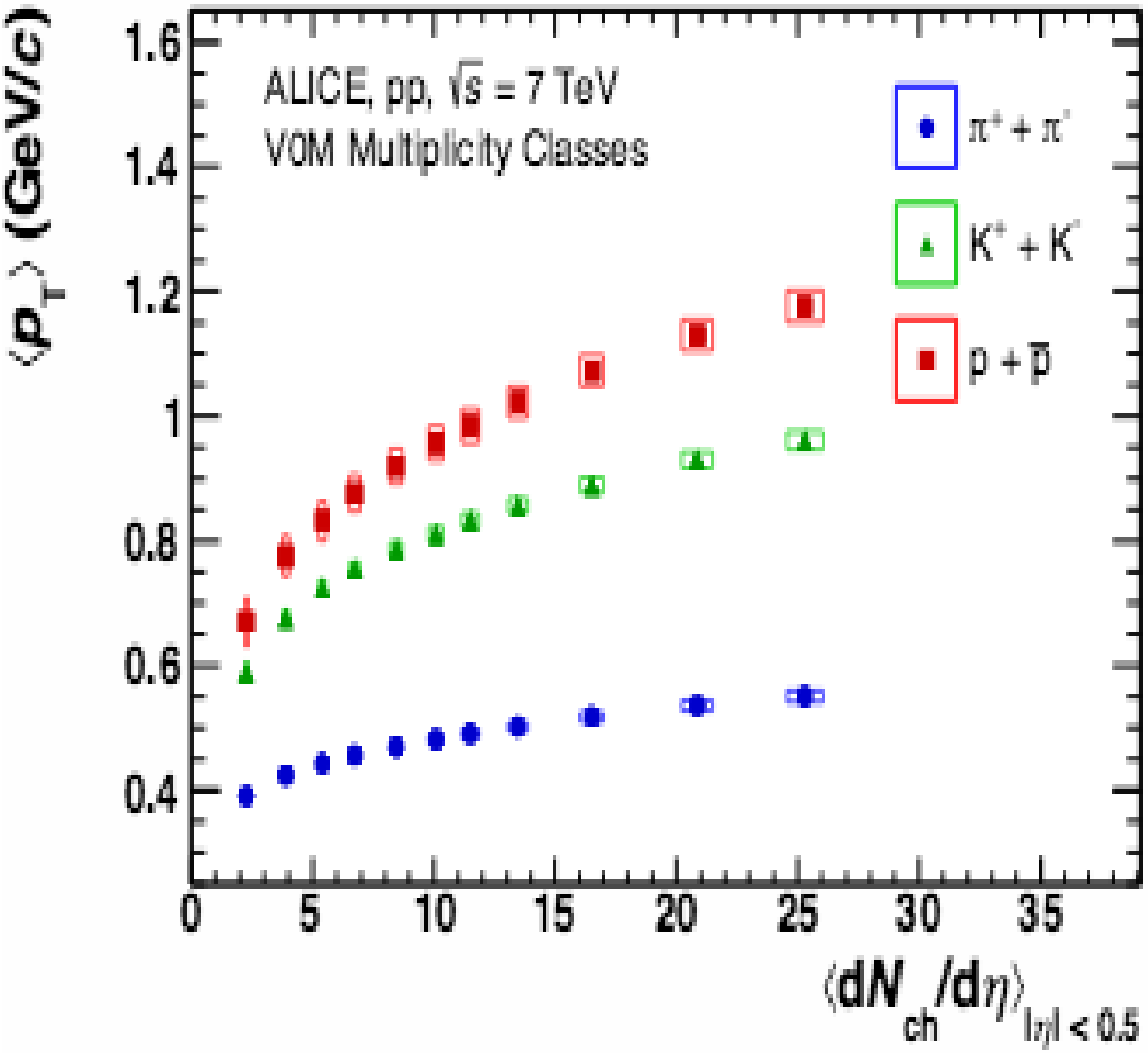
The results from V0M percentile and the corresponding to $\langle dN/d\eta \rangle |\eta|<0.3$ shows consistency in all the Crosschecks we made.

V0M gives greater $\langle p_T \rangle$ for intermediate Multiplicity Than the reference estimator, and start to converge for High N_{ch}.

Mean Pt for <dN/deta>

- Vytautas et all Analysis Note

https://aliceinfo.cern.ch/Notes/sites/aliceinfo.cern.ch.Notes/files/notes/analysis/akalweit/2015-Sep-15-analysis_note-AnalysisNote.pdf



Analysis and Event selection

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

Runs: 13 TeV

test pass2
LHC15f test pass2: (7.2 mill of evts)
MC Pythia6 Perugia 2011 **LHC15g3c2** 1.8 mill.
MC Pythia8 Monash 2011 **LHC15g3a2**: 2.19 mill,

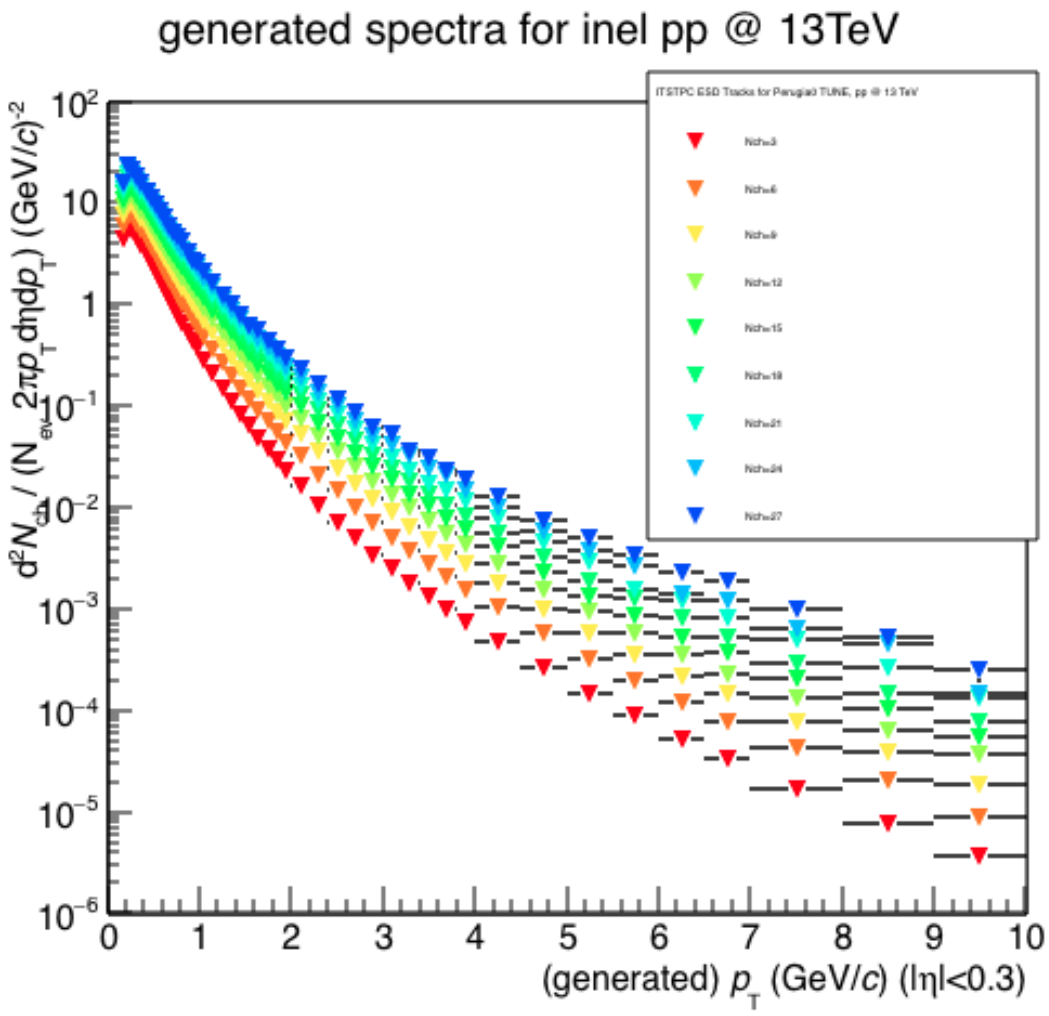
Pass2
LHC15f pass2: (59 mill of evts) good runs
MC Pythia6 Perugia 2011 **LHC15g3c3** 50 mill.
MC Pythia8 Monash 2011 **LHC15g3a3**: 40 mill,

Track selection taken for each analysis:

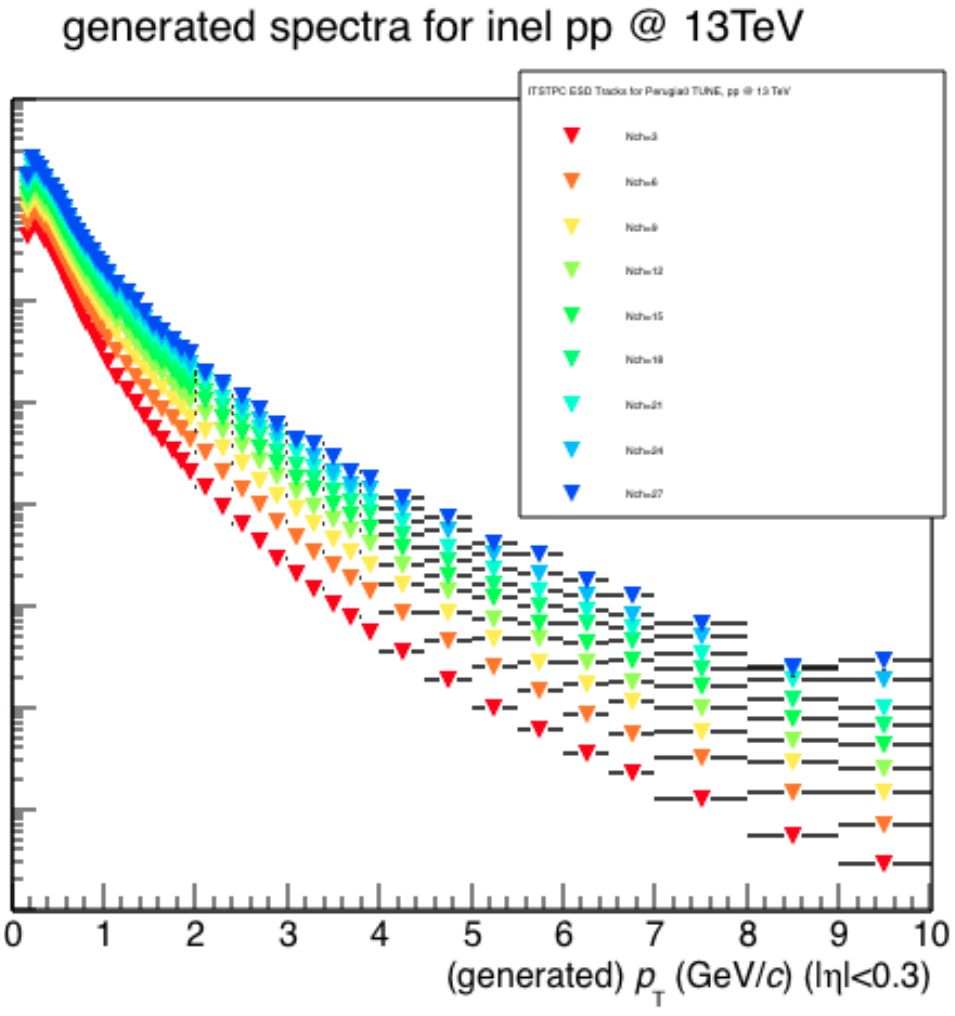
- So Analysis, Hybrid-track cuts for primary charged particles with $|\eta|<0.3$ and $0.15<p_T<10$ GeV/c.
- $<p_T>$ Analysis, Golden-track cuts with $|\eta|<0.3$ and $0.15<p_T<10$ GeV/c.
- Multiplicity, Reference multiplicity selection with $|\eta|<0.3$

Invariant yield spectra for MC full pass2

LHC15g3c3
Pythia6 Perugia 2011

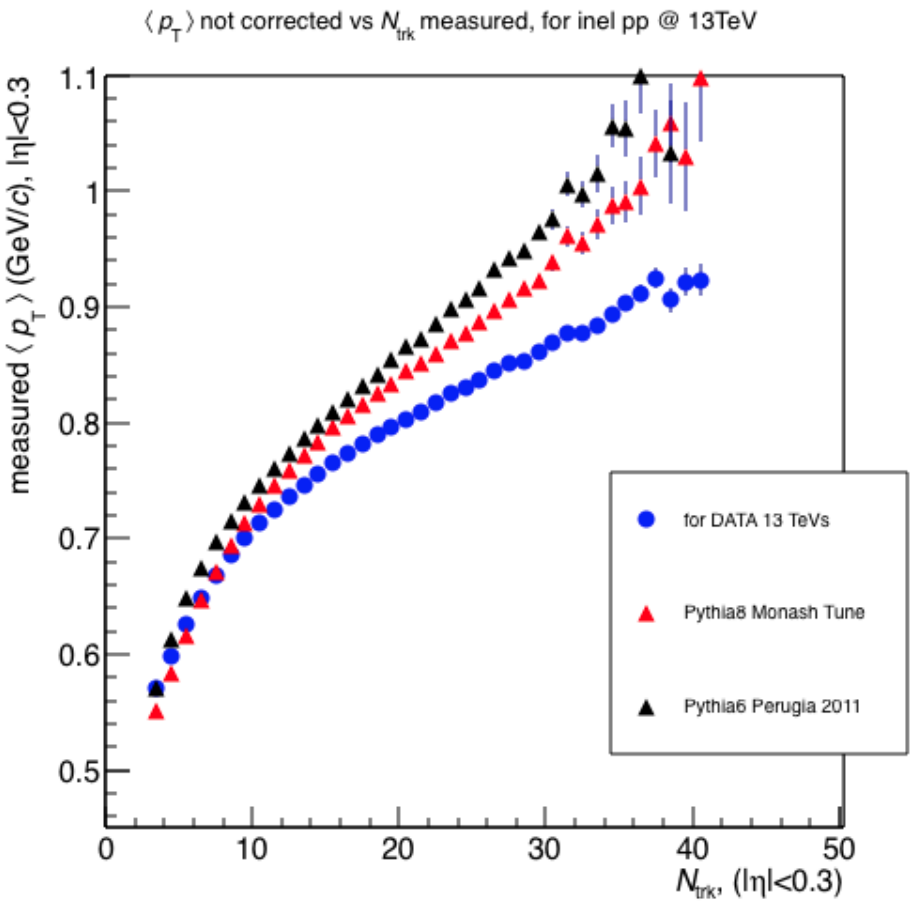


LHC15g3a3
Pythia8 Monash

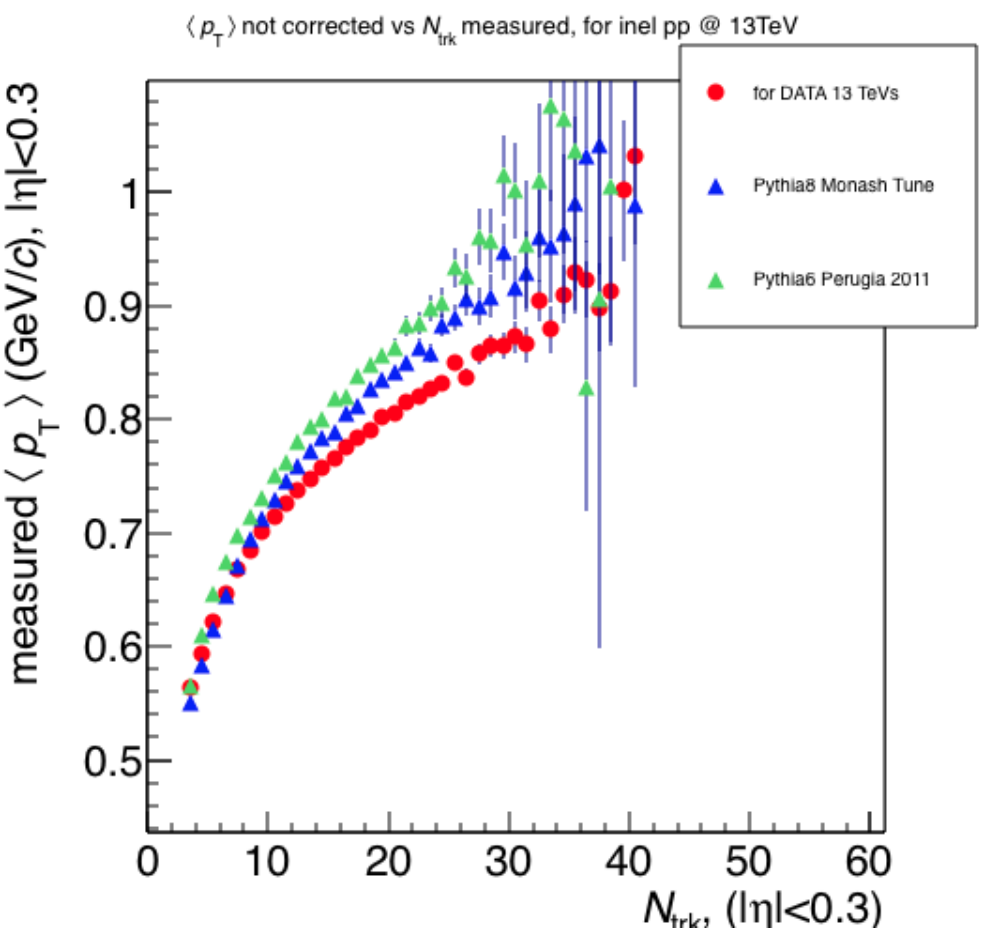


Mean Transverse Momentum

Full Pass2

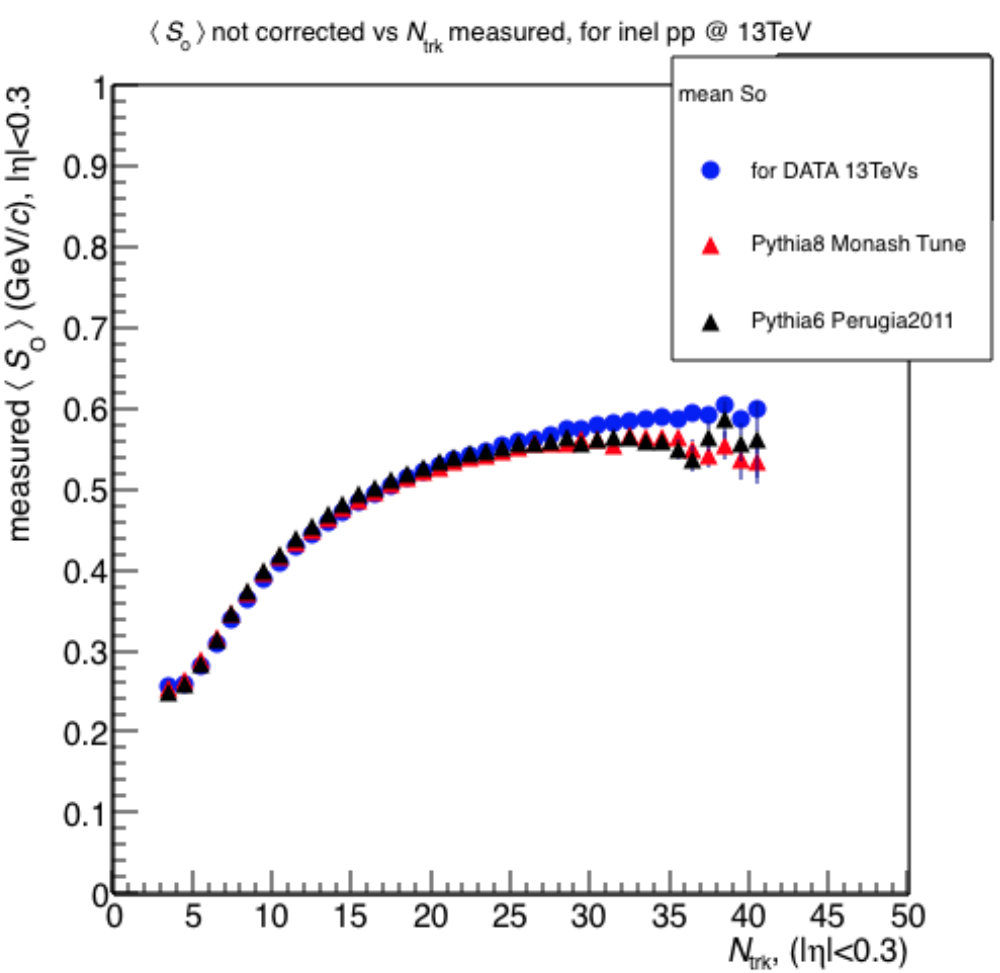


test_pass2

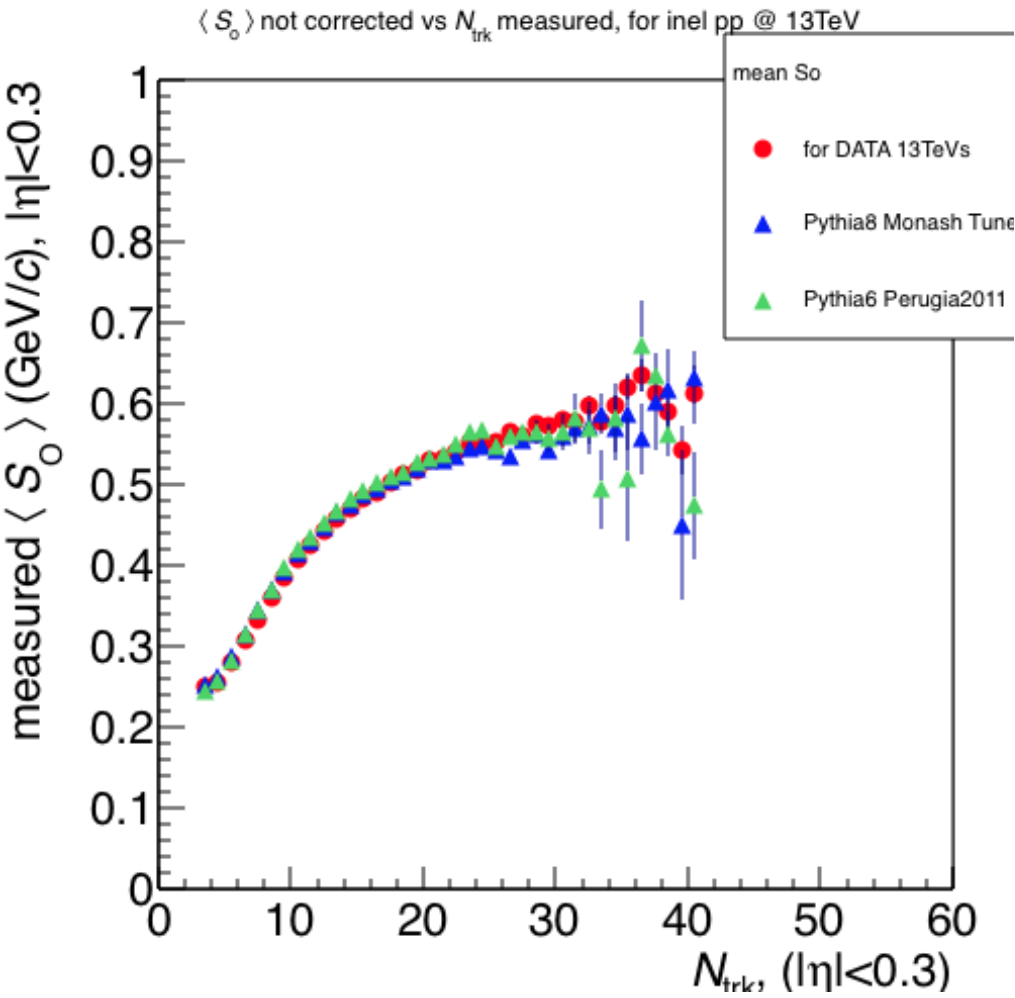


Mean Spherocity

Full Pass2

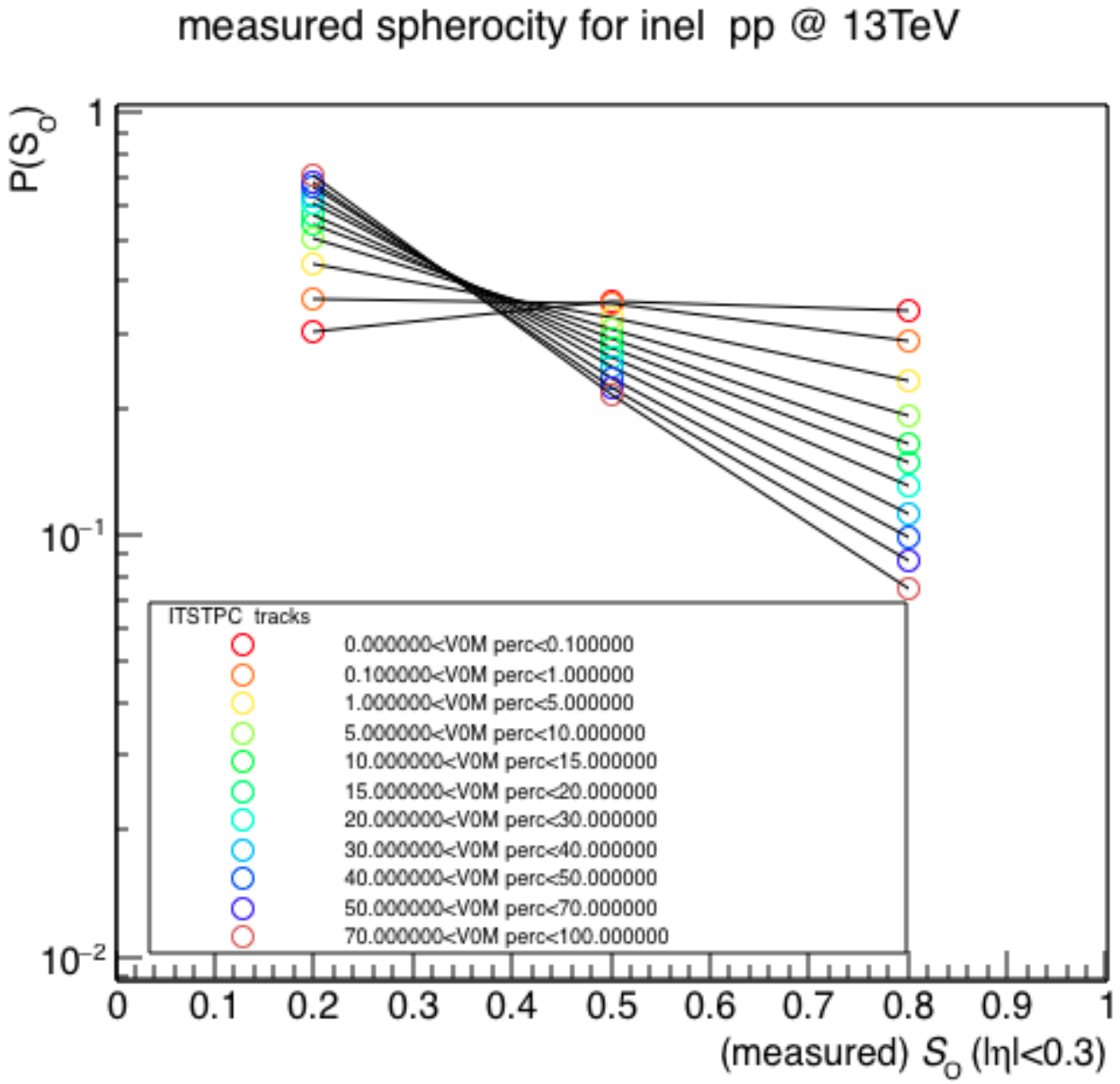


test_pass2



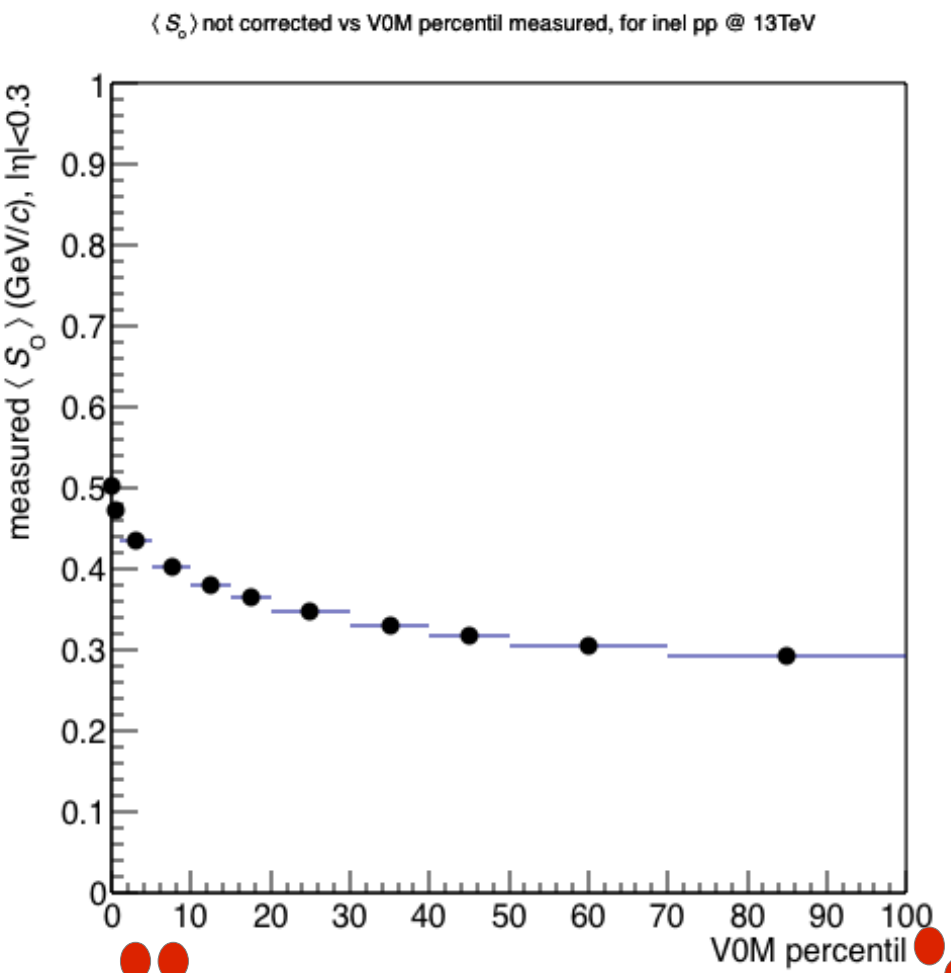
Probability of Spherocity for V0M percentils

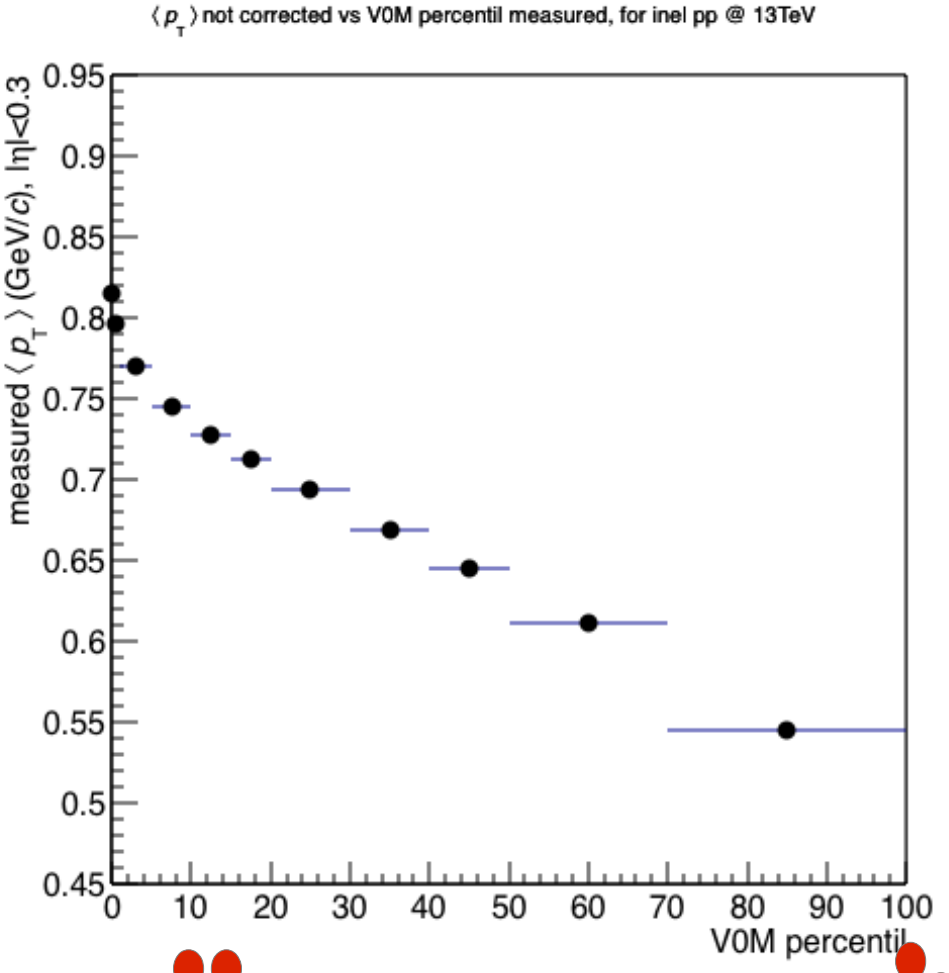
- LHC15f (pass2)

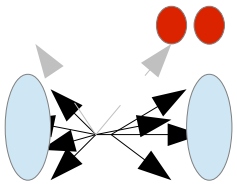


variable bin corrected

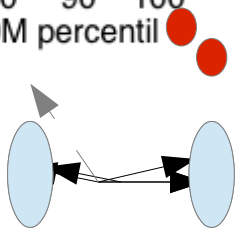
Mean So for V0M percentils • LHC15f (pass2)



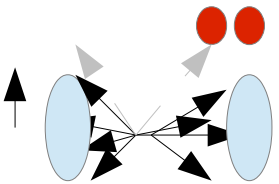




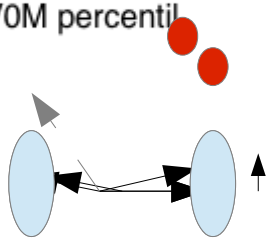
High So



Low So



High pT

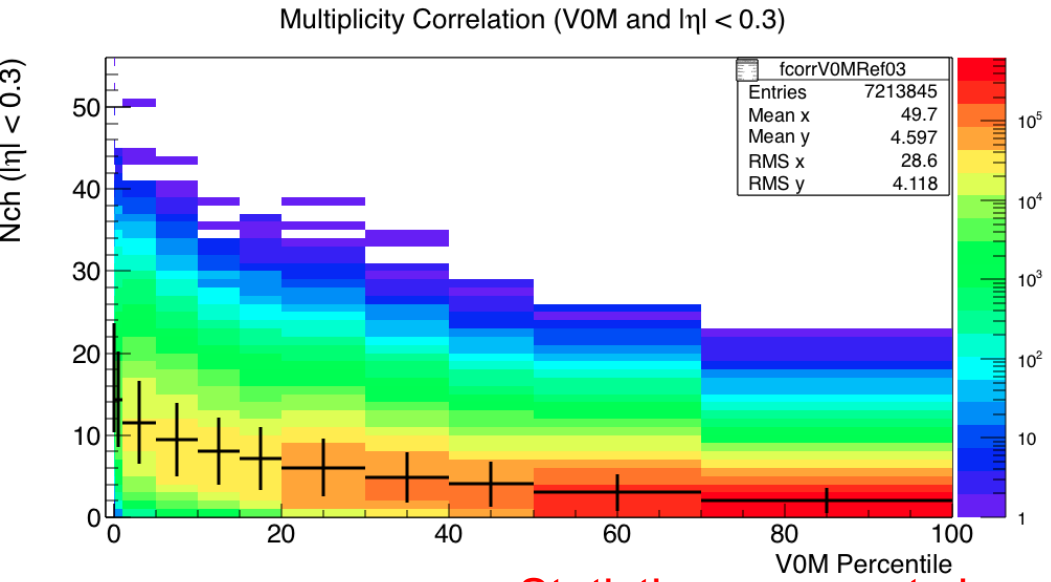


Low pT

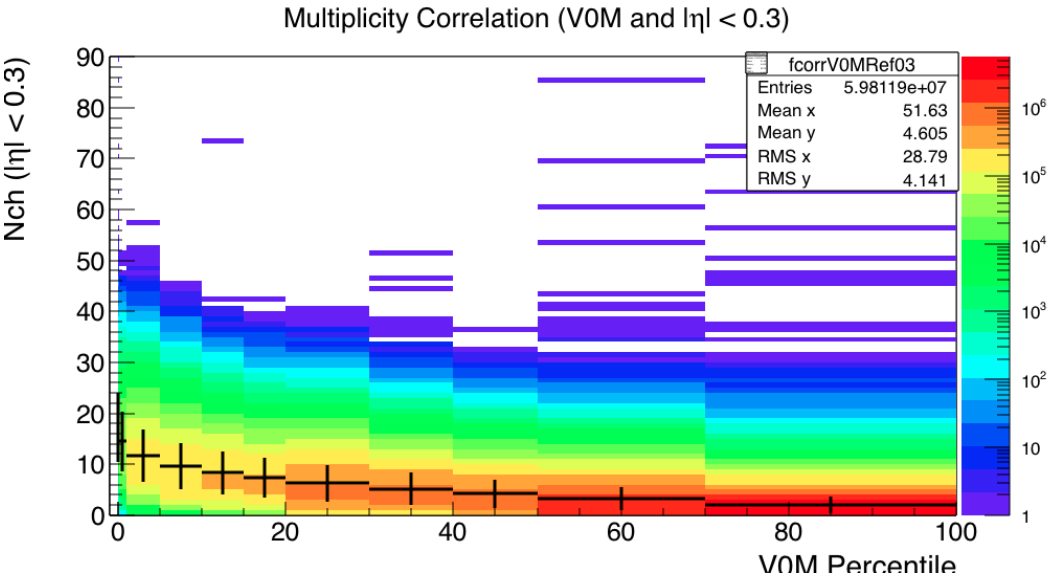
```
V0MbinsDefault={0.0,0.1,1.0,5.0,10.0,15.0,20.0,30.0,40.0,50.0,70.0,100.0};
```

Multiplicity correlation (midrapidity vs V0M percentils)

- LHC15f (test pass2)



- LHC15f (pass2)



Statistics seem not change too much in the mean value

```
V0MbinsDefault={0.0,0.1,1.0,5.0,10.0,15.0,20.0,30.0,40.0,50.0,70.0,100.0};
```

multiplicity in |eta|<0.3	17.20,	14.50, 11.69 , 9 .63 , 8 .33,	7.38,	6.29,	5.14,	4 .24,	3.21,	2.02

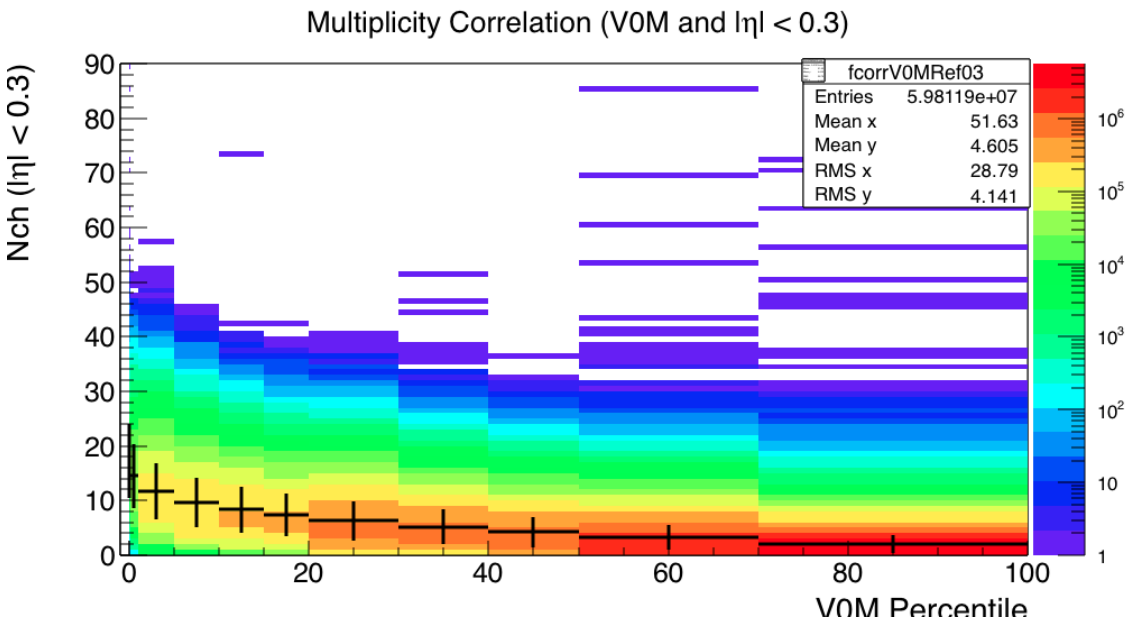
Proposal for the baseline common multiplicity binning scheme

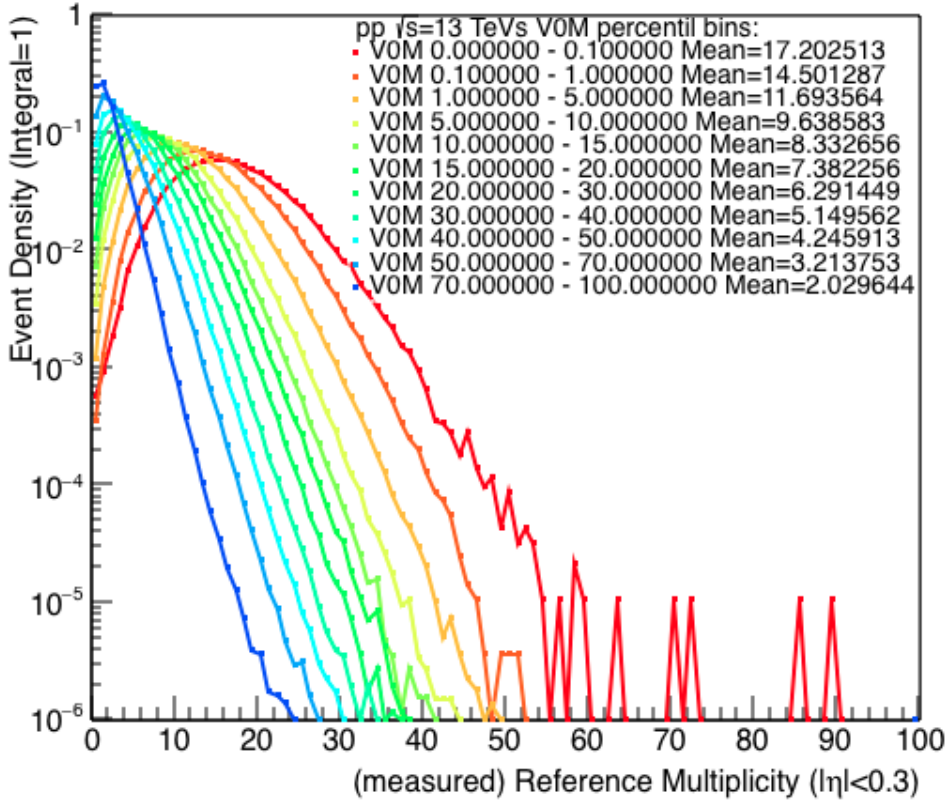
- V0M quantile
- no need to put fraction of cross-section: that's already there by definition.
- [0.00, 0.01] [0.01,0.10] [0.10, 1.0] [1.0, 5.0] [5.0, 10.0] [10.0, 15.0] [15.0, 20.0] [20.0, 30.0] [30.0, 40.0] [40.0, 50.0] [50.0, 70.0] [70.0, 100.0]

class (percentile)	[0.00, 0.01]	[0.01, 0.1]	[0.1, 1.0]	[1.0, 5.0]	[5.0, 10.0]	[10.0, 15.0]	[15.0, 20.0]	[20.0, 30.0]	[30.0, 40.0]	[40.0, 50.0]	[50.0, 70.0]	[70.0, 100.0]
multiplicity in |eta| < 0.5	28.7	24.3	19.9	15.6	12.6	10.7	9.3	7.7	6.1	4.8	3.5	2.3

Multiplicity correlation (midrapidity vs V0M percentils)

- LHC15f (pass2)






```
V0MbinsDefault={0.0,0.1,1.0,5.0,10.0,15.0,20.0,30.0,40.0,50.0,70.0,100.0};
```

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class (percentile)	[0.00, 0.01]	[0.01, 0.1]	[0.1, 1.0]	[1.0, 5.0]	[5.0, 10.0]	[10.0, 15.0]	[15.0, 20.0]	[20.0, 30.0]	[30.0, 40.0]	[40.0, 50.0]	[50.0, 70.0]	[70.0, 100.0]
multiplicity in |eta| < 0.5	28.7	24.3	19.9	15.6	12.6	10.7	9.3	7.7	6.1	4.8	3.5	2.3

Mean values are less than for |eta|<0.5 Due to small pseudorapidity range

Mean Pt and Mean So for <dN/deta> • LHC15f (pass2)