



Summary of WG1: Minimum bias and Underlying Event

Deepak Kar

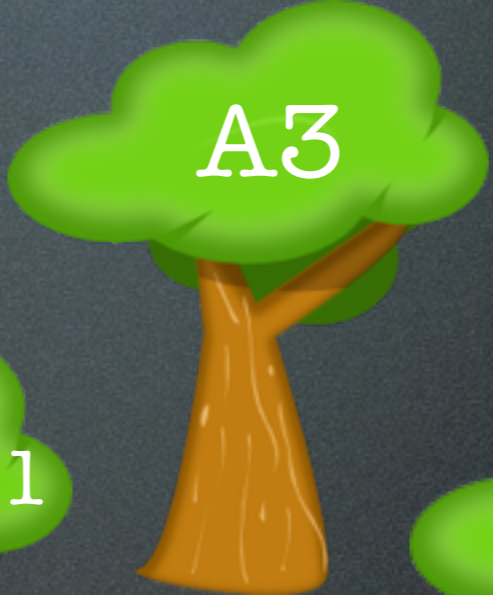
MPI@LHC, Chiapas, Mexico
27th November - 2nd December, 2016

Talks

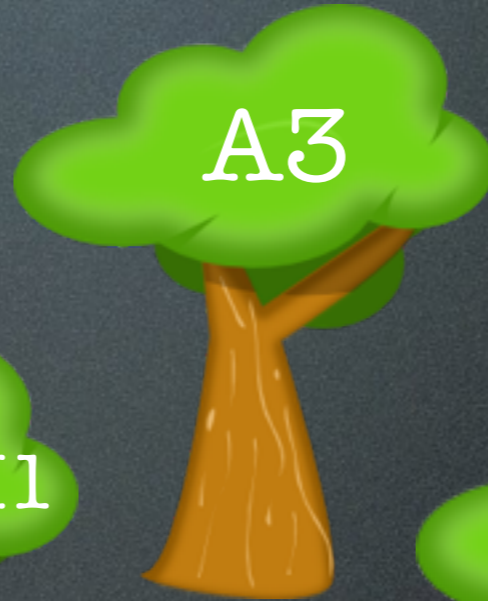
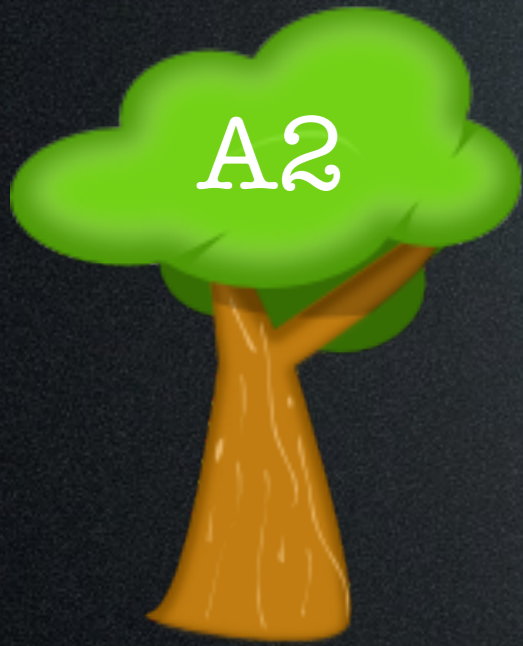
- STAR UE+particle spectra
- ATLAS MB
- ATLAS UE + Event shapes in Z
- CMS MB+UE

Stepping back a little

Tune Jungle?



Tune Jungle?



Is this
necessary?

Why?

- Experiments prefer in-house tunes
- Separate tunes for MB, UE, DPI, Forward activity...?
- More cross-talk needed?

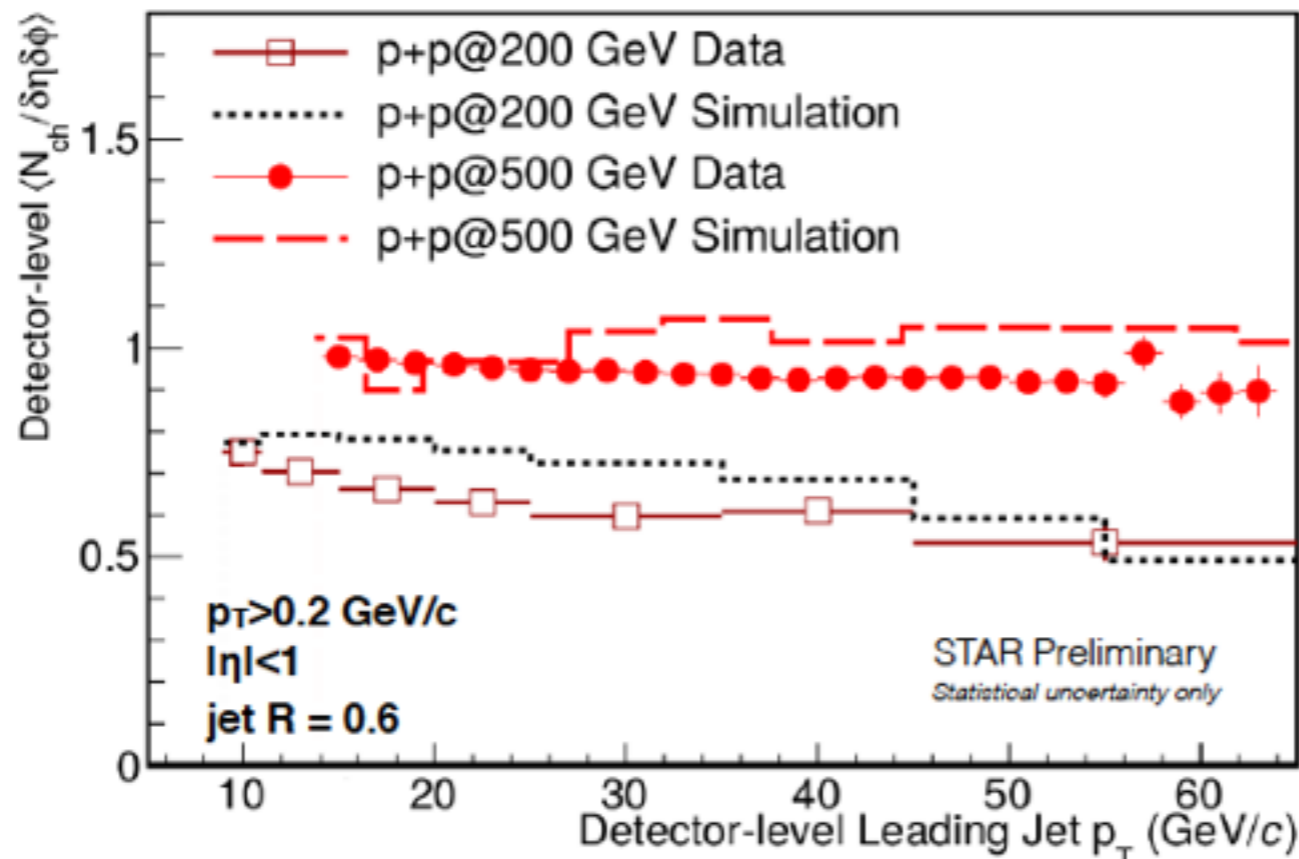
A Note on the Models

“The predictions of the model are reasonable enough physically that we expect it may be close enough to reality to be useful in designing future experiments and to serve as a reasonable approximation to compare to data. We do not think of the model as a sound physical theory . . .”

– Richard Feynman and Rick Field, 1978



Transverse Charged Particle Density Collision Energy Dependence



PYTHIA tunes into GEANT:

200GeV	perugia 2012 CTEQ6L1 PDF PARP(90)=0.213
500GeV	perugia 0

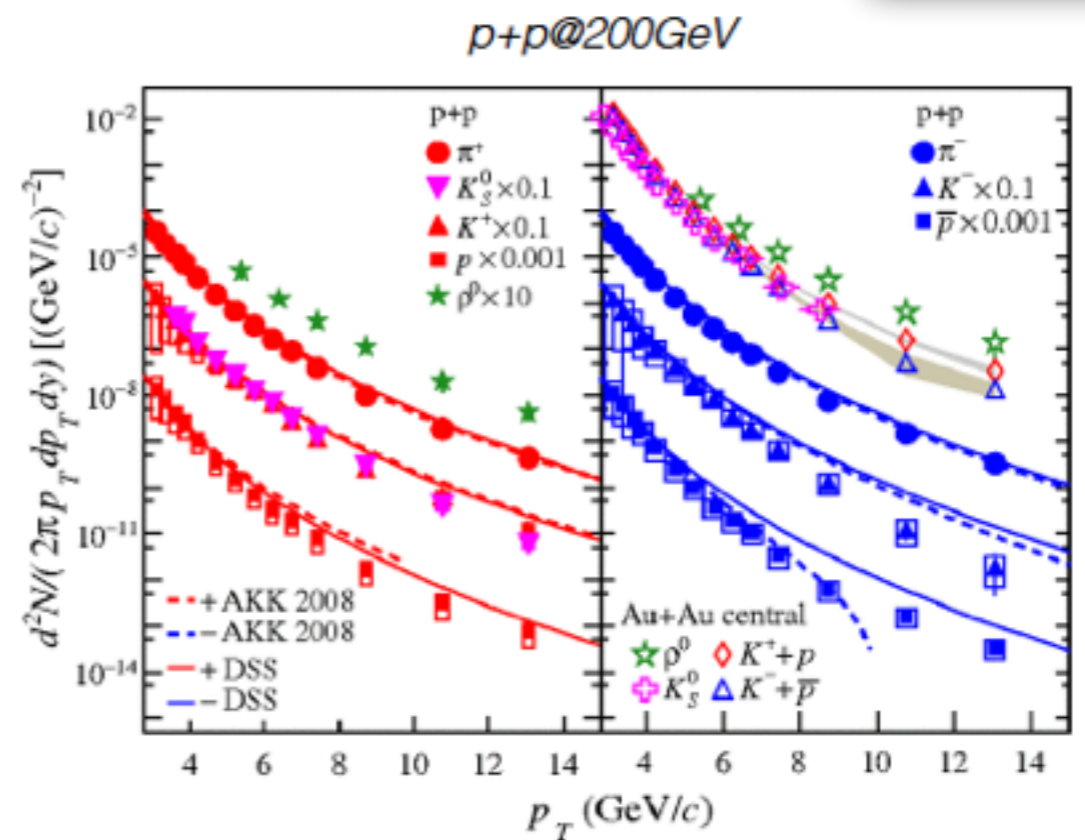
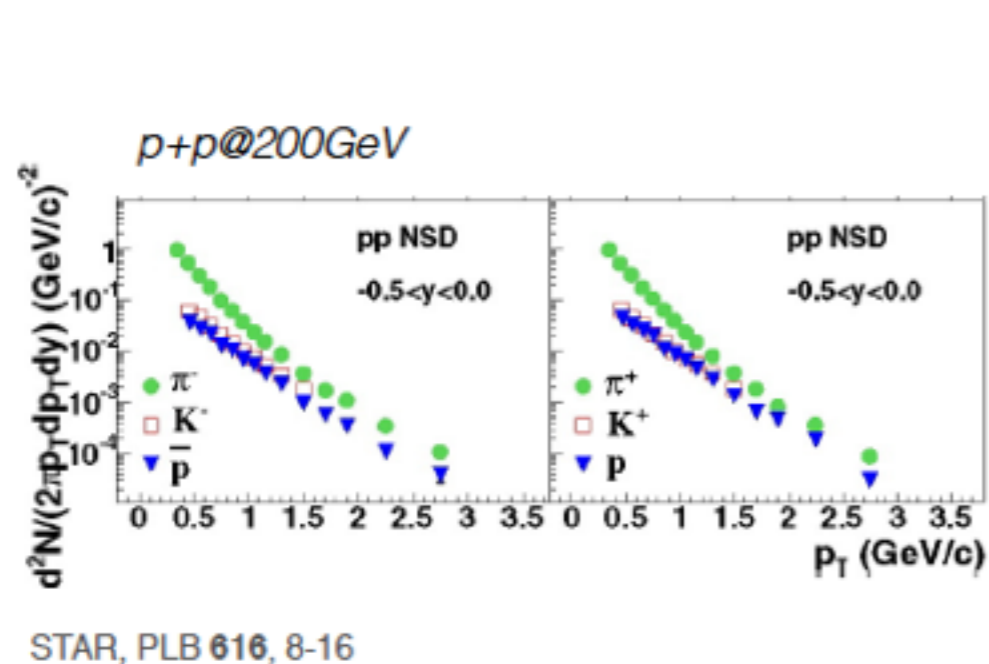
p+p@500GeV: Year 2009 data

- Transverse charged particle density slightly decreases with leading jet p_T for jet $p_T > 10$ GeV/c in both 200 and 500GeV collisions
- PYTHIA tunes over-predict data

STAR Particle Spectra

Li Yi's talk

Discussion on Pythia Tune

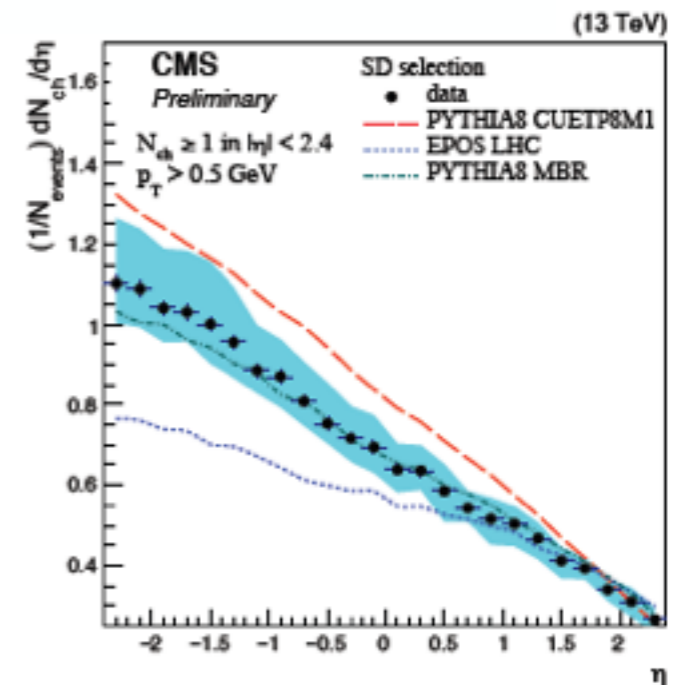
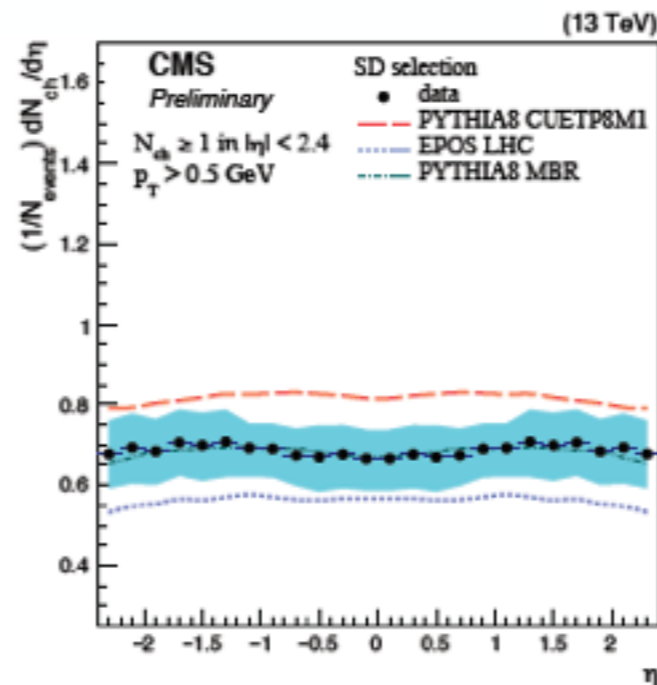
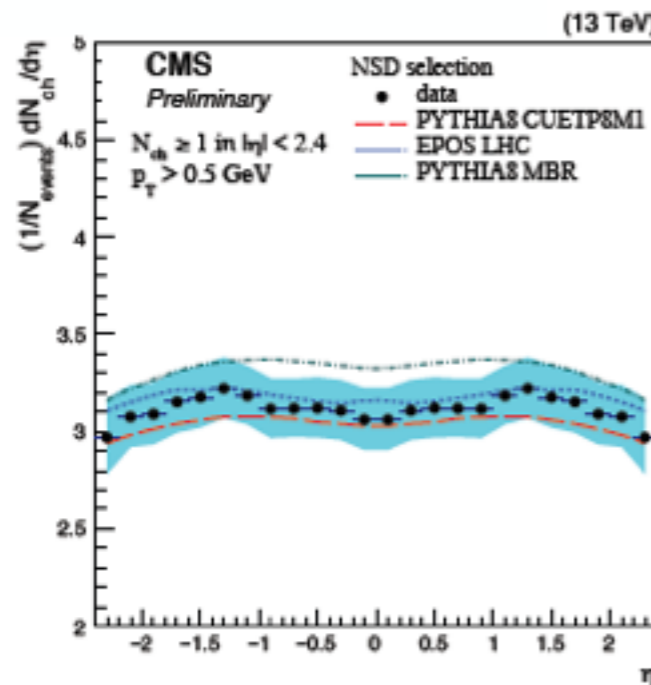
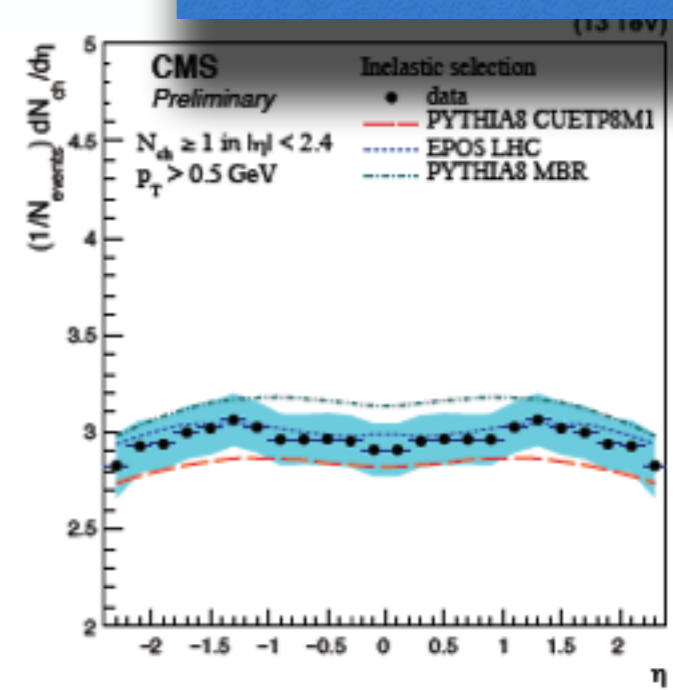
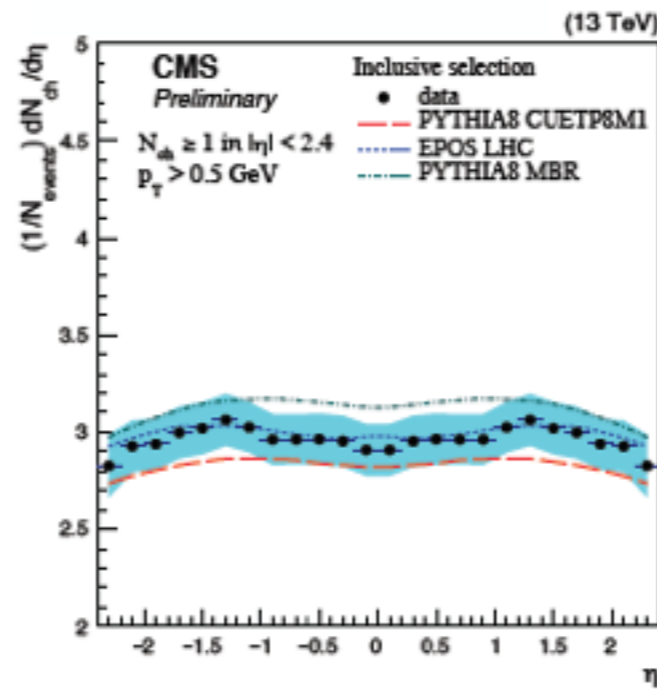
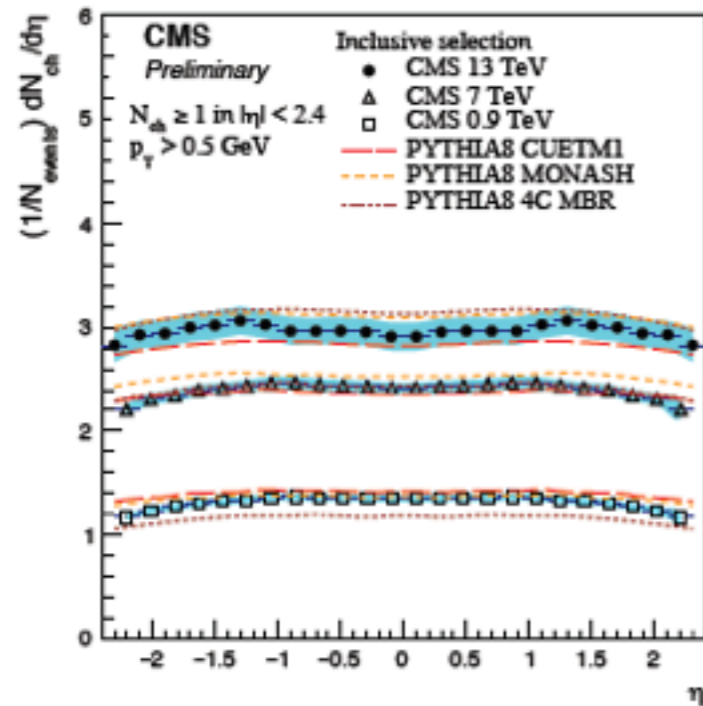


Compare Pythia tunes with MinBias π spectra

CMS MB

Juan
Luyando's
talk

Minimum Bias analysis results



CMS UE

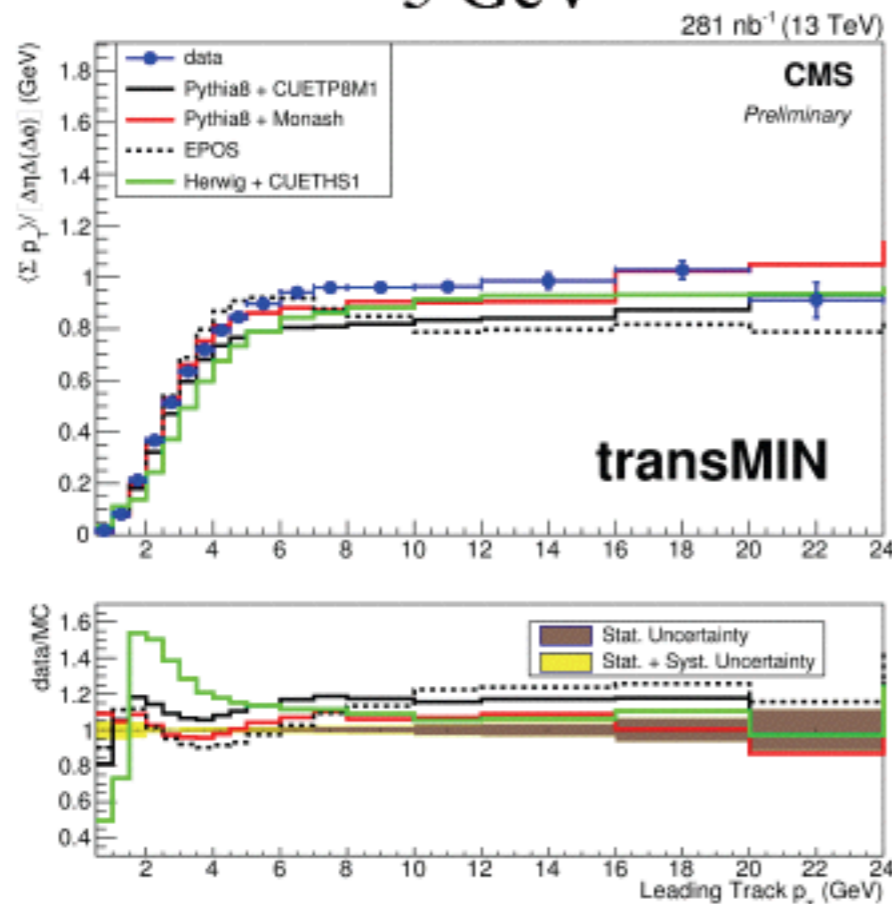
Juan Luyando's talk

Underlying event analysis

Leading

TransMIN: region with a lower activity

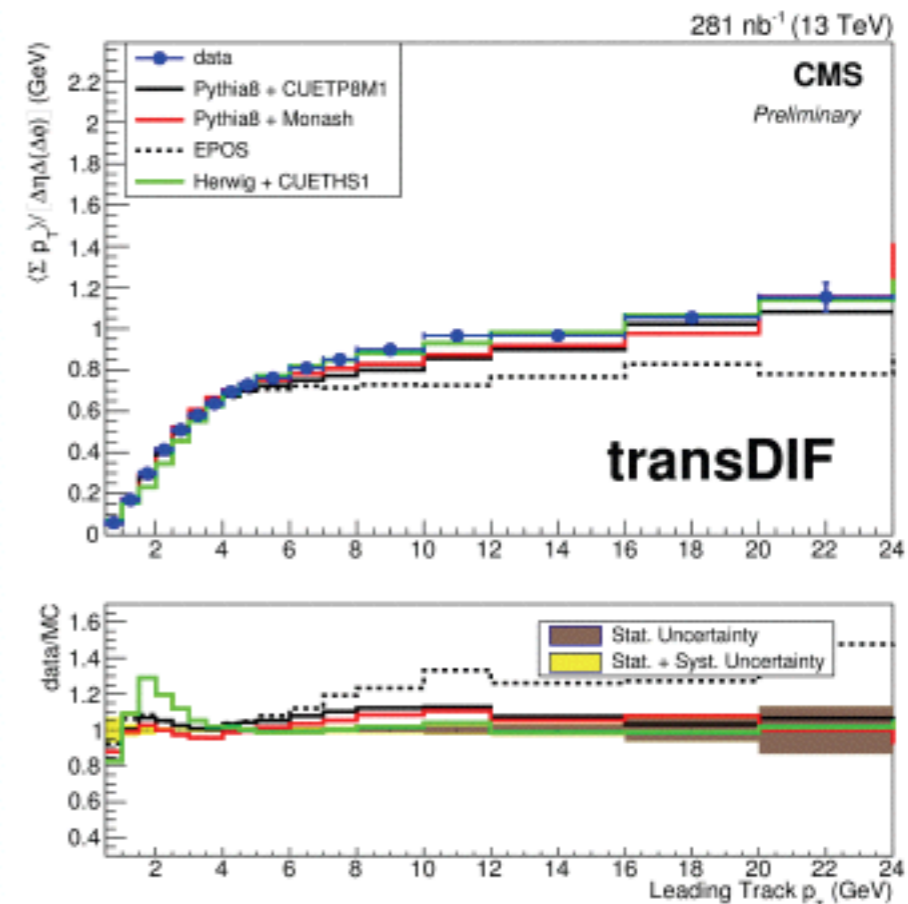
Saturation of MPI activity related to the impact parameter ~ 5 GeV



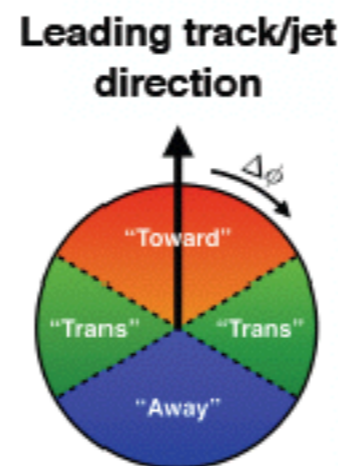
sensitive to **MPI**

TransDIF: TransMAX - TransMIN

After ~ 5 GeV constant rise originating from increasing ISR activity.

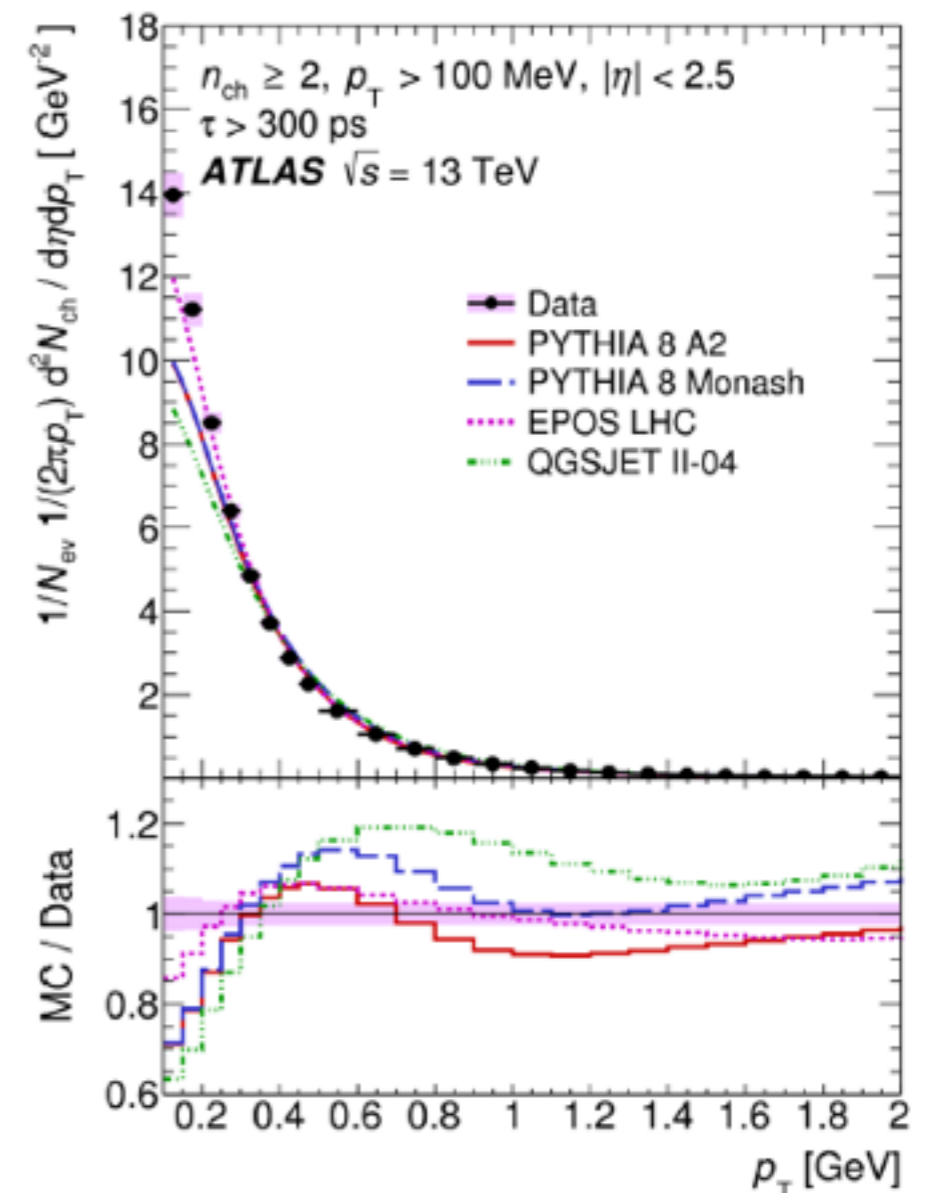
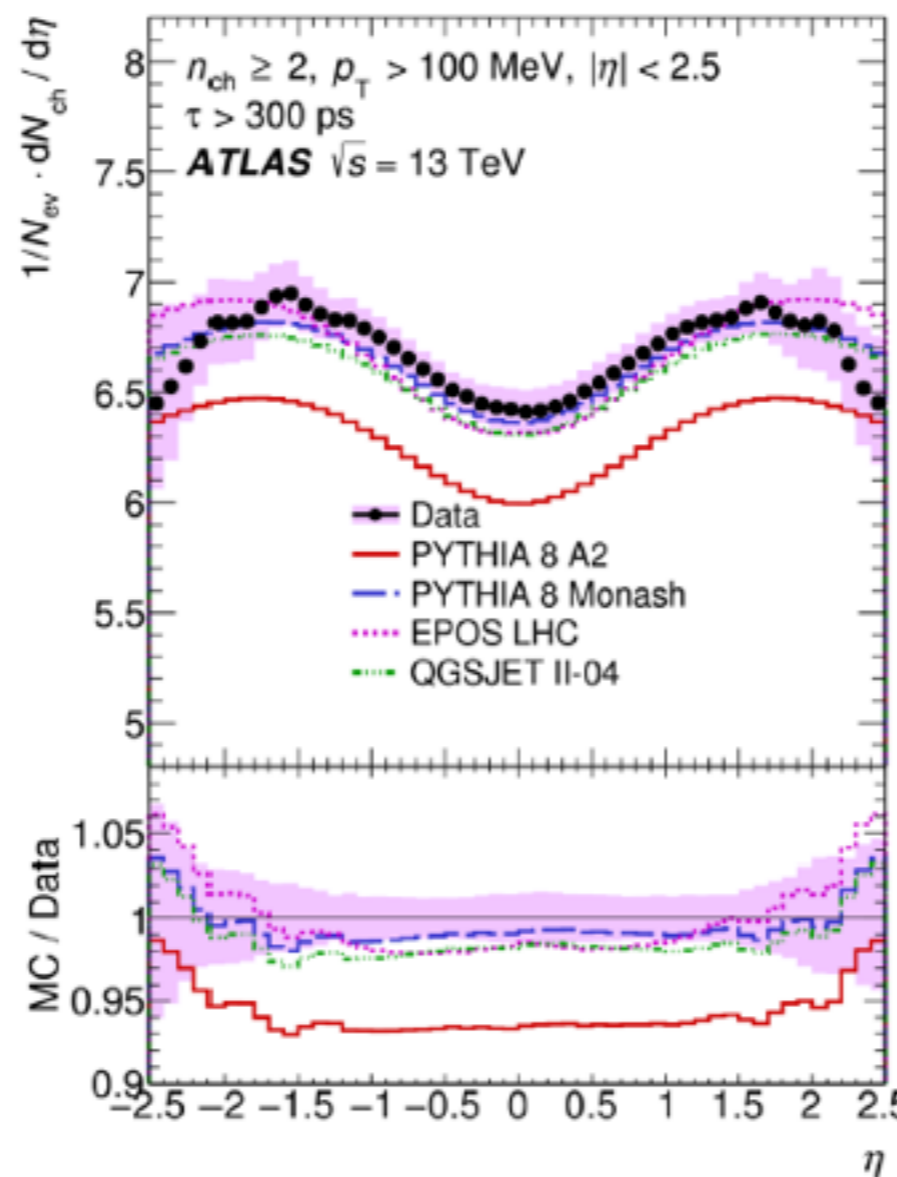


sensitive to **ISR** of hard process



13 TeV Results :: the 100 MeV Analysis :: $n_{ch} \geq 2$

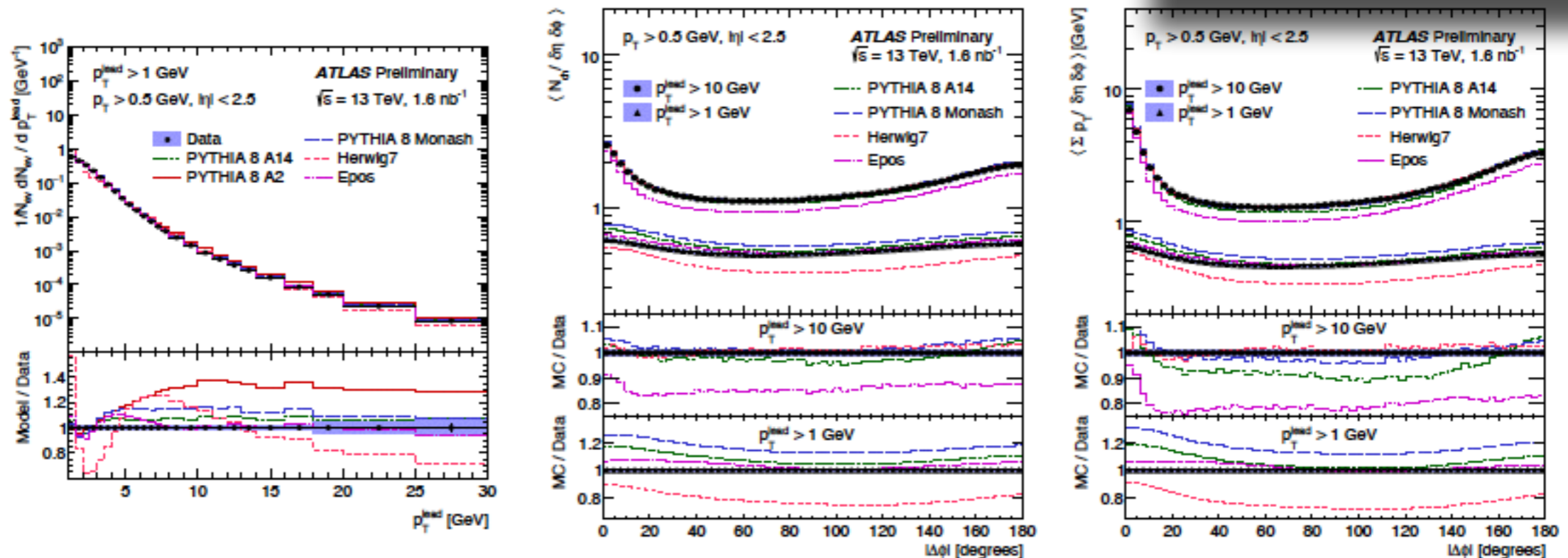
- All generators differ at forward rapidities, though within systematic uncertainties.
- Pythia8 A2 describes shape but fails at overall normalization.
- Diffractive component and total cross-section expected to be better described by an coming Pythia A3 tune.
- Only reasonable p_T dependence description, where QGSJET shows largest deviations.



ATLAS UE

Robert
Astalos's
talk

Leading charged particle p_T and Angular



N_{ev} vs p_T^{lead} : steeply falling distribution with a change of slope for $p_T^{lead} \geq 5$ GeV
broadly modelled by all generators, best description by **EPOS** and **PYTHIA 8 A14**

$p_T^{lead} > 1$ GeV \rightarrow $p_T^{lead} > 10$ GeV – transition from relatively isotropic minimum bias scattering to the emergence of hard partonic scattering structure and a dominant axis of energy flow, no clear best MC:

more inclusive selection ($p_T^{lead} > 1$ GeV) – **EPOS**

hard-scattering selection ($p_T^{lead} > 10$ GeV) – **HERWIG7** and **Pythia 8 Monash**

Discussion Points

- How to measure MPI effects in UE? Combine Z ES with Z UE or similar?
- High multiplicity events, how to disentangle their effects, if any?
- Forward tag events and then measure UE/MB?
- Better modelling forward activities?
- Common model for MB/UE/DPI ...?