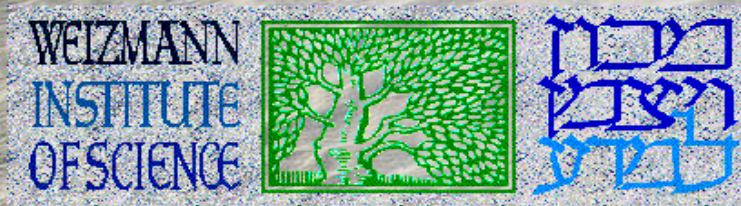


Measurements of charged particle spectra in $\sqrt{s_{NN}}=2.76$ Pb+Pb collisions with the ATLAS detector at the LHC

Alexander Milov



for ATLAS Collaboration



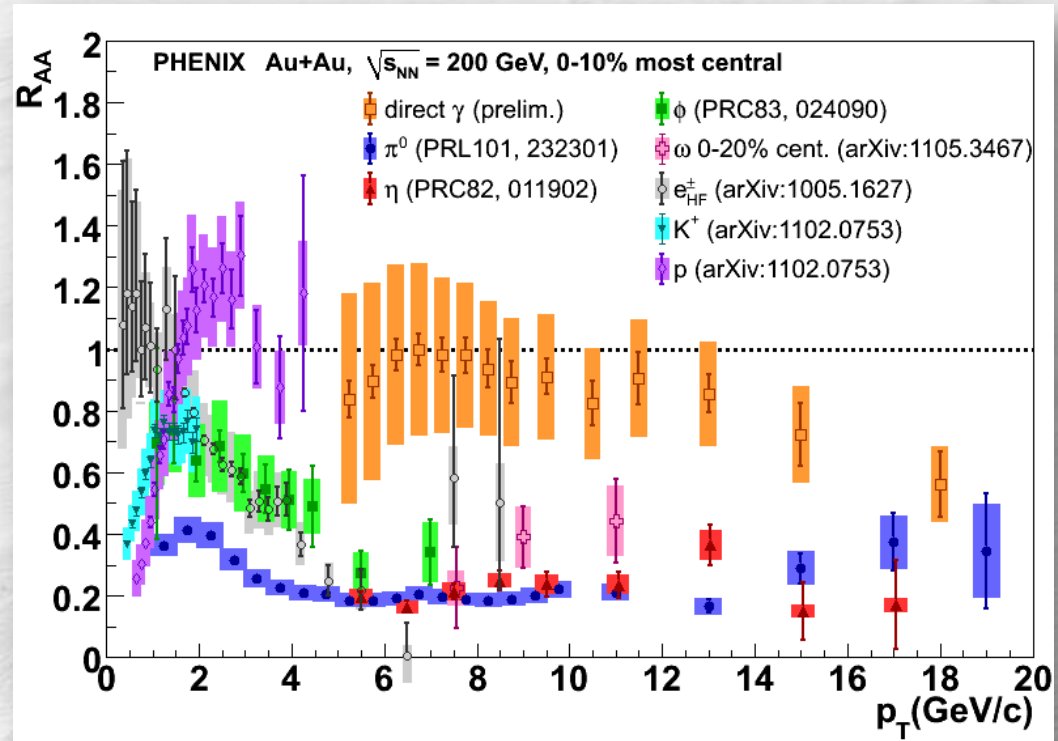
Spectra and R_{AA}

Measurement of unidentified particle spectra at high p_T in HI collisions is a way to understand the energy loss mechanism.

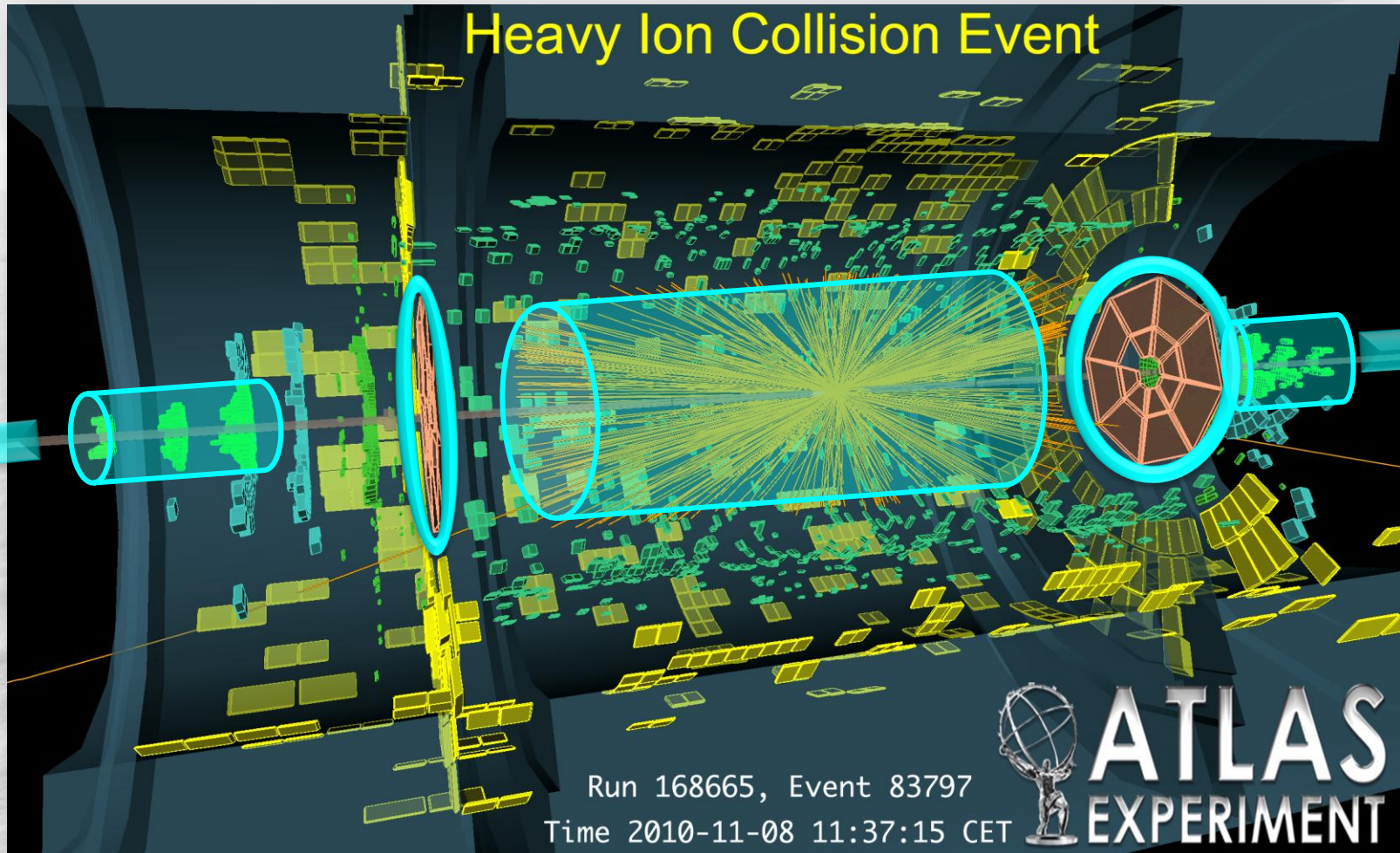
Large amount of experimental data exists on the suppression of high p_T particles in HI collisions at and below $\sqrt{s_{NN}}=0.2\text{TeV}$.

With the beginning of LHC operation the first data on the suppression become available at much higher initial energy.

Comparison between RHIC and LHC helps to answer the question how the QGP evolves between the two different energy regimes.



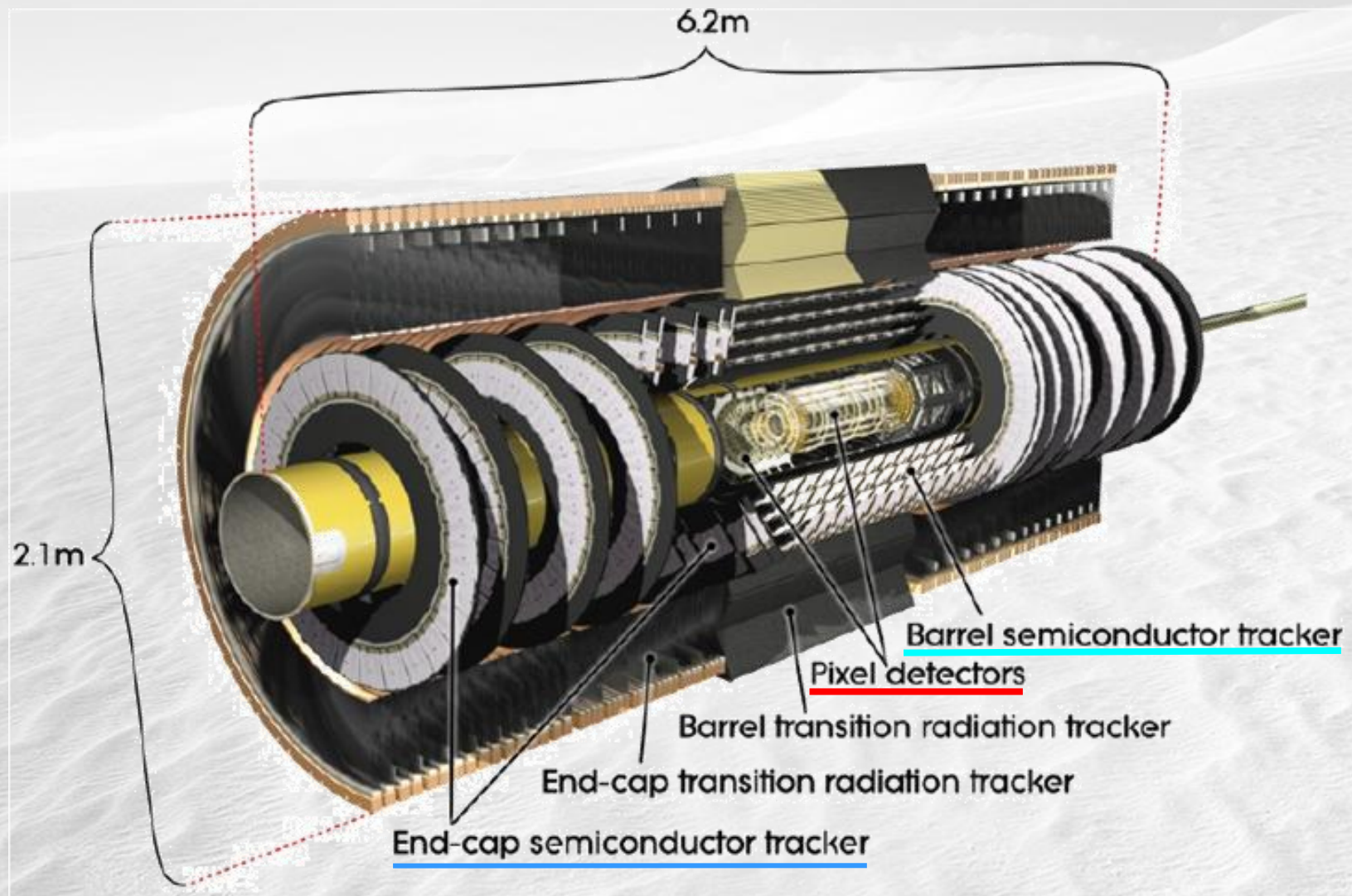
ATLAS performance in HI



Minimum Bias Trigger Scintillator
Zero Degree Calorimeter (140m from IP)
Forward Calorimeter

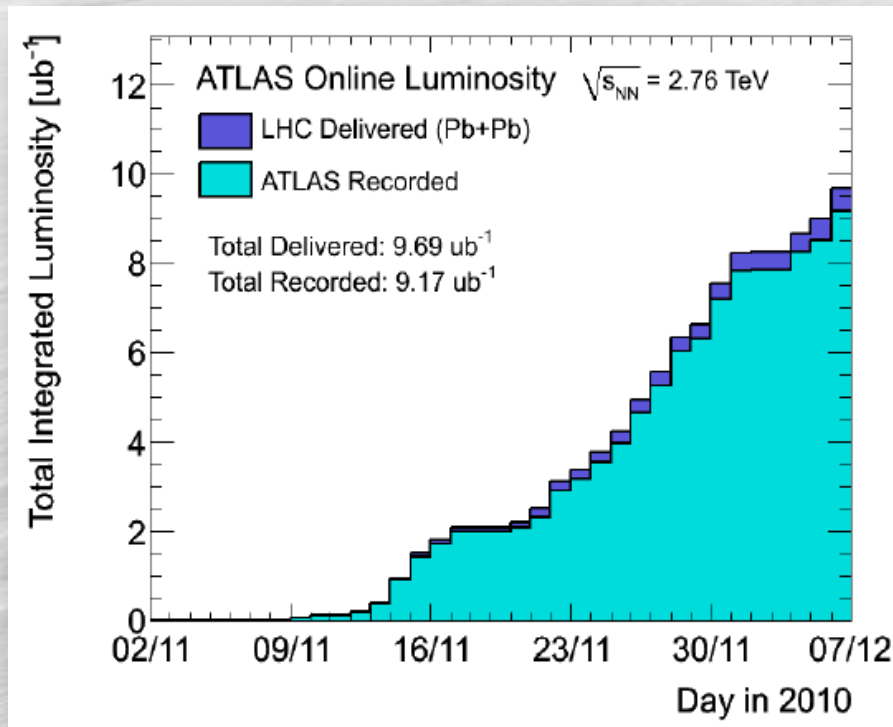
Inner Detector
tracking system

ATLAS Inner Detector tracker



Event sample

This analysis uses 43.6M minimum biased events corresponding to integrated luminosity of $7 \mu\text{b}^{-1}$.



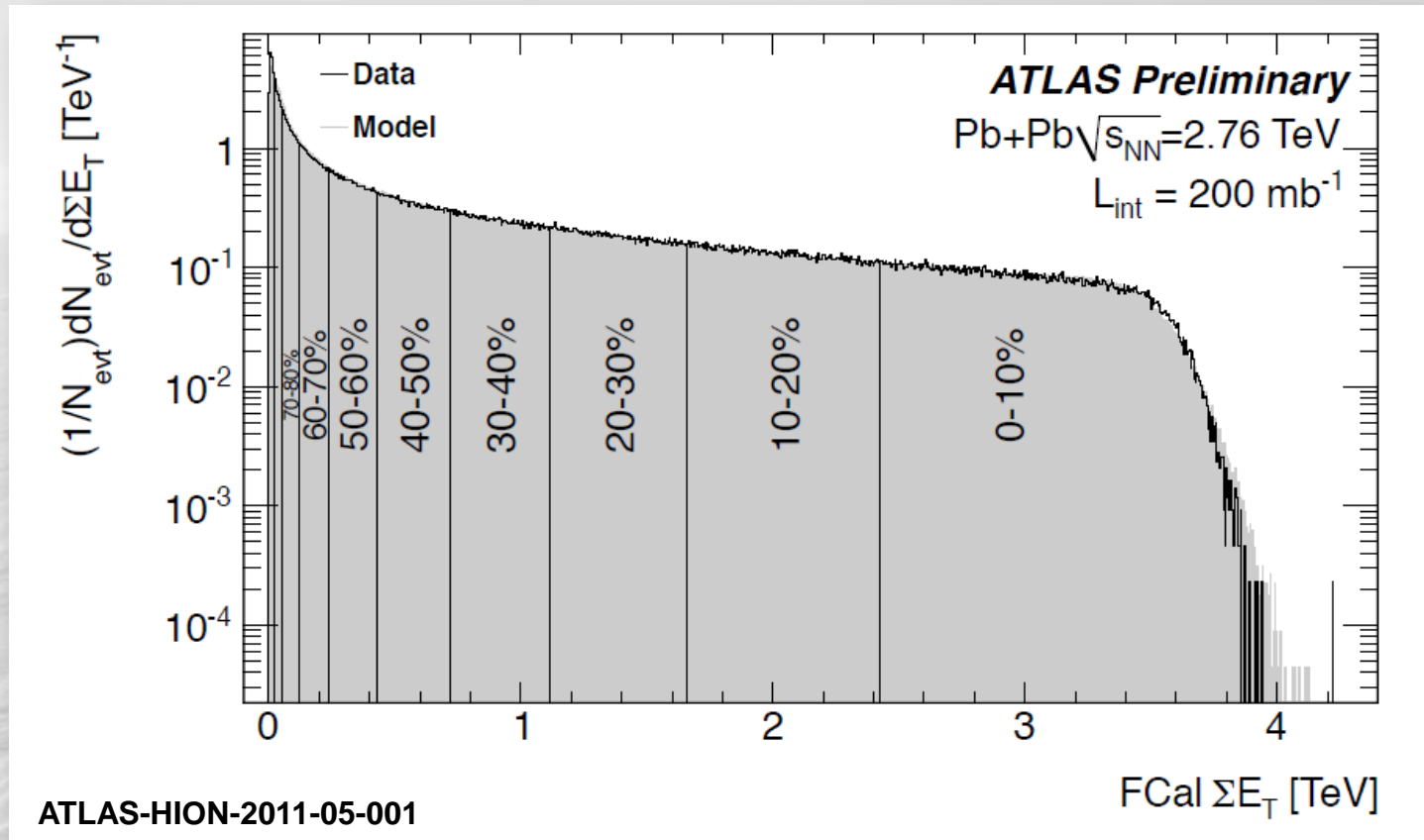
Events were selected by:

**Firing Minimum Bias Trigger
Scintillators on both sides
within $\Delta t = 3\text{ns}$**

**Producing a coincidence in
Zero Degree Calorimeter**

**Reconstructed vertex within
150mm from ATLAS center**

Centrality determination



Based on FCal energy ($3.2 < |\eta| < 4.9$), Glauber model MC and p+p data @ $\sqrt{s} = 2.76$ TeV. MB selection efficiency $100\% \pm 2\%$ efficiency

FCal response stability over entire run much better than 1% level.

Analysis

Tracking cuts.

Pixel detector:

- At least 2 hits in 3 layers

- The innermost layer hit, if such is expected

- No missing hits in layers

SCT detector:

- At least 7 hits in 9 layers

- No missing hits in layers

Primary vertex pointing cuts:

- within 3 standard deviations in transverse and longitudinal directions

Systematic uncertainties (currently very conservative):

Main sources:

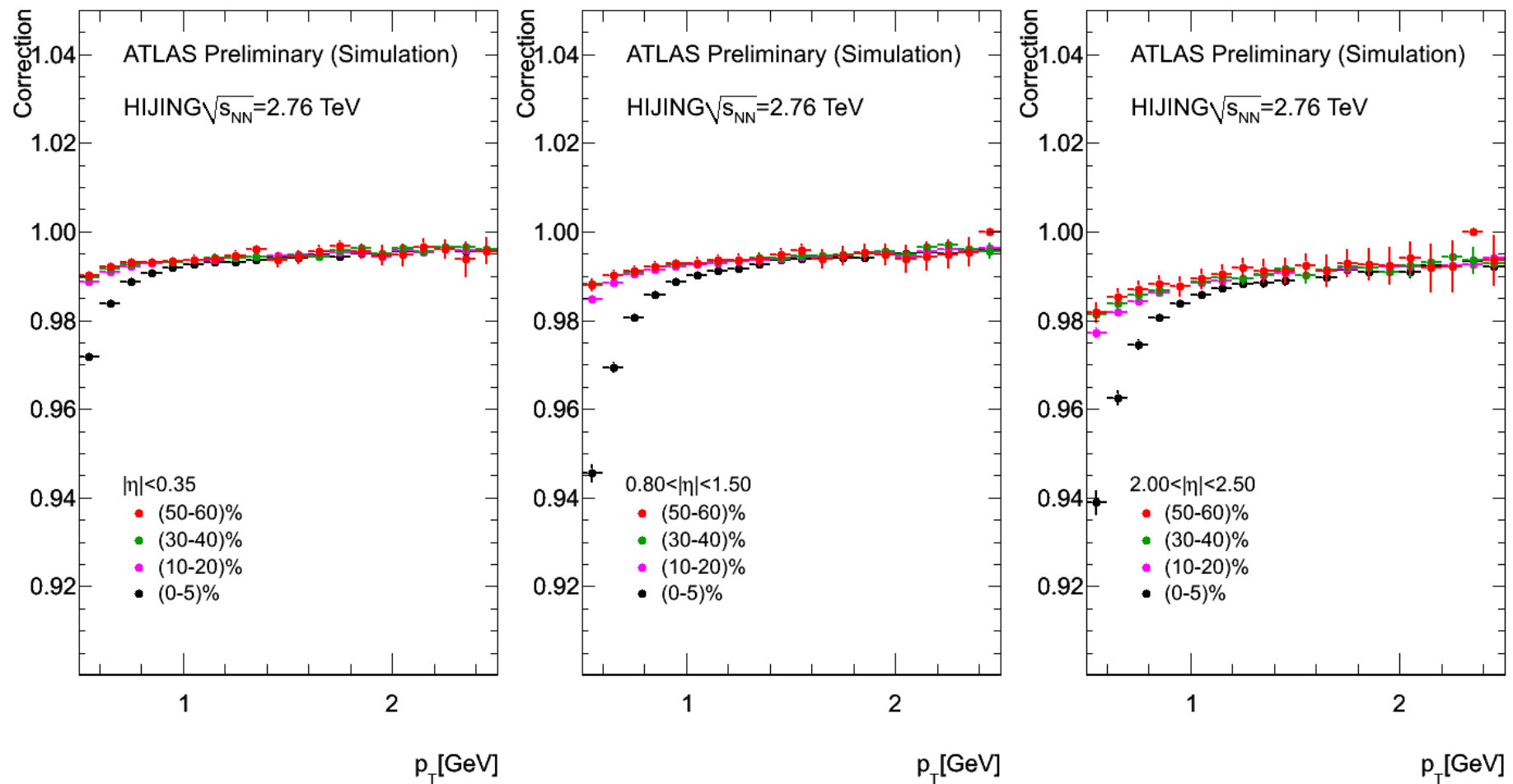
- efficiency and feed-down at low p_T (~5%)

- possible distortion of track p_T above 20 GeV

- in the most central collisions (<30%).

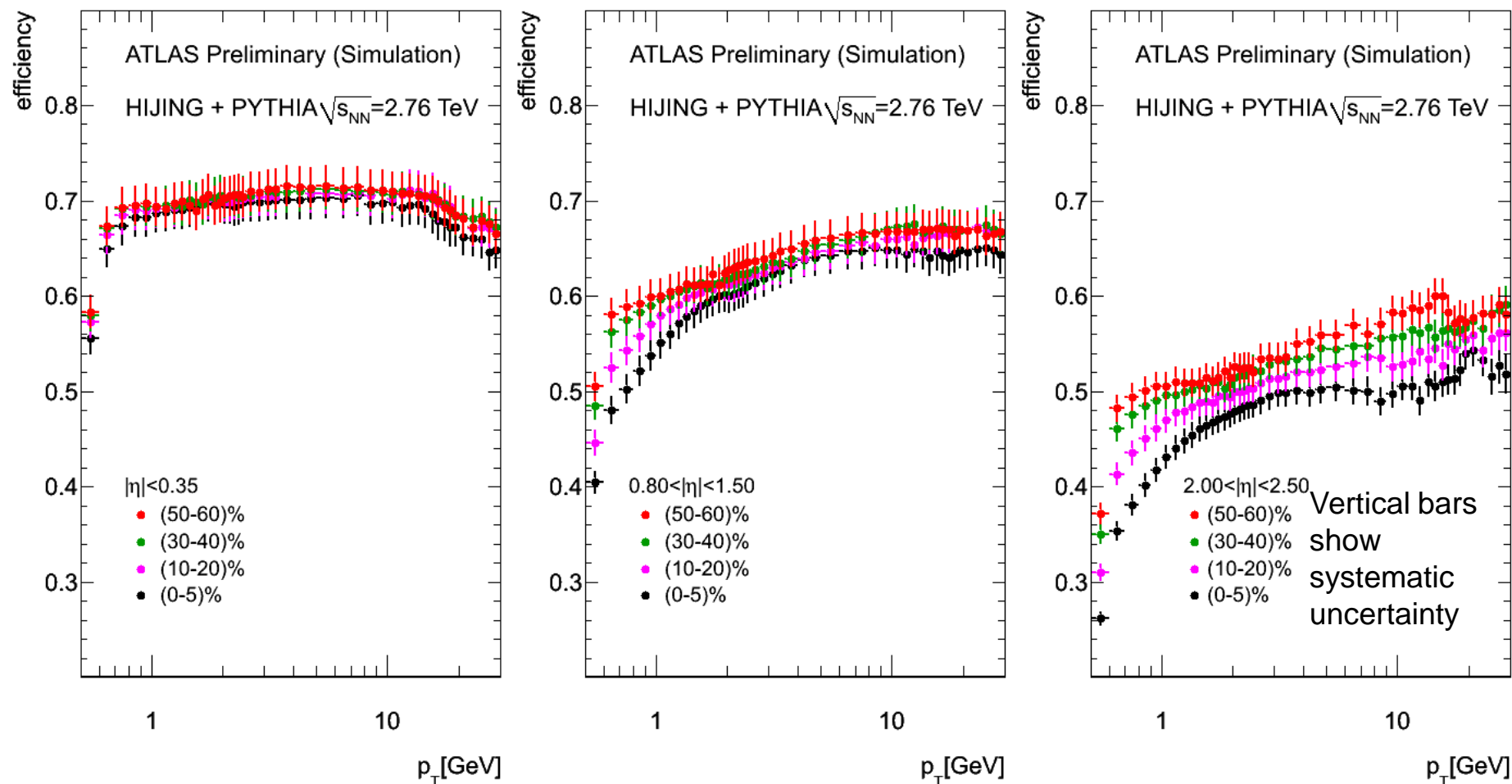
- uncertainty on N_{coll} for ratios.

Correction for off vertex tracks



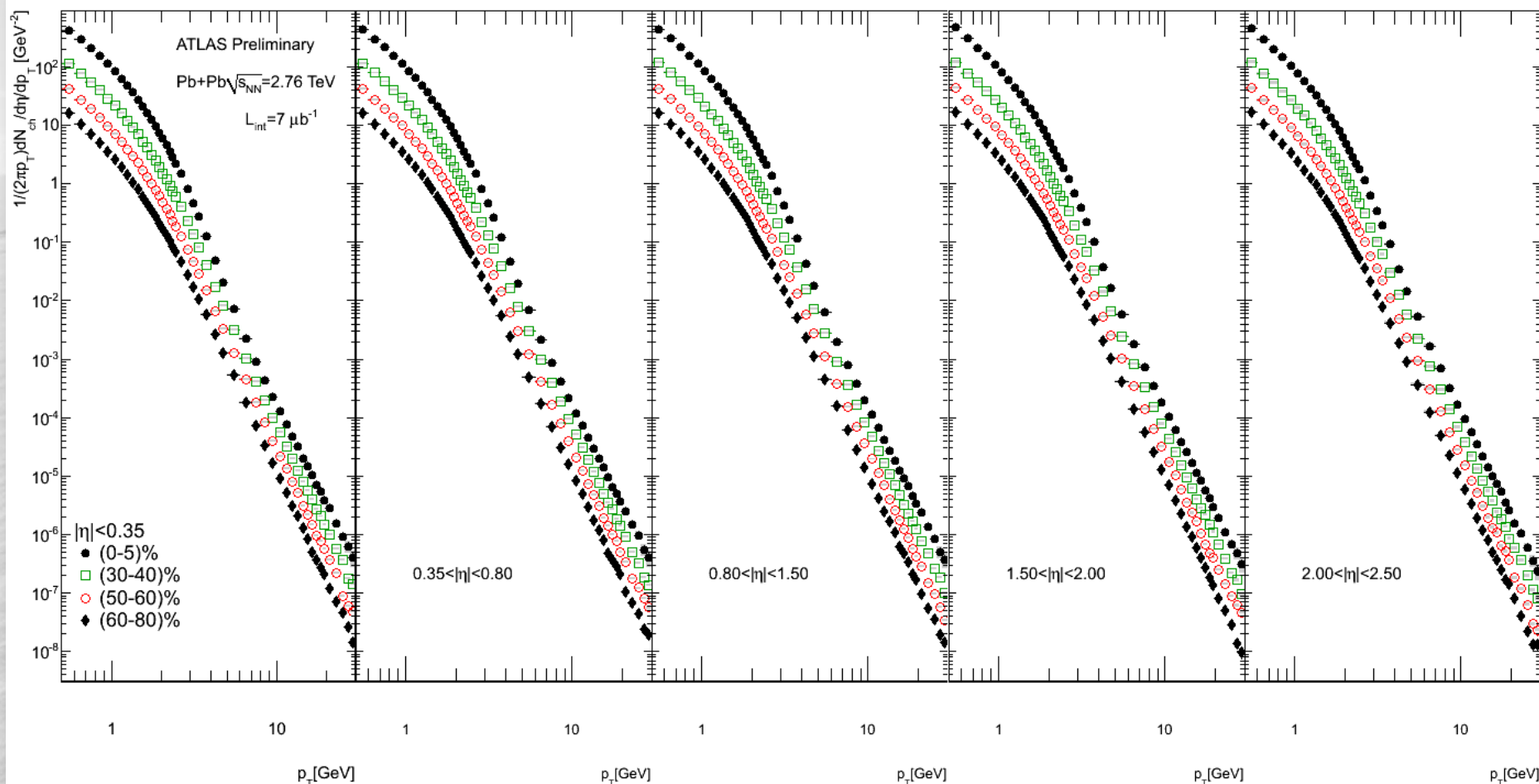
The raw spectra is corrected for the fake tracks and secondary particles at low p_T . Correction is based on the MC.

Efficiency Correction



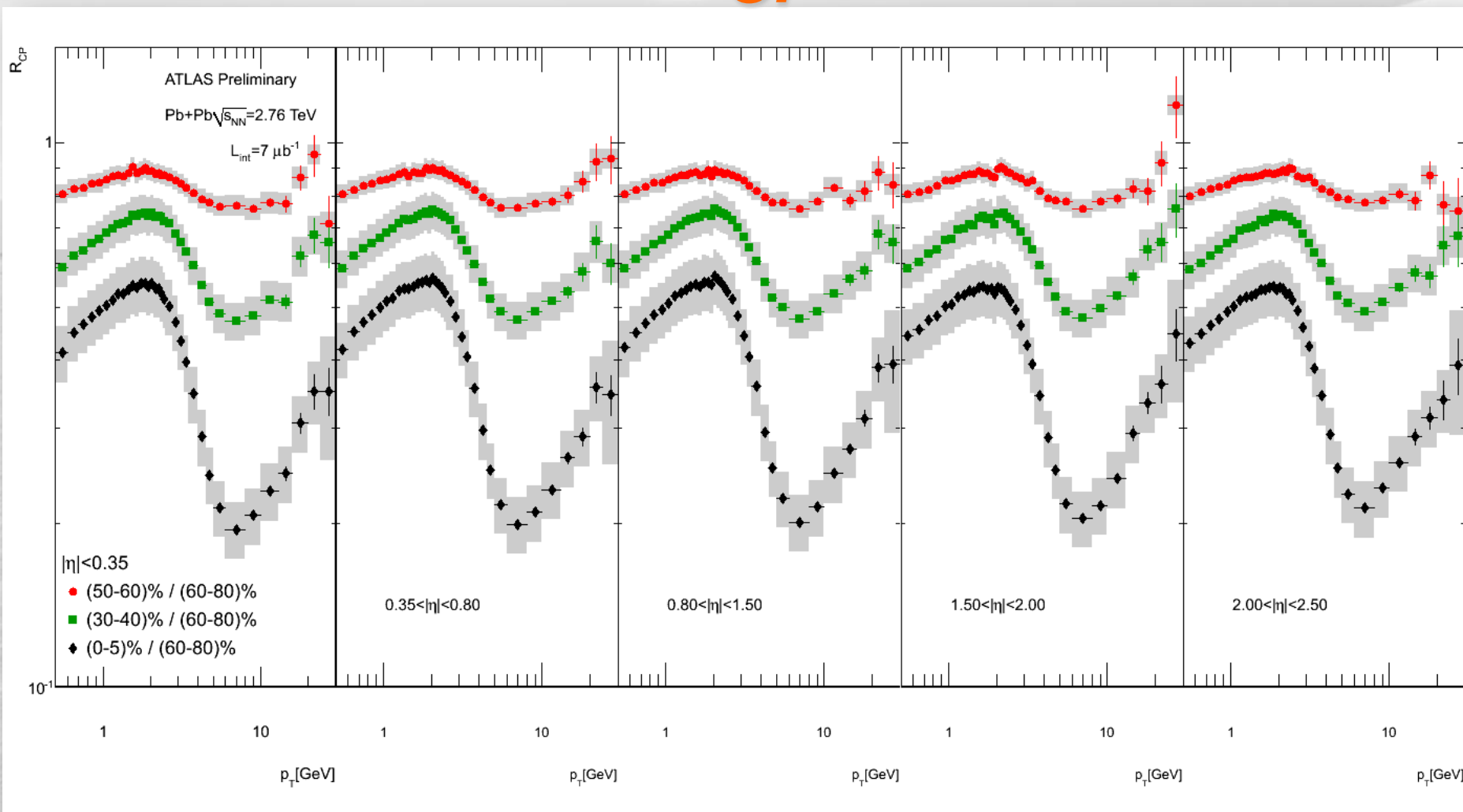
**Efficiency based on the PYTHIA events embedded in HIJING MC.
Loss at higher η is due to very restrictive cuts used in the analysis**

Spectra



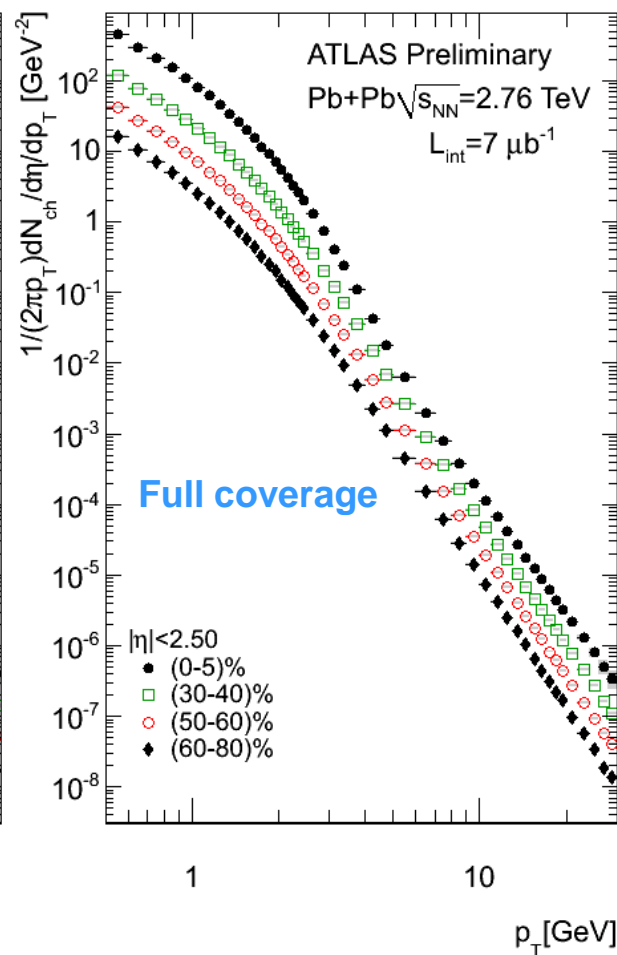
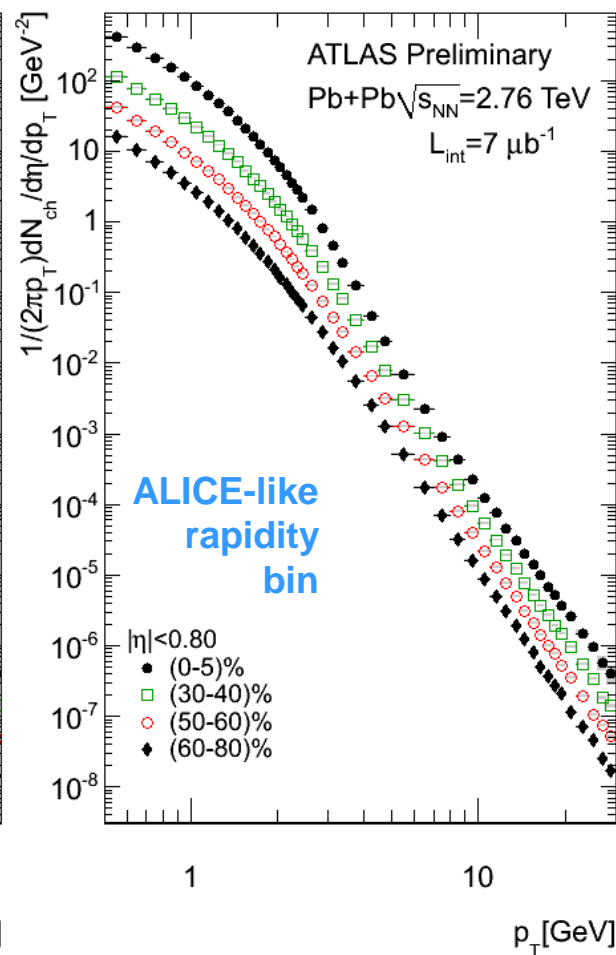
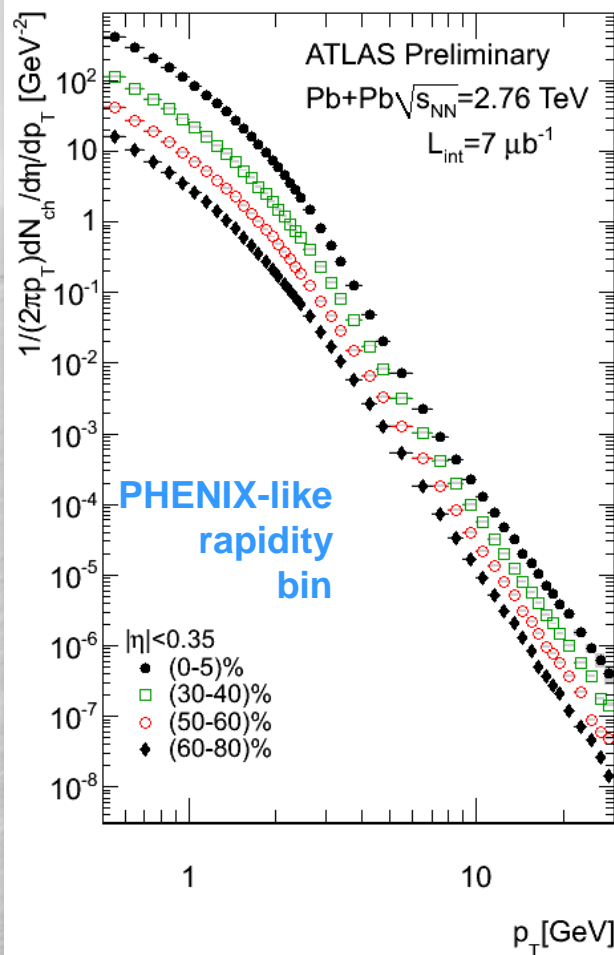
Fully reconstructed invariant spectra for different centralities measured at different rapidities up to $|\eta| < 2.5$. The spectra are shown up to 30 GeV

R_{CP}



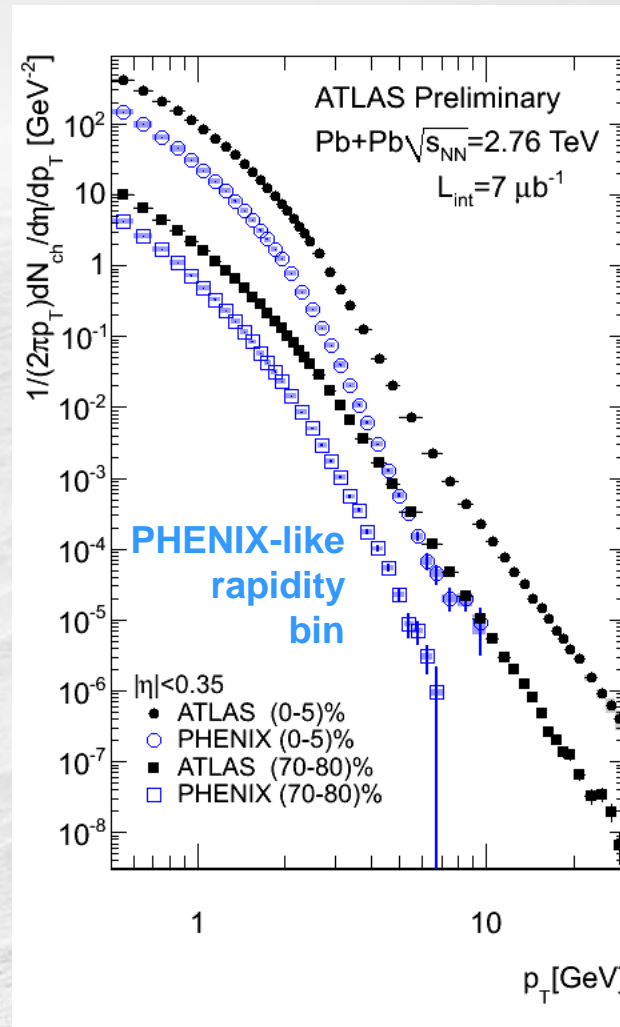
Central-to-Peripheral Nuclear Modification Factor. For the main result ATLAS uses (60-80)% centrality bin as the denominator.

Spectra Comparison



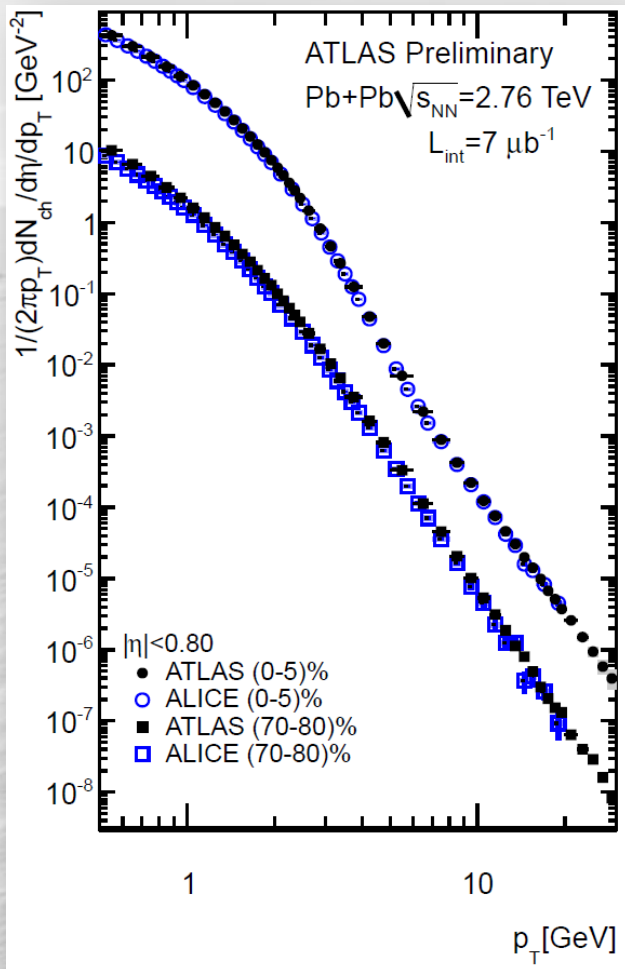
**Significant increase in particle production compared to $\sqrt{s_{NN}}=200$ GeV.
More prominent at high p_T .**

Spectra Comparison

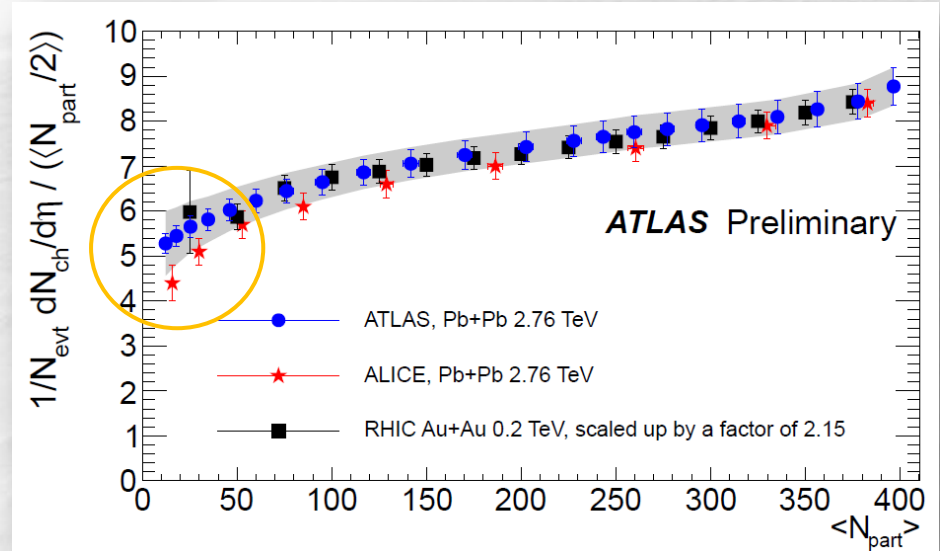


**Significant increase in particle production compared to $\sqrt{s_{NN}}=200$ GeV.
More prominent at high p_T .**

Spectra Comparison



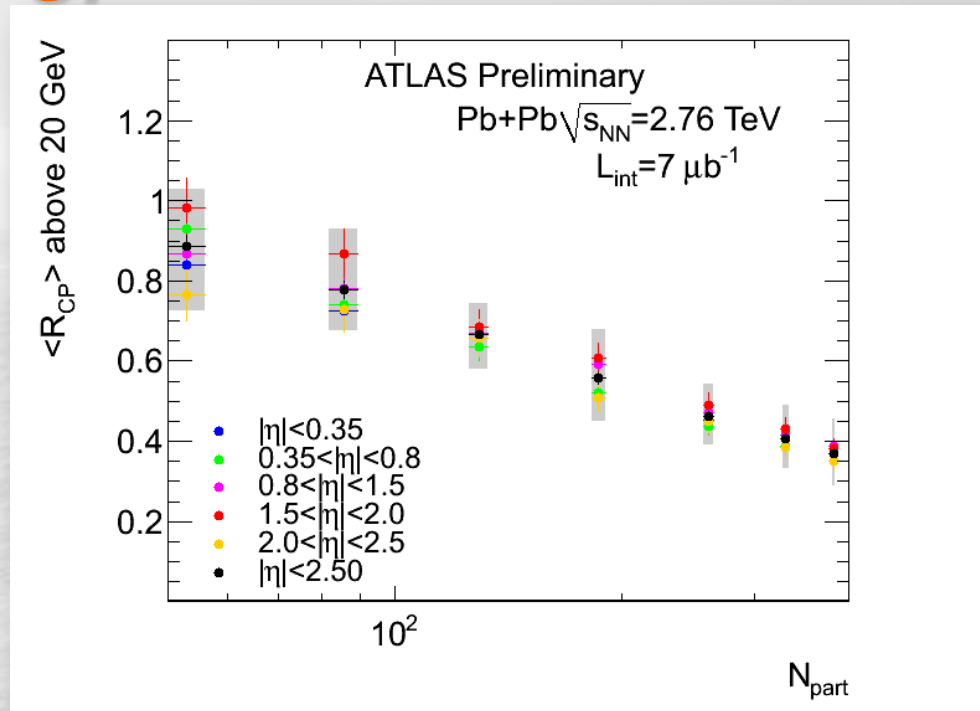
Good agreement in central bin
Higher yield than ALICE in (70-80)%



Similar effect is seen in the measurement of $2/N_{part} dN_{ch}/d\eta$ [ATLAS-HION-2010-01-001]

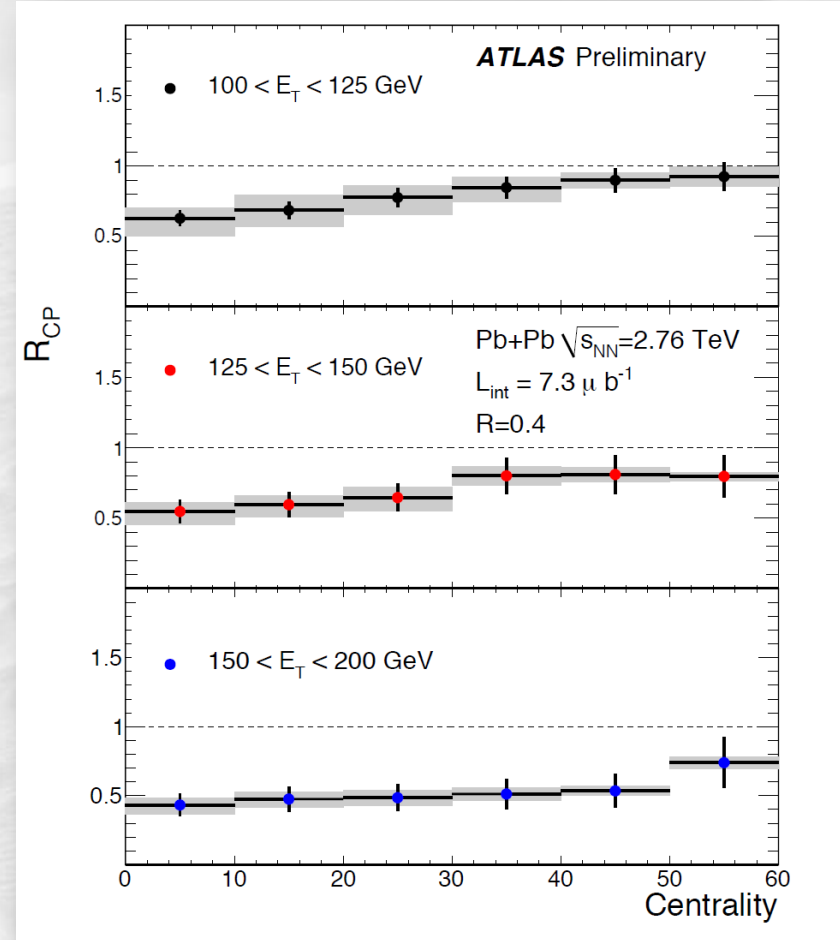
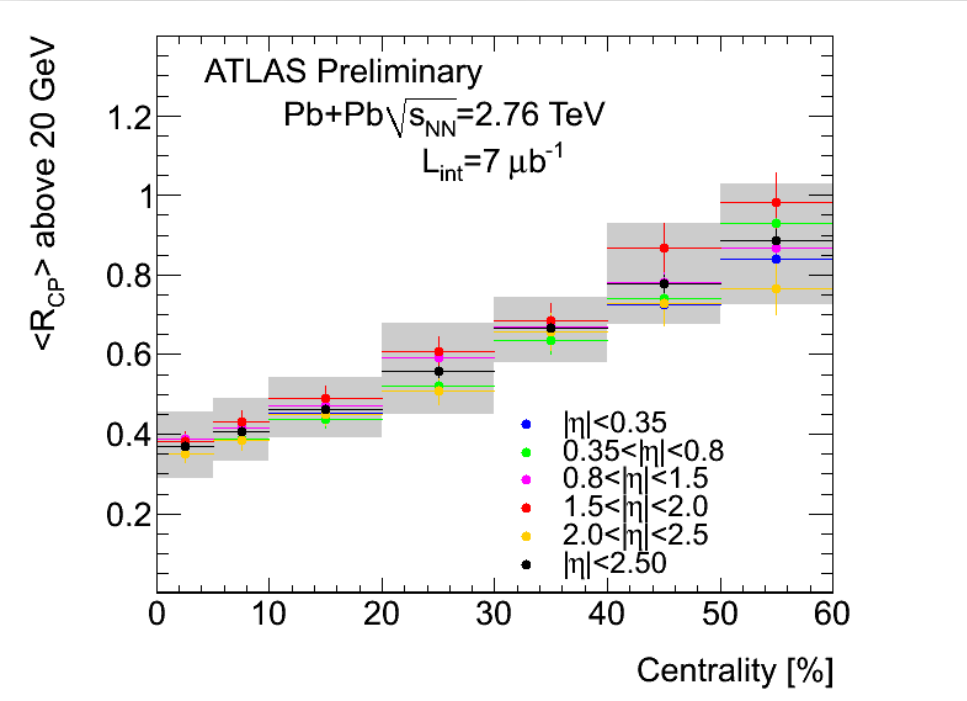
This suggests that there is a difference in the centrality cuts between ATLAS and ALICE.

R_{CP} above 20 GeV



At the highest p_T currently analyzed, the R_{CP} remains below 0.4 for the most central collisions. We see no indication that the R_{CP} at high p_T would follow binary scaling.

R_{CP} above 20 GeV



Centrality behavior of the charged particle R_{CP} resembles the suppression found in the measurement of fully reconstructed jets.

**“Measurements of Jets and Jets quenching...”
ATLAS Collaboration talk by A. Angerami 24/5**

Summary

ATLAS measures charged particle spectra and R_{CP} in the rapidity range $|\eta| < 2.5$.

All R_{CP} have minimum at around 7 GeV reaching 0.2 for the ratio of (0-5)% to (60-80)% centrality classes.

All R_{CP} s show steady rise with p_T above 10 GeV, and are still significantly suppressed at 30 GeV.

The spectra in (0-5)% centrality class agrees well with ALICE result, in (70-80)% class the shapes agree, with normalization consistent within stated centrality determination errors.