IS2021

The VIth International Conference on the INITIAL STAGES OF HIGH-ENERGY NUCLEAR COLLISIONS

Study of Underlying Event (UE) activity in pp and p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE

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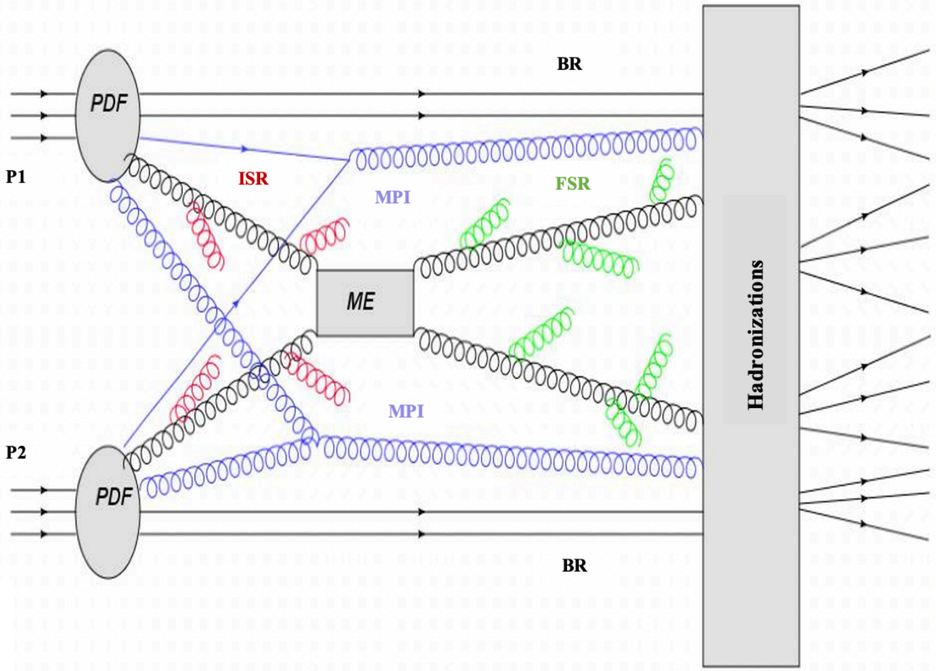
Introduction and Motivation



UE allows to access fundamental information on the hadron structure.

It provides basic step of event characterization process.

Provides a baseline for jet studies.

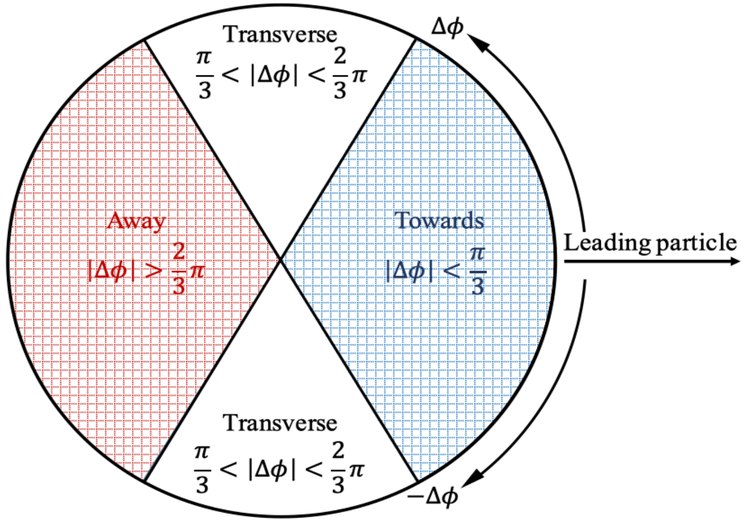
These studies serve as a powerful tool to tune Monte Carlo event generators.

pp collision: hardest scattering → leading interaction

other scattering → Underlying Event (UE)

(UE: Beam Remnants, Initial State Radiation, Final State Radiation, Multiple Partonic Interaction)

Introduction and Motivation

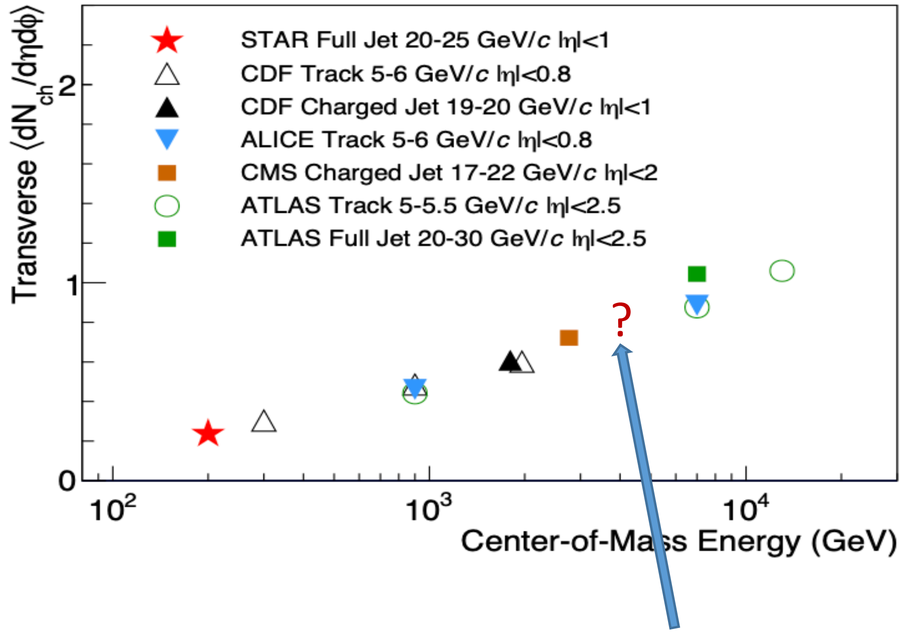


The traditional UE analysis is based on the measurement of particle production in three distinct topological regions.

Main observables:

Number density $\frac{1}{\Delta\eta.\Delta\Phi}\frac{1}{N_{ev}(pT,LT)}N_{ch}(pT,LT)$

Energy density $\frac{1}{\Delta\eta.\Delta\Phi}\frac{1}{N_{ev}(pT,LT)}\sum p_T\ (pT,LT)$



STAR Collaboration, Phys. Rev. D 101, 052004 (2020)

UE observables have been measured in pp collisions from RHIC to LHC energies

pp data at 5.02 TeV are missing!

Introduction and Motivation

pp and p-Pb collisions exhibit collective-like behavior and strangeness enhancement, raising the question whether a small drop of quark-gluon plasma is produced in small collision systems.

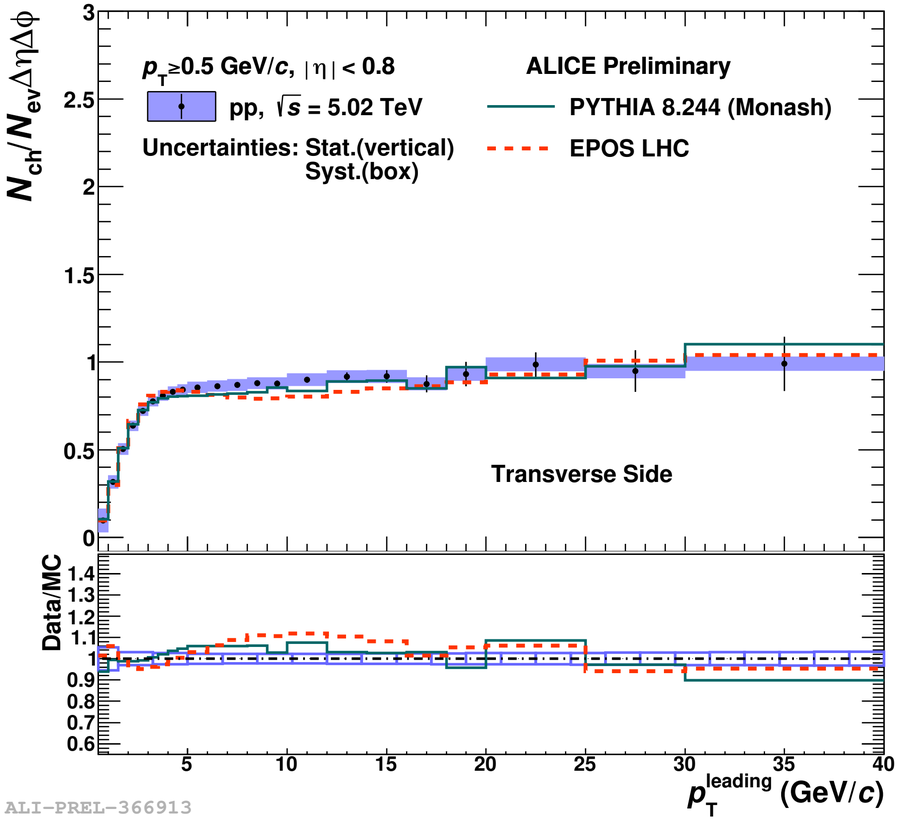
The goal of our work is to perform for the first time the UE analysis in p-Pb collisions.

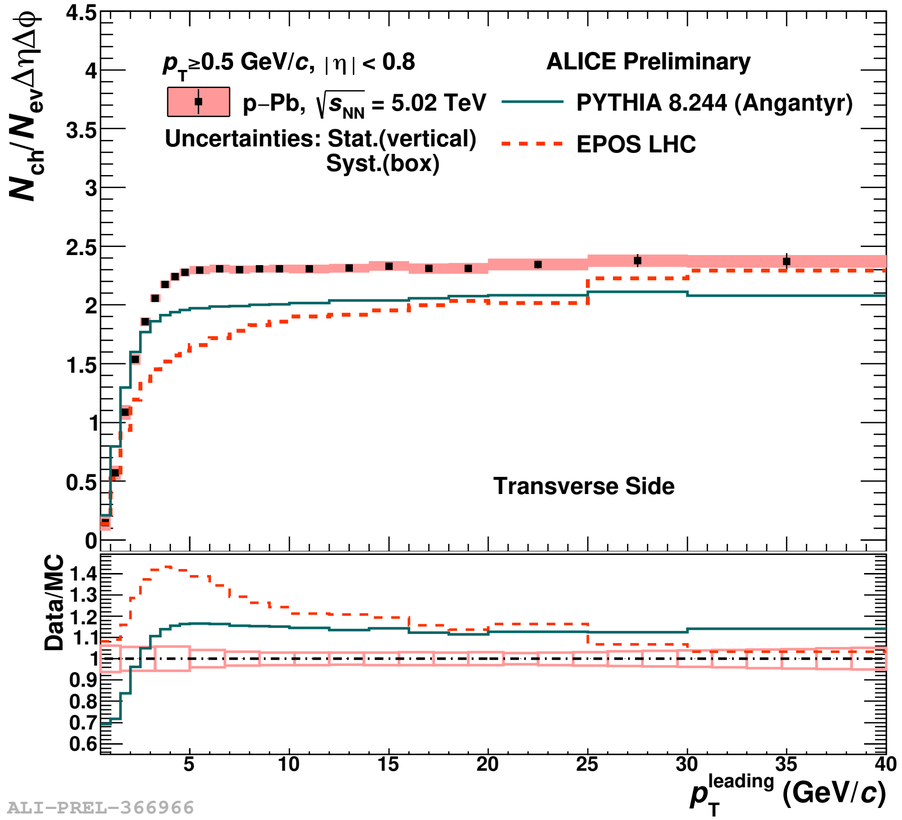
-We want to compare the UE observables (number density and the summed transverse momentum in the towards, away and transverse sides) in pp and p-Pb collisions for similar event classes (same $p_{\mathrm{T}}^{\mathrm{leading}}$ and same $\sqrt{s_{\mathrm{NN}}}$).

- The jet-like region is compared by subtracting the transverse side from the towards and away sides.

-Results are compared with QCD-inspired event generators.

Number density for $p_T \geq 0.5$ GeV/c





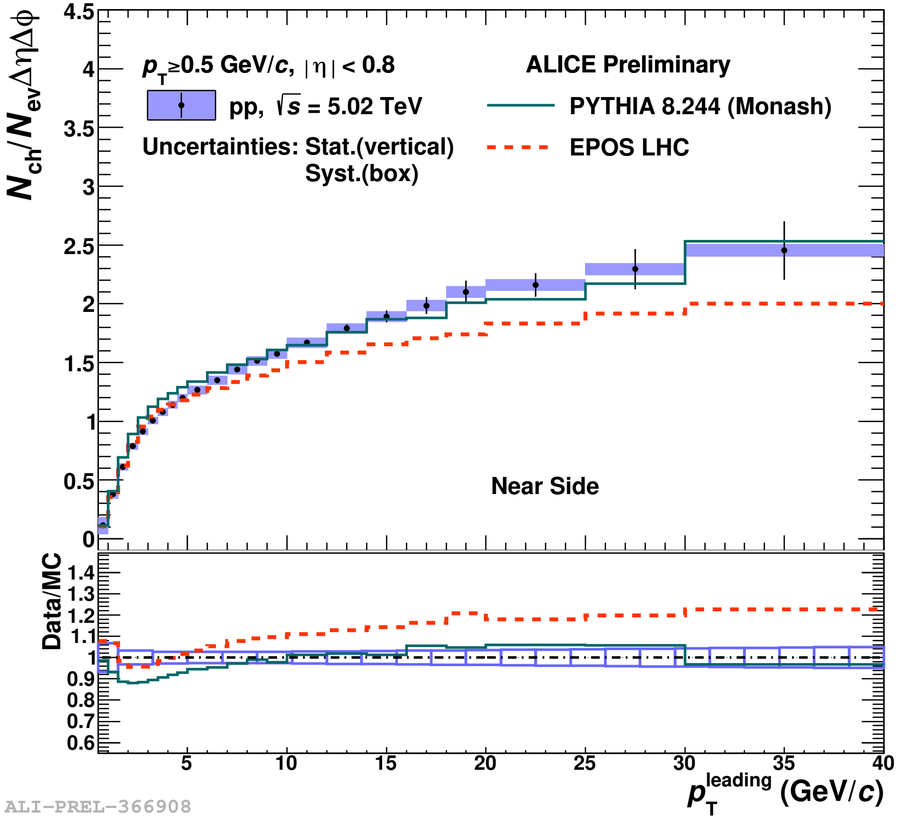
Transverse Side/region: Saturation of activity for $p_T^{leading}$ >5 GeV/c ("pedestal effect").

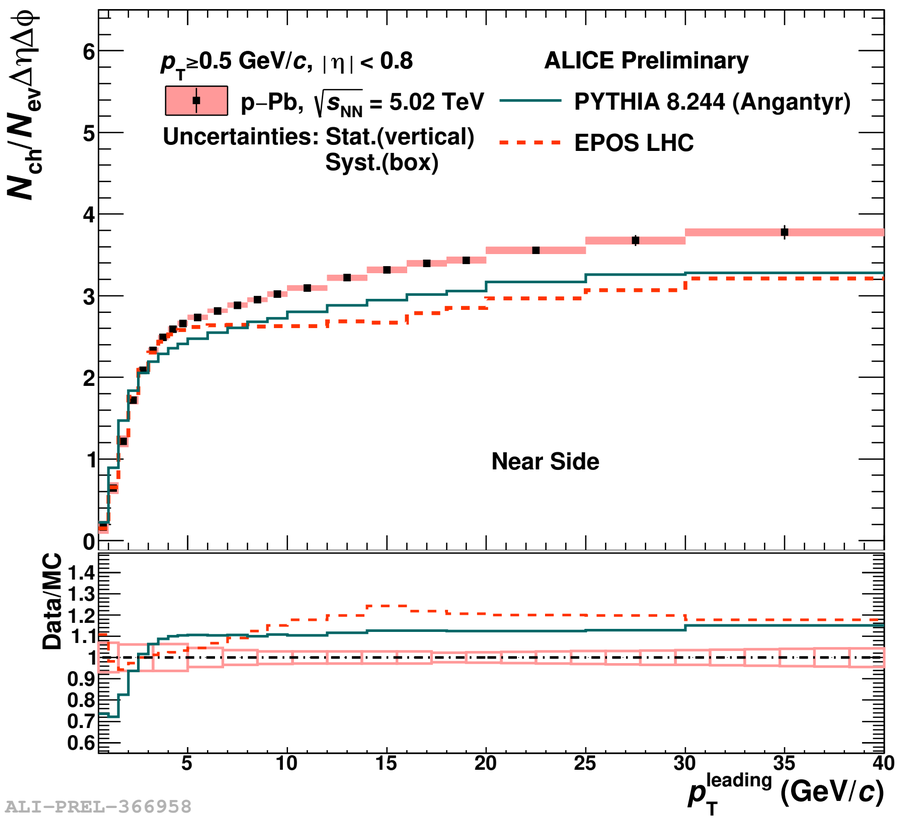
Qualitatively similar behavior in pp and p-Pb, but larger UE magnitude in p-Pb collisions.

For both collision systems EPOS LHC underestimates the trend at high $p_T^{leading}$, while for p-Pb collisions Pythia 8 underestimates (overestimates) the low (high) $p_T^{leading}$ part.

For pp collisions Pythia 8 describes the data well.

Number density for $p_T \geq 0.5$ GeV/c

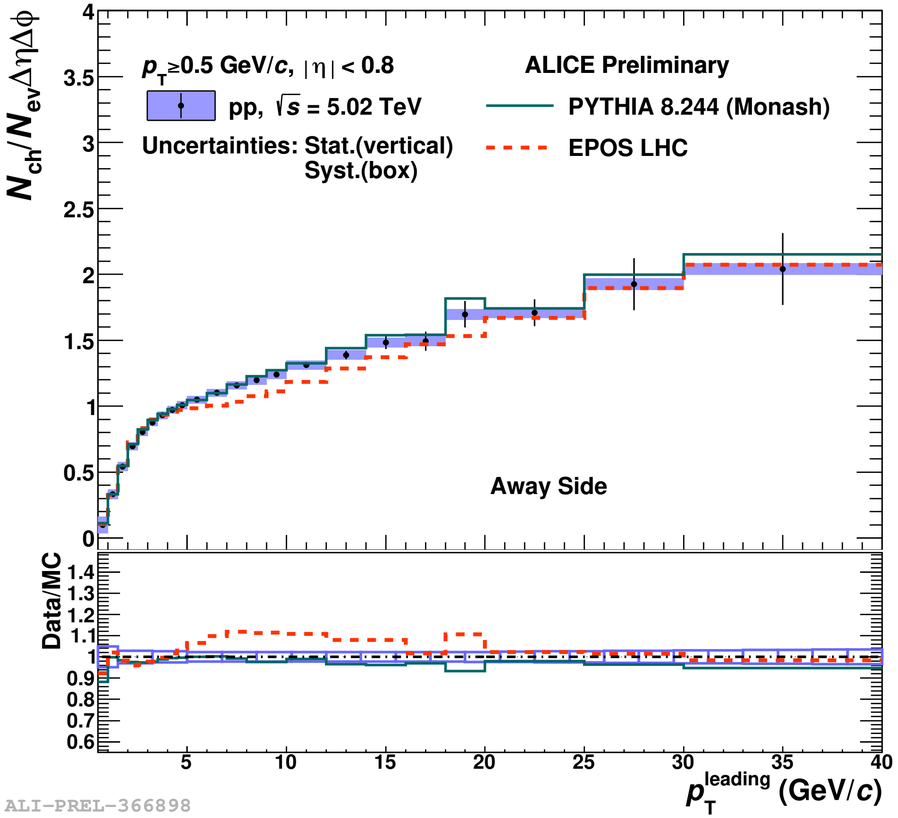


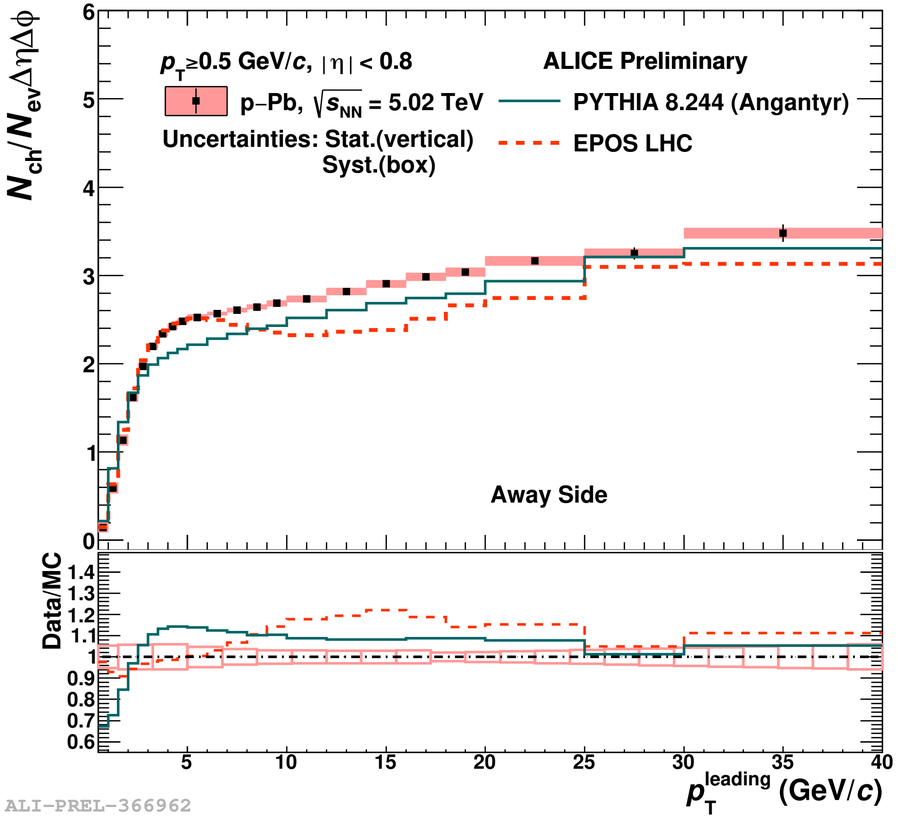


Near Side/towards region: The activity in pp increases faster with $p_T^{leading}$ than in p-Pb, because of the "UE activity" in p-Pb is higher than in pp.

For both collision systems EPOS LHC underestimates the trend at high $p_T^{leading}$, while for p-Pb collisions Pythia 8 underestimates (overestimates) the low (high) $p_T^{leading}$ part.

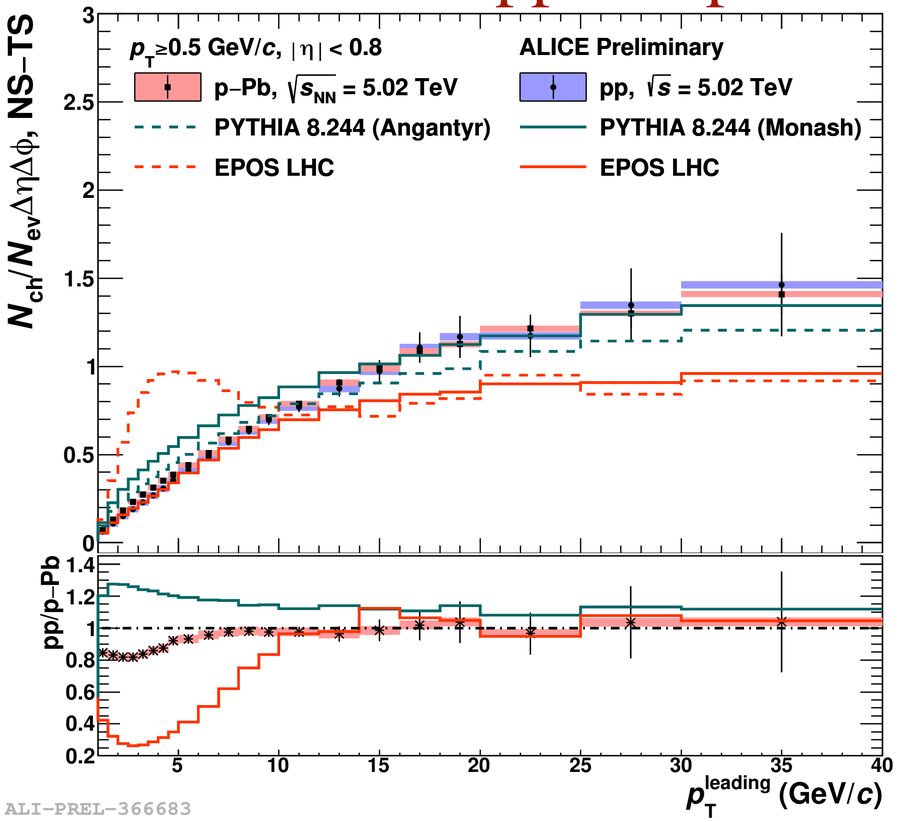
Number density for $p_T \geq 0.5$ GeV/c

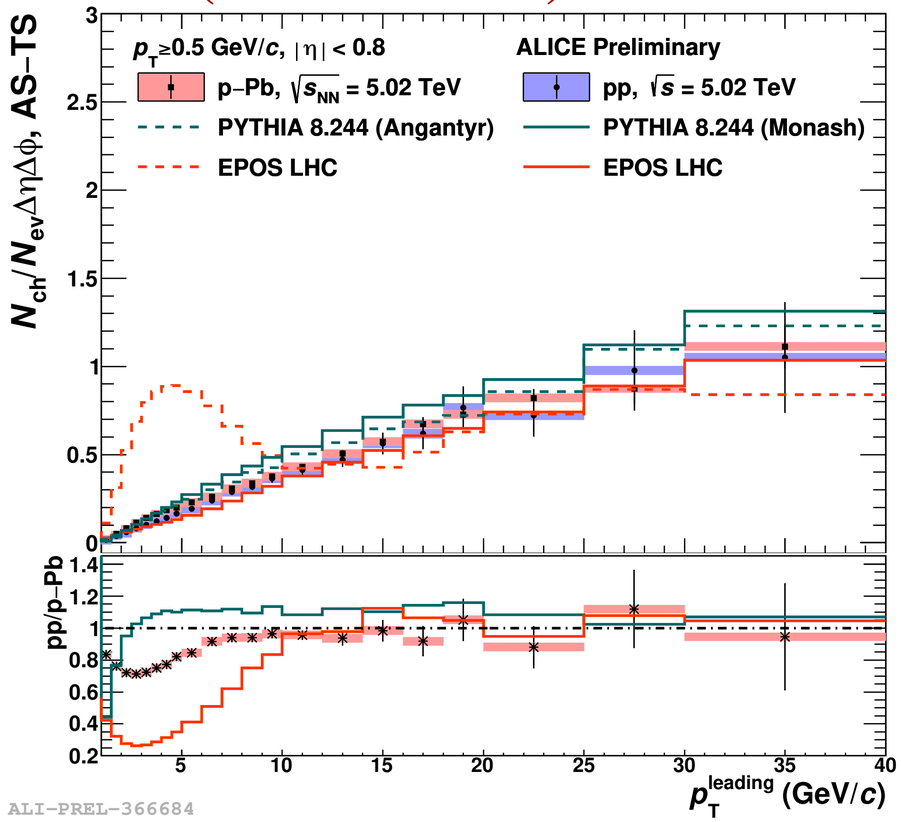




Away Side/region: A similar trend (like near side) is observed here as well. For this reason we also investigate the particle production in the jet-like region after the subtraction of the transverse side.

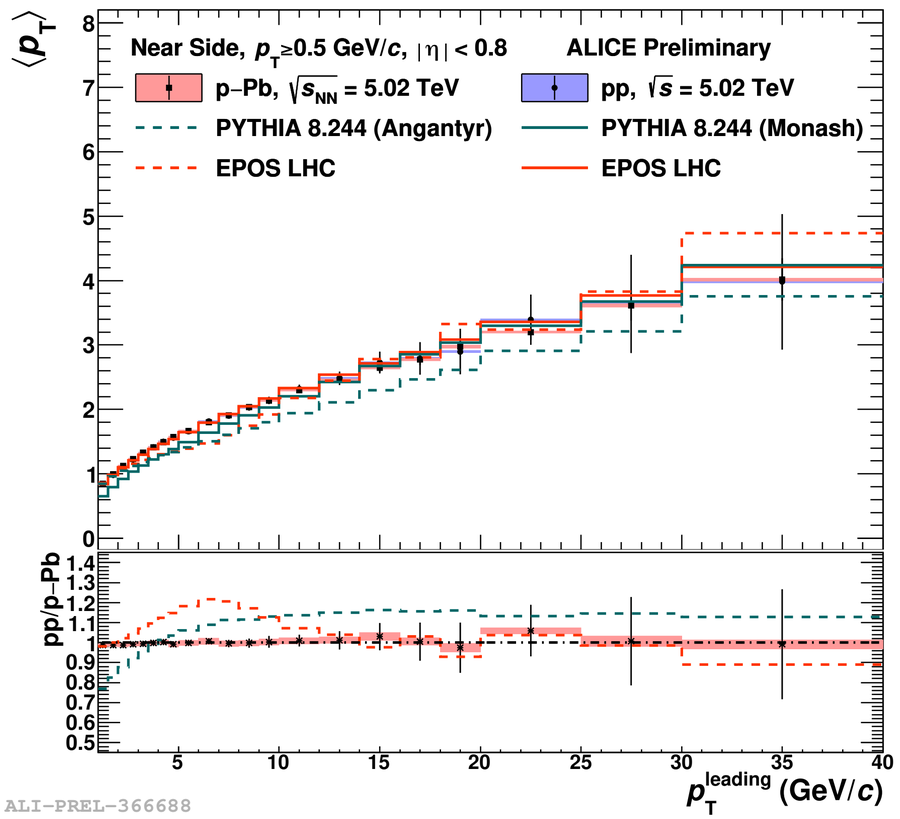
Number density NS-TS and AS-TS for $p_T \geq 0.5$ GeV/c for pp and p-Pb @ 5.02TeV (data vs MC)

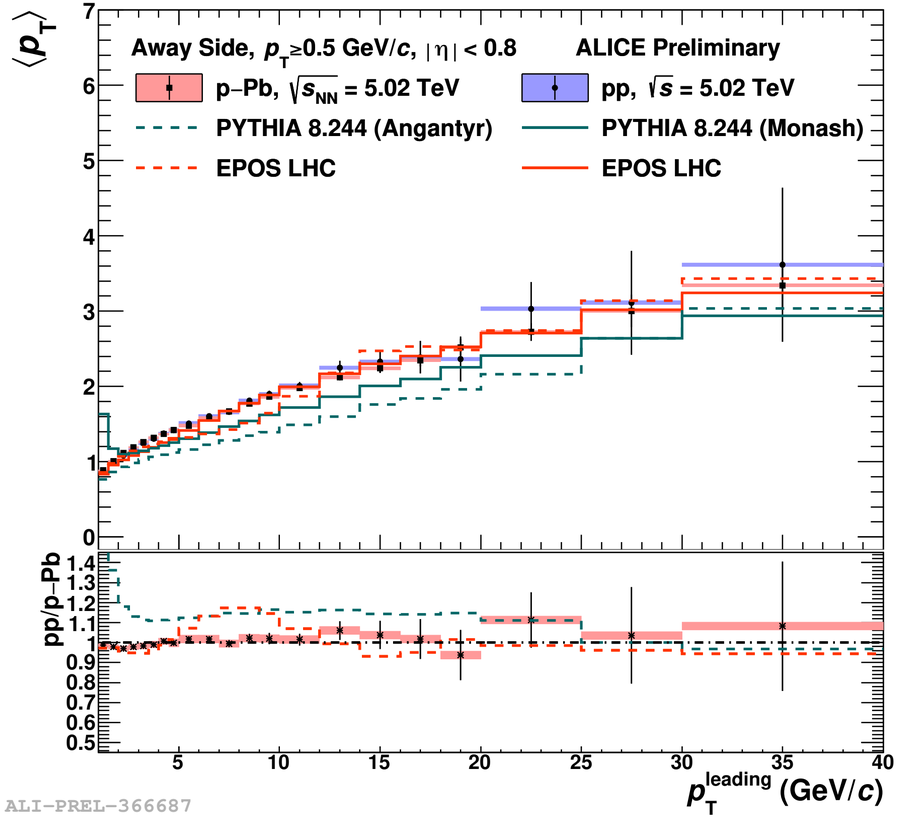




- The jet-like region is compared by subtracting the transverse side from the towards and away sides.
- At high $p_T^{leading}$ pp and p-Pb data agree with each other suggesting the absence of medium effects.
- This suggests that for $p_T^{leading}$ > 10 GeV/c the UE can be handled in much the same way in pp and p-Pb collisions.
- Useful for more advanced studies searching for jet quenching in small systems.

$\langle p_T \rangle$ near side and away side for $p_T \geq 0.5$ GeV/c for pp and p-Pb @ 5.02TeV (data vs MC)





- We used the average sum p_T and the number density in order to derive the $\langle p_T \rangle$.
- Results show the jet-like component give the same $\langle p_T \rangle$ for both pp and p-Pb collisions.
- Pythia underestimates (overestimates) the low $p_T^{leading}$ region for the $\langle p_T \rangle$ in the near (away) side.

Summary

- UE results exhibit qualitative similarities for pp and p-Pb data.
  - UE magnitude (TS) is much larger for p-Pb data as expected.

- To compare pp and p-Pb results quantitatively, jet-like components, NS-TS and AS-TS, were studied
  - For all $p_T^{leading}$, $\langle p_T \rangle$ was similar for pp and p-Pb.
  - For $p_T^{leading} > 10$ GeV/c, the number density was the same for pp and p-Pb.
    - This suggests that the jet component is the same (no jet quenching).

- The results suggest that the UE in p-Pb collisions shares the same features as the UE in pp collisions.

Acknowledgments

Support for this work has been received from CONACyT under the Grant No. A1-S-22917. Ahsan Mehmood Khan acknowledges the doctoral fellowship of CSC (Chinese Scholarship Council). The NSFC Grant 11775097 and Key Grant 12061141008, the National key research and development program of China under Grant 2018YFE0104700.

Thank you for your attention!

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