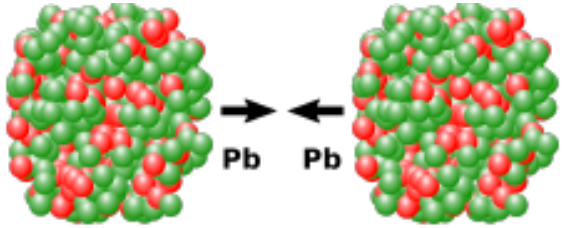
Summary and conclusions

Working group 5: High multiplicities and interactions with nuclei

High multiplicity pp collisions exhibit “radial flow” signatures

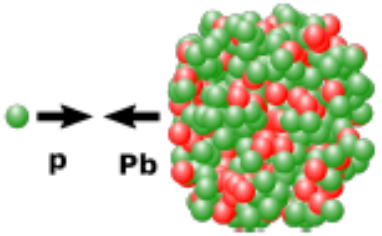
Study of hot and dense QCD matter

hydrodynamic evolution



Study of nuclear matter effects

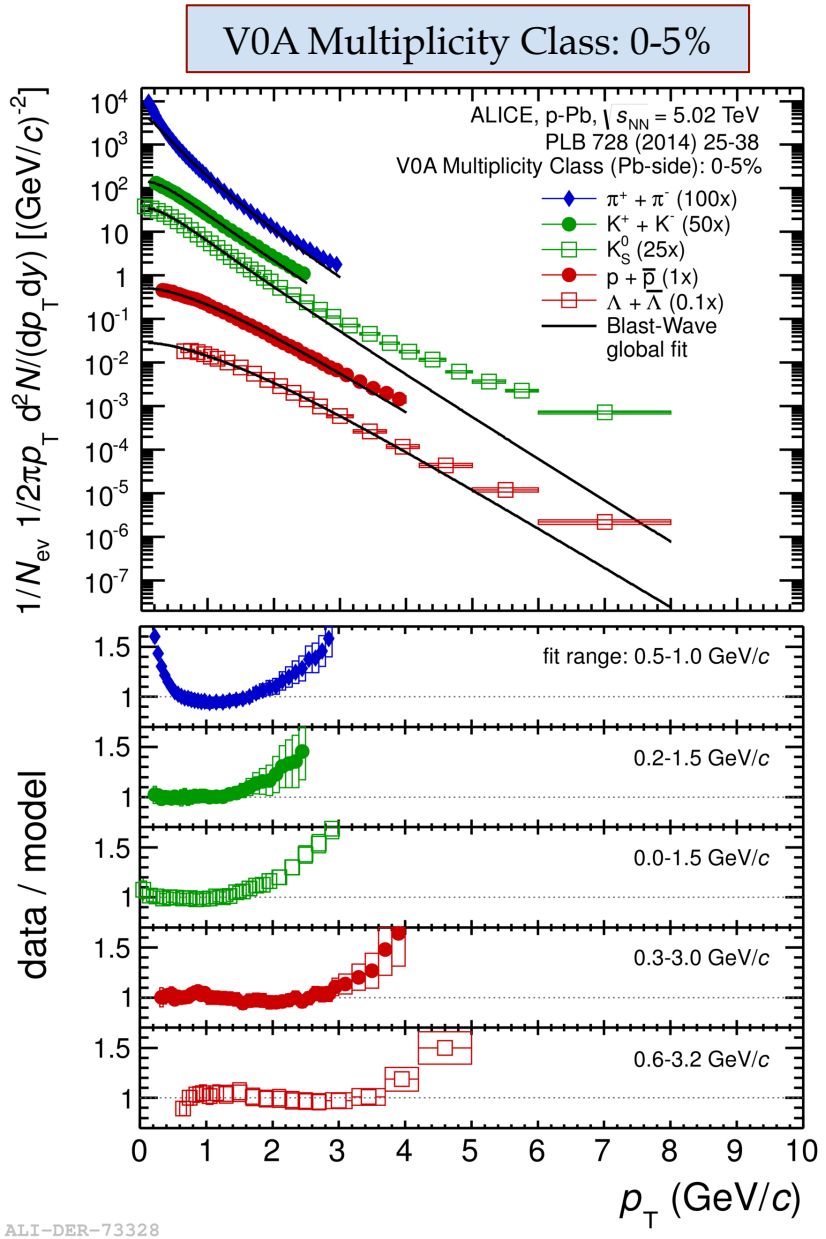
intermediate system between the Pb-Pb and the pp



Reference for measurement in other systems

deconfinement not expected

collectivity not expected

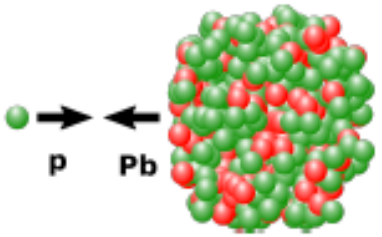


High multiplicity pp collisions exhibit “radial flow” signatures

- Is the result from the blast-wave analysis enough to conclude that radial flow is affecting the p_T spectral shape?
  - As shown by Gyula Bencedi, high multiplicity pp collisions have non negligible contributions from jets.

Study of nuclear matter effects

intermediate system between the Pb-Pb and the pp



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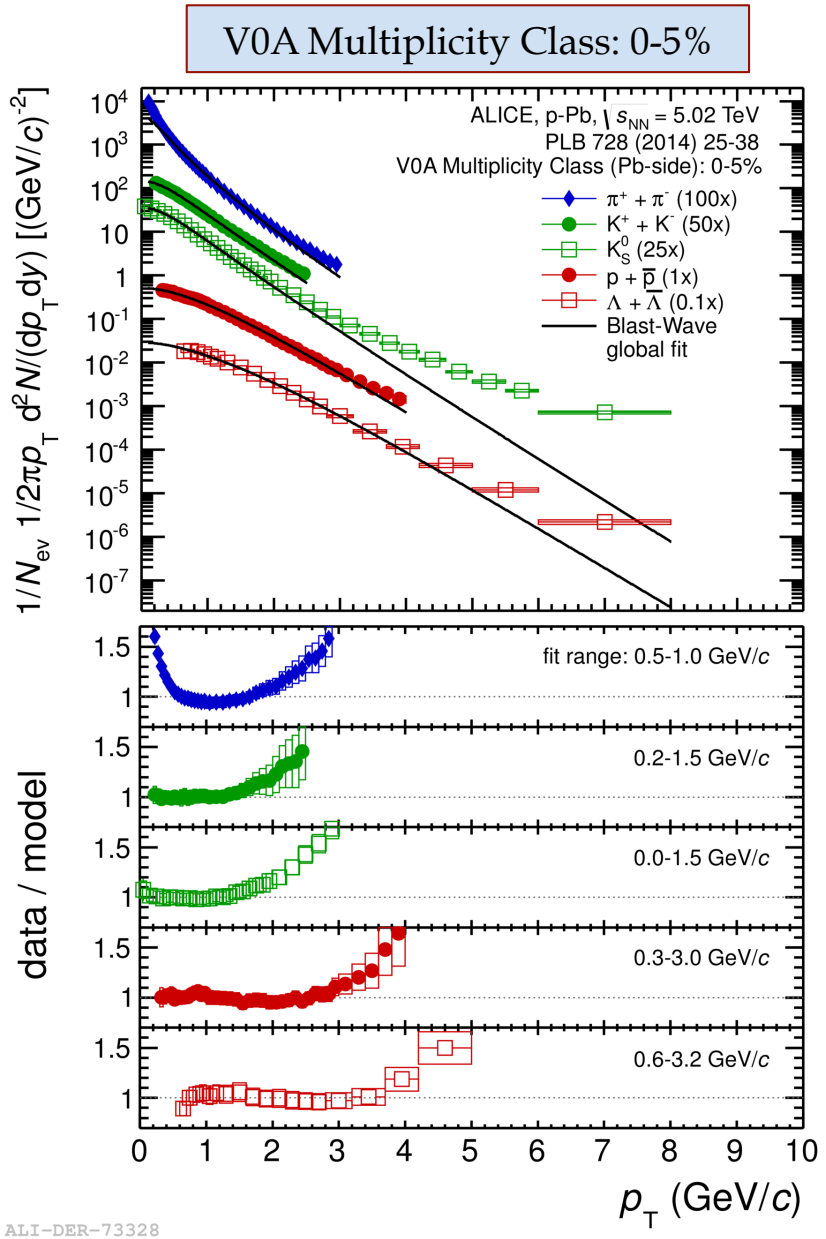

And also the ridge + elliptic flow

p_T range : 1.0 - 2.0 GeV/c

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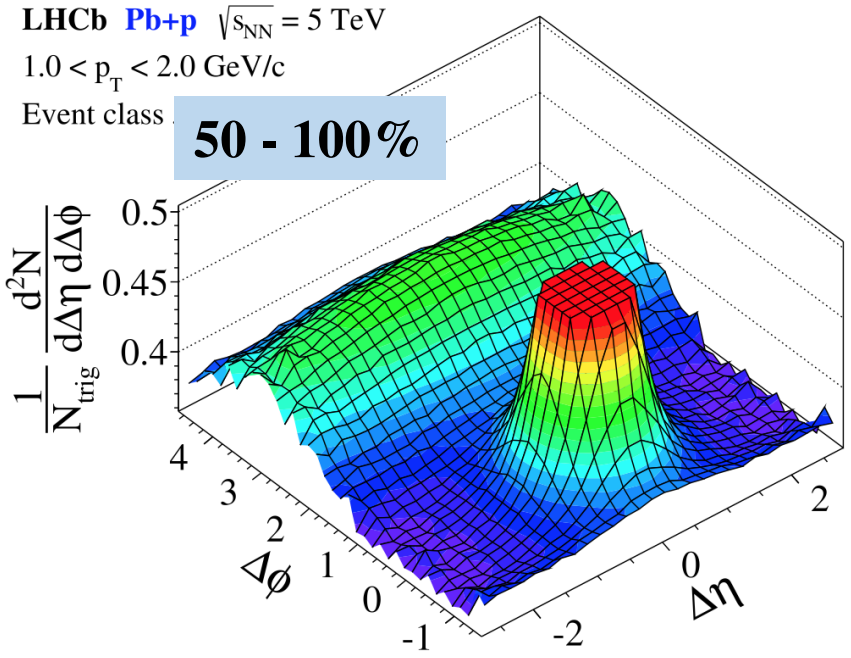
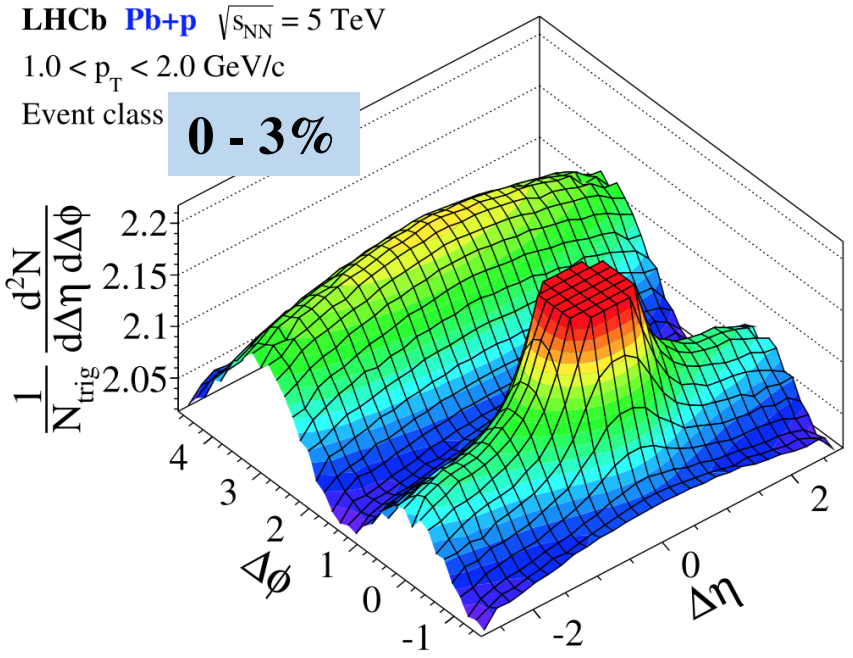


At low event activity (50-100%)



At high event activity (0-3%)

LHCb presented nice results on two particle correlations, the ridge structure has been observed in Pb-p collisions

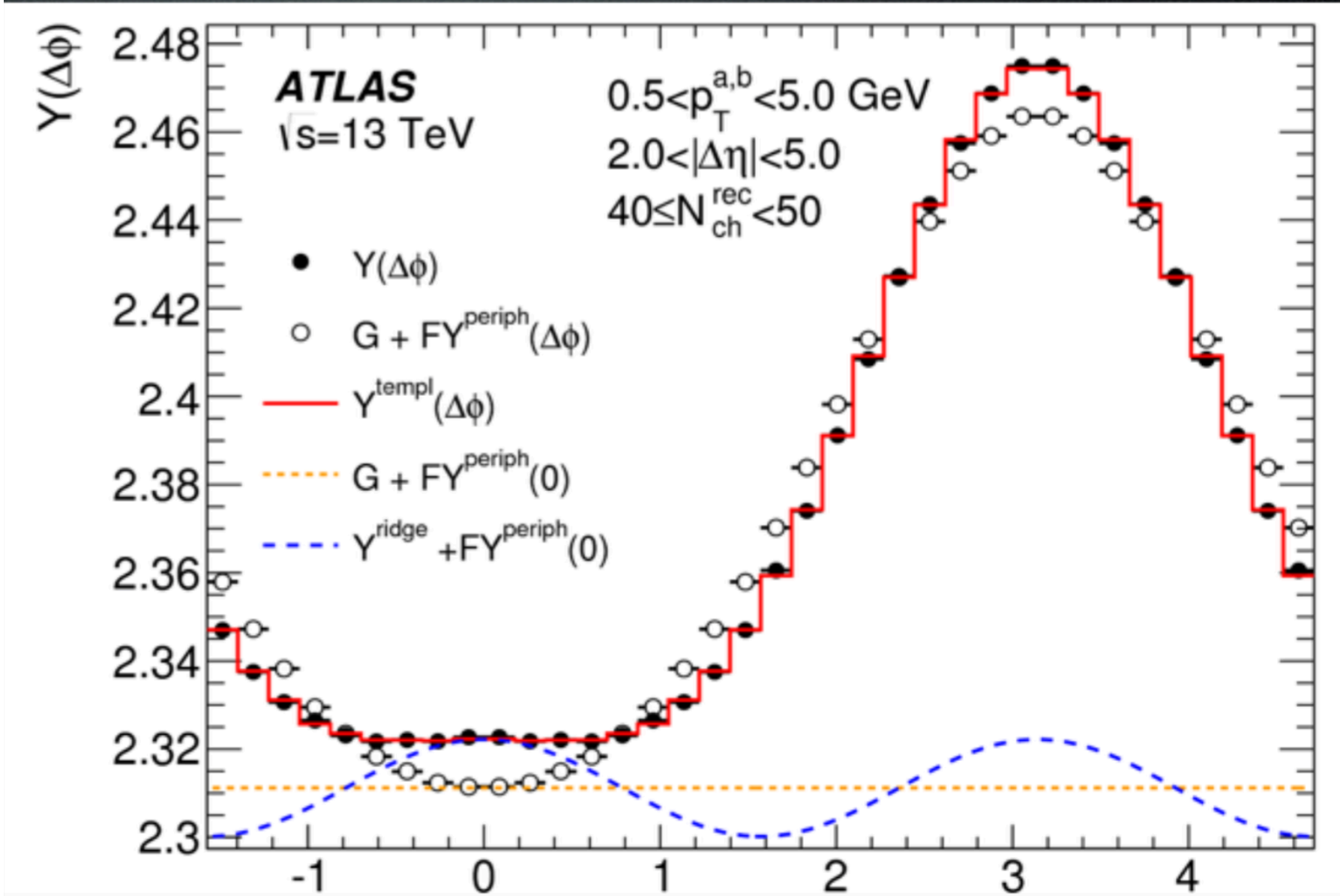
- ❑ It would be interesting to extract the Fourier coefficient
- ❑ Is it possible to compare with other experiments (e.g. expected multiplicities at mid-rapidity)?

New approach proposed by the ATLAS collaboration

- A soft component (ridge) is always assumed

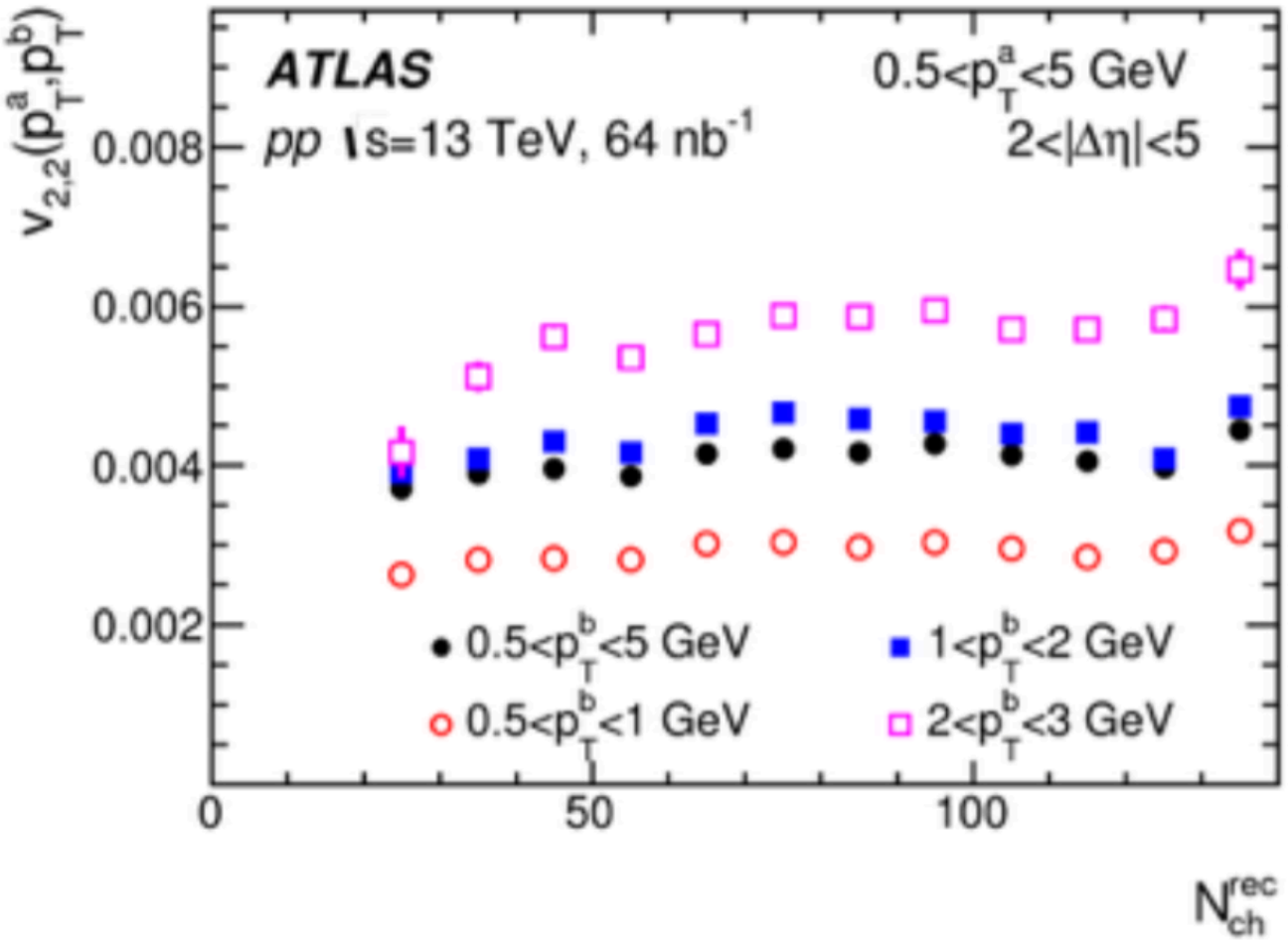
(Deepak Kar talk)

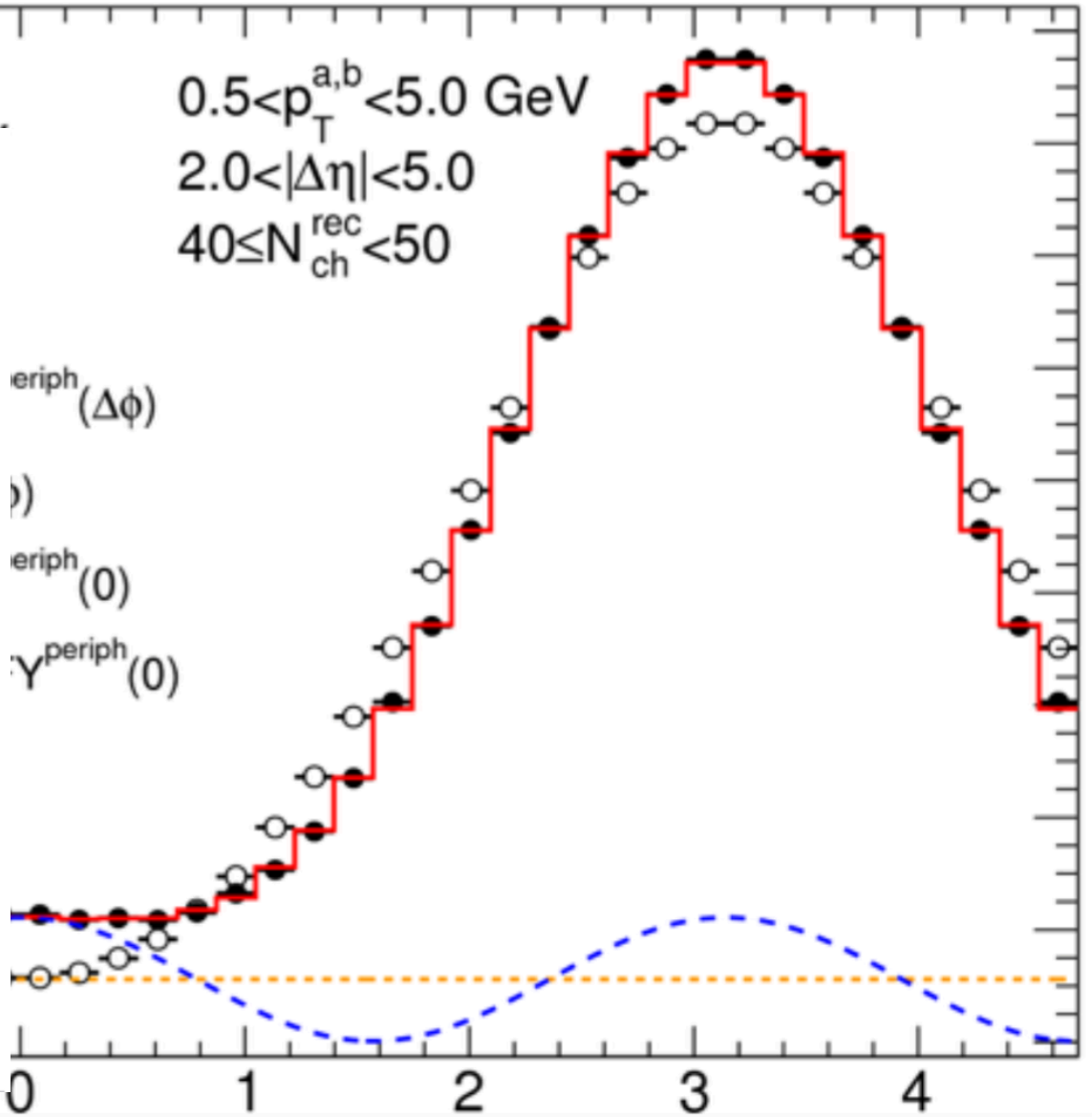
$$Y(\Delta\phi)_{Fit} \cong FY(\Delta\phi)_{low\text{-}mult} + A\cos 2\Delta\phi + C$$



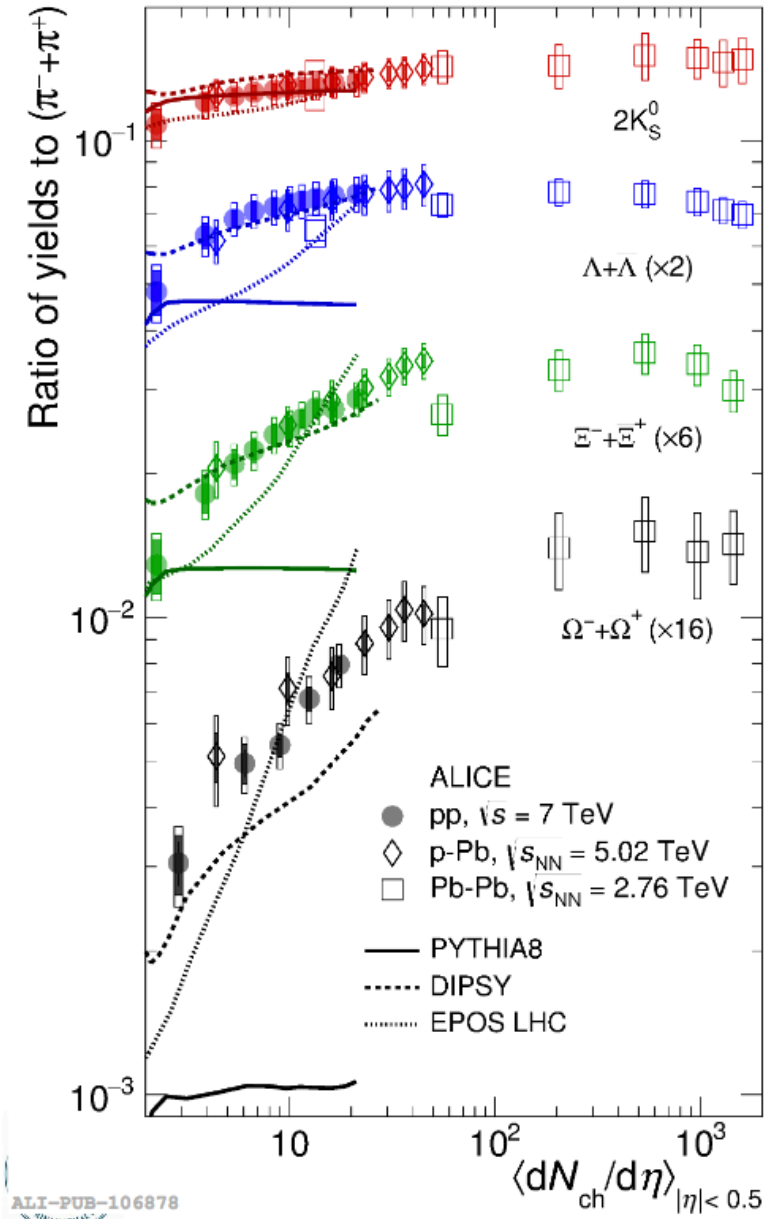
A nearly flat v2! How can we explain this with existing models?

$$Y(\Delta\phi)_{Fit} \cong FY(\Delta\phi)_{low\text{-}mult} + A\cos 2\Delta\phi + C$$





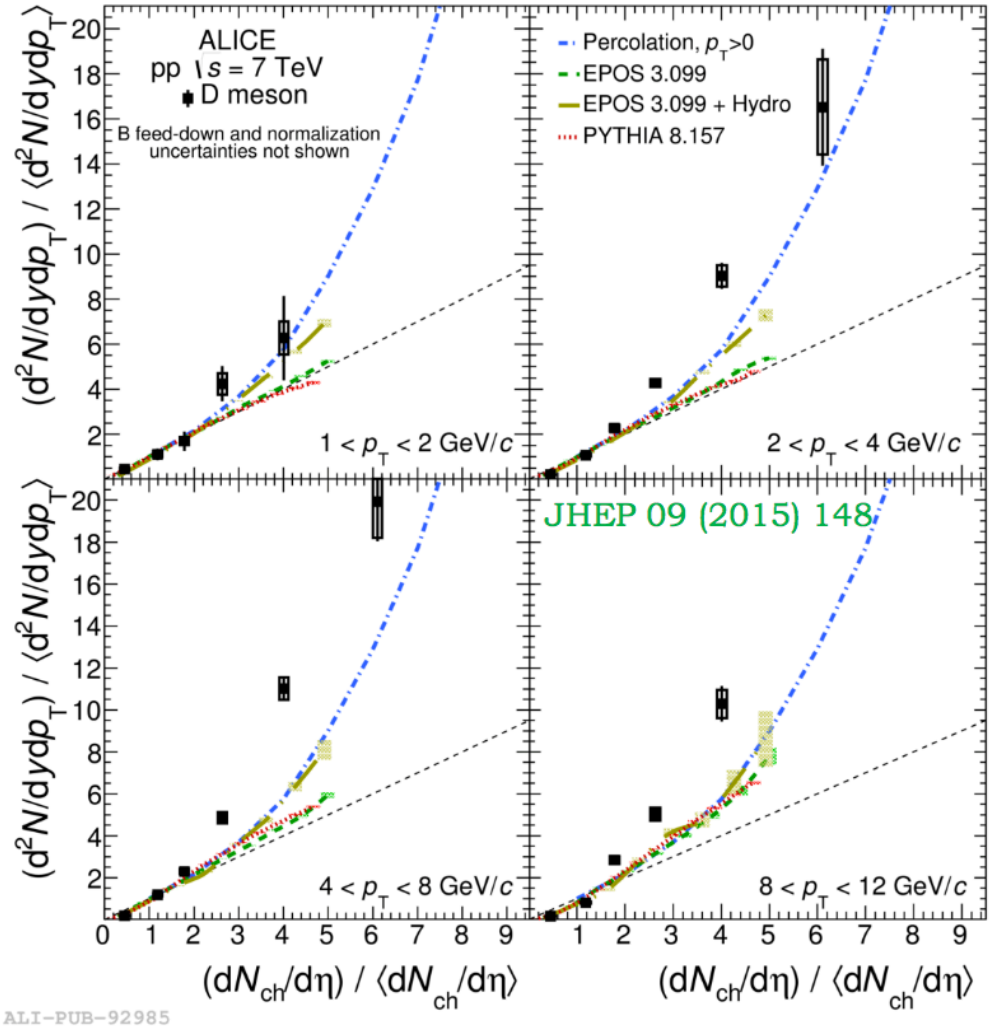
Strangeness Enhancement in pp and p-Pb



- Significant enhancement of strange & multi-strange particle production
- Similar trend is observed in p-Pb collisions
- Particle ratios reach values that are similar to those observed in Pb-Pb collisions
- Strangeness enhancement increases with the strangeness content in hadrons
- No MC models describes the data satisfactorily

ALICE

Heavy-flavor production in pp collisions at the LHC



Good description from Percolation Model.

Percolation model:

- Assumes collisions are driven by the exchange of colour sources between projectile and target.
- Colour sources have a finite spatial extension and can interact.

EPOS 3:

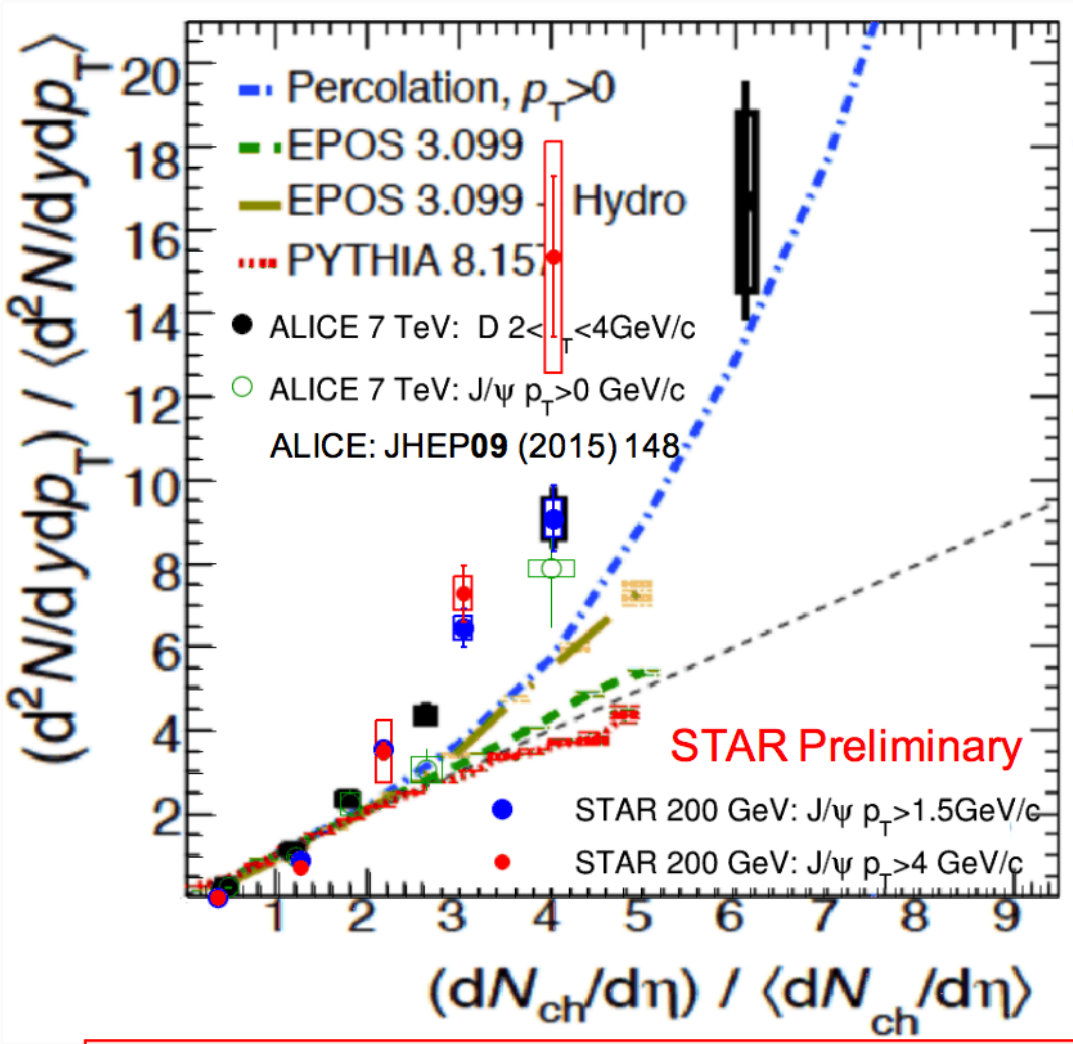
- Assumes hydro evolution.
- Hadronization via string fragmentation.

Pythia 8:

- Simulation includes colour reconnection and diffractive processes.
- SoftQCD process selection.
- Also MPI and ISR/FSR.

J/ψ Yield vs Event Activity (N_{ch})

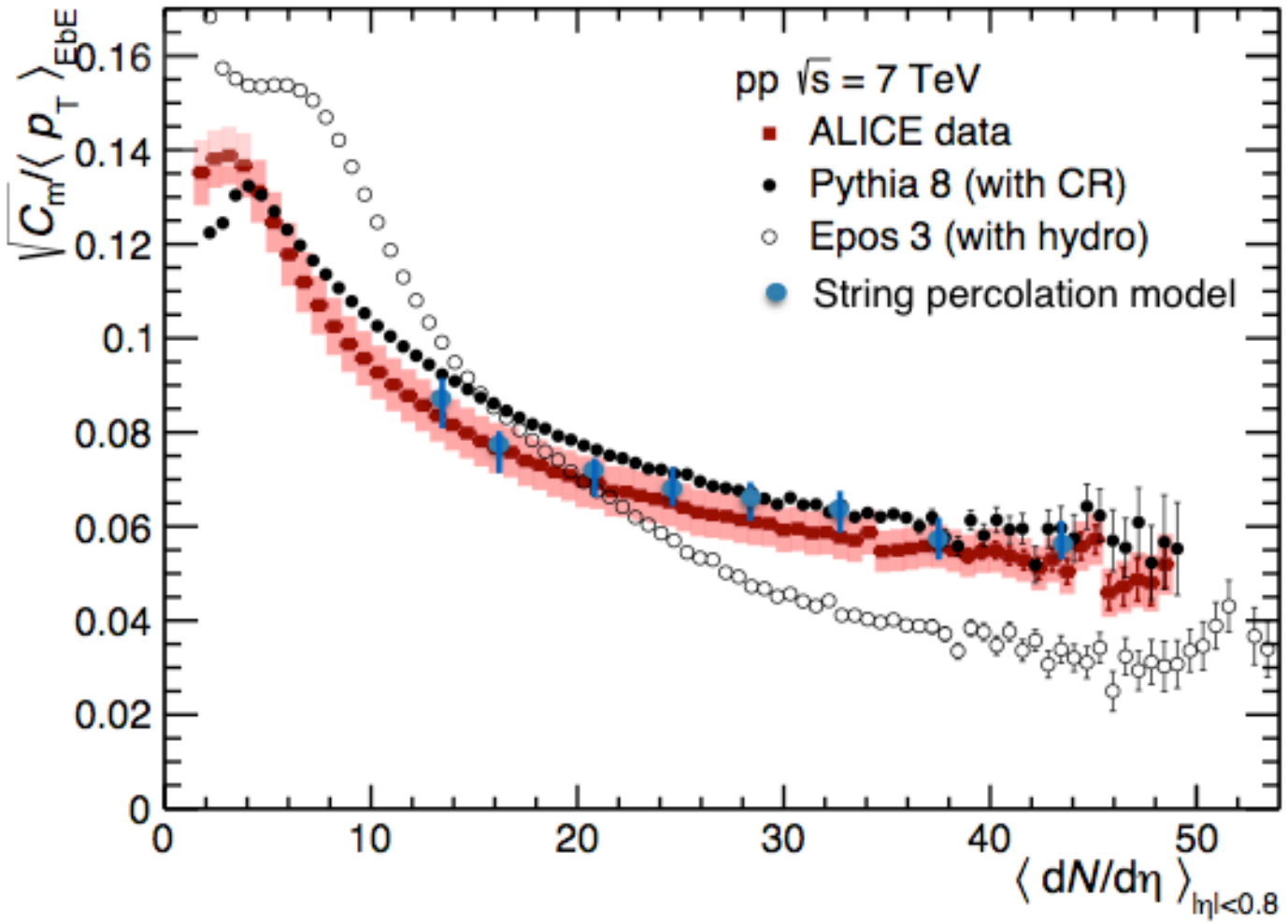
It would be important to compare same pT intervals. However, the same trend is observed



- **Percolation model**: exchange color sources in collisions. High energy density suppresses soft processes more than hard processes
  N_{hard} rises faster than N_{ch} at LHC
  Small collisional energy dependence
  N_{hard} rises faster than N_{ch} at RHIC
- **EPOS3+Hydro**: energy density in 7 TeV p+p collisions is high enough to apply hydrodynamic evolution to the core of the collisions
  N_{hard} rises faster than N_{ch} at LHC
  Strong collision energy dependence
  $\langle dN_{ch}/deta \rangle$ ~ 3 at 200 GeV
  ~ 6 at 7 TeV
  N_{hard} rises linearly as N_{ch} at RHIC

Stronger-than-linear rise following the same trend at 200 GeV and 7 TeV, suggests not a hot medium effect assumed in EPOS3+Hydro for p+p collisions

New observables are needed in order to extract more information from data



Irais Bautista

Mean pT fluctuations

- ❑ Pythia 8
- ❑ Epos 3
- ❑ String percolation model

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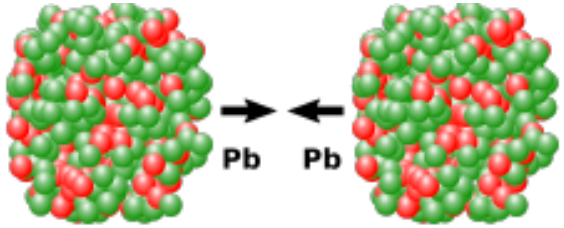

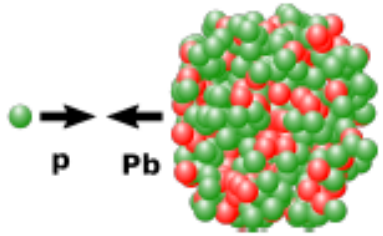

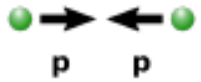

- One of the main conclusions is that pp and p-Pb collisions are more than reference measurements for heavy-ion physics
  - A stronger communication with the heavy-ion community is therefore encouraged
- Is there any unified description to all available data (pp, p-A, d-A, and A-A)?
  - One possibility are MPIs.
  - We have shown that with a very simple model for the interactions among partons (just before the hadronization) one can produce collective-like effects