



# Probing particle production and transport at top LHC energy with ALICE



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on behalf of the ALICE Collaboration

## Motivation

### Small systems manifest signs of collectivity

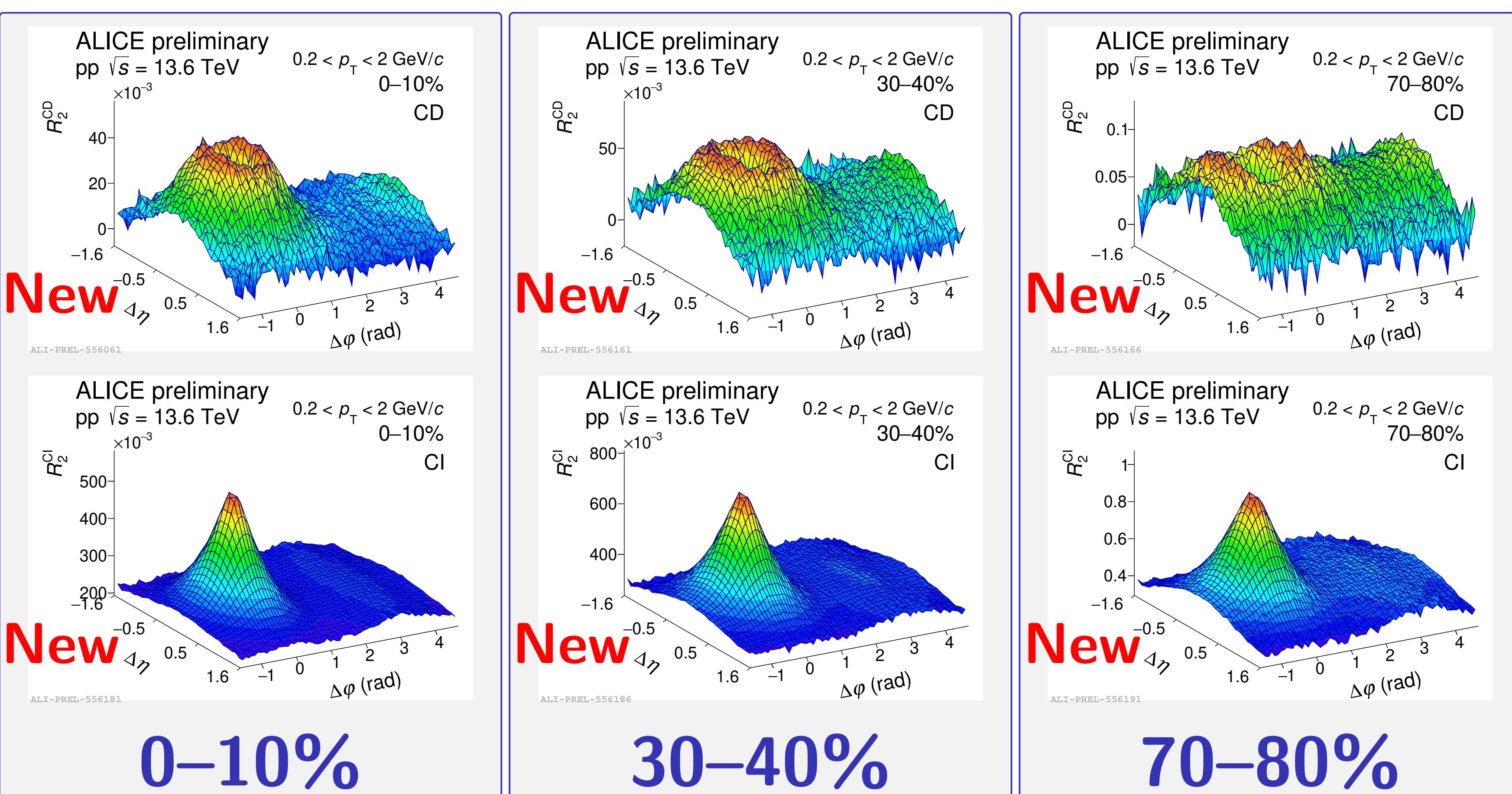
- Long-range longitudinal correlations and large azimuthal anisotropy

### Particle production and transport studies

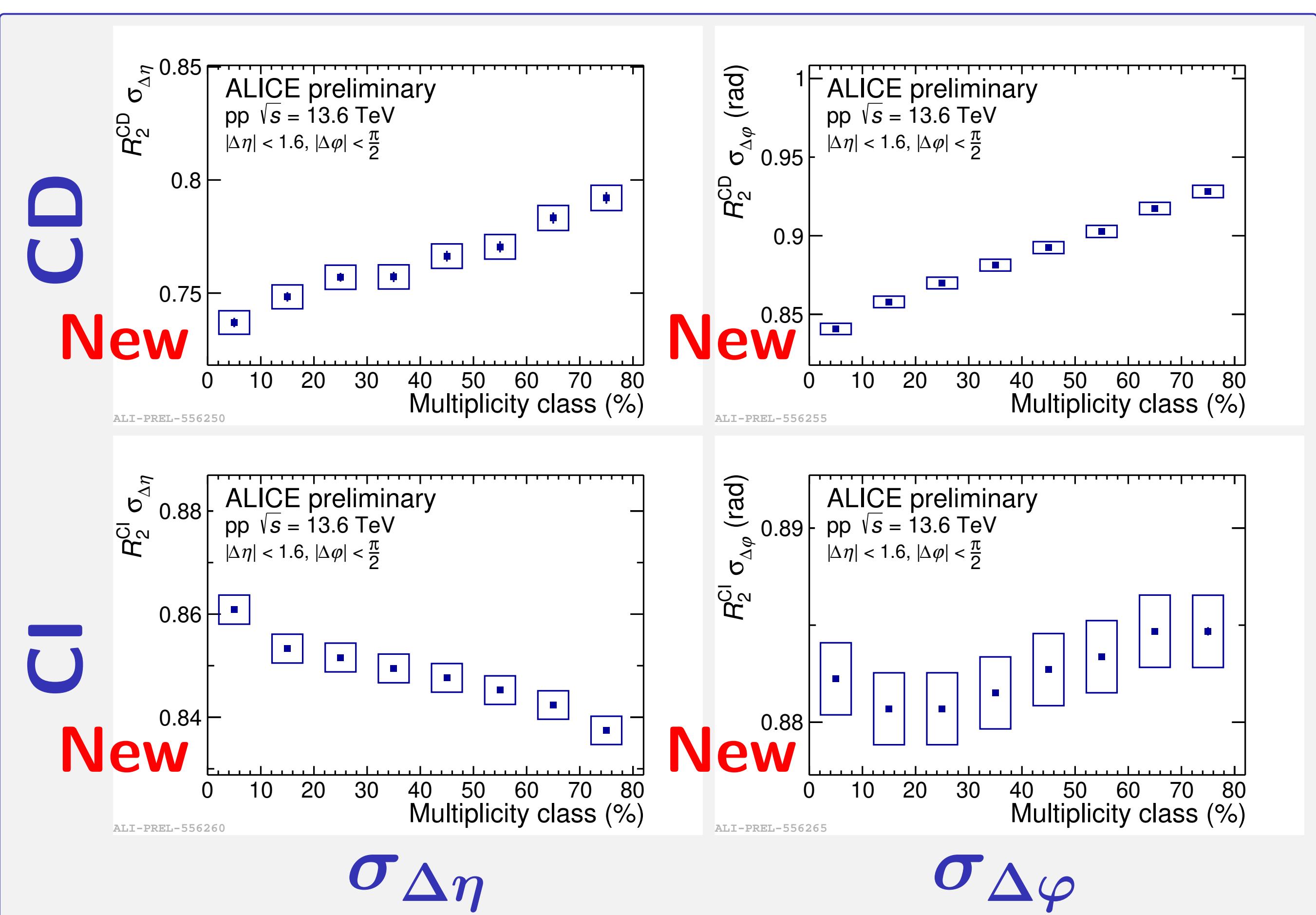
- From small to large collision systems
- Normalized two-particle cumulant  $R_2$  [1]
  - Sensitive to the presence of collectivity
  - p-Pb and Pb-Pb longitudinal and azimuthal widths evolution with multiplicity [2]
    - Overall trends shared among systems
    - Discontinuity in the transition between systems

## Behavior in pp at top LHC Run 3 energy?

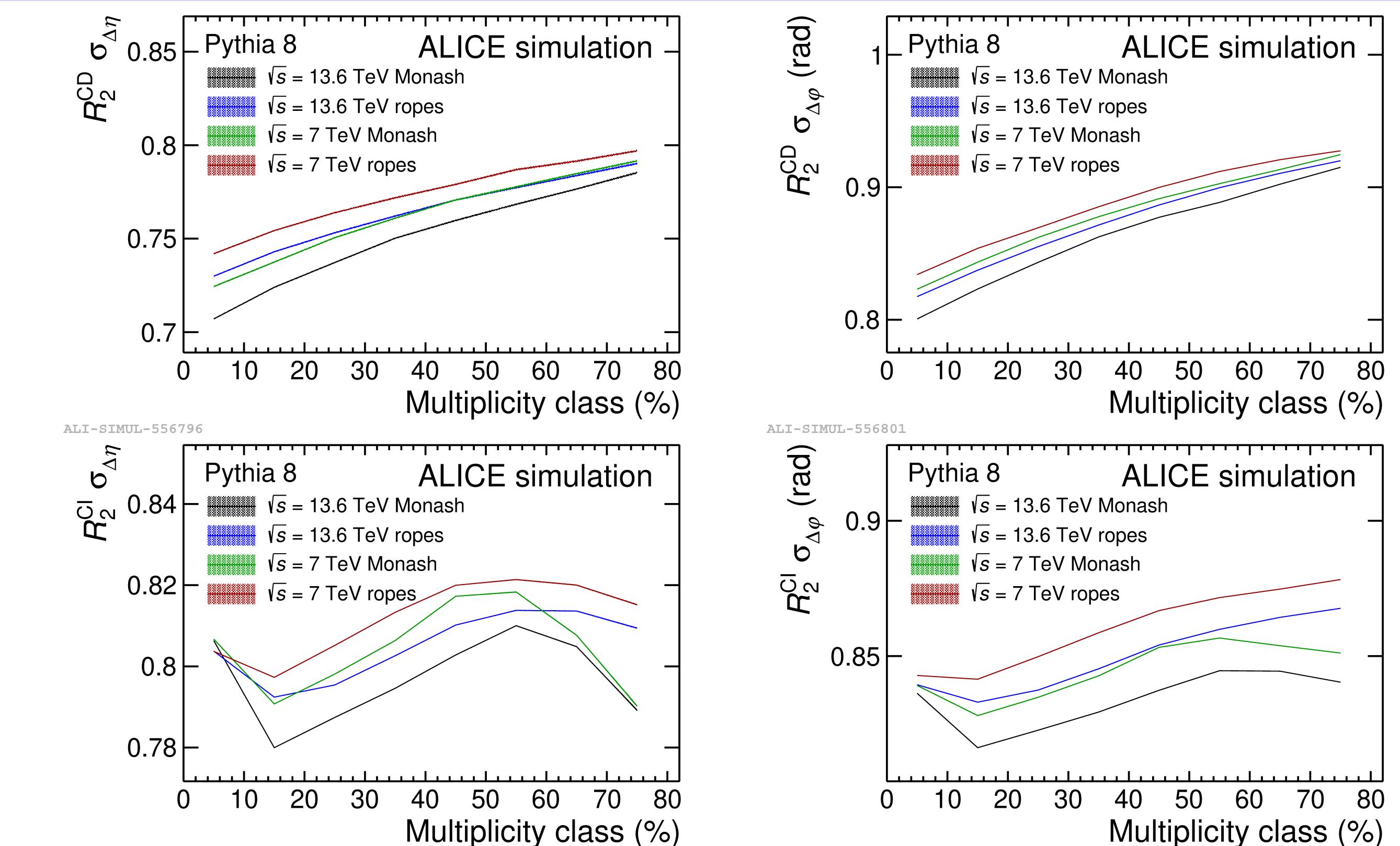
## $R_2^{CD}$ and $R_2^{CI}$ correlation functions



## Near-side peak widths evolution



## Widths evolution from Pythia 8



## Observable definition

$$R_2 = \frac{\rho_2}{\rho_1 \rho_1} - 1$$

$$\left\{ \begin{array}{l} \rho_2 = \frac{d^2 N^{+-}}{d\Delta\eta d\Delta\varphi} \\ \rho_1 = \frac{d^2 N^\pm}{d\eta d\varphi} \end{array} \right.$$

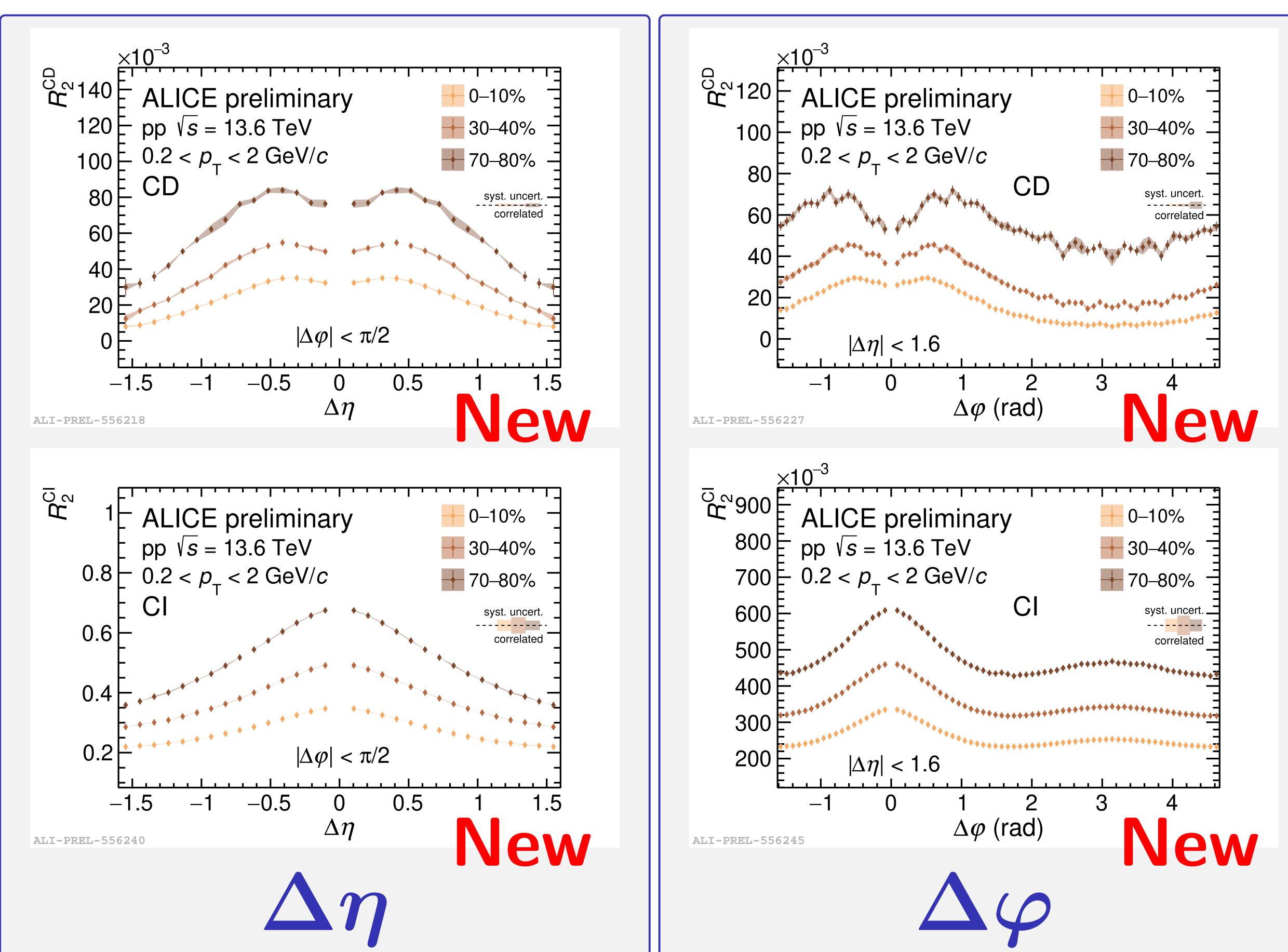
Charge independent (CI) sensitive to collective behavior

$$CI = \frac{1}{4} ((+-) + (-+) + (++) + (--) )$$

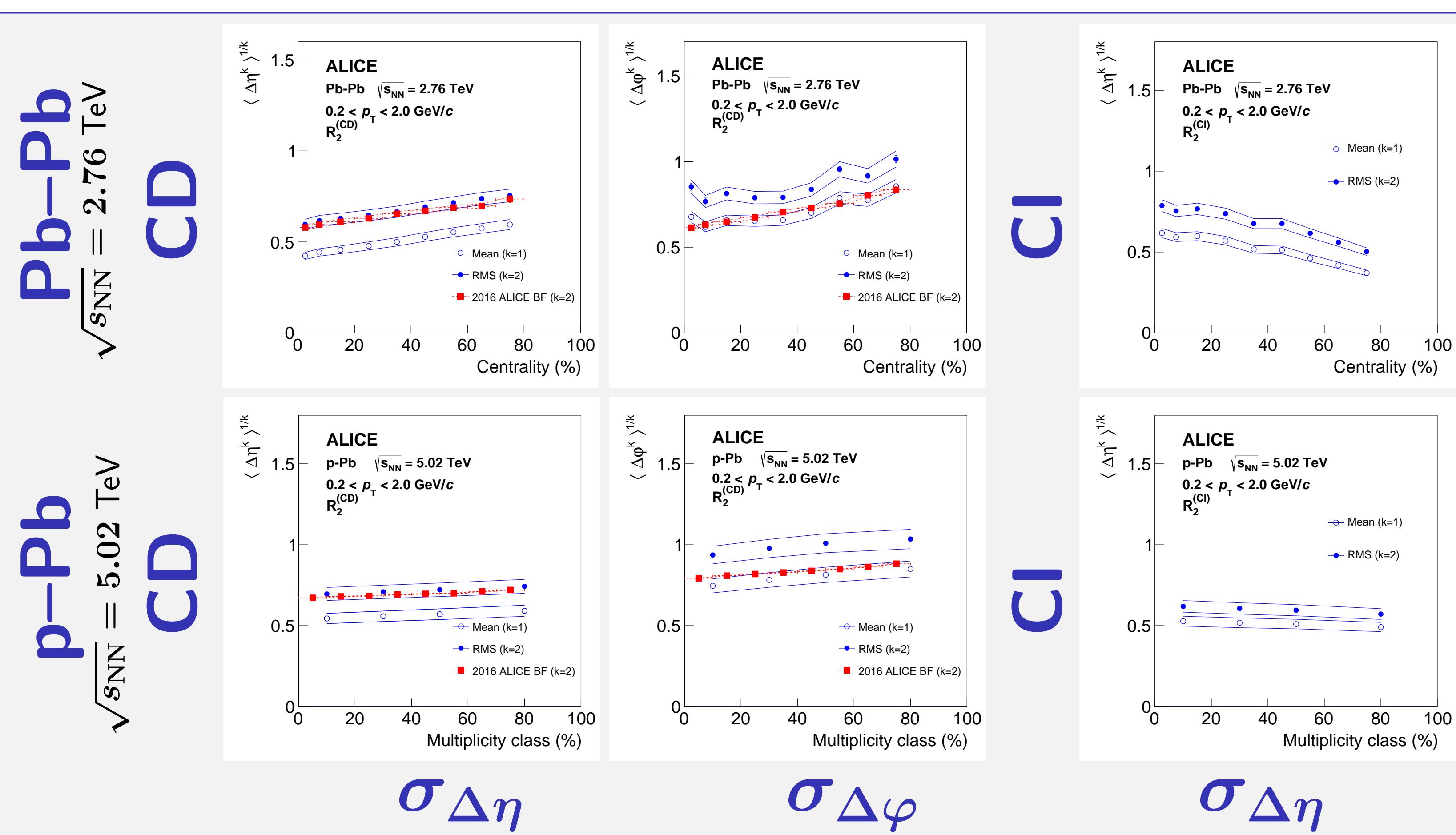
Charge dependent (CD) influenced by charge conservation

$$CD = \frac{1}{4} ((+-) + (-+) - (++) - (--) )$$

## $R_2^{CD}$ , $R_2^{CI}$ projection evolution



## Pb-Pb and p-Pb published results [2]



## Conclusions

- $R_2^{CD}$ : narrowing with increasing multiplicity
  - About 6% along  $\Delta\eta$  and 10% along  $\Delta\varphi$
  - Consistent with the overall narrowing trend in p-Pb and Pb-Pb
- $R_2^{CI}(\Delta\eta)$ : small (3%) broadening with increasing multiplicity
  - Consistent with the overall broadening in p-Pb and Pb-Pb
- $R_2^{CI}(\Delta\varphi)$ : flat as a function of multiplicity
- Pythia 8 qualitatively reproduce  $R_2^{CD}$  behavior

## Bibliography

- [1] Monika Sharma and Claude A. Pruneau. Methods for the Study of Transverse Momentum Differential Correlations. *Phys. Rev.*, C79:024905, 2009.
- [2] Shreyasi Acharya et al. Two particle differential transverse momentum and number density correlations in p-Pb and Pb-Pb at the LHC. *Phys. Rev. C*, 100(4):044903, 2019.