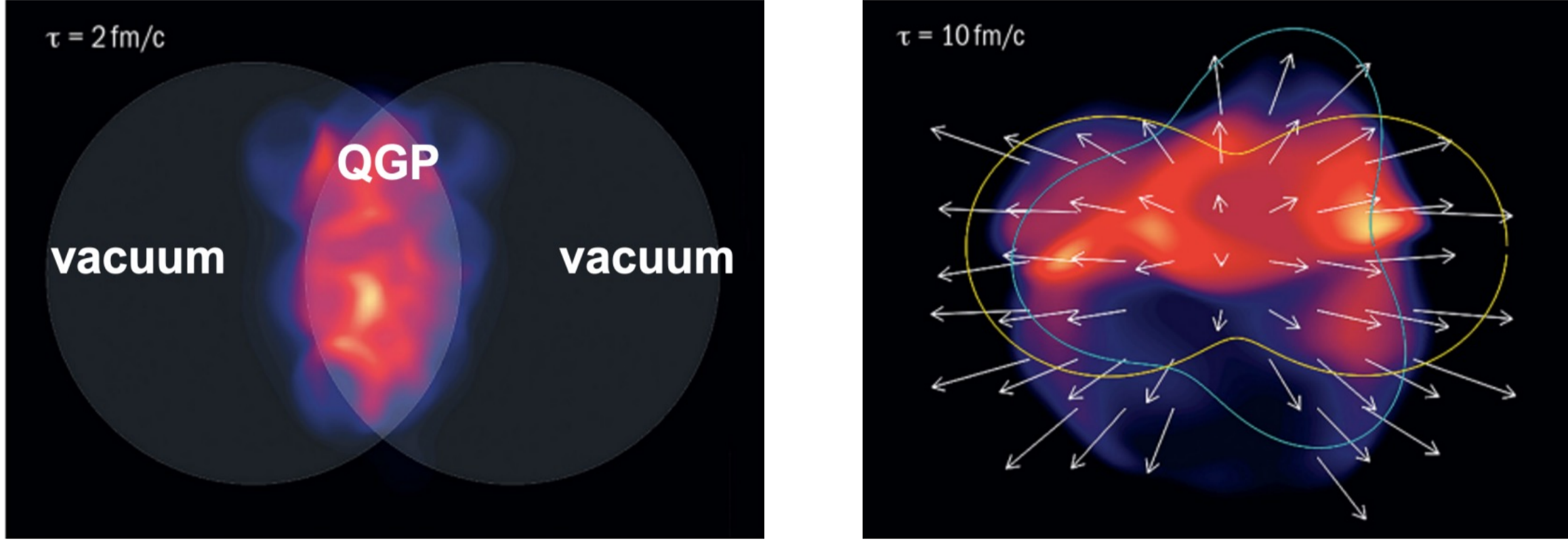


1. Introduction

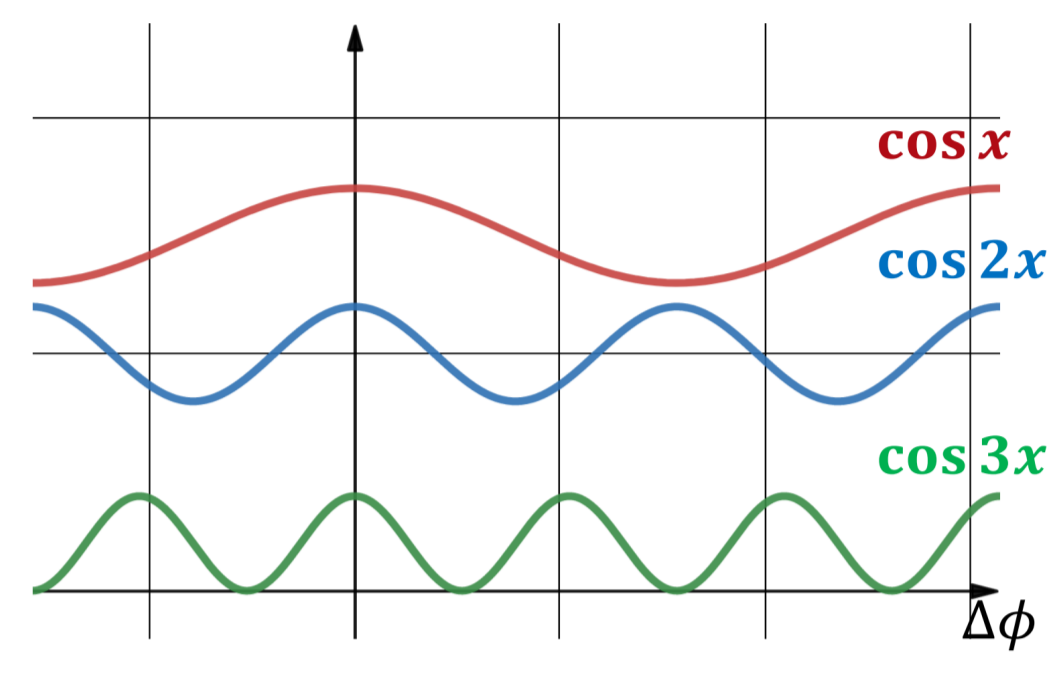
Anisotropic collective flow



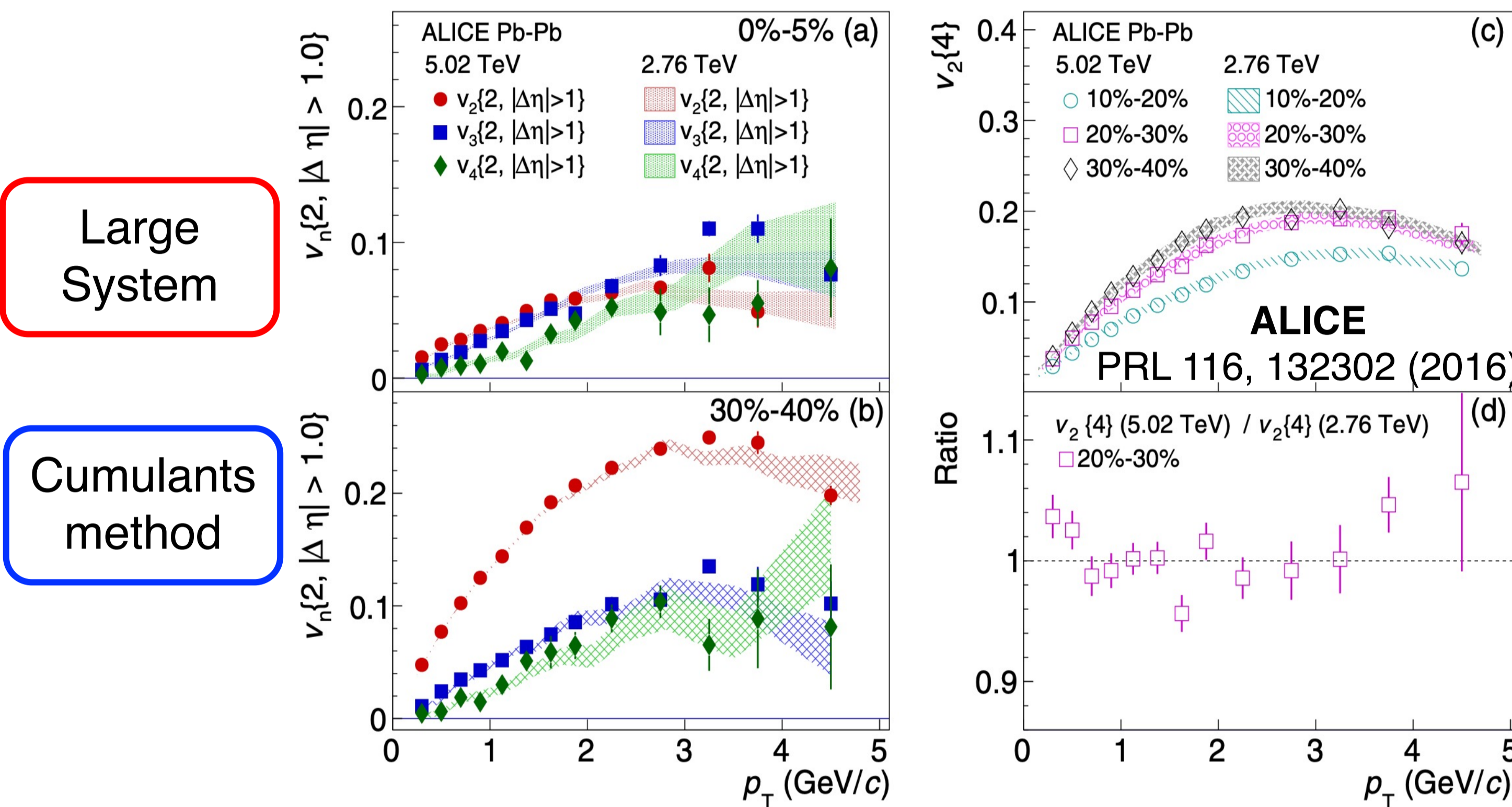
- Flow harmonics

$$\frac{dN}{d\phi} = \frac{N}{2\pi} \left[1 + 2 \sum_{n=1} v_n \cos n(\phi - \Phi_n) \right]$$

- Evolution and the properties of the QGP

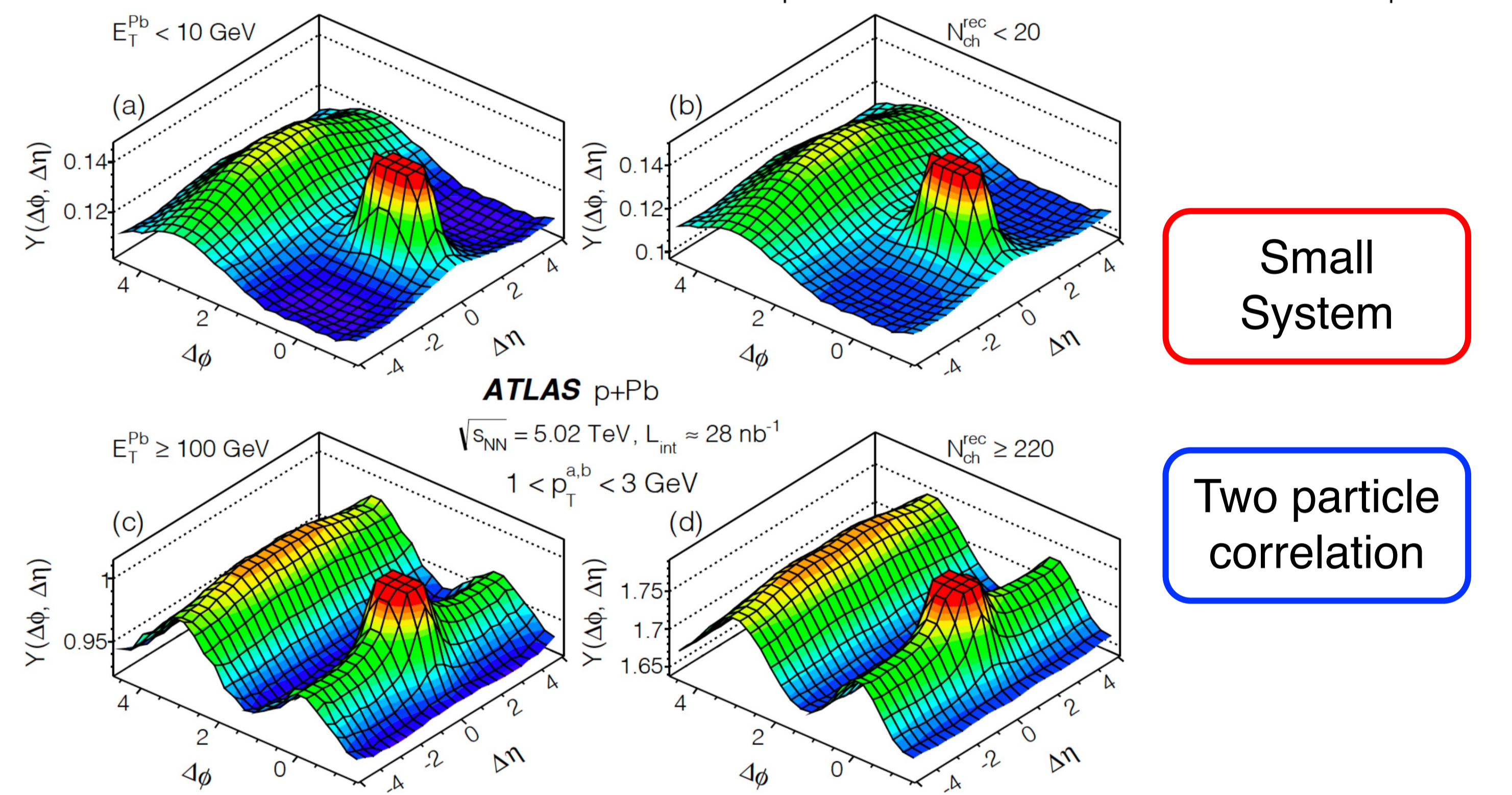


Existing LHC results at central rapidity



Large System

Cumulants method



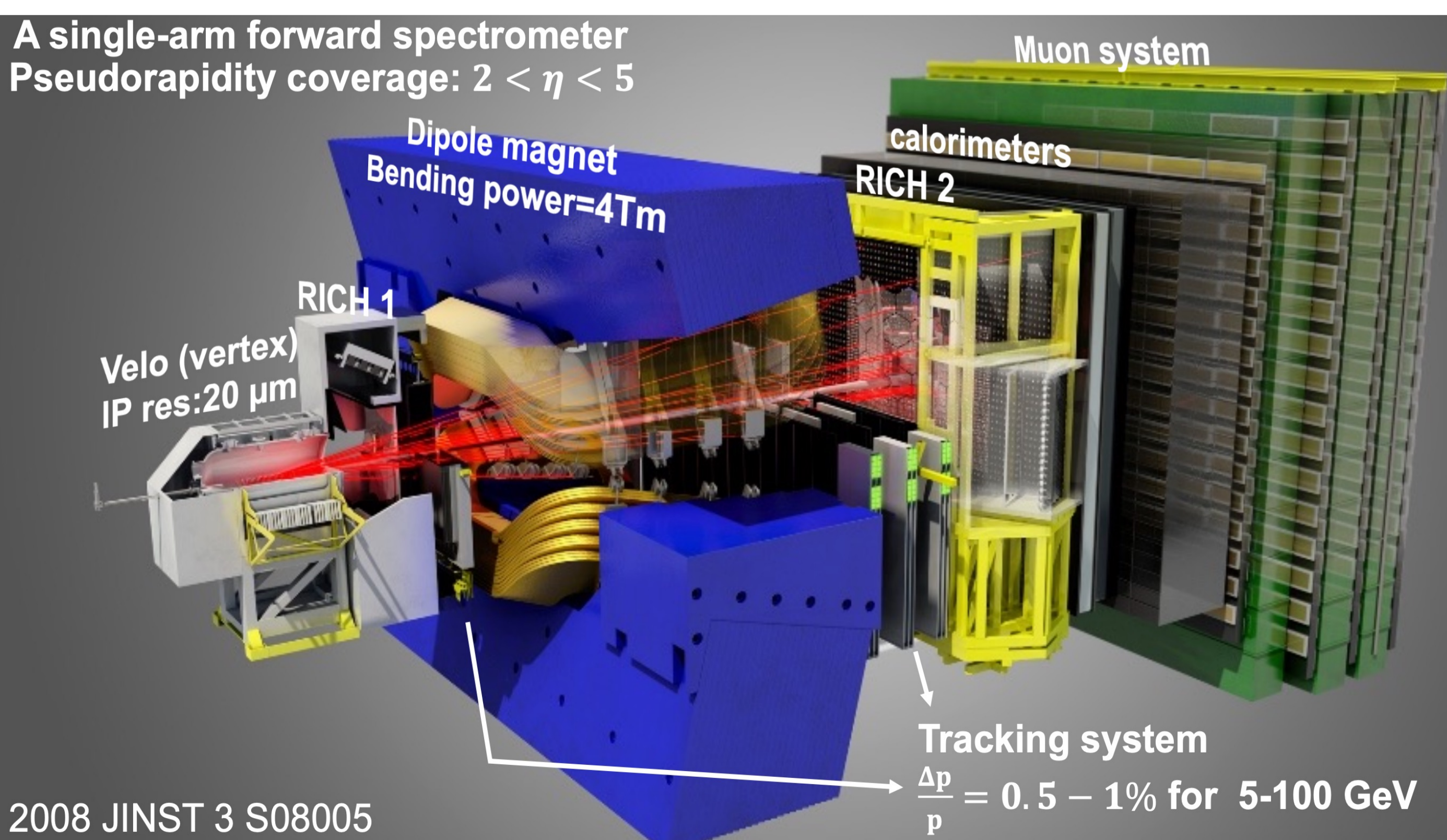
Small System

Two particle correlation

- What about the collective flow at forward rapidity?

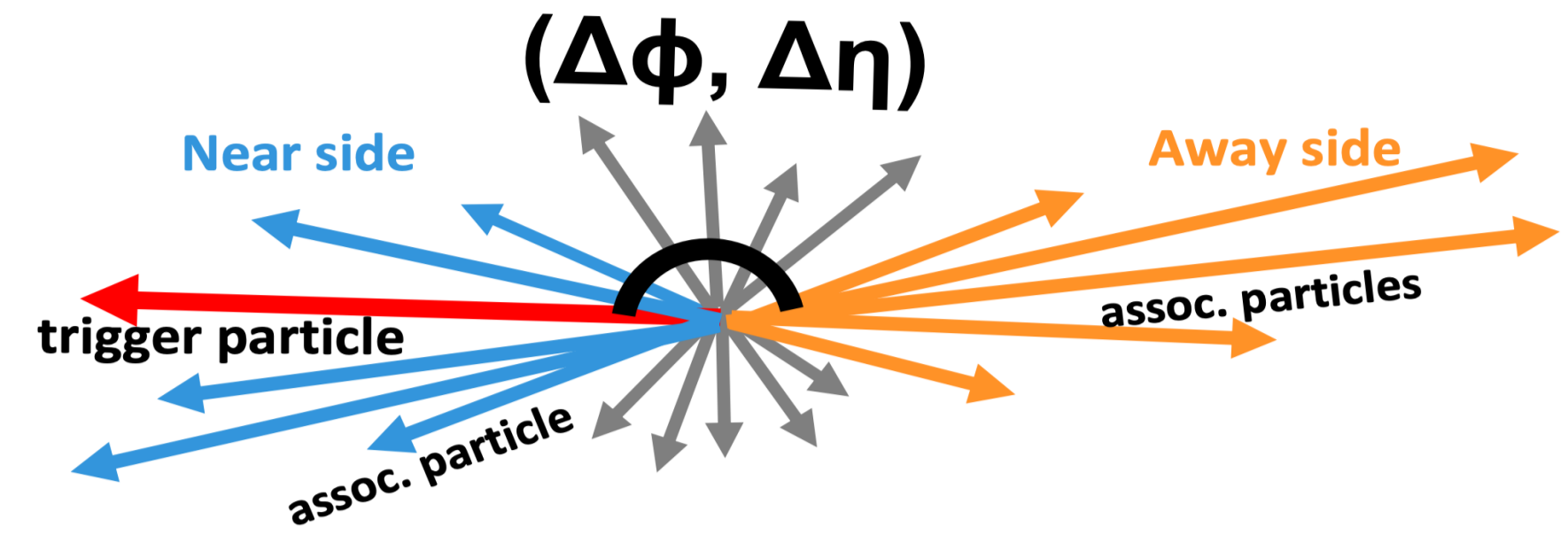
2. The LHCb detector

- Tracking system consists of a silicon-strip vertex detector (VELO) and three stations of silicon-strip detectors and straw drift tubes
- Provides a high-precision momentum measurement

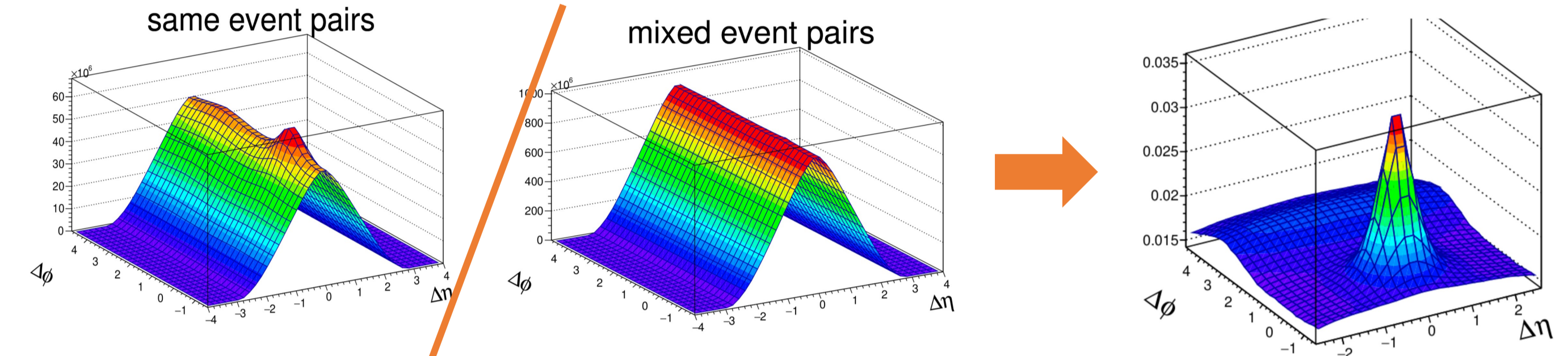


3. Analysis strategy

2D angular correlation with mixed-event correction



- A pair of charged hadrons: trigger + partner (associated)
- $\Delta\eta = \eta^{trig} - \eta^{assoc}$, $\Delta\phi = \phi^{trig} - \phi^{assoc}$
- Same event pairs: two hadrons from the **same event**
- Mixed event pairs: two hadrons from **different events**
- Correlation function = **same event pairs** / **mixed event pairs**



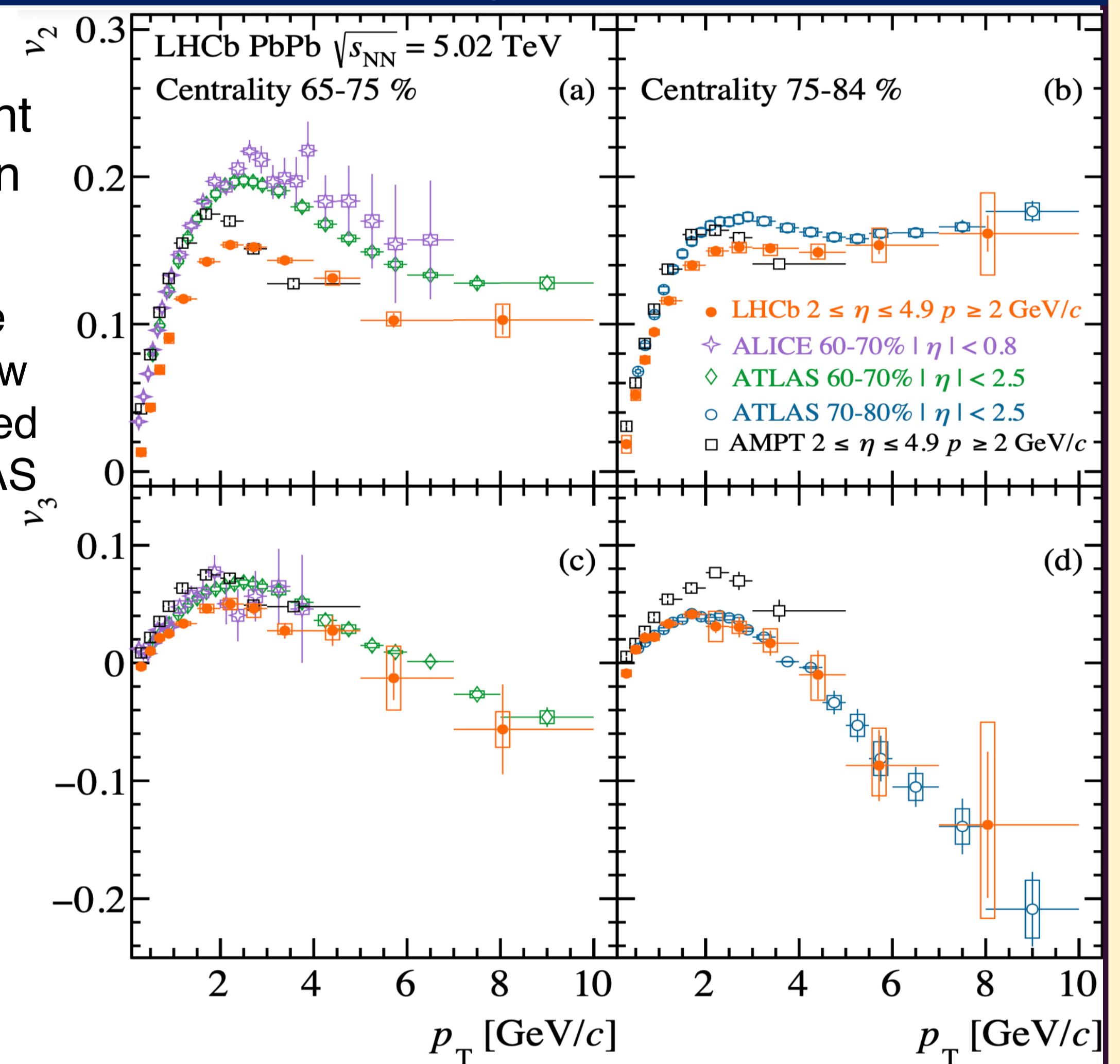
4. Results in PbPb at $\sqrt{s_{NN}} = 5$ TeV

Phys. Rev. C 109, 054908

First measurement of charged hadron $v_n(p_T)$ at LHCb

- LHCb results in the forward region show **weaker** v_n compared to ALICE and ATLAS results
- Constrain the theoretical model

ALICE: JHEP (2018) 103
ATLAS: Eur. Phys. J. C78 (2018) 997
AMPT: Z.-W. Lin and L. Zheng, Nucl. Sci. Tech. 32 (2021) 113

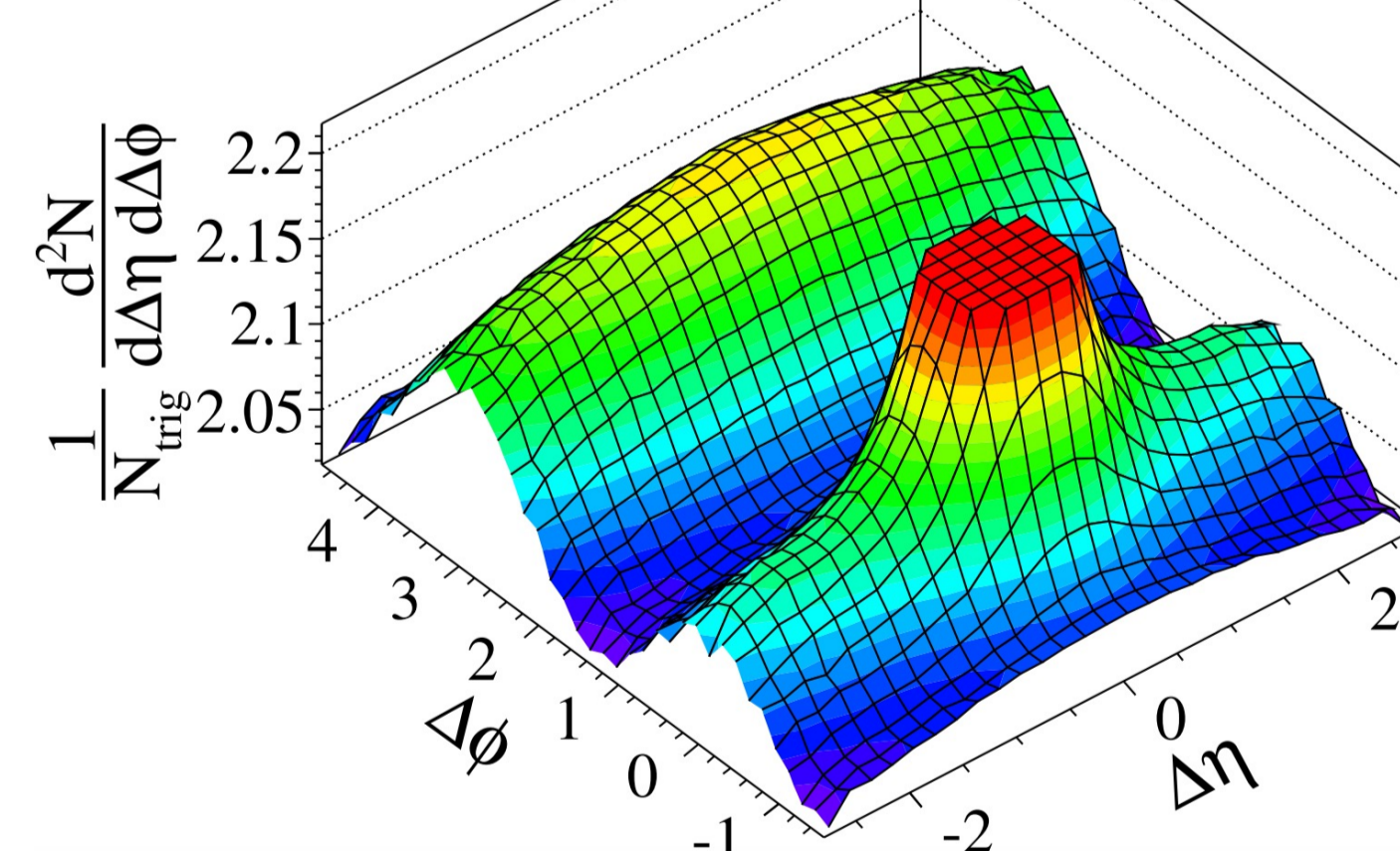


5. Results in Pp and pPb at $\sqrt{s_{NN}} = 5$ TeV

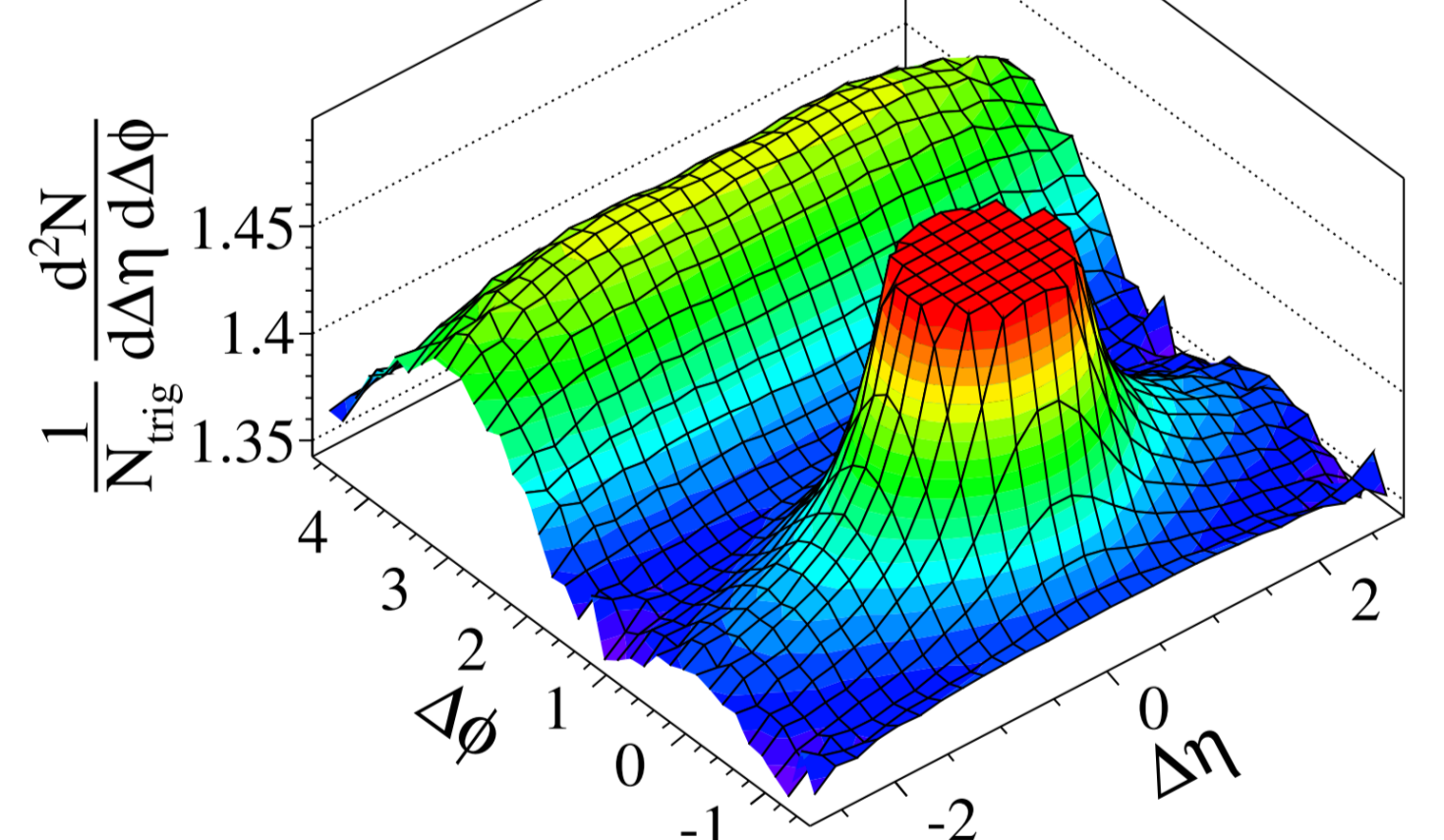
Two-particle angular correlations

Phys. Lett. B762 (2016) 473-483

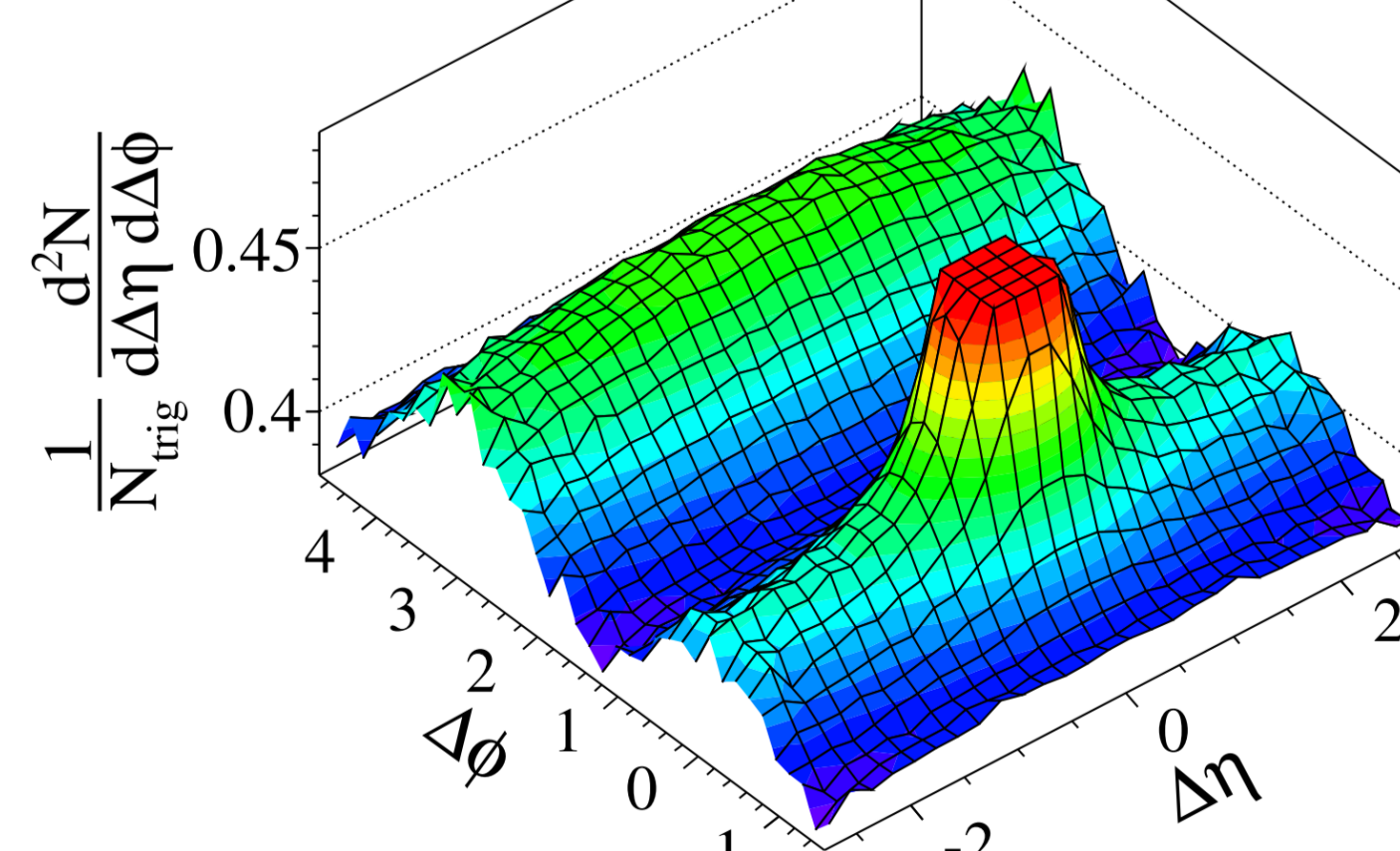
LHCb **Pb+p** $\sqrt{s_{NN}} = 5$ TeV
 $1.0 < p_T < 2.0$ GeV/c
Event class 0-3%



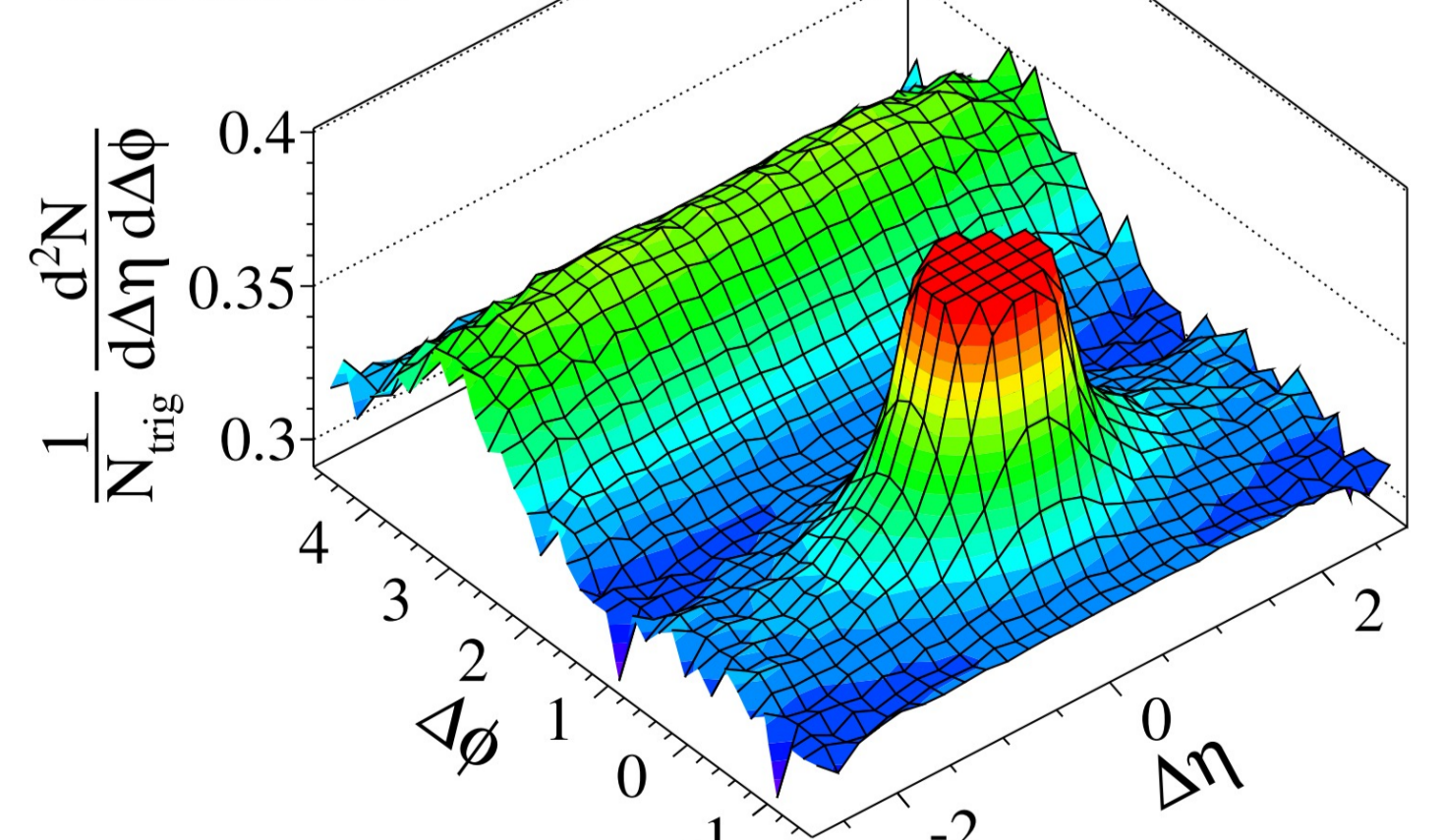
LHCb **p+Pb** $\sqrt{s_{NN}} = 5$ TeV
 $1.0 < p_T < 2.0$ GeV/c
Event class 0-3%



LHCb **Pb+p** $\sqrt{s_{NN}} = 5$ TeV
 $2.0 < p_T < 3.0$ GeV/c
Event class 0-3%



LHCb **p+Pb** $\sqrt{s_{NN}} = 5$ TeV
 $2.0 < p_T < 3.0$ GeV/c
Event class 0-3%



6. Summary

- Pronounced **near-side ridges** in both PbPb and pPb in the forward rapidity region
- Generally **smaller** v_2 and v_3 values than central rapidity
- Measurements of flow coefficients in pPb at 8TeV in process