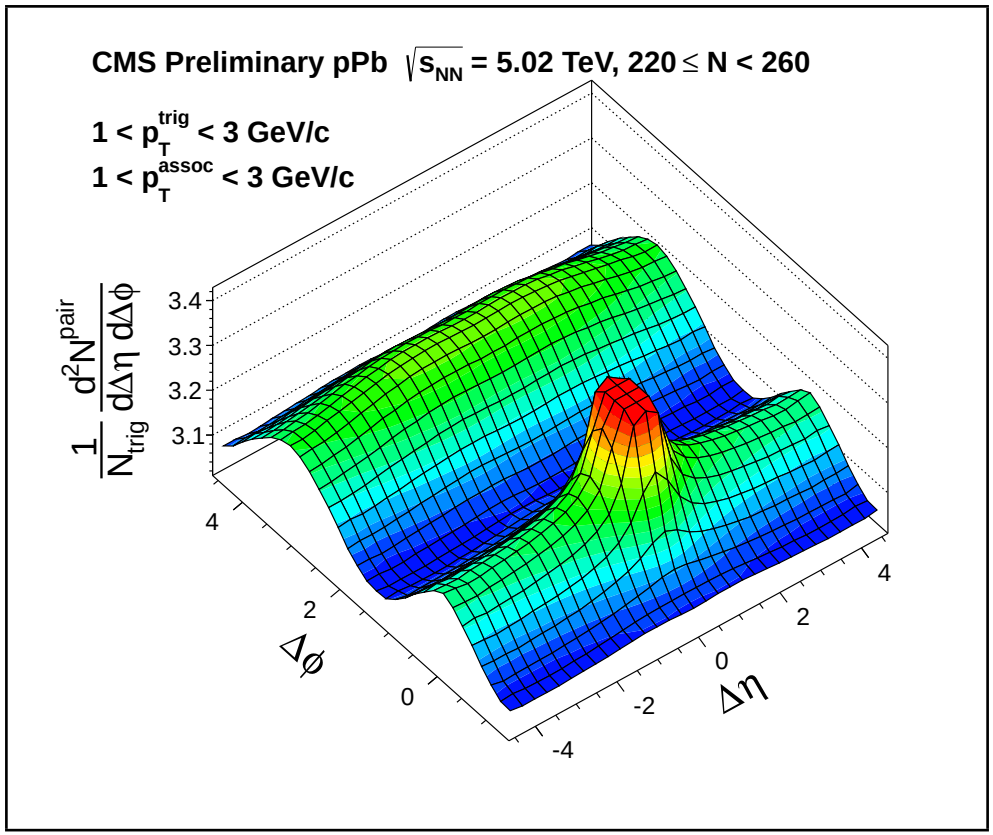
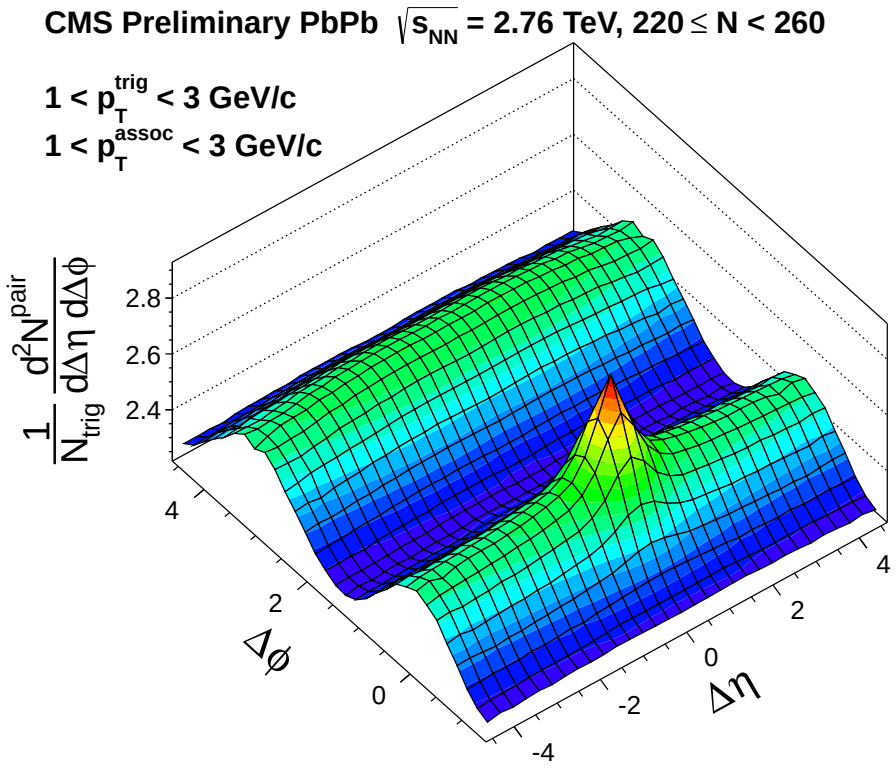
Two- and multi-particle correlations in p-Pb and Pb-Pb collisions

CMS PAS HIN-13-002

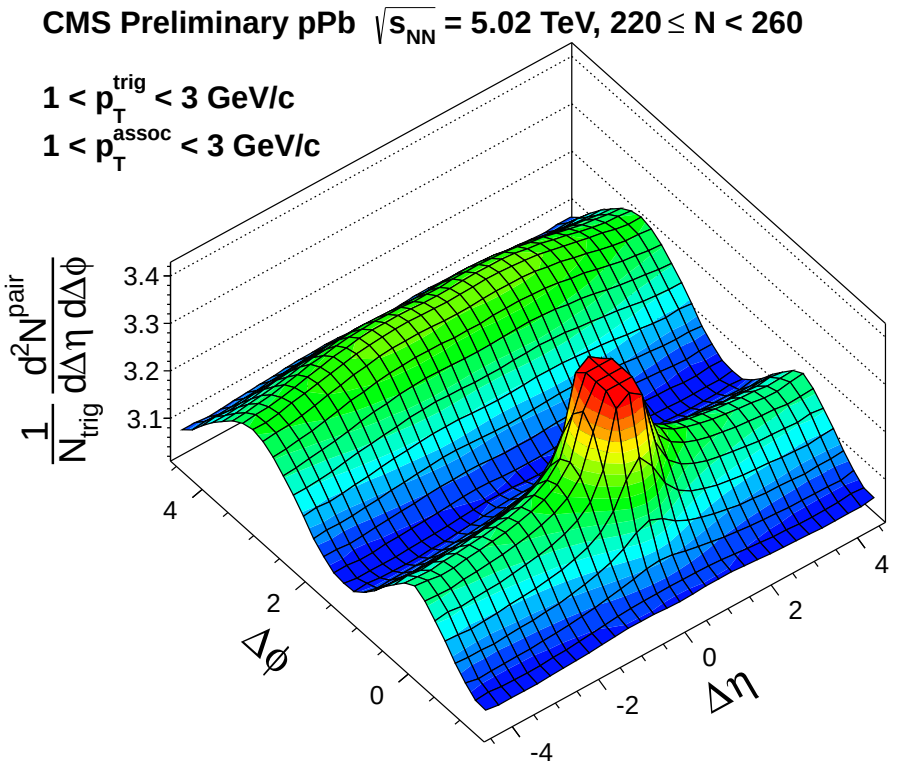


Two-particle correlations – 2D

Pb-Pb



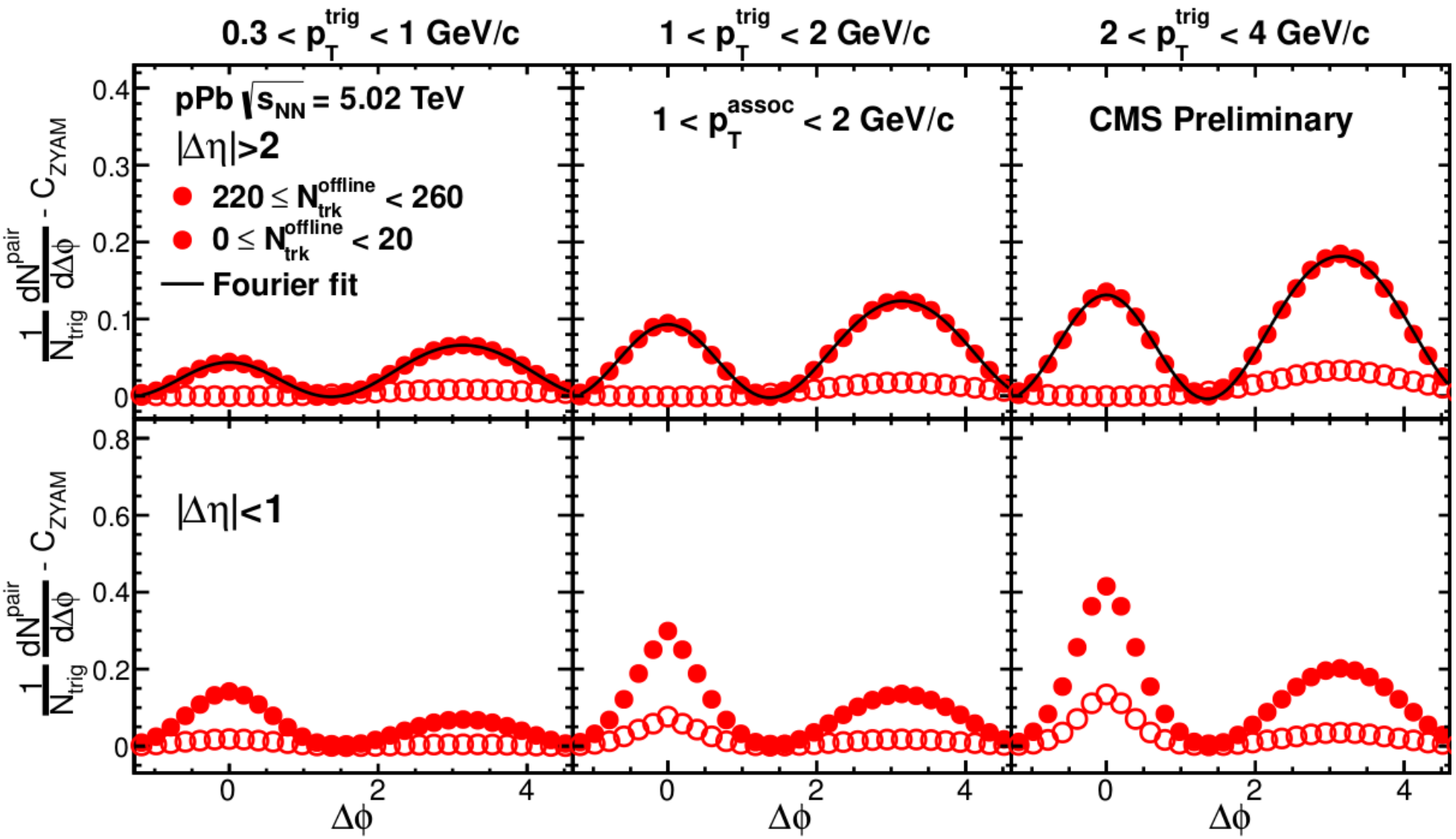
p-Pb



- Regions of interest
  - Near-side: short-range region ($|\Delta\eta| < 1$); the "jet"
  - Near-side: long-range region ($|\Delta\eta| > 2$); the "ridge"
  - Away-side

Let us look at the near-side; integrate over $\eta \Rightarrow$

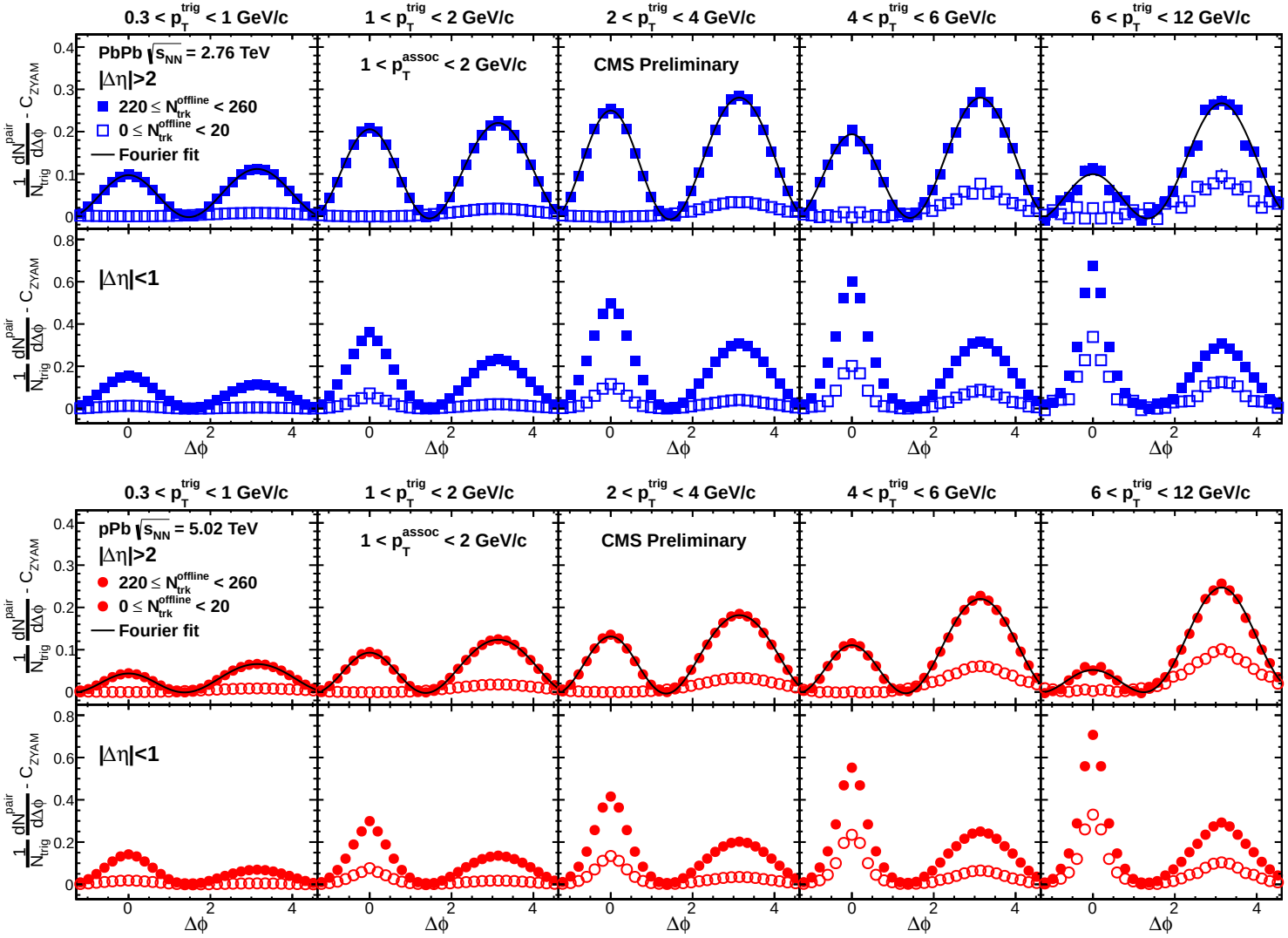
Two-particle correlations – 1D



Two-particle correlations – 1D

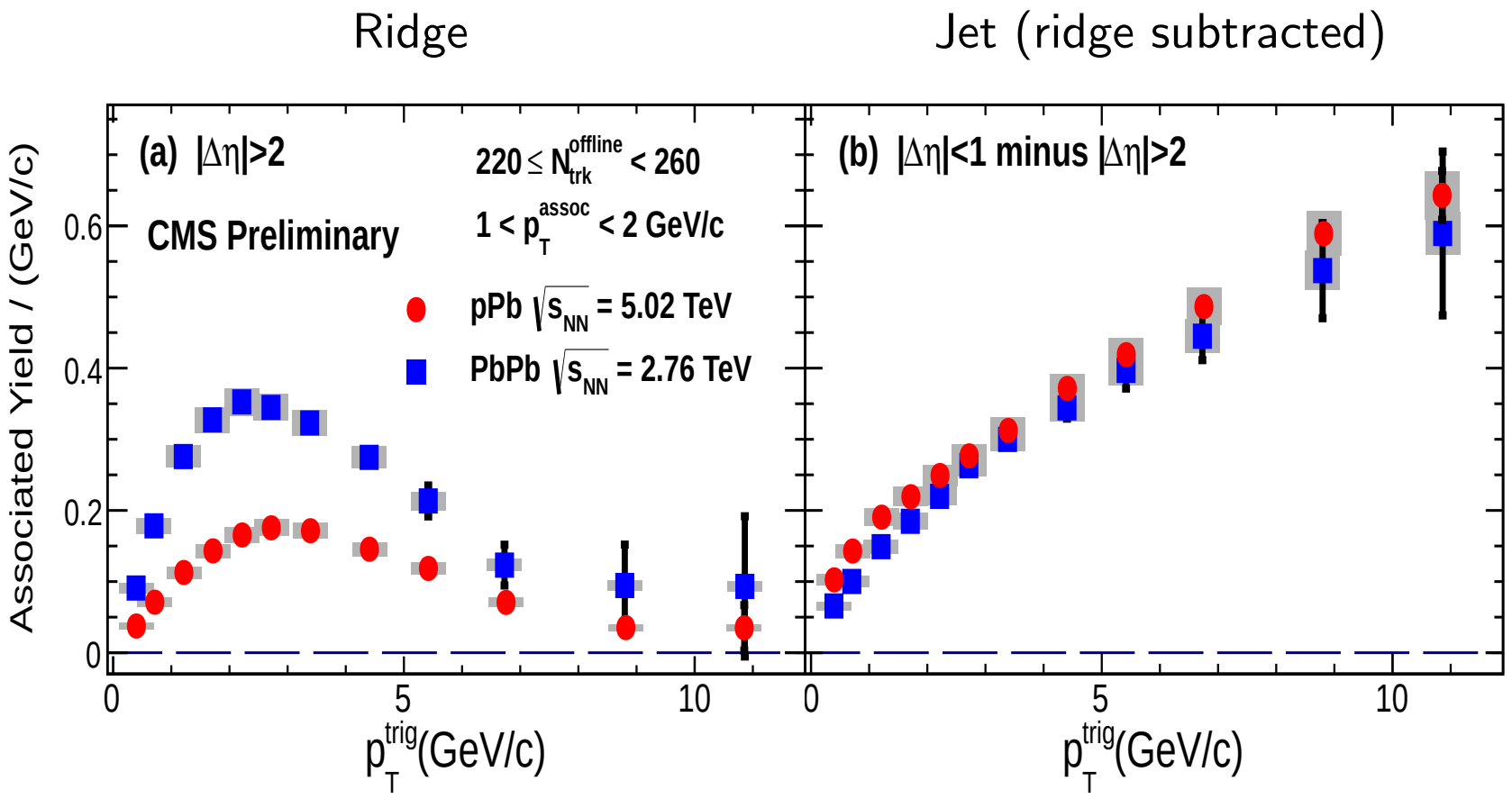
Pb-Pb

p-Pb



Five p_T^{trig} ranges, in the long-range and short-range regions
Top panels show Fourier fits including the first three terms

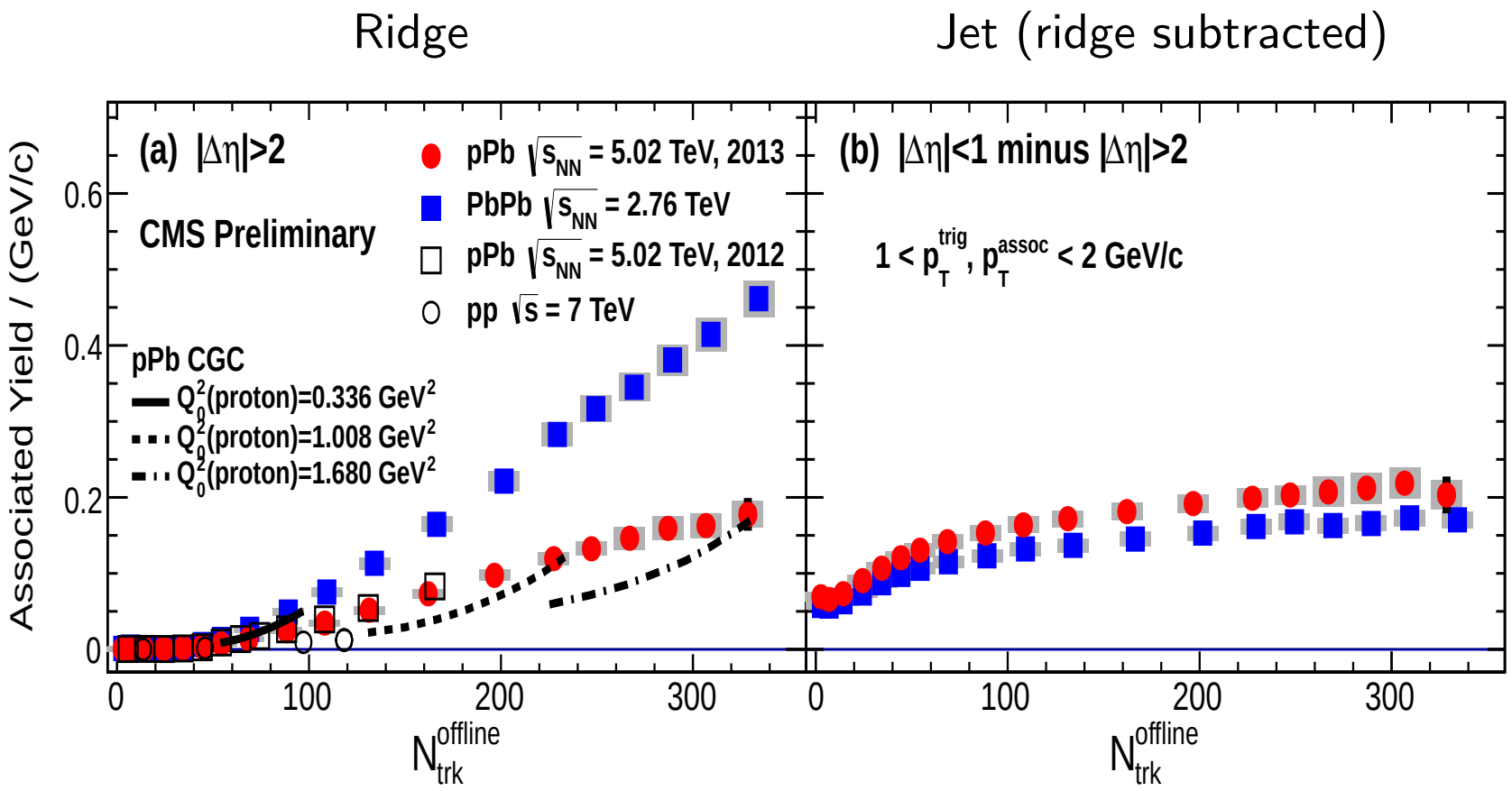
Two-particle correlations – associated yields vs p_T



Integrated over the region $|\Delta\phi| < 1.2$

Ridge yield increases, reach a maximum at 2-3 GeV/c, and falls with p_T
Jet yield increases steadily with p_T (more final state particles)

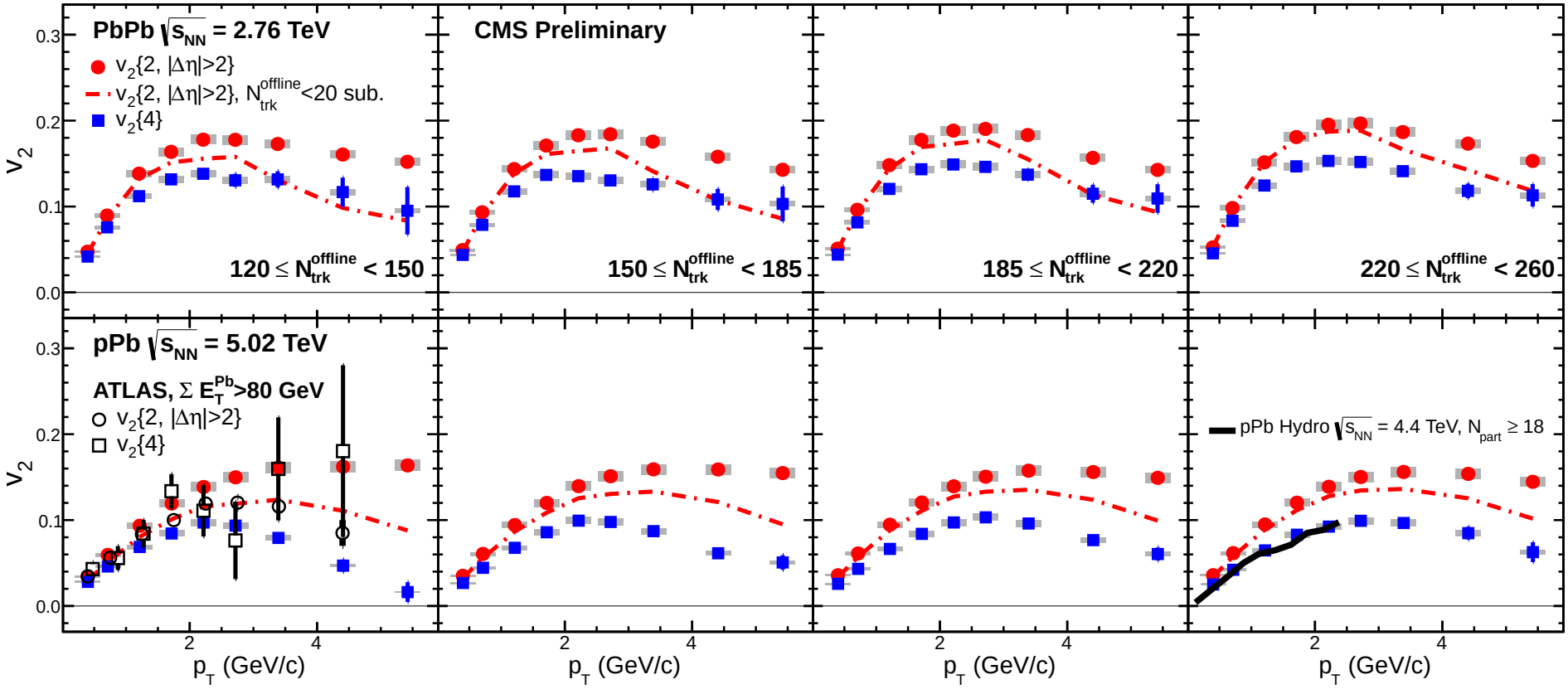
Two-particle correlations – associated yields vs multi



Associated yields for the near-side as a function of multiplicity $N^{\mathrm{trk}}_{\mathrm{offline}}$
Calculations from CGC theory are also shown with lines
(K. Dusling and R. Venugopalan, arXiv:1302.7018)

Ridge yield becomes significant at 40-50, followed by
a monotonic rise at least up to 350, for all(!) collision systems
Pb-Pb yields are factor two larger than in p-Pb, and factor eight larger than in p-p

Two-particle correlations – v_2 vs p_T

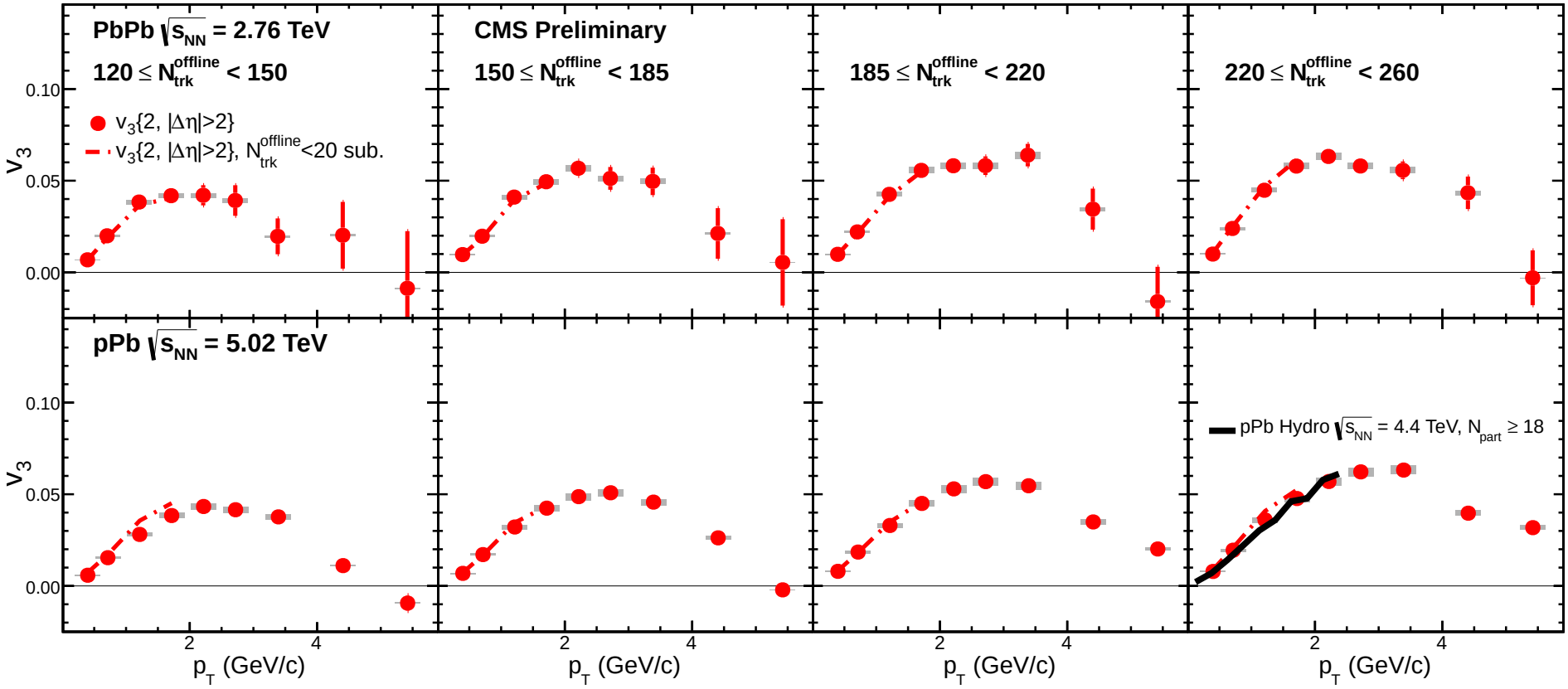


Fourier v_2 from two- and four-particle analysis for the p_T range of 0.3-3 GeV/c
Predictions from a hydrodynamic model are also shown with lines
(P. Bozek, Phys. Rev. C **85** (2012) 014911)

Open markers show the results from ALICE and ATLAS (2012 p-Pb data)

The magnitude of v_2 is larger in Pb-Pb than in p-Pb by about 30% for $p_T < 2$ GeV/c

Two-particle correlations – v_3 vs p_T



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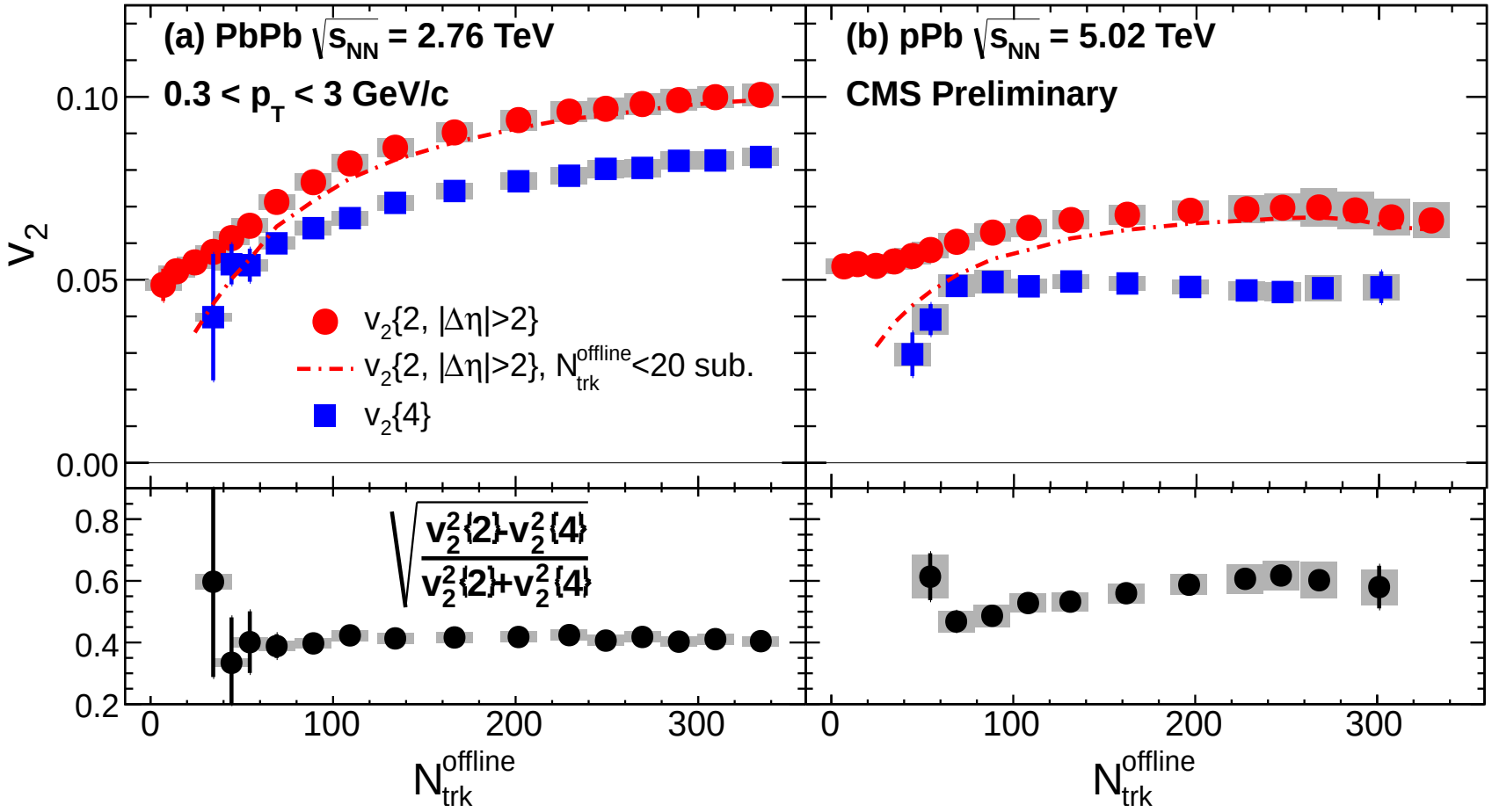
Similar p_T dependence for Pb-Pb and p-Pb

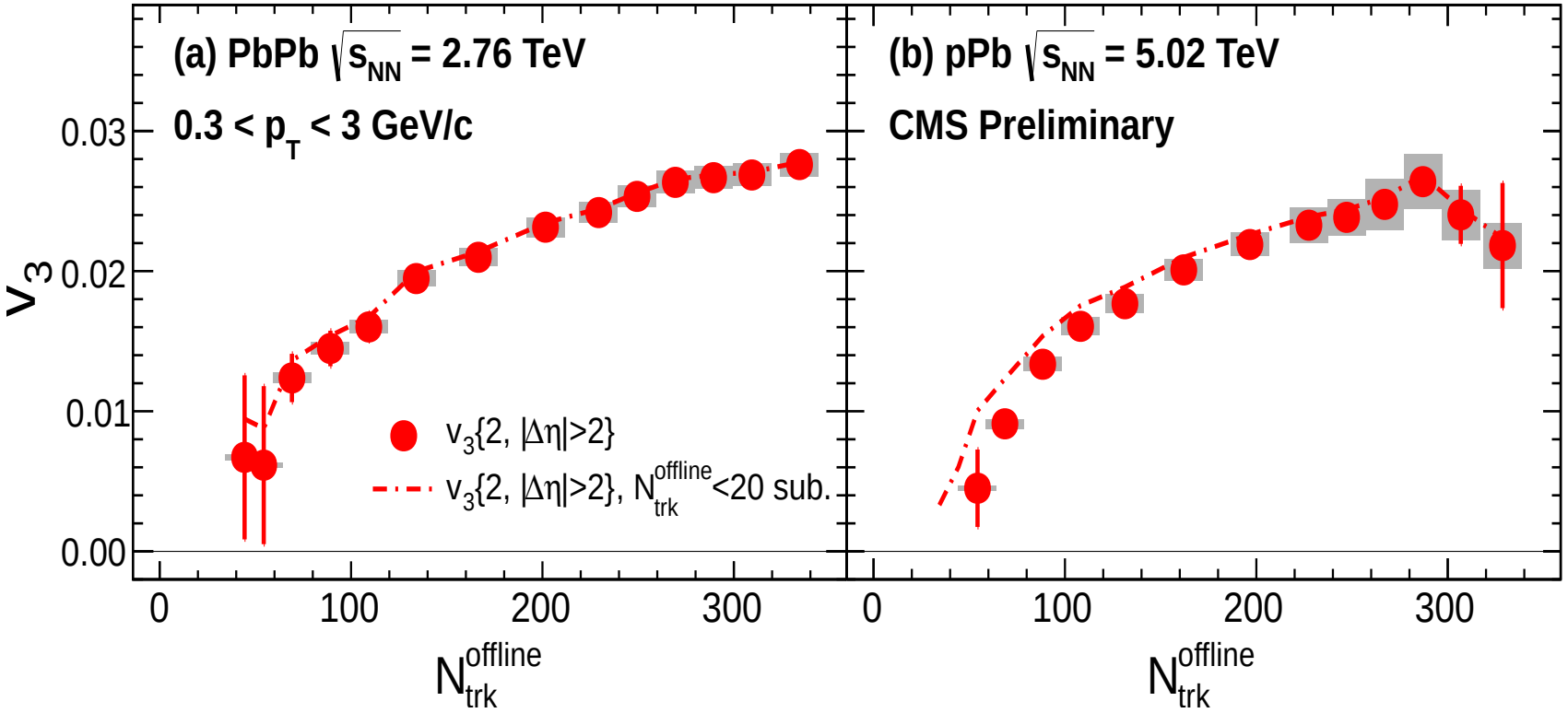
Two-particle correlations – v_2 vs multi



Moderate increase for Pb-Pb, but they remain relatively constant for p-Pb

Why? Elliptic flow v_2 is sensitive to the initial-state collision geometry, which is very different for the p-Pb and Pb-Pb systems

Two-particle correlations – v_3 vs multi



The magnitude of v_3 is similar for both systems

Why? Triangular flow v_3 component is largely determined by the offline event-by-event geometry fluctuations

Summary – correlations

Near-side long-range ($|\Delta\eta| > 2$) and short-range ($|\Delta\eta| < 1$) correlations;
Fourier harmonics, p-Pb vs Pb-Pb vs p-p

- Findings
  - New results are consistent with previous measurements, and in addition **extend the studied multiplicity range** by more than factor two
  - The integrated near-side ridge **yield continues to increase** with particle multiplicity for p-Pb
  - The v_2 and v_3 values are found to follow a **similar p_T dependence** as found for the ridge yield, with peak values in the p_T range of 2-3 GeV/c
  - Quite **similar to low-multiplicity Pb-Pb**, except v_2 at higher p_T
  - Significant **constraints on theoretical interpretations** (hydrodynamics and color glass condensate models

Thank you for your attention!