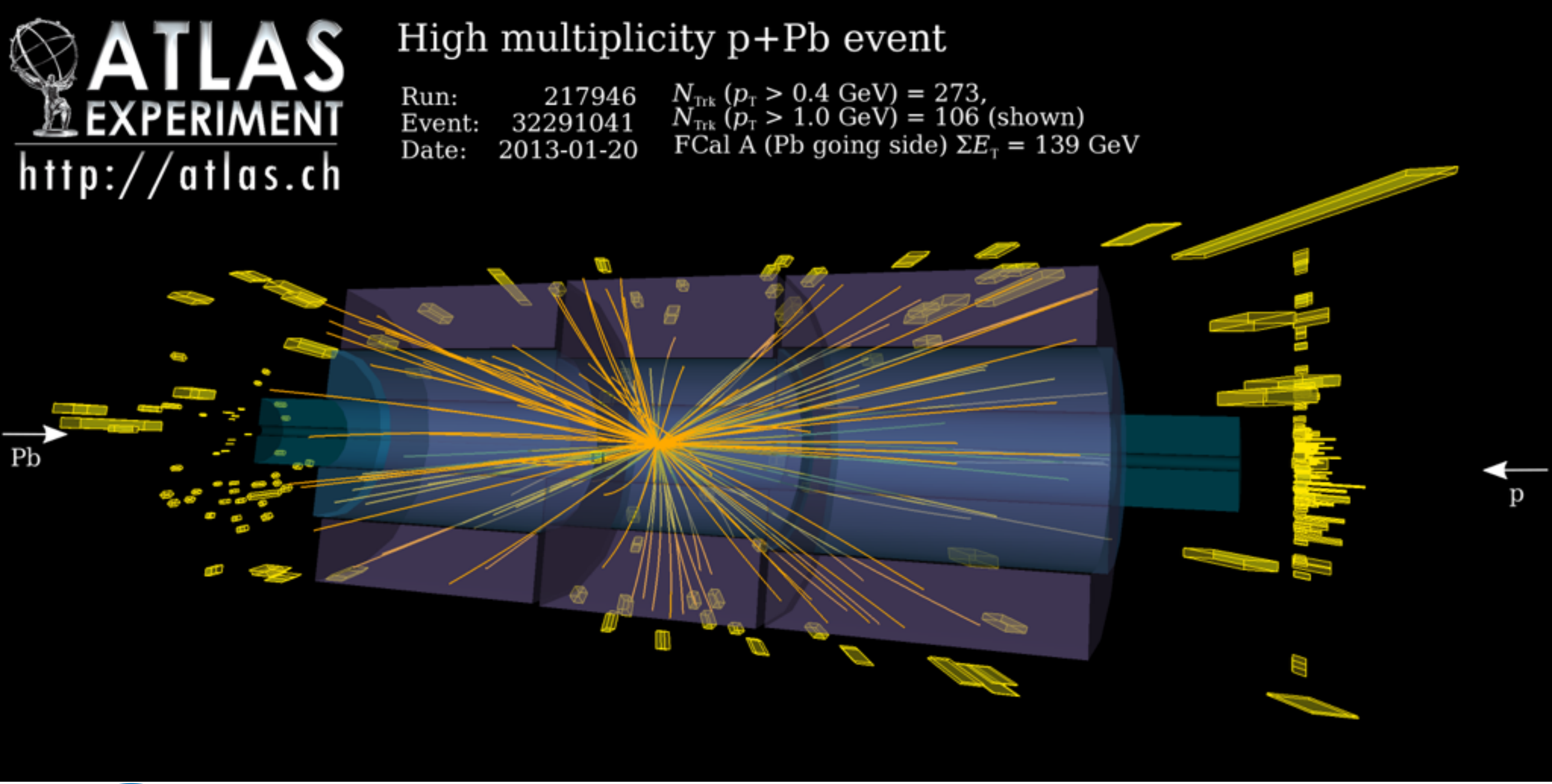
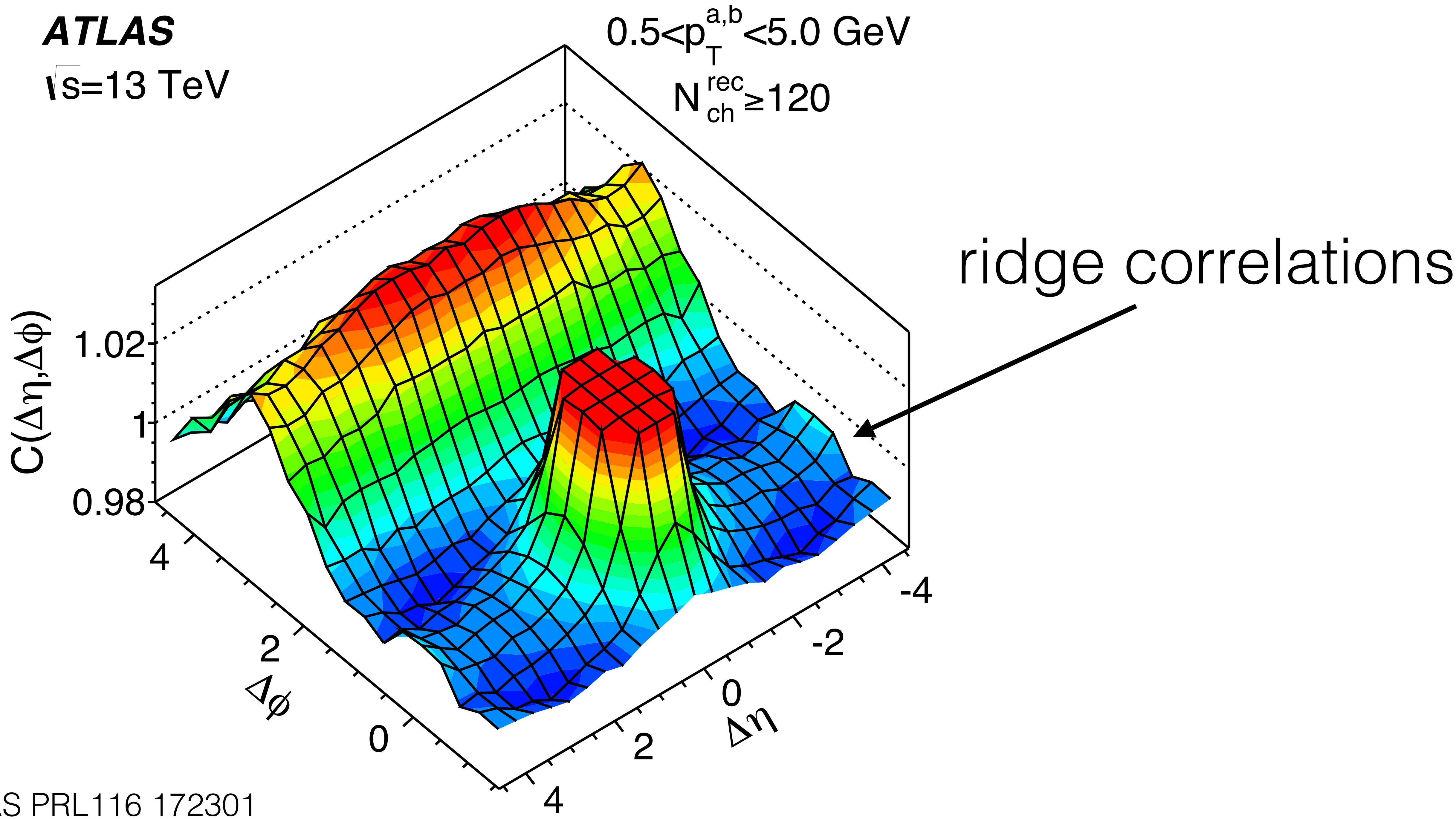


Measurement of the ridge correlations in pp and pPb collisions with the ATLAS detector at the LHC

Anne M. Sickles
for the ATLAS Collaboration

ridge correlations in pPb & pp



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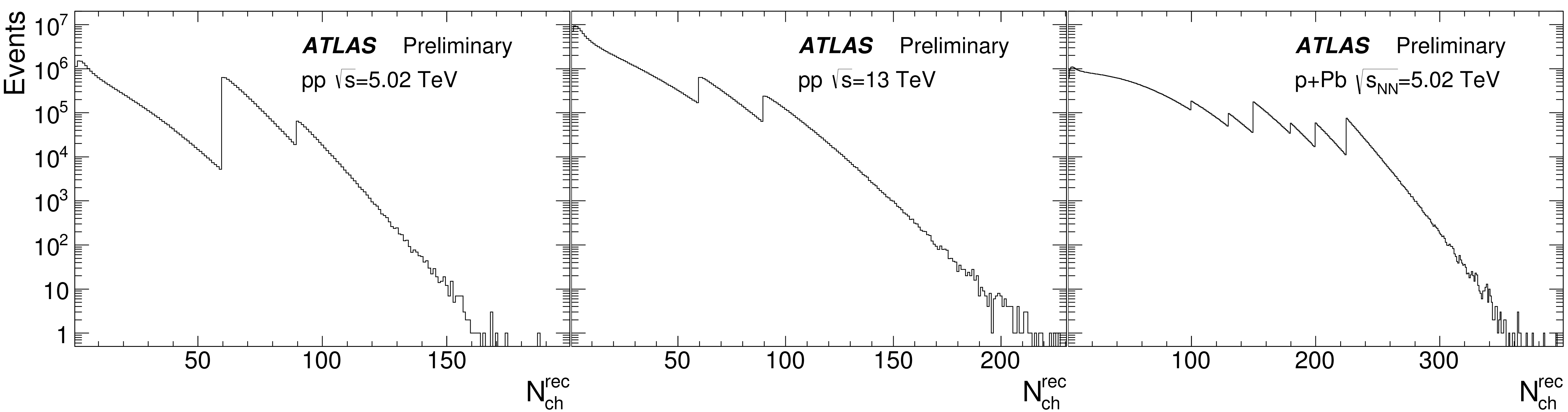
what are the properties of the ridge?
how do those depend on collision energy and system?
what is the multiplicity dependence of the ridge?

datasets

- **pp**: 2.76 TeV, 5.02 TeV, 13 TeV
- **pPb**: 5.02 TeV
- high multiplicity triggers provide large sample of these rare events



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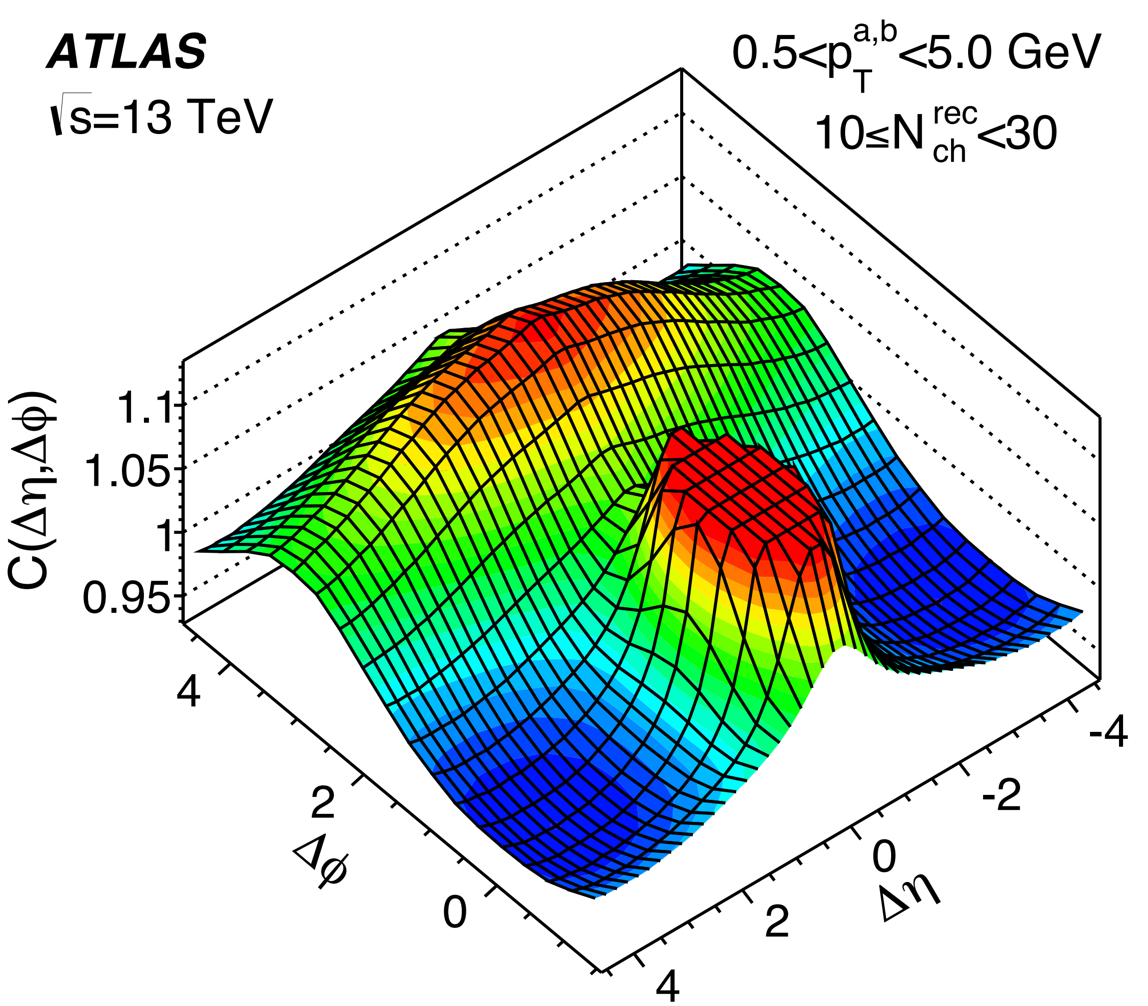
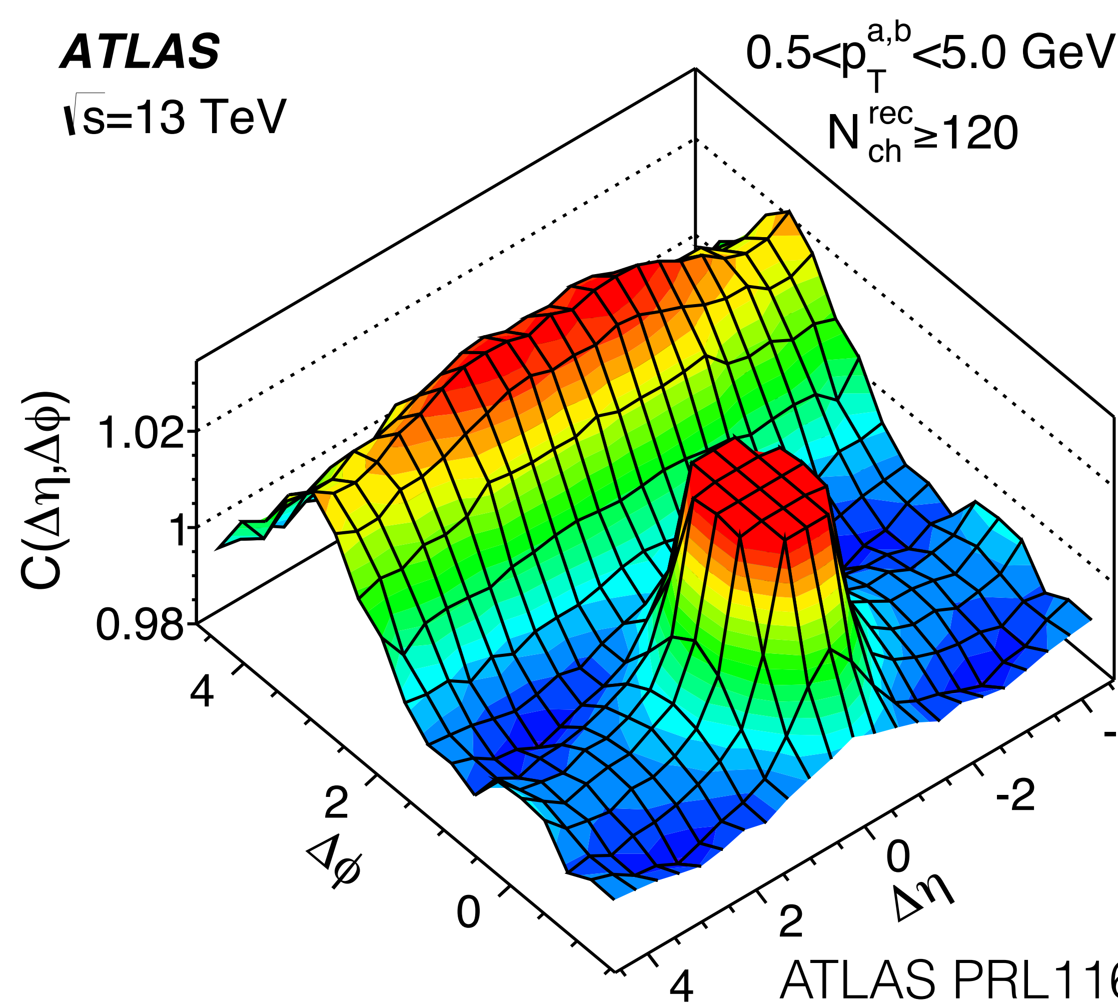
how to extract the ridge signal

- ridge is a small effect compared to other features of the two particle correlations
- observed to grow with track multiplicity
  - →use template fitting to extract the correlated signal

low multiplicity



high multiplicity



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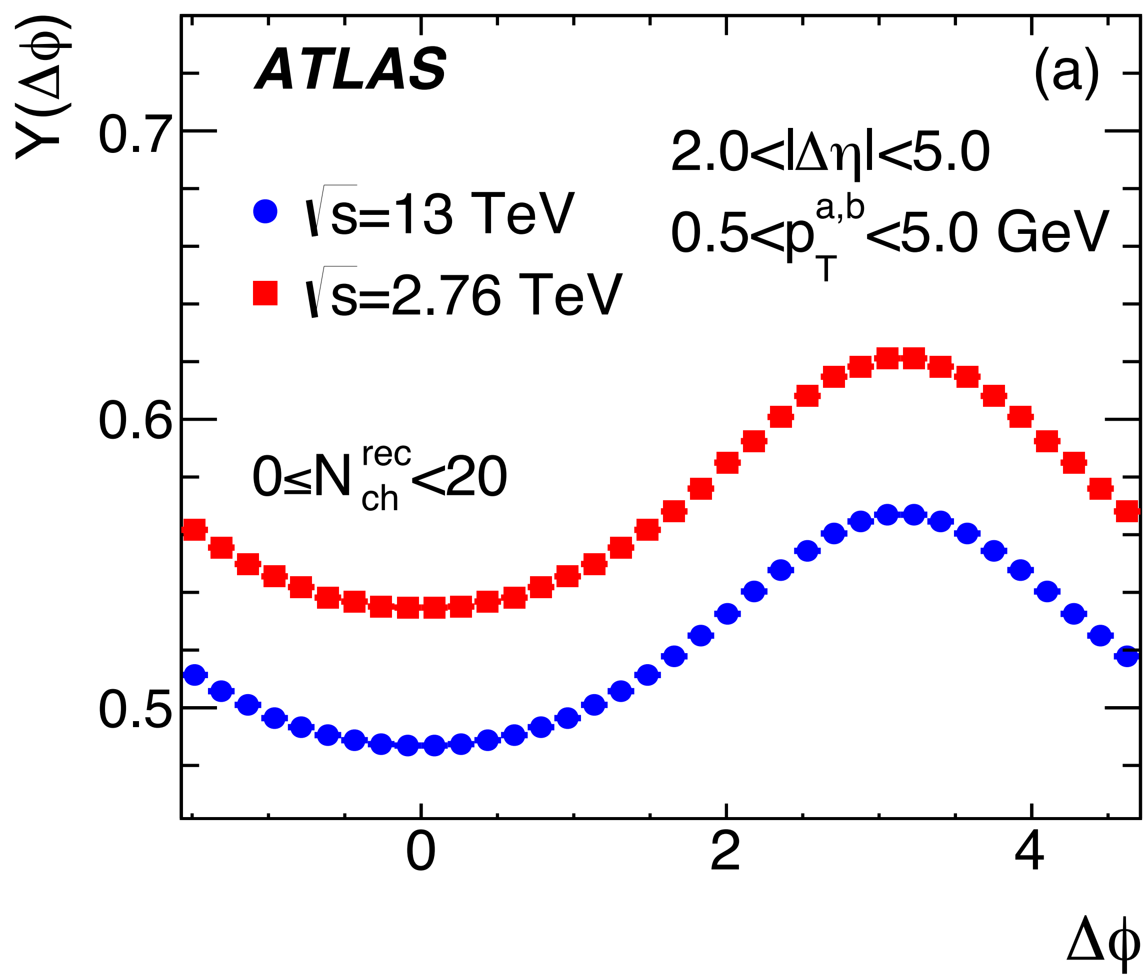
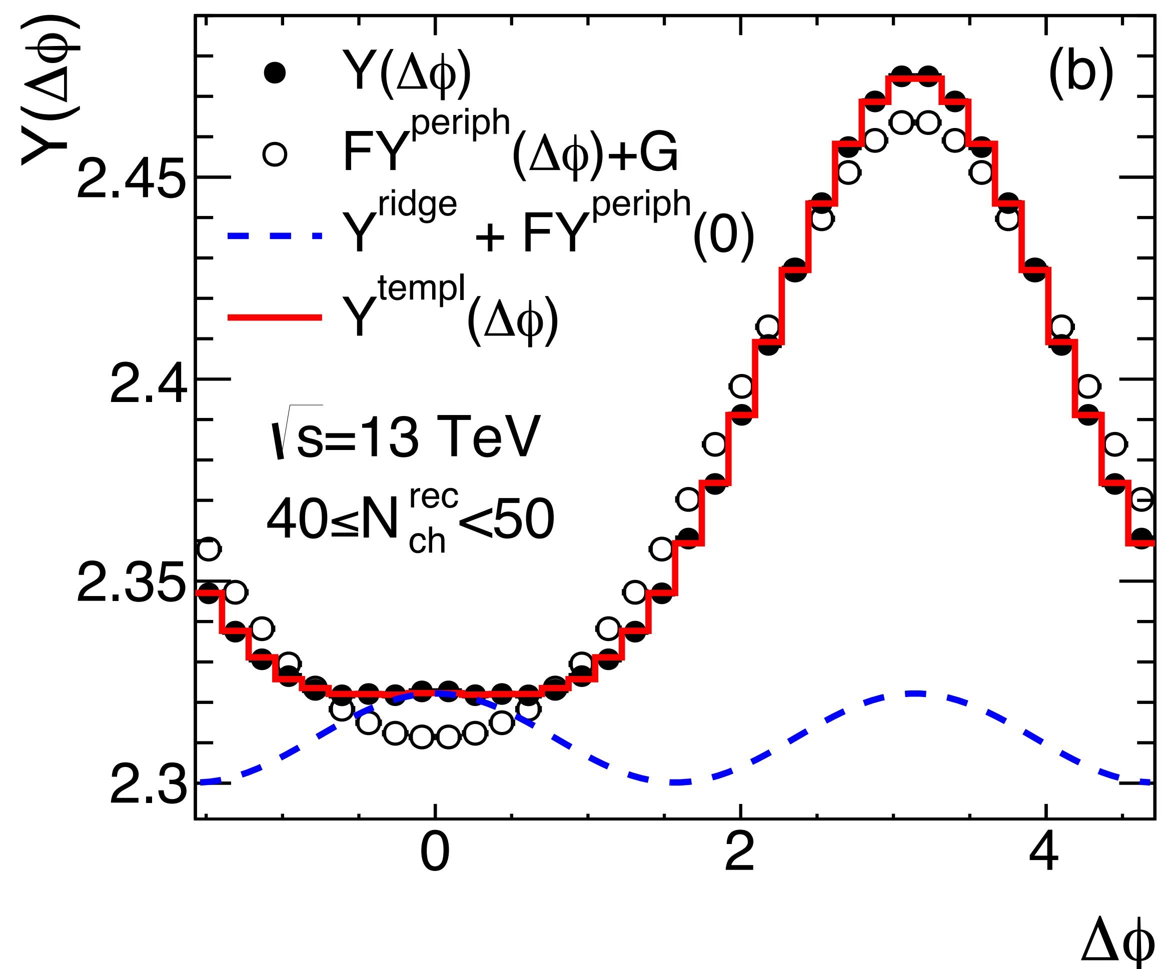
fitting procedure

$Y^{periph}(\Delta\Phi)$, $N_{ch}^{rec} < 20$

$40 < N_{ch}^{rec} < 50$





$$Y^{\mathrm{templ}}(\Delta\phi) = F\,Y^{\mathrm{periph}}(\Delta\phi) + Y^{\mathrm{ridge}}(\Delta\phi)\,,$$

fit free parameters:
F & $v_{2,2}$

$$Y^{\mathrm{ridge}}(\Delta\phi) = G\,(1 + 2v_{2,2}\cos(2\Delta\phi))\;,$$

G fixed such that:

$$\int_0^\pi d\Delta\phi\; Y^{\mathrm{templ}} = \int_0^\pi d\Delta\phi\; Y$$

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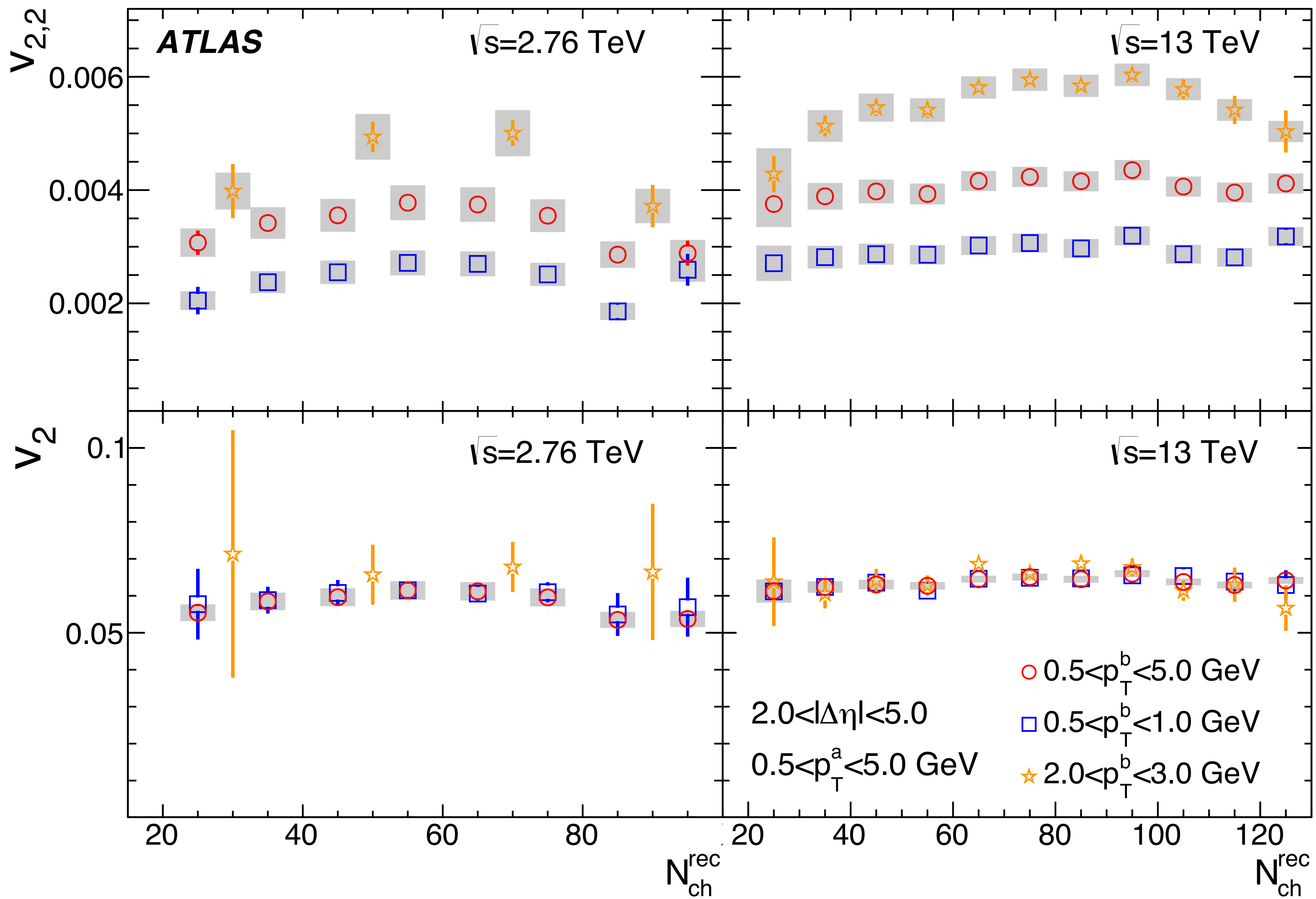
extracted v2,2

$$v_2(p_{T1}) = v_{2,2}(p_{T1}, p_{T2}) / \sqrt{v_{2,2}(p_{T2}, p_{T2})},$$

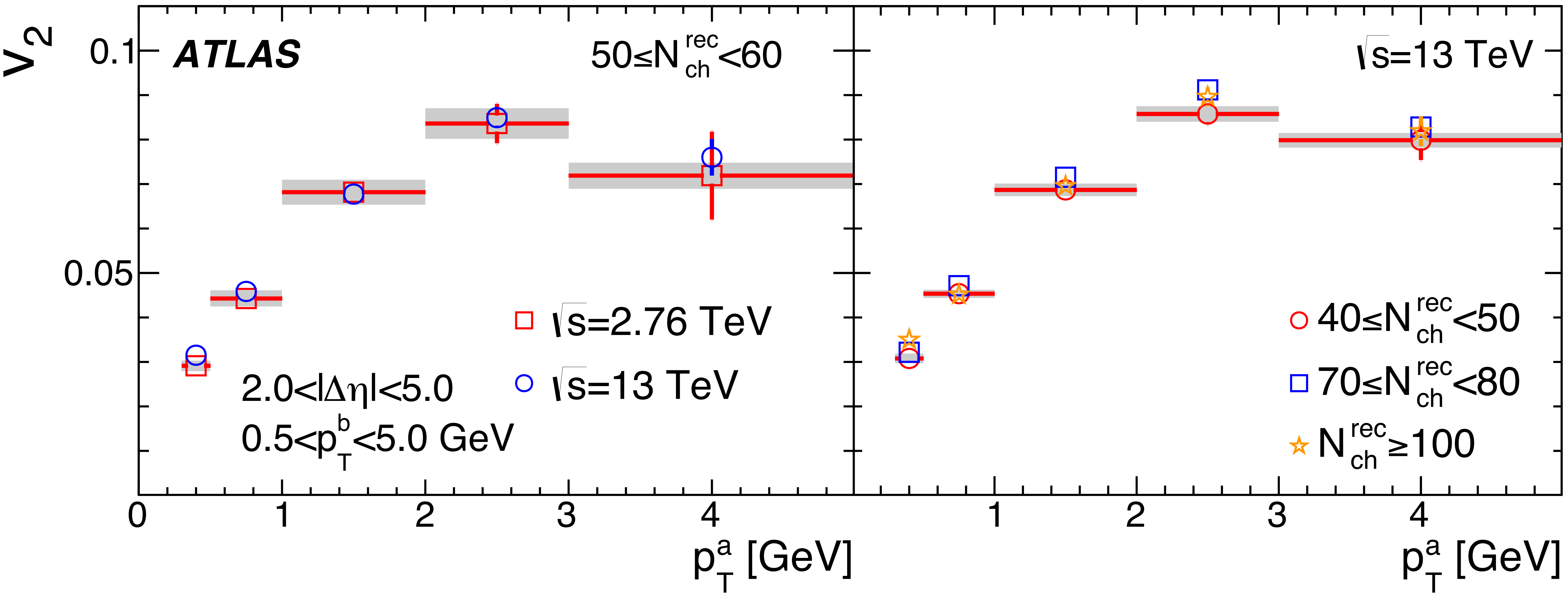
$v_{2,2}$

v_2



extracted v_2 independent of $p_{T,2}$ range: **factorization**

v_2 in pp at 2.76 & 13 TeV

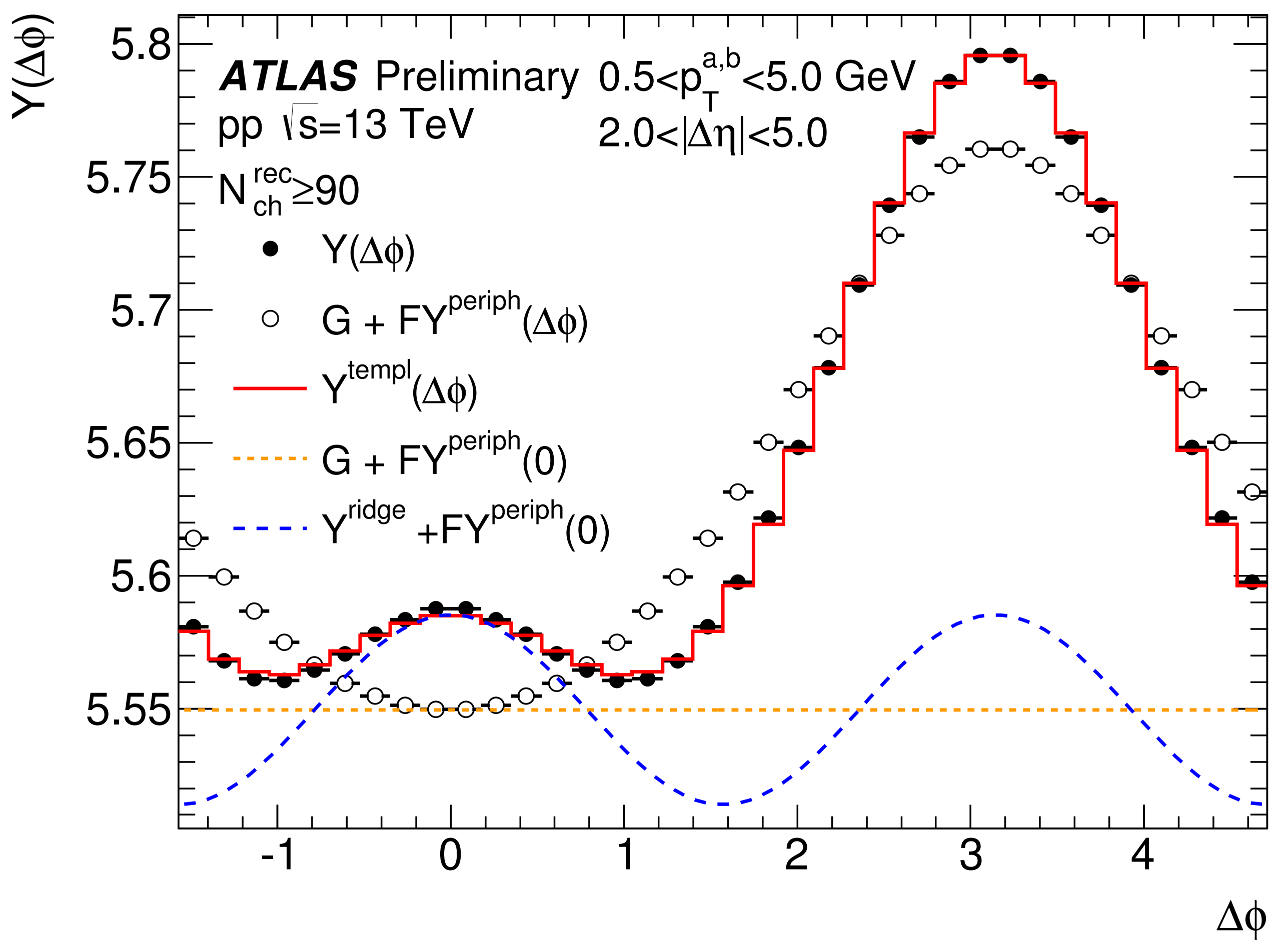


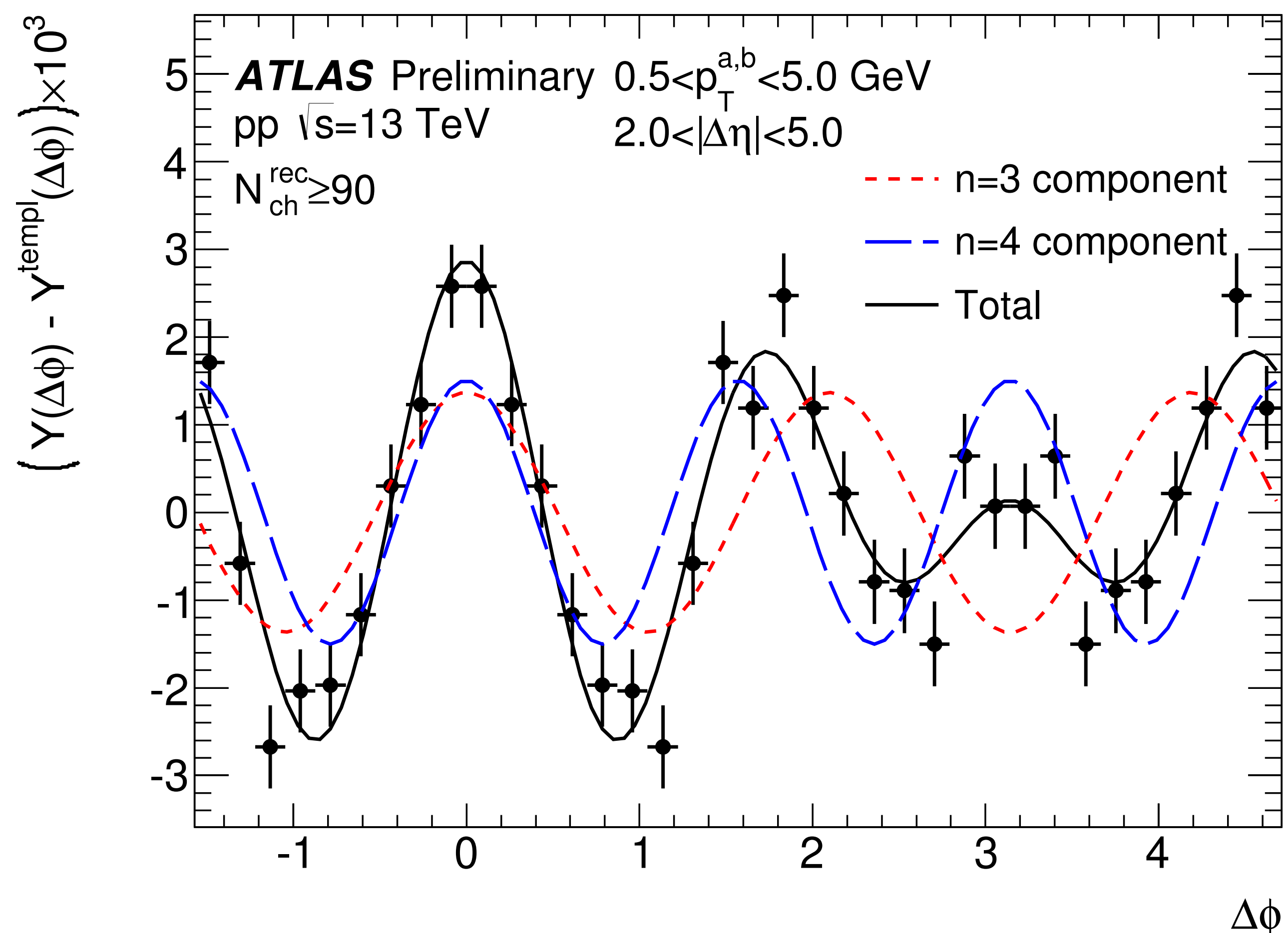
v_2 independent of $\sqrt{s}$ & track multiplicity

n > 2 Fourier coefficients

$Y(\Delta\phi)$

$\left(Y(\Delta\phi) - Y^{templ}(\Delta\phi)\right)\times 10^3$





residual deviations from template consistent with **cos(3ΔΦ)** & **cos(4ΔΦ)** components

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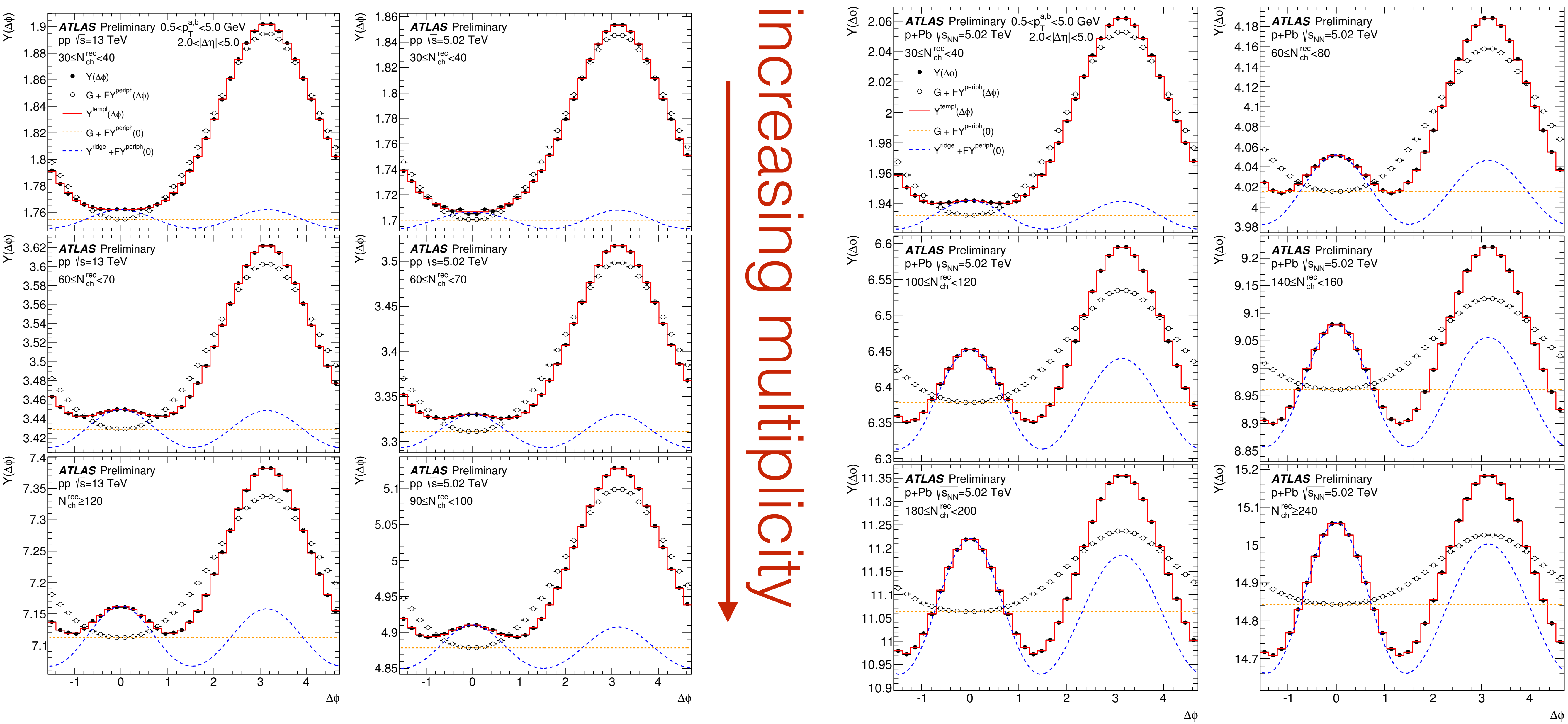
5.02 TeV: pp & pPb collisions

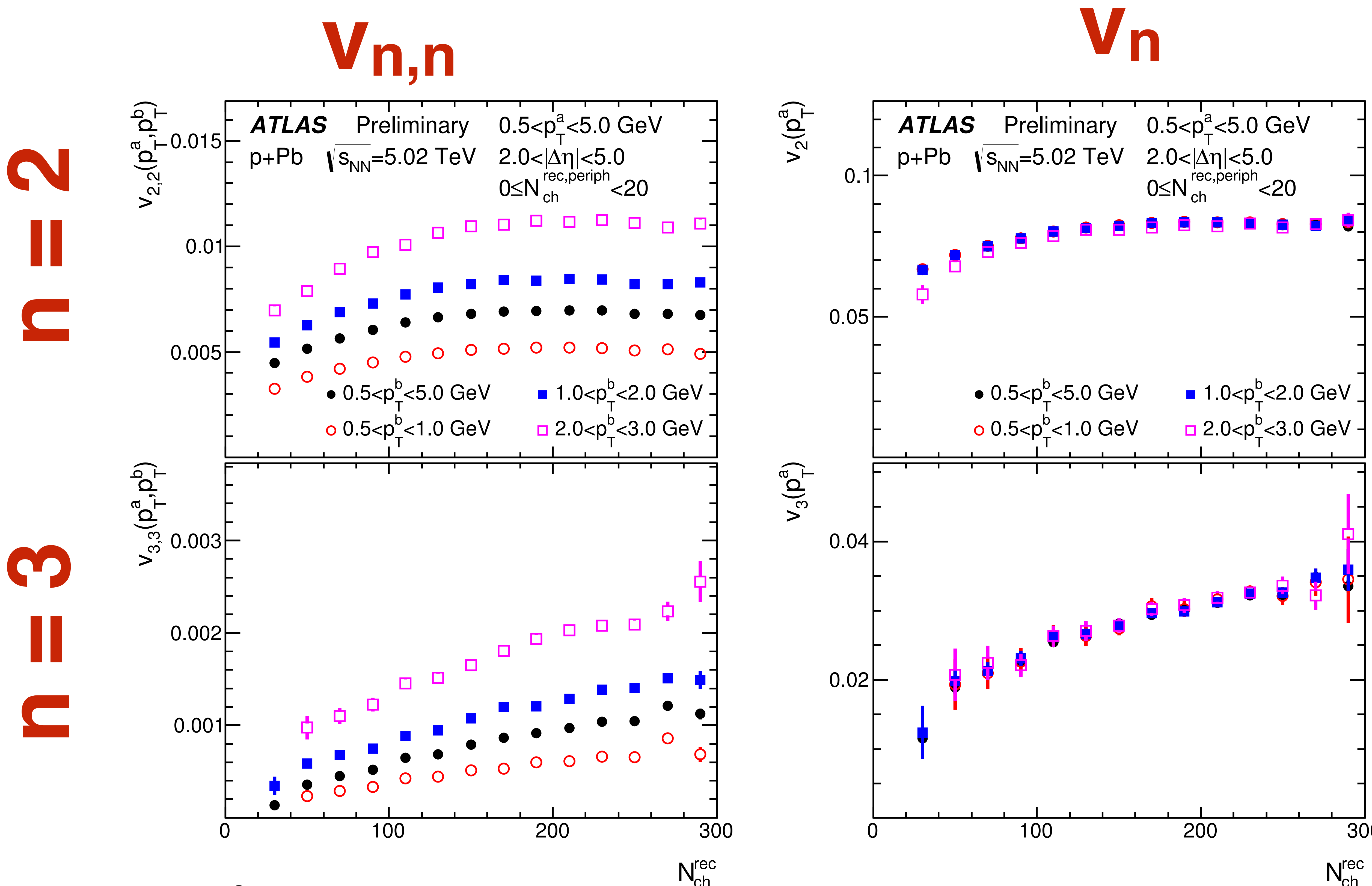
pp 13 TeV | pp 5.02 TeV | pPb 5.02 TeV



similar features in all collision systems

template fits enable v_2 extraction

pPb: n = 2, 3 modulations



factorization observed in pPb as well!

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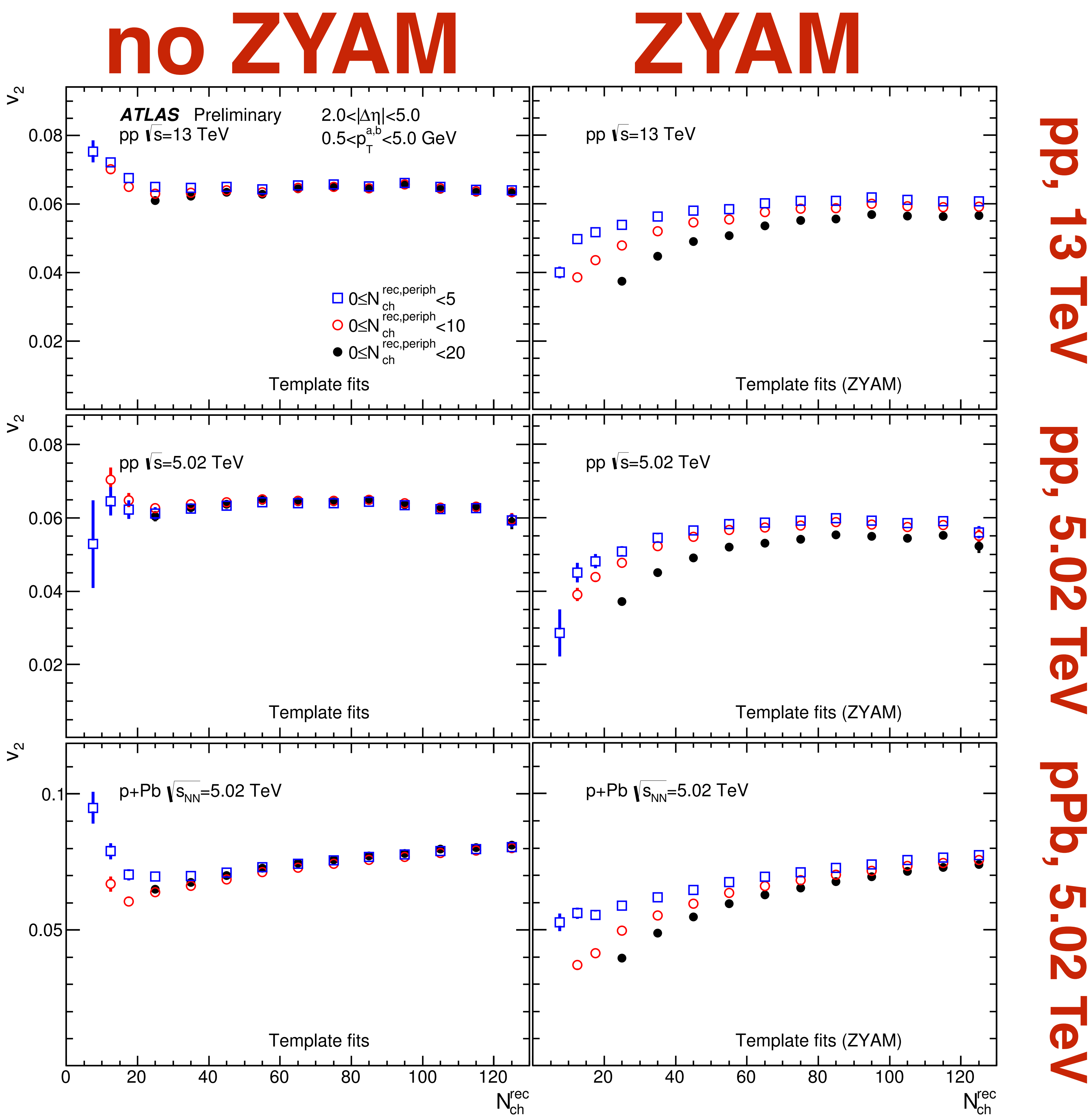
template fits with and without ZYAM



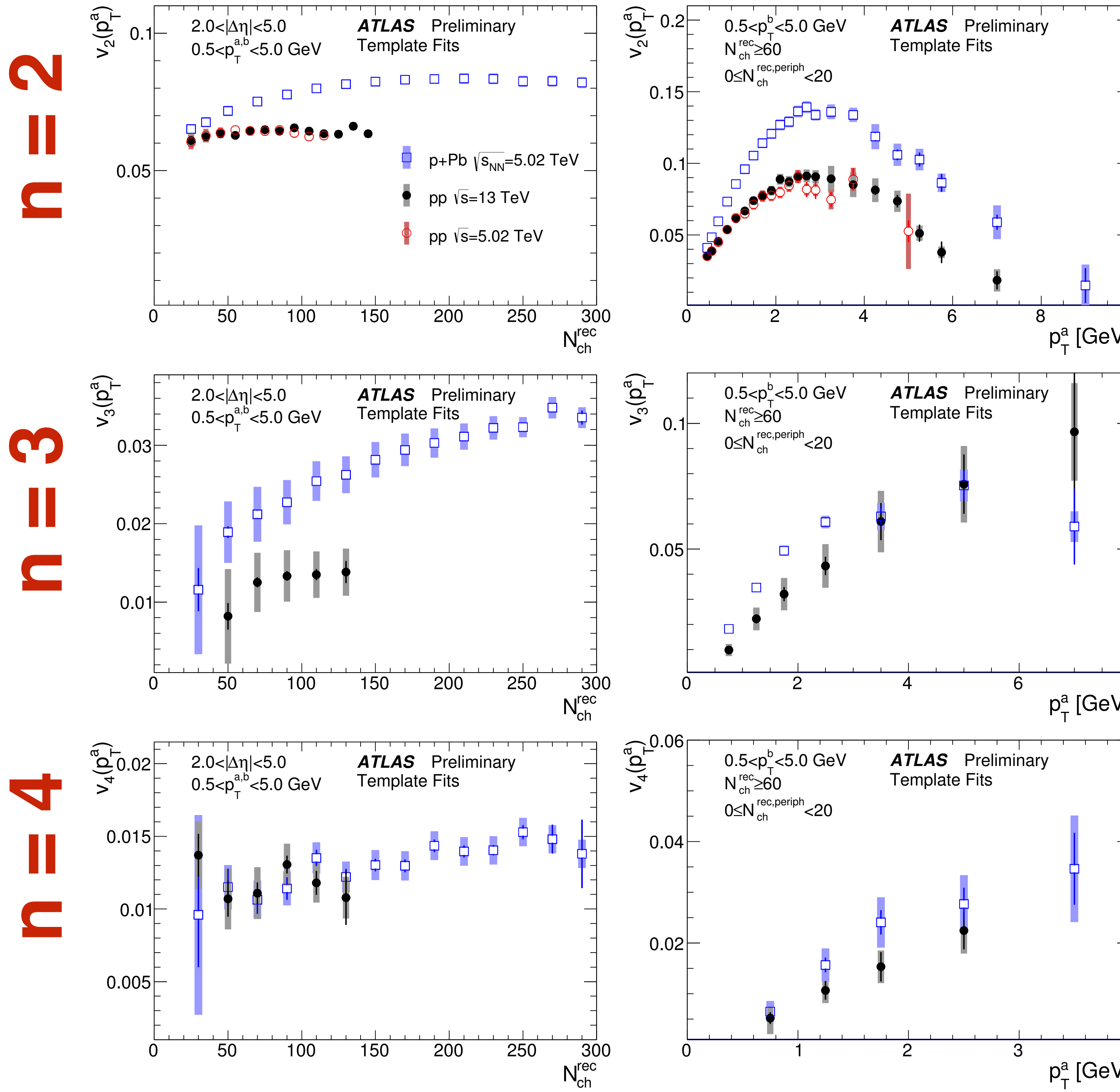
modified template fitting method reduces low N_{ch} dependence of v_2 on choice of peripheral bin

pPb & pp comparison

pPb: larger v_2 & v_3 than pp

pp: consistent v_2 between **5.02** & **13** TeV

v_n vs N_{ch} — v_n vs p_T



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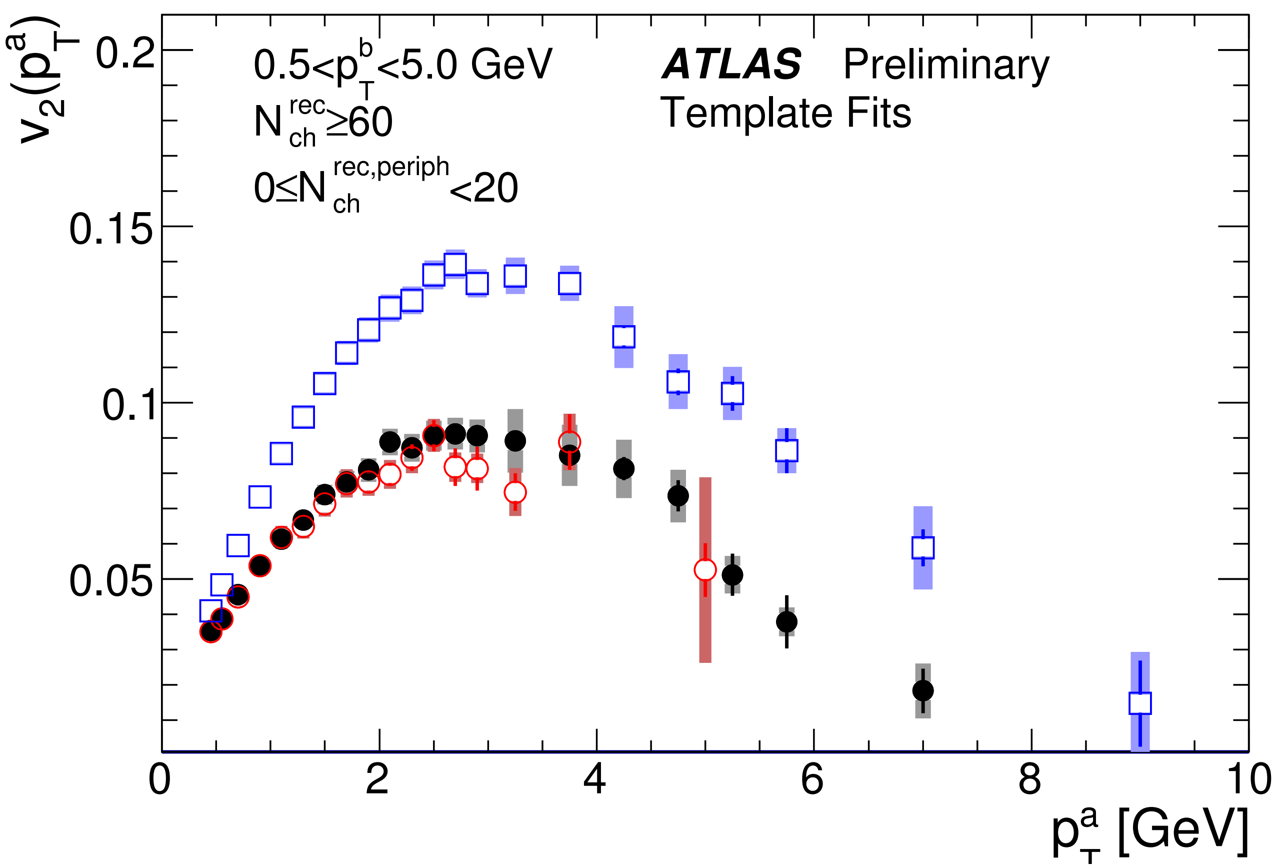
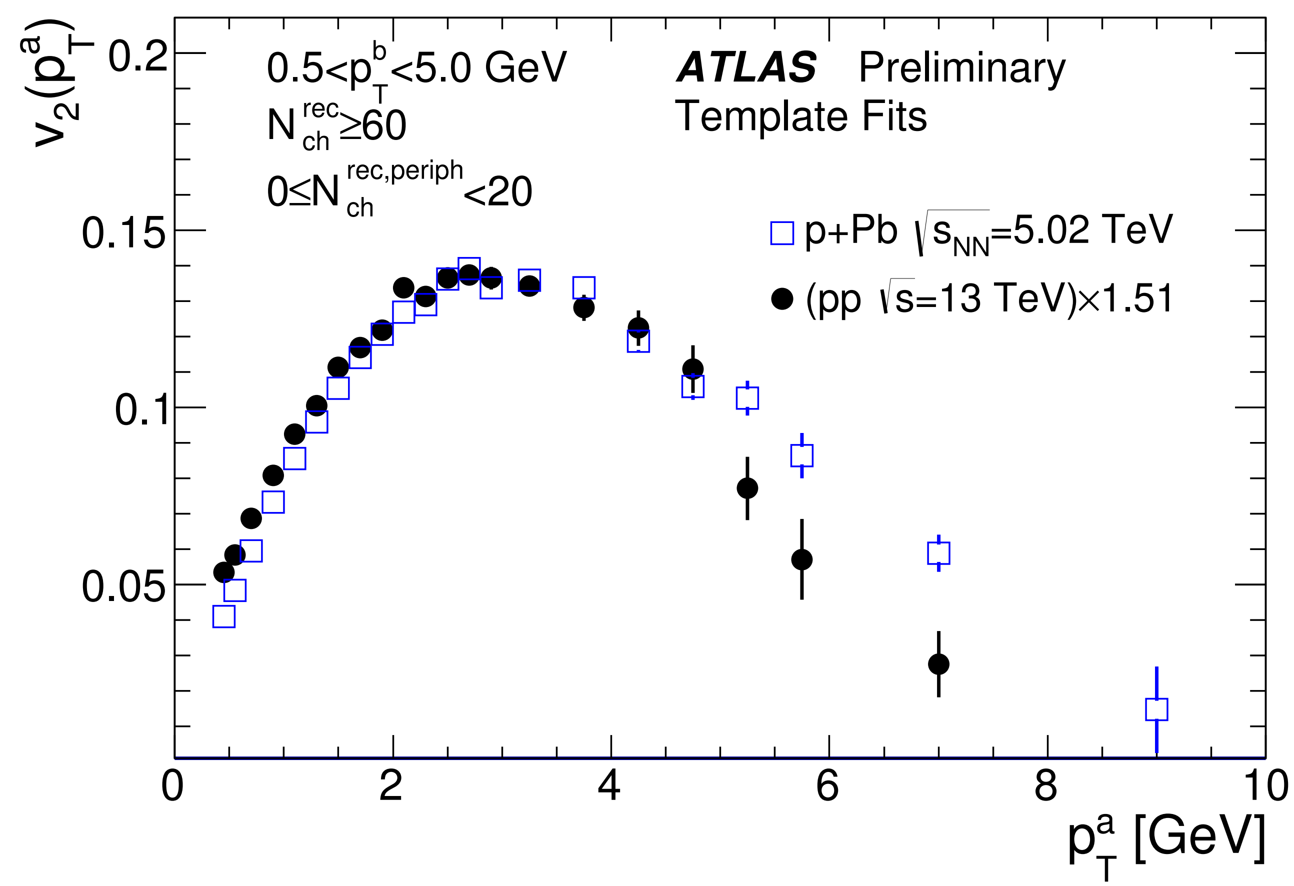
p_T dependence of v_2 in pp & pPb

pp scaled by 1.51





similar (but not identical) shapes between pp & pPb

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summary

- template fitting method provides a robust method to extract v_N in very small systems
  - independent of identifying a signal free peripheral sample
- pp collisions: no collision energy dependence observed in 2.76, 5.02 & 13 TeV
- pp v_N independent of multiplicity
- pPb: increase in v_2, v_3 & v_4 with multiplicity
- similar shapes, but not magnitudes of $v_2(p_T)$ in pp & pPb collisions
- these measurements provide a wealth of data to understand anisotropies in small systems
- **looking forward to 8 TeV pPb data this year!**