Measurements of long-range azimuthal anisotropies in pp collisions at $\sqrt{s}$=5.02 and 13 TeV and p+Pb collisions at $\sqrt{s_{NN}}$=5.02 TeV with the ATLAS detector

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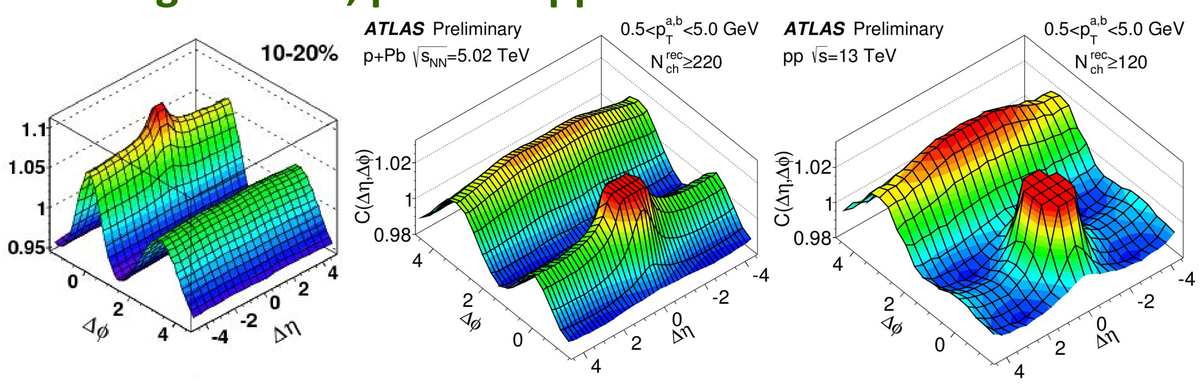
Motivation

➤ **Ridge in A+A, p+A and pp collisions**



Long range correlation persists with decreasing system size

➤ **Is origin of all three ridges similar?**

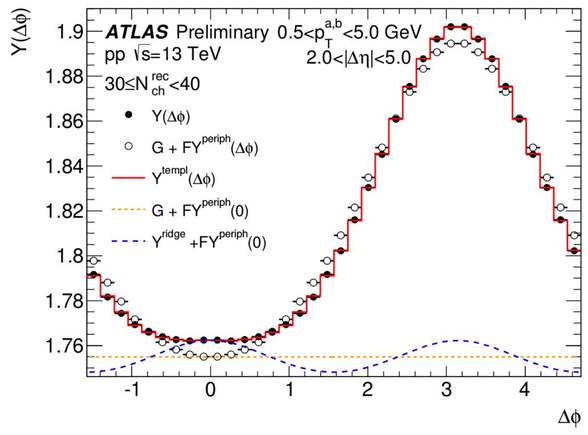
➤ **Does pp arise from single particle azimuthal anisotropy?**

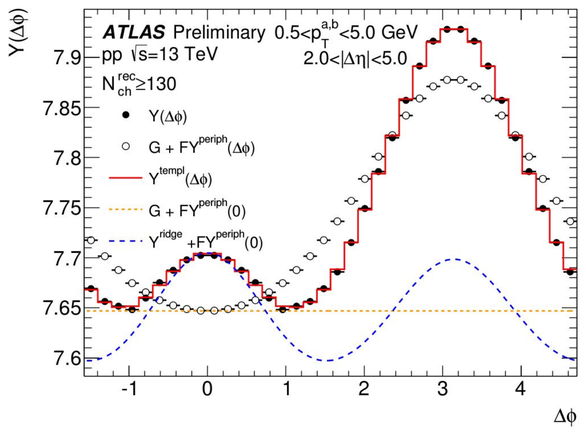
Phys. Rev. C 86 (2012) 014907, Phys. Rev. Lett. 110 (2013) 182302,
Phys. Rev. Lett. 116 (2016) 172301

Method

➤ **New template fitting method to extract long range corr.**

$$Y^{\mathrm{templ}}(\Delta\phi) = F\,Y^{\mathrm{periph}}(\Delta\phi) + Y^{\mathrm{ridge}}(\Delta\phi), \quad Y^{\mathrm{ridge}}(\Delta\phi) = G\left(1 + \sum_{n=2}^{\infty} 2v_{n,n}\cos(n\Delta\phi)\right)$$





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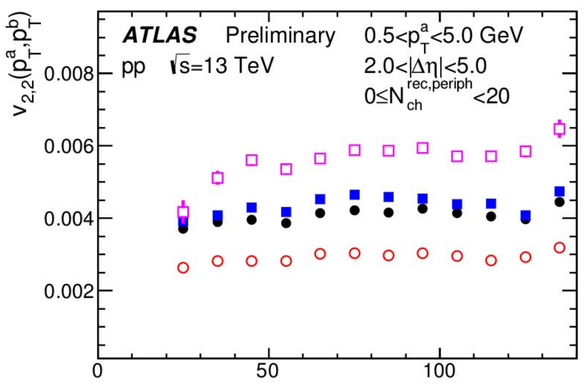
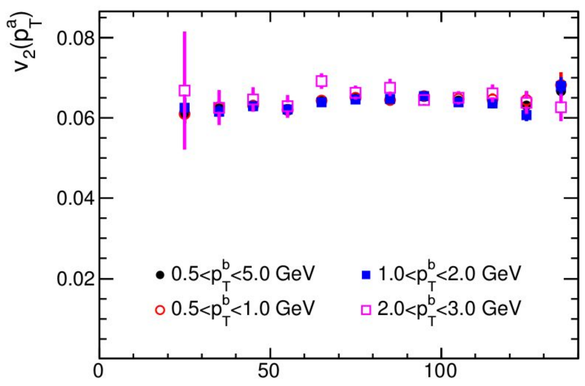
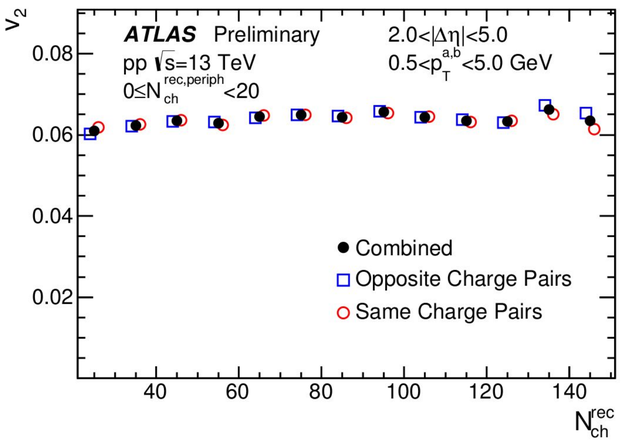
➤ **Significant long-range correlations present in low multiplicity events.**

➤ **At high multiplicity, yields much larger than what ZYAM based methods estimate.**





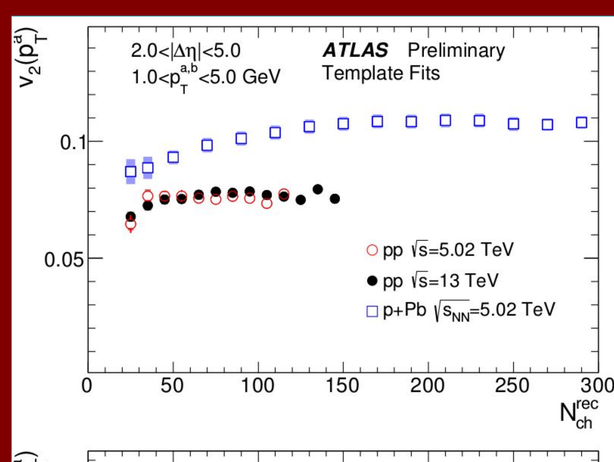
➤ **At low p_T, the $v_{n,n}$ from the template fits factorize into single particle anisotropies v_n.**

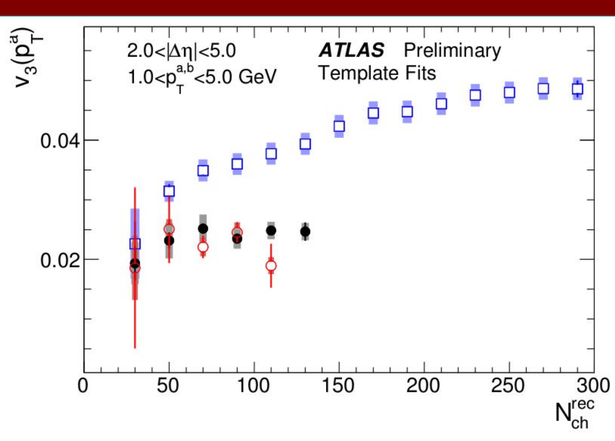


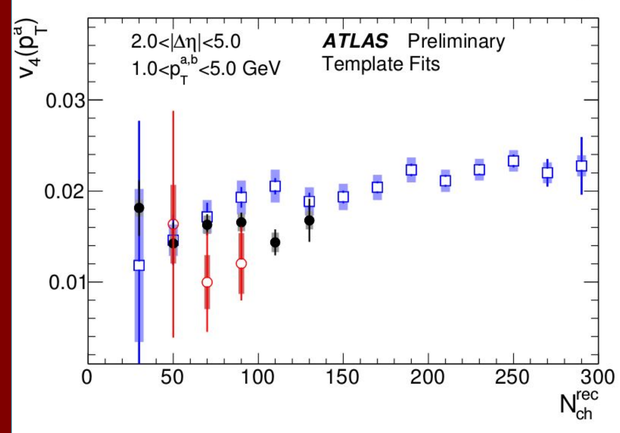
Long-range correlation identical for same and opposite-charge pairs.

Unlikely to be originating from few-particle correlations.

Measurements





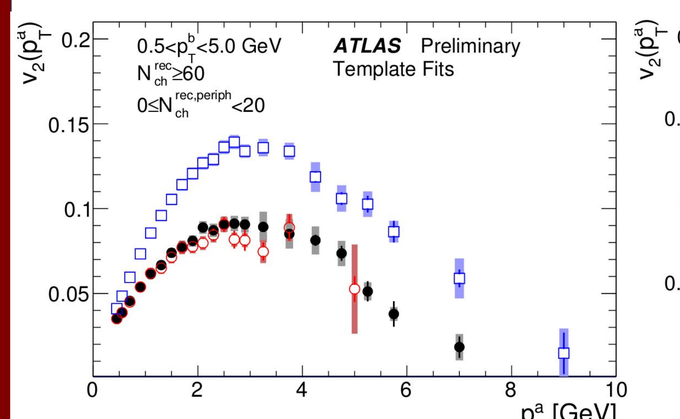


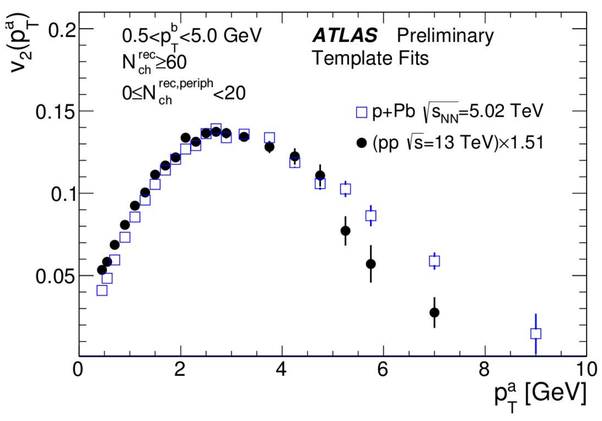
In previous publication have shown no change in v_2 between 2.76 TeV and 13 TeV pp collisions as well.

➤ **No dependence of pp v_n on multiplicity**

➤ **No dependence on collision energy as well**

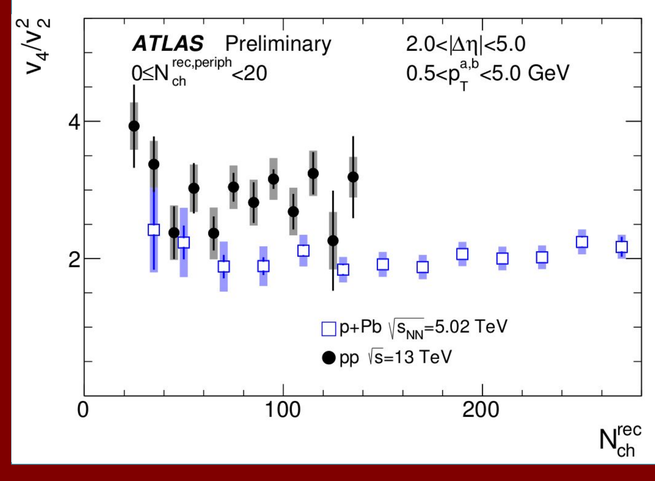
➤ **p+Pb v_n also exhibit only weak multiplicity dependence**





➤ **p_T dependence of v_n also identical between 5.02TeV and 13 TeV pp collisions**

➤ **Shape of $v_2(p_T)$ quite similar between pp and p+Pb**



Observe v_4/v_2^2 scaling in both pp and p+Pb collisions.

Such scaling is expected from hydrodynamic models in A+A collisions.

Conclusion

- **Long-range correlation in pp and p+A collisions arises from single-particle anisotropies v_n.**
- **Long range correlation is present at all multiplicities, i.e. ridge is not a rare phenomenon.**
- **v_n are independent of collision energy in pp collisions**
- **p_T dependence of pp and p+Pb v_n are quite similar**
- **Ridges in A+A, p+A and pp collisions might have common origin**