Long-range correlations in pp collisions at $\sqrt{s} = 13.6$ TeV

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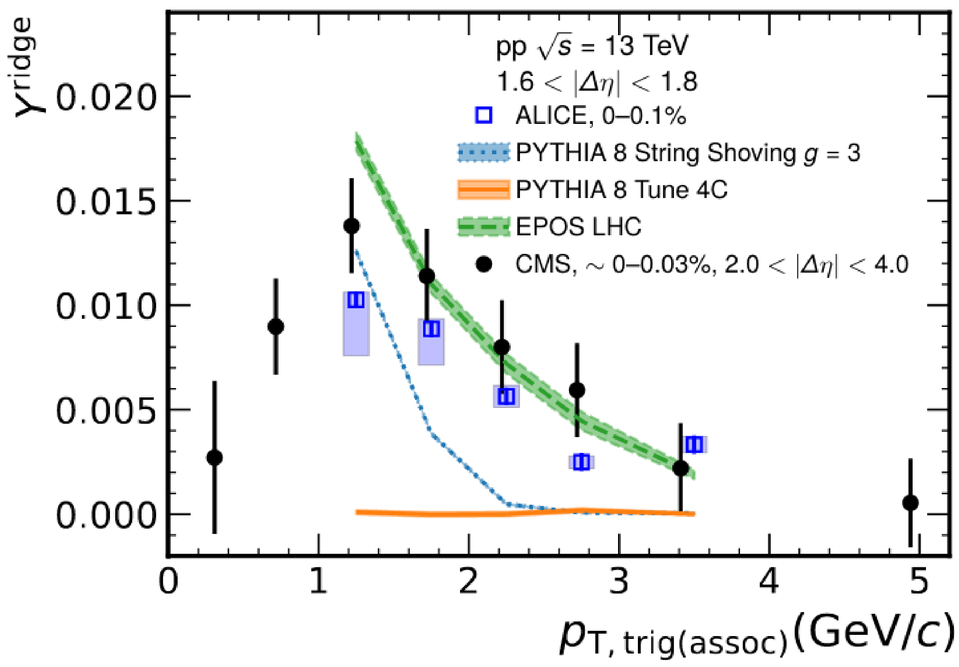
Motivation

- The collective, hydrodynamic behavior in heavy ion collisions is a well-studied phenomenon.
- Recent results show signs of similar behavior in smaller systems e.g. pp collisions, but the origin of these effects is unknown for small systems.



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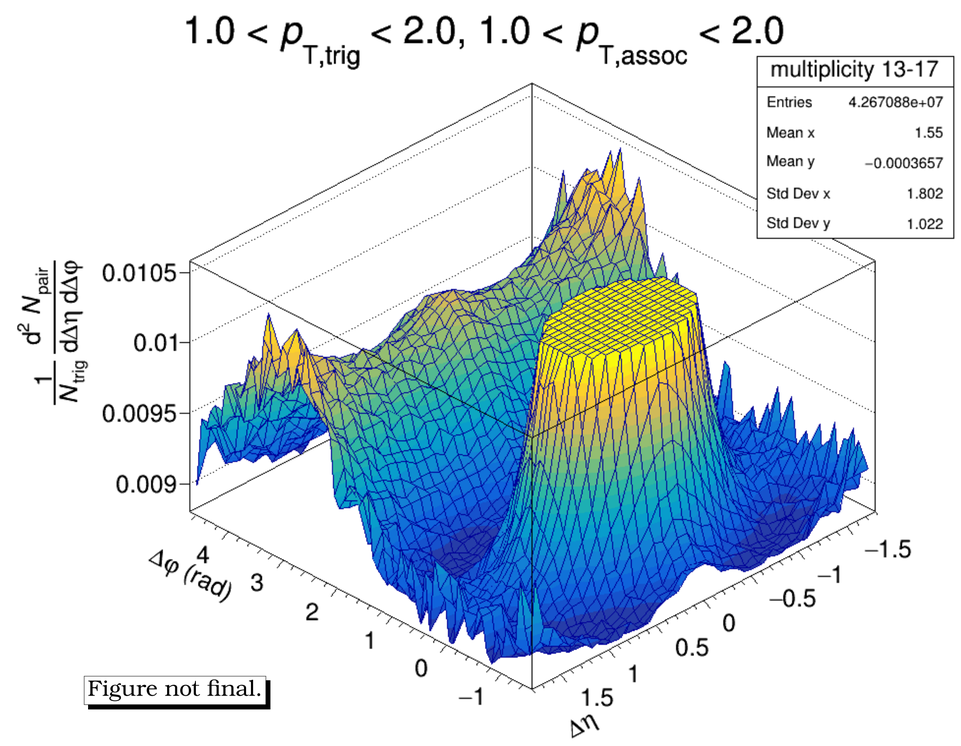
Collective behavior is present in high-multiplicity pp collisions. Simulations incorporating repulsion or fluid description reproduce the results.



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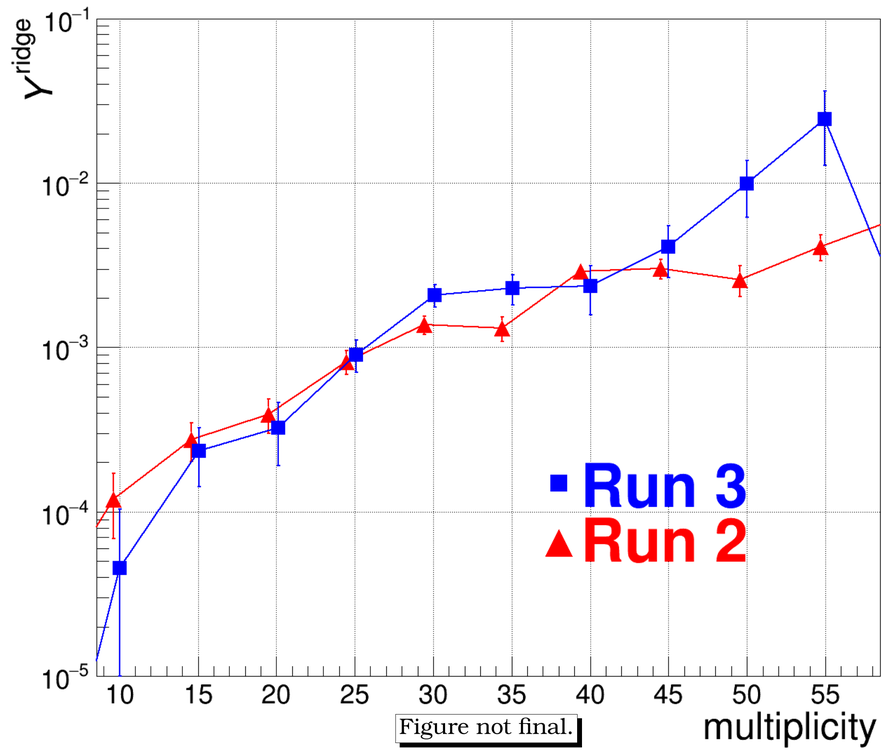
- Data on low multiplicity pp collisions from Run 3 of the LHC can improve our understanding on small system collectivity by investigating previously unexplored regimes.

Results

The results of the ridge yield calculations are shown in the plot below.



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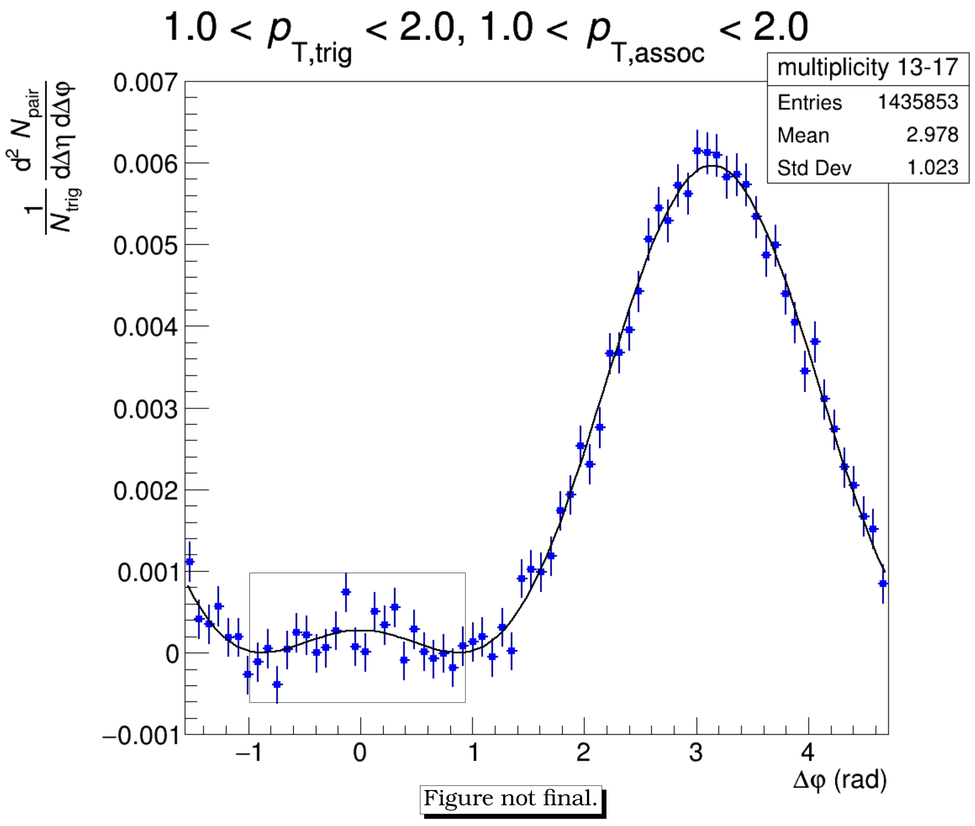
Early results from Run 3 are similar to previous findings.

Methods

The collective behavior of the pp system is quantified by the ridge yield Y^{ridge} and is obtained in the following way:

- Project the correlation function along the $\Delta\varphi$ axis over the region $1.4 < |\Delta\eta| < 1.8$.
- Integrate over the symmetric bump around the origin.



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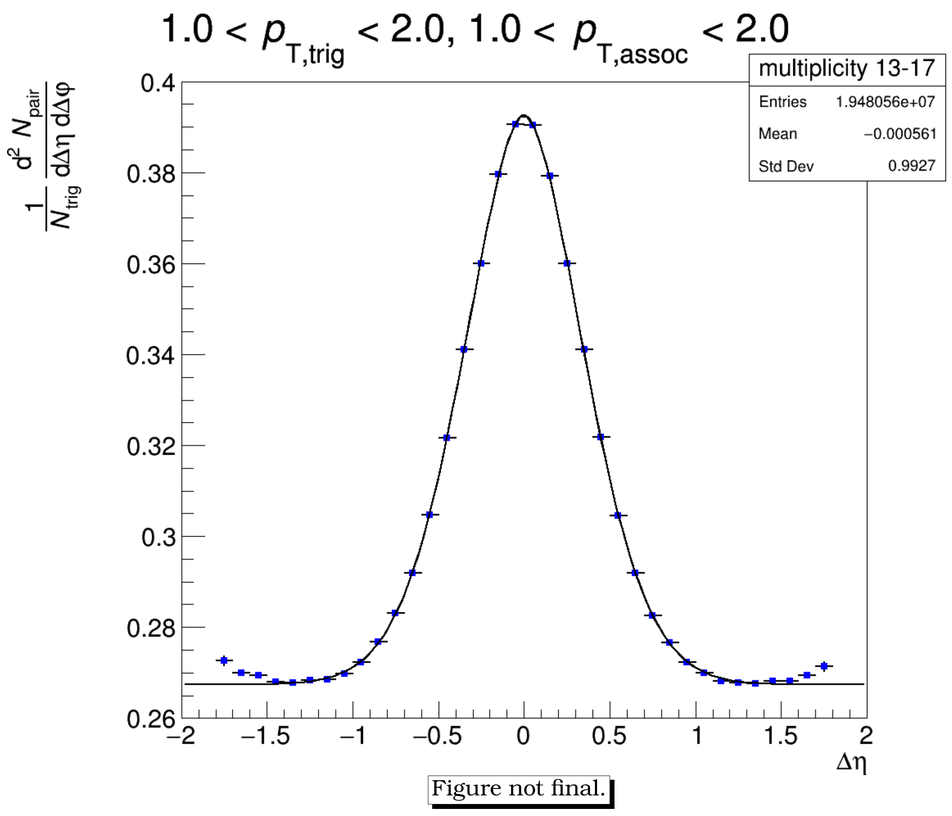
Systematic uncertainty

There are many sources of systematic uncertainty that can affect the results, including:

- The choice of the $\Delta\eta$ interval, i.e. the effect of the jet peak on the result.
- The integration bounds for $\Delta\varphi$.
- Residual two-particle acceptance effects (the non-physical upward bend at long-range $\Delta\eta$).



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A generalized Gaussian distribution is fitted to the projection of the data along the $\Delta\eta$ axis to estimate the effect of non-flow contamination on results, and jet shape modification.

The effects of the different systematic uncertainties have been summarized in the table below.

Sources	Systematic uncertainty (%)
$\Delta\eta$ interval	$\pm 4.7 - 35\%$
$\Delta\varphi$ integration bounds	$\pm 8.4 - 11\%$
Wing correction	$\pm 6.3 - 17\%$
Total (in quadrature)	$\pm 10 - 38\%$

Conclusions

- The results show evidence for the existence of collective-like behavior in low multiplicity pp collisions.
- Future work is needed to mitigate the effects of systematic uncertainty.