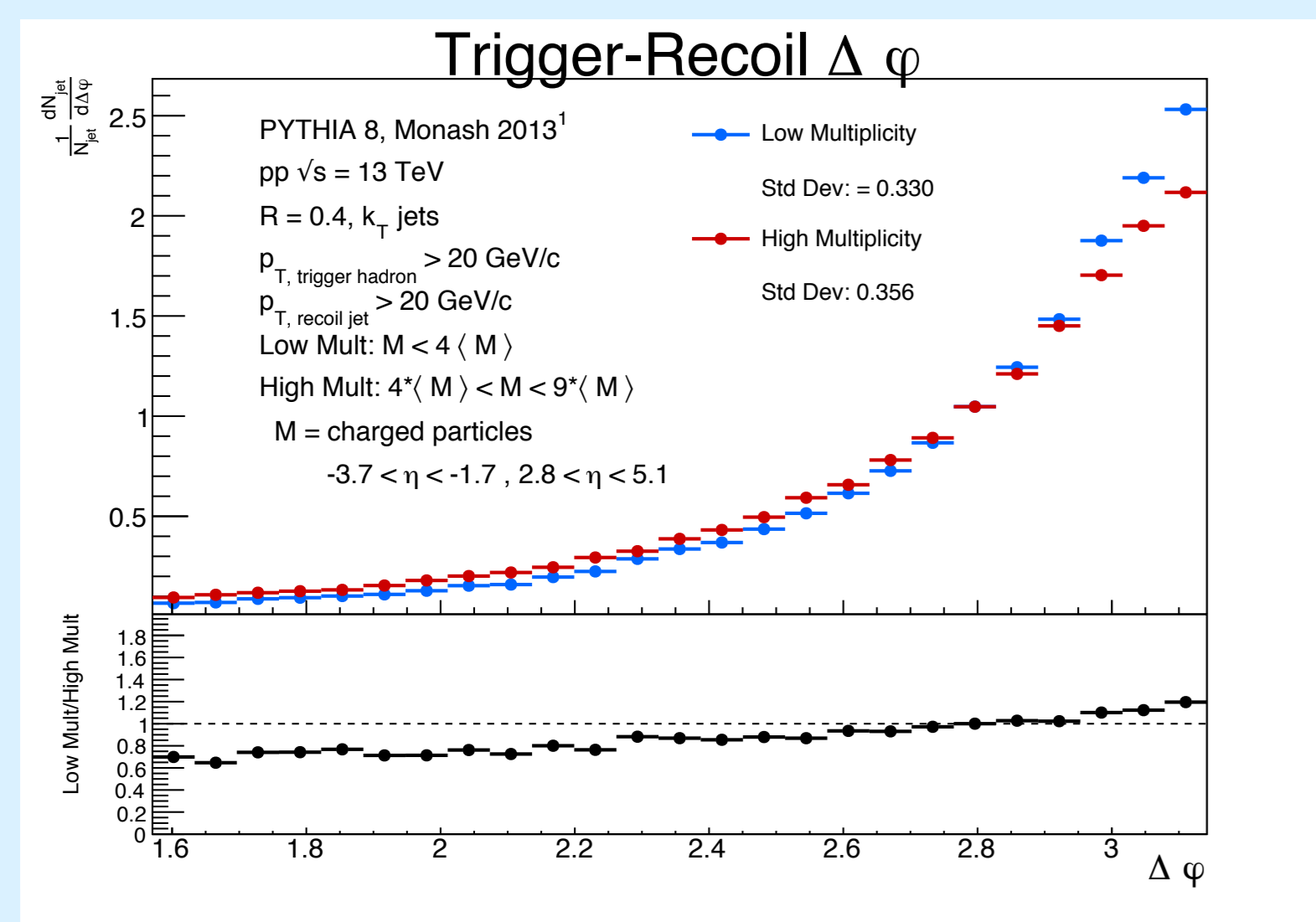


# Monte Carlo Studies of Correlations between Leading Hadrons and Jets

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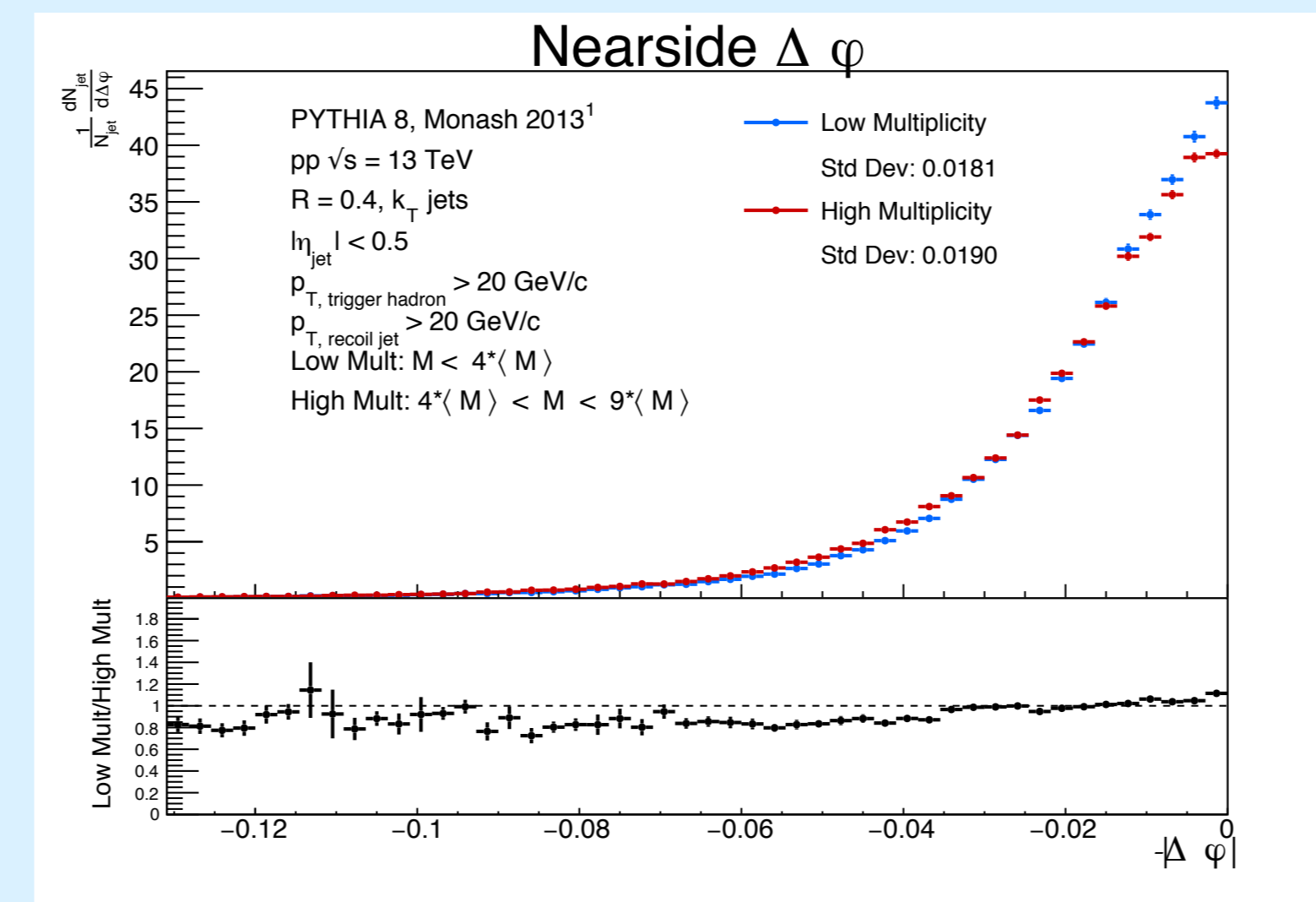
## The Search for QGP Signatures in Small Systems

- Traditionally, it has been assumed that the QGP does not form in small system collisions. This is in part due to a lack of observation of jet modification.
- Studies involving improved statistics for high energy pp collisions have challenged this assumption.
- In high multiplicity pp collisions, there have been recent preliminary observations of  $\Delta\phi$  broadening in hadron-jet correlations. This result can be replicated in PYTHIA 8, which does not simulate the medium.



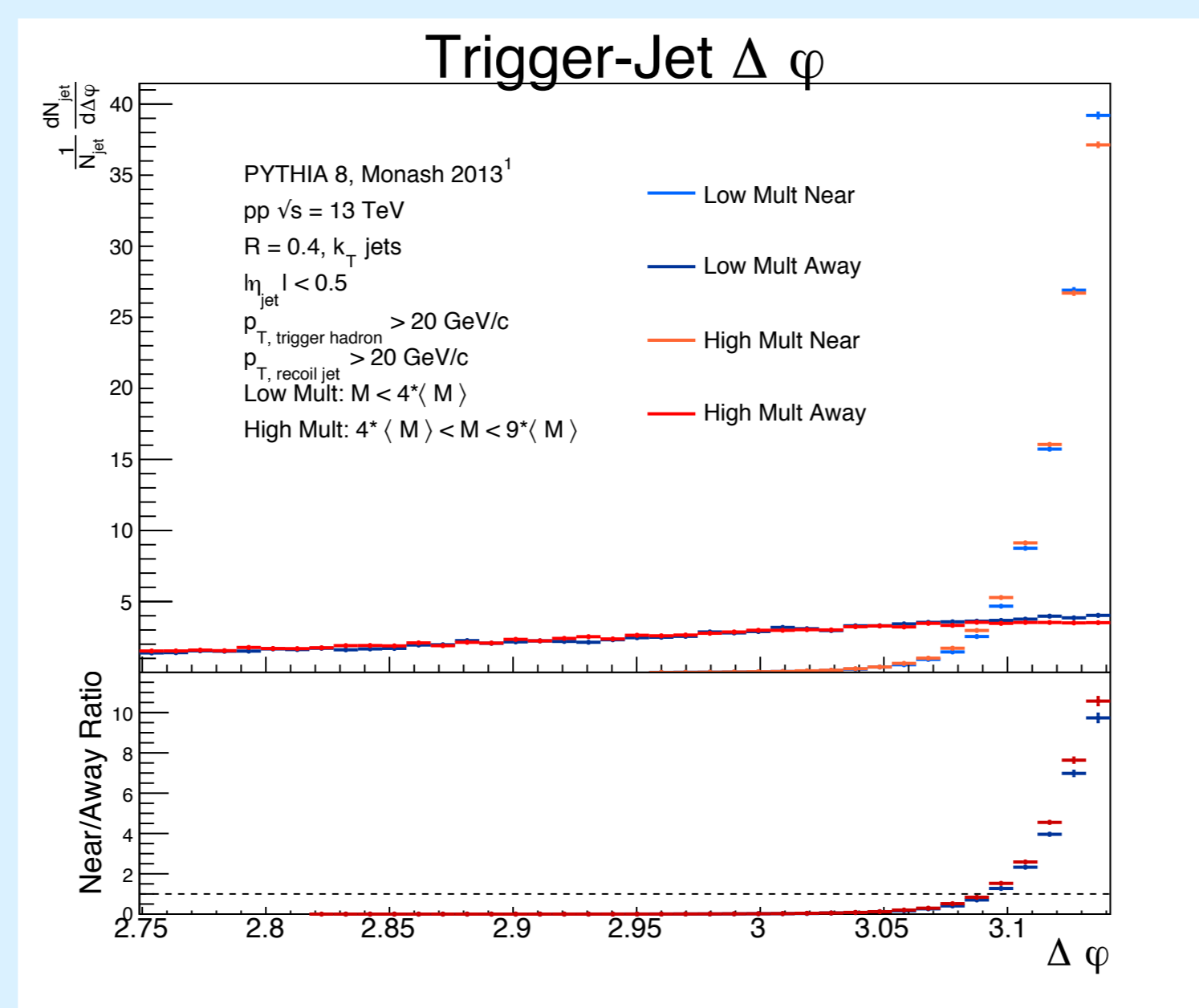
## Trigger Hadrons as Proxies for Jets

- While jet quenching due to QGP formation is a tempting explanation for  $\Delta\phi$  broadening, alternative explanations must first be considered.
- When studying hadron-jet correlations, it is worthwhile to examine the spatial relationship between trigger hadrons and their associated jets.
- In PYTHIA 8, slight broadening of the near-side high multiplicity  $\Delta\phi$  distribution is observed, mimicking what is seen in the away-side.



Angle ( $\Delta\phi$ ) between leading hadrons and associated near-side jets is shown for di-jet events.

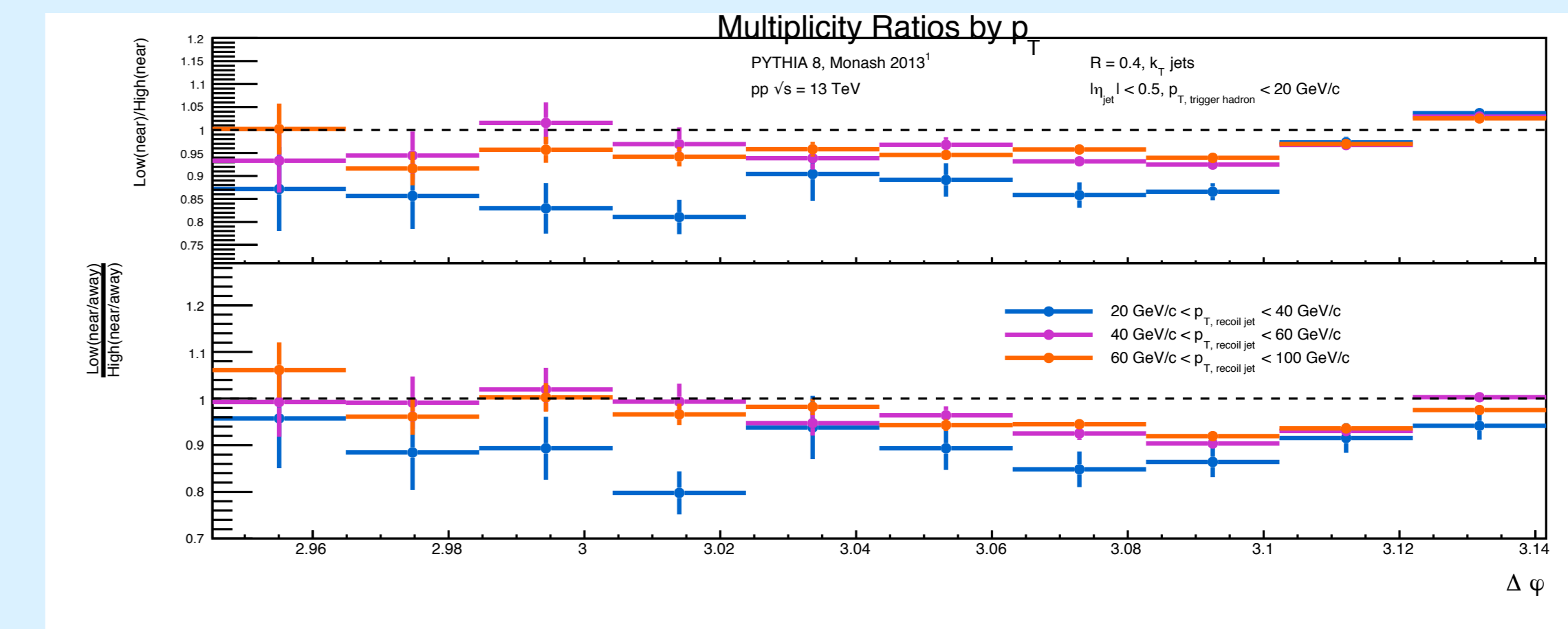
## Relationship Between Near- and Away-Side Broadening



- The extent of away-side broadening dependence on near-side broadening can be quantified by examining the ratio of their respective  $\Delta\phi$  distributions.
- The ratios show similar dependence for high and low multiplicity events, though they are not statistically equivalent.
- This suggests additional contributing mechanisms to away-side broadening.

## Dependence on Recoil $p_T$

- Preliminary observations of acoplanarity exhibit a recoil  $p_T$  dependence, with lower  $p_T$  jets showing more broadening.
- This is also seen in near-side  $\Delta\phi$  distributions, but ratios of low to high multiplicity results suggest varying levels of dependence on near-side effects, with low  $p_T$  recoil jets demonstrating relatively more broadening in relation to near-side behaviour.



## Outlook

- While it is prudent to consider near-side effects in hadron-jet correlation studies of jet acoplanarity, they cannot fully account for observed broadening.
- Comparisons to di-jet correlations may provide additional information to help illuminate the extent of near-side contributions.

1. P. Skands, S. Carrazza, J. Rojo. Tuning PYTHIA 8.1, the Monash 2013 Tune. *Eur. Phys. J. C* 74 (2014) 8, 3024.