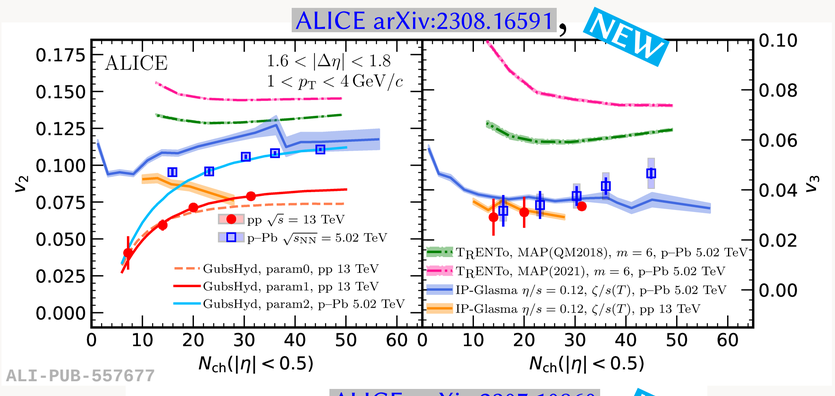
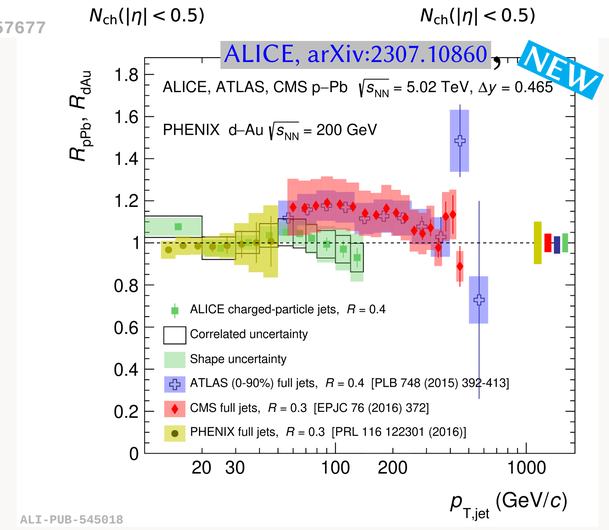
Search for jet quenching effects in high-multiplicity pp collisions with ALICE

Motivation → QGP in pp?

ALICE arXiv:2308.16591, NEW



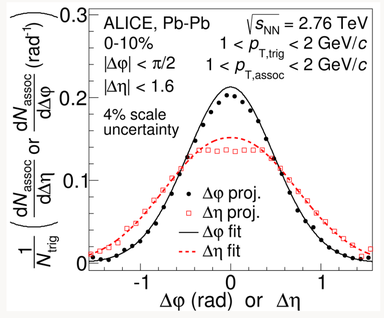
ALICE, arXiv:2307.10860, NEW

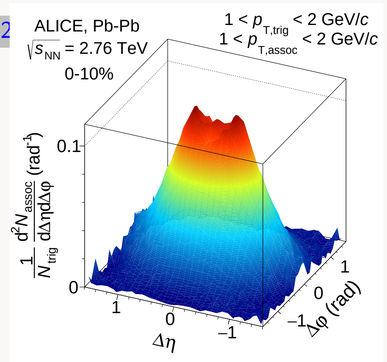


- Even though flow signatures are observed
- No sign of jet quenching in small systems

Observables

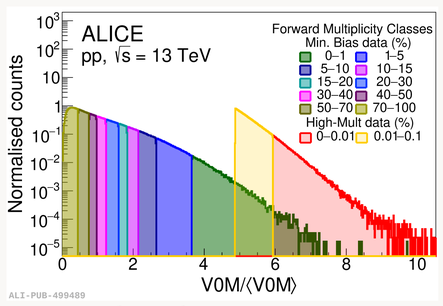
ALICE, Phys.Rev.Lett. 119 (2017)102

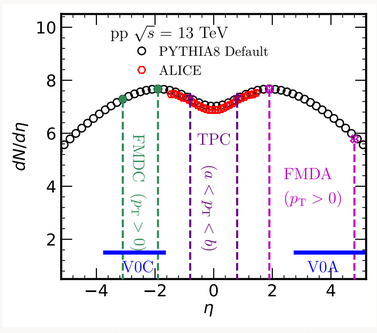




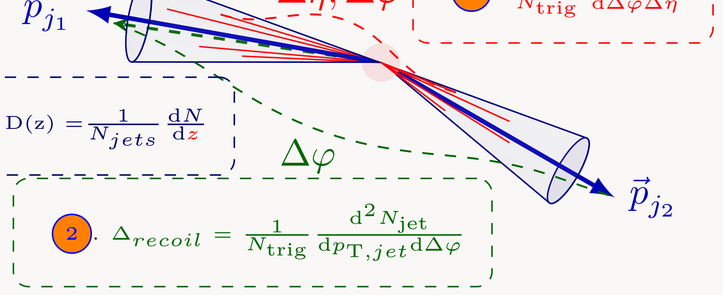
- Low p_T 2PC shows "broadening" both in $\Delta\varphi$ and $\Delta\eta$, and "double peaks" in $\Delta\eta$.
- Double hump peaks around $\Delta\eta \approx 2$ from jets in a model.
  (X.N. Wang et al. Phys.Lett.B 777 (2018) 86-90)
- Is this a shock-wave signal in Pb–Pb?
- What about pp collisions at $\sqrt{s}$ = 13 TeV?
  1. hadron-hadron correlations?
  2. hadron-jet correlations?
  3. intra-jet correlations?

Experimental Method



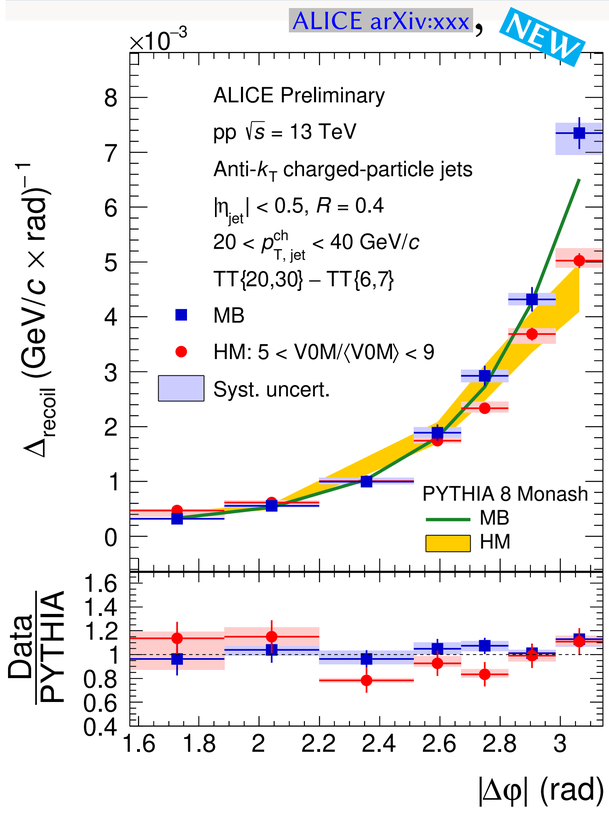


- Multiplicity estimation with accepted charged tracks
  - $|\eta| < 1.0$, $p_T > 0.2$ GeV/c : N_{ch}
  - V0M = V0A + V0C

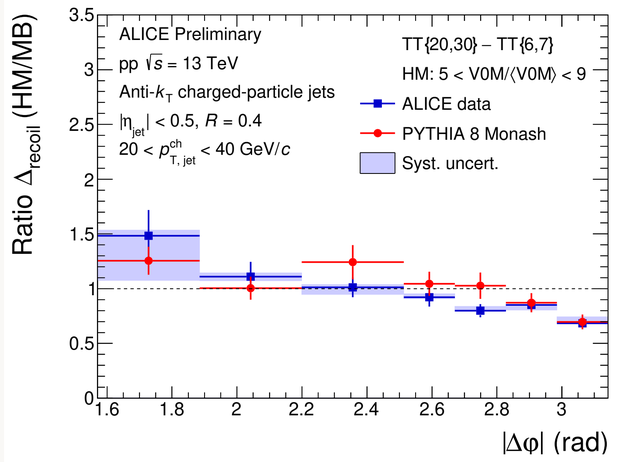


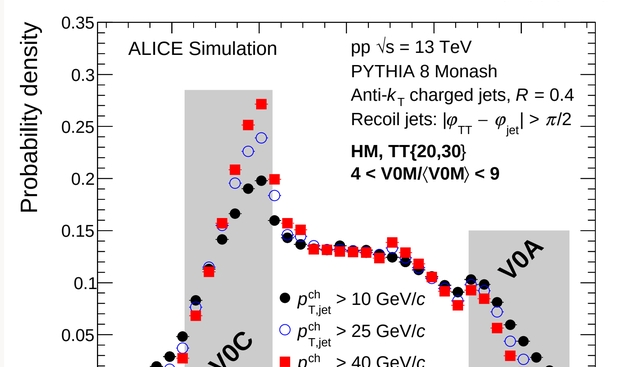
Results 2. hadron-jet

ALICE arXiv:xxx, NEW



- **Broadening and Suppression** in HM events.
- PYTHIA8 Monash tune shows similar effects
- These observations are due to a bias towards multi-jet final states that is induced by the combined requirements of a hard process in the central barrel and high multiplicity in the forward direction.

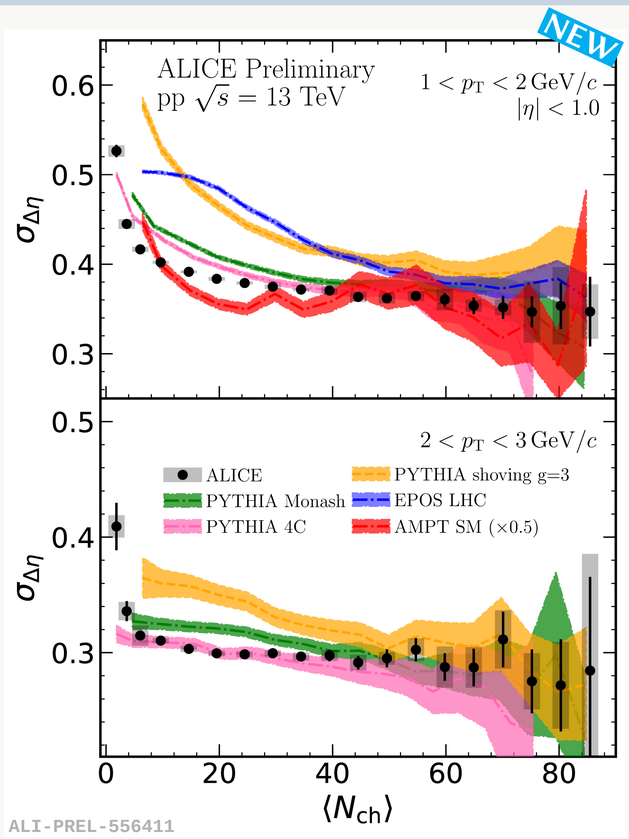




- HM event selection → significant bias in distribution of high-p_T recoil jets, enhancing jets in the backward detector acceptance (V0C)
- asymmetric due to coverage of V0A and V0C

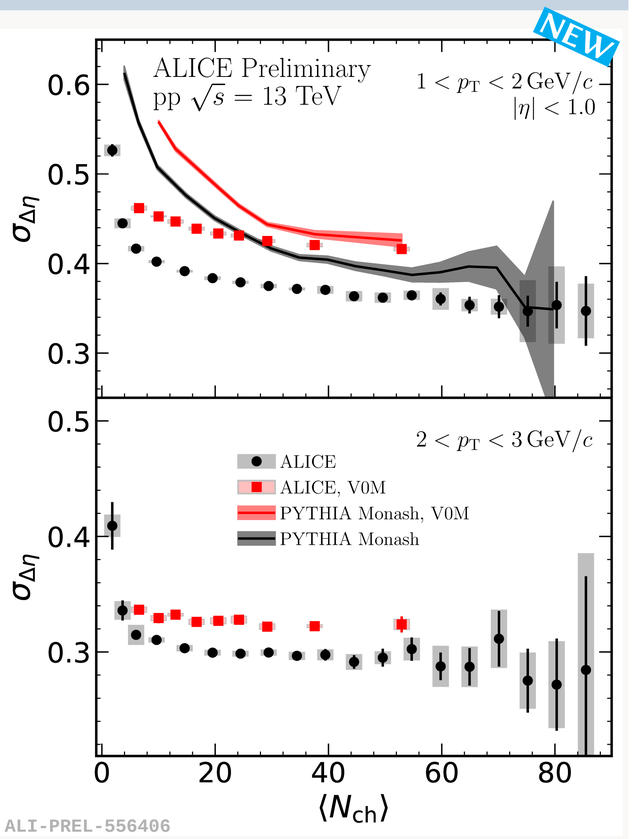
1. hadron-hadron

NEW



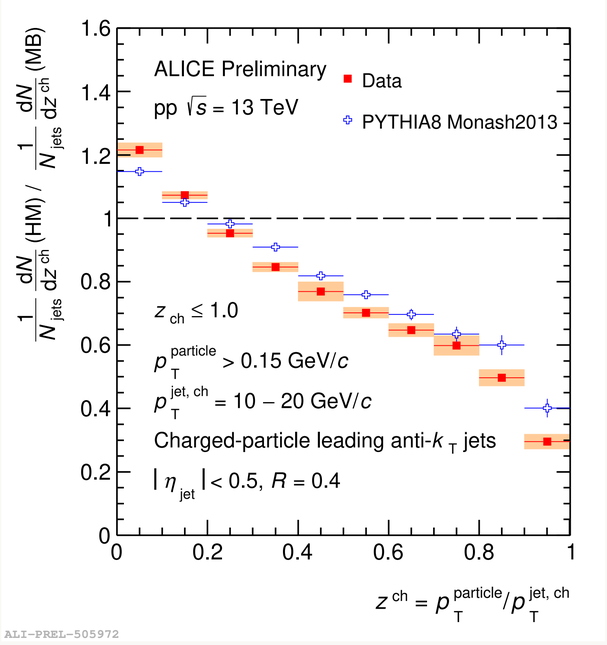
- **Narrowing** with increasing multiplicity
- Most of model calculation show narrowing toward high multiplicity but wider than the data
- Weak multiplicity dependence toward higher multiplicity events.

NEW



- Results from V0M have a similar multiplicity dependence but the widths from N_{ch} are smaller.
- PYTHIA8 shows the similar differences between two multiplicity selections.
- N_{ch} for V0M multiplicities are from the paper (ALICE, EPJC 81 (2021) 630)

Results 3. Intra-jet



- Jet fragmentation is **softer** in HM events, which is shown in PYTHIA8 as well

Take-home messages:

- **Jet observables in pp show different modifications in HM w.r.t MB events.**
  1. hadron-hadron correlations : **narrowing** toward HM events.
  2. hadron-jet correlations : **broadening** in HM events.
  3. intra-jet correlations : **softening** of jet fragmentation in HM events.
- **The similar modifications are also seen in the PYTHIA8 model.**
- **What is the origin of these modifications in HM events?**
  - Due to the kinematic bias between the hard process in the central barrel and HM selections in the forward detectors
  - To identify jet quenching, first disentangle these observed effects.
- These measurements indicate a possible bias in the LM-template method for flow extraction, as it assumes no modification of the jet shape in HM compared to LM events (see arXiv:2308.16591(ALICE), arXiv:2303.05806(S. Ji et al.)).

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