Searching for energy loss in *pp* and *p*+A: Event activity selection bias on final-state properties

University of Colorado Boulder

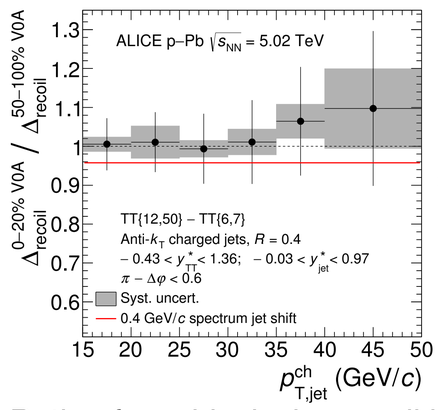
Dennis V. Perepelitsa
+ J. Nagle, S. Lim, Q. Hu, K. Hill

Lund University

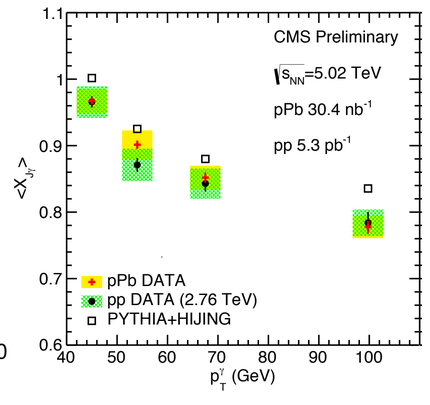
3rd International þing on QCD challenges from *pp* to AA

Background

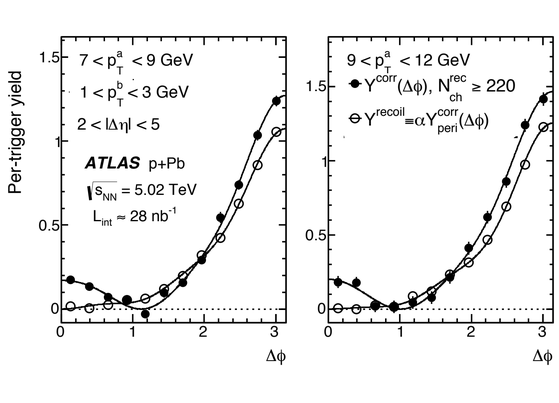
- *How to search for energy loss in pp and p+A collisions?*
- *Difficult to control R_{pA}, so consider intra-event correlations*
  - *here: h+jet, ɣ+jet, high-p_T v_2 (examples from data right)*
- *Strategy: look for changes in "high-multiplicity" events*
  - *here: N_{ch}^{mid} (# of > 0.4 GeV ch. particles in $|\eta| < 2.5$), or ΣE_T^{fwd} (all in $|\eta| = 3.2$-4.9), more definitions possible*
- *However, these must impose some bias on the selected final states… here, quantify the effect*



Ratio of semi-inclusive recoil jet dist. ALICE PLB 783 (2018) 95



Photon+jet p_T balance CMS PAS-HIN-13-006



Two-particle correlation at high-p_T, ATLAS PRC 90 (2014) 4044906

Hadron-triggered semi-inclusive recoil jet distribution

Simulation setup

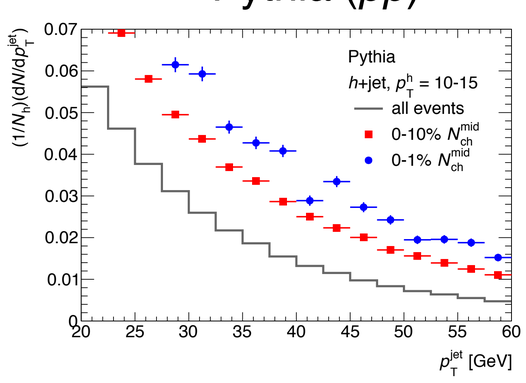
- *p_T^h = 10-15 GeV, $|\eta^h| < 2.5$, generated by HardQCD:all with pTHatMin = 10 GeV*
- *take all R=0.4 jets, $|\eta^{jet}| < 2.8$ that have $\Delta\phi > 3\pi/4$*

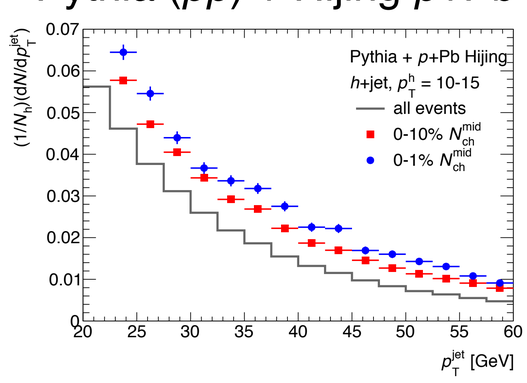
Conclusions:

- *In pp, large-N_{ch}^{mid} selection increases the jet p_T from which the trigger hadron comes*
  - *and enhances multi-jet topologies*
- *In pp, large-ΣE_T^{fwd} selection pulls balancing jet(s) out of mid-rapidity region*
- *In p+Pb, both effects are somewhat diluted*

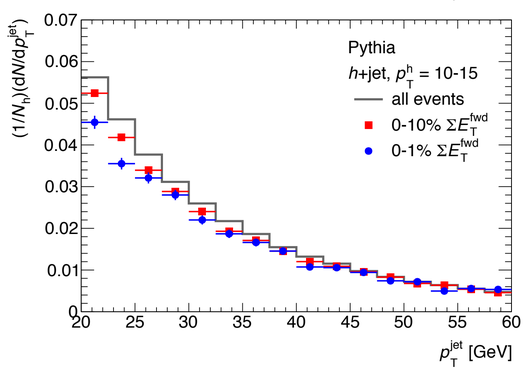
Pythia (*pp*) | Pythia (*pp*) + Hijing *p*+Pb

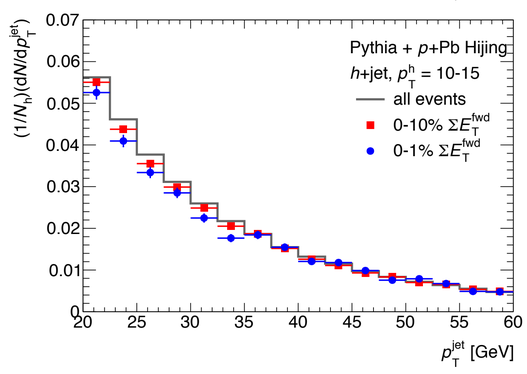
N_{ch}^{mid} selection





ΣE_T^{fwd} selection





Photon + inclusive jet p_T balance

Simulation setup (1M events):

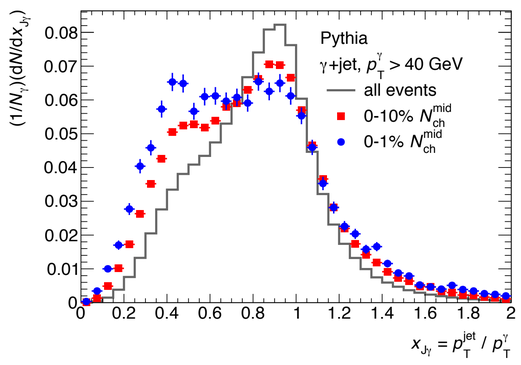
- *$p_T^\gamma > 40$ GeV, $|\eta^\gamma| < 2.4$, generated by PromptPhoton:all with pTHatMin = 35 GeV (no fragmentation photon contribution)*
- *take all R=0.4 jets, $|\eta^{jet}| < 2.8$ that have $\Delta\phi > 3\pi/4$*

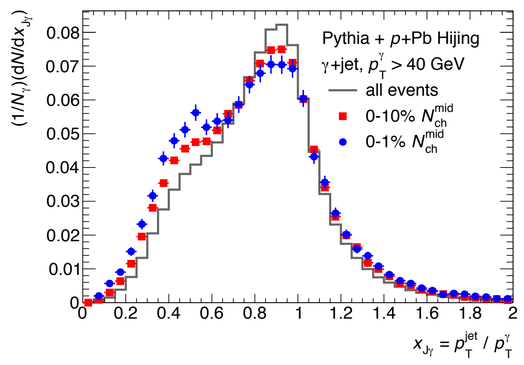
Conclusions:

- *In pp, large-N_{ch}^{mid} selection enhances photon + 2 (or more) jet topologies*
- *In pp, large-ΣE_T^{fwd} selection pulls the leading jet out of mid-rapidity region*
  - *bigger effect than for h+jet (fewer balancing jets?)*
- *In p+Pb, both effects are somewhat diluted*

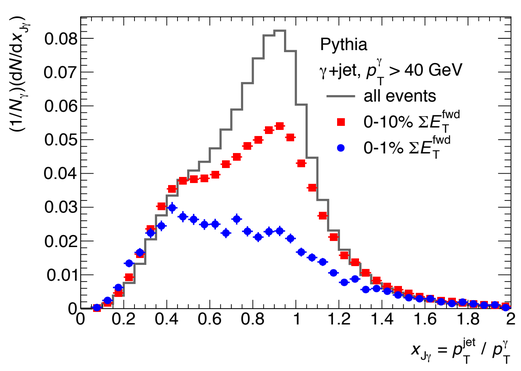
Pythia (*pp*) | Pythia (*pp*) + Hijing *p*+Pb

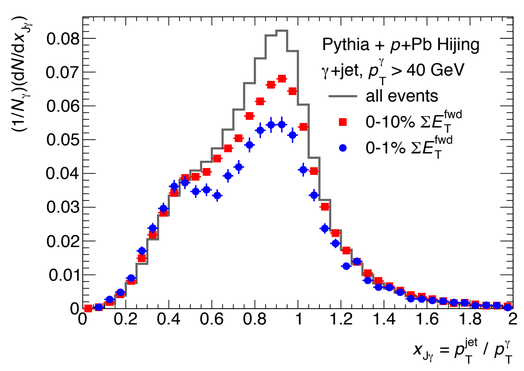
N_{ch}^{mid} selection



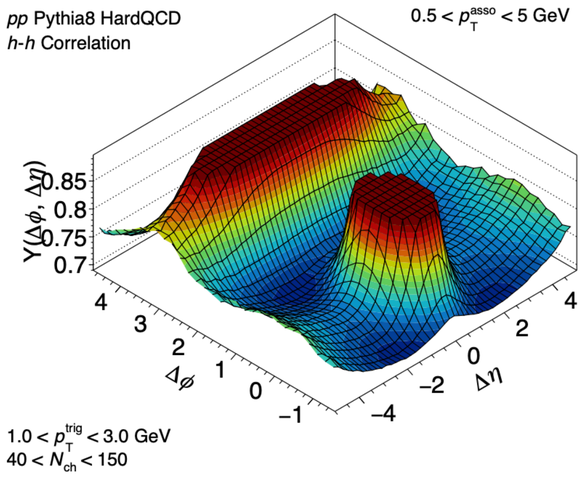


ΣE_T^{fwd} selection





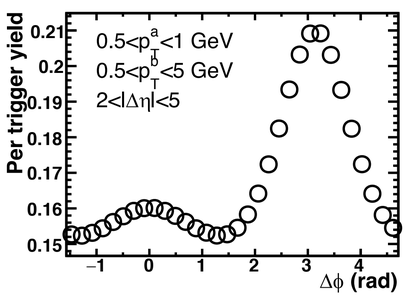
Two-particle correlations at high-p_T

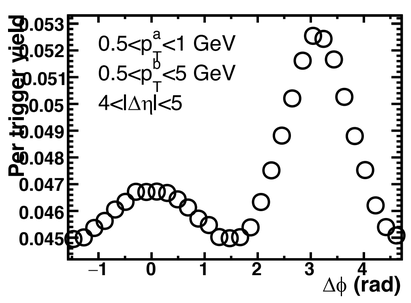


At high-p_T (trigger hadron >10 GeV), particles come from jet fragmentation

- *apparent near-side in ridge in Pythia in jet-triggered events(!)*

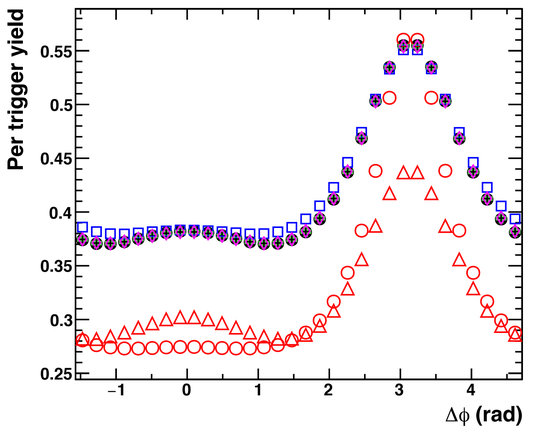
$|\Delta\eta| = 2$-5 ⟶ *$|\Delta\eta| = 4$-5*





Interesting systematic dependence (both quite different from genuine flow signature):

- *magnitude increases with $\Delta\eta$ separation (above)*
- *magnitude decreases with multiplicity*



Arises from implementation of ISR in Pythia

- *"phiIntAsym" seems to introduce angular correlation of ISR to hard scattering to model color coherence effects*

If this is in data, it will generally mask flow signal (subtracting non-flow using low mult. selection would give $v_2 < 0$ at HM) — what are implications?