Multiplicity dependence of jet-like two-particle correlations in p–Pb collisions with ALICE

Emilia Leogrande (Utrecht University), on behalf of the ALICE Collaboration [*emilia.leogrande@cern.ch*]

Two-particle correlations in p–Pb collisions: the double ridge and the jet-like structures

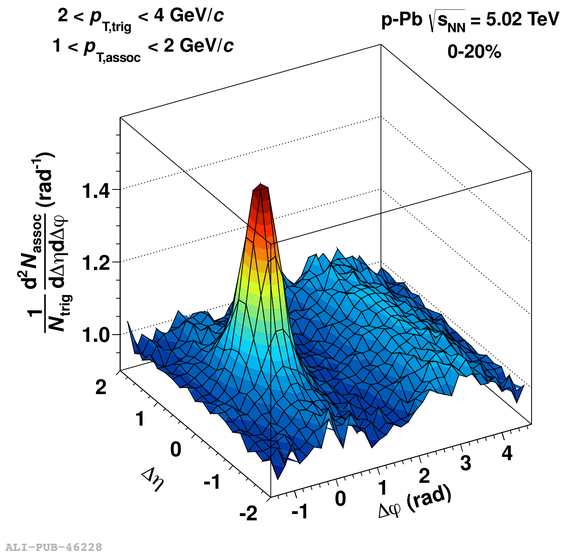
Two-particle correlations:

- Trigger particle with a transverse momentum $p_{T,trig} > p_{T,trig\ min}$
- Associated particles within $p_{T,assoc\ min} < p_{T,assoc} < p_{T,trig}$

Per-trigger yield:

$$\frac{1}{N_{trig}} \frac{d^2 N_{assoc}}{d\Delta\eta d\Delta\varphi} \quad (1)$$

Correlations from jet on top of a double ridge[1,2] structure.



Multiplicity measurement: V0A

V0A (direction of Pb fragments) covering $2.8 < |\eta| < 5.1$

Forward multiplicity

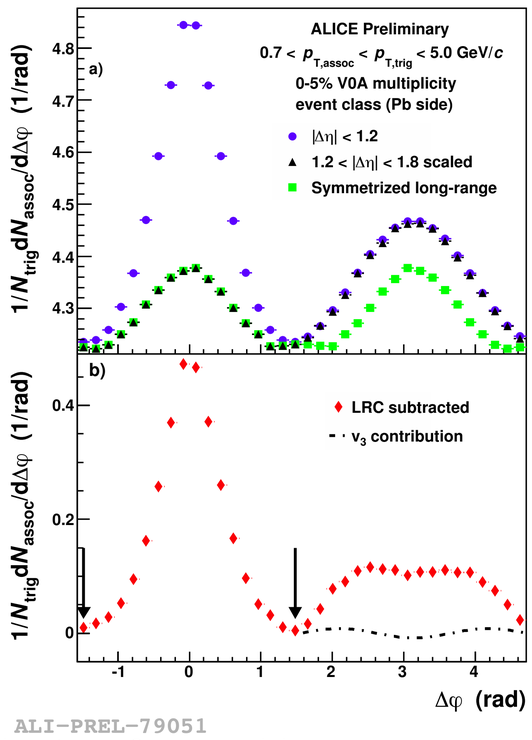
Multiplicity distribution sliced in percentiles of cross section to define event classes (V0A multiplicity classes)

Midrapidity multiplicity

Charged particle multiplicity at midrapidity in each V0A class

Ridge subtraction

Near-side long-range (black) symmetrized around $\pi/2$ (green) subtracted from short-range (blue)



Contribution from odd components (dashed curve) added in the systematic uncertainties.

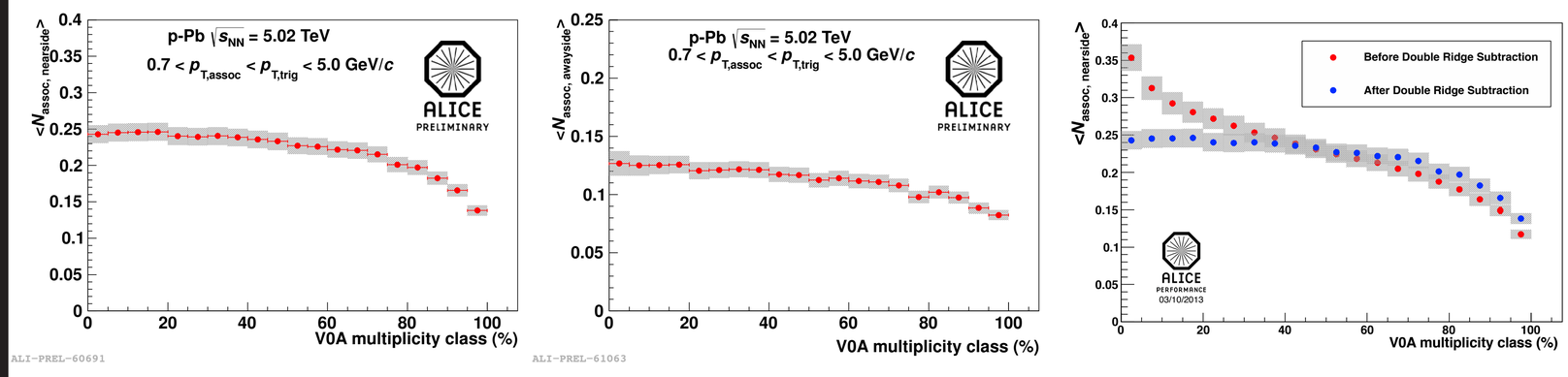
Per-trigger yields

$\langle N_{assoc,nearside} \rangle$ = integral of the near-side above the combinatorial background

$\langle N_{assoc,awayside} \rangle$ = integral of the away-side above the combinatorial background

NEAR-SIDE and AWAY-SIDE

EFFECT OF SUBTRACTION

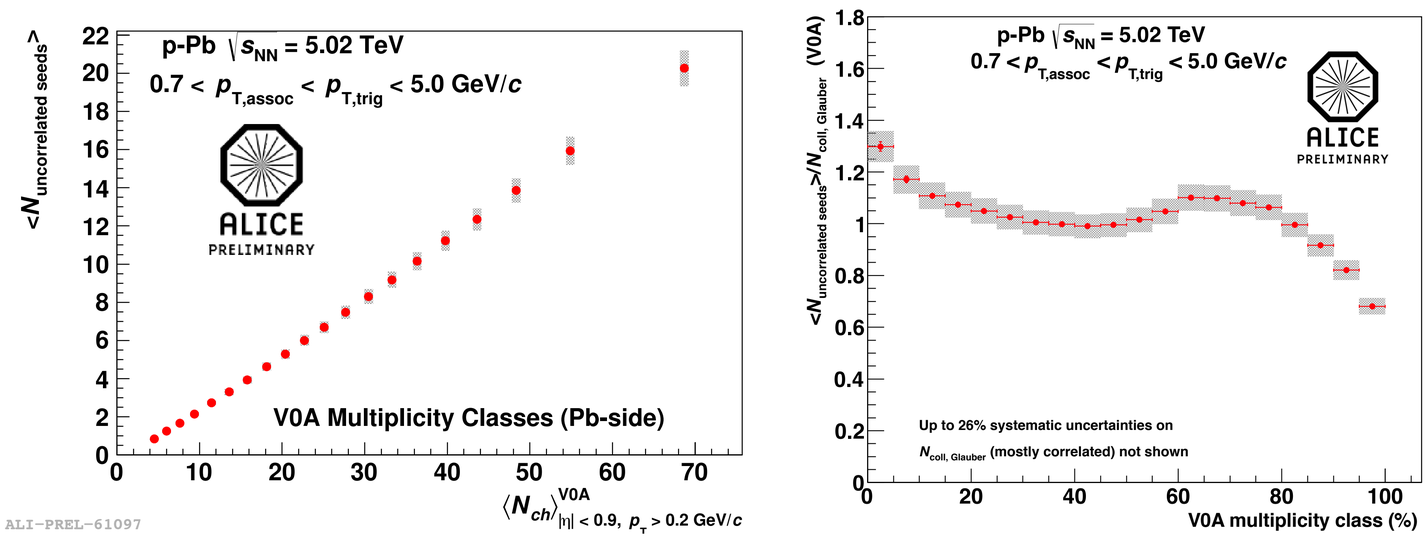


- Per-trigger yields nearly constant apart from low multiplicity
  → number of hard processes (contributing to trigger and associated particles) and soft particles (contributing to trigger particles) exhibit the same evolution with multiplicity
- Plateau observed only after subtraction of long-range correlations
  → minijets and ridge structures are additive in two-particle correlations
  → consistent with a picture where minijet-associated yields originate from the incoherent fragmentation of multiple nucleon-nucleon collisions

Uncorrelated seeds: the link to MPIs

Uncorrelated seeds: independent sources of particle production (linearly correlated to multi-parton interactions (MPIs) in Pythia[3]).

$$\langle N_{\text{uncorrelated seeds}} \rangle = \frac{\langle N_{trig} \rangle}{\langle N_{\text{trig correlated}} \rangle} = \frac{\langle N_{trig} \rangle}{1 + \langle N_{assoc,nearside} \rangle + \langle N_{assoc,awayside} \rangle} \quad (2)$$



- Number of uncorrelated seeds increases linearly with multiplicity at midrapidity
- Linear trend is broken at low multiplicity
- Number of uncorrelated seeds scales with N_{coll} from Glauber Monte-Carlo calculations only in the intermediate multiplicity region
  → in high- and low-multiplicity events the number of semi-hard scattering estimated with Glauber has a bias

Summary

- Number of hard processes and soft particles exhibit the same evolution with multiplicity
- Minijet and ridge structures are additive
- Minijets arise from incoherent fragmentation of multiple nucleon-nucleon collisions
- Number of uncorrelated seeds increases linearly with multiplicity at midrapidity
- The number of semi-hard scatterings from Glauber Monte-Carlo calculations in low and high multiplicity events is biased

References

[1] ALICE Collaboration, *Long-range angular correlations on the near and away side in p–Pb collisions at $\sqrt{s_{NN}}$ =5.02 TeV*, Phys.Lett. B719 (2013) 29-41

[2] ALICE Collaboration, *Long-range angular correlations of π, K and p in p–Pb collisions at $\sqrt{s_{NN}}$ =5.02 TeV*, Phys.Lett. B726 (2013) 164-177

[3] ALICE Collaboration, *Multiplicity dependence of two-particle azimuthal correlations in pp collisions at the LHC*, JHEP 1309 (2013) 049