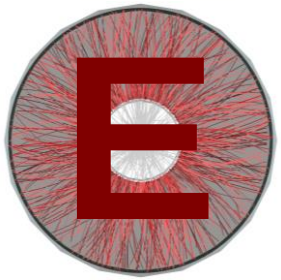
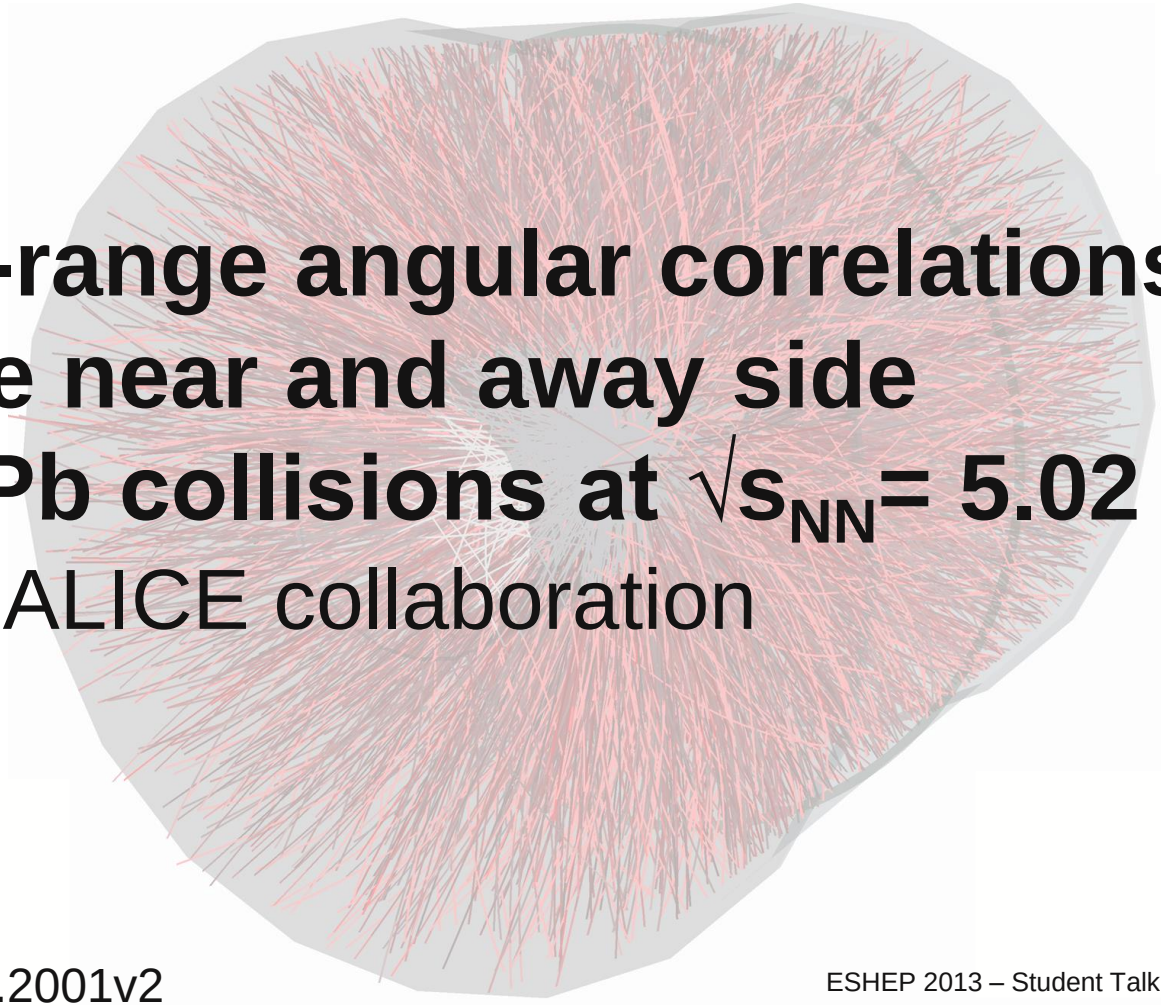


Heavy Ion Physics

Discussion Group E

Gyula, Alexander, Priscilla, Bedrich, Nils, Arseniy, Antonio, Ruth, Martin, Federico, Hale, Edmund, Livia, Johannes, Antonella, Maximilian, Florian, Francesca



Long-range angular correlations on the near and away side in p–Pb collisions at $\sqrt{s_{NN}}$= 5.02 TeV

by the ALICE collaboration

arXiv:1212.2001v2

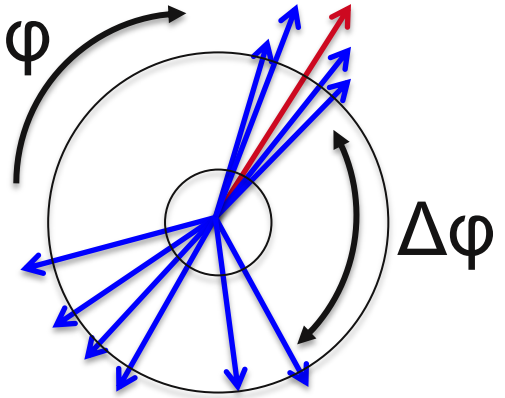
Motivation

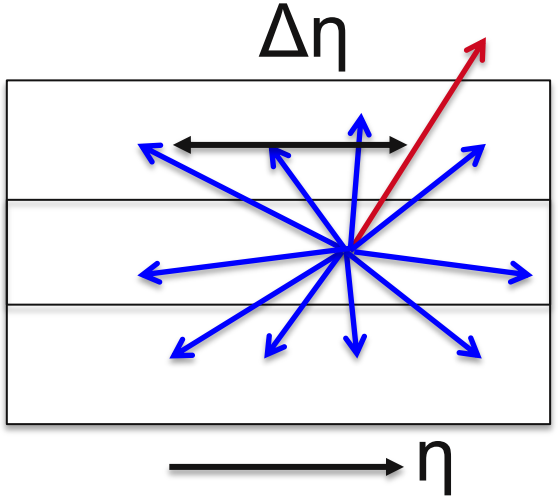
- **Why study p-Pb collisions?**
  - QCD at high parton density
  - Probe parton distribution functions
    → Inspect Pb-ion with proton
  - Important control measurement for observables in Pb-Pb
- **Why study two-particle angular correlations?**
  - Interesting tool to study high-multiplicity events
    → Significant structures observed in pp collisions
  - Different underlying physics possibly relevant in p-Pb

Two Particle Correlation

- **Associate** a particle to a **trigger** particle in specific p_T intervals
  - $p_{T,assoc} < p_{T,trig}$

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

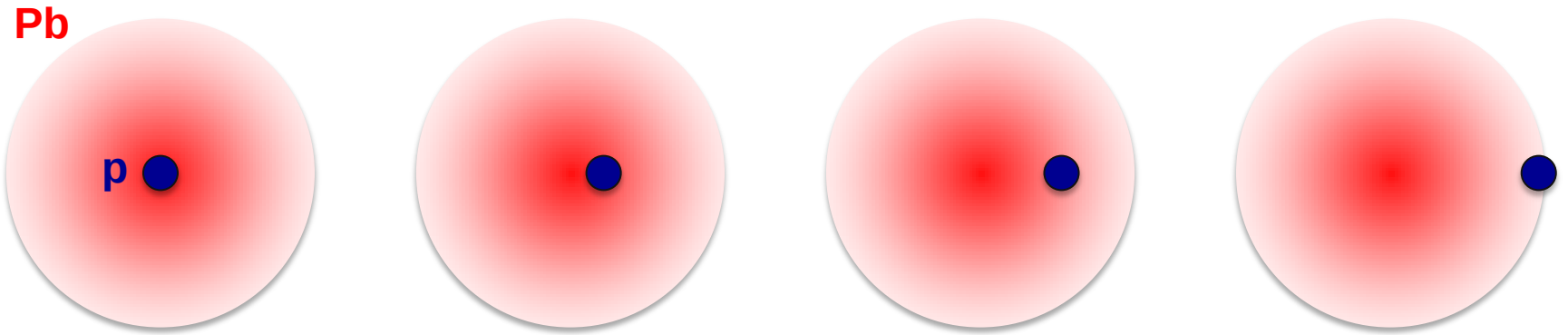




- 4 hour test run in September 2012
  - 1.7 million p-Pb events

Event Classes

- Define four event classes based on forward multiplicity measurement



0 – 20 %

20 – 40 %

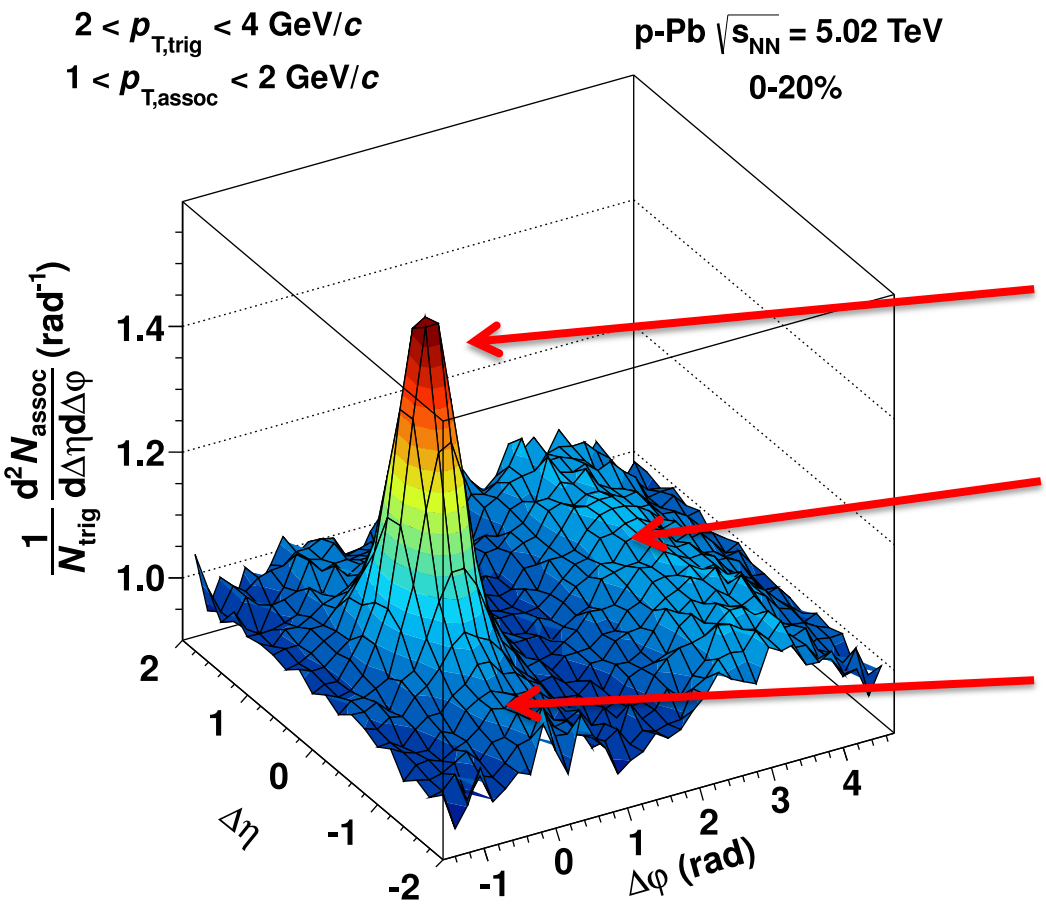
40 – 60 %

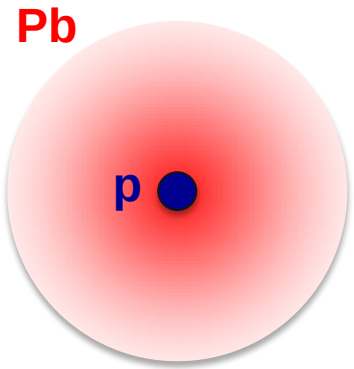
60 – 100 %

Highest multiplicity

Lowest multiplicity

The Ridge





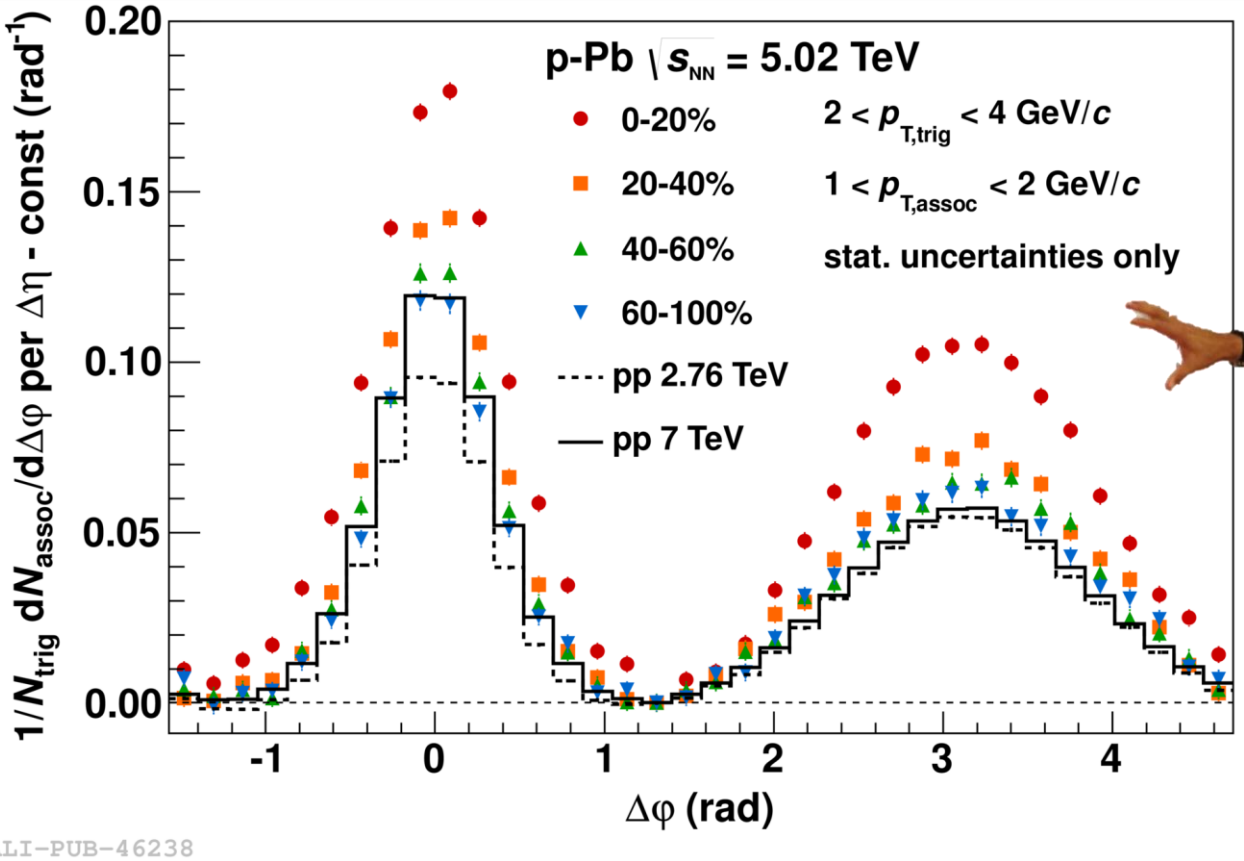
Near-side jet
($\Delta\phi \sim 0, \Delta\eta \sim 0$)

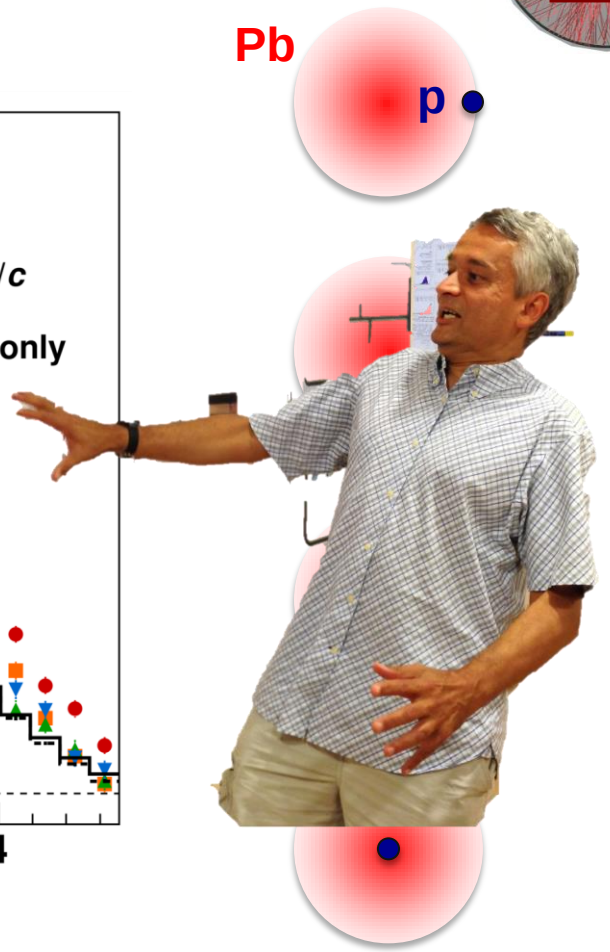
Away-side (recoil) jet
($\Delta\phi \sim \pi$, spread in $\Delta\eta$)

Near-side ridge
($\Delta\phi \sim 0$, spread in $\Delta\eta$)

ALI-PUB-46228

Projection in Δφ



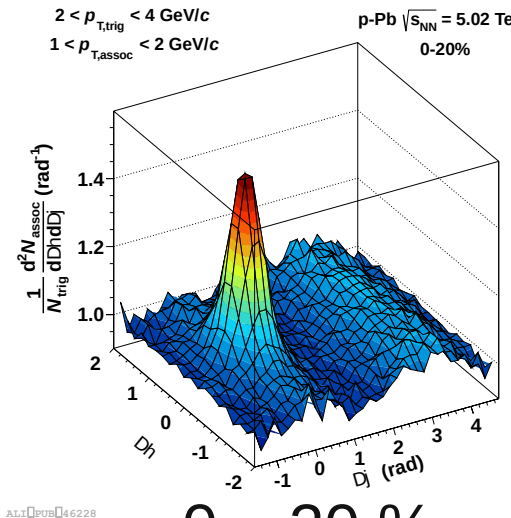


- Excess of yield on near-side previously measured by CMS*
- Excess of yield on near-side **and away-side**

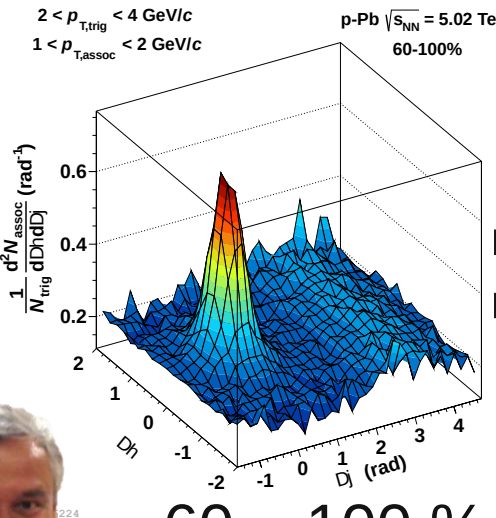
*arXiv:1210.5482 [nucl-ex].

Subtracting the Background

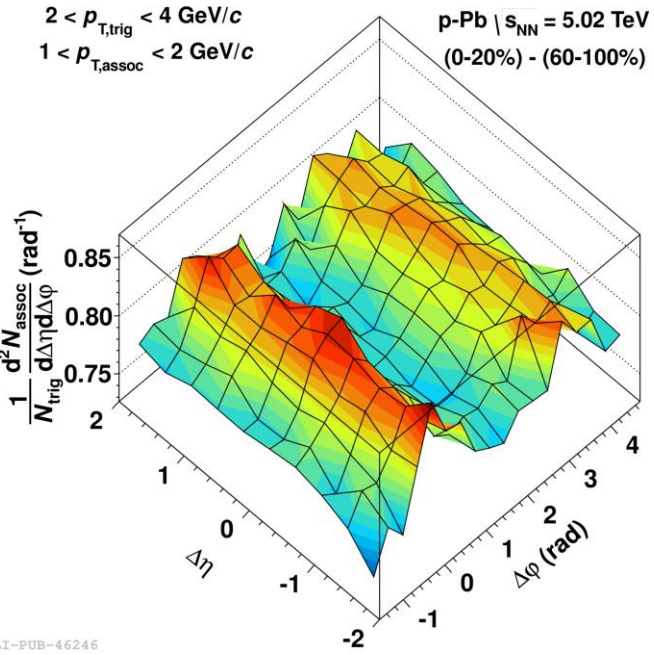
→Separate jet and ridge component!

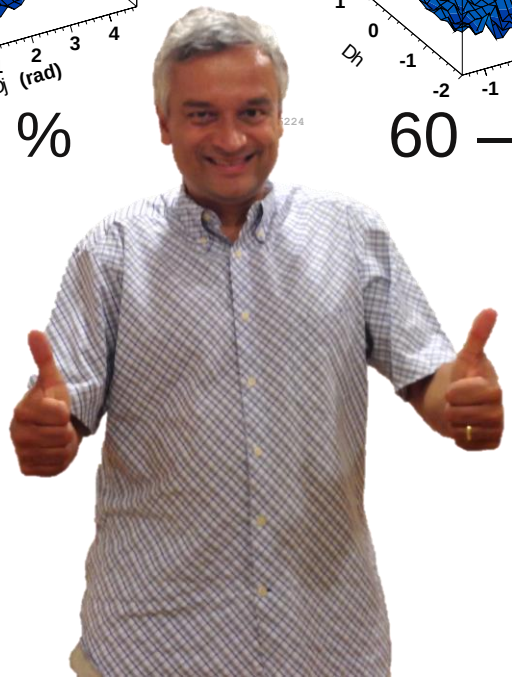


0 – 20 %



60 – 100 %





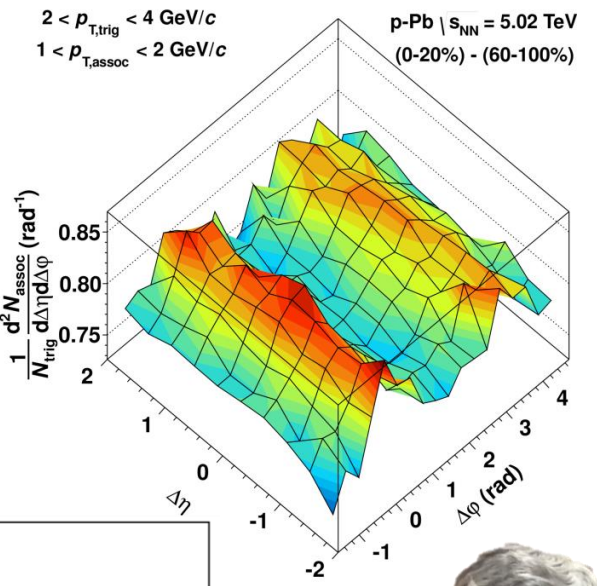
→ Double ridge structure

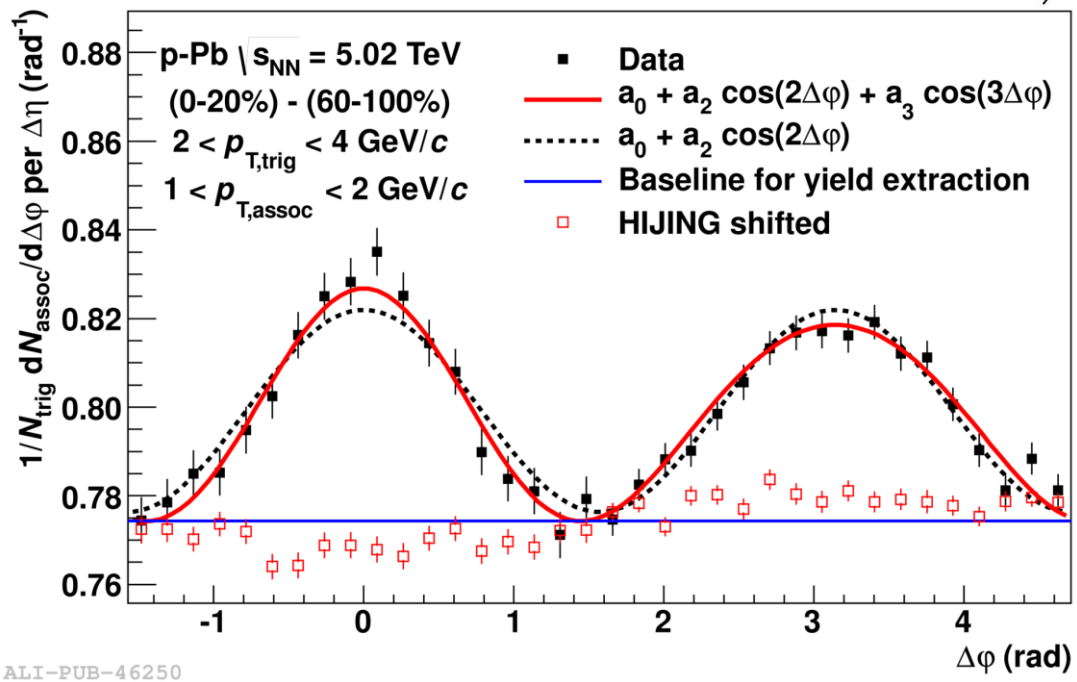
!!!

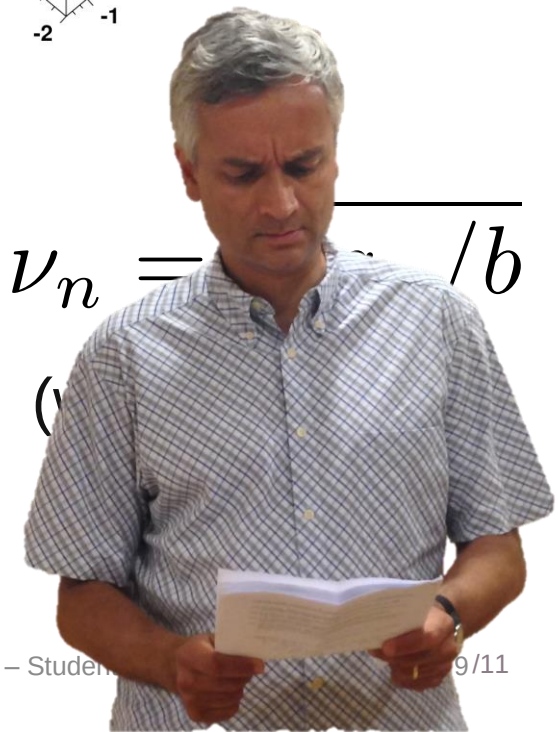
The Double Ridge

Projection in Δφ

- Significant contributions from cos(2Δφ) and cos(3Δφ) terms







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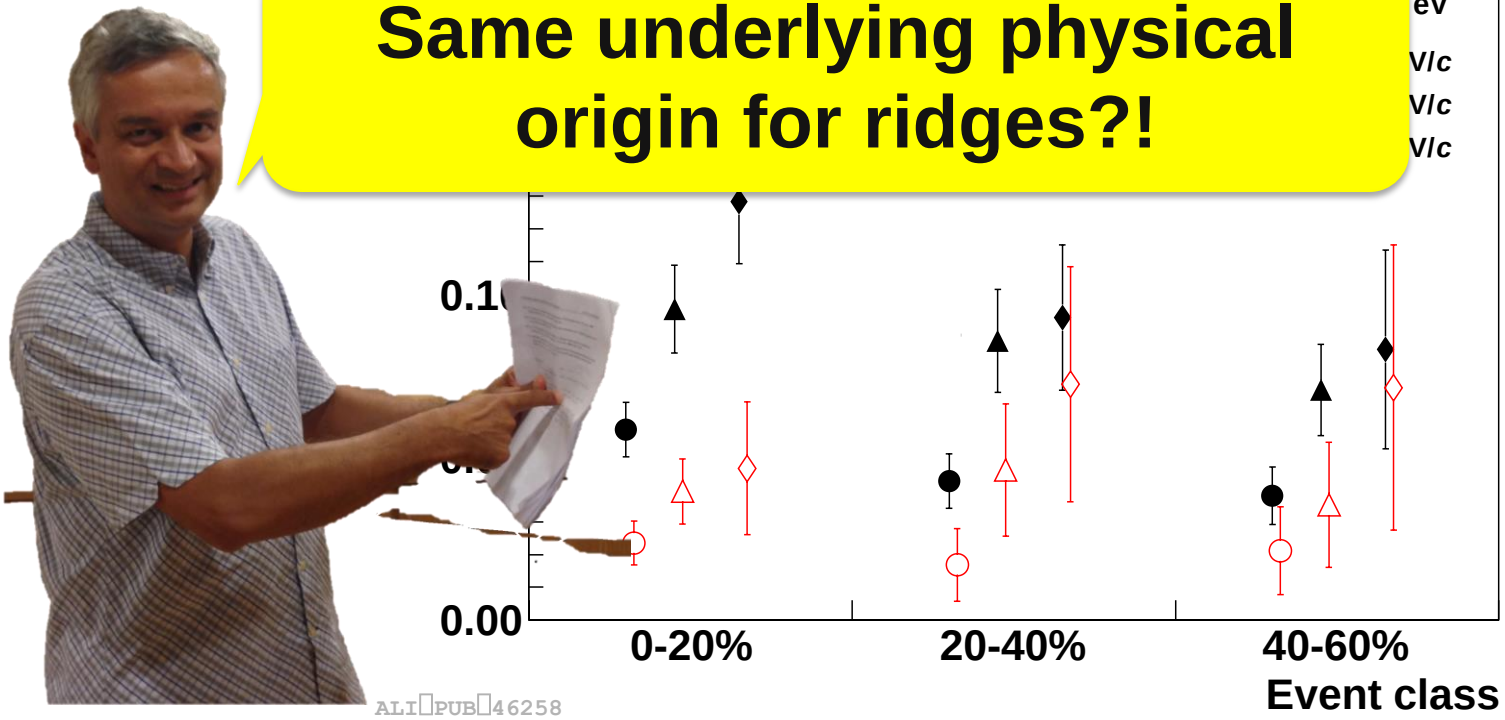
Strength of v_2 and v_3 Coefficient



- v_2
  - Strong dependence on p_T
  - Light dependence on centrality
- v_3
  - Light dependence on p_T within uncertainties

Summary

- Significant double ridge structure has been observed in high-multiplicity p-Pb collisions
  → Results confirmed by ATLAS, arXiv:1212.5198 [hep-ex].

Structure described qualitatively by hydrodynamic models!

Drops of strongly coupled medium?

→ Strongly implied by ATLAS & CMS

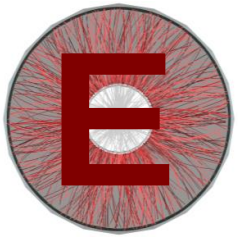
- … also described qualitatively by other models…

→ No clear answer from theory

→ p-Pb maybe not good as control measurement, but a lot more…

Thank you for your attention!

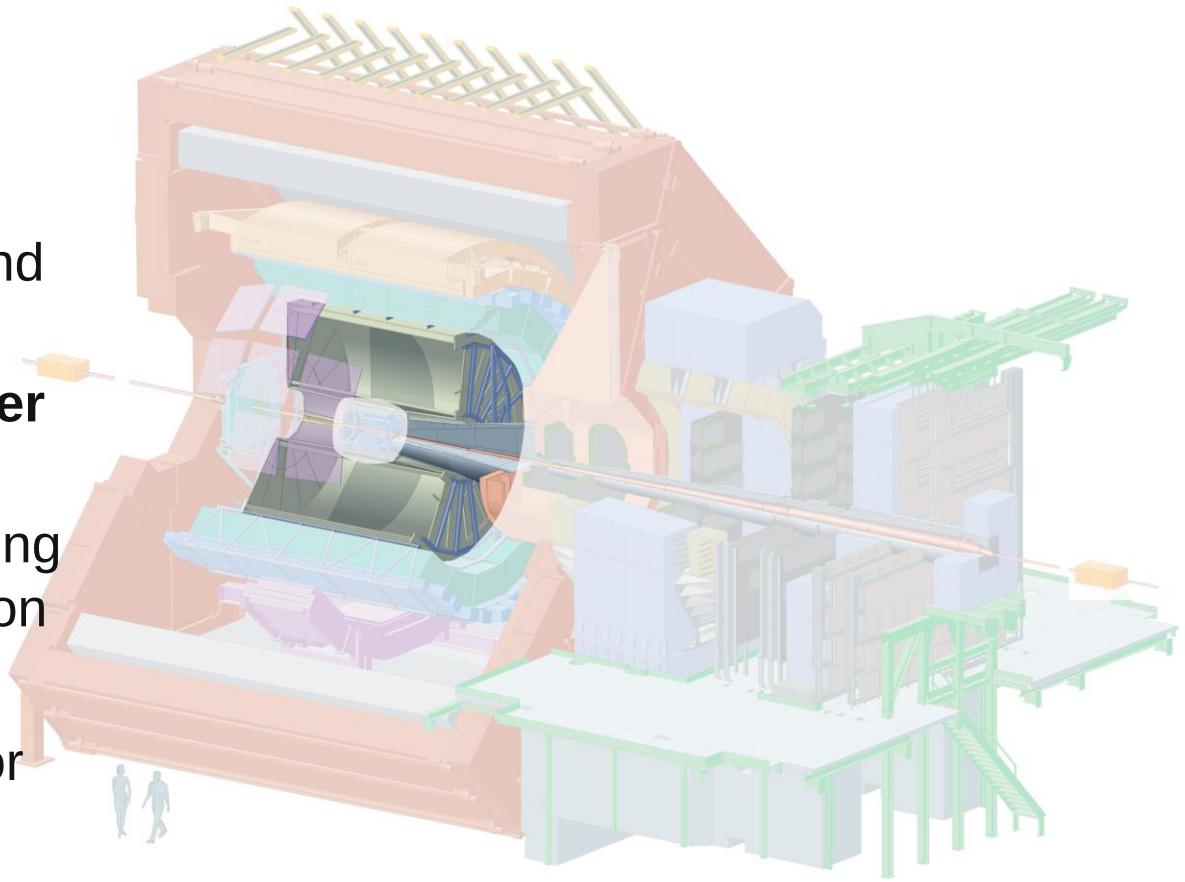
… and many thanks to Krishna!!!



Backup Slides

A Large Ion Collider Experiment

- **Inner Tracking System (ITS)**
  - Track reconstruction and particle identification
- **Time Projection Chamber (TPC)**
  - Main detector for tracking and particle identification
- **VZERO**
  - Scintillator tiles used for centrality estimation
- **Zero Degree Calorimeter**
  - Neutron calorimeters



Event classes

And track selection

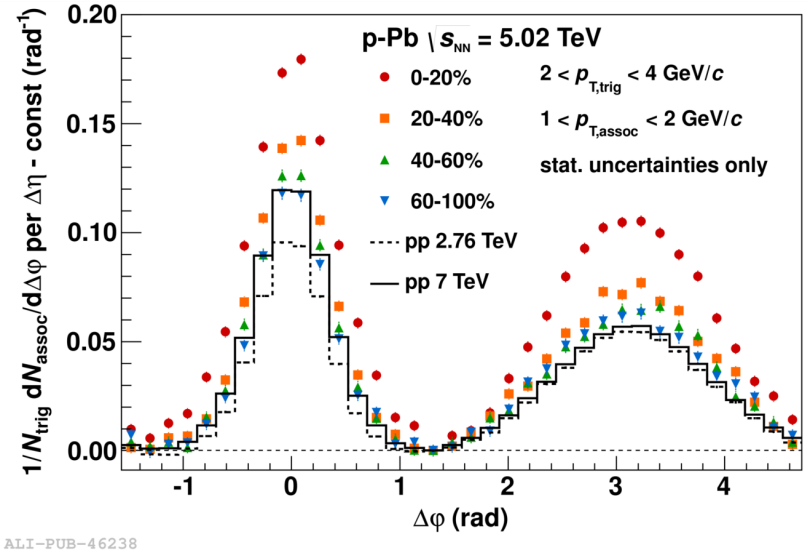
Event class	V0M range (a.u.)	$\langle dN_{ch}/d\eta \rangle|_{|\eta|<0.5}$ $p_T > 0$ GeV/c	$\langle N_{trk} \rangle|_{|\eta|<1.2}$ $p_T > 0.5$ GeV/c
60–100%	< 138	6.6 ± 0.2	6.4 ± 0.2
40–60%	138–216	16.2 ± 0.4	16.9 ± 0.6
20–40%	216–318	23.7 ± 0.5	26.1 ± 0.9
0–20%	> 318	34.9 ± 0.5	42.5 ± 1.5

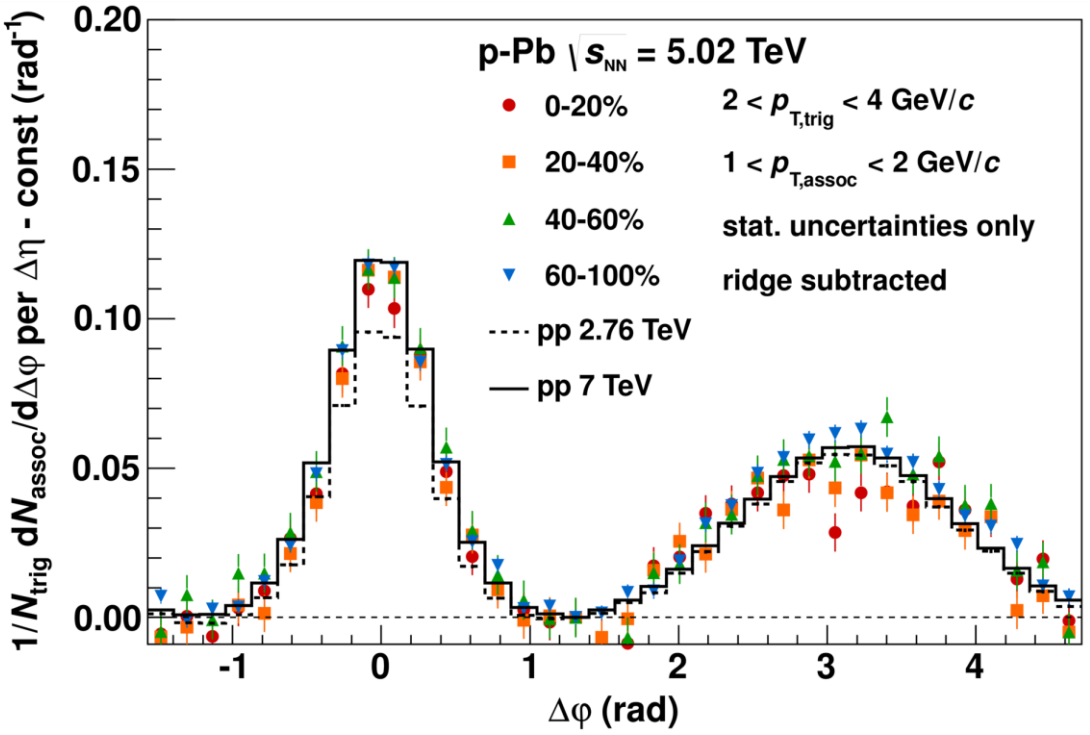
- Standard track selection criteria for tracks with $0.5 < p_T < 4$ GeV/c
- Tracks within fiducial region of $|\eta|<1.2$

Symmetric Ridge

Consistency Check

- Subtract symmetric double ridge component estimated in $1.2 < |\Delta\eta| < 1.8$

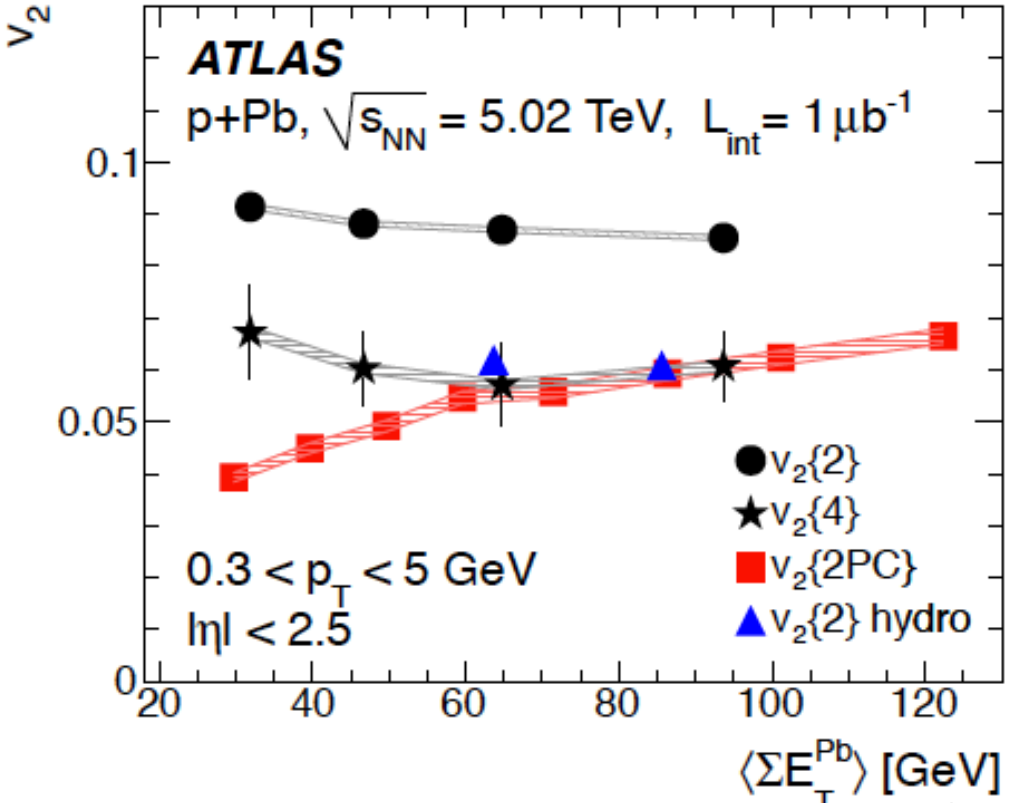




Recent results from ATLAS* (& CMS)

- Analysis from long p-Pb run in early 2013

→ Excellent agreement between data and hydrodynamic model



*arXiv:1303.2084v2