

Sergey Petrushanko

Lomonosov Moscow State University,
Skobeltsyn Institute of Nuclear Physics

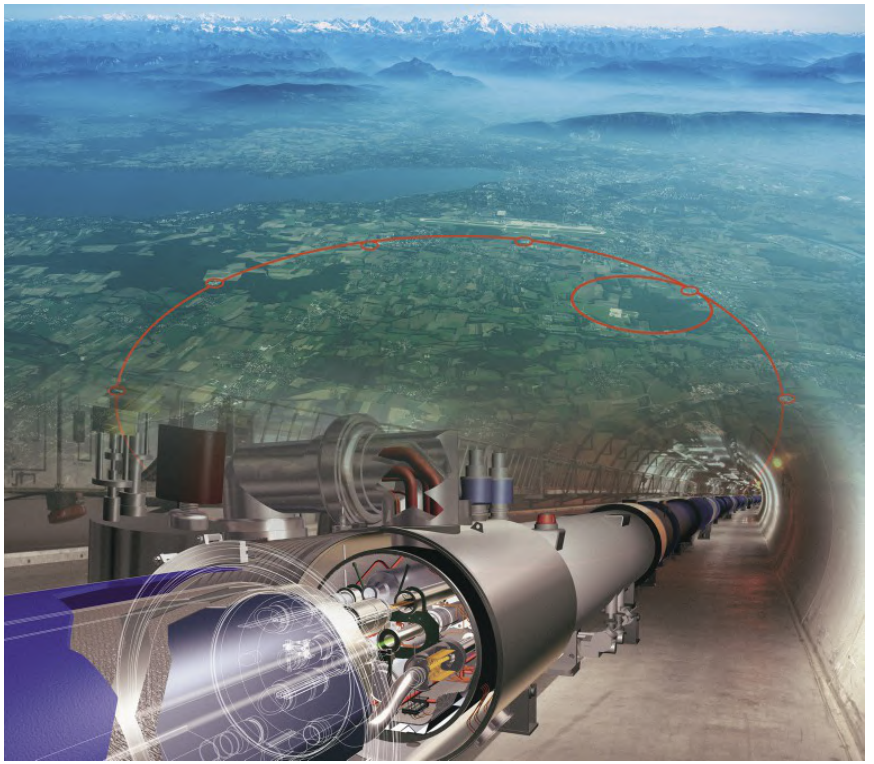
Recent results of the LHC experiments on heavy ion physics

ICPPA-2026: 8th International Conference on Particle Physics and Astrophysics

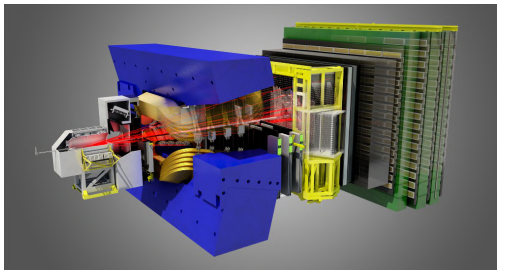
National Research Nuclear University "MEPhI"
Moscow, Russia
27 – 30 October 2026



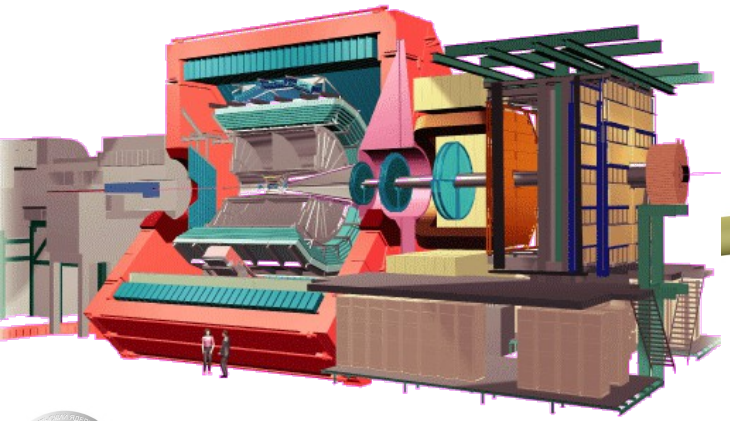
Heavy Ion Physics at the LHC



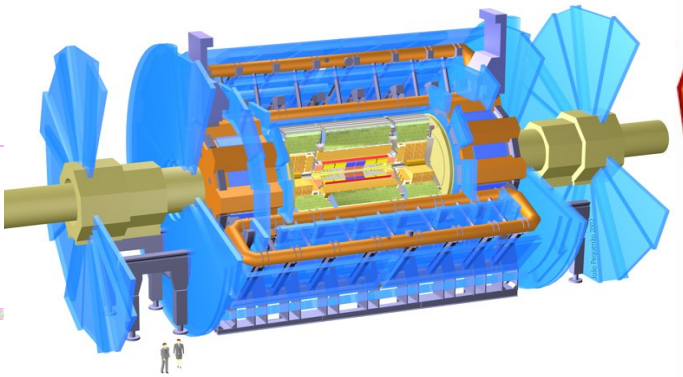
LHCb



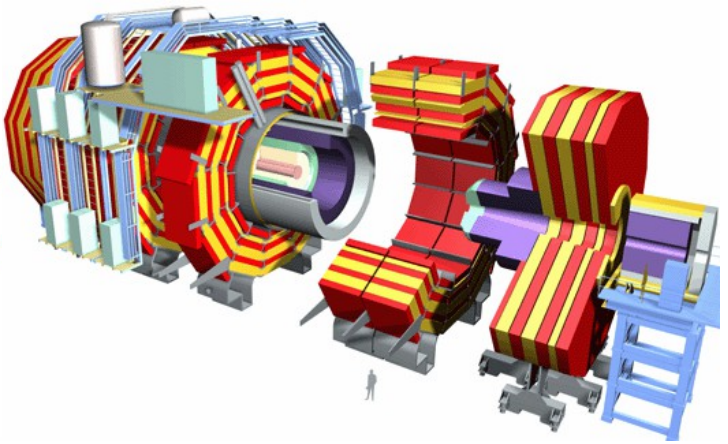
ALICE



ATLAS



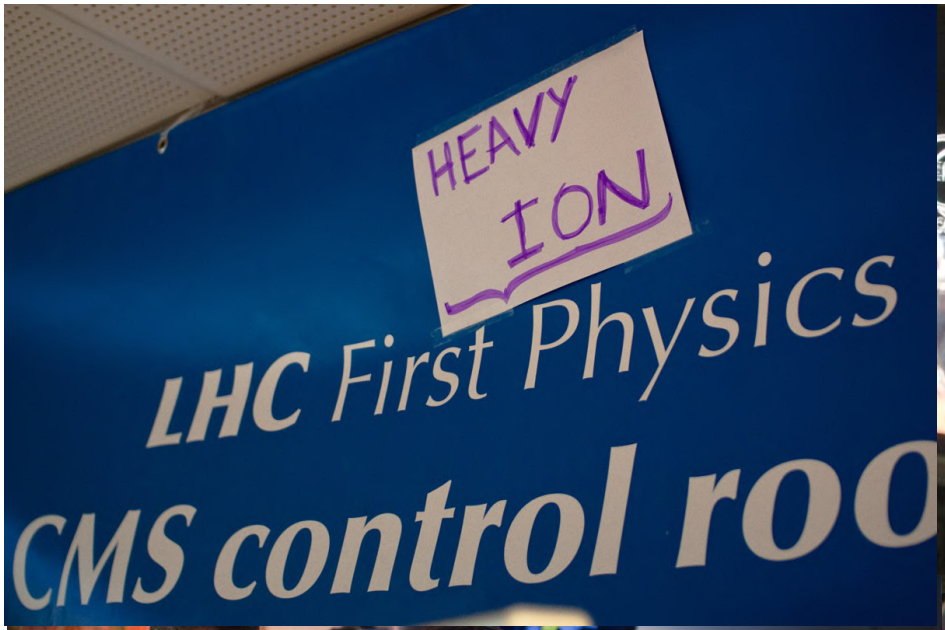
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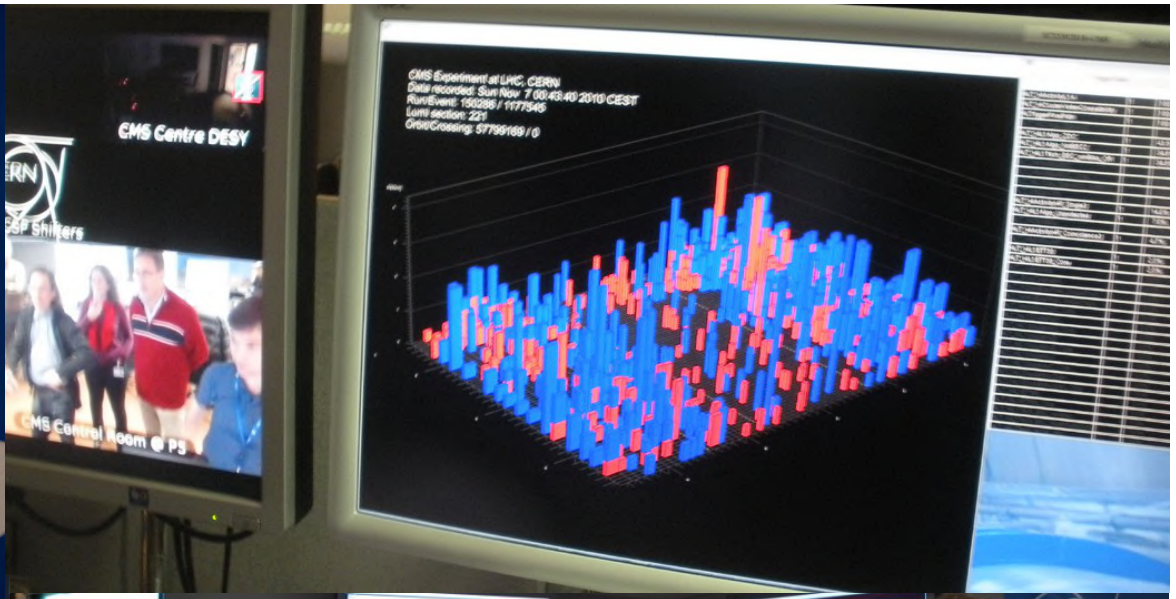




November 7, 2010 0:27. CMS Control Room

НИИЯФ МГУ











Heavy Ion Physics at the LHC
New Results

13th International Conference on Hard and Electromagnetic Probes of High-Energy Nuclear Collisions

21 – 26 June 2026, Vanderbilt University, USA

https://indico.cern.ch/event/1428985/





Antonio Palasciano **ALICE** Collaboration Overview
Riccardo Longo **ATLAS** Collaboration Overview
Soohwan Lee **CMS** Collaboration Overview
Óscar Boente García **LHCb** Collaboration Overview



Heavy Ion Physics at the LHC
New Results

XXXI International Conference on Ultra-relativistic Nucleus-Nucleus Collisions (Quark Matter 2025)
Apr 6 – 12, 2025, Goethe University Frankfurt, Frankfurt am Main

https://indico.cern.ch/event/1334113/

Light ion collisions at the LHC 2025
Dec 1 – 3, 2025, CERN, Geneva

https://indico.cern.ch/event/1597414/

The 22nd International Conference on Strangeness in Quark Matter (SQM2026)
March 22 – 27, 2026, University of California Los Angeles (UCLA)

https://indico.global/event/13943/



Alice

ALICE

INFN

ALICE overview

Antonio Palasciano*

on behalf of the ALICE Collaboration

*Politecnico & INFN, Bari

13TH INTERNATIONAL CONFERENCE ON HARD AND ELECTROMAGNETIC PROBES OF HIGH-ENERGY NUCLEAR COLLISIONS

HP2026





Alice

Exploring QCD at high energy densities

Antonio Palasciano
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QCD in extreme conditions: formation of a **Quark-Gluon Plasma (QGP)**
In the laboratory: heavy-ion collisions at high energies
A lot is understood, but some key questions remain.

Medium response and transport:

- How do heavy quarks interact with the QGP?
- How do partons lose energy in hot QCD matter?
- What are the transport properties of the medium?

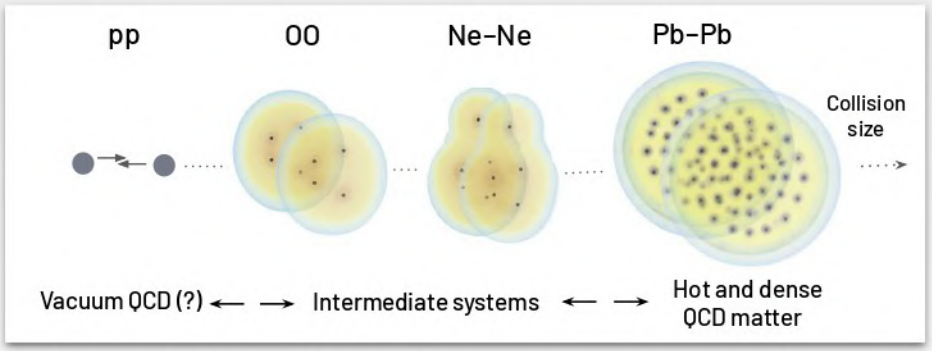
Direct access to space-time evolution:

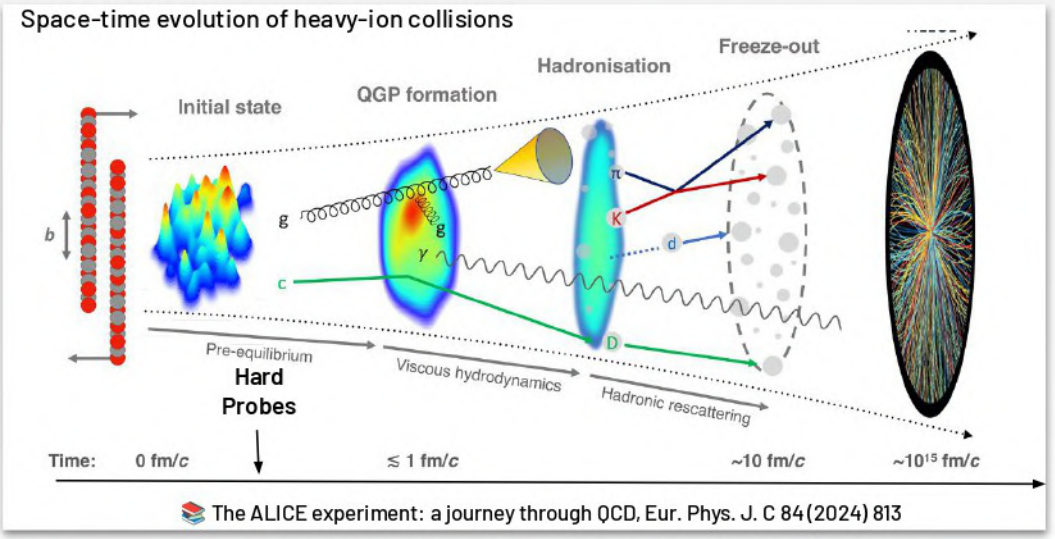
- What are the initial conditions of the system?
- Can we access the medium temperature?

The new frontier:

- can pp still be considered a vacuum baseline?
  → **collectivity already seen in high-mult pp and p-Pb, but no observation of parton energy loss**

- **What happens when we collide light ions?**





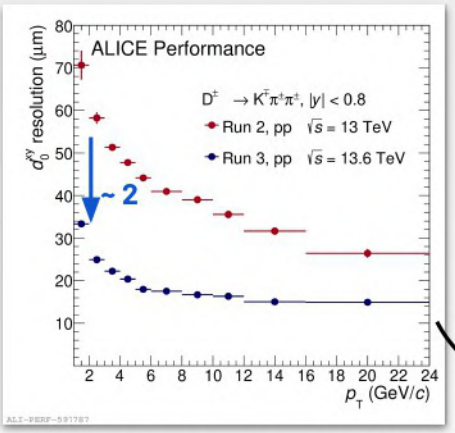


Alice

Entering the precision era of charm

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ALICE

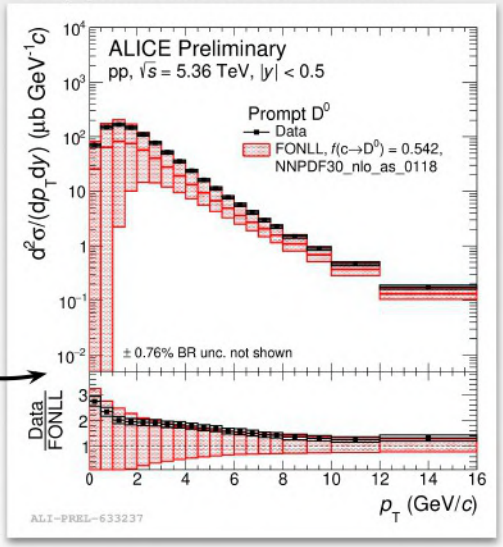


Run 3 reconstruction performance

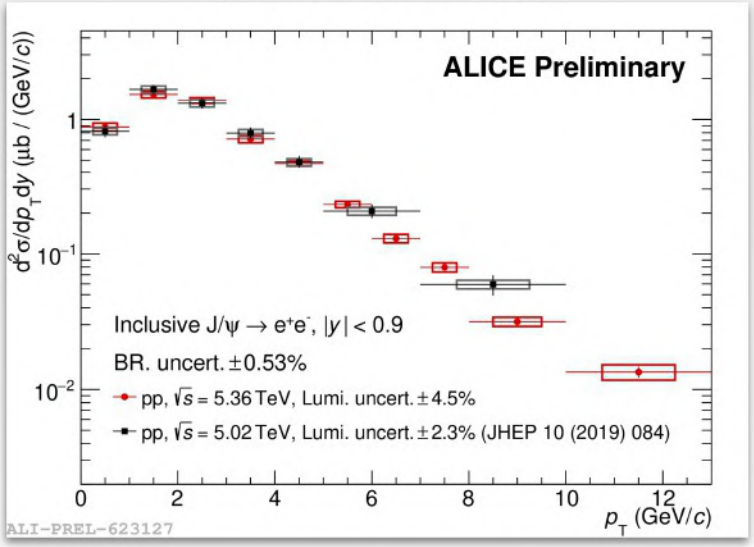
✓ x2 improvement in transverse impact-parameter resolution

✓ x5 improvement along the beam direction

D^0 production cross-section in pp collisions at $\sqrt{s}$ = 5.36 TeV



J/ψ production cross-section in pp collisions at midrapidity



The upgraded ALICE detector has opened the era of precision heavy-flavour measurements:

- Improved ITS2 vertexing → precise reconstruction of displaced heavy-flavour decays
- Excellent tracking and PID → precision charm and quarkonium measurements at low p_T
- Unprecedented Run 3 statistics → high-precision differential measurements

Liang Dong, Jinjoo Seo
HF&Quarkonia,
24/06 9:50 AM

Jianhui Zhu,
HF&Quarkonia,
24/06 3:20 PM

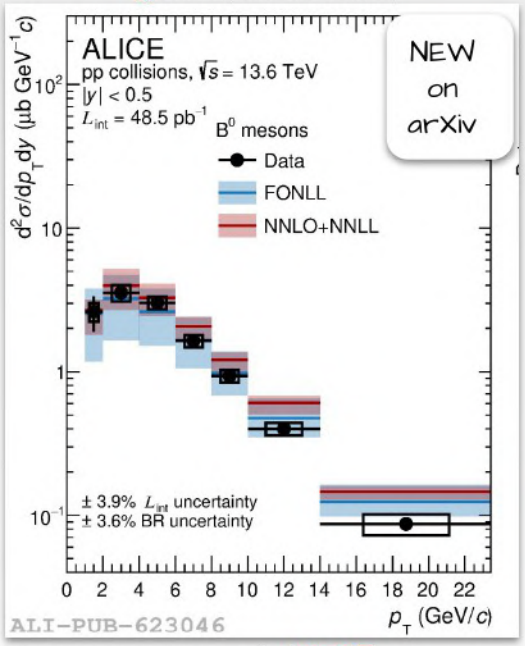


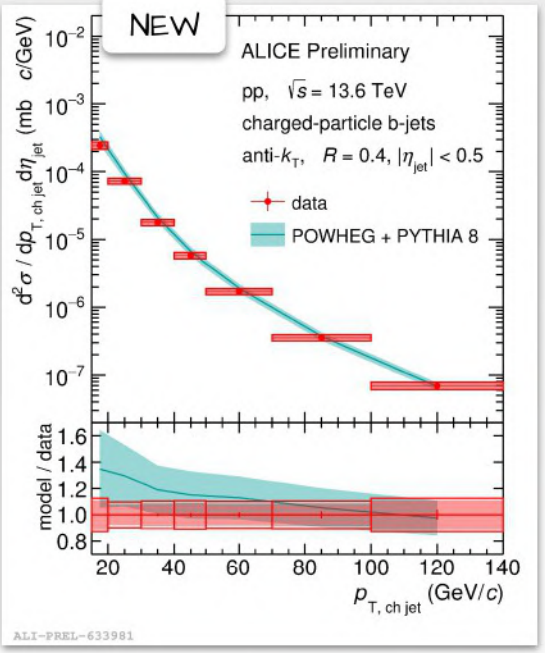
Alice

Beauty as a pQCD benchmark

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ALICE, arXiv:2603.18904





First B-meson measurements in ALICE:

- enabled by upgraded **pointing resolution, continuous readout** and **software trigger**
- providing unique access to beauty production at low p_T
- good compatibility with FONLL and NNLO pQCD predictions

From beauty hadrons to **b-jets**:

- improved b-jet identification with **Graph Neural Networks**
- paving the way toward b-jet quenching studies

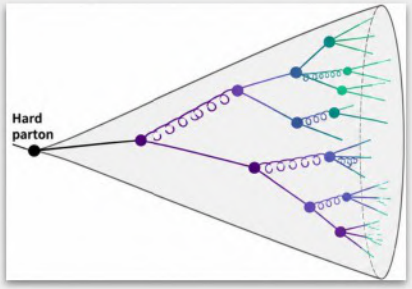
Hard Probes 2026 ALICE overview 7

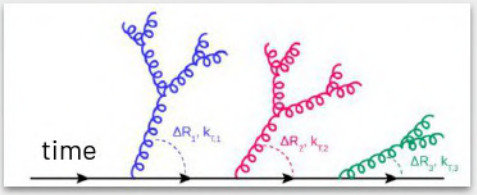


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Mapping the jet evolution with the Lund Plane

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Jets evolve from hard, wide-angle splittings to soft, collinear radiation
→ the Lund plane makes this evolution visible

The primary Lund jet plane (LJP)

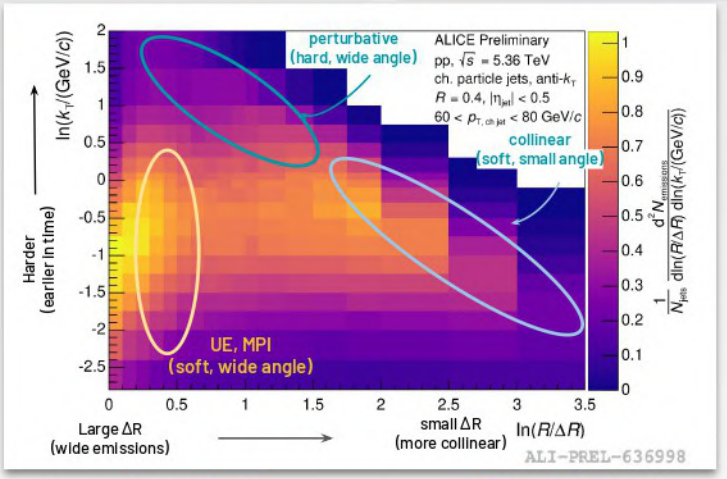
- maps emissions into coordinates:

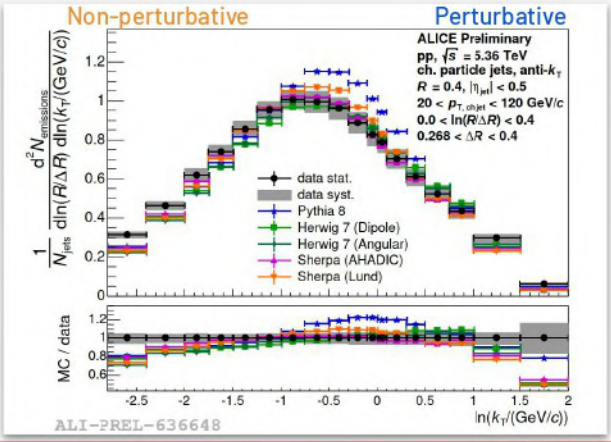
$$k_T = p_{T,\text{soft}}\,\Delta R_{ij} \quad \Delta R_{ij} = \sqrt{(\Delta\eta)^2 + (\Delta\phi)^2}$$

- is filled by iterative declustering on the leading branch

- Region-by-region projections provide strong model constraints

Zoltan Varga,
Jet, 23/06 2:20PM



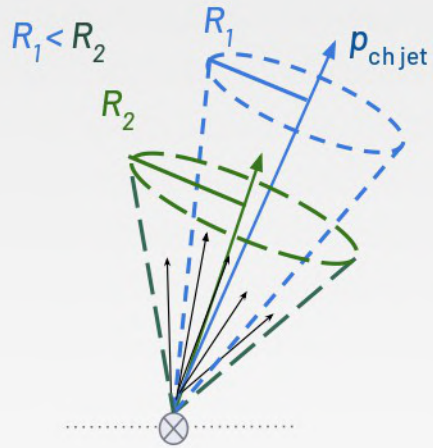


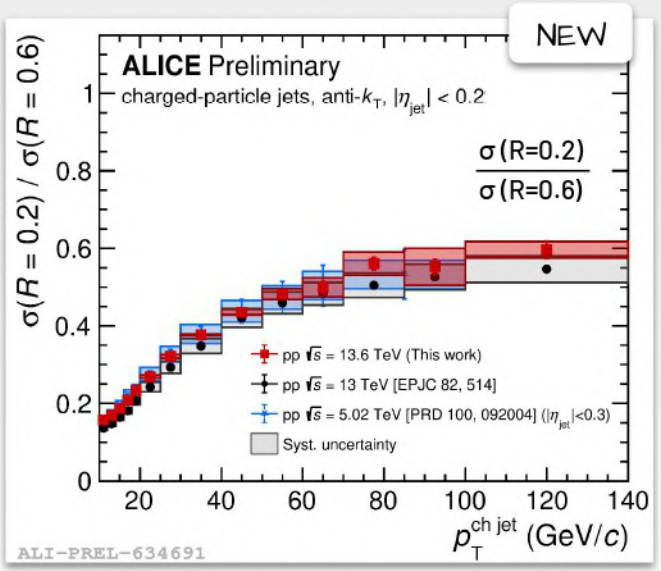


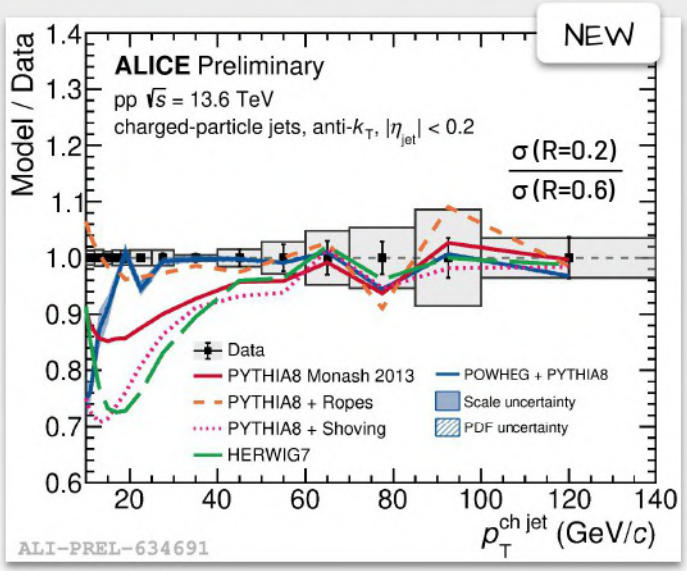
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Angular scales of jet production in pp

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The jet radius R sets the **angular scale** of the jet definition:

- small R: emphasizes the collimated jet core;
- large R: includes radiation at larger angles.

- Improved precision compared to Run 2
- POWHEG+PYTHIA8 provides good description for $p_T > 20$ GeV/c
- PYTHIA8+Ropes agrees with data over the full p_T range
- At low-p_T, non-perturbative effects dominate, leading to larger differences among generators.



Alice

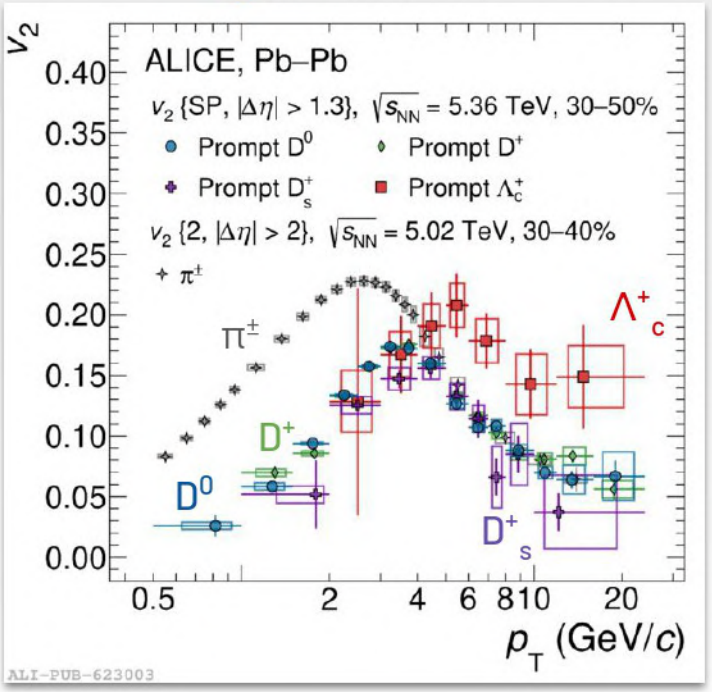
Charm hadron flow

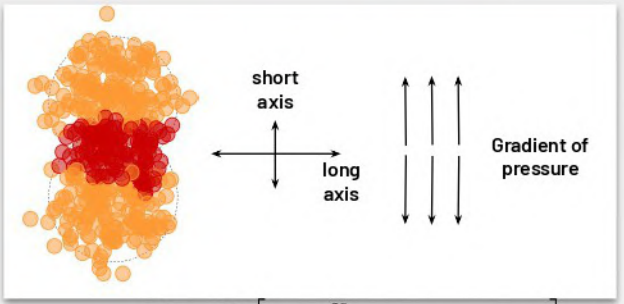
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ALICE

✓ Collectivity

arXiv:2603.18966





$$\frac{dN}{d\phi} = \frac{N_0}{2\pi}\left[1 + 2\sum_{n=1}^{\infty} v_n \cos\left(n(\phi - \Psi_n)\right)\right]$$

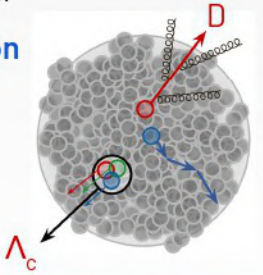
All D-meson species show positive v_2:

- Charm-quarks participate in the system collective motion

First measurement of $v_2(\Lambda_c)$ in Pb–Pb:

- Evidence of **baryon-meson splitting** in HF

→ **charm hadronisation by recombination**



M. F. Torres Cabrera, HF&Quarkonia, 23/06 2:20PM



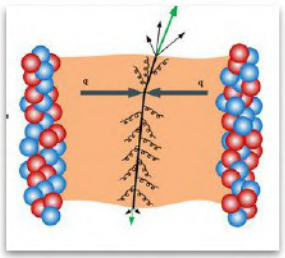
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Jet suppression in Pb–Pb collisions

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✓Energy Loss

Jet suppression as a clear signature of parton energy loss in the medium



Nuclear modification factor

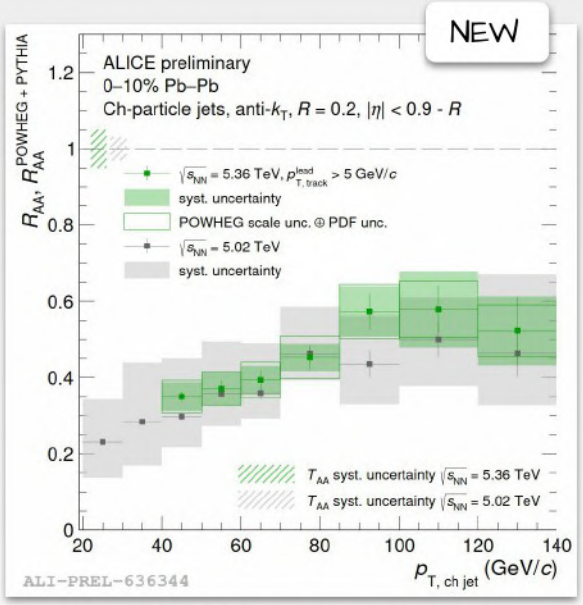
$$R_{\mathrm{AA}}^{\mathrm{ch\,jet}} = \frac{1}{\langle N_{\mathrm{coll}} \rangle} \frac{d^2 N_{\mathrm{AA}}^{\mathrm{ch\,jet}}/dp_{\mathrm{T}}}{d^2 N_{\mathrm{pp}}^{\mathrm{ch\,jet}}/dp_{\mathrm{T}}}.$$

Central-to-Peripheral Ratio

$$R_{\mathrm{CP}} = \frac{\langle N_{\mathrm{coll}}^{\mathrm{P}} \rangle}{\langle N_{\mathrm{coll}}^{\mathrm{C}} \rangle} \frac{d^2 N_{\mathrm{jets}}^{\mathrm{C}}/dp_T\, d\eta}{d^2 N_{\mathrm{jets}}^{\mathrm{P}}/dp_T\, d\eta}$$

Aimeric Landou, Jet, 24/06 9:50 AM

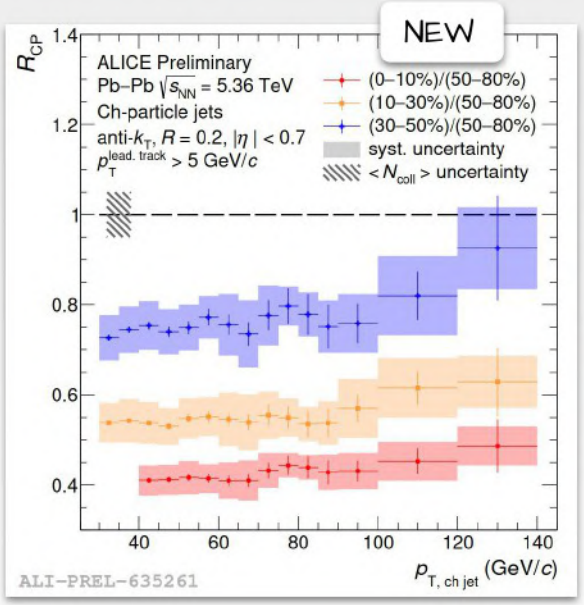
NEW



* $R_{\mathrm{AA}}^{\mathrm{POWHEG+PYTHIA}}$, obtained using POWHEG+PYTHIA predictions as the pp baseline

- First jet measurement with Run 3 Pb–Pb data

NEW



- Highlights evolution of jet modification as a function of centrality

Alice

Jet quenching through leading subjets

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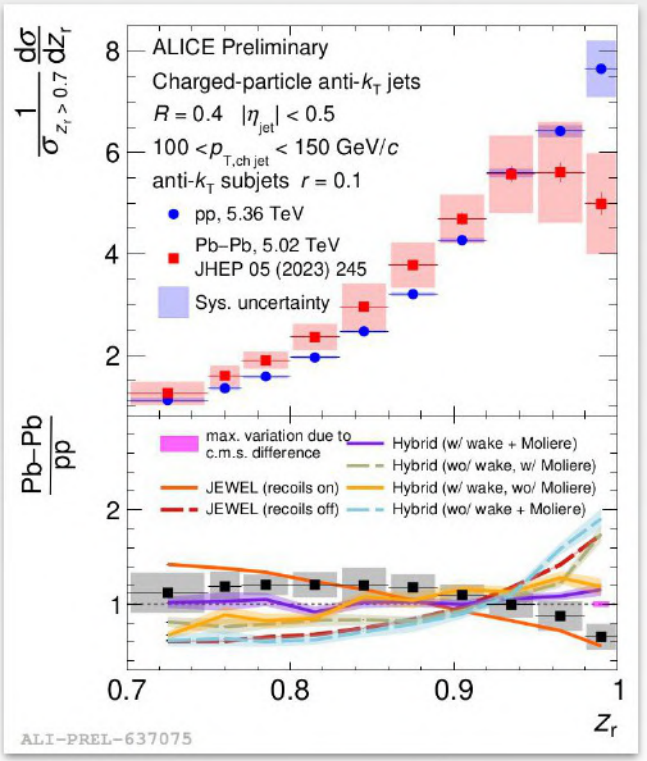
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✓Energy Loss



Fraction of jet momentum carried by the hardest inner part of the jet

$$z_r = \frac{p_{T,\text{leading subjet}}}{p_{T,\text{jet}}}$$



- Improved precision with updated pp reference using Run 3 data
- Jets are dominated by a single hard core
- In Pb–Pb, the distribution slightly shifts toward lower values of z_r

Medium response or large-angle transport?

- Among the models only JEWEL (recoils on) qualitatively describes the data in the full range.

→ **hint of medium response**
→ **more precise measurements are needed**

Luisa Bergmann
Jet, 23/06, 15:50 PM

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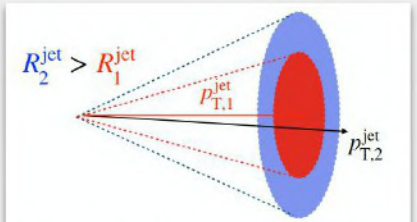
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Quantifying jet energy redistribution

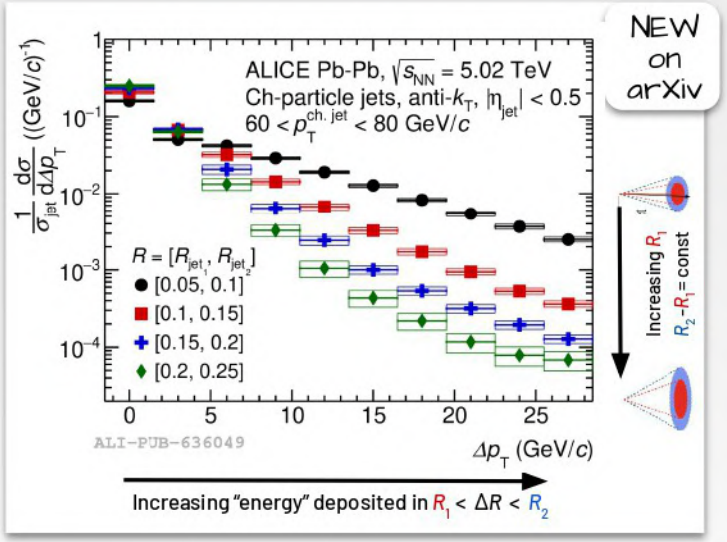
Antonio Palasciano
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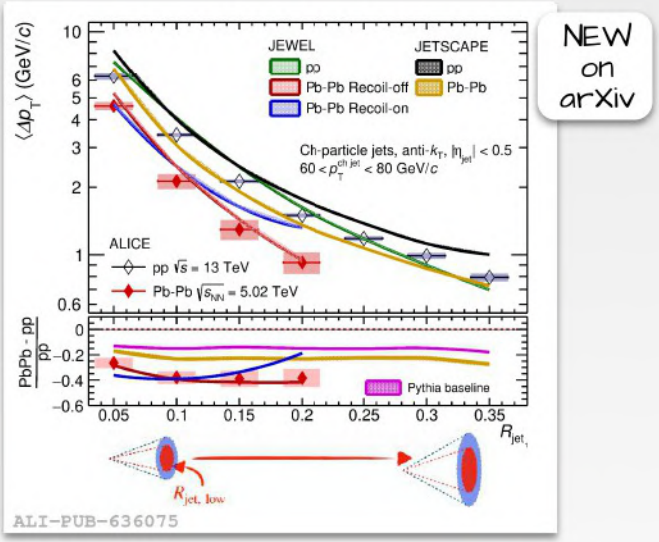
ALICE

✓Energy Loss



ALICE, arXiv:2606.20061





- Jets, also in Pb–Pb, are highly collimated:
  - → the jet is concentrated around a hard core
  - → $\langle \Delta p_T \rangle$ decreases rapidly with R
- Pb–Pb jets contain less energy in ΔR than pp
  - a) out-of-cone redistribution of particles
  - b) narrowing of surviving jet cores
- Both JEWEL recoil configurations are compatible with the data within uncertainties

Preeti D. Lesser,
Jet, 24/06 3:20 PM



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Probing early magnetic fields with HF hadrons

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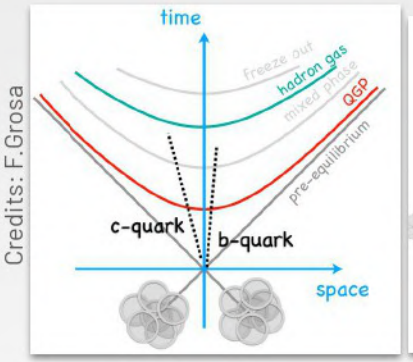
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✓Initial Stages

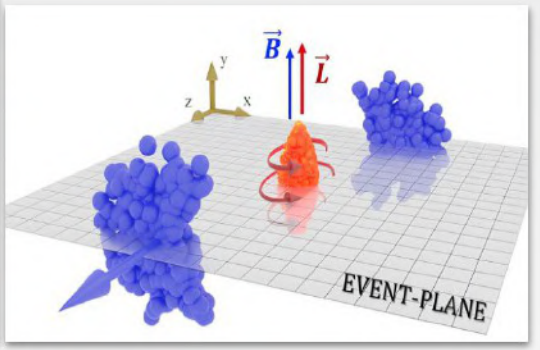
HF quarks produced earlier than the medium:

→ sensitive to vorticity and magnetic field

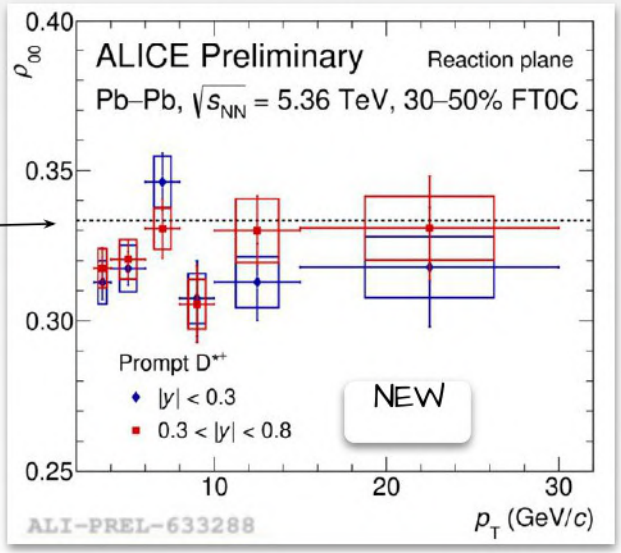
→ spin polarisation transferred to vector mesons during hadronisation



Credits: F.Grosa



$\rho_{00} = 1/3$ no spin alignment



Within current uncertainties:
D^{*+} : no evidence of spin alignment

Centrality- and rapidity-differential measurements can disentangle the effects of the collision **geometry**, angular momentum and magnetic fields.

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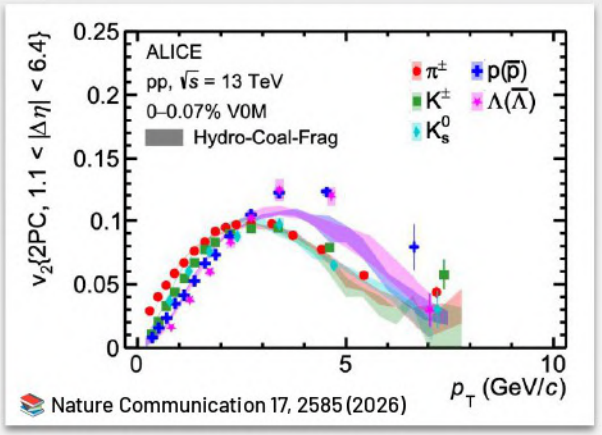
Alice

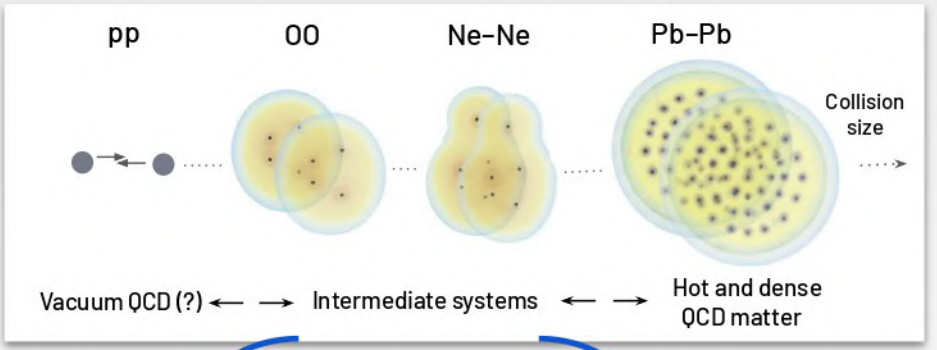
Evidences of collectivity across systems

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ALICE

✓ Collectivity

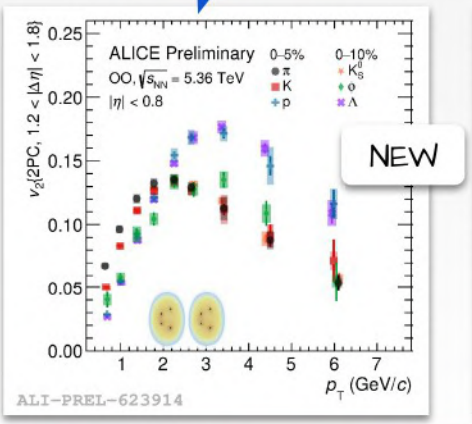


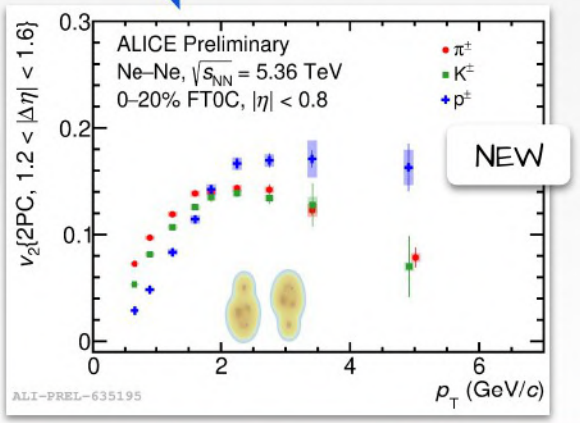


- High-mult pp: evidence of partonic collective effects

Common features:

- mass ordering at low-p_T
  → collective expansion of the medium
- baryon-to-meson splitting at intermediate p_T
  → driven by quark constituents





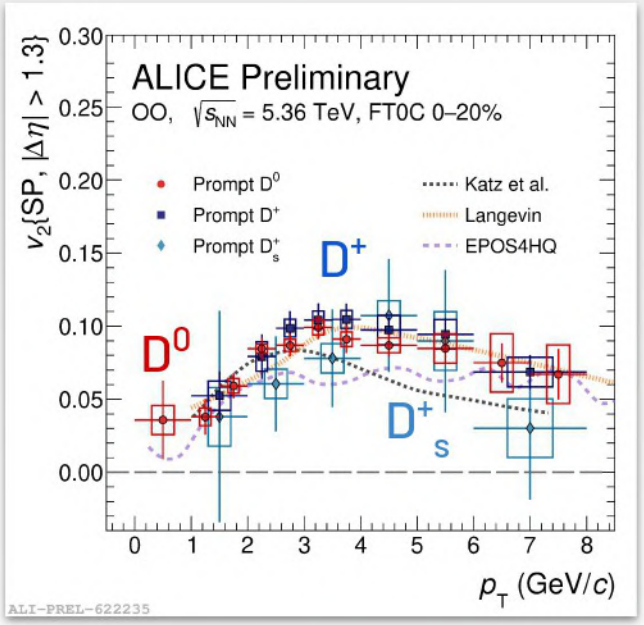


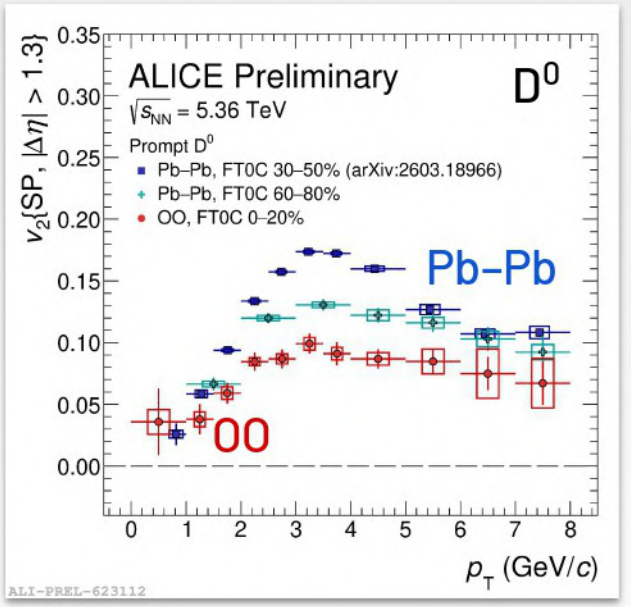
Alice

Charm collectivity in OO collisions

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✓ Collectivity





A **positive v_2** is measured for all the **D meson species** also in **OO**:
- good agreement with **models including QGP formation** in intermediate systems

Sizable differences between **peripheral Pb–Pb** and **central OO**
- dN/dy in central OO ≈ peripheral Pb–Pb but **OO has smaller eccentricity**

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Alice

$R_{OO}(\pi^0)$

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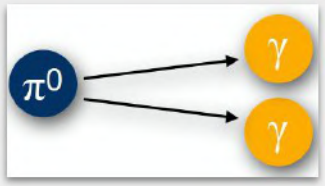
ALICE

✔ Energy loss

Nicolas Strangmann, Small&Intermediate, 23/06 09:30 AM

Nuclear modification factor

$$R_{AA} = \frac{1}{A^2}\frac{\sigma_{AA}}{\sigma_{pp}}$$



The $R_{OO}(\pi^0)$ is measured exploiting the **full OO sample** collected in 2025

→ **a suppression of 9σ is measured with respect to unity**

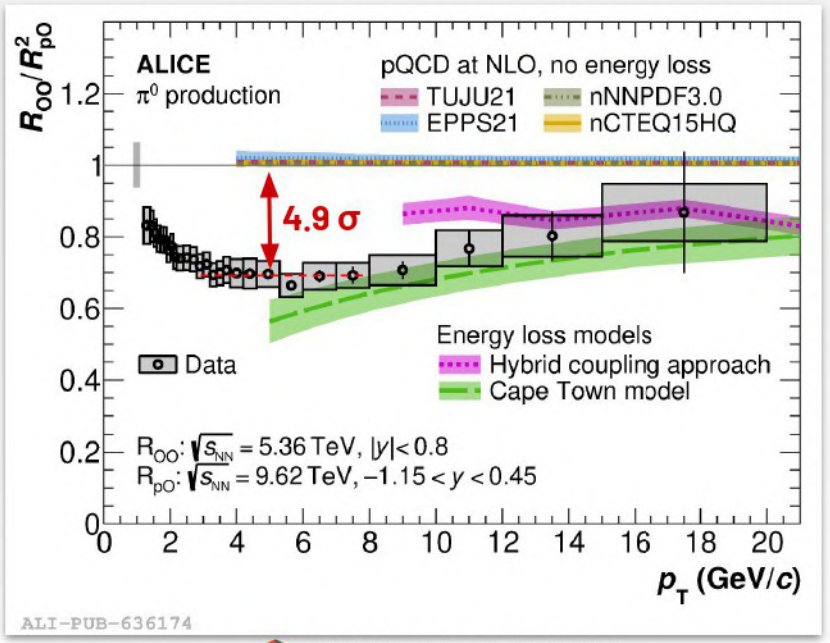
The **$R_{OO}(\pi^0)$ shows similar shape to the R_{AA} of heavy-ion collisions**

Is it possible to exclude Cold Nuclear Matter effects?

$$R_{pO} = \frac{1}{16}\frac{\sigma_{pO}}{\sigma_{pp}} \longrightarrow R_{OO}/R_{pO}^2$$

No CNM effects:
Direct probe for Energy loss

✓ 4.9σ evidence for energy loss in oxygen-oxygen collisions



ALICE, arxiv:2606.19967

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Alice

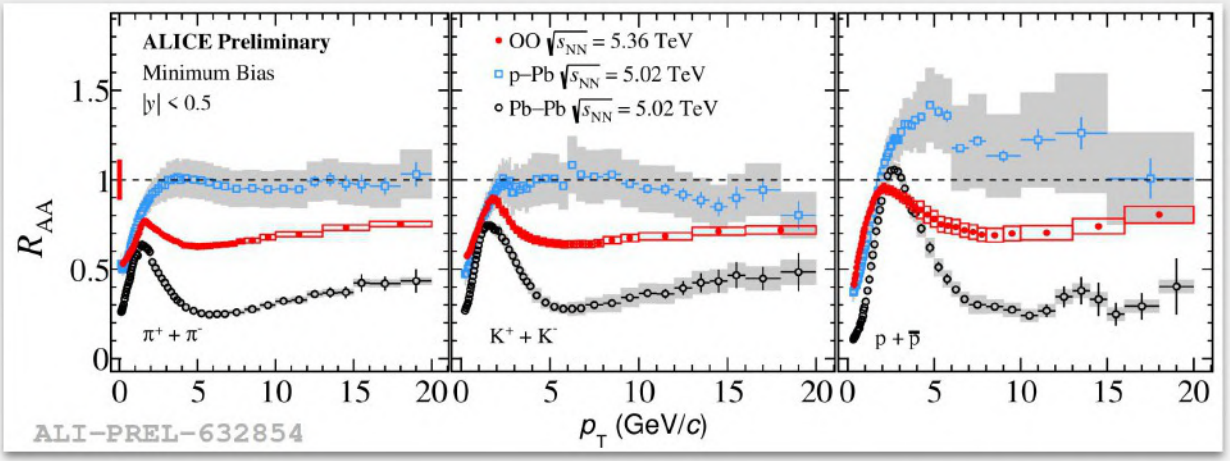
R_{OO} of identified hadrons

Antonio Palasciano
antonio.palasciano@poliba.it

? Energy loss

Nuclear modification factor

$$R_{AA} = \frac{1}{A^2}\frac{\sigma_{AA}}{\sigma_{pp}}$$

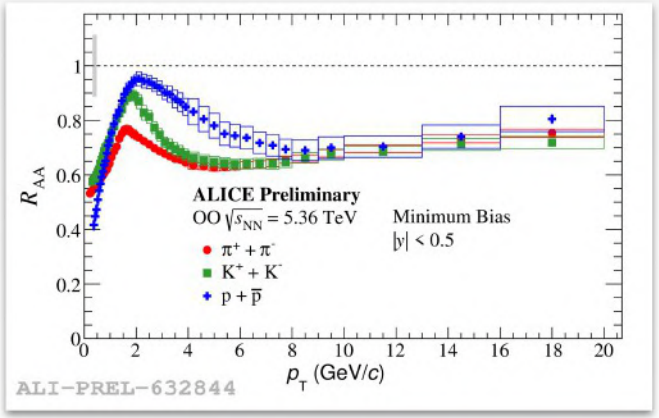


Similarly, the R_{00} has been measured for light-flavour charged particles:

- an increase at low p_T, reflecting the interplay of several effects
- an increasing trend starting at intermediate p_T due to reduced relative energy loss

The hierarchy in the particles species can be ascribed to:

- radial flow + CNM + hadronisation by recombination + Parton energy loss



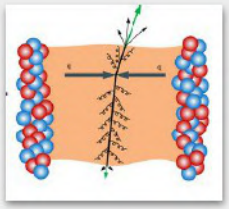


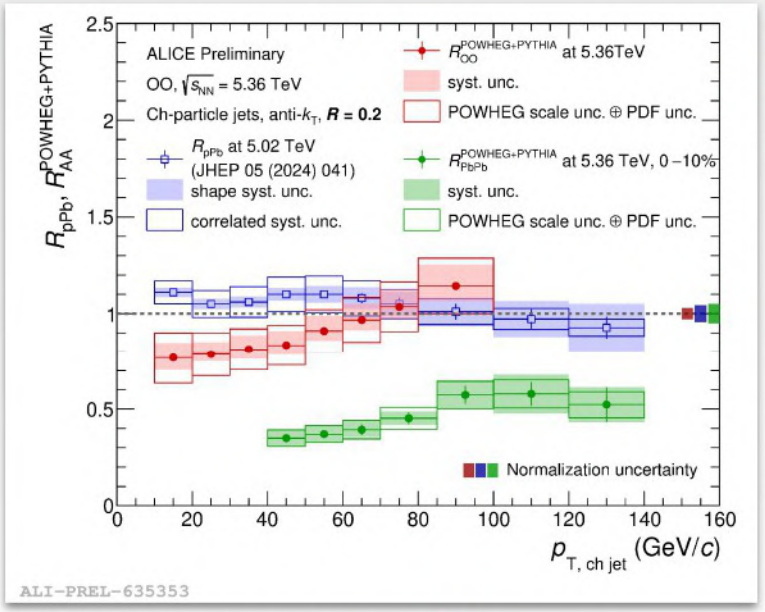
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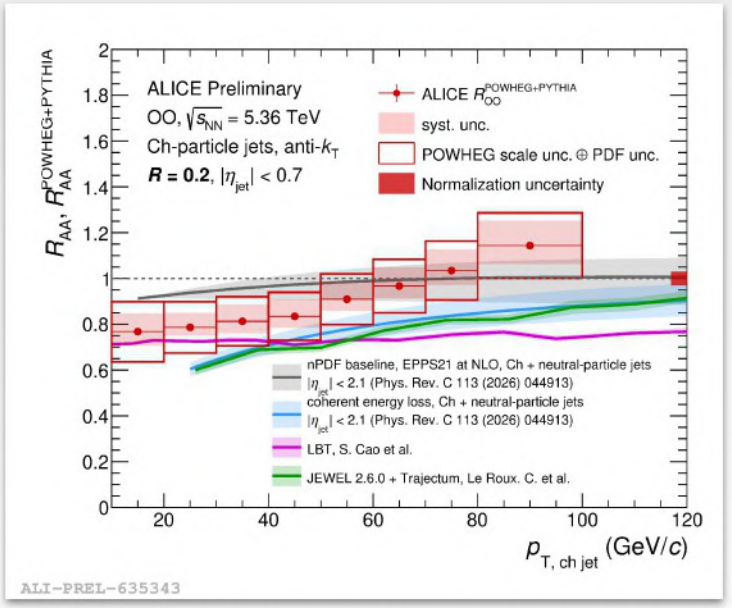
R_{OO} of inclusive jets

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? Energy loss







- Hint of suppression at low p_T in OO
  → indications of nuclear modification factor hierarchy :

$$R_{AA}(\text{Pb–Pb}) < R_{OO} < R_{pPb}(\approx 1)$$

- Current uncertainties do not allow a clear discrimination between different energy loss scenarios

Aimeric Landou, Jets, 24/06 9:50 AM

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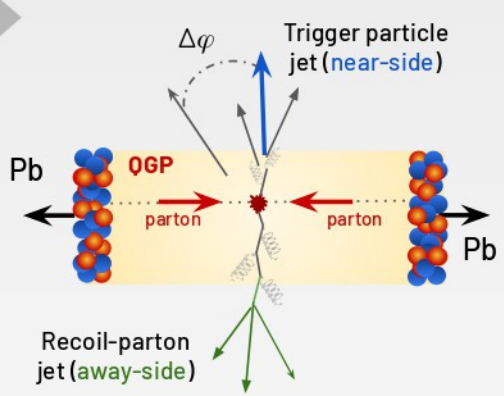
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High-p_T hadron suppression in OO

Antonio Palasciano
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ALICE

? Energy loss



Angular correlation peak yields (multiplicity of particles) retain sensitiveness to:

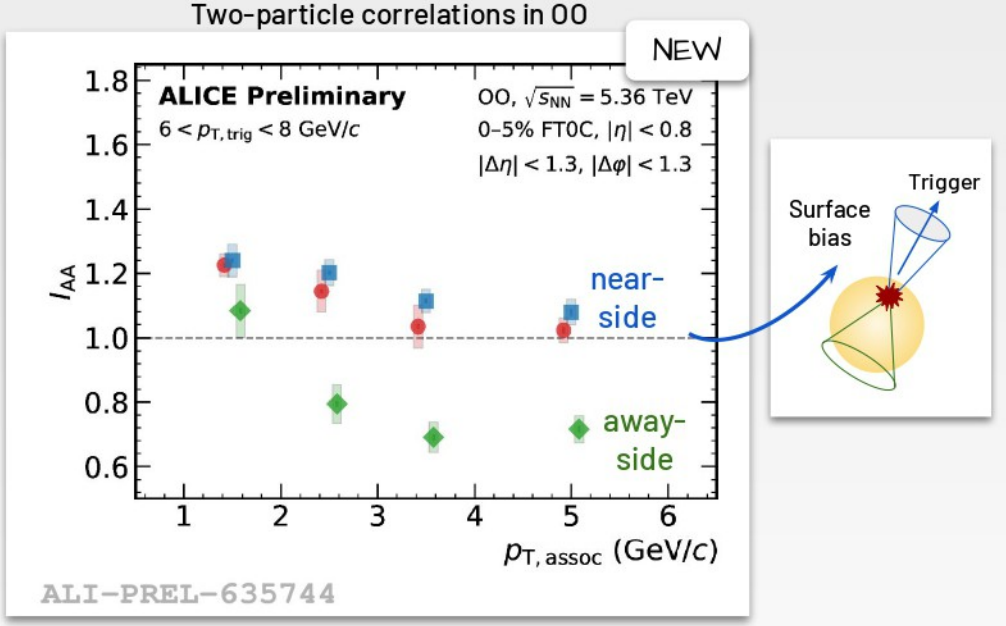
→ hard-scattering parton fragmentation

→ **energy loss** in the medium

$$I_{AA} = \frac{Yield_{\mathrm{AA}}}{Yield_{\mathrm{pp}}}$$

→ Probing **sequential suppression of high-p_T particles** in jets

Two-particle correlations in OO



- decreasing recoil-jet I_{AA} with associated particle p_T

→ **indication of energy loss**

Neelkamal Mallick, Joonsuk Bae
Small&Int.Sys., 23/06 2:40 PM



Alice

Nuclear modification factor in OO for quarkonia

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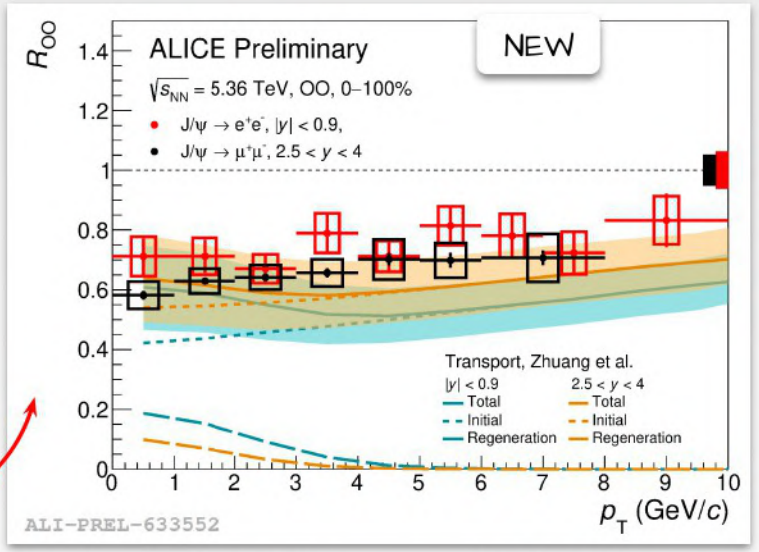
? Quarkonia suppression

Nuclear modification factor

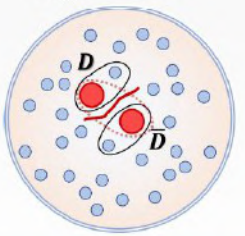
$$R_{AA} = \frac{1}{A^2}\frac{\sigma_{AA}}{\sigma_{pp}}$$

R_{po}:
- exhibits a **moderate suppression at low p_T**
- approaches unity at high p_T
- good compatibility with energy-loss only predictions (no nPDF included)

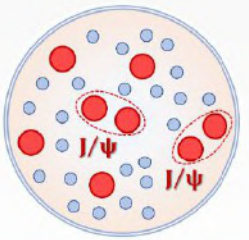
R_{oo}:
- Indication of suppression in the full p_T range
- Data are compatible with transport models including QGP



Quarkonium suppression



Quarkonium regeneration



Liang Dong, Jinjoo Seo
HF&Quarkonia,
24/06 9:50 AM

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Alice

Nuclear modification factor in OO for quarkonia

Antonio Palasciano
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ALICE

? Quarkonia suppression

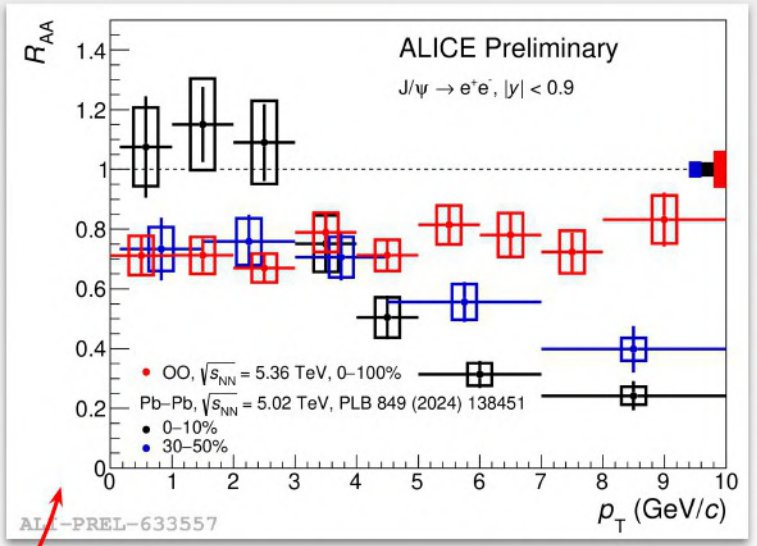
Nuclear modification factor

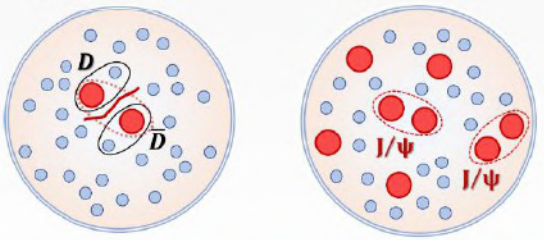
$$R_{AA} = \frac{1}{A^2}\frac{\sigma_{AA}}{\sigma_{pp}}$$

R_{pO}:
- exhibits a **moderate suppression at low p_T**
- approaches unity at high p_T
- good compatibility with energy-loss only predictions (no nPDF included)

R_{OO}:
- Indication of suppression in the full p_T range
- Data are compatible with transport models including QGP

R_{PbPb}:
- stronger high-p_T suppression and stronger regeneration at low-p_T





Liang Dong, Jinjoo Seo
HF&Quarkonia,
24/06 9:50 AM

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Alice

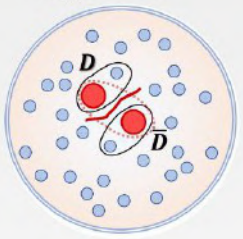
Excited quarkonium production in OO collisions

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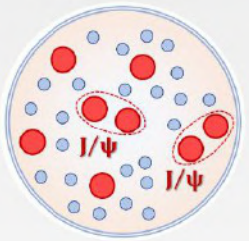
ALICE

? Quarkonia suppression

Quarkonium suppression



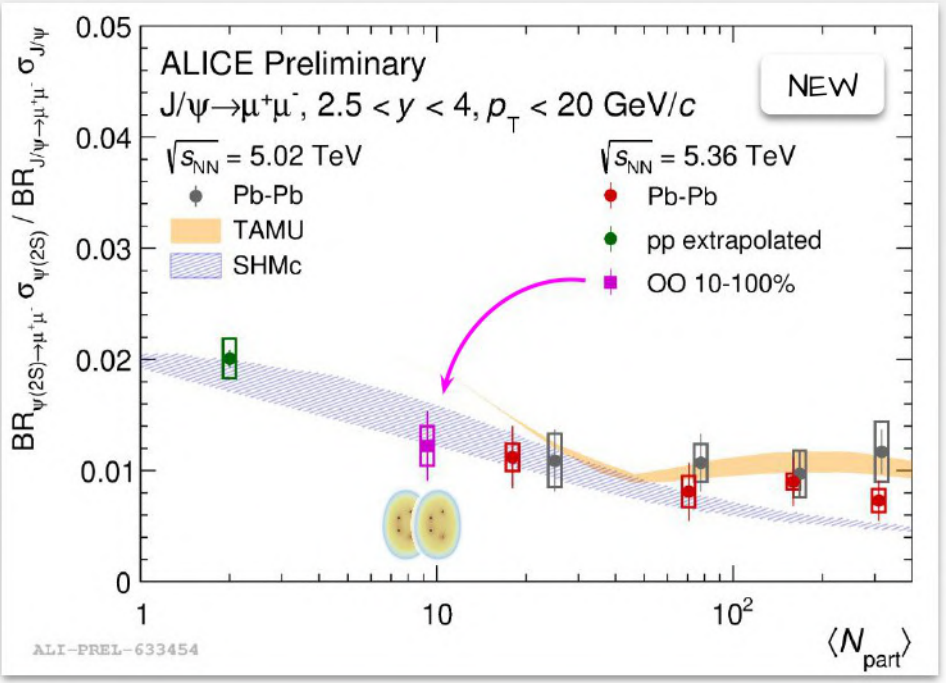
Quarkonium regeneration



Sara Garetti, HF&Quarkonia, 24/06 11:40 AM

Excited quarkonium states are expected to be more suppressed in a color-dense medium:

- lower binding energies compared to the ground state
- strong interplay between suppression and regeneration





Atlas


ATLAS Highlights for
HP2026
Riccardo Longo
On behalf of the ATLAS Collaboration
22/06/2026
Hard Probes 2026 - Nashville (TS)
MUR
INFN
TORINO
UNIVERSITÀ
DI TORINO

ATLAS Heavy Ion Data Summary

This talk

Run 1

System	$\sqrt{s_{NN}}$ [TeV]	L_{int}
Pb+Pb	2.76	0.15 nb^{-1}
p+p	2.76	4 pb^{-1}
p+Pb	5.02	29 nb^{-1}

Run 2

System	$\sqrt{s_{NN}}$ [TeV]	L_{int}
Pb+Pb	5.02	2.25 nb^{-1}
p+p	5.02	298 pb^{-1}
p+Pb	5.02	0.5 nb^{-1}
p+Pb	8.16	165 nb^{-1}
Xe+Xe	5.44	3 μb^{-1}

Run 3

System	$\sqrt{s_{NN}}$ [TeV]	L_{int}
Pb+Pb	5.36	9 nb^{-1}
p+p	5.36	465 pb^{-1}
p+O	9.62	11 nb^{-1}
O+O	5.36	8 nb^{-1}
Ne+Ne	5.36	1 nb^{-1}



ATLAS HI group @ the light-ion run

Run 3 brought a ~4 increase in statistics in Pb+Pb and new unique light-ion data samples

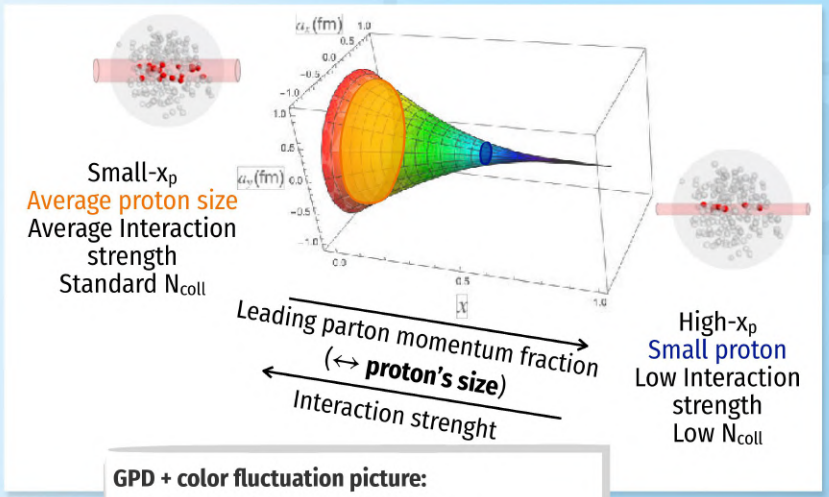


Color fluctuations & event geometry in pA

See talk by R. Jirasek **Tue, 14:00**

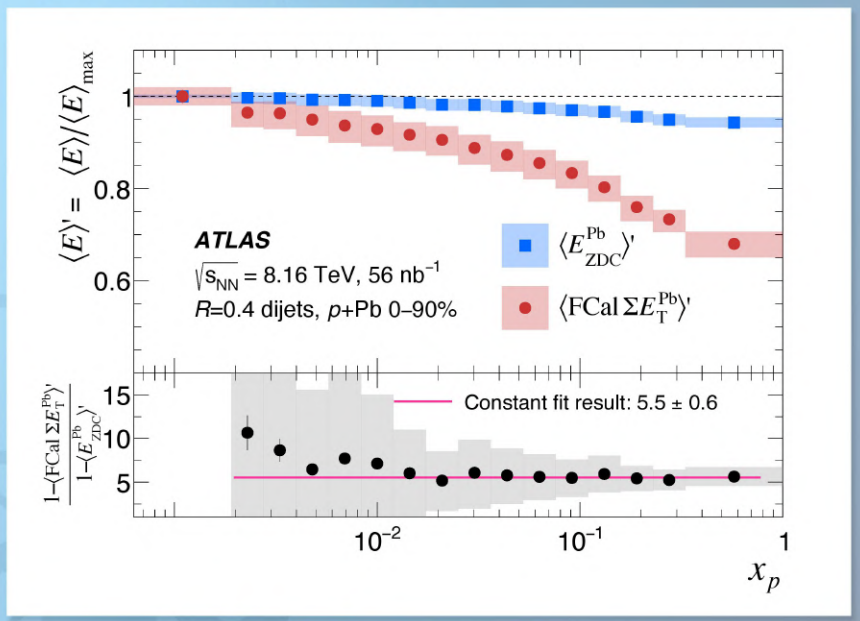
Final for HP26

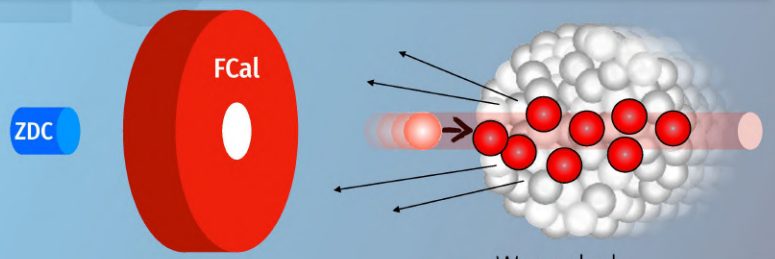
- Use dijets to directly check ***event geometry estimators*** for x_p***-driven biases*** in hard scatterings in p+A
- The analysis leverages the **ZDC** capabilities to characterize the **nuclear breakup in p+Pb**
- **Compared to E_T** in the **FCal**, the **ZDC Energy ~5.5 times less sensitive to hard scattering** kinematics (but still sensitive to it)



GPD + color fluctuation picture:
Alvioli et al., PRD 98 (2018) 071502
Brodsky et al., MDPI Physics 4 (2022) 2, 633-646

PLB 877 (2026) 140440





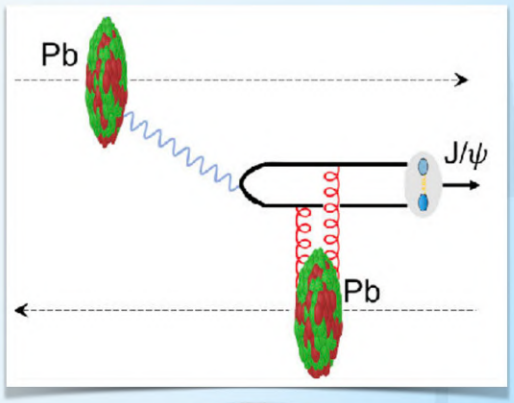


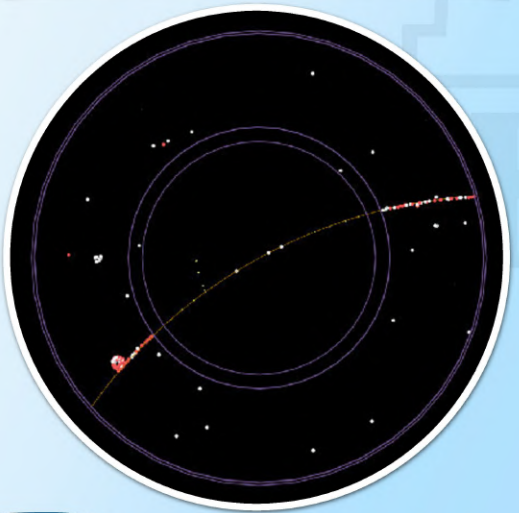
Atlas

Coherent J/Psi production in UPC

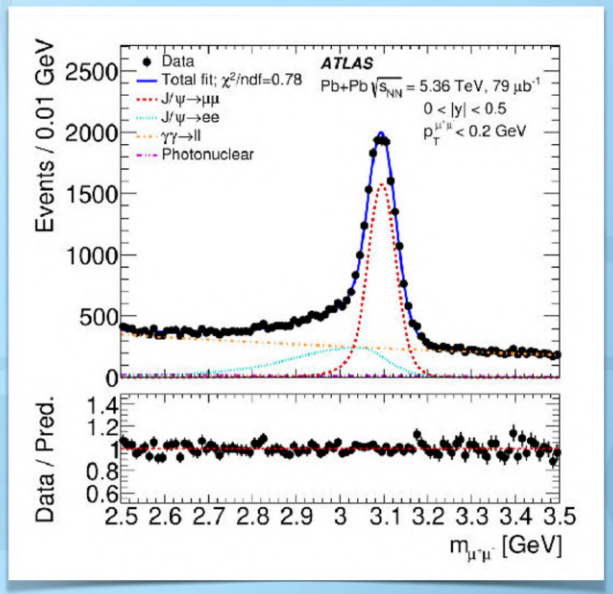
See talk by P. Rybczynski **Wed, 11:40**

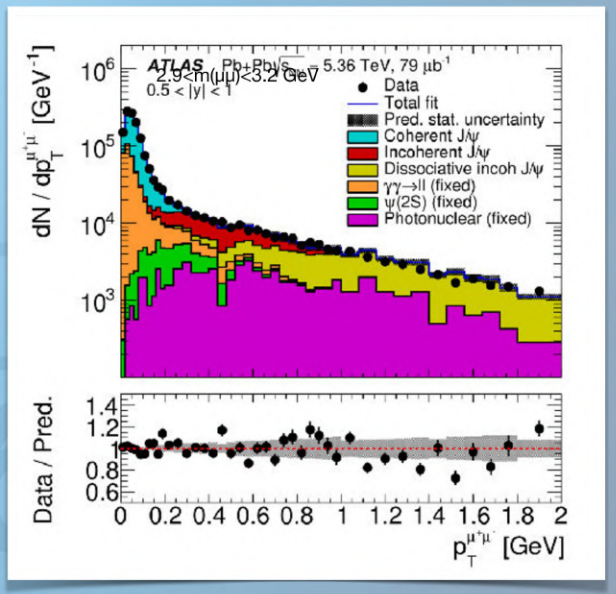
Final for HP26





- $J/\psi \to \mu\mu$ events recorded using a dedicated ***TRT-based trigger targeting 2-tracks***





- Signals and main backgrounds are modeled in ***template fits*** using STARlight MC
- No muon ID used → ***fits to mass line shape***

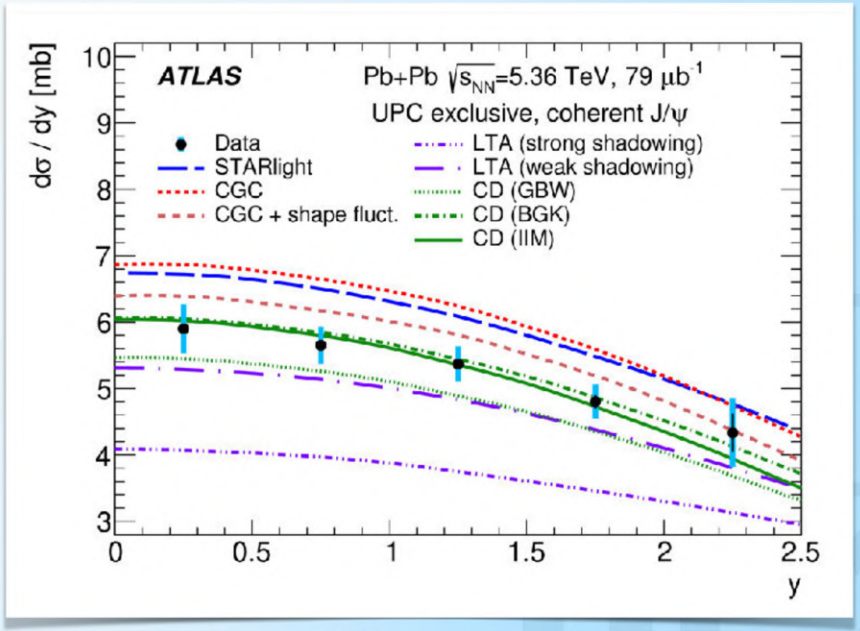
JHEP 04 (2026) 020

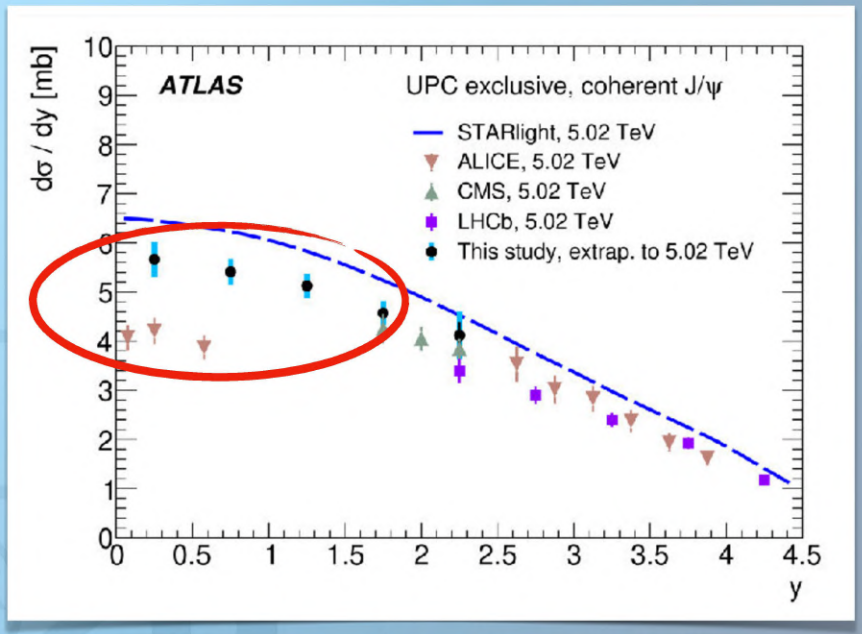


Coherent J/Psi production in UPC

See talk by P. Rybczynski **Wed, 11:40**

Final for HP26





- Comparison with several theory predictions → ***CGC + shape fluctuations and color dipole (CD) models reasonably describe data***

- Results extrapolated to 5.02 TeV
- ***Agreement with*** previous measurements at y~2 (***CMS, LHCb***)
- ***Tension w/*** previous ***ALICE*** mid-rapidity measurements. Could it be due to exclusivity requirements?

JHEP 04 (2026) 020

Coincident UPC events

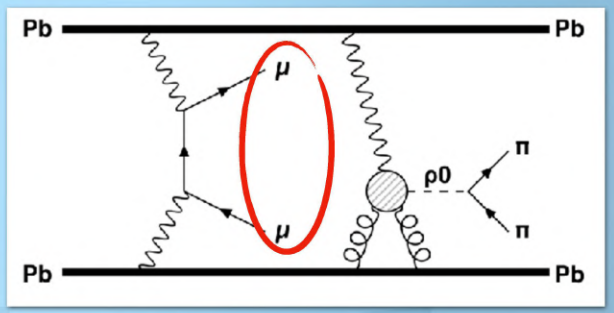
See talk by P. Rybczynski **Wed, 11:40**

Final for HP26

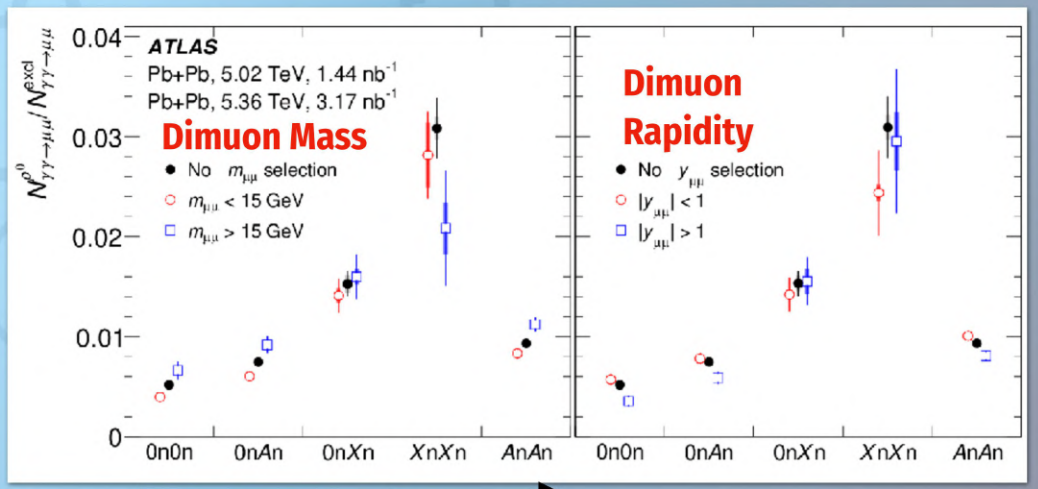
arXiv:2504.07795

- Measure the rate of coincident occurrences of

$$\gamma\gamma \to \mu\mu \text{ and } \gamma + A \to \rho^0 + A$$



- Confirms the presence of ***multi-photon-induced processes in UPC collisions.***
- The ***probability*** for the coincident process is not a static number. It ***evolves with Pb-Pb impact-parameter***!
- This can be a ***key factor*** when understanding ***exclusivity requirements*** in different analyses; see Dyndal, Harland-Lang, ***arXiv:2604.19879***



ZDC selections

0_n = no neutrons, X_n = at least one neutron
A_n = no requirement on neutrons

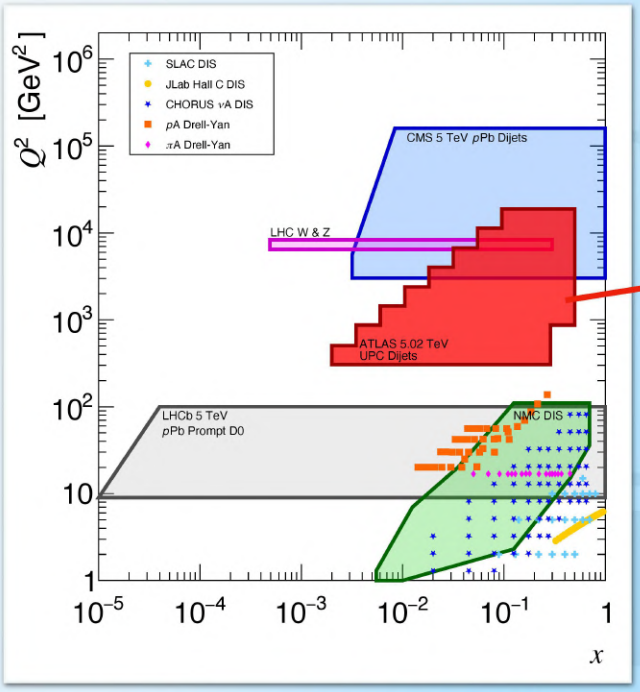


Atlas

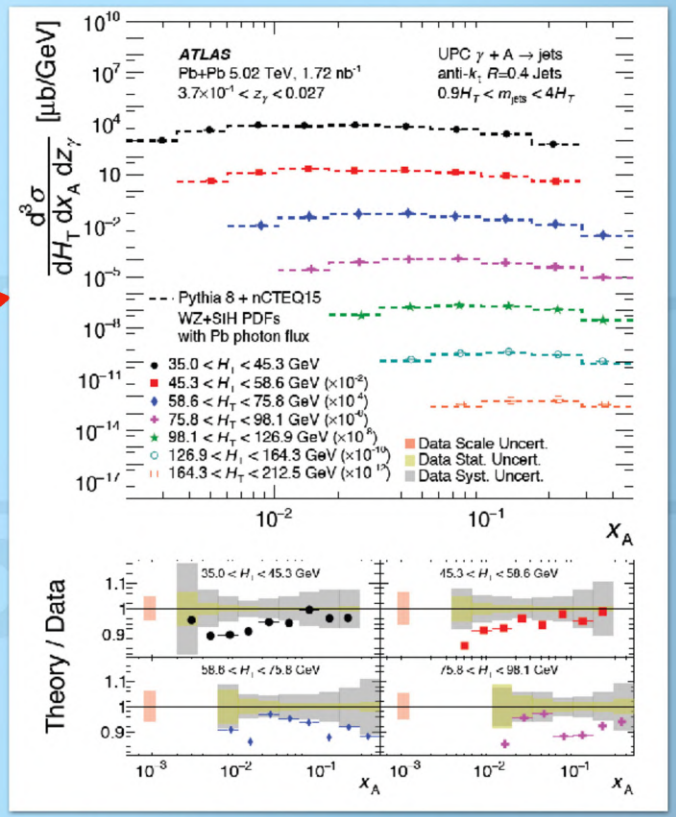
Dijet cross-section in UPCs

See talk by P. Potepa **Wed, 15:40**

ATLAS Recap



EPPS21 data + ATLAS UPC dijets



Phys. Rev. D 111 (2025) 052006

3D unfolded extraction of UPC dijet cross-section in Pb+Pb @ 5.02 TeV - selecting on **0nXn neutron topologies**

- H_T (hard-scale)
- z_γ (γ resolution power),
- x_A(parton momentum fraction in the Pb)

Comparison to different nPDFs in a unique (x,Q_2) phase space

Next step: harness dijets in UPC to learn about photon fluxes and b-dependence of nPDFs



Atlas

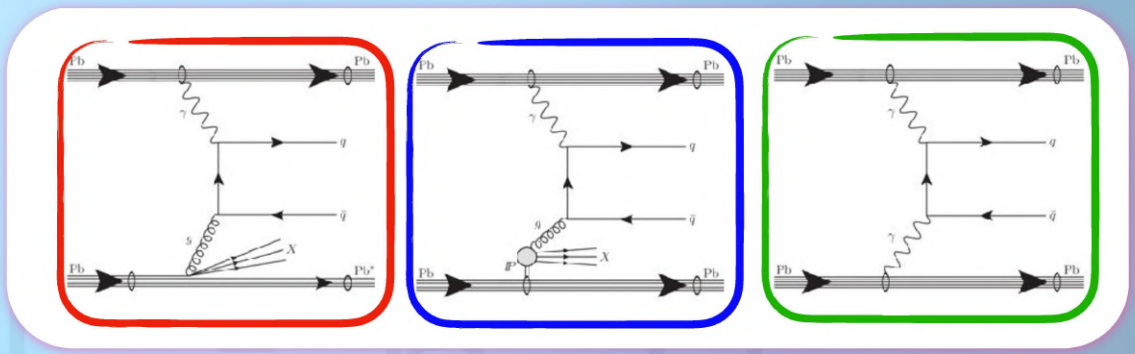
Diffractive dijet cross-section in UPCs

See talk by P. Potepa **Wed, 15:40**

New for HP26

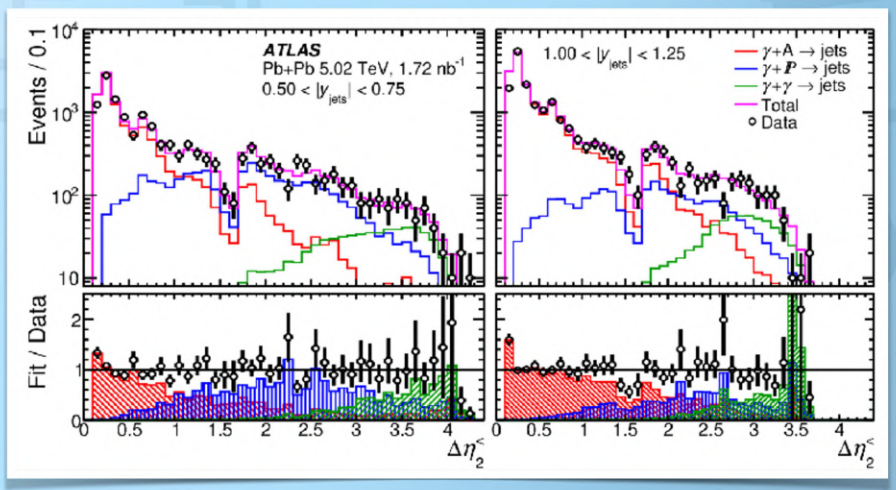
Use:

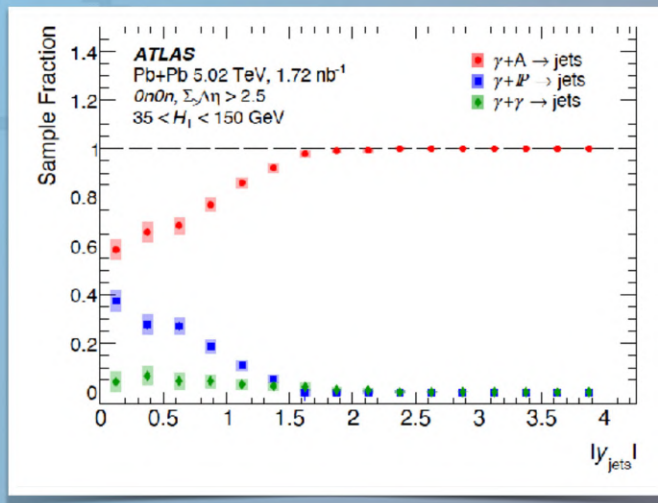
- 0n0n topologies from the ZDC
- template fits of the minimum rapidity gap distribution;



To separate:

- $\gamma + A \rightarrow$ jets
- $\gamma + \mathbb{P} \rightarrow$ jets
- $\gamma + \gamma \rightarrow$ jets





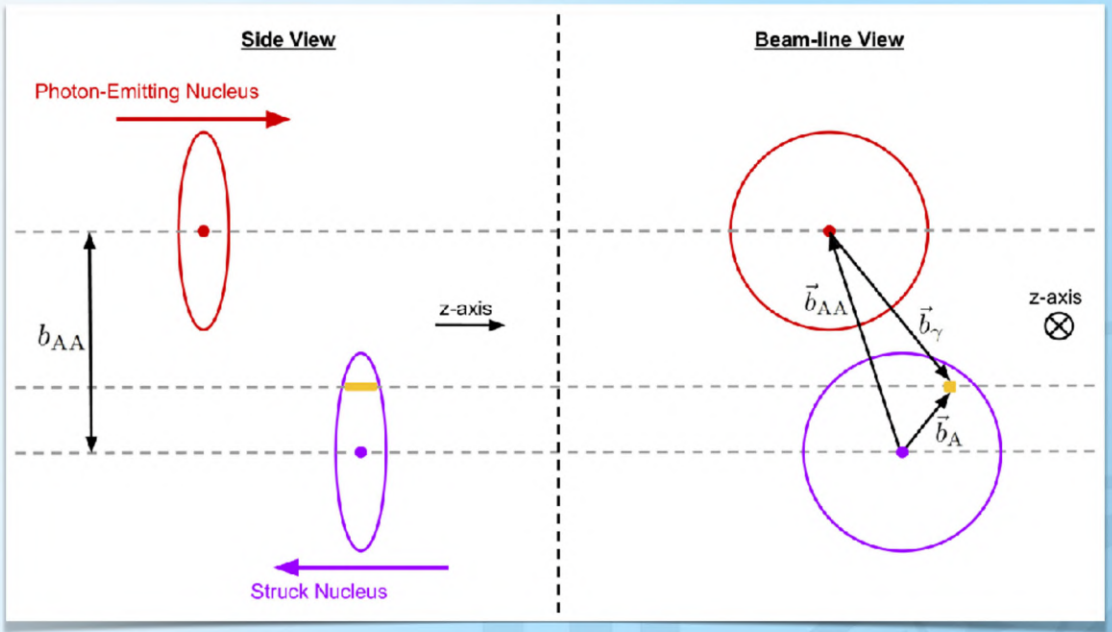


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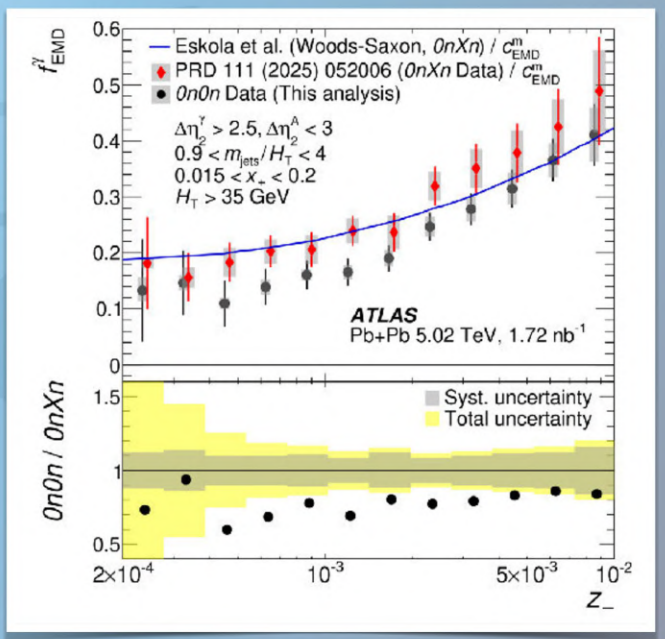
...and impact parameter

See talk by P. Potepa **Wed, 15:40**

New for HP26



- Marked reduction of $f^{\gamma}_{\mathrm{EMD}}$ in 0n0n topologies compared to 0nXn



- By **increasing the impact parameter** (0n0n, larger $\vec{b}_{\mathrm{AA}}$ compared to 0nXn), we are now **probing a more peripheral** (larger $\vec{b}_{\mathrm{A}}$, weaker EMD) class of **UPC interactions**
- **If I change $\vec{b}_{\mathrm{A}}$, do nPDFs change? Check via cross-section ratio**

arXiv:2604.24435



Atlas

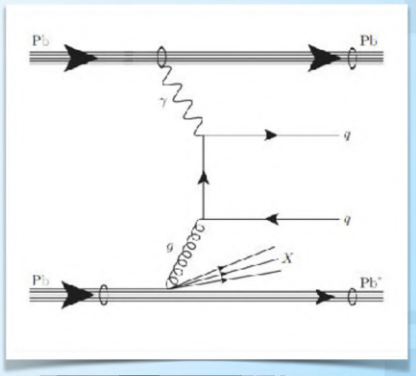
Observation of b-dependence on nPDFs

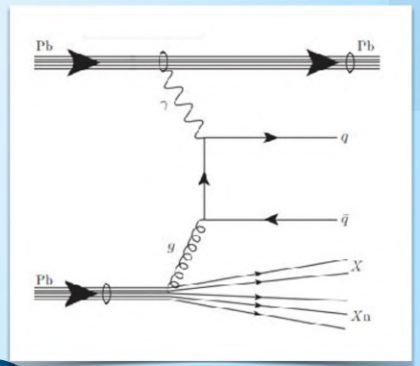
See talk by P. Potepa **Wed, 15:40**

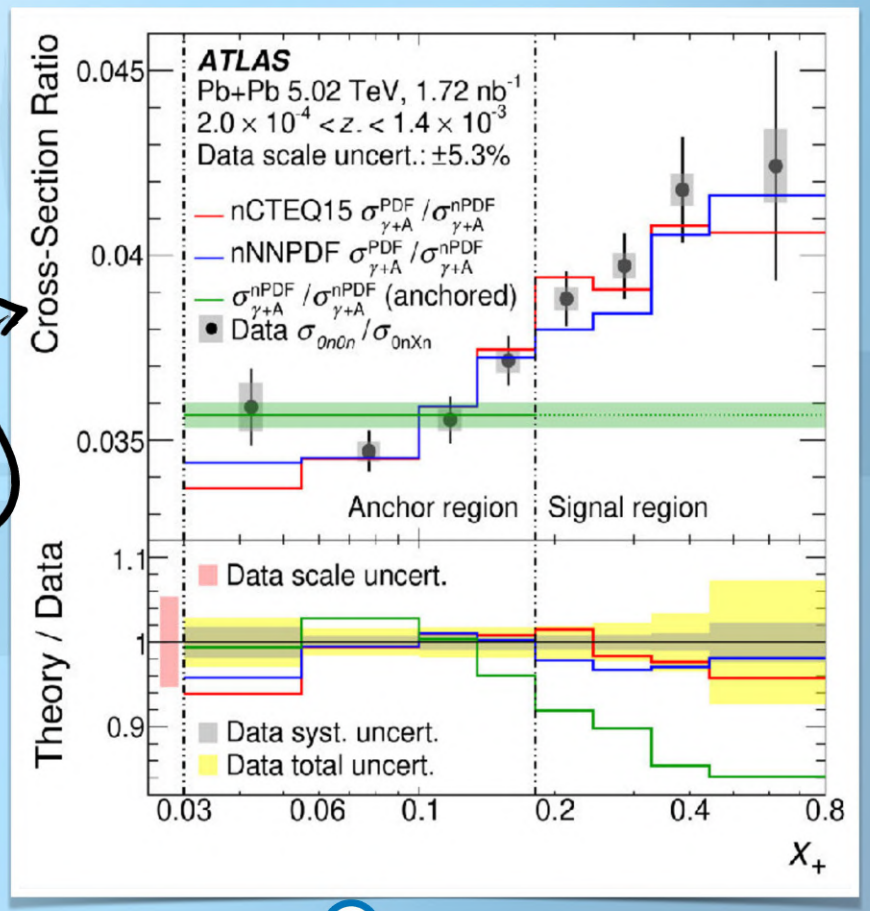
New for HP26

Direct comparison by taking ratio of 0n0n/0nXn cross-section

$$\frac{0n0n}{0nXn}$$







- Monotonically increasing trend with Bjorken-x of the struck parton (x_+) in the nucleus
- Comparison to theory: ratio between free proton PDF and nPDF for **different sets**
- **Null hypothesis:** modifications are the same in the numerator and denominator

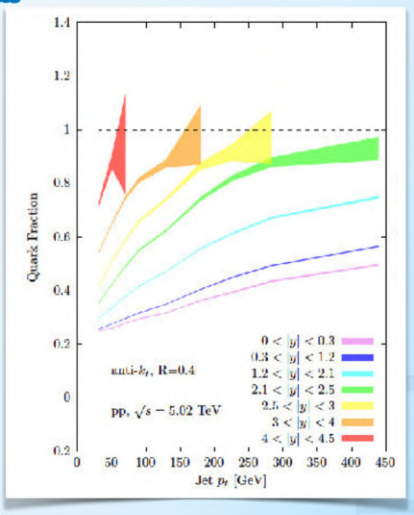


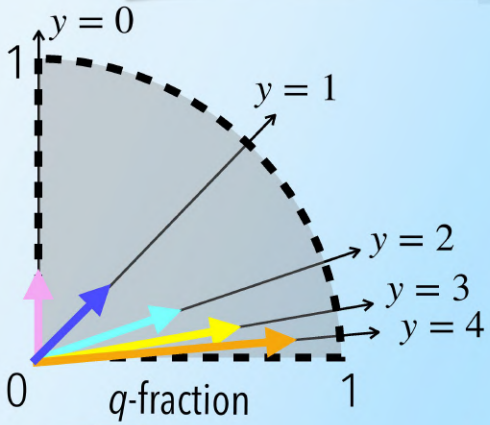
Flavor and rapidity dependence of E_{Loss}

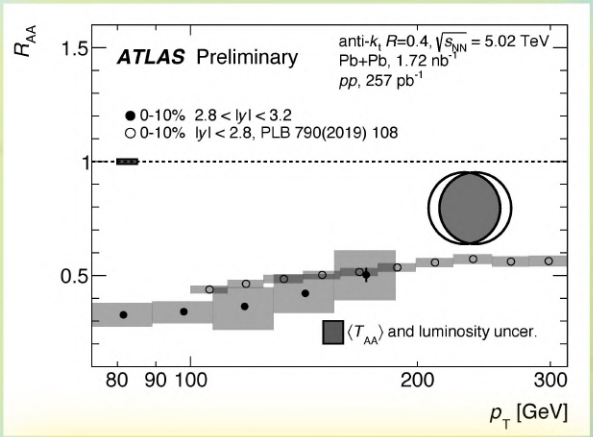
See talk by F.Pauwels **Tue, 10:20**

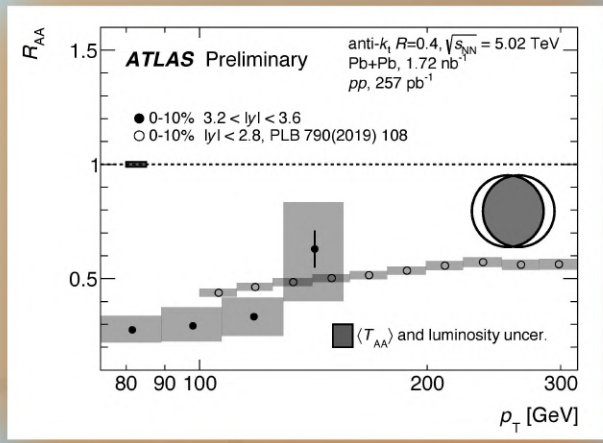
New for HP26

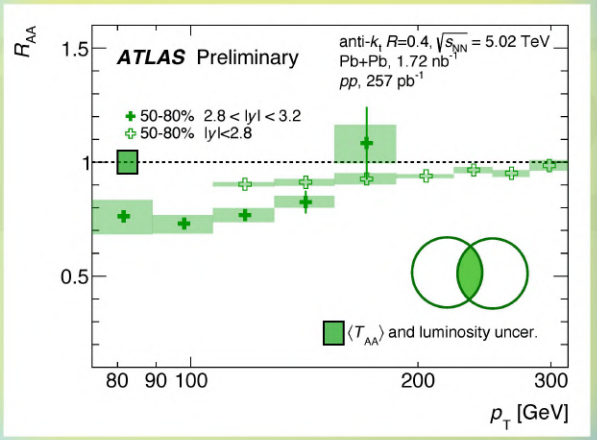
Pablos, Soto-Ontoso PRD 107, 094003











- Uses rapidity (y) as an additional lever arm to centrality and p_T
- Extends y coverage of existing ATLAS results [**PLB 790 (219), 108**]
- ***Forward y***: larger q-fraction, steeper p_T spectra, different QGP densities and longitudinal evolution
- R_{AA}: decreasing trend with y, p_T and centrality

ATLAS-CONF-2026-008



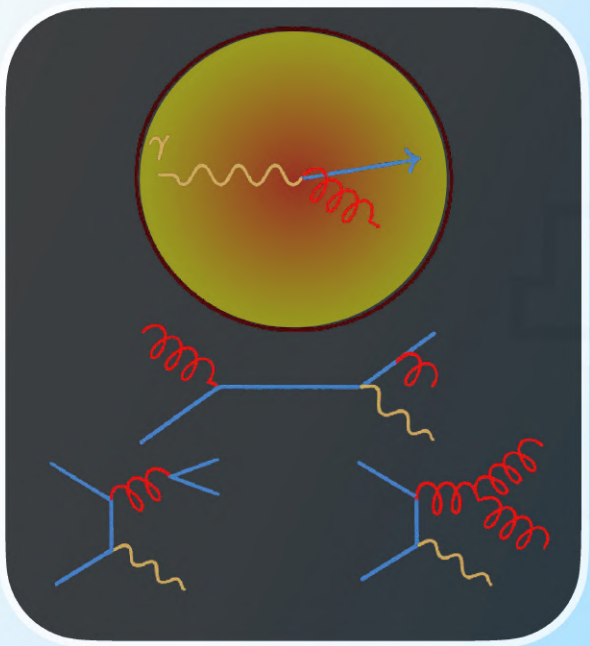
Atlas

γ+multijet calibrated probes of the QGP

See talk by F.Pauwels **Tue, 10:20**

Final for HP26

arXiv:2606.17760



$$x_{JJ} = \frac{(\vec{p_1} + \vec{p_2})_T}{p_T^\gamma}$$

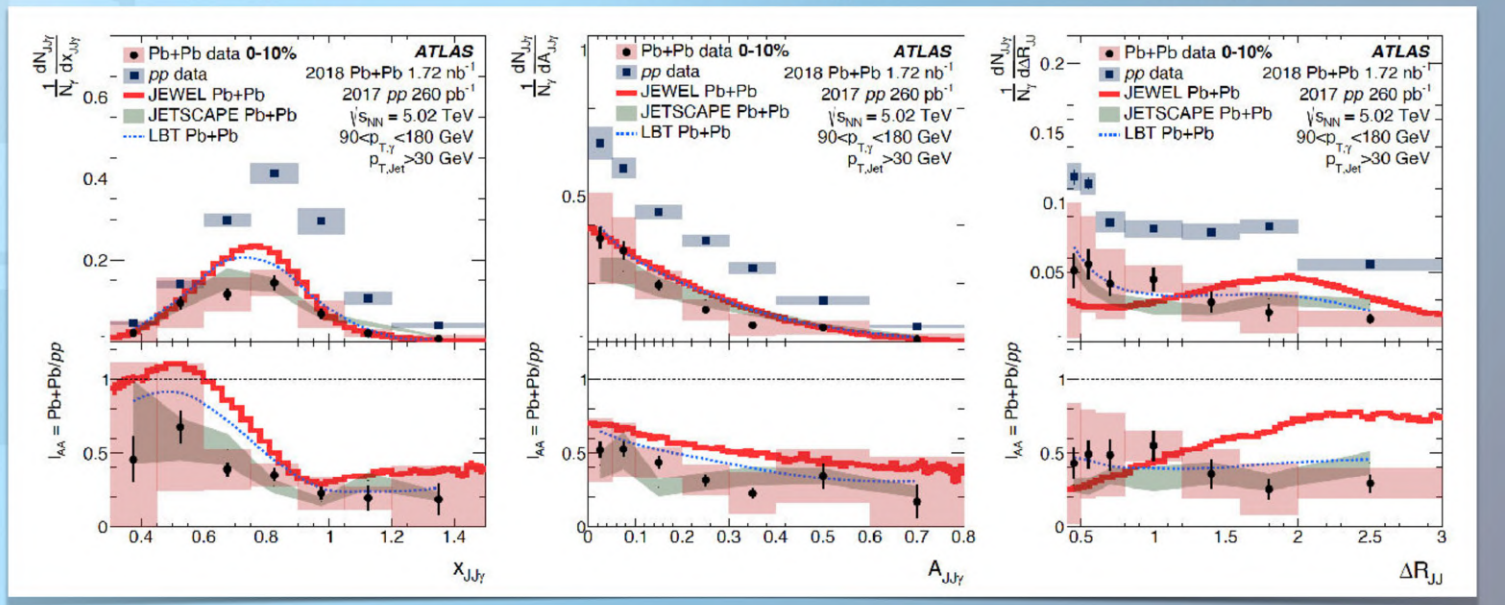
Overall E_{loss} of the two-jet system

$$A_{JJ} = \frac{(\vec{p_1} - \vec{p_2})_T}{p_T^\gamma}$$

Relative E_{loss} between the two color charges

$$\Delta R_{JJ} = \sqrt{\Delta\phi_{1,2} + \Delta\eta_{1,2}}$$

Angular separation of the two jets



Results provide ***new constraints on microscopic parton E_{loss} mechanisms*** in QGP



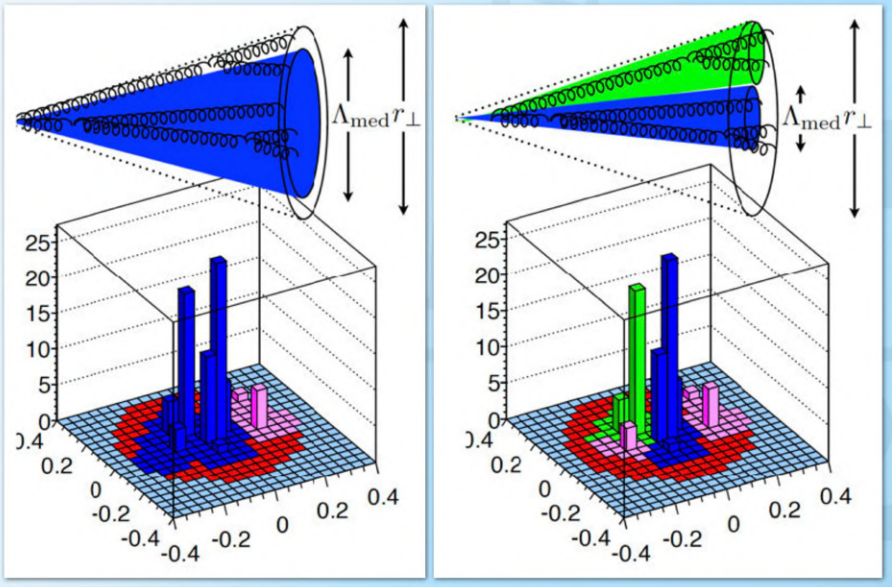
Atlas

Probing color coherence via jet substructure

See talk by A. Sickles **Tue, 9:30**

ATLAS Recap

$\Lambda_{\mathrm{med}} \rightarrow$ Medium resolution scale



Does the plasma see the jets as multiple color sources or as a single colored object?

J. Casalderrey-Solana et al., PLB 725 (2013) 357–360



Atlas

ATLAS jet substructure: Episode III

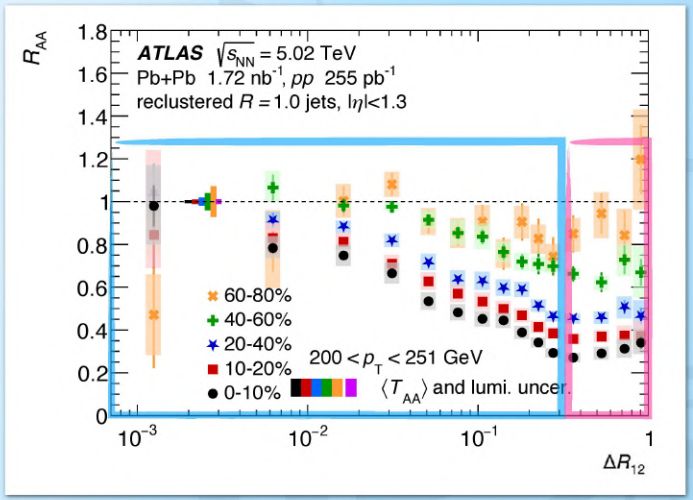
See talk by A. Sickles **Tue, 9:30**

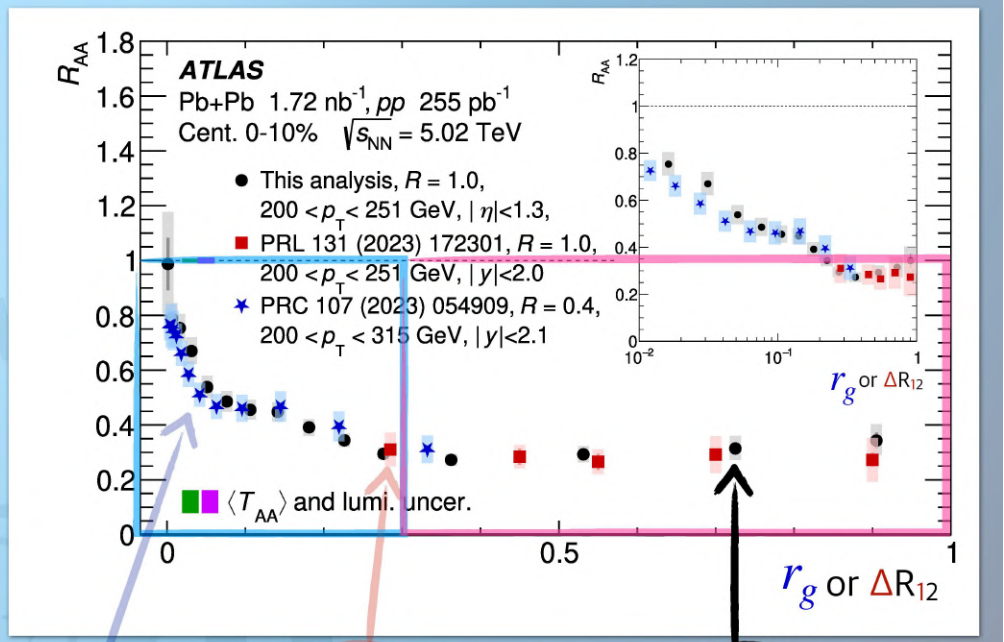
New for HP26

PLB 871 (2025) 139929

Angular separation $\Delta R_{12} = \sqrt{\Delta y_{12}^2 + \Delta \phi_{12}^2}$

- Same R = 1.0 jets as **PRL 131 (2023) 172301**, with substructure evaluated using tracks with $p_T > 4$ GeV and SoftDrop $(z_{\rm cut} = 0.15, \beta = 0)$





- Sharp $R_{\rm AA}$ **decrease** with ΔR_{12}, followed by **flattening** behavior
- New analysis provides a **bridge** between the previous two measurements

Standard size (R=0.4) de-clustered & groomed jets; **Substructure with tracks (●) & calo-clusters (□)**

Large R jets (R=1.0) re-clustered; **Substructure with R=0.2 jets**

Large R jets (R=1.0) re-clustered; **Substructure with tracks**



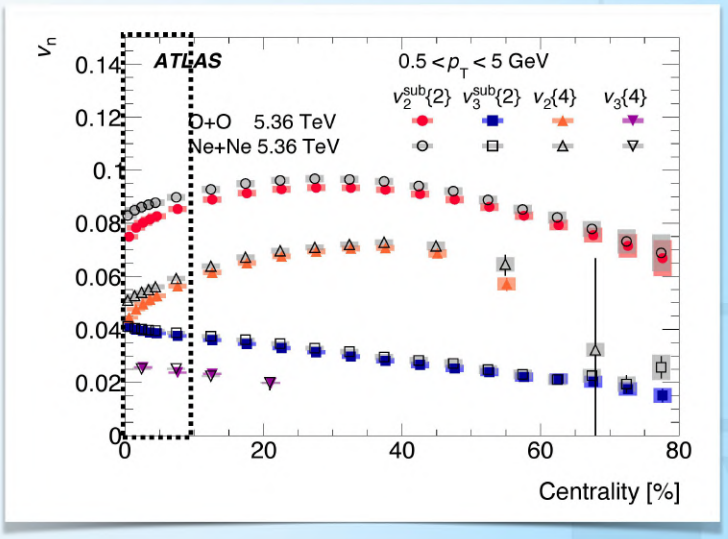
Atlas

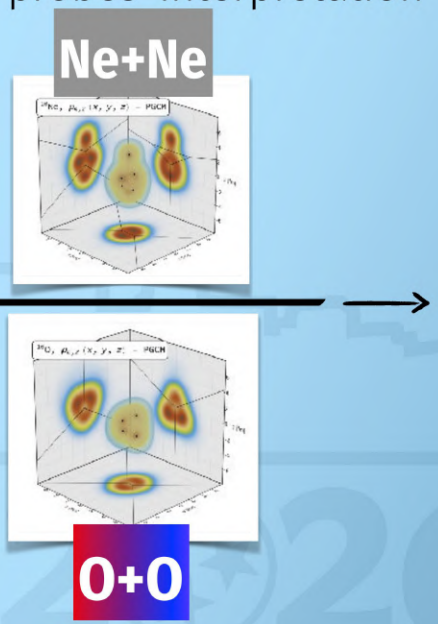
Nuclear structure imprinting on flow in

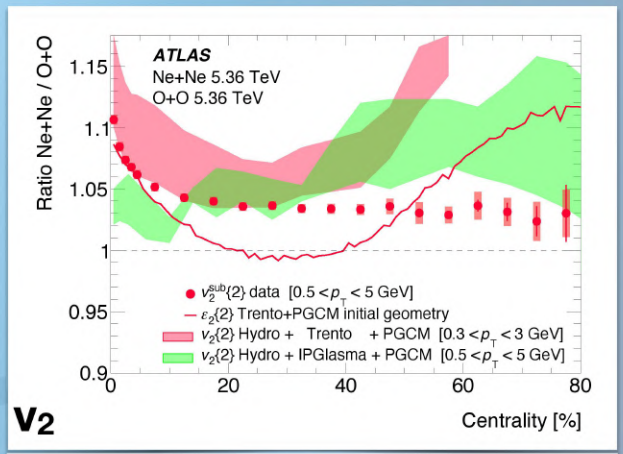
See talk by B. Seidlitz **Tue, 14:00**

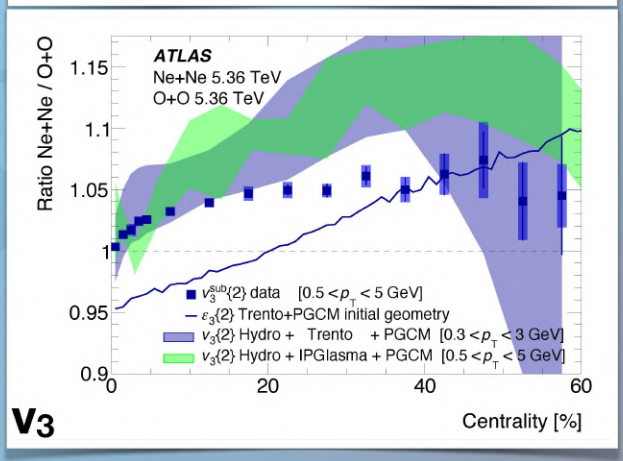
New for HP26

Not really hard probes - but critical for hard probes' interpretation









- Usual trend with centrality (e.g., v_2 reduced in more central collisions): trivial geometry?
- But O+O v_2 decreases more rapidly than Ne+Ne while approaching geometrical saturation: **nuclear geometry!**

PRC 113 (2026) 045205



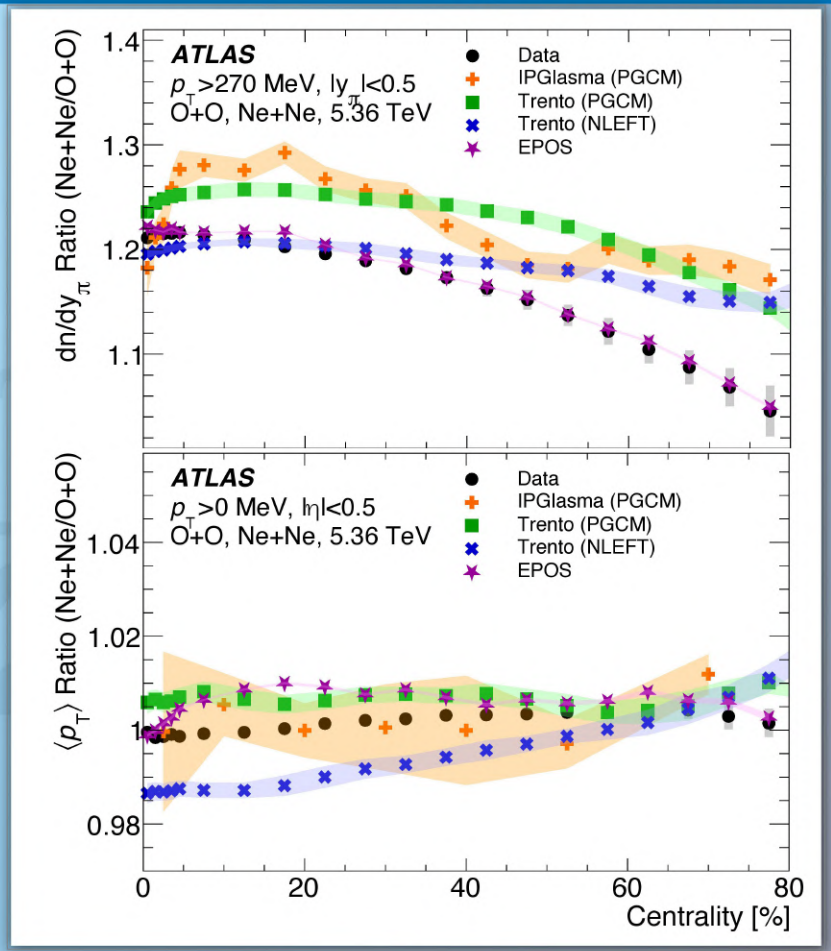
Atlas

Bulk properties in light-ions

See talk by B. Seidlitz **Tue, 14:00**

New for HP26

- Clear signatures of QGP collective motion - needs to be described
- Comprehensive measurement of $dN/d\eta$ in both O+O and Ne+Ne
  - Comparison with several models on the market - leveraging uncertainty cancellation in ratios
- Baseline for understanding **particle production** and **collective effects in light-ion collisions**, and contribute to a more complete picture of the **onset and evolution of QGP** dynamics as a function of system size.



arXiv:2606.20257



Atlas

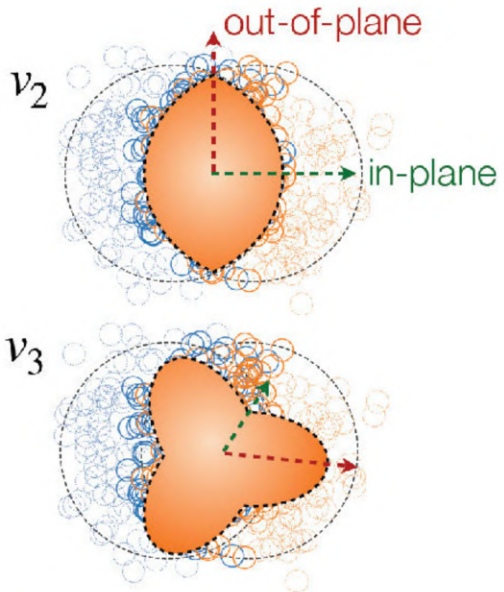
Azimuthal anisotropies of jets in OO

See poster by M. Savic **Tue, 18:00**

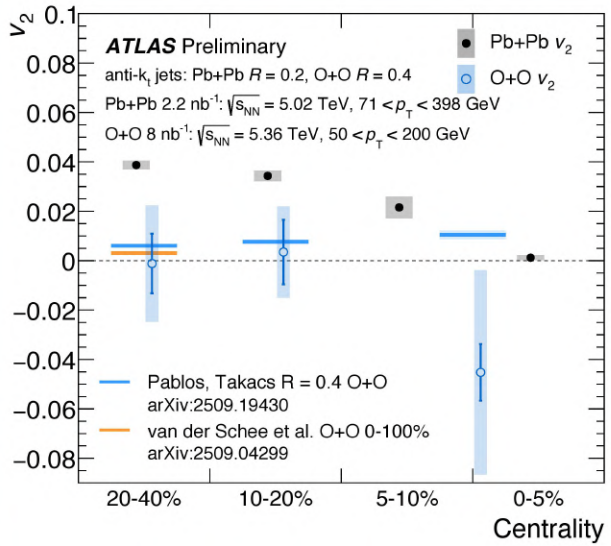
See talk by R. Kavak **Tue, 16:30**

New for HP26

$$\frac{dN_{\text{jet}}}{d\phi} \propto 1 + 2\sum_{n=1}^{\infty} v_n \cos(n(\phi - \Psi_n))$$



- Probes the **path-length dependence** of partonic energy loss in the medium
- ***Is there enough QGP transverse area to induce azimuthal modulations of jets?***



- Yes, in Pb+Pb (**PRC 105 (2022) 064903**)
- In O+O, theory **expects** a **very elusive signal**...
- The first measurement of jet v_2 confirms this expectation
  - Preliminary results compatible with zero within the current experimental precision

ATLAS-CONF-2026-006



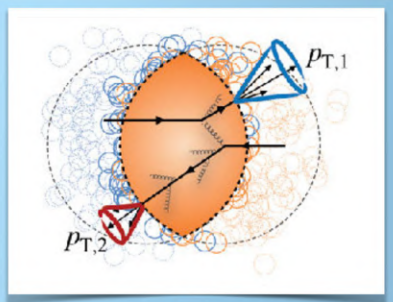
Atlas

Dijet Asymmetry: an ATLAS trademark

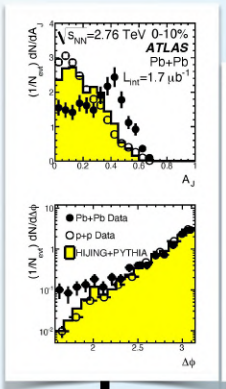
See talk by R. Kavak **Tue, 16:30**

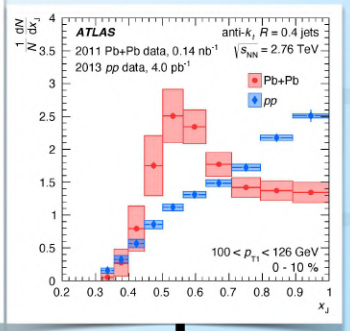
New for HP26

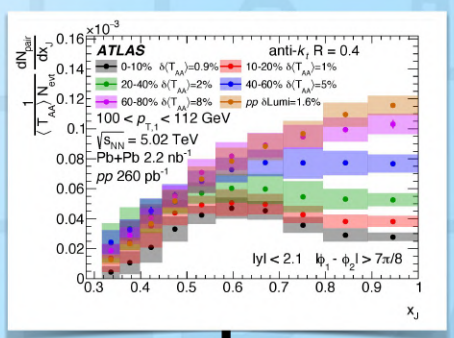
A recap of ATLAS dijet momentum imbalance measurements - from 2010 to today....

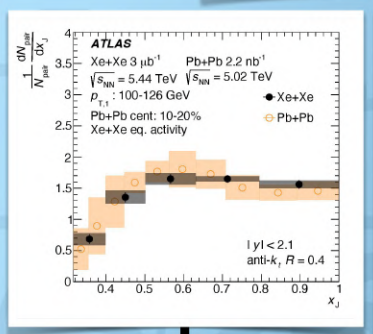


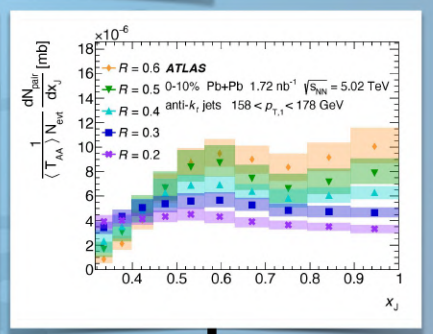
$$x_J = \frac{p_{T,2}}{p_{T,1}}$$











HP2026

2010 — First Observation of Dijet Asymmetry (and jet quenching) in Pb+Pb @ LHC
Phys. Rev. Lett. 105 (2010) 252303

2017 — First fully unfolded measurement of x_J
Phys. Lett. B 774 (2017) 379

2022 — First absolutely normalized measurement of x_J
Phys. Rev. C 107 (2023) 054908

2023 — First measurement of x_J in another collision system
Phys. Rev. C 108 (2023) 024906

2024 — First measurement of x_J dependence on jet radius
Phys. Rev. C 110 (2024) 054912

2026 — **Observation of centrality-dependent Dijet Asymmetry in O+O and Ne+Ne**
arXiv:2606.20463

Riccardo Longo

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22/06/2026

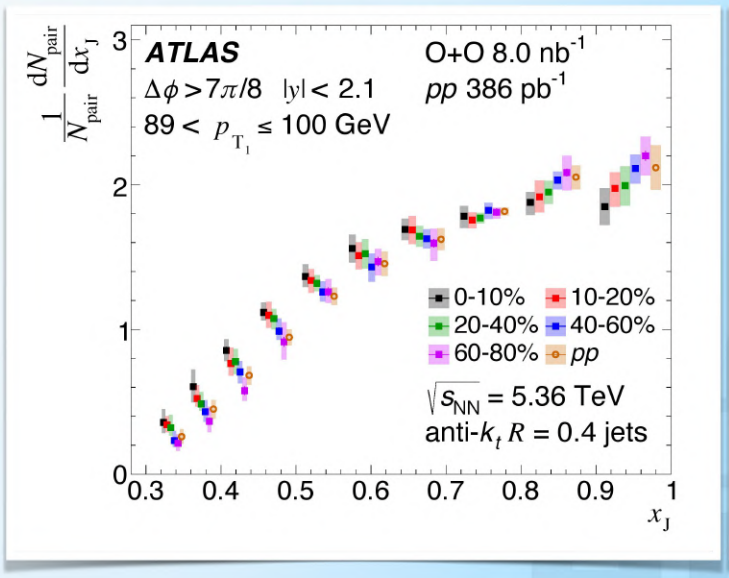


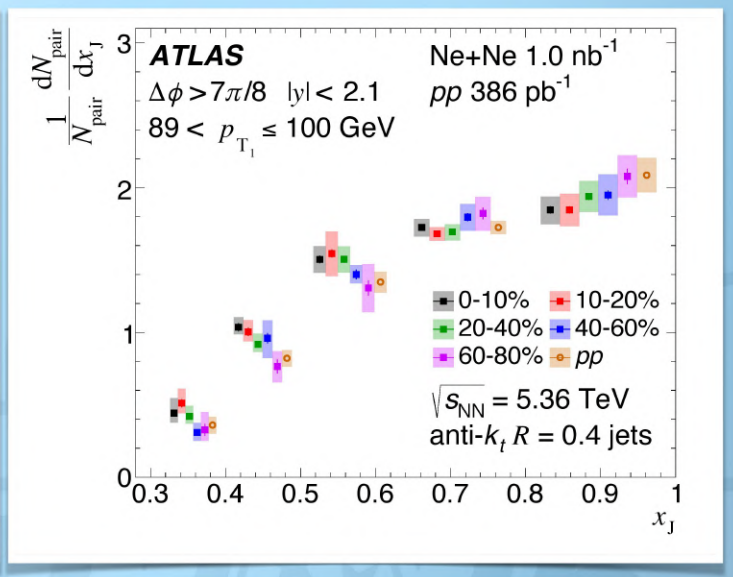
Atlas

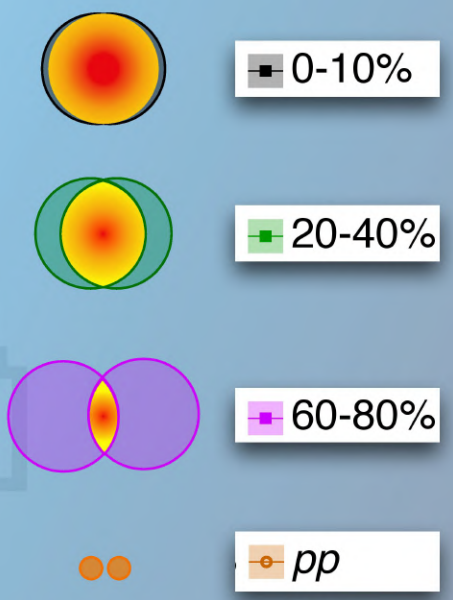
Centrality-dependent x_J modification in light ions

See talk by R. Kavak **Tue, 16:30**

New for HP26







- Measure self-normalized x_J distributions for ***both O+O and Ne+Ne***
- Show ***systematically increasing modification with increasing centrality***
- ***How significant*** is the modification observed?

arXiv:2606.20463



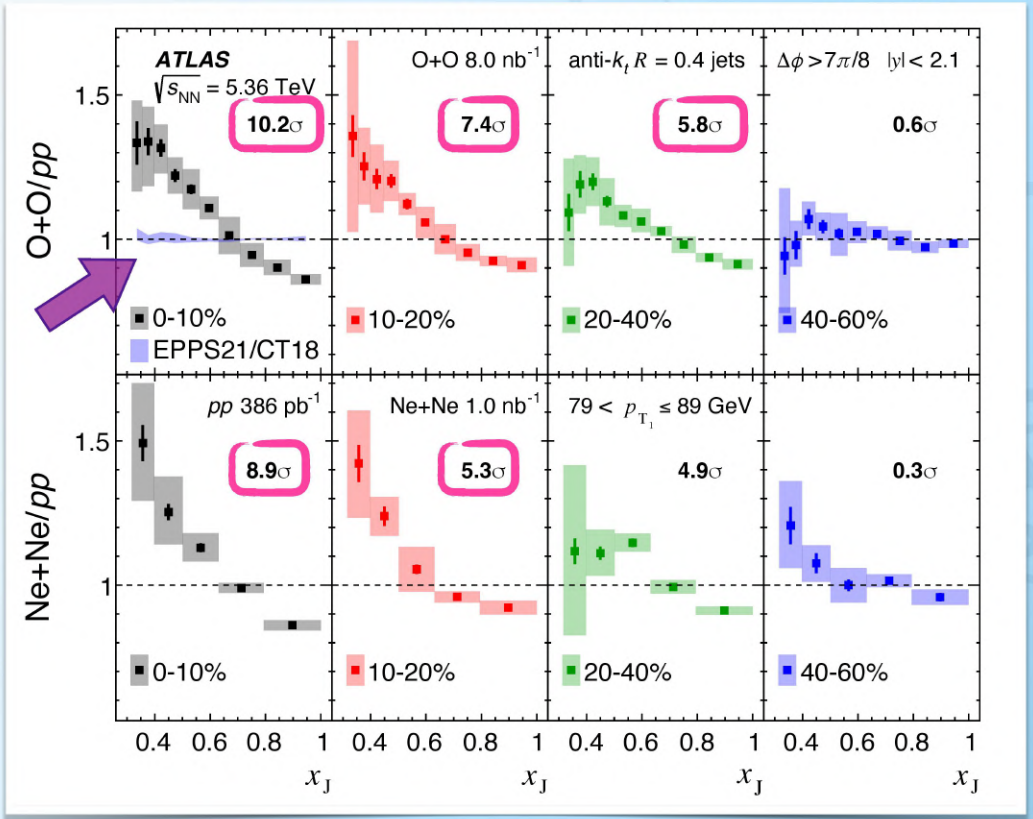
Atlas

Observation of centrality-dependent x_J modification

See talk by R. Kavak **Tue, 16:30**

New for HP26





- Relative suppression of balanced dijets in favor of unbalanced pairs is clearly visible in the **ratio to pp distributions**
- Quantify significance using a χ^2 test against the **null hypothesis of no modification** (i.e. ratio of 1)
- Analysis as a function of centrality and leading jet p_T
- ATLAS observes **significant (>5σ)** modification out to mid-central light-ion collisions.
- **Non-quenching baseline** solely based on **nPDF effects** (centrality integrated) is **not significant** for x_J modification through the explored phase space
- ***Unambiguous observation of parton energy loss in both O+O and Ne+Ne collisions***

arXiv:2606.20463

Riccardo Longo

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22/06/2026

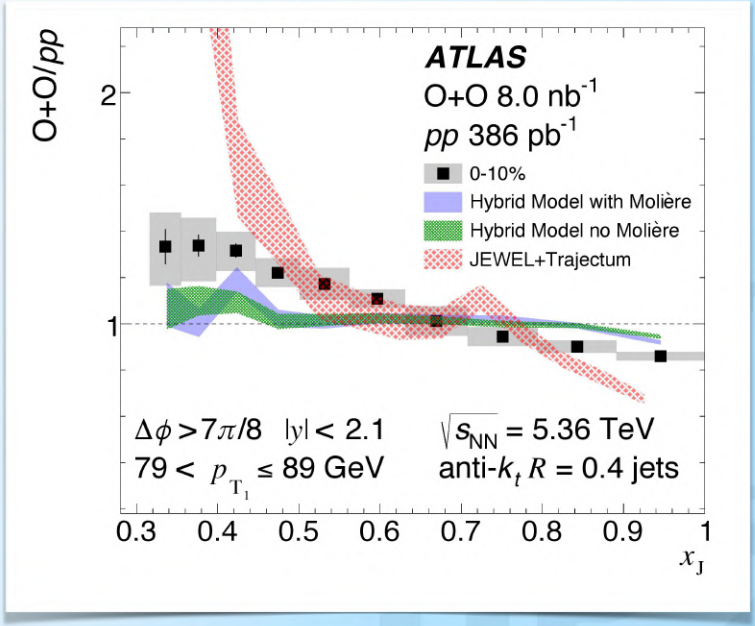


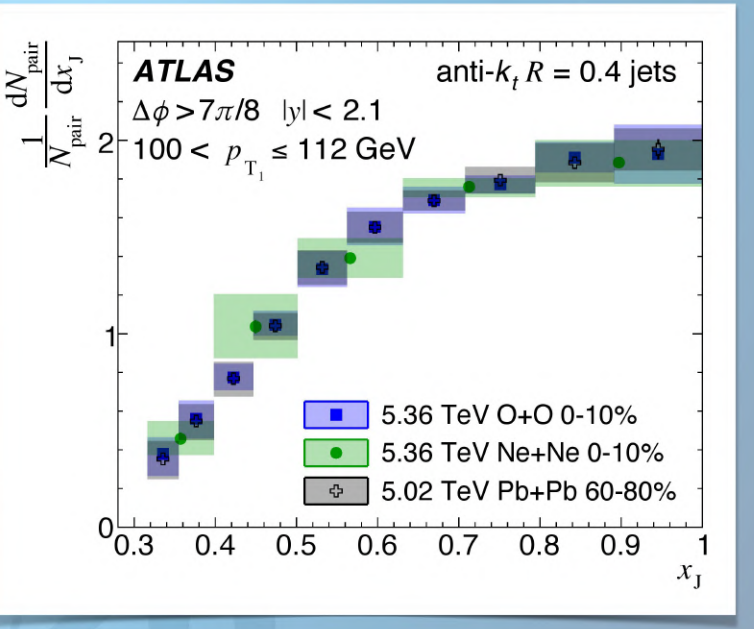
Atlas

x_J in O+O vs Theory & peripheral Pb+Pb

See talk by R. Kavak **Tue, 16:30**

New for HP26





- Comparison to **Hybrid** (w/ and w/o Molière, no discrimination power) and **Jewel+Trajectum** (w/o recoil)

- **x_J distributions** are **very similar** to **peripheral Pb+Pb** at matched event activity
- More to find out in peripheral Pb+Pb collisions leveraging high-statistics Run 3 samples?



Atlas

Modification of parton shower in OO via $\gamma + h$

See talk by B. Seidlitz **Tue, 14:00**

New for HP26

ATLAS-CONF-2026-007

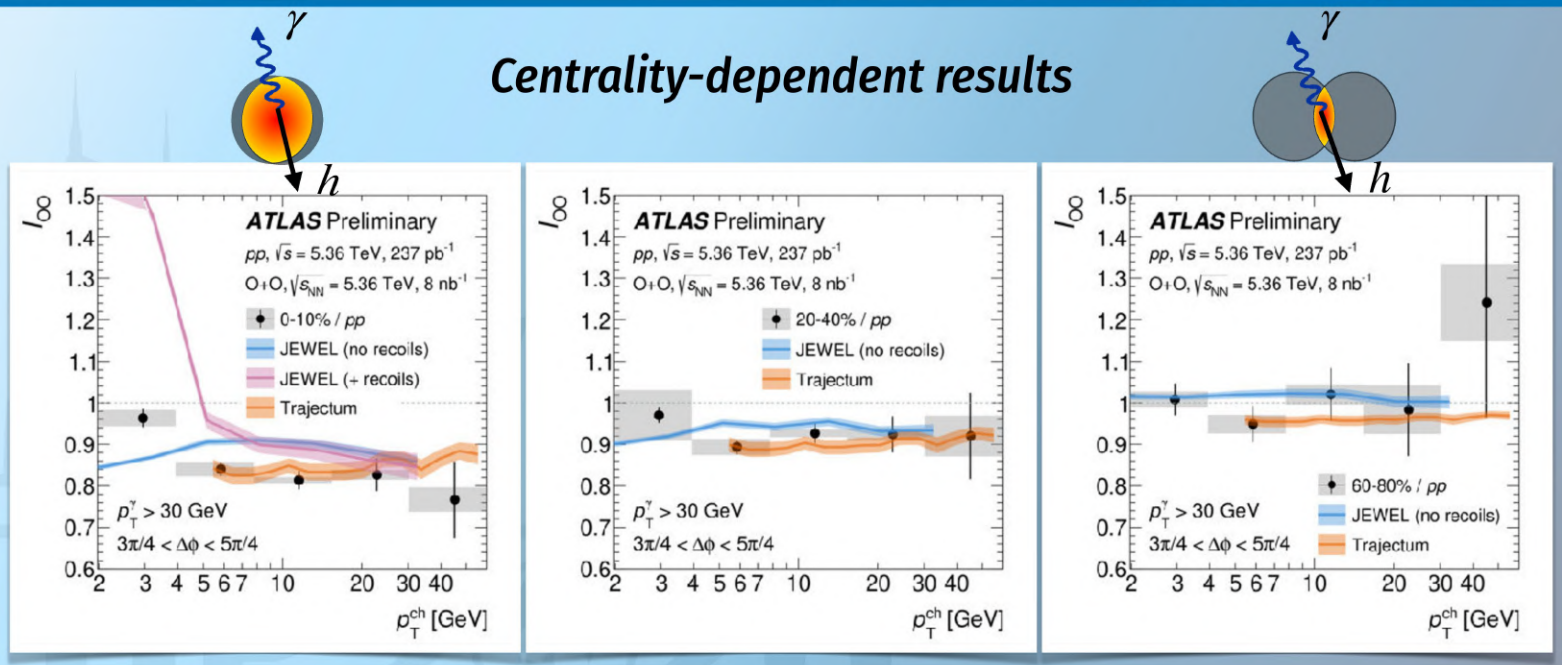
Per-photon yield

$$Y(p_T) = \frac{1}{N_\gamma} \frac{\mathrm{d}^2 N_{\mathrm{ch}}}{\mathrm{d}p_T \mathrm{d}\Delta\phi}$$

And corresponding OO to pp ratio

$$I_{OO} = \frac{Y_{OO}}{Y_{pp}}$$

Centrality-dependent results



I_{OO} shows a sizable **suppression in central** events, **fading** away **in peripheral** collisions

Observation **consistent with E_{Loss} in QGP in OO** - provides input on modification of the parton shower

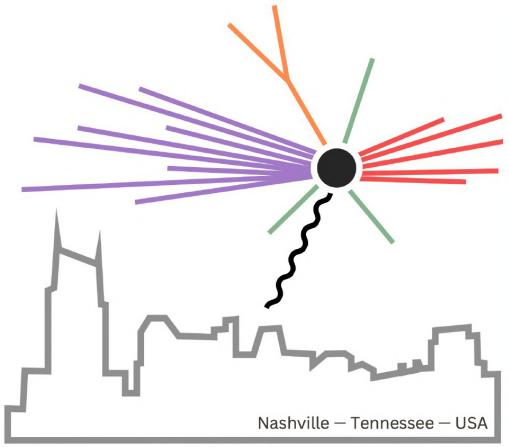


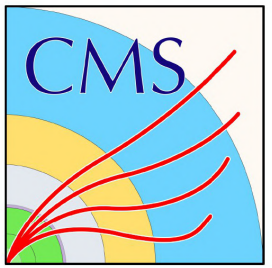
Cms





CMS Overview





Soohwan Lee
(Korea University)

On behalf of the CMS collaboration

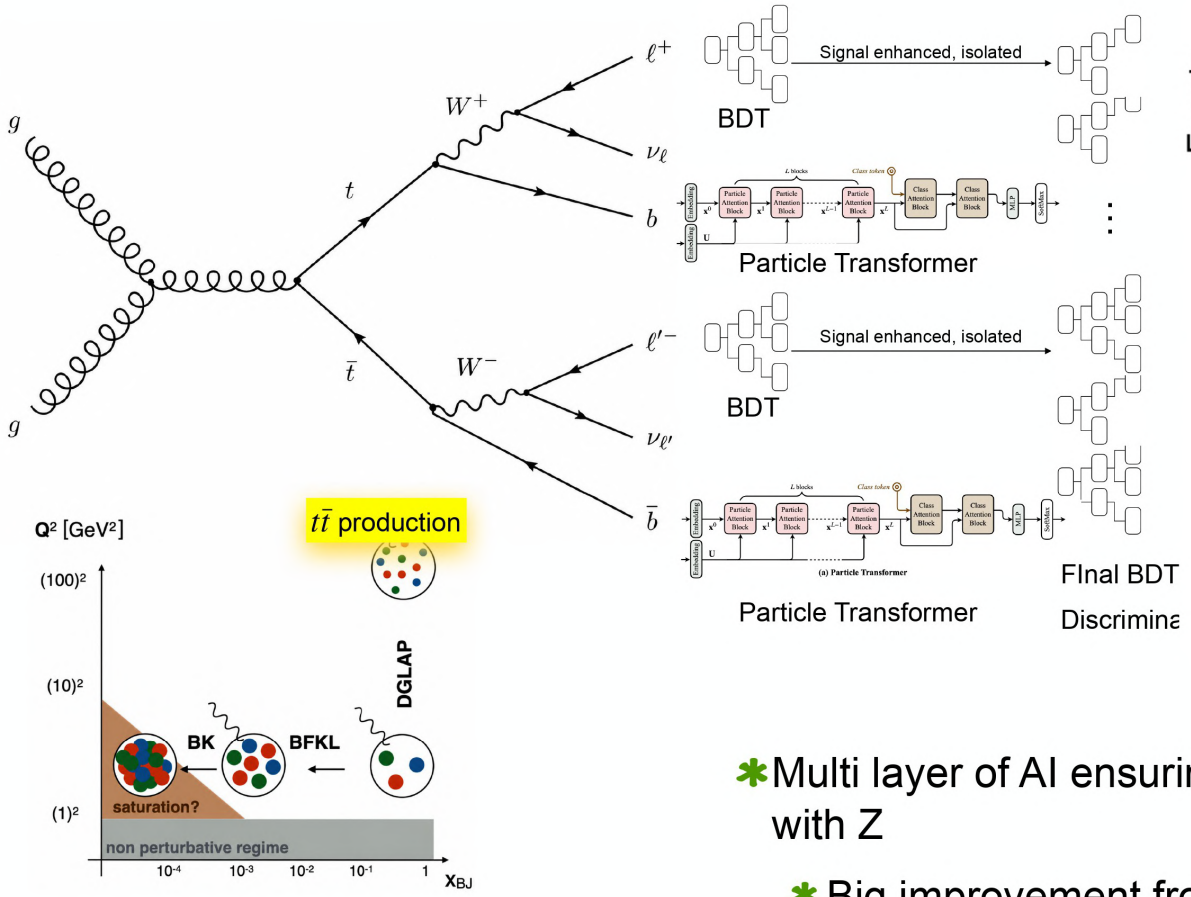
Vanderbilt University, USA
June, 22nd 2026

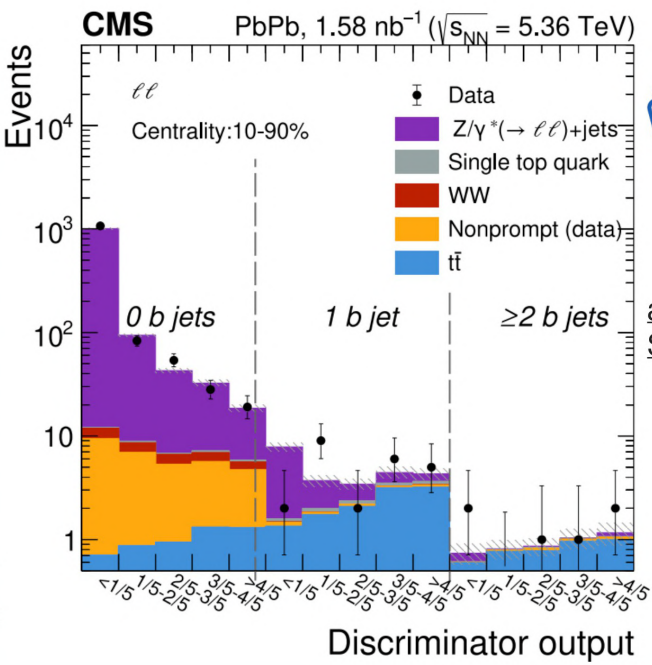
13th International Conference on Hard and Electromagnetic Probes of High-Energy Nuclear Collisions





Cms







arXiv:2604.27091,
Submitted to JHEP

- Multi layer of AI ensuring high purity signal + control region studied with Z
  - Big improvement from our Run 2 result, with significance $> 5\sigma$
    - Mainly driven by the improved techniques (AI)

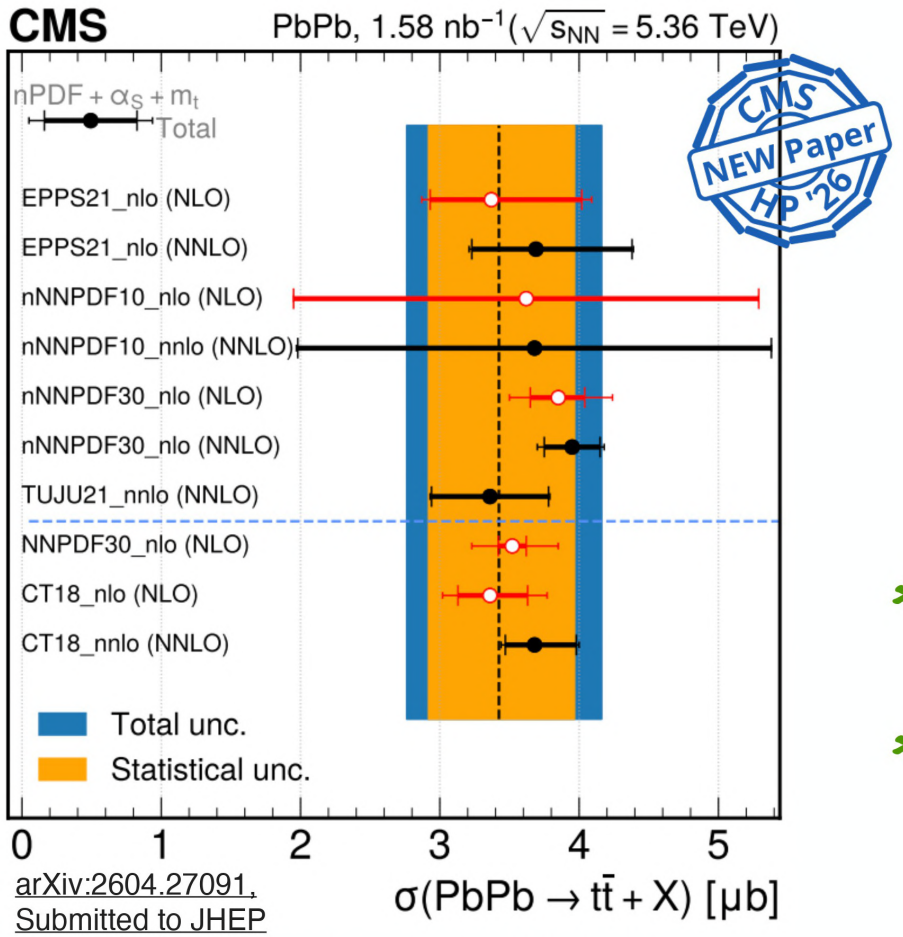
$t\bar{t}$ in Run3 PbPb (2023)

Wednesday, G. Krintiras



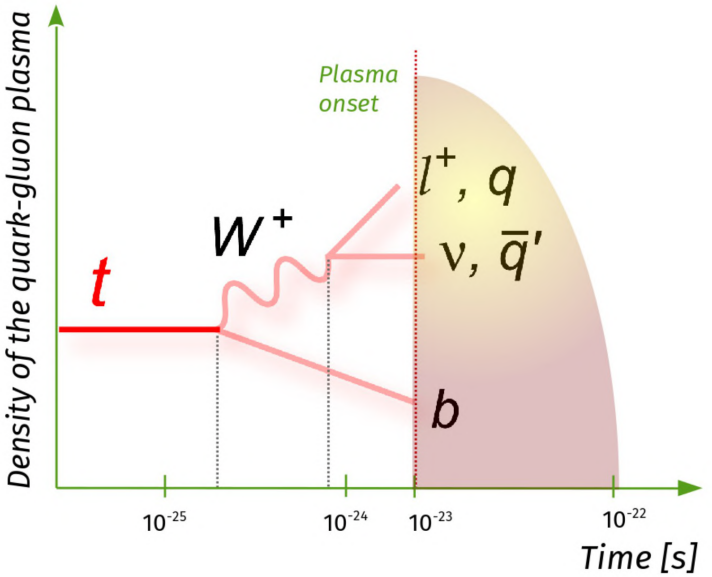
Cms

$t\bar{t}$ in Run3 PbPb (2023)



arXiv:2604.27091, Submitted to JHEP

Wednesday, G. Krintiras



- Cross section data compatible with MC NNLO+NNLL
  - $t\bar{t}$ production/decay before medium modification
- More to come with the full Run 3 data!
  - $t\bar{t}$ as chronograph for hard QCD jets*

*PRL 120 (2018) 232301

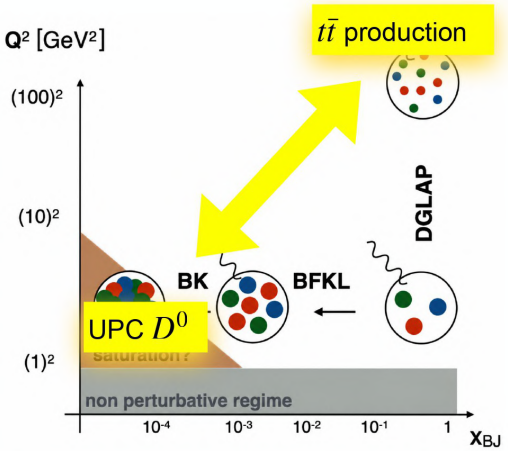


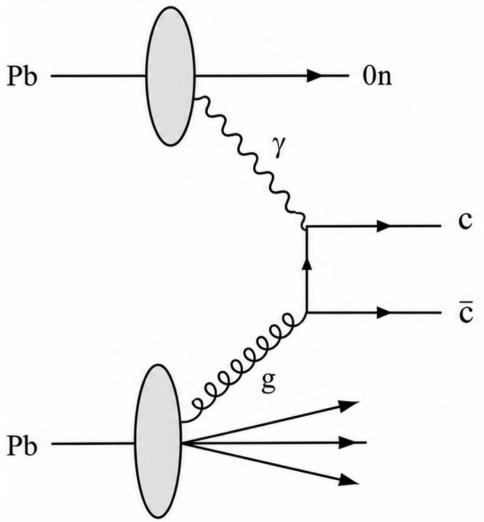
Cms

Probing gluon nPDF with UPC D^0

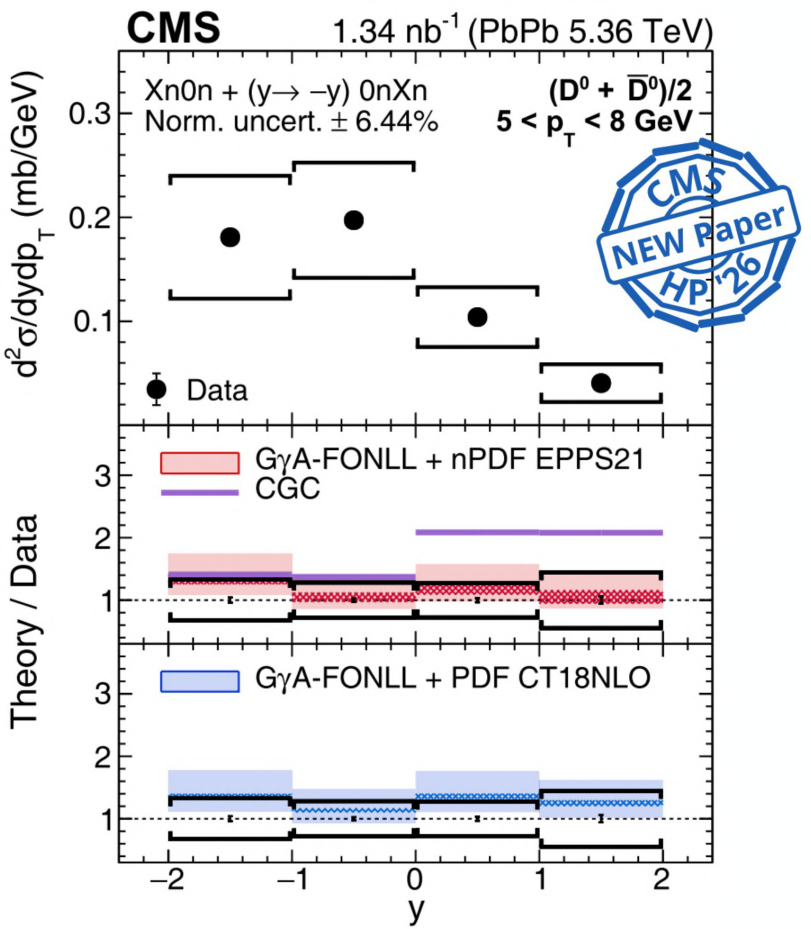
$Q^2 \approx p_{T,c}^2 + m_c^2$

$x \approx e^{-y}\sqrt{Q^2/s_{NN}}$





PRL 136 (2026), 122303



- Probing the low Q scale in small-x with heavy flavor
- New publication compares pQCD + nPDF and npQCD dynamic model with saturation model (CGC)

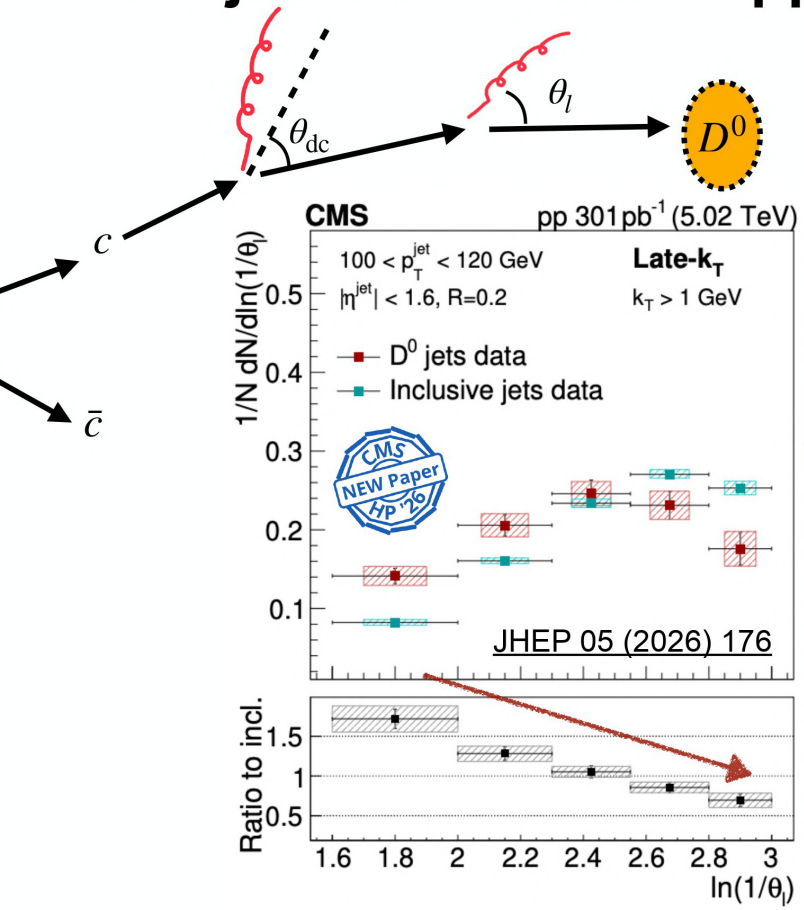
Wednesday, C. McGinn



Cms

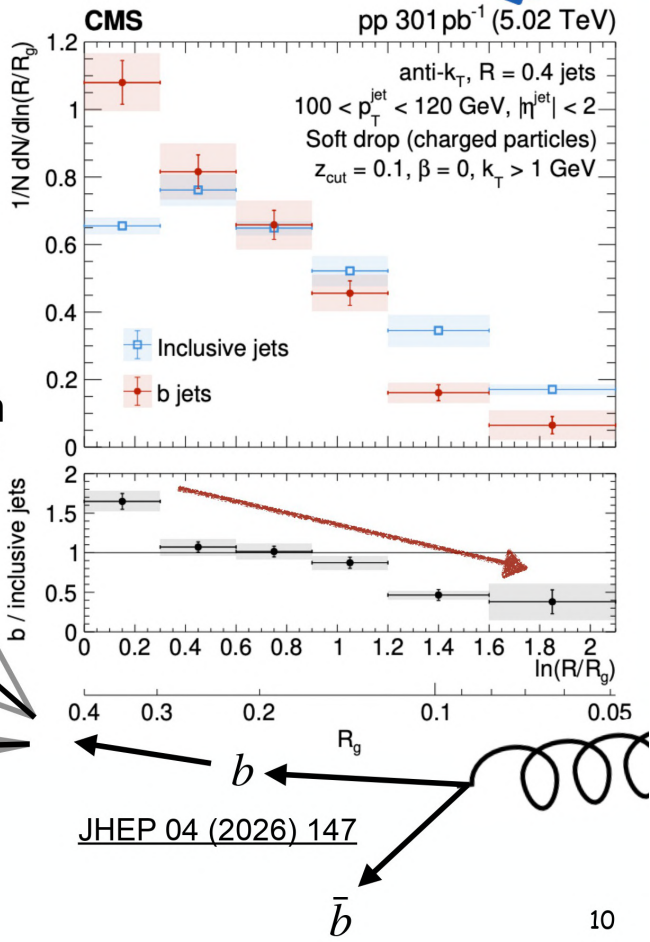
Dead cone effect in vacuum

b/c-jet shows clear suppression in the collinear radiation



$$\theta_{dc} \propto \frac{m_q}{E}$$

- CMS measured dead cone(dc) effect via jets containing
  ← D^0 mesons and
  partially reconstructed b hadrons →
- What kind of physics can we learn about using the dead cone in AA?

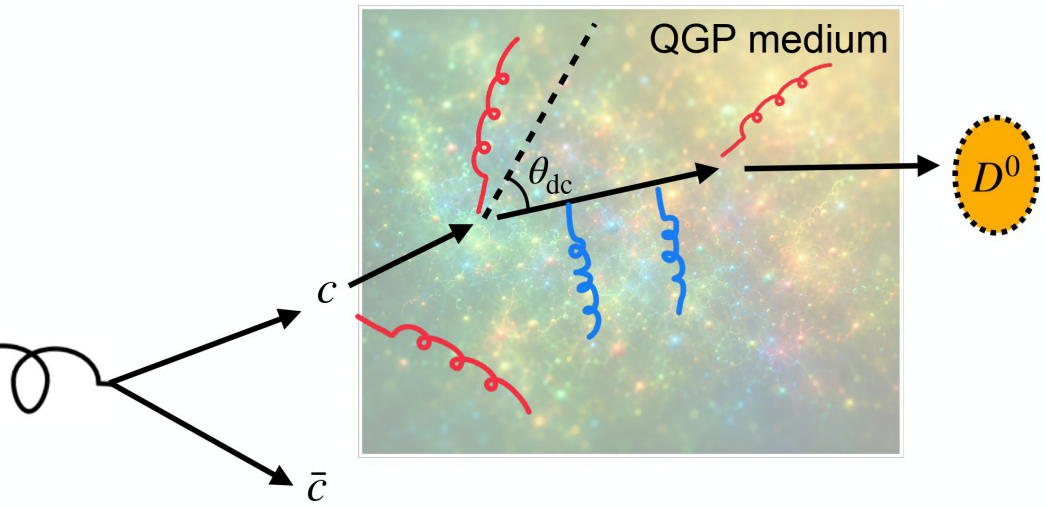


Tuesday, J. Mijuskovic

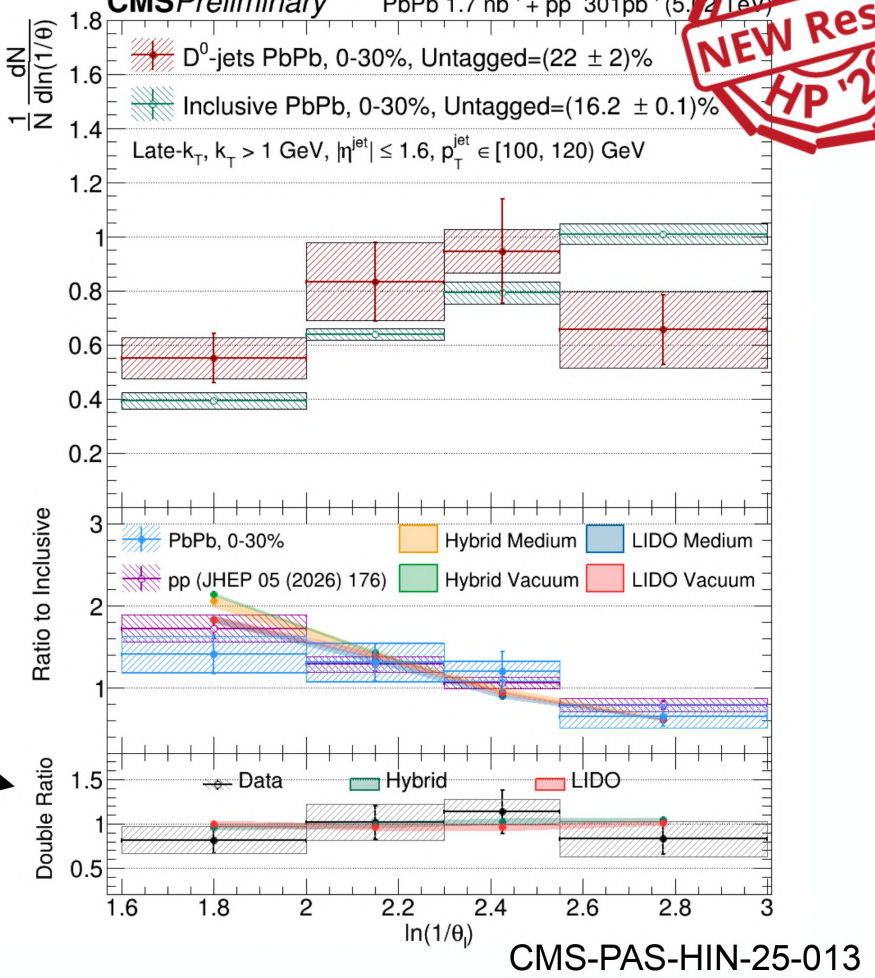


Cms

Dead cone effect in PbPb



- First measurement of the dead cone effect in AA!
- Suppression level similar to vacuum
- Indicates no dead cone filling effect
  - Future: check in b jets!



CMS-PAS-HIN-25-013

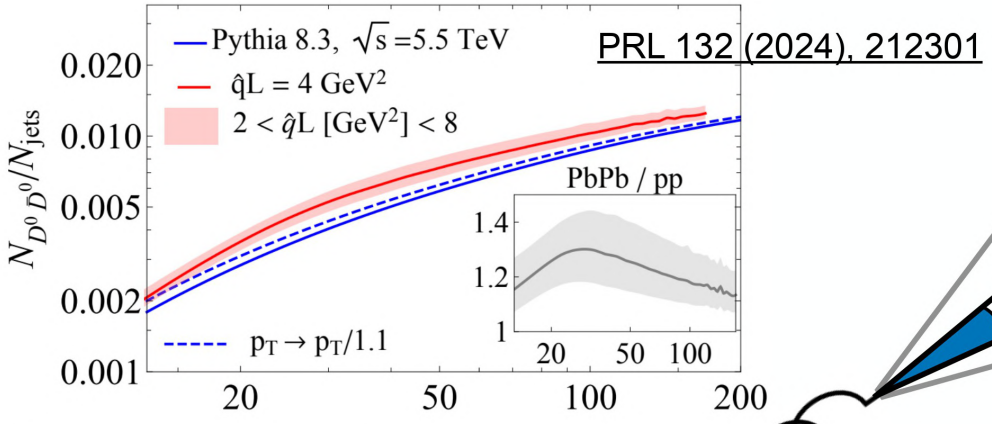
Tuesday, L. Frosina



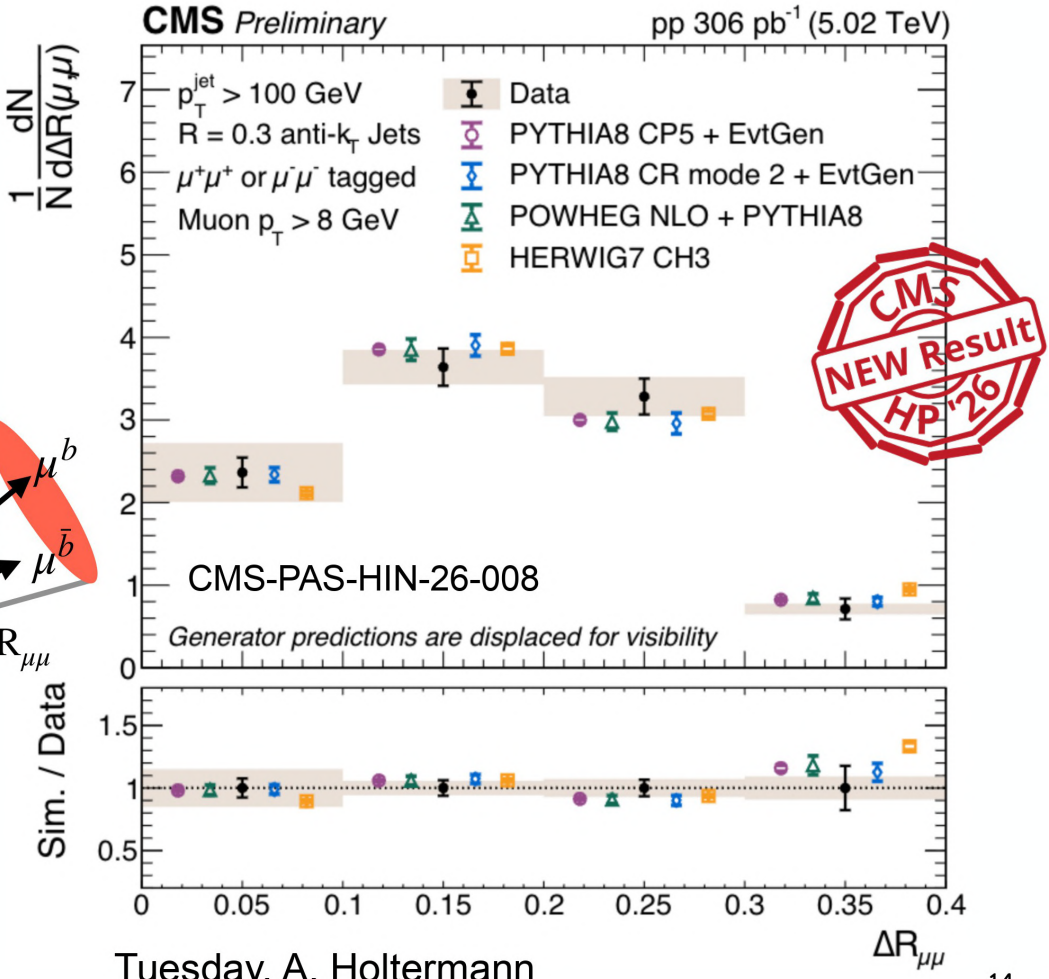
Cms

Probing sensitivity to gluon splitting via $g \to b\bar{b}$ in pp

- New measurement of dimuon correlation in jets
- $g \to b\bar{b}/c\bar{c}$ probes medium induced radiation, k_T broadening, and time structure of quenching



PRL 132 (2024), 212301

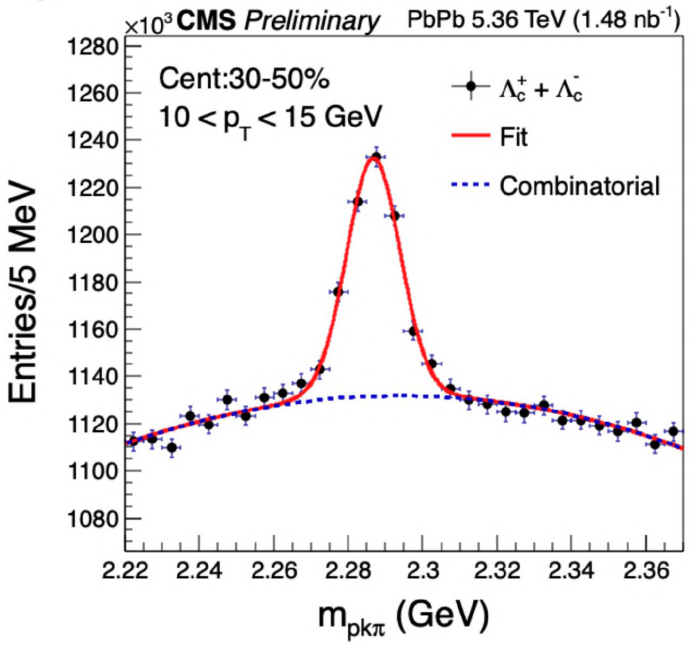


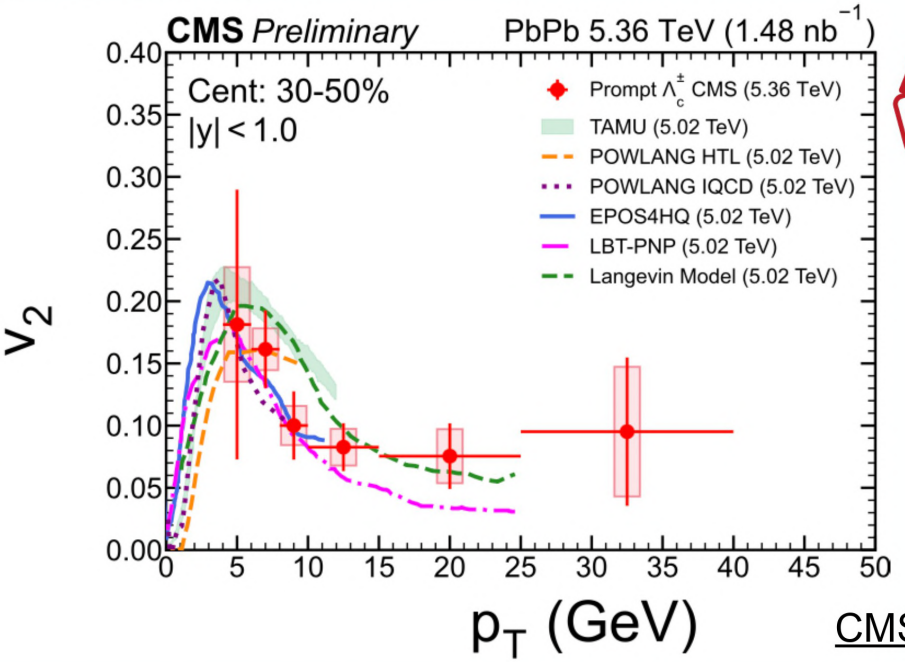
Tuesday, A. Holtermann



Cms

$\Lambda_c^{\pm}$ anisotropic flow in PbPb





CMS NEW Result HP '26

CMS-PAS-HIN-25-022

- Enhanced statistics with the large minimum bias trigger data
- $\Lambda_c^{\pm}$ flow measurement hadronization and path-length dependent energy loss with high p_T?
- More to come with the full Run 3 data

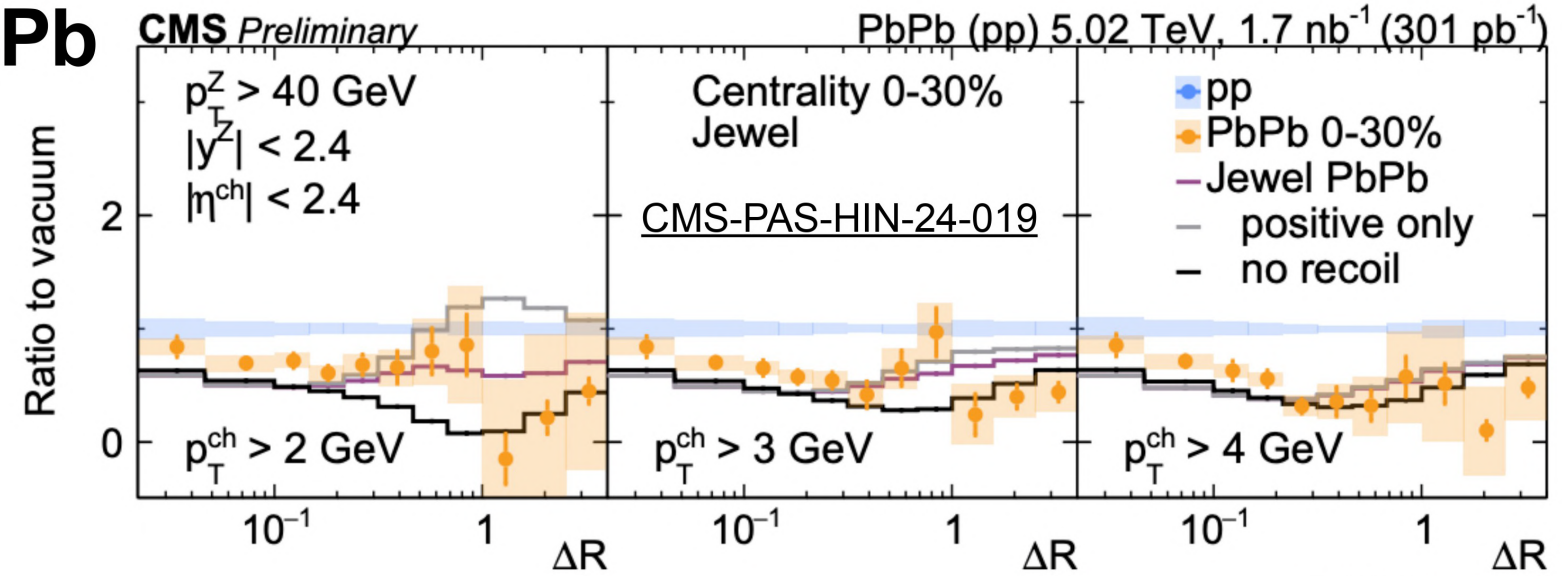
Tuesday, D. Singh Yadav



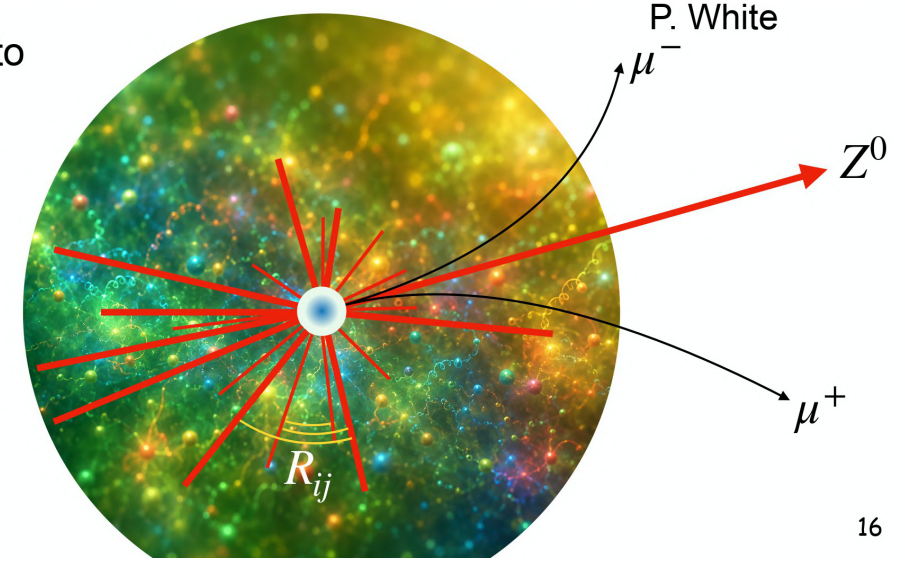
Cms

Z EEC in PbPb

Wednesday, P. White



- Clean event selection of the hard scale of the event by the p_{T}^{Z} to study energy flow from hard QCD recoil
- Successful extraction where we see clear nuclear modification stronger at central collision/higher hadron p_{T}
- Implications are model(Jewel, Hybrid) dependent

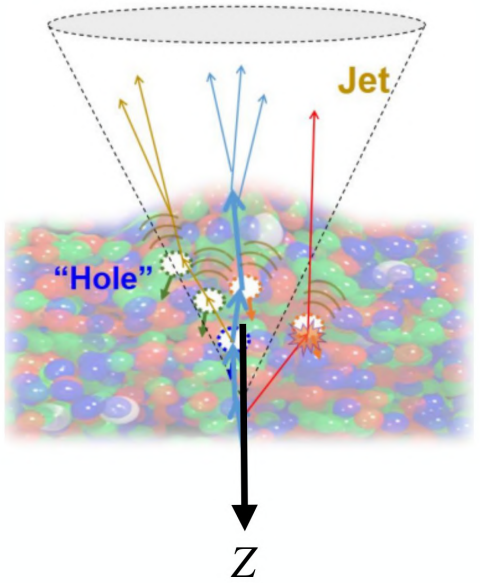


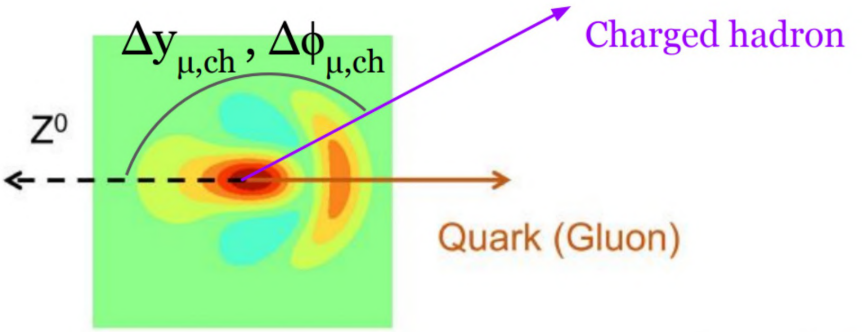
$$\mathrm{EEC}(\Delta R) = \frac{1}{N_Z} \sum_{\text{event}} \left[\sum_{i,j} p_T^i p_T^j \, \delta\left(\Delta R - \Delta R_{ij}\right) \right]$$

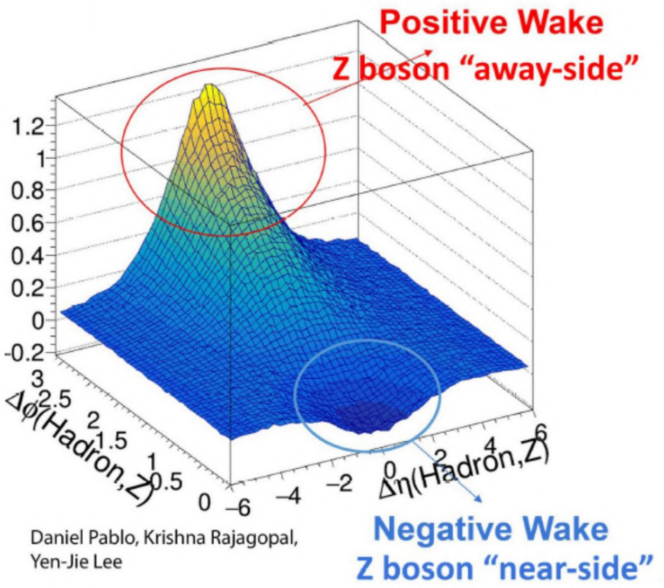


Cms

Z–hadron correlation





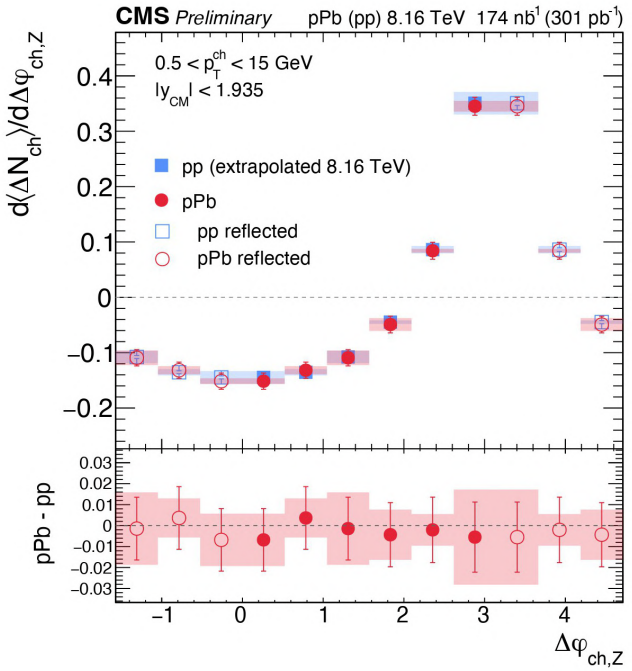


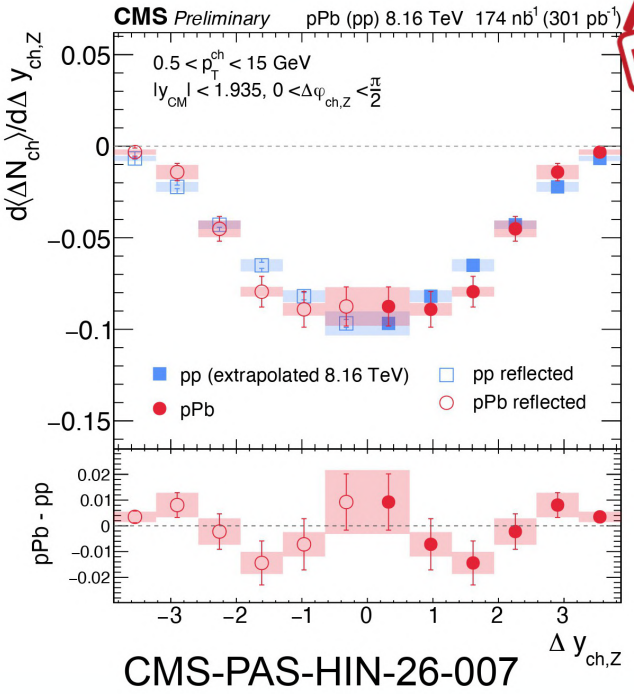
- Z boson lets us probe the diffusion wake effect
- Depletion of particles from negative wake at Z going direction!



Cms

Z–hadron correlation in pPb





CMS-PAS-HIN-26-007



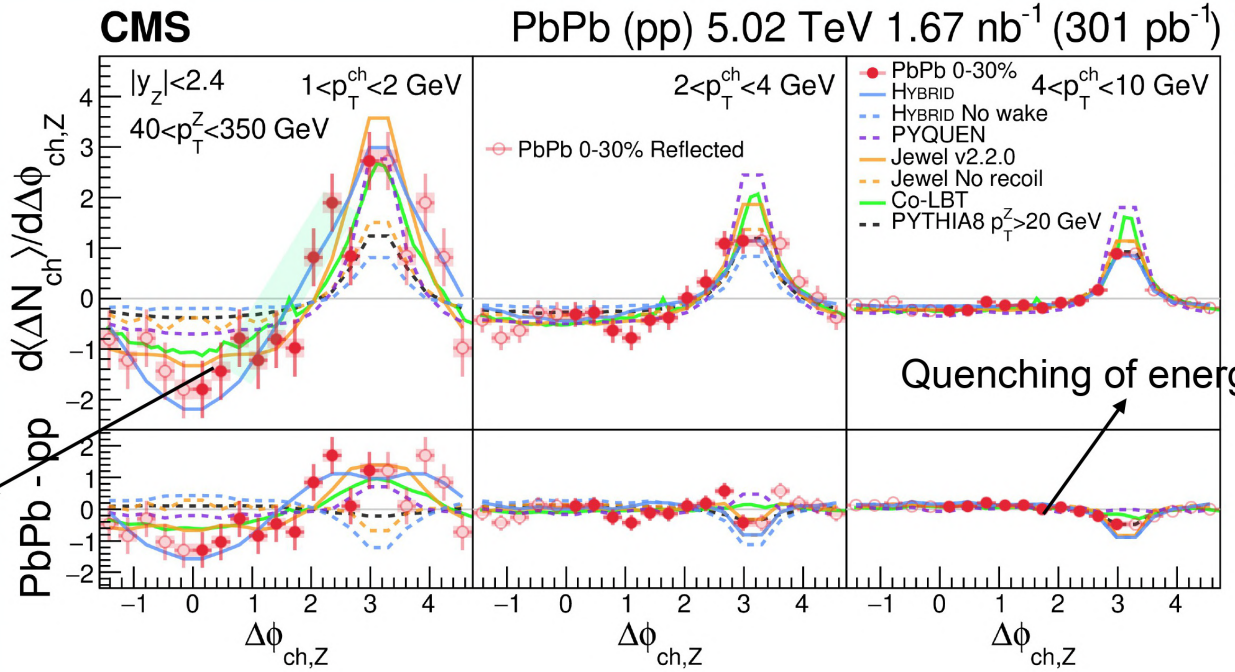
- First Z - hadron correlation in pPb
  - No modification observed, compatible between pPb and pp (extrapolated from 5 TeV)
    - Low p_T: medium response, high P_T: jet quenching scenario!
    - No sign of cold nuclear matter driven modification

Wednesday, K. Devereaux



Cms

Z–hadron correlation in PbPb



CMS NEW Paper HP '26

PLB 874 (2026) 140120

Quenching of energetic partons in recoil jet

Sensitive to wake response

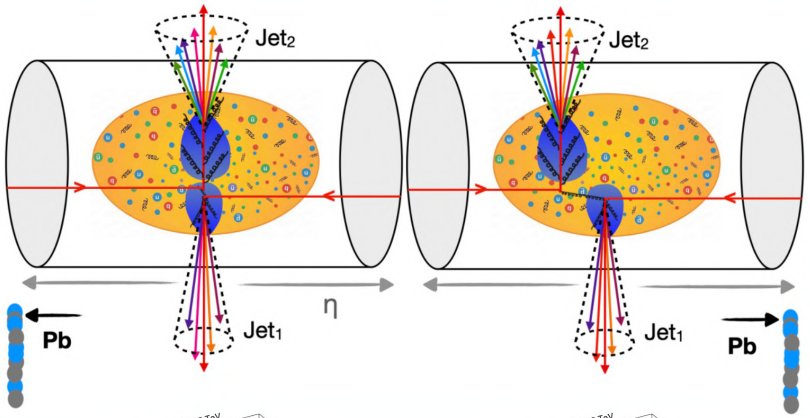
- pPb measurement established as good baseline, how about in PbPb?
  - Depletion of soft particles from diffusion wake response from recoiling parton(s) + jet quenching
- Using Z = clean environment but can we use dijets for higher statistics?

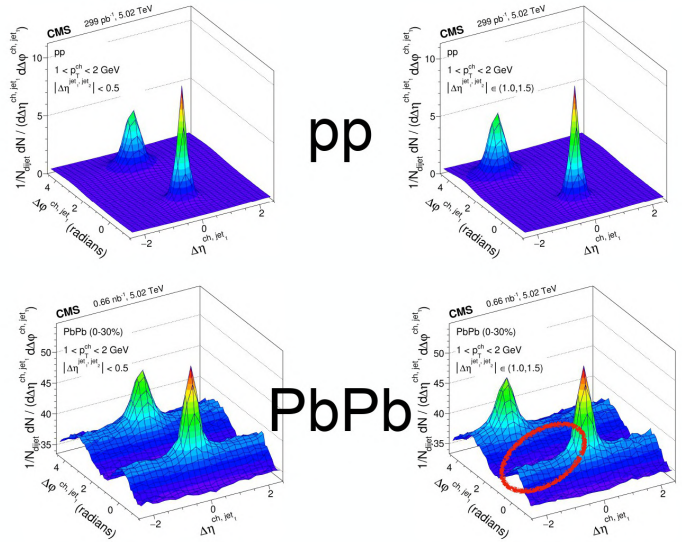
Wednesday, K. Devereaux



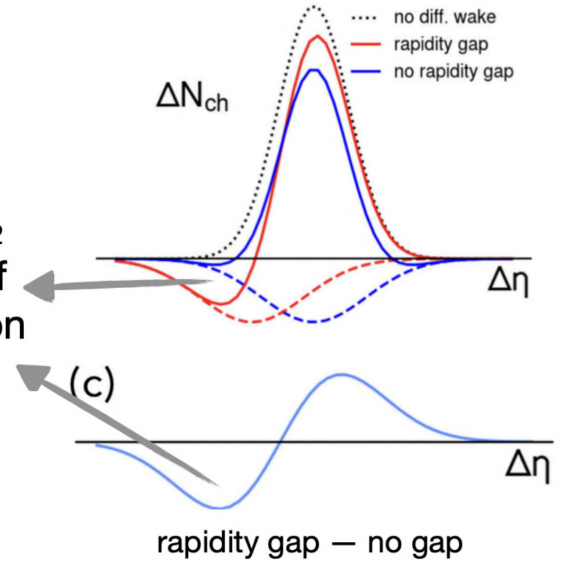
Cms

Observation of diffusion wake induced particle depletion (PbPb)





Diffusion wake of jet_2 visible at near-side of jet_1-hadron correlation

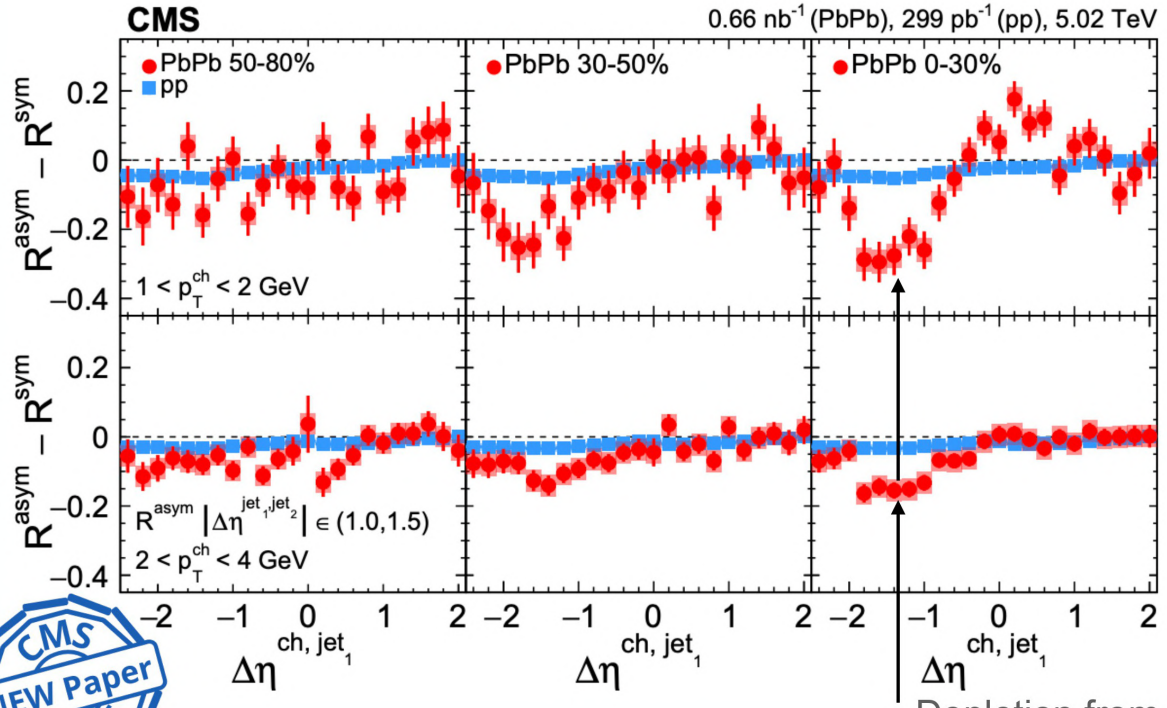


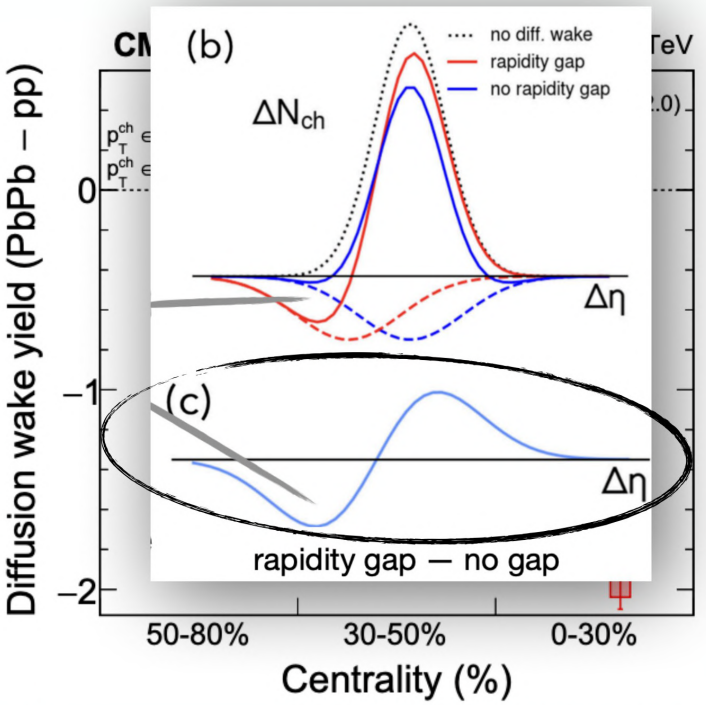
- Abundant dijets + excellent jet resolution in PbPb @CMS = sensitivity to subtle effect near the jet peak 👀



Cms

Wake induced charged particle depletion in PbPb





Depletion from jet wake
(Stronger for low p_T charged particles)

arXiv:2602.19431, submitted to PRL

- Signal stronger going to central events when probed with wider gap + lower p_T
- First observation(> 5σ) of diffusion wake effect in heavy ion collisions

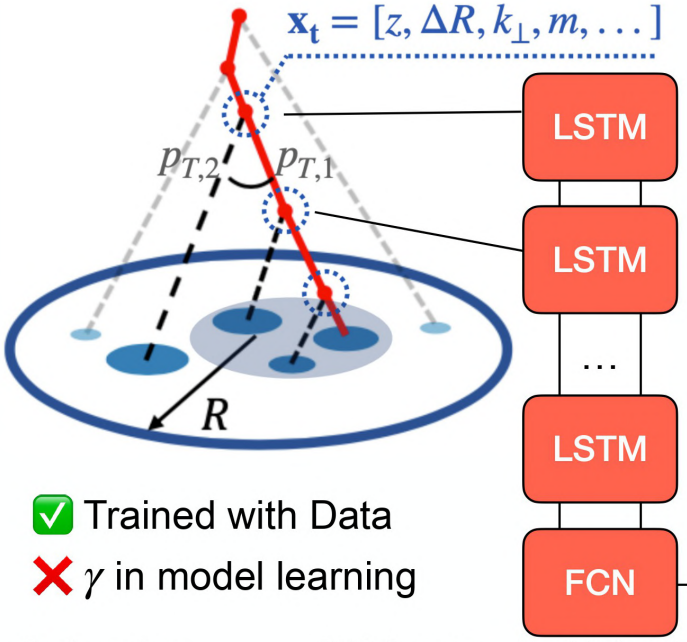
Wednesday, R. Pradhan



Cms

Accessing jet information from AI in PbPb

- CMS leverage artificial intelligence from particle tracking to jet tagging
- Can we train a model to learn about jet quenching?
  - Declustered γ-jet substructure →Use AI for sequential data!



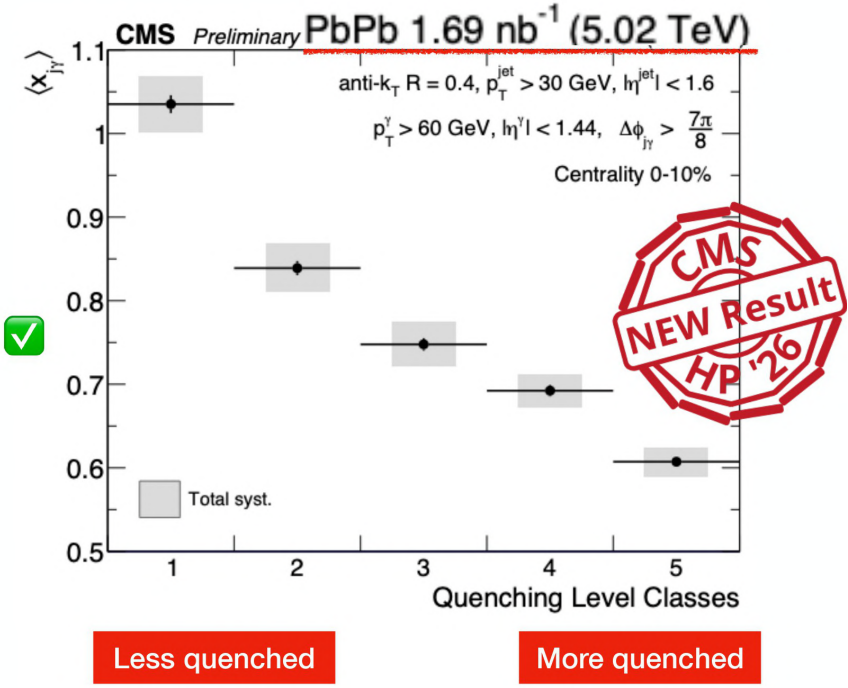
✅ Trained with Data

❌ γ in model learning

Real data physics validation ✅

$$\langle x_{j\gamma} \rangle = \langle p_T^{\text{jet}} / p_T^{\gamma} \rangle$$

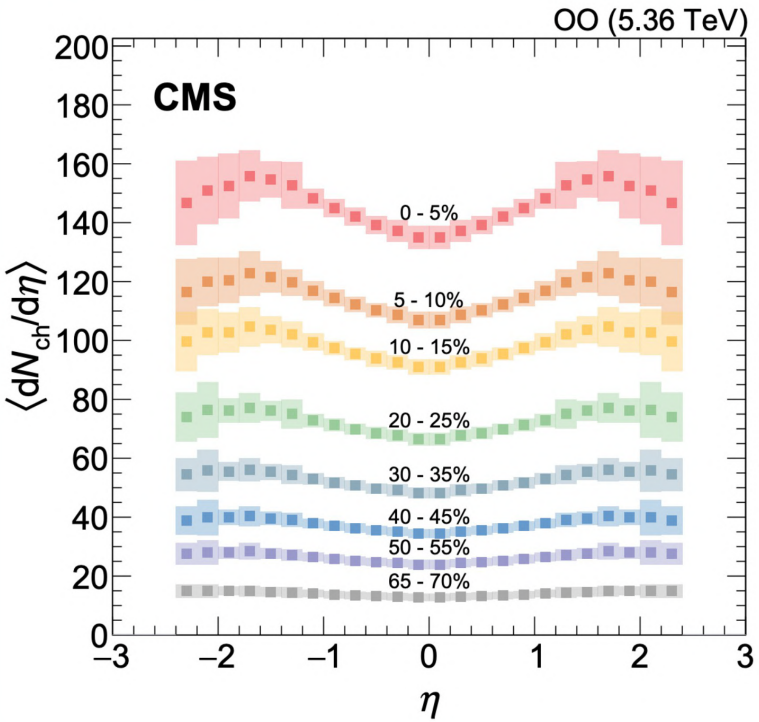
1. Like vacuum
   …
5. Most quenched

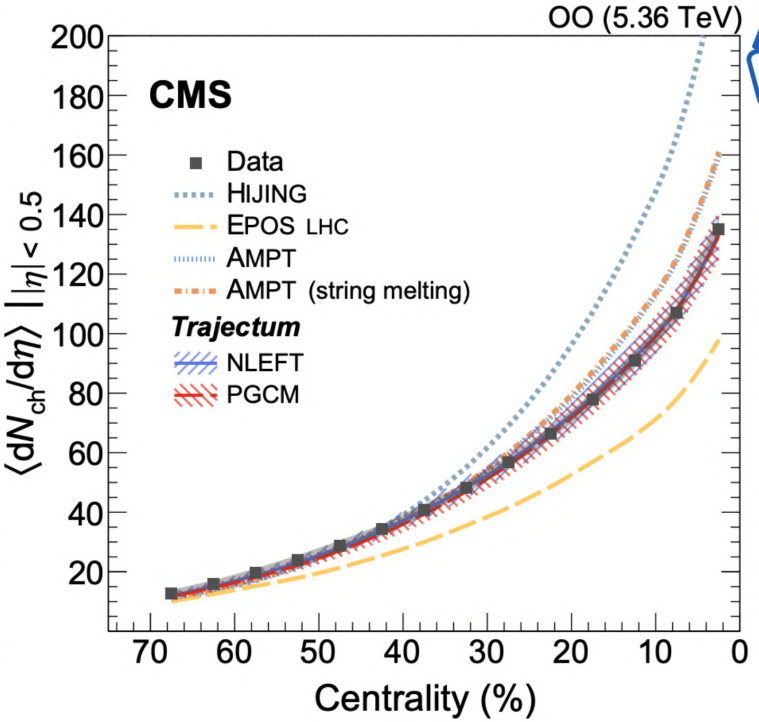




Cms

Understanding particle production in OO





CMS NEW Paper HP '26

Submitted to PLB

arXiv.2606.02285

- Ground work to characterize the geometry of OO collisions
- Centrality dependence measurement used to tune models

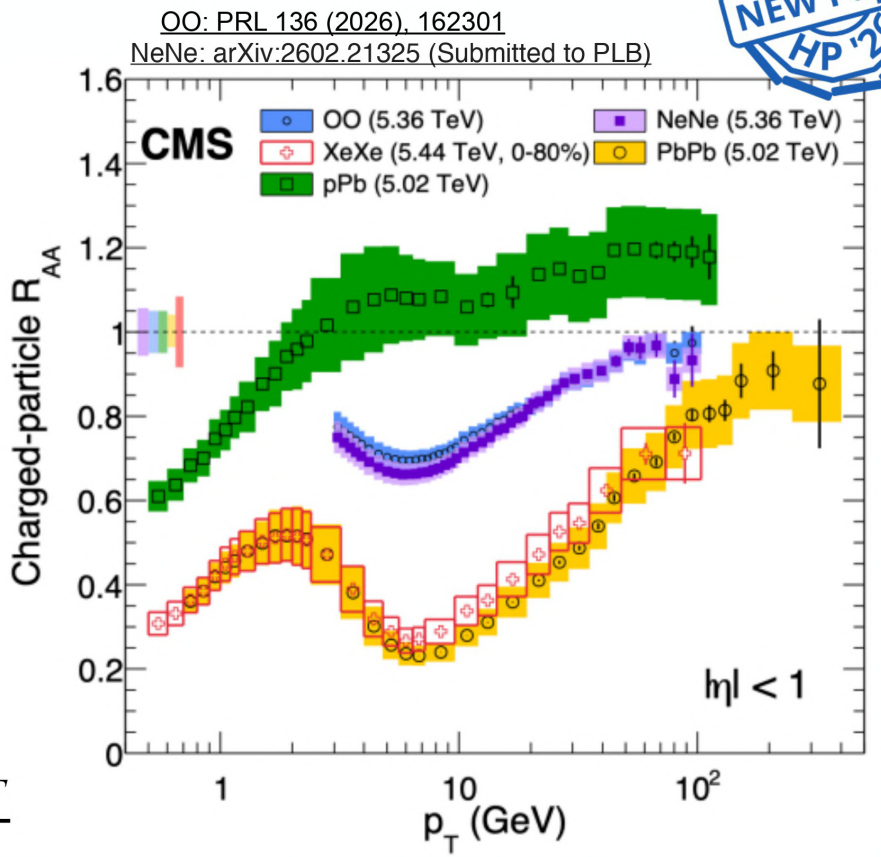


Cms

Particle production in light ion collisions

- Clear hierarchy between small and large systems!
- All features of medium response shown
  - Radial flow effect in low p_{T}
  - Parton energy loss in high p_{T}

OO: PRL 136 (2026), 162301
NeNe: arXiv:2602.21325 (Submitted to PLB)



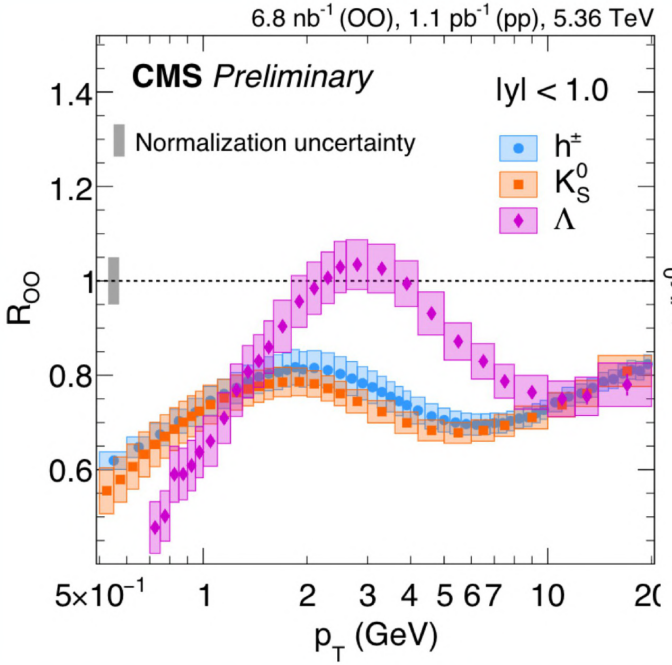
$$R_{AA} = \frac{1}{A^2} \frac{\mathrm{d}\sigma_{\mathrm{AA}}/\mathrm{d}p_T}{\mathrm{d}\sigma_{\mathrm{pp}}/\mathrm{d}p_T}$$

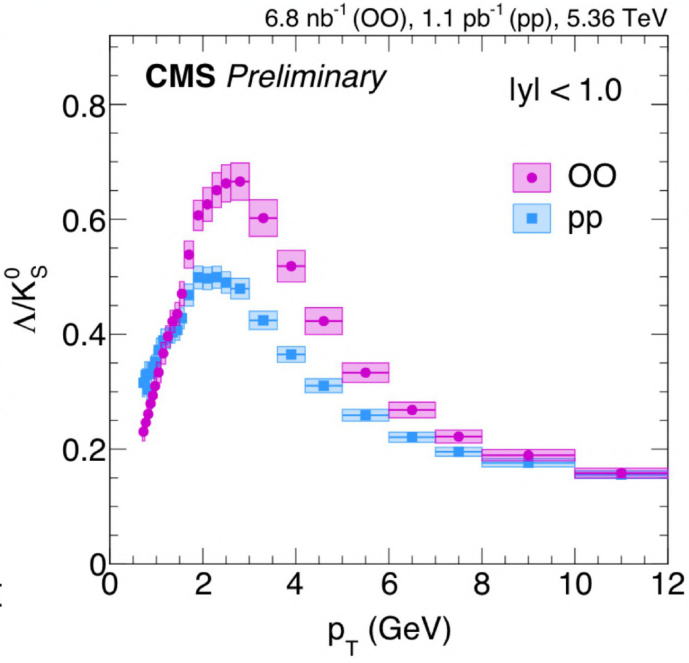
Tuesday, V. Pant



Cms

Strange particle production in light ion collisions







CMS-PAS-HIN-25-020

- R_{OO} of charged particles, K^0_S and Λ to down to 500 MeV
- Enhancement of strange baryon-to-meson(Λ/K^0_S) ratio from quark-coalescence + radial flow
  - Clear distinction of Λ/K^0_S from pp, comparable to peripheral PbPb qualitatively

Tuesday, S. Das



Cms

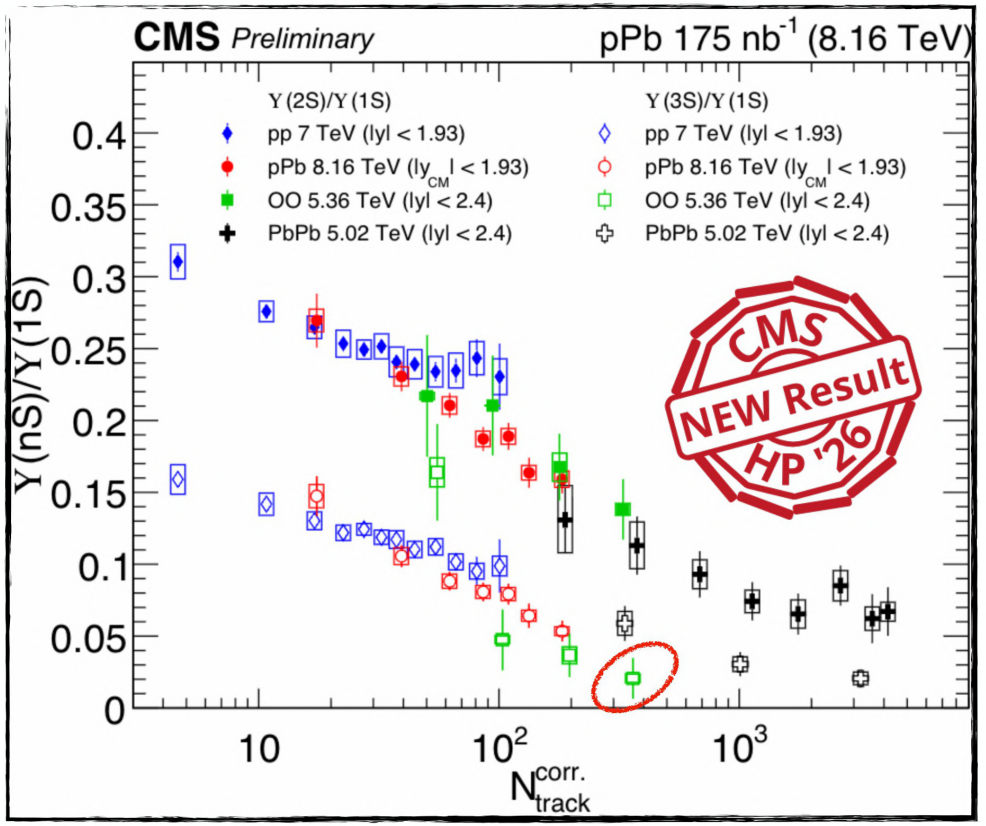
Υ suppression in small systems

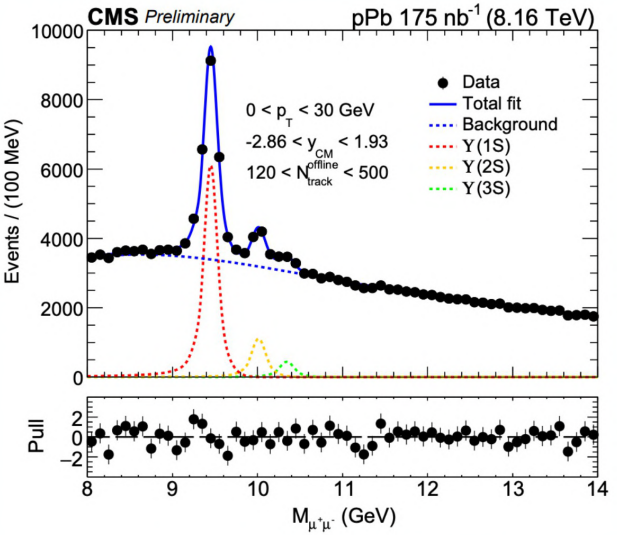
pPb

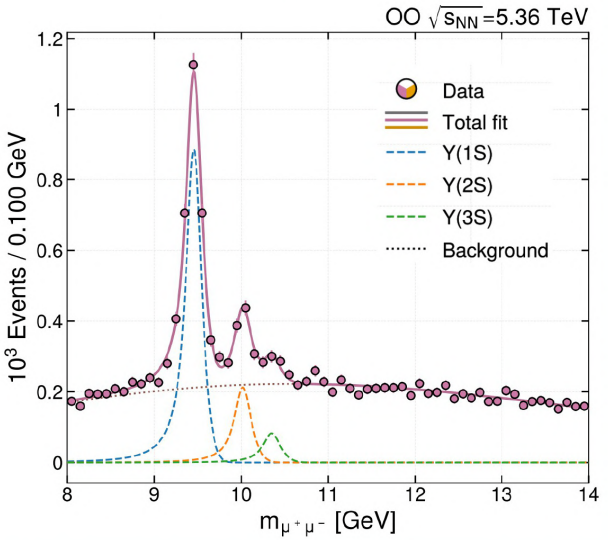
OO

pPb: CMS-PAS-HIN-25-005

OO: CMS-PAS-HIN-25-015







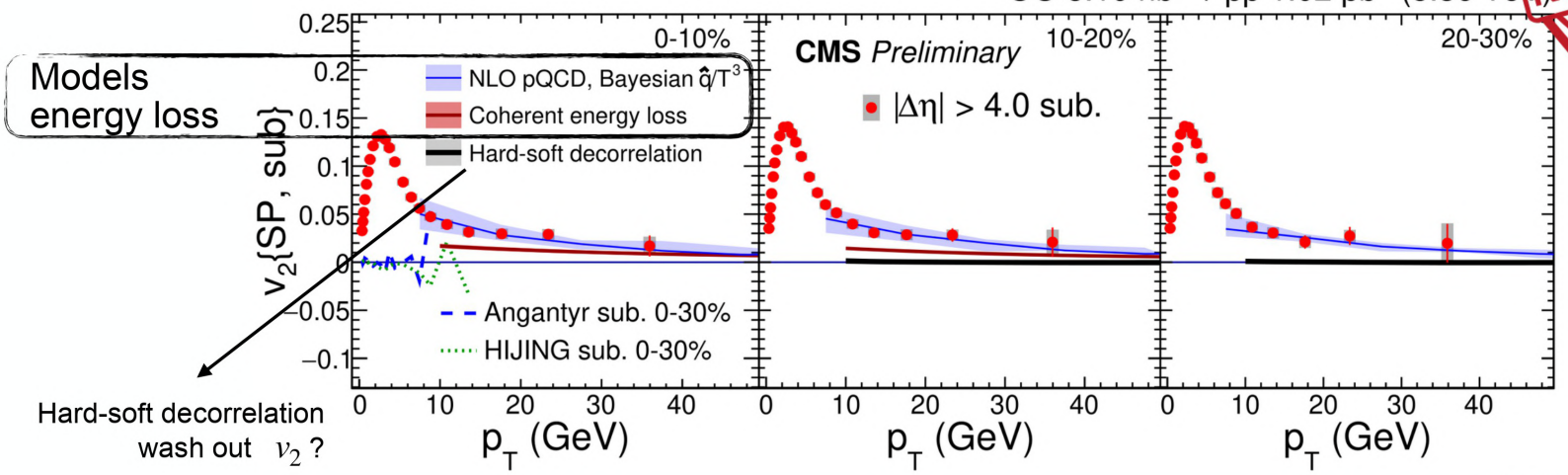
- Υ(nS)/Υ(1S) sensitive to final state modifications
- Strong suppression of $\Upsilon(3S)/\Upsilon(1S)$ in high multiplicity OO ~ central PbPb?

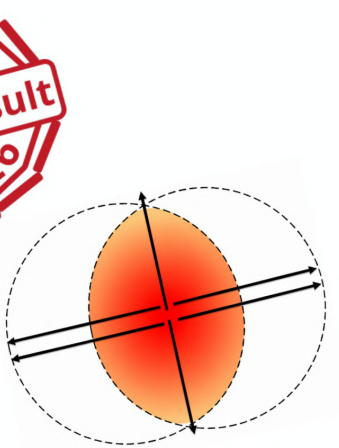
Wednesday, A. Baty



Cms

Path length dependent E-loss in OO





[F. Arleo, G. Falmagne, 2024]

CMS-PAS-HIN-26-005

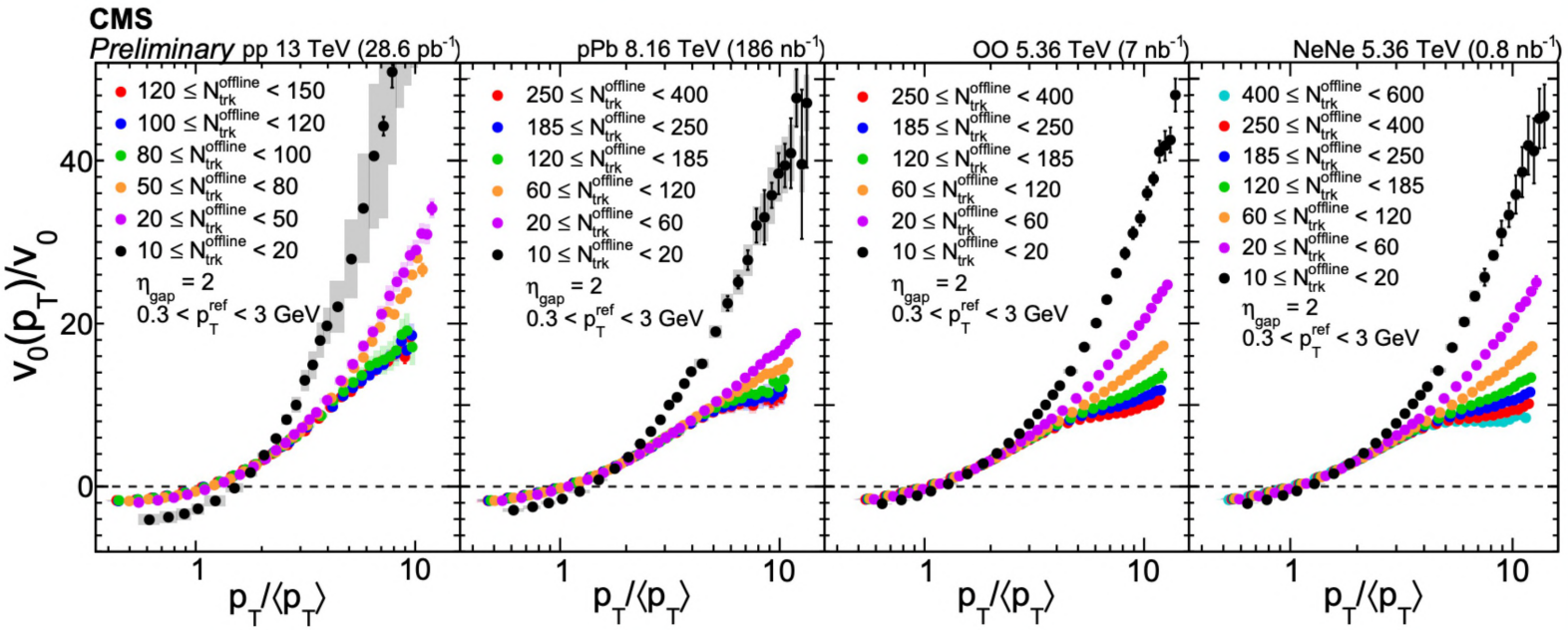
Tuesday, S. Tuo

- Study early time energy loss from high p_T v_2!
  - Non-flow effects, significant in high p_T, are carefully removed with pp subtraction and wide sub-event η gap
  - Well described by the pQCD parton model with T constraint and radiative energy loss



Cms

Measuring $v_0(p_T)$ across systems in CMS





CMS-PAS-HIN-25-016

- First measurement of $v_0(p_T)$ characterizing p_T dependent radial flow fluctuations in light ions
- Normalized correlation with p_T as $v_0(p_T)/v_0$ vs $p_T/\langle p_T \rangle$ hints at similarity across systems at multiplicity > 20 up to $p_T/\langle p_T \rangle \leq 2$
  - Collective behavior? We are up for discussion on the implications!



LHCb overview

Hard Probes 2026
22/06/2026

Óscar Boente García
On behalf of the LHCb collaboration



Lhc-b

D^0 production in OO and NeNe

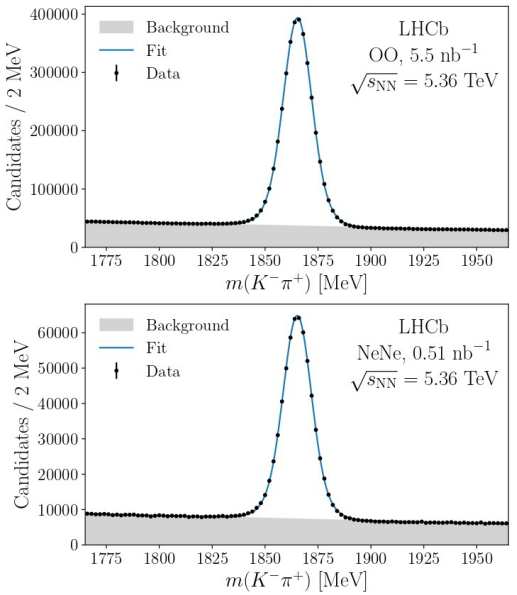
New in Hard Probes!

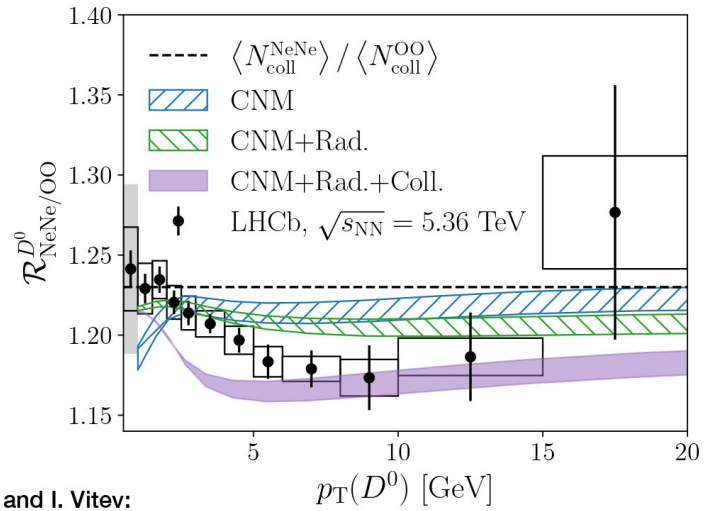
J. Lin talk, 24/06 (HF and Quarkonia)

arXiv:2605.27273

- Data from 2025 light ion run:
  - Optimal detector performance, very clean sample

- $\mathcal{R}^{D^0}_{\mathrm{NeNe/OO}} \equiv \dfrac{\mathrm{d}N^{\mathrm{NeNe}}_{D^0}/\mathrm{d}p_{\mathrm{T}}}{\mathrm{d}N^{\mathrm{OO}}_{D^0}/\mathrm{d}p_{\mathrm{T}}} \dfrac{N^{\mathrm{OO}}_{\mathrm{inel}}}{N^{\mathrm{NeNe}}_{\mathrm{inel}}}$
- Difference between OO and NeNe collisions
- Shape indicates QGP-like effects in NeNe :
  - **Study onset of QGP production with increasing nucleus size**





W. Ke and I. Vitev:
Phys. Rev. C107 (2023) 064903



Lhc-b

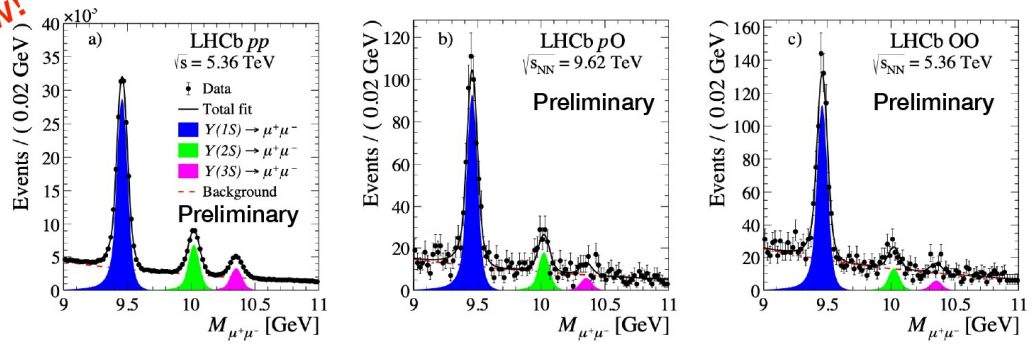
Bottomonia in pp, pO and OO

New in Hard Probes!

J. Lin talk, 24/06 (HF and Quarkonia) LHCb-PAPER-2026-027 (in preparation)

- Clean $\Upsilon(1S)$, $\Upsilon(2S)$ and $\Upsilon(3S)$ signals observed across Run 3 data → pp, pO and OO collisions

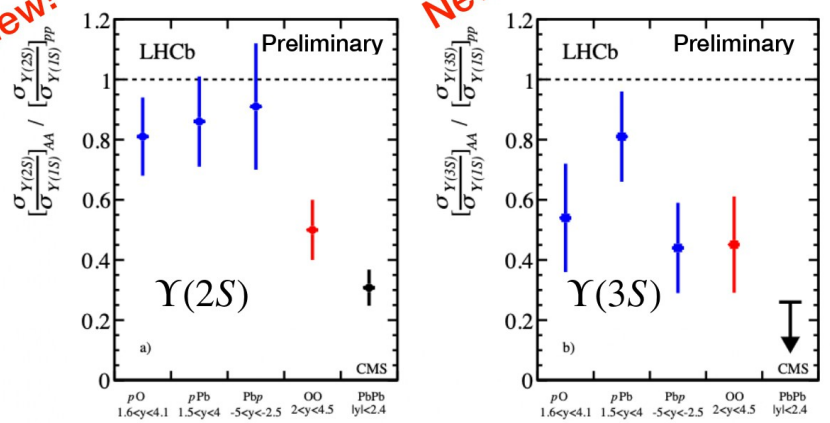
New!



$\Upsilon(nS)$ suppression: **Signature of QGP formation**

pPb, Pbp: JHEP 11 (2018) 194
CMS: PRL 120 (2018) 14, 142301

New!



- Double ratios excited-to-ground state with pp: **cancel initial-state effects**
- $\Upsilon(2S)$ suppressed about a factor 2 compared to pp, 4.8σ difference
  - **Pointing to emergence of QGP in OO collisions**
  - pO, pPb, Pbp serve as a reference for Cold Nuclear Matter effects



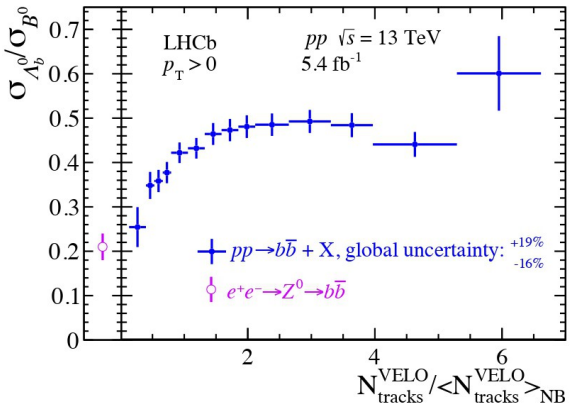
Lhc-b

Heavy-flavor hadronization in *pp* and *p*Pb

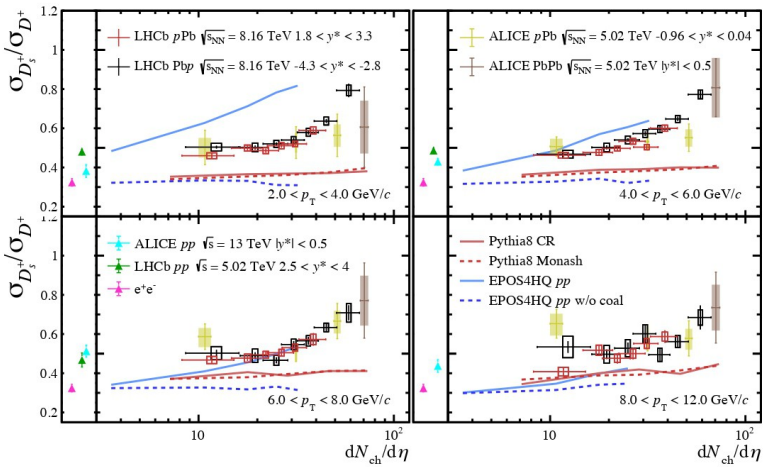
Poster M. Durham
Poster C. Da Silva

- Hadron ratio measurements with multiplicity in small systems
- Deviation from fragmentation mechanism observed across the beauty and charm sectors
  - Emergence of collective effects at high-multiplicity, coalescence mechanism?
  - **Is this picture universal for across all hadron systems?**

Λ_b^0-to-B^0 in *pp*



D_s^+-to-D^+ in *p*Pb



D_s^+, D^+: Phys. Rev. D 110 (2024) L031105
Λ_b^0, B^0: Phys. Rev. Lett. 132, 081901



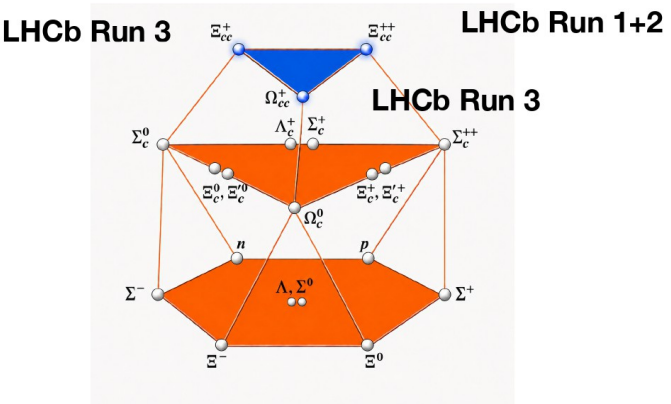
Lhc-b

First observation of Ξ_{cc}^+ and Ω_{cc}^+ states

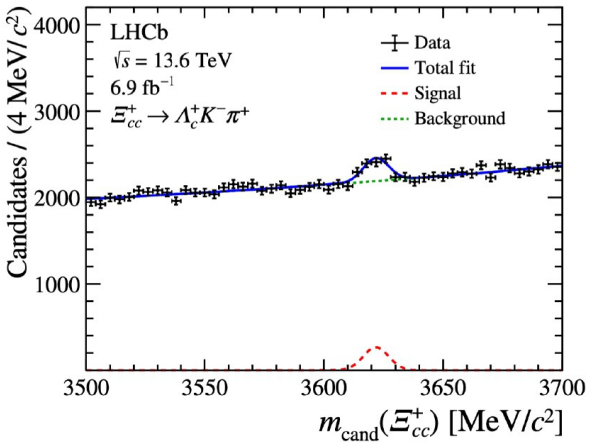
New in Hard Probes!

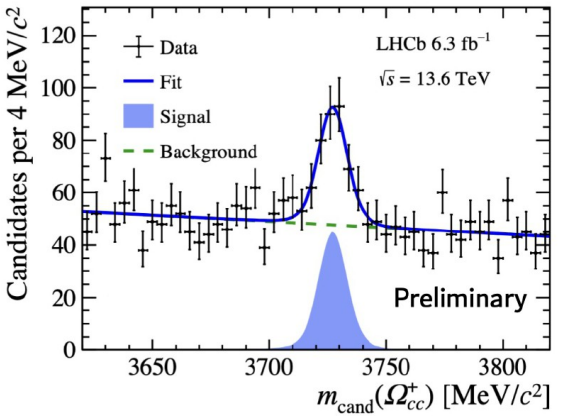
- **First new hadrons discovered with Run 3 data**
  - Run 1+2 searches were previously inconclusive (SCPMA 64 (2021), 101062; SCPMA 63 (2020) 2, 221062)
- Observation in $\Xi_{cc}^+ \to \Lambda_c^+(pK^-\pi^+)K^-\pi^+$ (ccd) and $\Omega_{cc}^+ \to \Omega_c^0(\to pK^-K^-\pi^+)\pi^+$ (ccs)
  - Yield per fb^{-1} improved factor ~ 4 thanks to improved fully-software trigger
- **New future probes of charm hadronization in medium !**

Ξ_{cc}^+: arXiv:2603.28456 Ω_{cc}^+: LHCb-PAPER-2026-022, in prep.



All members of the spin-1/2 20-plet of ground-state baryons established







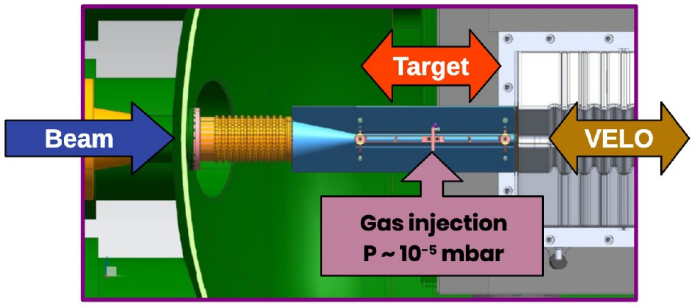
Lhc-b

Charmonia in fixed-target mode

New in Hard Probes!

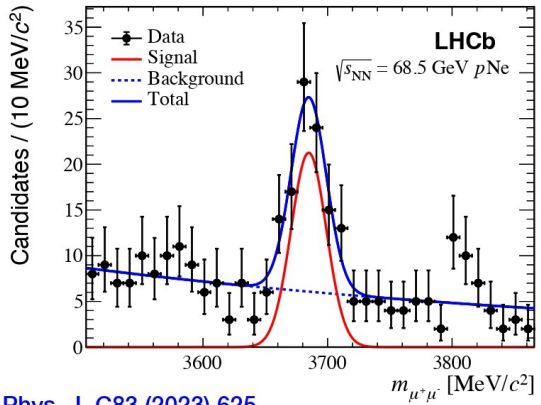
LHCb-PAPER-2026-026, in preparation

- **SMOG2:** fixed-target system upgrade in Run 3
  - Increased luminosity vs Run 2 fixed-target and simultaneous data-taking with collider mode
  - New gases: H_2, D_2, Xe, CH_4
- New measurement of $\psi(2S)$ **and** J/ψ **cross-section ratio** in pAr and pp collisions
  - Precise determination of cold nuclear matter effects at $\sqrt{s_{NN}} = 113\,\text{GeV}$



Phys.Rev.Accel.Beams 27 (2024) 11, 111001

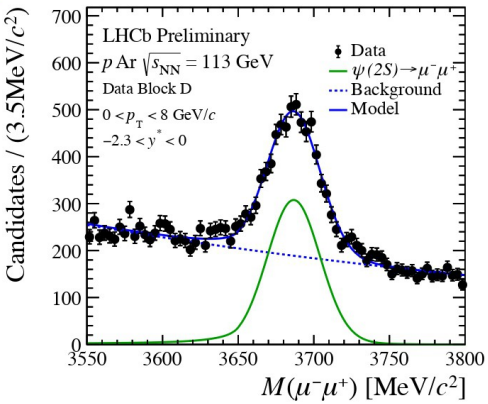
pNe, **largest sample of Run 2**



Eur. Phys. J. C83 (2023) 625

New!

pAr, **2024 data**





Lhc-b

Charmonia in fixed-target mode

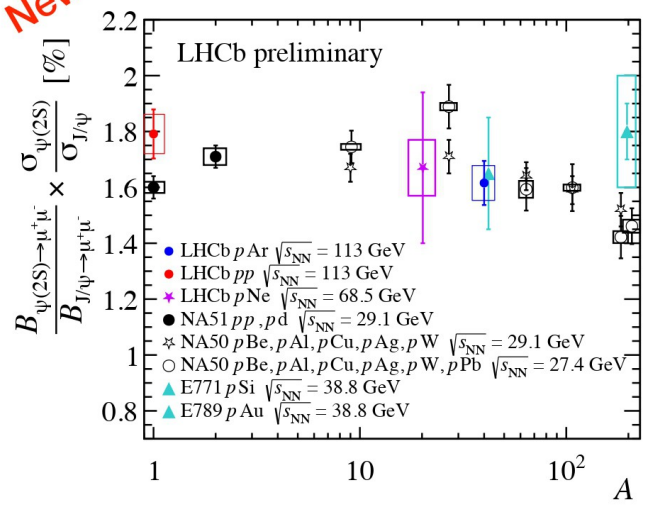
New in Hard Probes!

LHCb-PAPER-2026-026, in preparation

- Cross-section ratio **in line with previous fixed target measurements** at various target size
  - Increased precision wrt Run 2 measurement (EPJC 83 (2023) 625)
- Double ratio pAr-to-pp : $\left[\frac{\sigma_{\psi(2S)}}{\sigma_{J/\psi}}\right]_{p\mathrm{Ar}} \Big/ \left[\frac{\sigma_{\psi(2S)}}{\sigma_{J/\psi}}\right]_{pp} = 0.902 \pm 0.038 \pm 0.017$

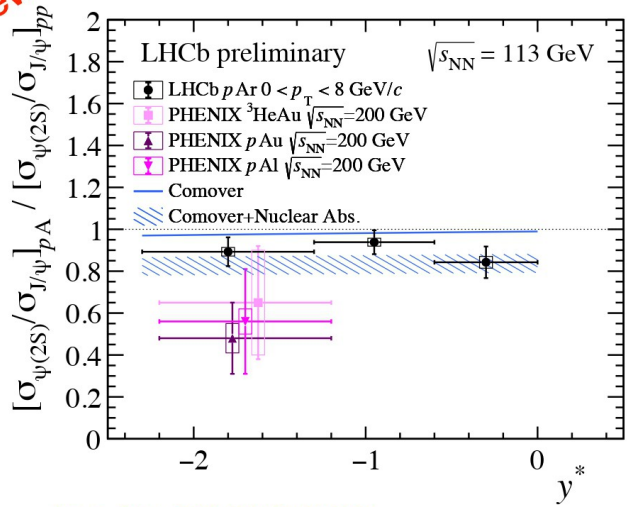
  Phys. Lett. B 749 (2015) 98
  JPCS 422 (2013) 012018
  - Dominated by final-state effects, initial state effects cancel out
  - Indication of **mild suppression**, probing interplay of nuclear absorption and comover effects

New!



New!

See J. Authier talk. 24/06 (HF and Quarkonia)



PHENIX: Phys. Rev. C 95 (2017) 034904



Lhc-b

Λ_c^+ polarization in pNe

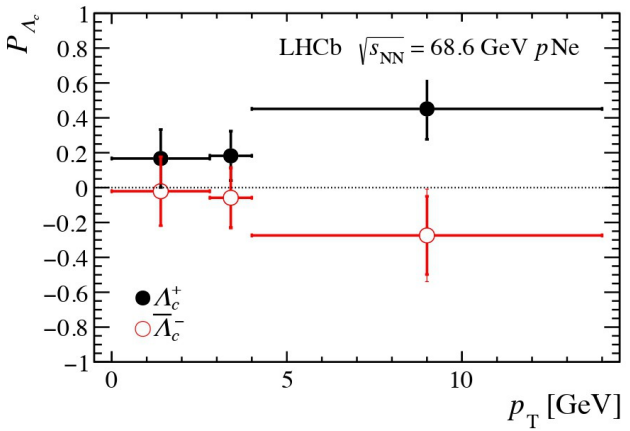
New in Hard Probes!

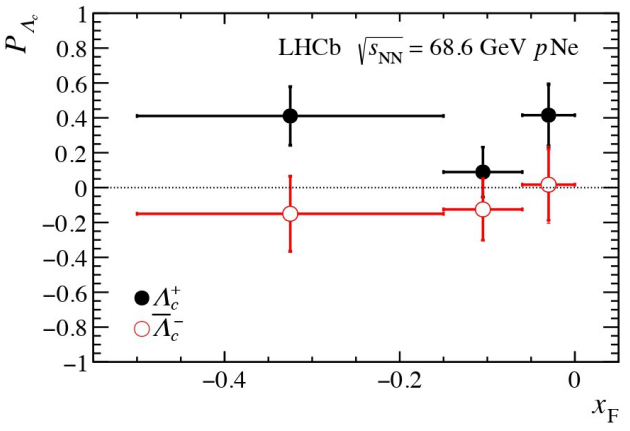
arXiv:2602.17184, *accepted by PRL*

- Charm baryon polarisation driven by **heavy quark polarization**→Unique probe of spin dependent physics
- Exploit accurate amplitude model of $\Lambda_c^+ \to pK^-\pi^+$ measured in large pp sample
  PR D 108 (2023) 012023
- First determination separately for Λ_c^+ and $\overline{\Lambda}_c^-$:
  - Integrated Λ_c^+ polarization at 2.4σ significance: $P_{\Lambda_c^+} = (24 \pm 9 \pm 2)\%$
  - Integrated $\overline{\Lambda}_c^-$ polarisation consistent with zero: $P_{\overline{\Lambda}_c^-} = (-8 \pm 12 \pm 3)\%$

Great prospects for Run 3 !

See J. Authier talk, 24/06 (HF and Quarkonia)
See D. Loomis poster







Lhc-b

New insights in Jet Parton Shower

New in Hard Probes!

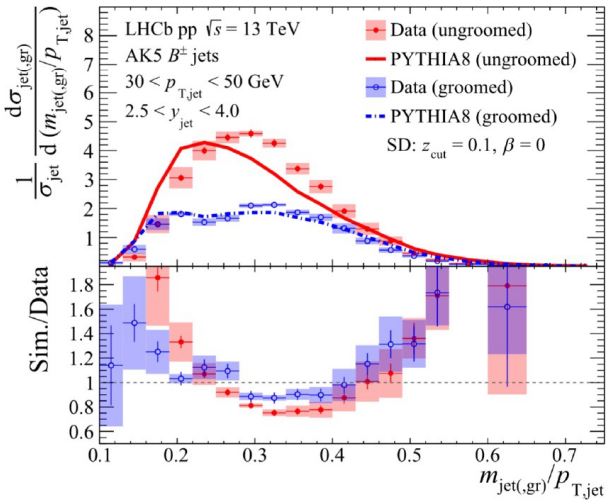
See E. Lesser talk&poster, 23/06 (Substructure)

- Forward coverage + full tracking & calorimetry + vertexing and forward boost
  - ➡ Unique insights on Jet Physics, especially for heavy-flavour jets

Beauty Jet mass

Phys. Lett. B 869 (2025) 139854

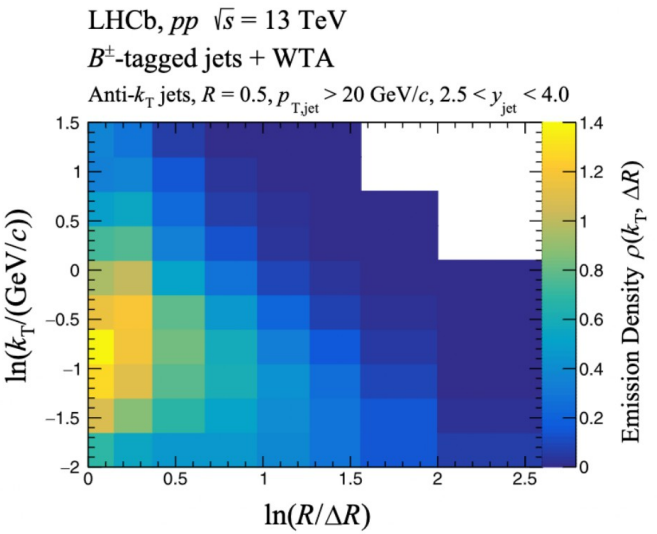
- $m_{\text{jet}} = \sqrt{E_{\text{jet}}^2 - p_{\text{jet}}^2}$; $m_{\text{jet}}/p_{\text{T,jet}}$ **calculable at any order with pQCD**
- Compare Grooming and Winner Take All (WTA)



Lund Jet Plane

Phys. Rev. D 112, 072015 (2025)

- **First observation of dead cone** effect in **beauty-quark** jets





Lhc-b

Studying hadronization with jets

New in Hard Probes!

- New hadron production measurements in Jets at LHCb

See E. Lesser talk&poster, 23/06 (Substructure)

Longitudinal Momentum carried by the hadron

$$z \equiv \frac{\vec{p}_{\text{jet}} \cdot \vec{p}_{\text{HF}}}{\left|\vec{p}_{\text{jet}}\right|^2} \sim \frac{p_{\text{T,HF}}}{p_{\text{T,jet}}}$$

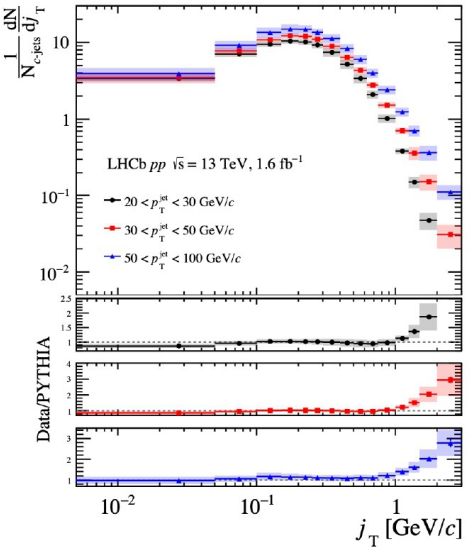
Transverse Momentum carried by the hadron

$$j_{\text{T}} \equiv \frac{\left|\vec{p}_{\text{jet}} \times \vec{p}_{\text{HF}}\right|}{\left|\vec{p}_{\text{jet}}\right|}$$

Charged hadrons in c&b-tagged jets

- Quantitative description of fragmentation of a beauty/charm quark into hadrons

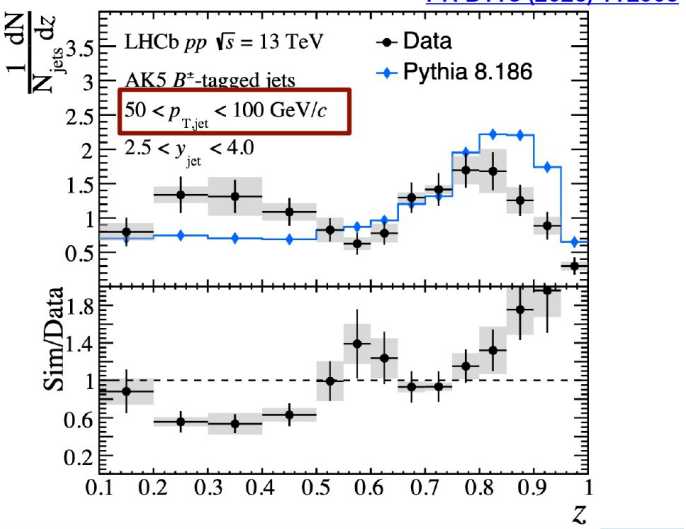
JHEP 04 (2026) 029



$B^{\pm}$ fragmentation in Jets

- Increased non-isolated contribution compared with PYTHIA

PR D113 (2026) 112006





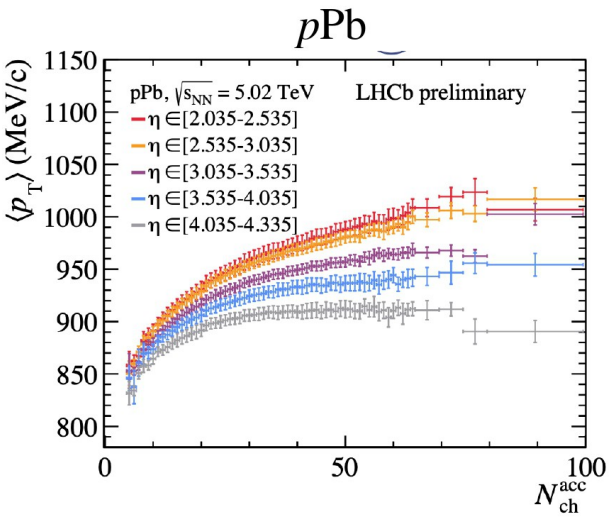
Lhc-b

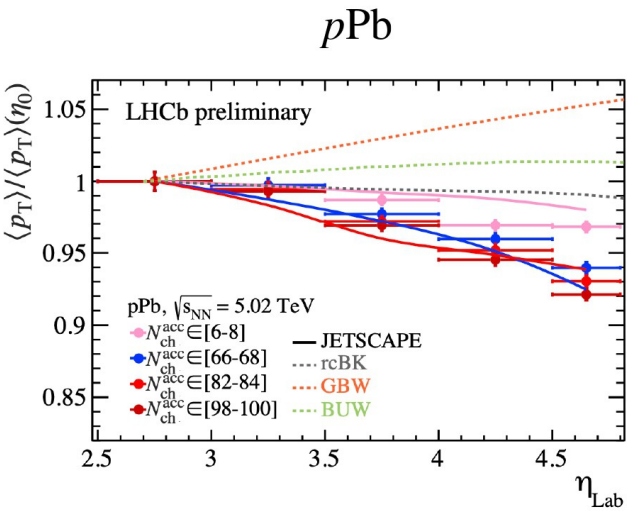
$< p_T >$ in pp, pPb and Pbp

New in Hard Probes!

See T. Boettcher talk, 24/06 (nPDF/Saturation/Early) **Poster E. Saltclah** LHCb-PAPER-2026-012, in prep.

- $< p_T >$ of charged particles is sensitive to saturation and (3+1D) hydrodynamics
- First determination of $< p_T >$ **in forward region for pp, pPb and Pbp collisions**
  - Cover wide range of multiplicities and different Bjorken-x





- Pseudorapidity-dependent trend **emerging at the largest multiplicities:**
  - Trend with multiplicity **in line with JETSCAPE calculations** (arXiv:2601.17234)
  - CGC-based models (rcBK, GBW, BUW) do not reproduce data



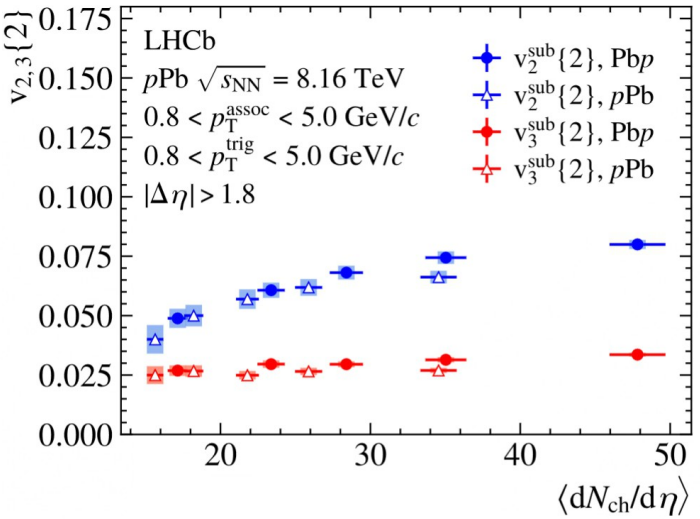
Lhc-b

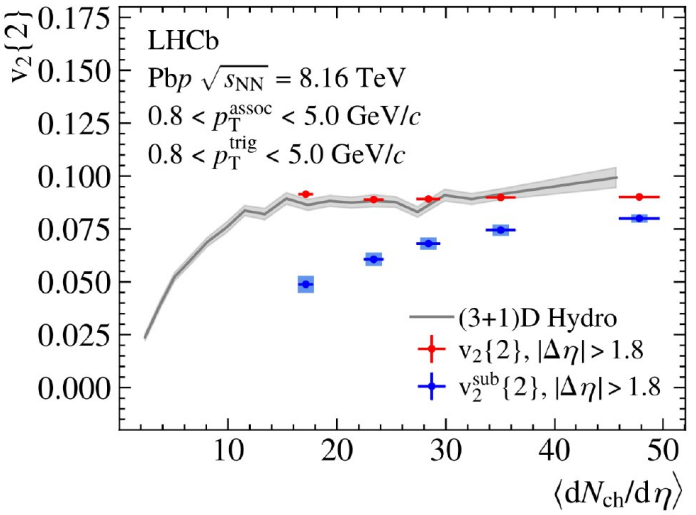
Flow in pPb and Pbp

New in Hard Probes!

JHEP 10 (2025) 124

- How can we explain flow in small systems ? **The mystery since early 2010s**
  - Hydrodynamic response of a formed medium ?
  - Initial state ?
- First LHCb flow measurement in pPb **and** Pbp **collisions** → **probe different Bjorken-x**
- Compatible v_2 and v_3 measured in both systems:
  - Indicates no dependence on initial-stage
  - However hydrodynamic prediction does not reproduce v_2 at forward rapidity







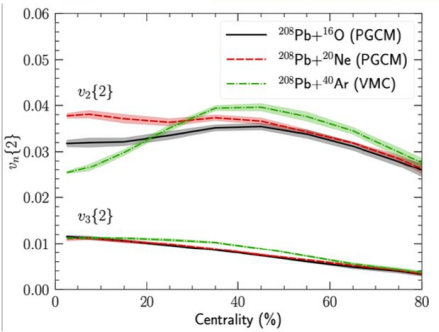
Lhc-b

Flow PbAr & PbNe

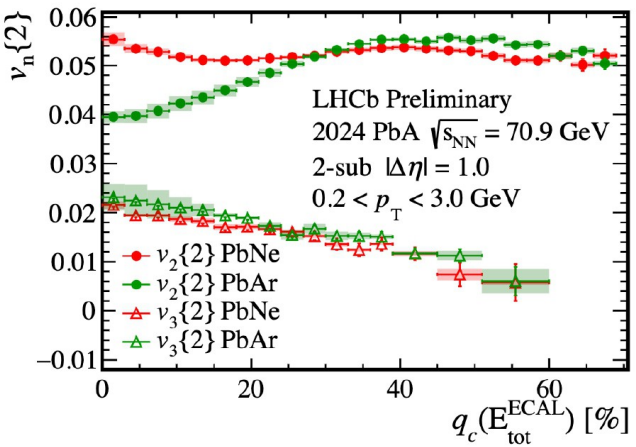
New in Hard Probes!

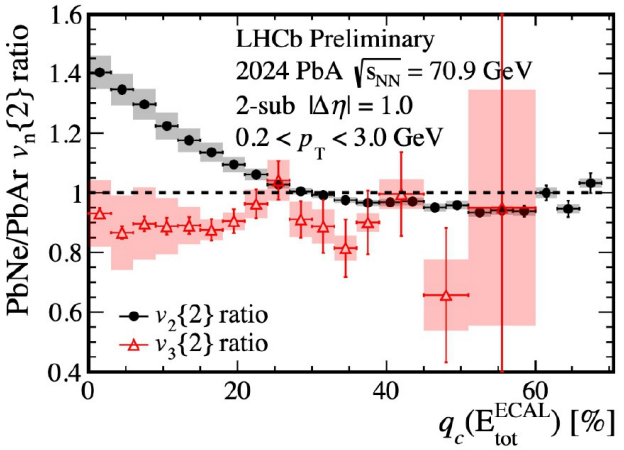
See T. Boettcher talk, 24/06 (nPDF/Saturation/Early) **See poster H. Delgarito** LHCb-CONF-2025-001

- In AA collisions, hydrodynamic response is consequence of initial geometry
- Data of PbAr and PbNe fixed-target collisions at $\sqrt{s_{\mathrm{NN}}} = 70.9\,\mathrm{GeV}$
- First flow measurement at LHCb with cumulant method:
  - Results qualitatively consistent with **bowling-ping shape of Ne** nucleus
  - Link between the **initial geometry of the QGP** and **hydrodynamic flow** in medium-size systems



Prediction by Chun Shen, showed at QM2025







Lhc-b

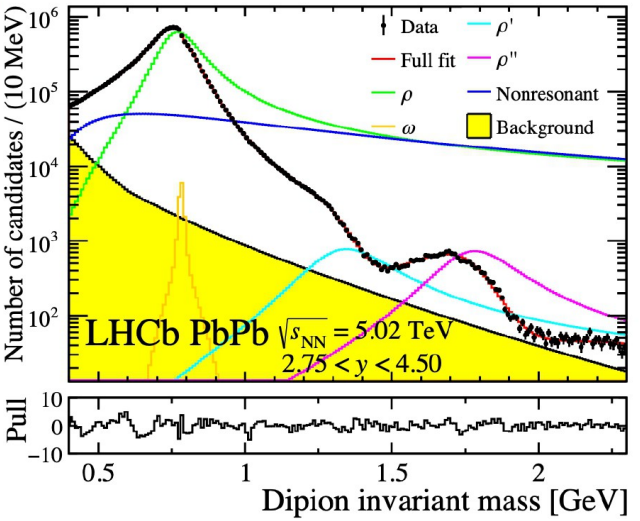
Coherent ρ, ω, ρ' and ρ'' in UPC

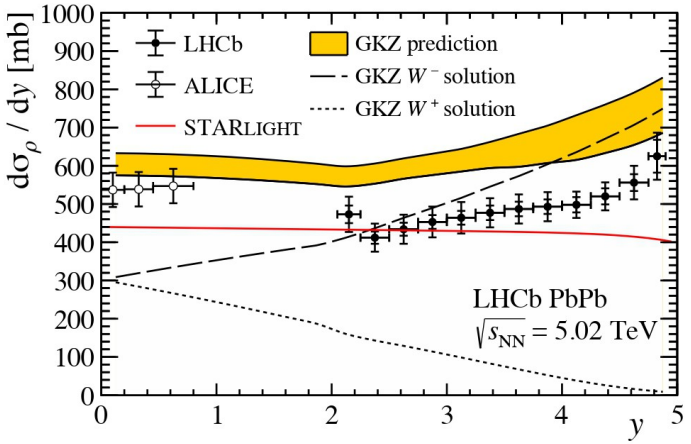
New in Hard Probes!

See D. Brandenburg talk, 24/06 (nPDF/Saturation/Early)

JHEP 11 (2025) 103

- Vector meson photo production in UPC
  - Sensitivity to shadowing and saturation
- PbPb sample Run 2, $\mathcal{L}_{\rm int} = 0.228\,{\rm nb}^{-1}$
- Loose low $p_{\rm T}$ trigger provides **exceptionally clean dipion sample**



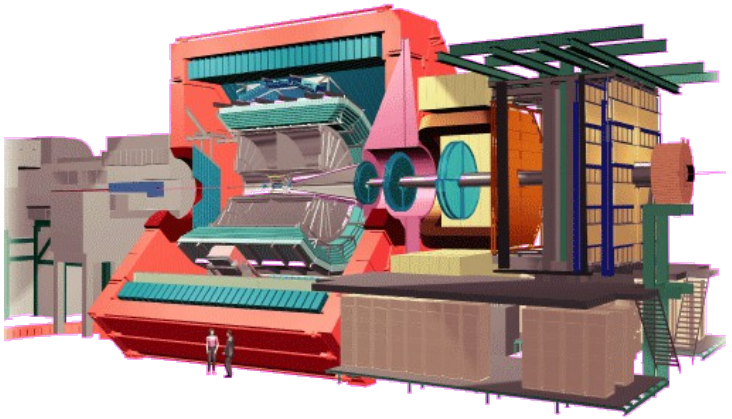


- Rapidity dependence not reproduced by STARLIGHT
- Guzey, Kryshen and Zhalov (GKZ) prediction overestimates cross-section

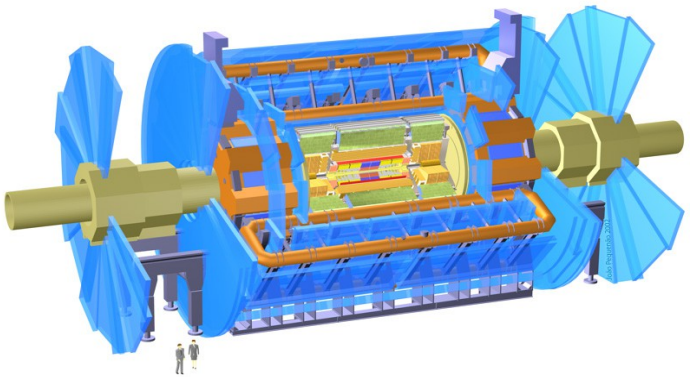


SUMMARY

ALICE

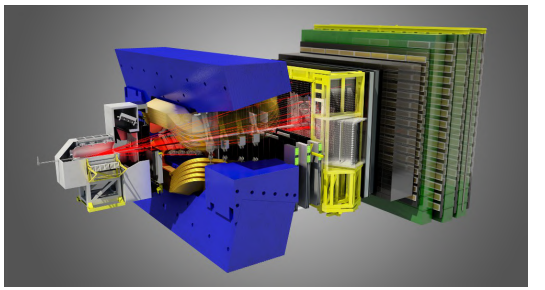


ATLAS

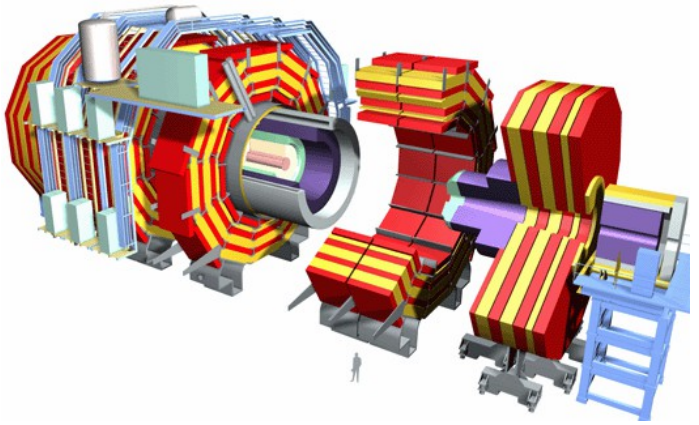


- So many interesting heavy-ion physics results with LHC experiments in p+Pb, Pb+Pb, Xe+Xe. O-O, Ne-Ne, p-O collisions in Run3...
- Heavy-ion program at the LHC with Run4 will provide us more exciting opportunities!
- Stay tuned!

LHCb



CMS





BACK UP