LHCb Highlights

Tom Boettcher
on behalf of the LHCb collaboration

The 22nd International Conference on
Strangeness in Quark Matter
22-27 March, 2026, Los Angeles, CA

LHCb at SQM 2026

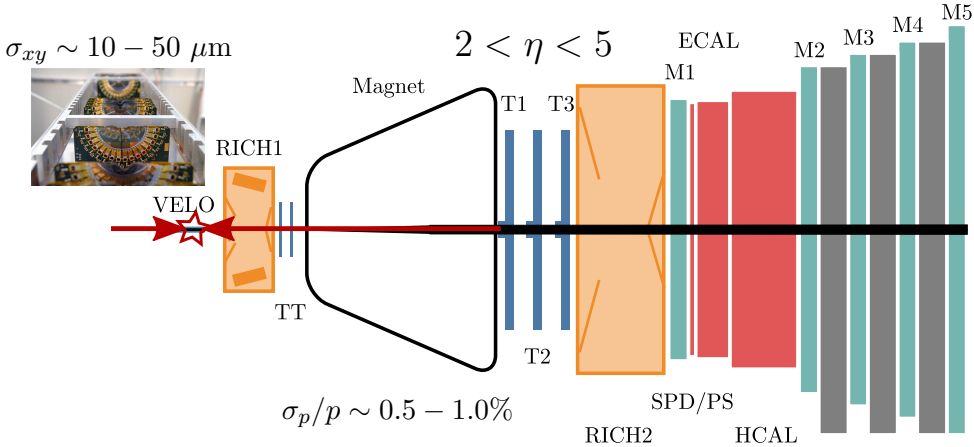
Talks

- "Λ polarization measurements at LHCb," Daniel Brandenburg, Tues. 8:45
- "First results from light-ion collisions at LHCb," JiaZhao Lin, Tues. 10:55
- "Femtoscopy studies at LHCb," Jackson Pybus, Tues. 11:35
- "Flow measurements at LHCb," Cesar Luiz Da Silva, Tues. 15:35
- "Open heavy flavor and strangeness production in nuclear collisions at the LHCb experiment," Oleksandr Kot, Wed. 8:45
- "Charm and quarkonium production in collider and fixed-target mode at LHCb," Carolina Arata, Wed. 9:45

Posters

- "Studies of ϕ meson production at LHCb," JiaZhao Lin
- "Bulk physics in small systems at LHCb," Matt Durham
- "Strangeness production at LHCb," Julie Berkey
- "New results in Ultra-Peripheral Collisions at LHCb," Nicolas Schmidt

The LHCb detector (Int. J. Mod. Phys. A 30, 1530022 (2015))



tracking, **calorimetry**, **RICH**, **muon** systems

Can reconstruct and identify: γ, $e^{\pm}$, $\mu^{\pm}$, $\pi^{\pm}$, $K^{\pm}$, p, d, ^{3}He

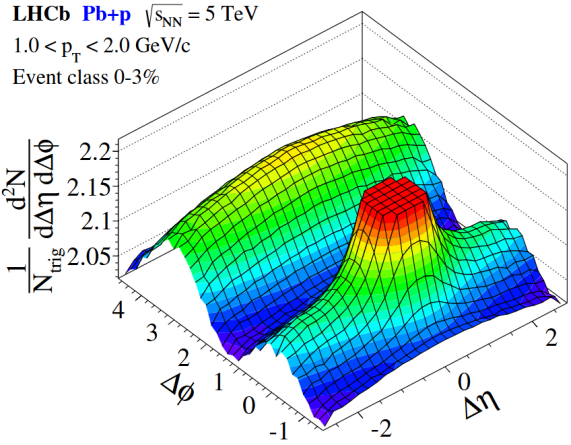
SMOG gas injection system allows LHCb to study fixed-target pA and PbA collisions.

LHCb provides unique opportunities to study hadron collisions

- **Rapidity:** LHCb covers forward/backward rapidity in collider mode and central rapidity in fixed-target mode.
- **Energy:** LHCb studies collisions at 5–13.6 TeV in collider mode and 68–110 GeV in fixed-target mode.
- **Collision system:** In addition to pp, pPb, PbPb, OO, and NeNe, LHCb has collected pH, pD, pHe, pNe, pAr, PbNe, PbAr, OH, and NeNe fixed-target collisions.
- **Flavor:** LHCb's vertexing, PID, and flexible trigger are ideal for studying processes involving heavy-flavor hadrons and other rare probes.

LHCb offers multiple independent ways to vary the initial state configuration, medium properties, and hadronization environment.

Small systems

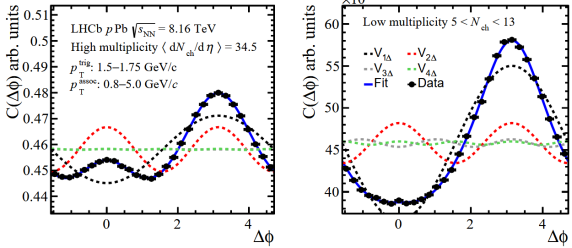


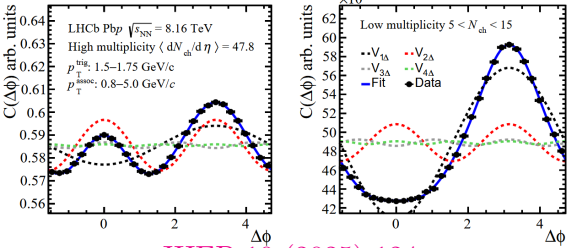
PLB762 (2016) 473-483

- What is the origin of the long-range near-side ridge? QGP formation? Initial-state effects?
- Measuring both rapidity and multiplicity dependence of collectivity can help disentangle final- and initial-state effects.

Small systems: flow

C. Da Silva, Tues. 15:35





JHEP 10 (2025) 124

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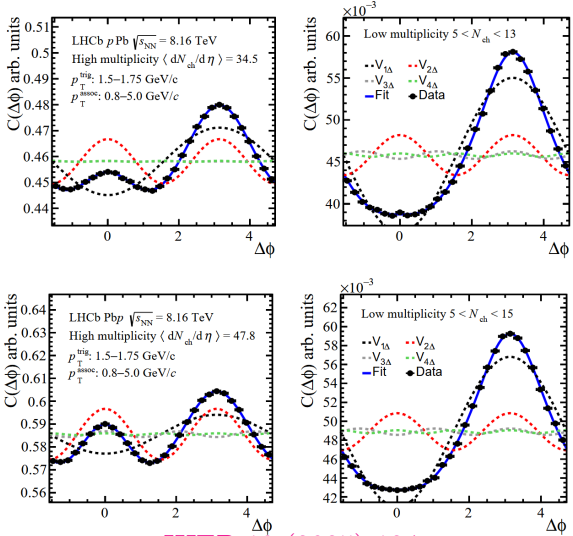

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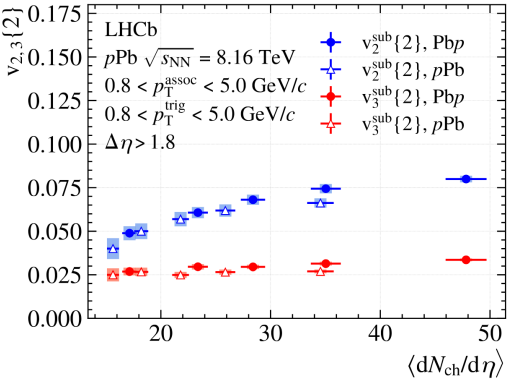
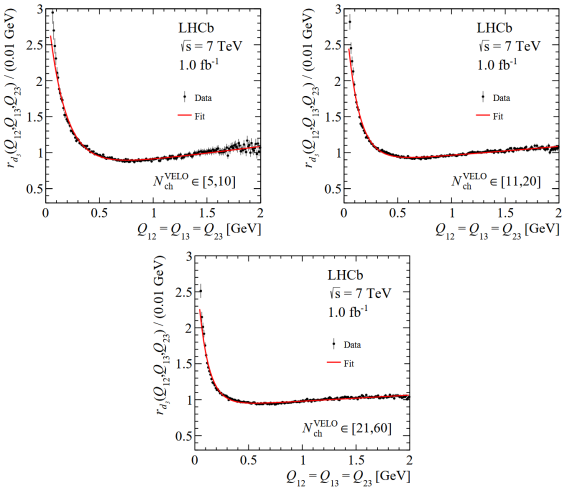
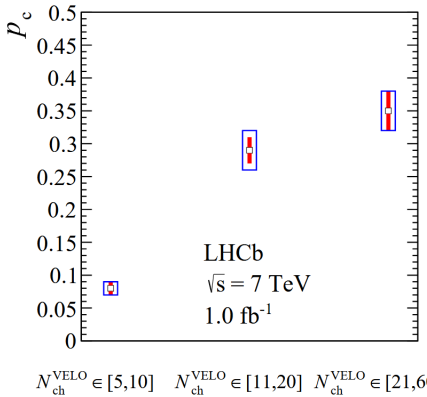


Probes collectivity vs. multiplicity for very different initial state configurations.

Small systems: Bose-Einstein correlations J. Pybus, Tues. 11:35

JHEP 08 (2025) 174



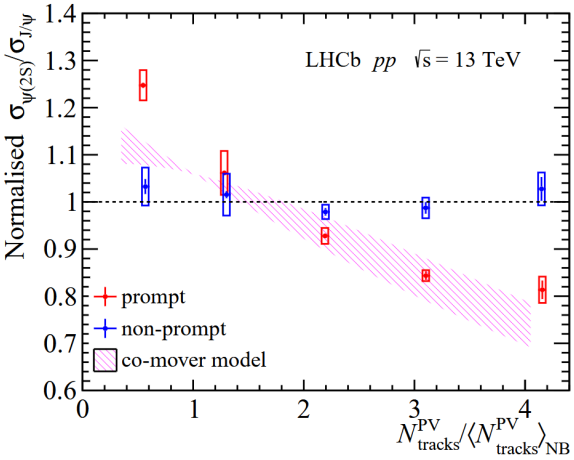


Sensitive to the thermalization and coherence of the particle producing source.

Small systems: charmonium suppression

C. Arata, Wed. 9:45

JHEP 05 (2024) 243

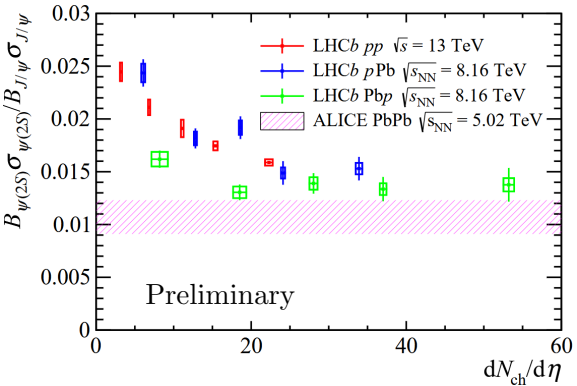


- Charmonium suppression has been observed in high-multiplicity pp and pPb collisions.
- Qualitatively described by models of $c\bar{c}$ interacting with comoving hadrons.

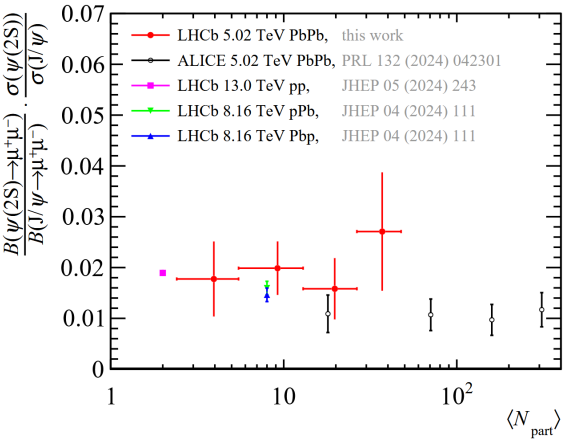
Small systems: charmonium suppression

C. Arata, Wed. 9:45

JHEP 11 (2025) 169

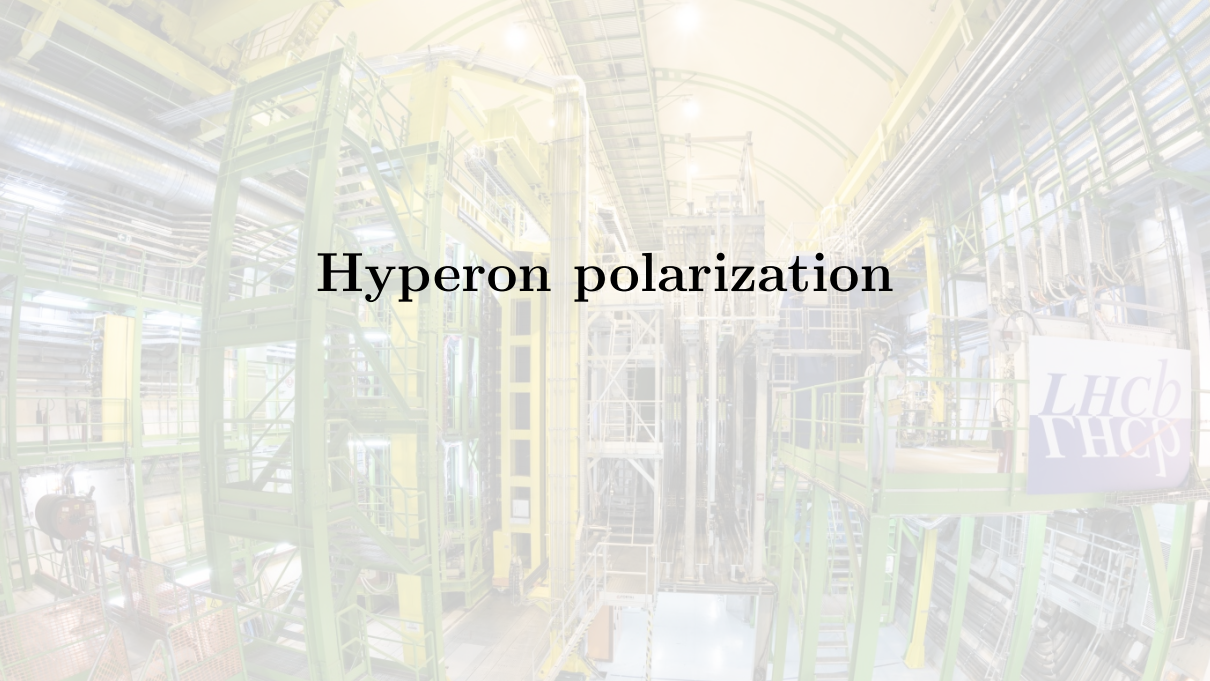


JHEP 07 (2025) 235

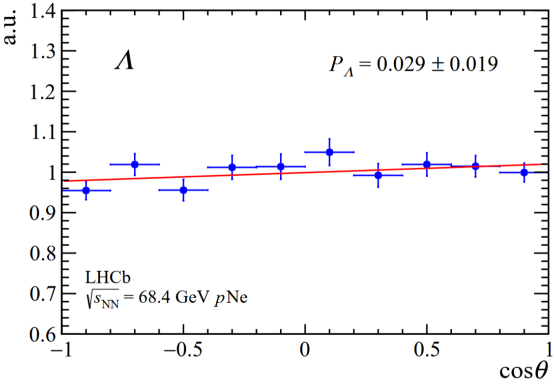


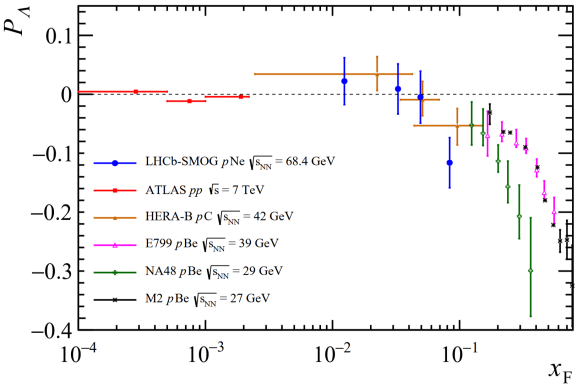
See stronger suppression in the Pb-going direction, similar to PbPb collisions. This is inconsistent with suppression originating entirely from comovers!

Hyperon polarization



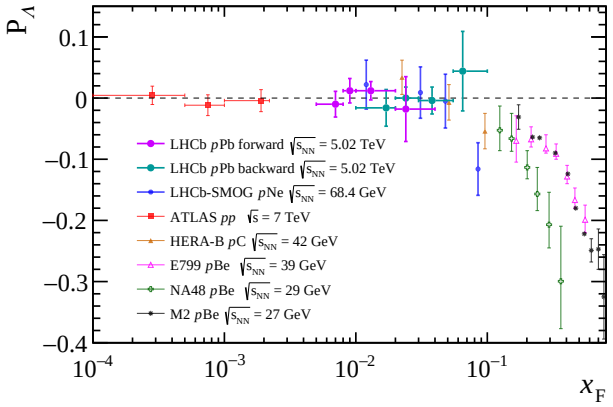
JHEP 09 (2024) 082





LHCb pPb and pNe Λ polarization data probe the spin effects in hadronization over a wide range of x_F, constrain transverse-momentum dependent PDFs and FFs.

PRD 112 (2025) 112022



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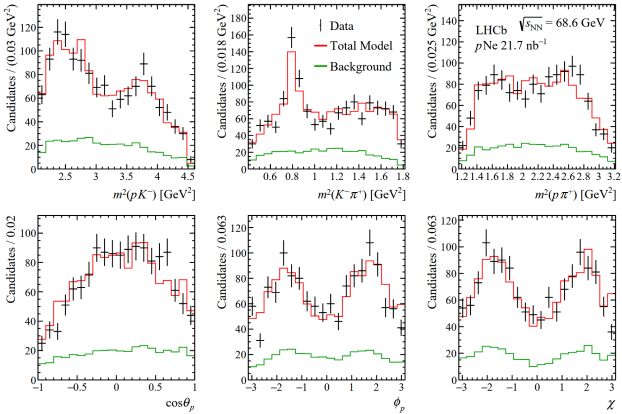
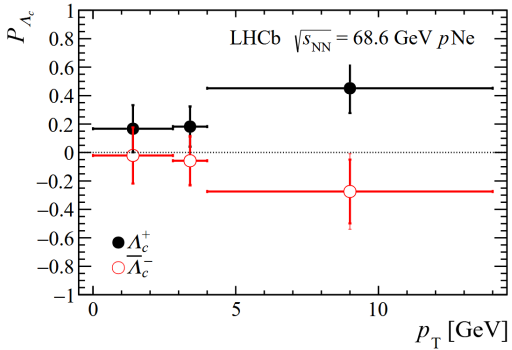
LHCb-PAPER-2025-060 (NEW!)

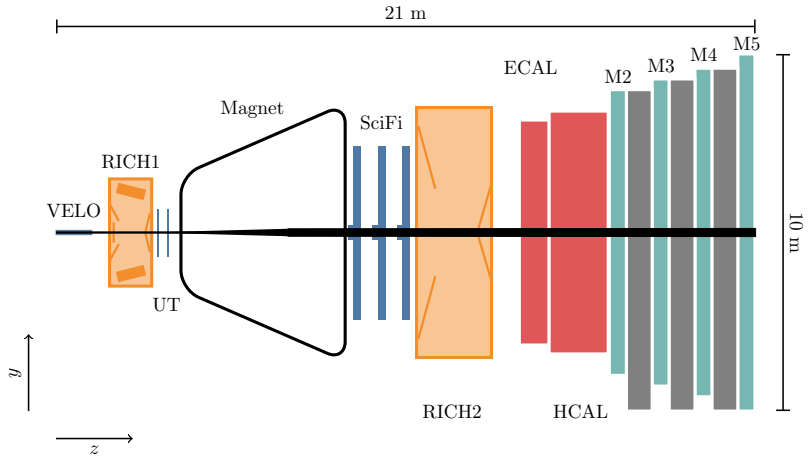




Extends TMD PDF/FF studies to the charm sector and serves as a first step towards measuring charm baryon EDMs.

The LHCb upgrade

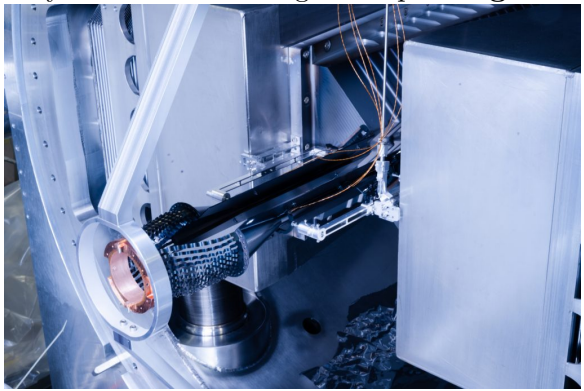
The upgraded LHCb detector (JINST 19 (2024) P05065)

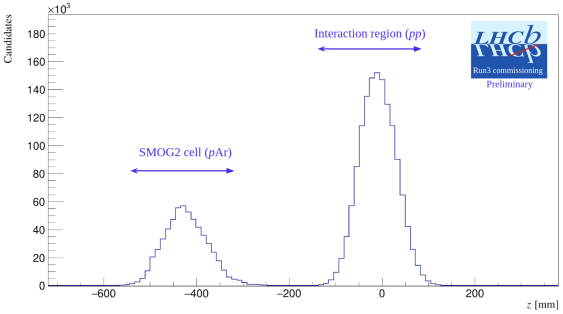


Brand new tracking system and front-end electronics. Read out entire detector at 40 MHz and process every event in software.

The SMOG2 system (Phys. Rev. Accel. Beams 27, 111001)

System for **m**easuring **o**verlap with **g**as 2

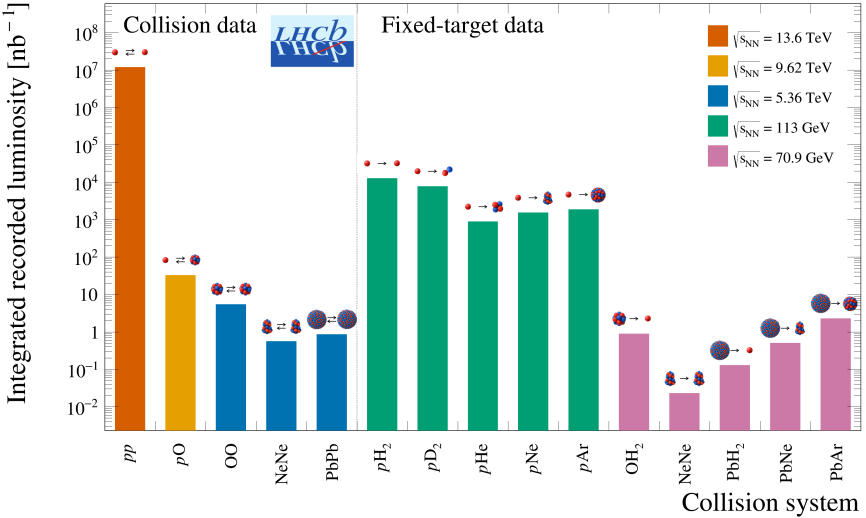




LHCb-FIGURE-2023-001

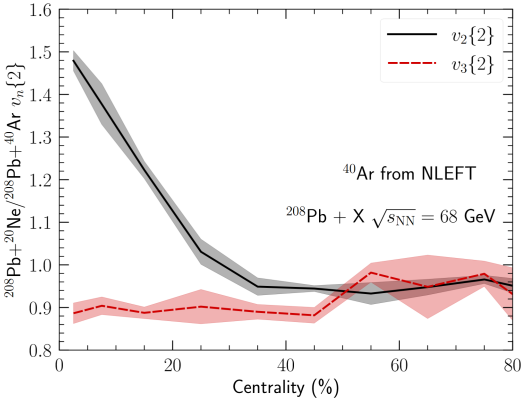
Concurrent collider and fixed-target data collection is enabled by a dedicated gas cell and real-time reconstruction of all events.

LHCb in 2025


Collision data
LHCb
Fixed-target data
$\sqrt{s_{NN}}$ = 13.6 TeV
$\sqrt{s_{NN}}$ = 9.62 TeV
$\sqrt{s_{NN}}$ = 5.36 TeV
$\sqrt{s_{NN}}$ = 113 GeV
$\sqrt{s_{NN}}$ = 70.9 GeV
Integrated recorded luminosity [nb^{-1}]
10^{8}
10^{7}
10^{6}
10^{5}
10^{4}
10^{3}
10^{2}
10
1
10^{-1}
10^{-2}
pp
pO
OO
NeNe
PbPb
pH$_2$
pD$_2$
pHe
pNe
pAr
OH$_2$
NeNe
PbH$_2$
PbNe
PbAr
Collision system

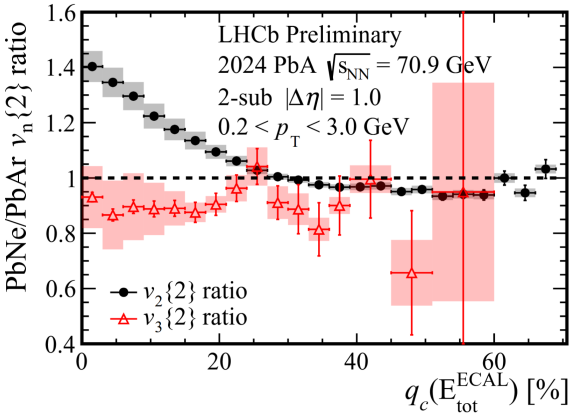
First results from Run 3

LHCb-CONF-2025-001



We can use the structure of Ne to establish a clear link between the initial geometry of the QGP and hydrodynamic flow?

LHCb-CONF-2025-001



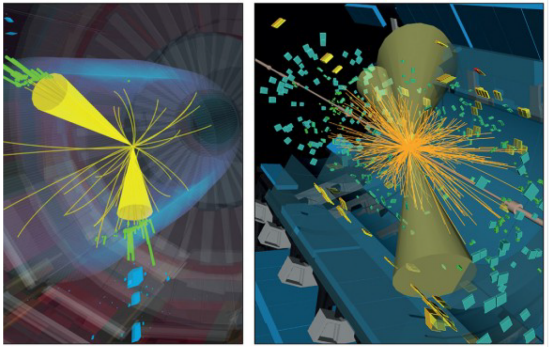
We can use the structure of Ne to establish a clear link between the initial geometry of the QGP and hydrodynamic flow?

CERNCOURIER

STRONG INTERACTIONS | NEWS

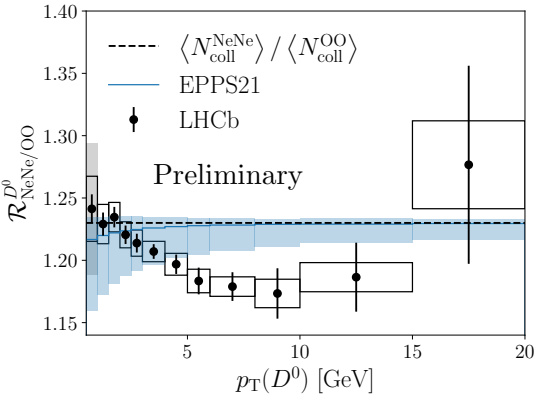
First oxygen and neon collisions at the LHC

7 November 2025



LHCb collected $\sim 10\times$ more luminosity than expected during the 2025 light ion runs.

LHCb-PAPER-2026-008 (NEW!)



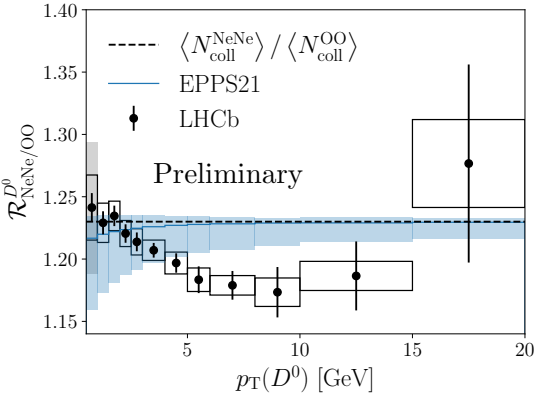
$$\mathcal{R}^{D^0}_{\mathrm{NeNe/OO}} \equiv \frac{\mathrm{d}N^{\mathrm{NeNe}}_{D^0}/\mathrm{d}p_{\mathrm{T}}}{\mathrm{d}N^{\mathrm{OO}}_{D^0}/\mathrm{d}p_{\mathrm{T}}} \frac{N^{\mathrm{OO}}_{\mathrm{inel}}}{N^{\mathrm{NeNe}}_{\mathrm{inel}}}$$

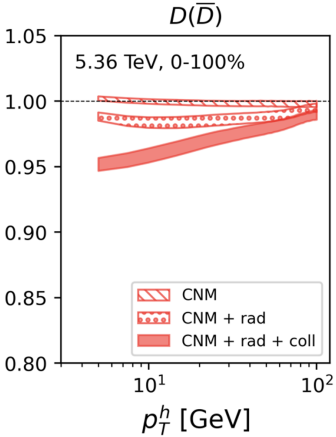
- High precision allows us to differentiate between OO and NeNe collisions.
- Shape points to an enhancement of QGP-like effects in NeNe collisions.

Charm production in light-ion collisions

J. Lin, Tues. 10:55

LHCb-PAPER-2026-008 (NEW!)





PRC 107 (2023) 6, 06490

Note ratio of $R_{\rm AA}$ has different normalization.

Final thoughts

- LHCb has unique capabilities to address some of the most pressing questions in heavy-ion physics.
- In Run 3, LHCb has collected large datasets from a wide variety of collision systems in both fixed-target and collider modes.
- We are just starting to tap LHCb's potential!

Thank you!