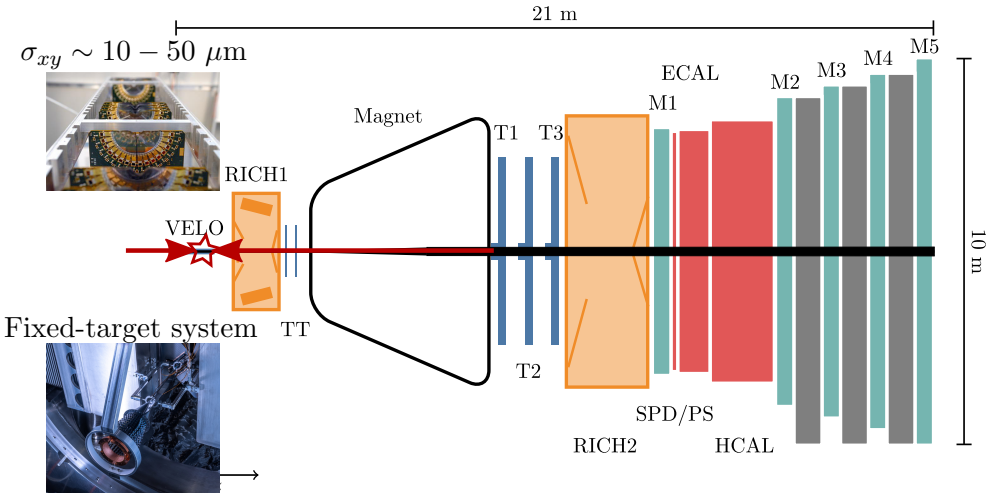
Recent results from LHCb

Tom Boettcher
on behalf of the LHCb collaboration

University of CINCINNATI

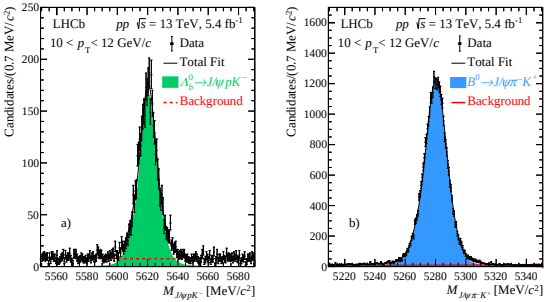
LHCb is a unique tool for heavy-ion physics Int J Mod Phys A 30, 1530022 (2015)



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

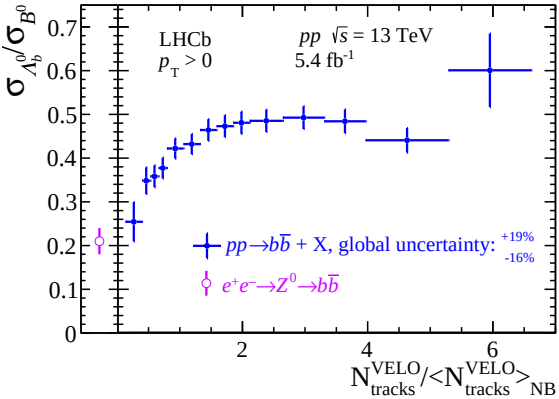
Can reconstruct and identify: γ, $e^{\pm}$, $\mu^{\pm}$, $\pi^{\pm}$, $K^{\pm}$, p, d, ^{3}He

Beauty hadronization modification (Jianqiao Wang: Tuesday, 11:20AM)



Particle ID and precise vertexing provide clean heavy-flavor signals down to 0 p_{T}.

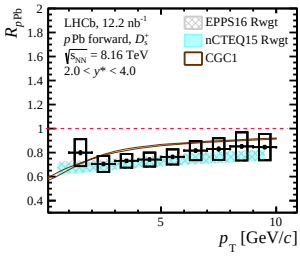
PRL 132 (2024) 081901

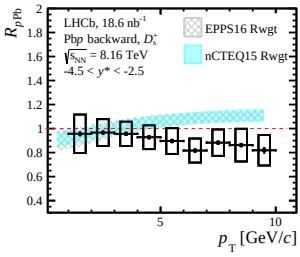


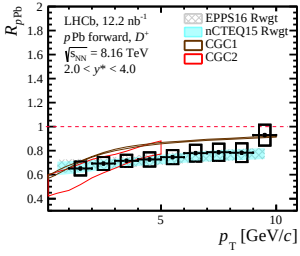
Probes interactions between b quarks and bulk particles.

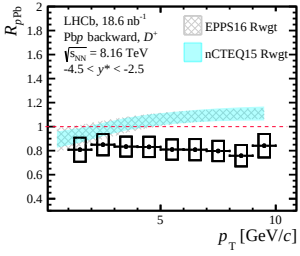
Open charm production (arXiv:2311.08490)

- Charm production in pPb collisions probes the structure of nucleons
- Jianqiao Wang: Tuesday, 11:20AM



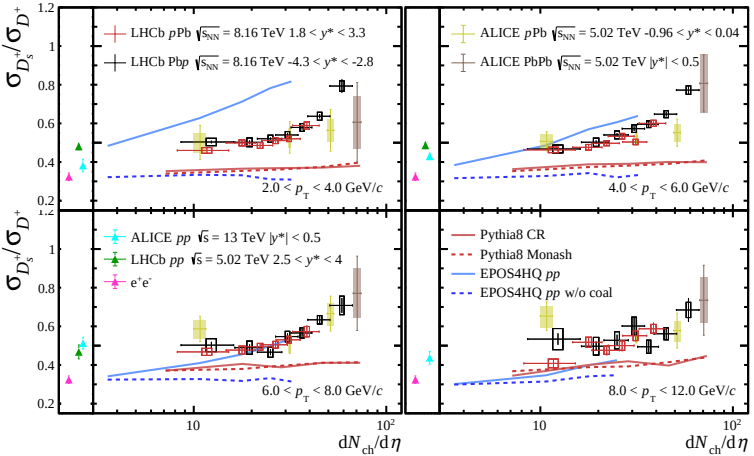






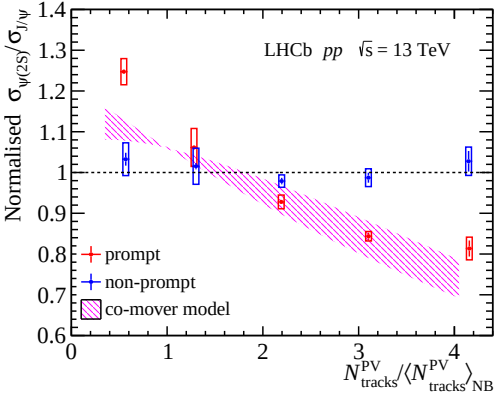
Open charm production (arXiv:2311.08490)

- $D_s^{\pm}$ production in pPb collisions probes the hadronization of c and s quarks.
- Clara Landesa Gomez: Tuesday, 11:40AM



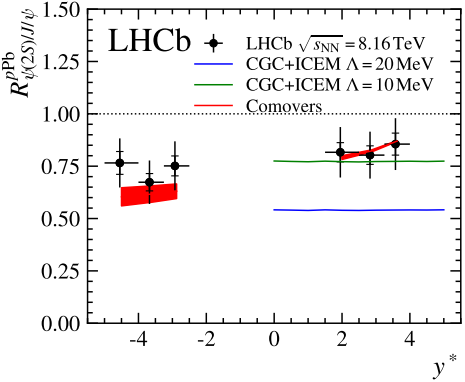
Charmonium production (Youen Kang: Tuesday, 3:40PM)

Probes the interplay of hot and cold nuclear effects in small systems.



arXiv:2312.15201 (accepted by JHEP)

$$R^{p\mathrm{Pb}}_{\psi(2S)/J/\psi} = R^{\psi(2S)}_{p\mathrm{Pb}} \Big/ R^{J/\psi}_{p\mathrm{Pb}}$$



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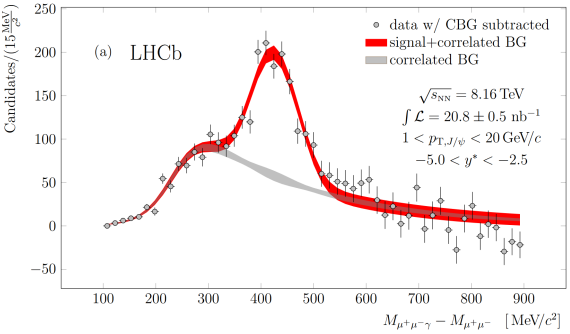
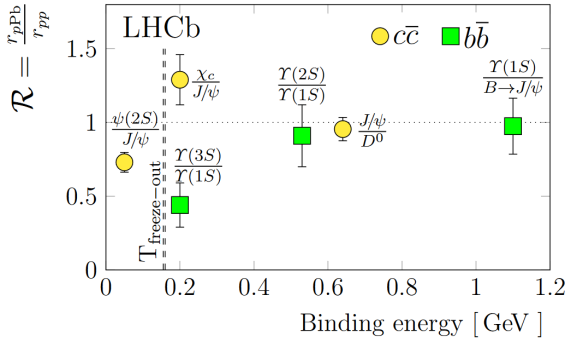
Higher charmonium states (Youen Kang: Tuesday, 3:40PM)

We look for suppression of quarkonium states with different binding energies to take the temperature of the medium produced in pPb collisions.

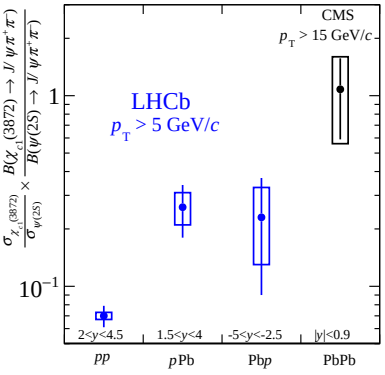


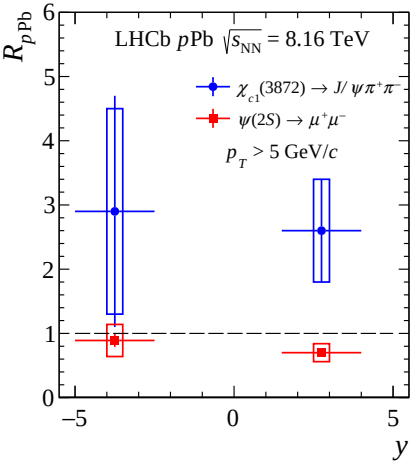


PRL 132 (2024) 102302

Exotic hadron production (Youen Kang: Tuesday, 3:40PM)

We can also use nuclear effects to study the hadronic physics of exotic charmonium states. The $\chi_{c1}(3872)$ experiences different nuclear effects than conventional charmonia!

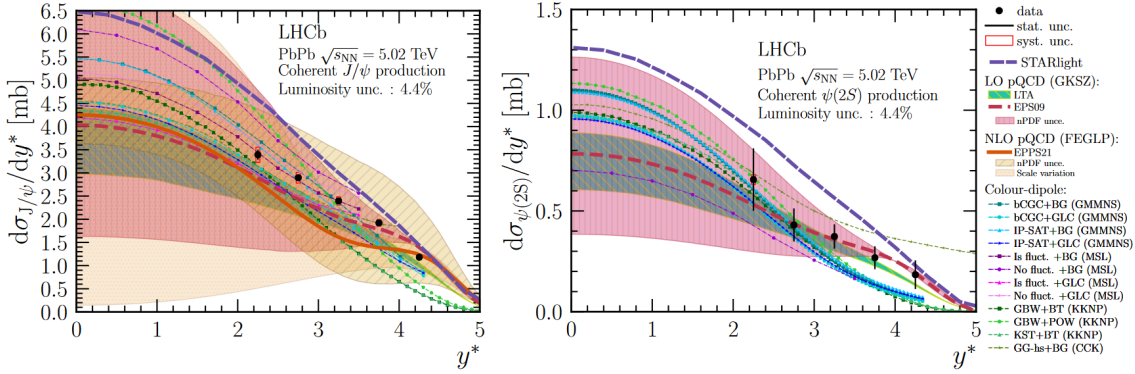




arXiv:2402.14975 (accepted by PRL)

Charmonium in Ultra-Peripheral Collisions (Hengne Li: Tuesday, 5:10PM)

Vector meson production in UPCs is sensitive to the low-x gluon distribution in the nucleus and constrains saturation models.



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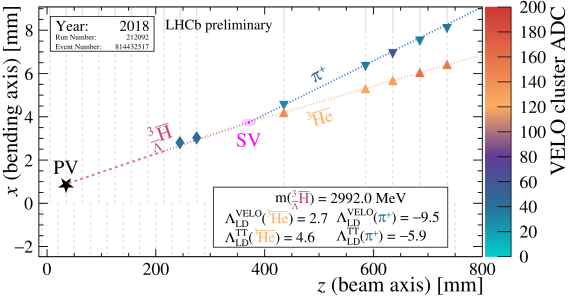
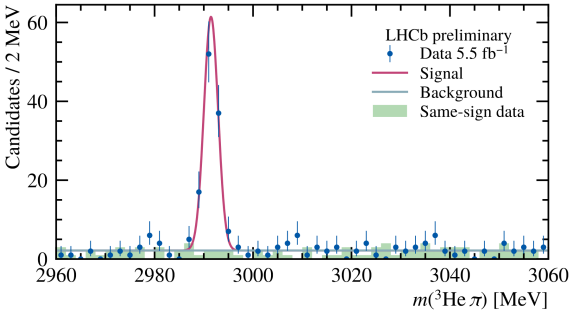
Light (anti)nuclei (Gediminas Sarpis: Wednesday, 8:30AM)



Use energy loss in silicon sensors and TOF information from forward tracker to identify helium.

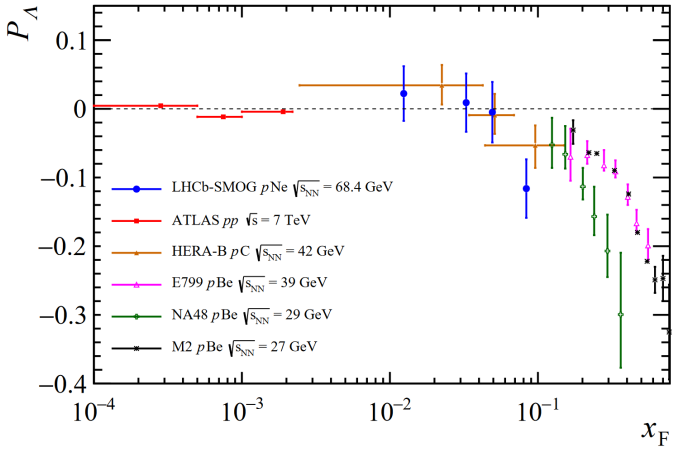


PID and topology provide a clean antihypertriton signal.

LHCb-CONF-2023-002

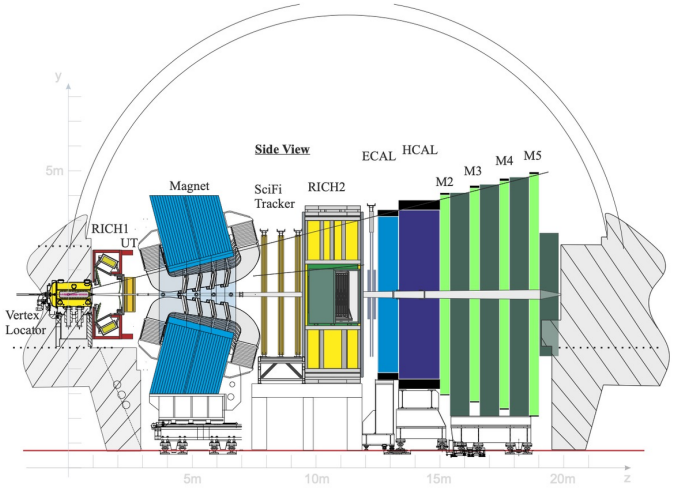
Hyperon polarization (Chiara Lucarelli: Wednesday, 11:00AM)

Λ polarization in fixed-target collisions is sensitive to transverse-momentum dependent fragmentation at relatively high x_{F}.



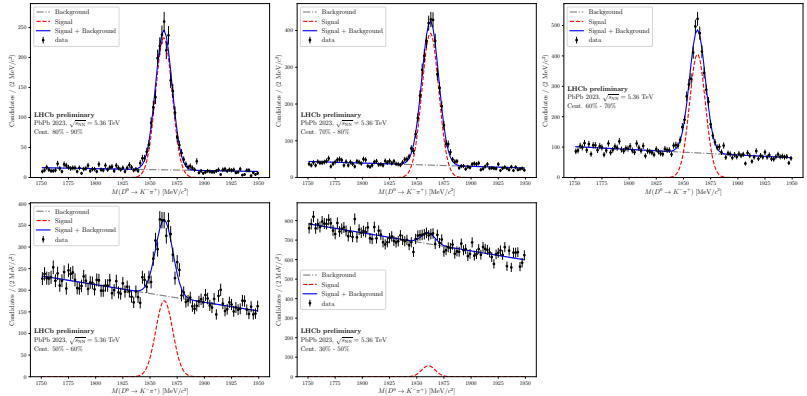
The upgraded LHCb detector (JINST 19 (2024) 05, P05065)

- Brand new tracking detectors expand PbPb centrality reach from $\sim 60\%$ to 30%.
- Front-end electronics upgraded to read out the full detector at 40 MHz.
- Every collision is processed in software: CSBS 4 (2020) 1, 7



First look at 2023 PbPb data (LHCb-FIGURE-2024-004)

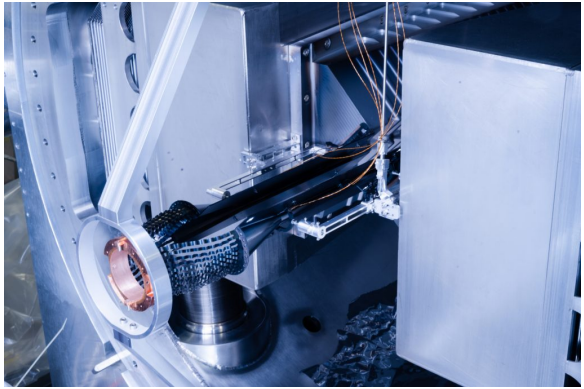
LHCb can reconstruct heavy flavor signals down to 30% centrality.



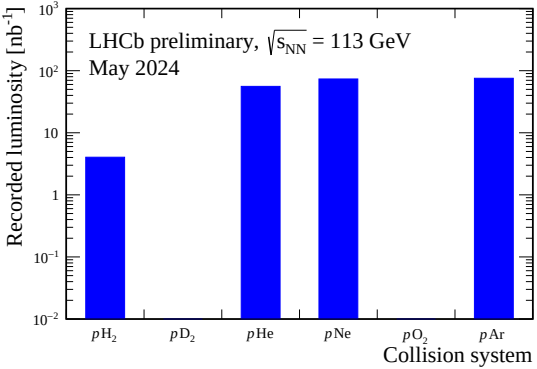
Data collected with VELO retracted. Efficiency and vertex resolution will improve in 2024, resulting in larger, cleaner signals.

The SMOG2 system

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

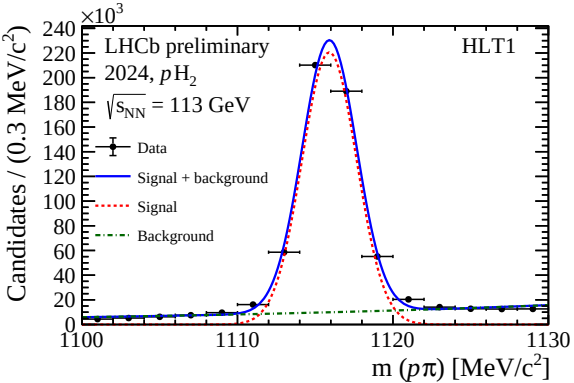


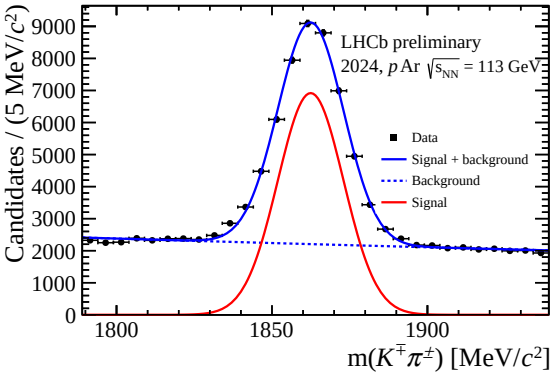
Concurrently collect collider and fixed-target data using a gas injection system



LHCb-FIGURE-2024-005

SMOG2 data from May 2024





LHCb-FIGURE-2024-005

Final thoughts...

- LHCb is a general-purpose detector at forward rapidity with a diverse heavy-ion physics program
- LHCb has many unique opportunities
  - Unique kinematic reach (low x and p_{T})
  - Vertexing and PID
  - Fixed-target collisions
- The upgraded LHCb detector will have even more opportunities!

Thank you!