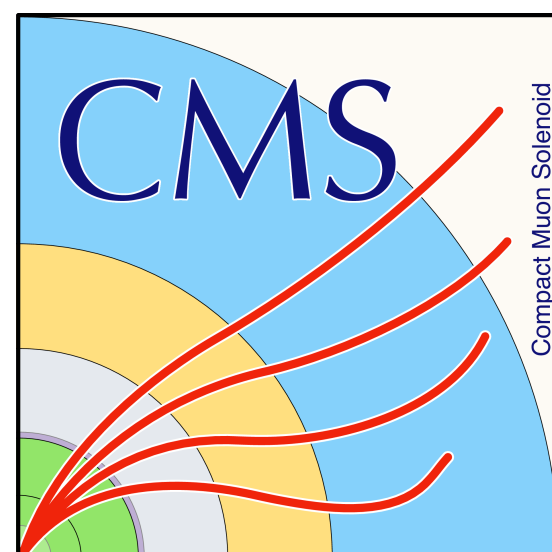


New Ion Collisions @ LHC 4

CMS Perspective

Sruthy Jyothi Das
For CMS collaboration

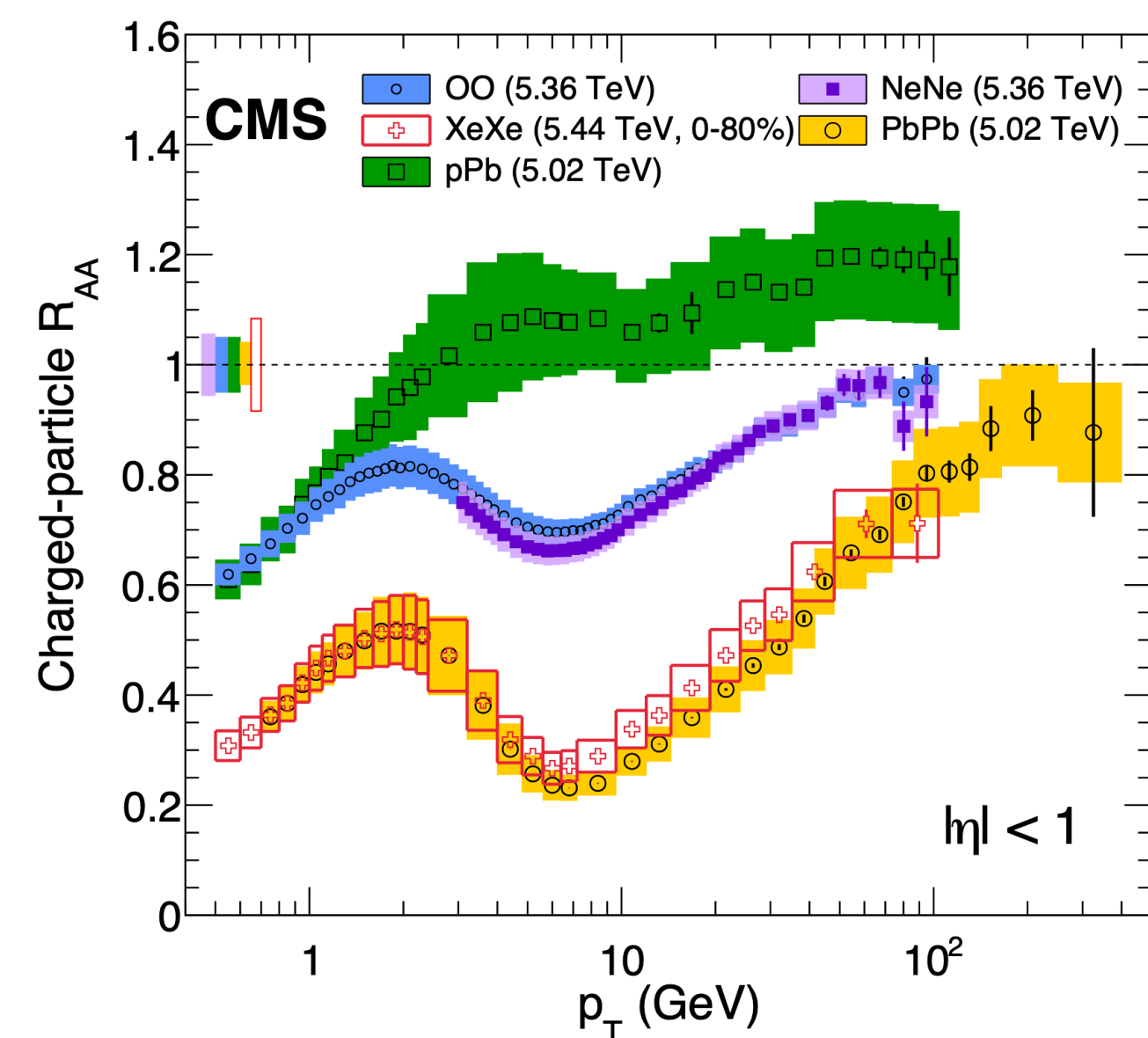
EMMI Workshop: Light-ion collisions 2026
September 25, 2026
Heidelberg, Germany



*UIC heavy ion group's work
is supported by US DOE-NP*

What $\sim 8 \text{ nb}^{-1}$ Oxygen-Oxygen opened up!

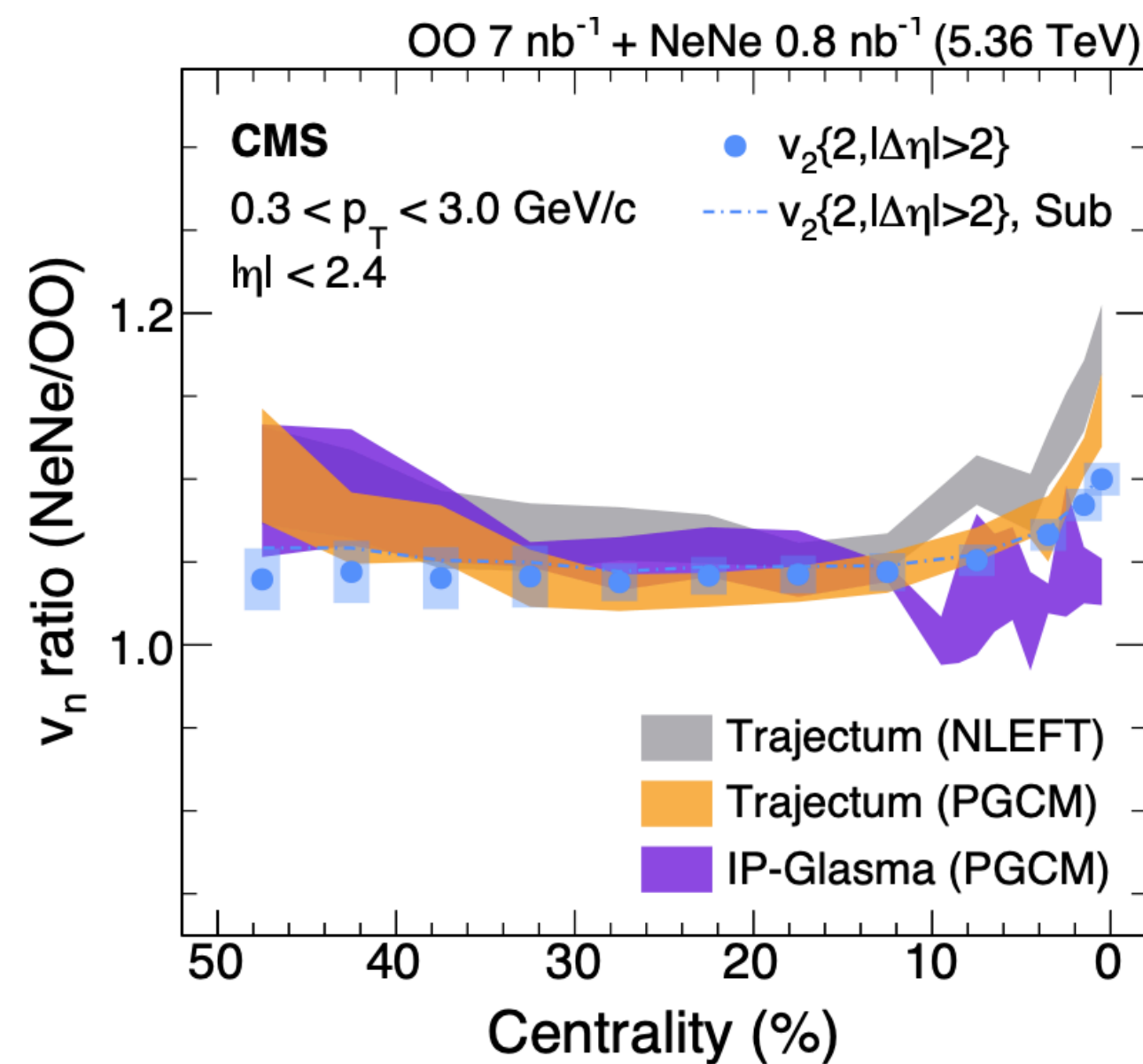
Particle Suppression



OO: PRL 136 (2026) 162301

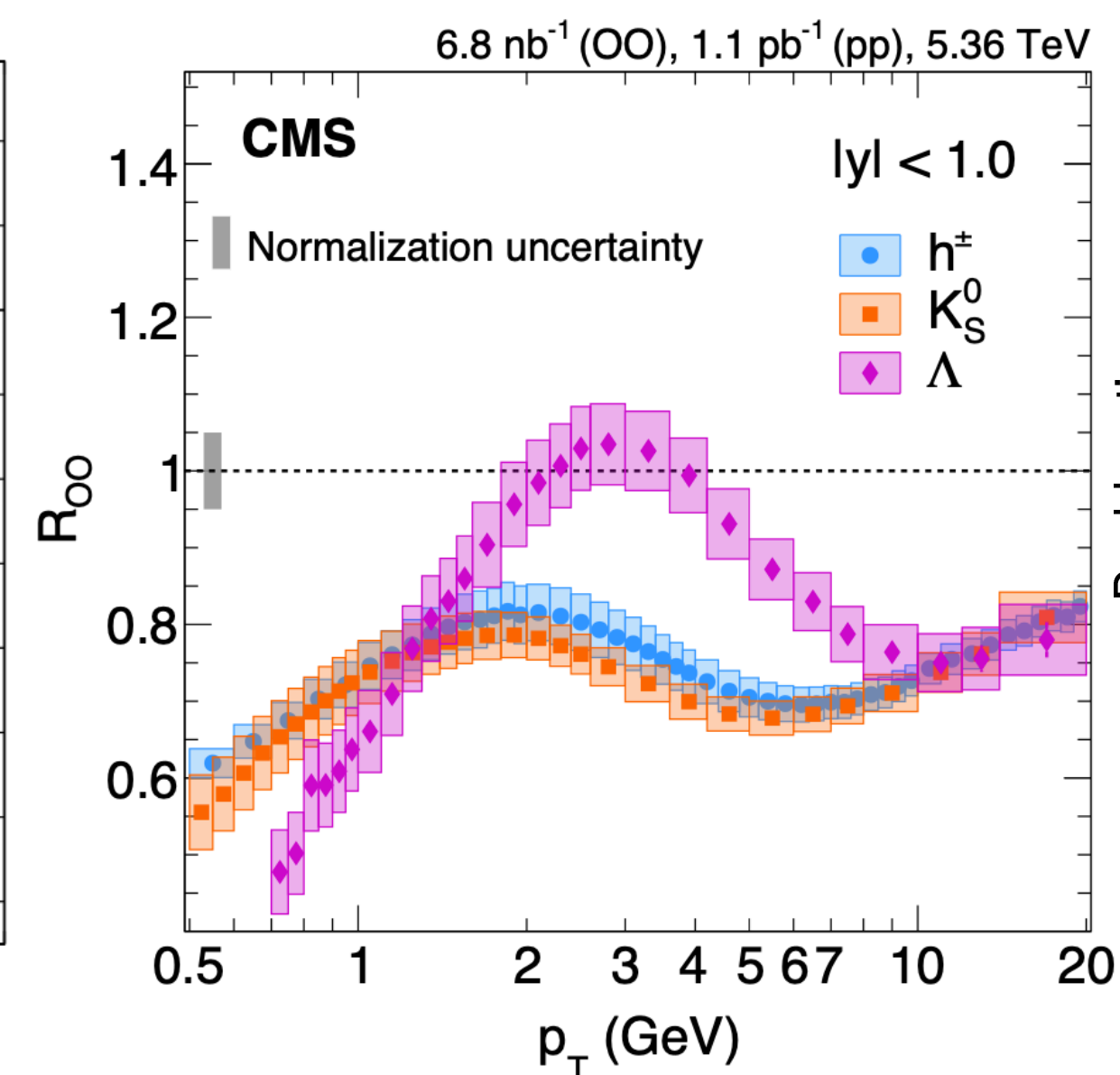
NeNe: PLB 880 (2026) 140679

Flow / Geometry



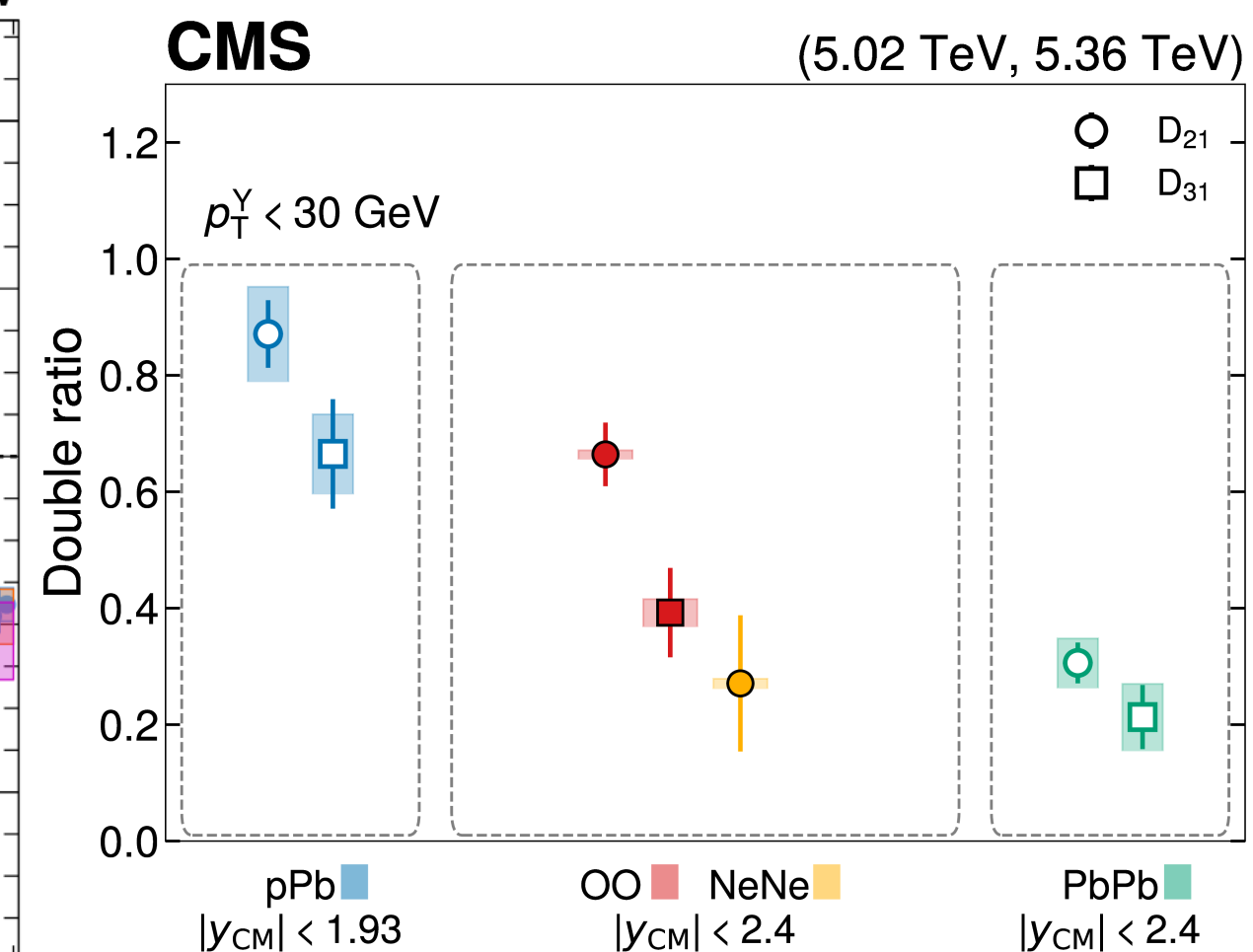
PRL 137 (2026) 082302

Strangeness



arXiv:2608.18256

Heavy flavor

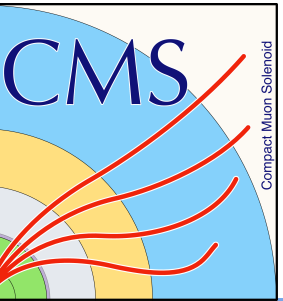


arXiv:2607.13758

Demonstrated oxygen-oxygen can deliver useful luminosity with relatively shorter runs

Established a broader physics program for light ions: See CMS overview talk by [A. Baty](#)

CMS in Run 4: New Light Ion Capabilities



1) **Tracker:** upgrade with acceptance extended up to $|\eta| < 4.0$, with higher precision

2) **MTD:** serve as TOF detector for PID, $p/K/\pi$ separation with dE/dx , $|\eta| < 3.0$

3) **HGCAL:** improved forward particle measurements, along with a radiation-hard **ZDC** and **PPS** for tagging outgoing proton

4) **L1 + DAQ:** with expanded bandwidth, save all hadronic events with high luminosity

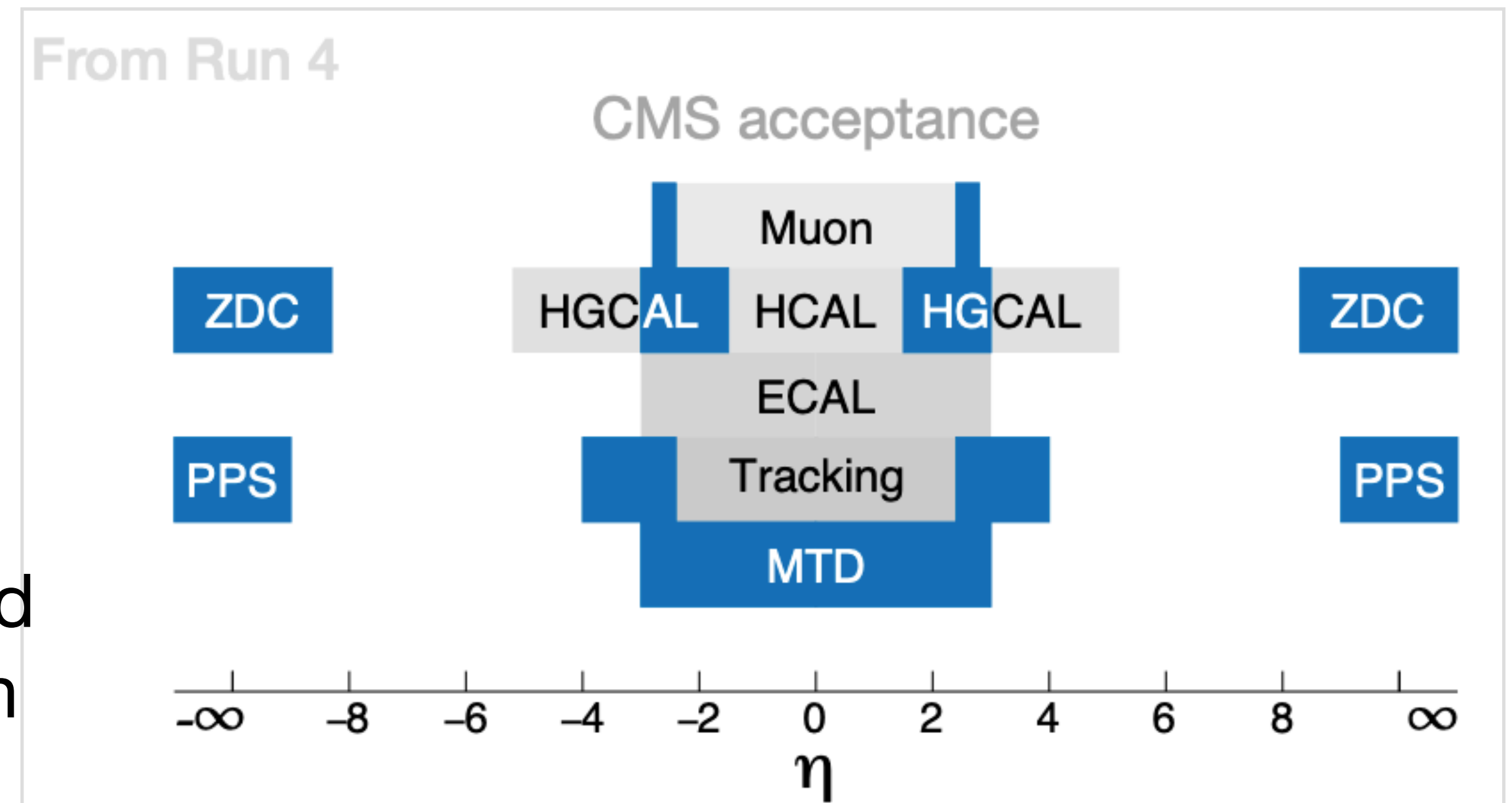


Figure from [J. Wang](#)

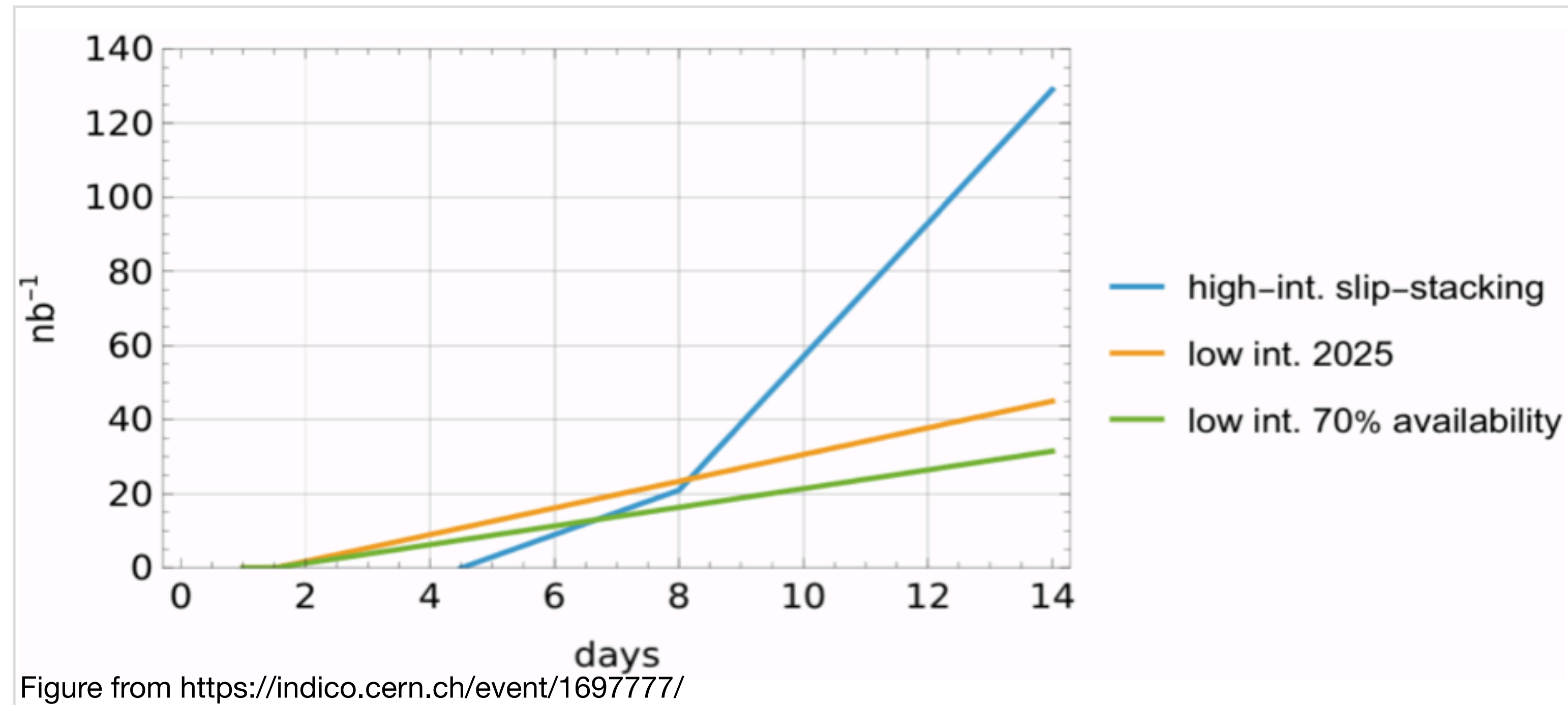
More acceptance + timing + rate $\rightarrow$ broader physics reach
in small and light-ion systems

Strong Interest in higher OO luminosity

High-statistics OO supports:

- Small system QGP precision measurements
- Heavy flavor
- nPDF measurements
- Jets and substructure
- UPCs
- EW bosons

Oxygen projected lumi



1) Interested in a longer OO run, ~2 weeks or more if high lumi can be achieved, but not a 1 week OO run unless the current luminosity estimates change

Might have some interest in other ions too..

Interest in colliding smaller ions up to including Kr

Collision system	One-week $\mathcal{L}_{\text{int}} \left[\text{nb}^{-1} \right]$
$^4\text{He} + ^4\text{He}$	COMING SOON
$^{12}\text{C} + ^{12}\text{C}$	COMING SOON
$^{24}\text{Mg} + ^{24}\text{Mg}$	COMING SOON
$^{40}\text{Ar} + ^{40}\text{Ar}$	COMING SOON
$^{40}\text{Ca} + ^{40}\text{Ca}$	COMING SOON
$^{44}\text{Ca} + ^{44}\text{Ca}$	COMING SOON
$^{48}\text{Ca} + ^{48}\text{Ca}$	COMING SOON
$^{76}\text{Ge} + ^{76}\text{Ge}$	COMING SOON
$^{86}\text{Kr} + ^{86}\text{Kr}$	COMING SOON
$^{136}\text{Ba} + ^{136}\text{Ba}$	COMING SOON
$^{136}\text{Xe} + ^{136}\text{Xe}$	COMING SOON

- Small system QGP studies
- nPDF determination in smaller ions
- Jets substructure modification in smaller system
- UPC measurements

2) For the above physics interests, it is important that **we have at least one high-statistics dataset, including a corresponding pp reference.**

However, we can only make a more informed decision once we have time to evaluate **the new luminosity estimates for each collision system.**

Table from <https://indico.cern.ch/event/1697777/>

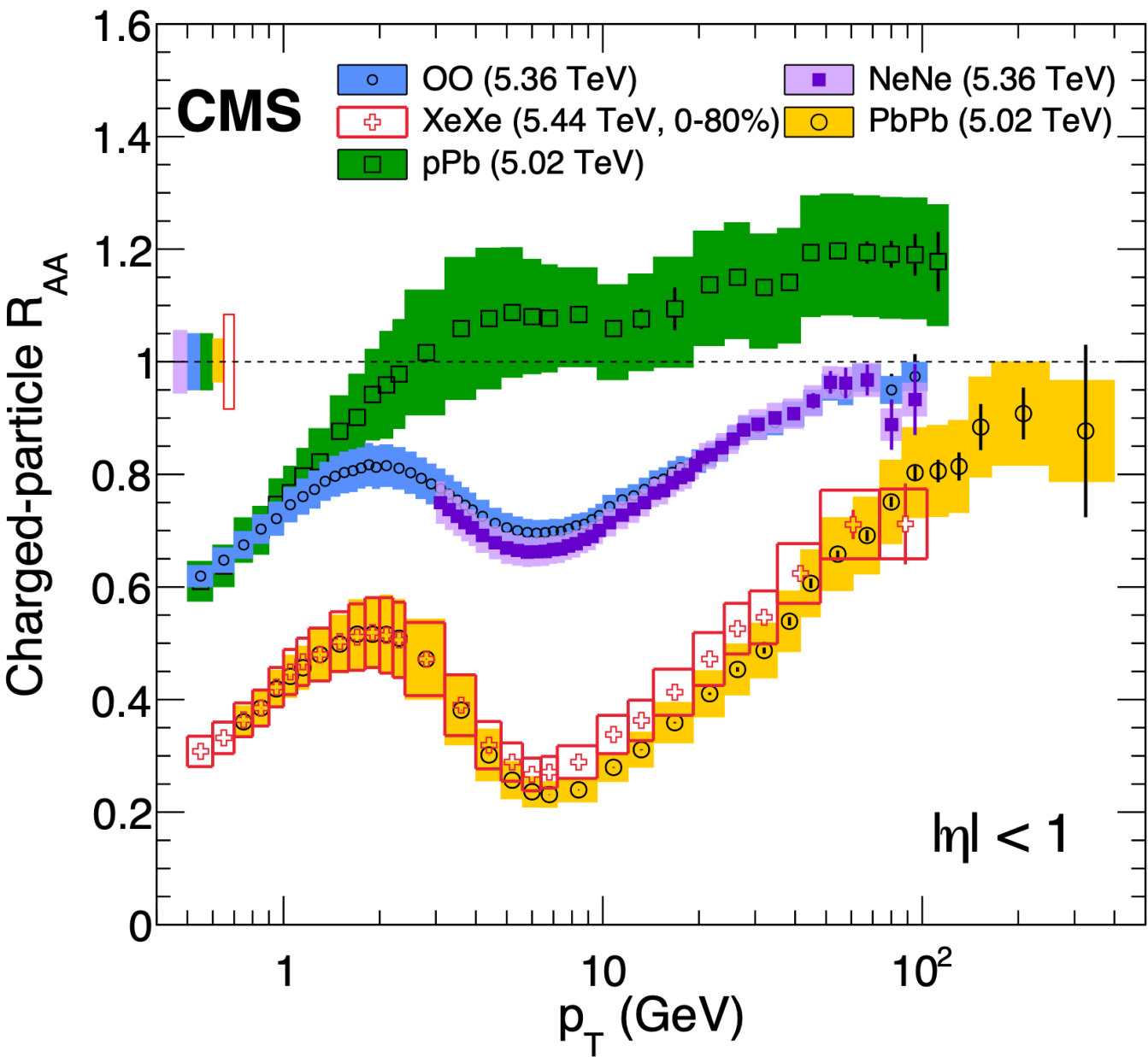
Might have some interest in other ions too..

Interest in colliding smaller ions up to including Kr

Collision system	One-week $\mathcal{L}_{\text{int}}$ [nb ⁻¹]
⁴ He + ⁴ He	COMING SOON
¹² C + ¹² C	COMING SOON
²⁴ Mg + ²⁴ Mg	COMING SOON
⁴⁰ Ar + ⁴⁰ Ar	COMING SOON
⁴⁰ Ca + ⁴⁰ Ca	COMING SOON
⁴⁴ Ca + ⁴⁴ Ca	COMING SOON
⁴⁸ Ca + ⁴⁸ Ca	COMING SOON
⁷⁶ Ge + ⁷⁶ Ge	COMING SOON
⁸⁶ Kr + ⁸⁶ Kr	COMING SOON
¹³⁶ Ba + ¹³⁶ Ba	COMING SOON
¹³⁶ Xe + ¹³⁶ Xe	COMING SOON

⁴He+⁴He can be particularly interesting for small system QGP studies

- parton energy loss in ⁴He+⁴He with ppref baseline
- nPDF determination is important to isolate parton energy loss



OO: PRL 136 (2026) 162301

NeNe: PLB 880 (2026) 140679

Might have some interest in other ions too..

Collision system	One-week $\mathcal{L}_{\text{int}}$ [nb ⁻¹]
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⁴⁰ Ca + ⁴⁰ Ca	COMING SOON
⁴⁴ Ca + ⁴⁴ Ca	COMING SOON
⁴⁸ Ca + ⁴⁸ Ca	COMING SOON
⁷⁶ Ge + ⁷⁶ Ge	COMING SOON
⁸⁶ Kr + ⁸⁶ Kr	COMING SOON
¹³⁶ Ba + ¹³⁶ Ba	COMING SOON
¹³⁶ Xe + ¹³⁶ Xe	COMING SOON

¹³⁶Ba+¹³⁶Ba and ¹³⁶Xe+¹³⁶Xe are disfavored if other HIN beam time has to be sacrificed

Table from <https://indico.cern.ch/event/1697777/>

Might have some interest in other ions too..

Collision system	One-week $\mathcal{L}_{\text{int}}$ [nb ⁻¹]
$^4\text{He} + ^4\text{He}$	COMING SOON
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$^{136}\text{Ba} + ^{136}\text{Ba}$	COMING SOON
$^{136}\text{Xe} + ^{136}\text{Xe}$	COMING SOON

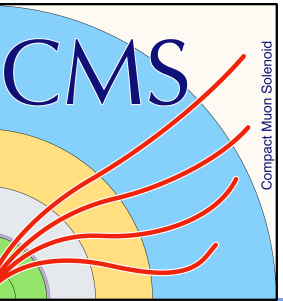
3) Short scans of several species have less priority than a longer run at the moment, particularly if we have to sacrifice other HIN beamtime.

Still interested in pilot run possibilities.

4) We would welcome the additional flexibility a second ion source would give the HIN program

Table from <https://indico.cern.ch/event/1697777/>

New Ions @ LHC abstracts



We are **internally collecting abstracts** to coordinate simulation campaigns for [New Ion Collisions @ LHC Run 4 effort](#) (deadline October 31st, 2026)

New Ion Collisions @ LHC Run 4 - Call for Abstracts

31 October 2026
America/Chicago timezone

Enter your search term

Overview

Call for Abstracts

EMMI Workshop on Light Ion Collisions 2026

We would like to warmly thank all colleagues who contributed to the first call for community input on New Ion Collisions @ LHC Run 4 (<https://indico.cern.ch/event/1655628/>). The response was very positive and underscored broad community interest in the initiative.

We recall that the approved ion program for LHC Run 4 currently comprises p -Pb and Pb-Pb collisions (see e.g. [CERN-2019-007](#)). From the inputs received, we identified compelling physics cases for collisions with additional ion species that merit further development and that, should the opportunity arise, could be considered for inclusion in the Run 4 program. A summary of the outcome of the first phase is provided at the bottom of this page (see the document *Summary_NewIons@LHC4.pdf*).

Special thanks to LPCC HI WG Conveners (CMS), Austin Baty and Andre Stahl, for helping coordinate the CMS input to the Run 4 new-ion effort!

1) High statistics OO remains a strong interest ~2 weeks or more, at least $O(100) \text{ nb}^{-1}$

2) Other ions species are also of interest, but lumi projections and pp references are important

3) Short scans are currently less preferable compared to longer runs, interested in pilot runs

4) CMS is internally collecting abstracts for simulation studies to evaluate the physics reach