

Synergies with UPC/Saturation Programs

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EMMI Workshop: Light Ion Collisions 2026
Heidelberg, Germany



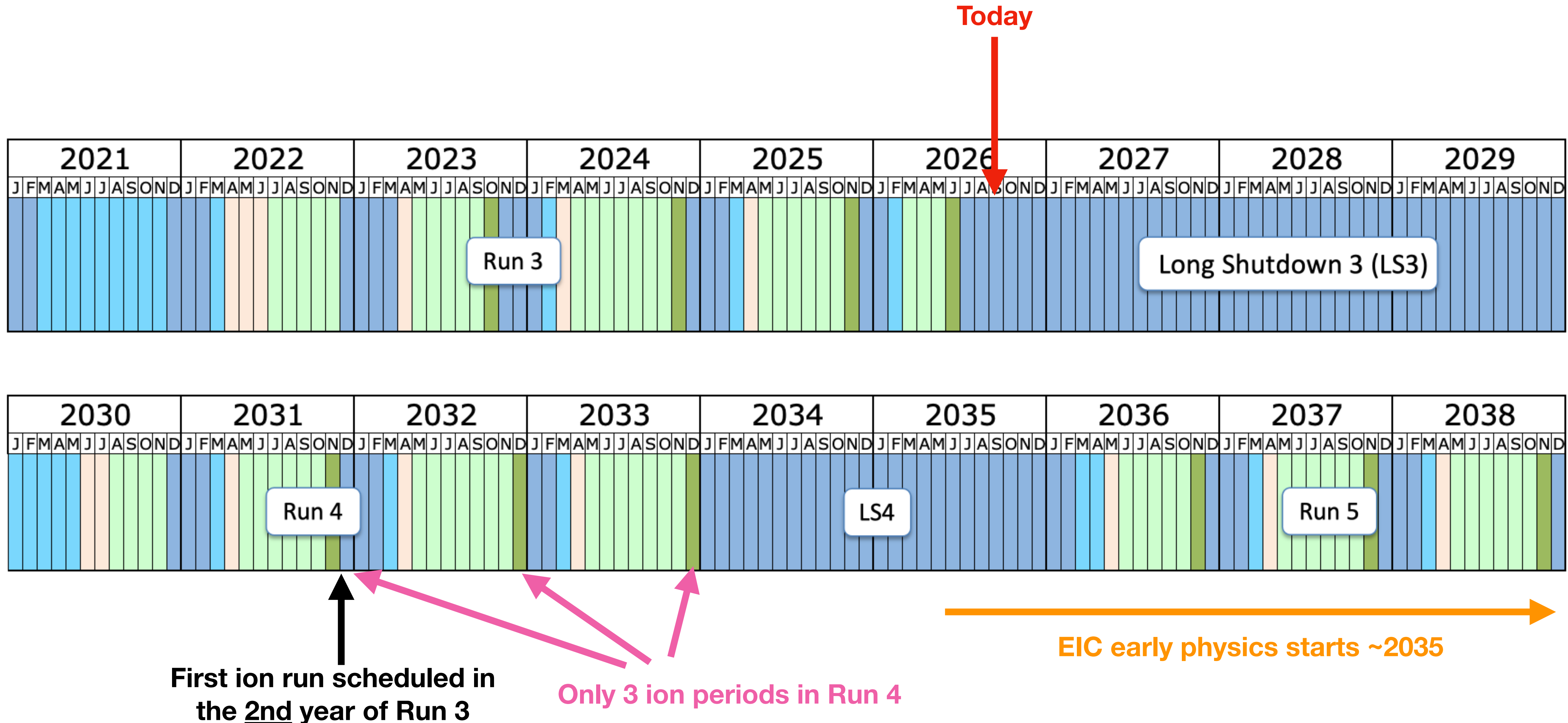
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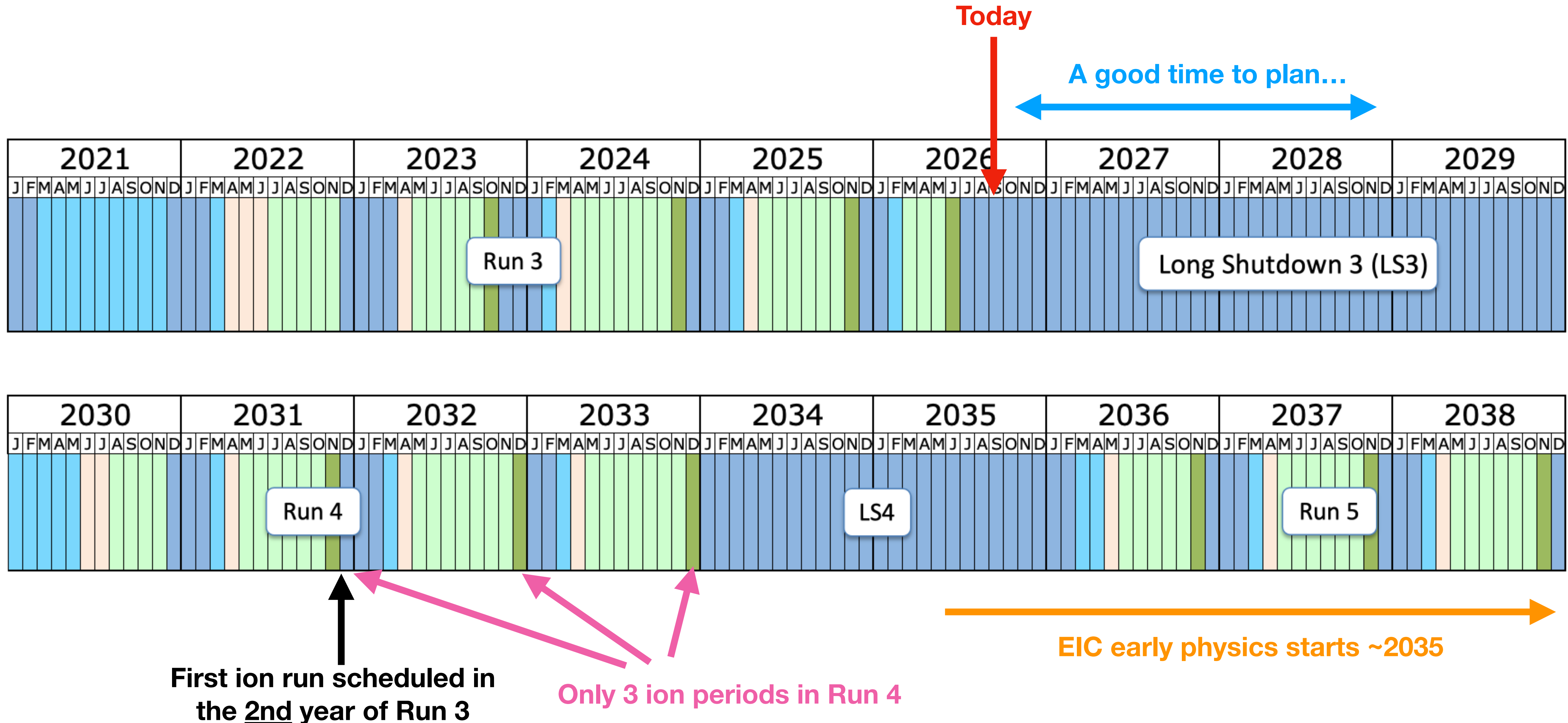
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The UIC group is supported by the DoE Office of Science

Setting the stage...

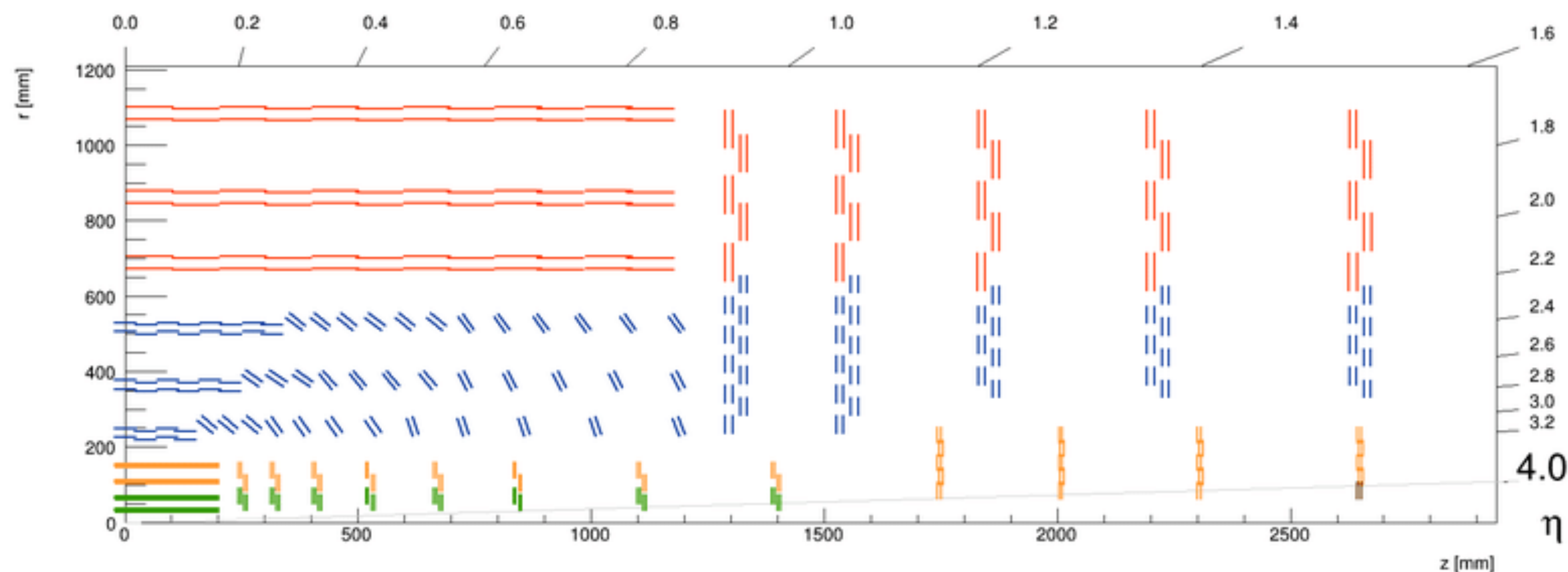


Setting the stage...



LHC Experimental Upgrades

- Run 4 upgrades: better tracking (all experiments)
 - CMS: PID capabilities + High-Granularity Calorimeter + forward (PPS, FSC)
 - CMS+ATLAS: ZDC Upgrades
 - ALICE: FoCAL
 - All experiments: DAQ upgrades/refinements
- Run 5: ALICE 3



FoCAL detector setup in 2023 testbeam!

July saturation workshop

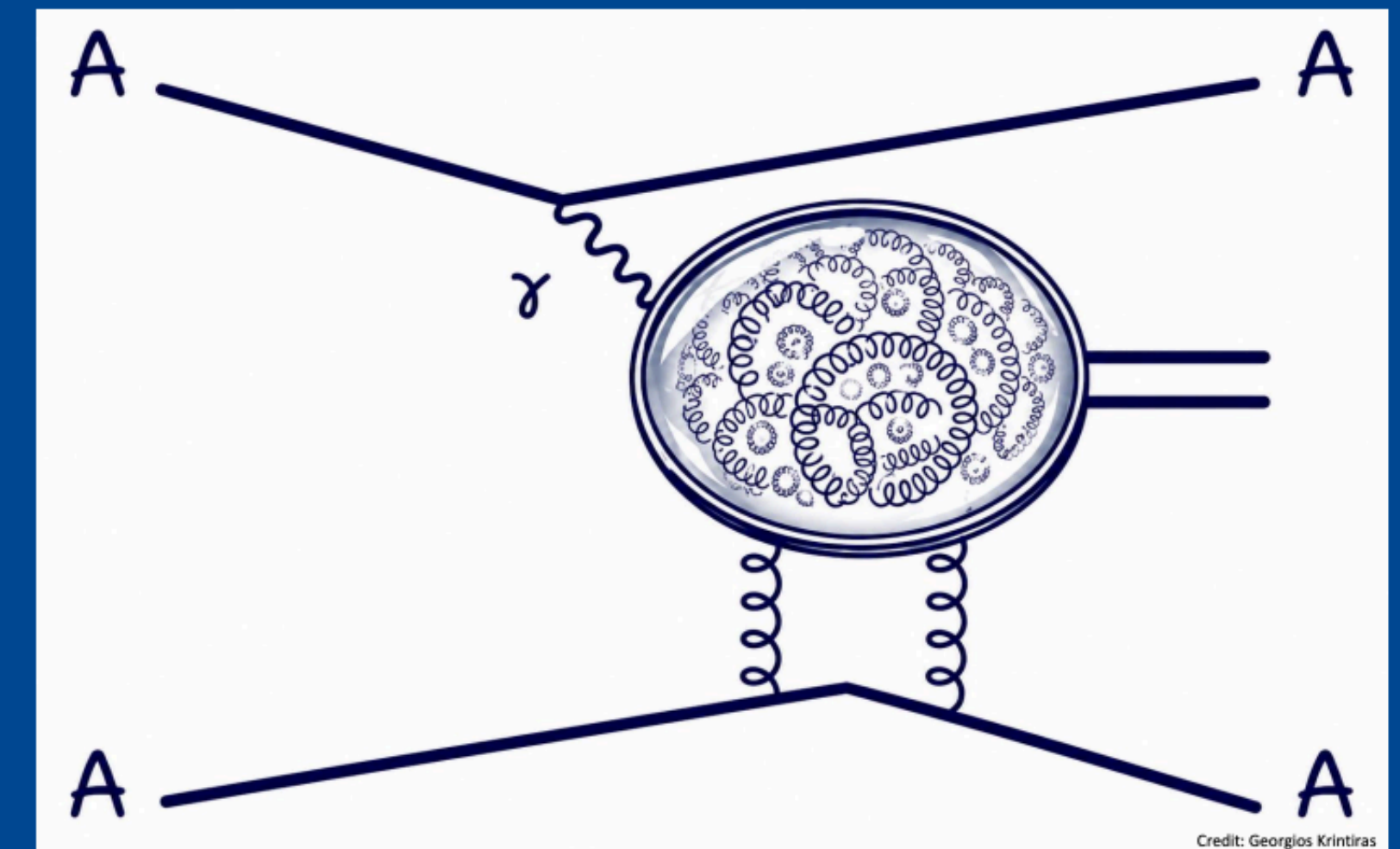
- **Organized in conjunction with the LPCC Forward Physics working group**
- **Significant discussion of opportunities for light ions in the future, as well as synergies with the EIC**
- **Proposal for some type of white paper to be written in timescale of $O(1 \text{ yr})$**
- **Likely to focus more on Run 5**
- **Opportunity for shared light-ion studies**

ExtreMe Matter Institute EMMI

EMMI Workshop

Mining for gluon saturation
at the LHC and the future EIC

July 6 – 10, 2026
GSI, Darmstadt, Germany



The workshop focuses on the search for the high-gluon-density regime and gluon saturation at the LHC — a central goal of current LHC physics and a key motivation for the Electron-Ion Collider (EIC) at BNL. This regime enables controlled, non-linear QCD calculations within the Color Glass Condensate framework. Saturation effects are expected at high energies and small but perturbative hard scales, and are amplified in heavy nuclei due to enhanced gluon densities.

Key Topics:

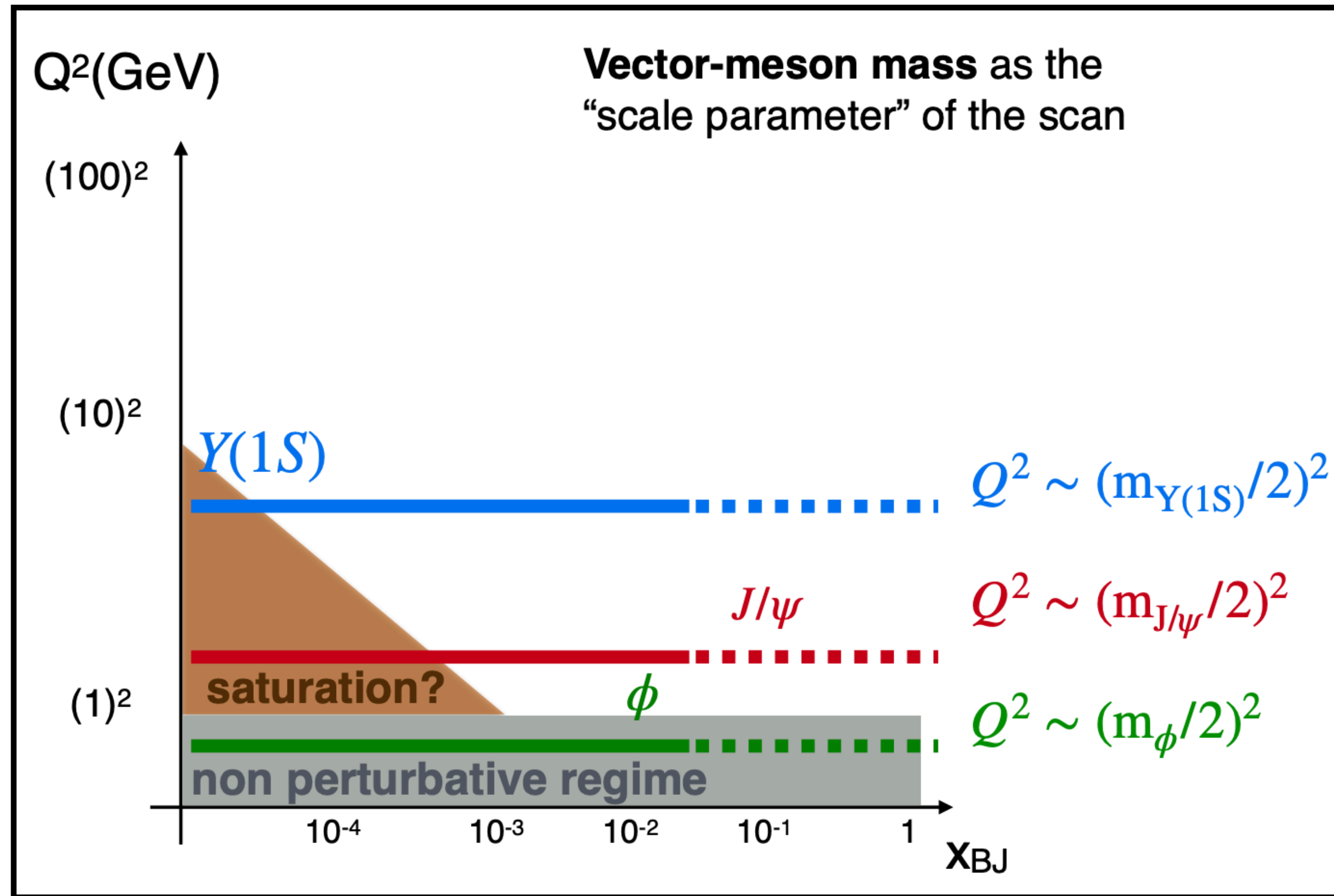
- Saturation effects vs. collinear approaches
- Gluon saturation and transverse momentum dependent PDFs
- Diffractive events

Organizers:

Christophe Royon
Edmond Iancu
Georgios Krintiras
Gian Michele Innocenti
Lydia Beresford
Martin Hentschinski
Ronan McNulty

Vector Meson Photoproduction

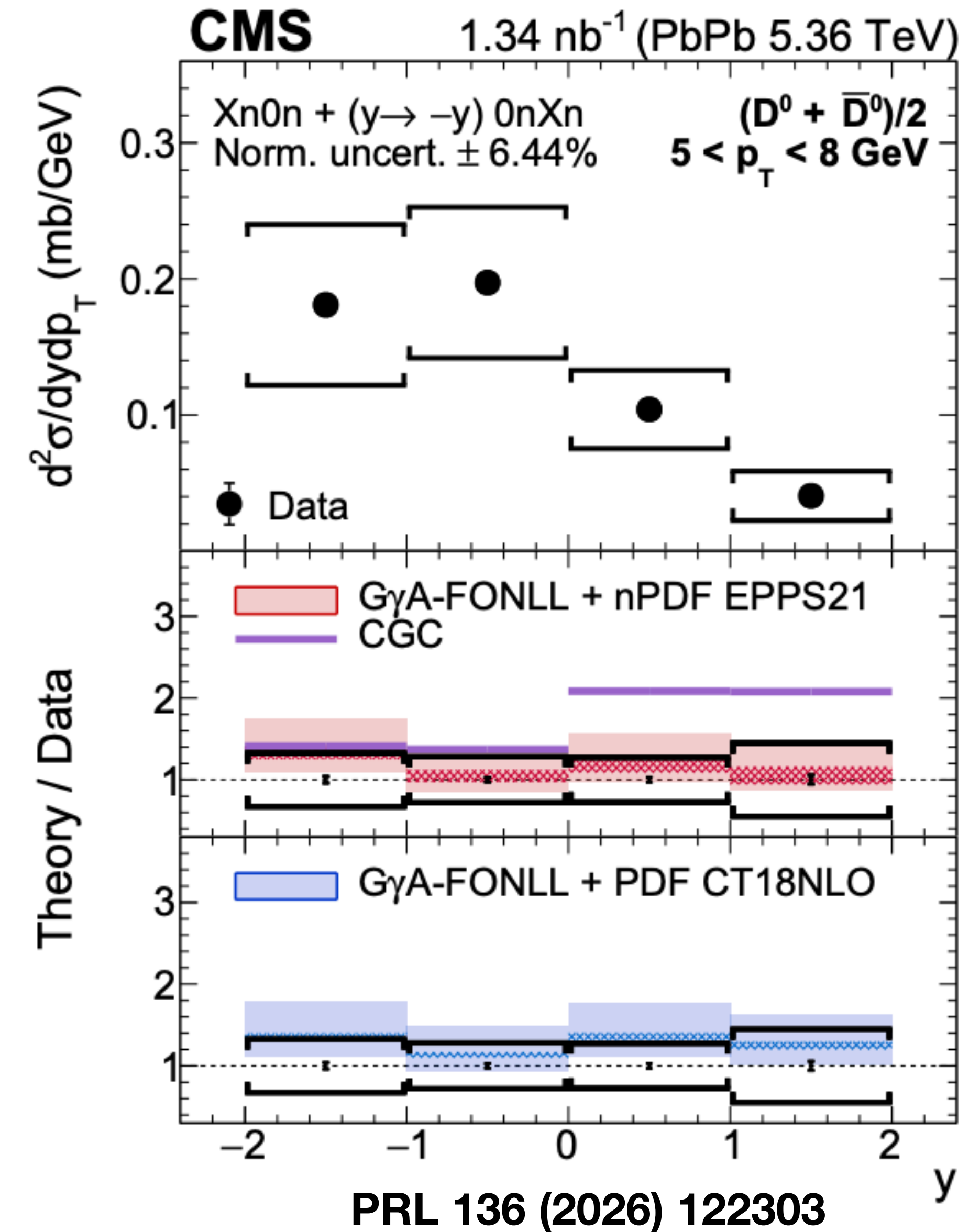
- Scan Q^2 and A dependence of VM photoproduction
- Feasibility for higher-mass states depends strongly on delivered luminosity b/c of photon flux scaling



From Gian Michele Innocenti's IS '25 talk

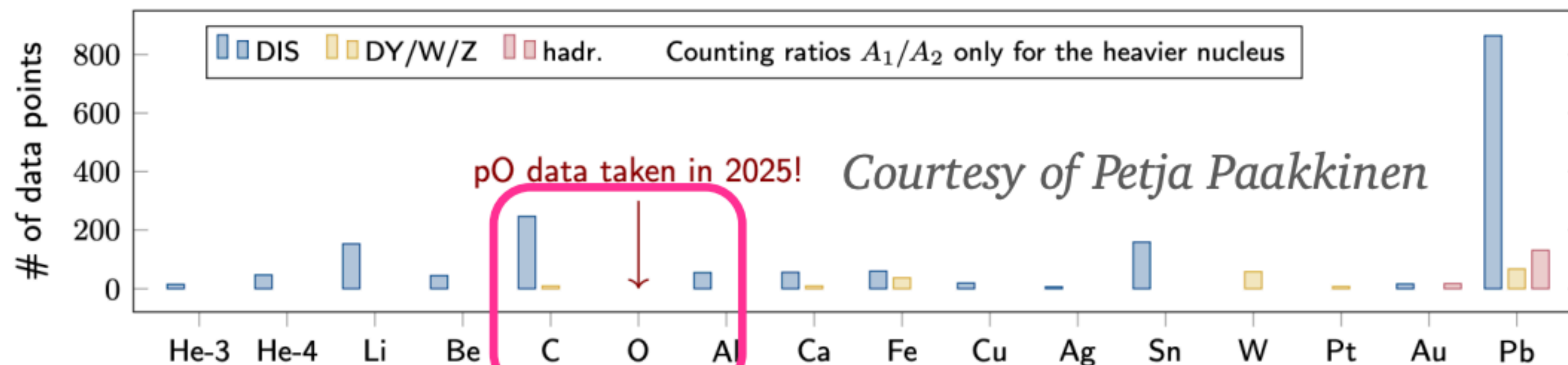
Open heavy flavor photoproduction

- Exploration of forward open heavy flavor photoproduction using extended tracking systems
- Complementary to VM photoproduction measurements
- Similarly depends on delivered luminosity



nPDF studies

- Exploration of nPDFs for small- A nuclei at low- x
- Going to be a major topic of study at the EIC
- γA or pA collisions at LHC will provide complementarity and enable cross-checking across different colliders
- Many possible observables: hadrons, jets, EWK bosons, etc...



A -dependence of gluon nPDF is practically unconstrained!

Luminosity estimates

- Optimal ion to run will depend on many factors
- A-scaling of photon flux (for UPC)
- A-scaling of saturation effects
- Luminosity delivered vs. A
- Requires dedicated studies

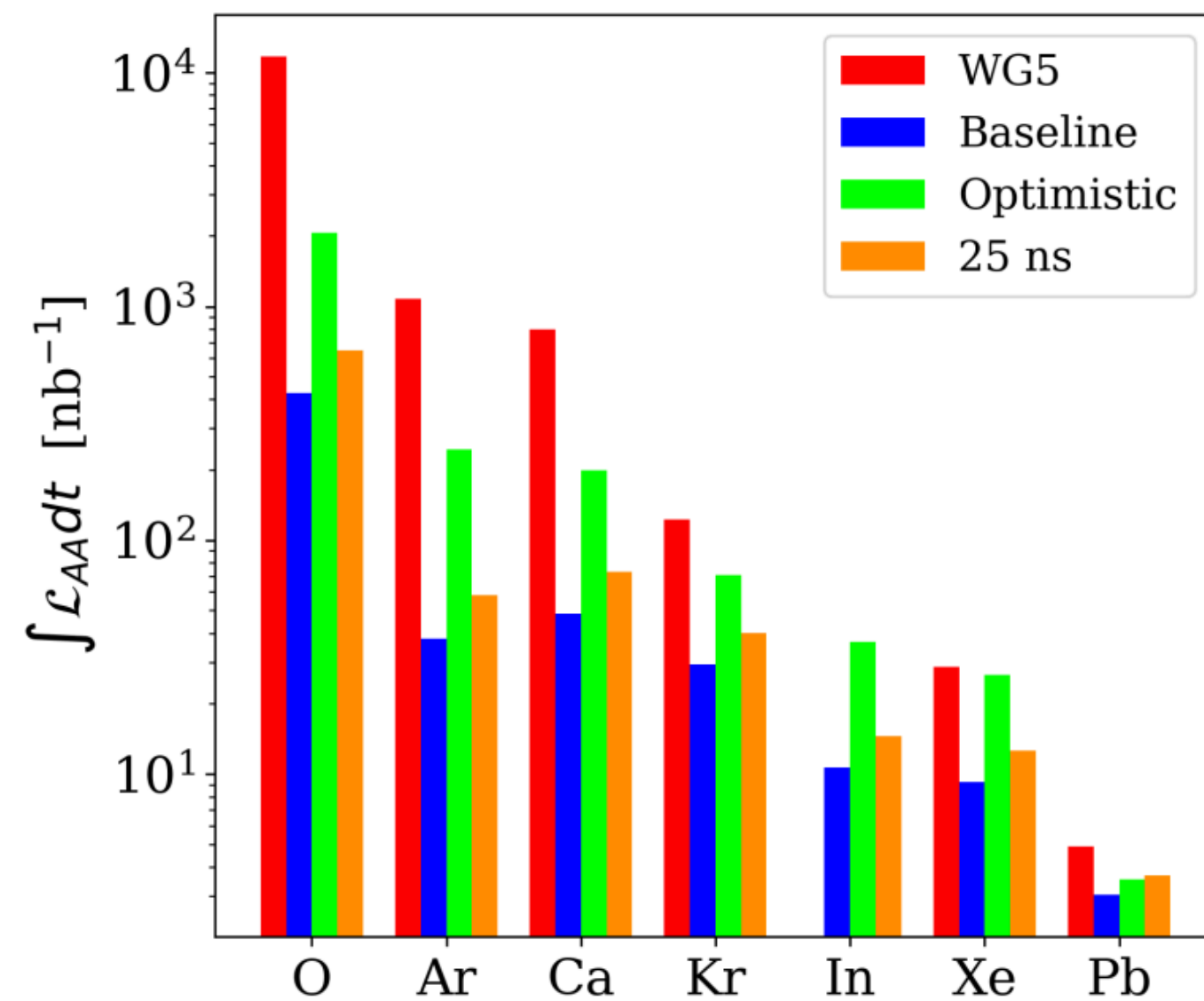


Figure 10: One-month integrated ion-ion luminosity $\int \mathcal{L}_{AA} dt$ in nb^{-1} for the various cases.

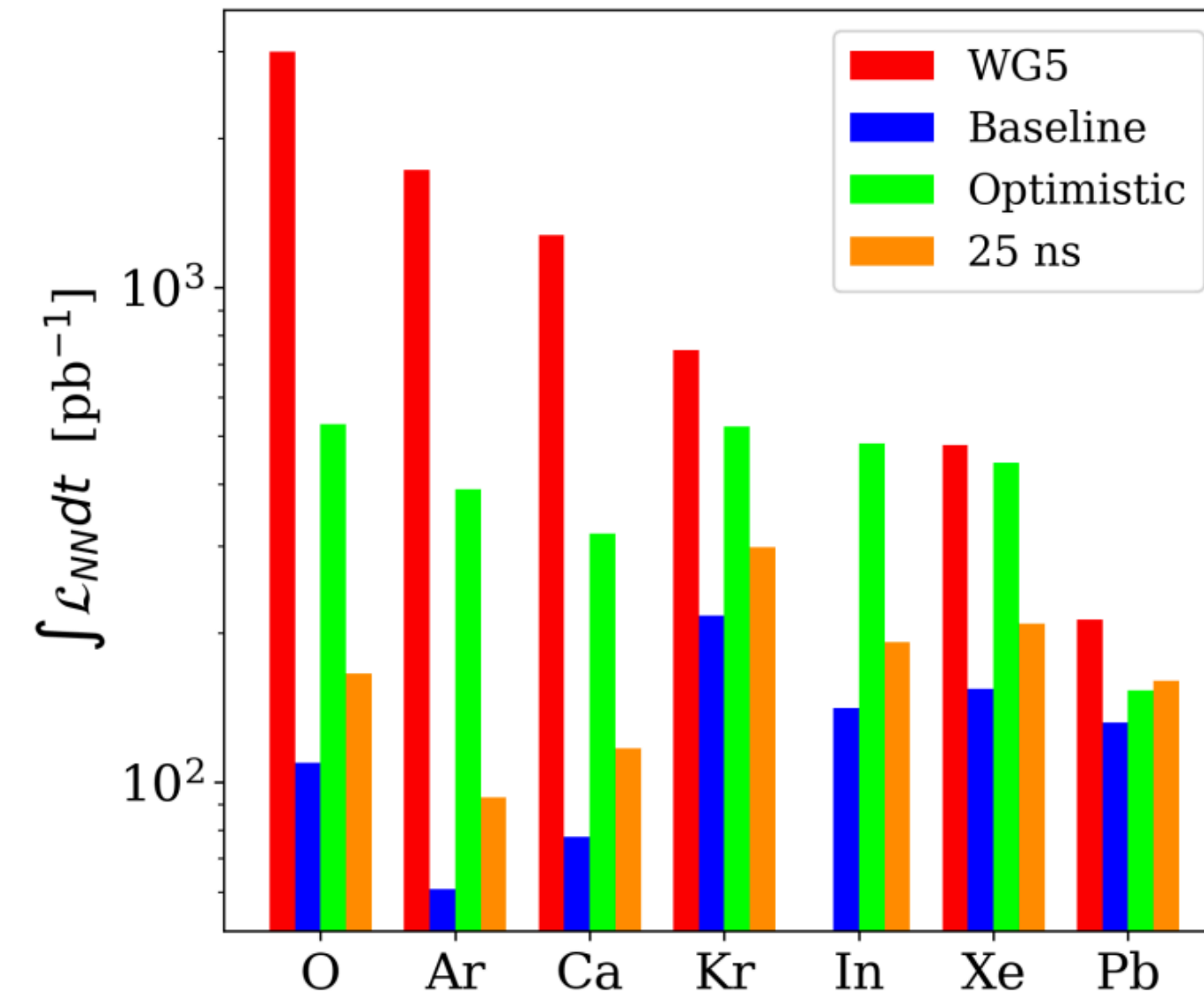
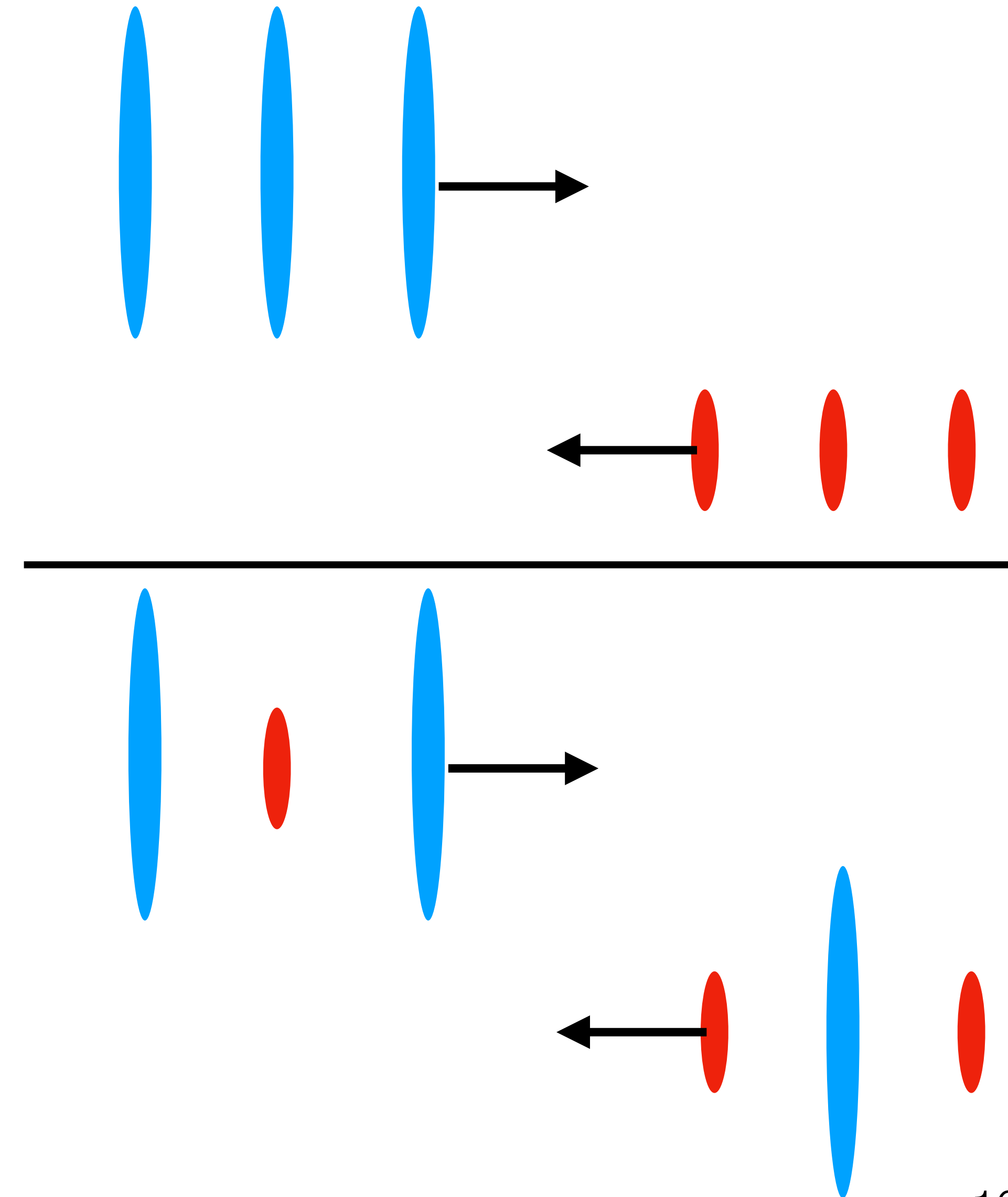


Figure 11: One-month integrated nucleon-nucleon luminosity $\int \mathcal{L}_{NN} dt$ in pb^{-1} for the various cases.

Second ion source

- **Having a second source would allow:**
 - **A+B collisions (for example, PbO for UPCs)**
 - **Potential for simultaneous A+A, B+B, A+B, B+A collisions to cancel uncertainties**
 - **Fast turn-around for swapping non-gaseous ions**
- **Hugely beneficial if one wants to maximize photon flux while still studying light ions**



Summary

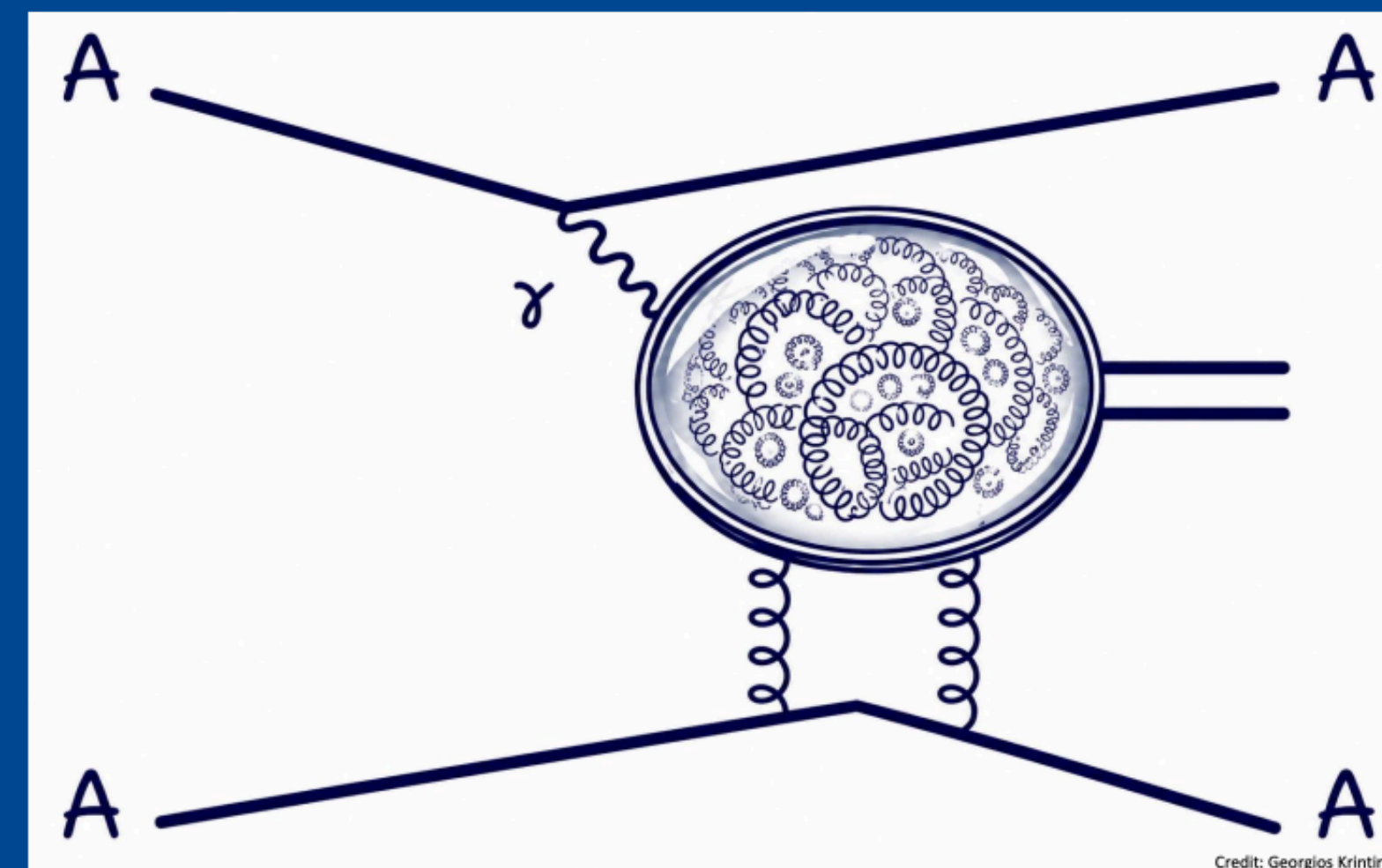
- **Discussions ongoing within Forward physics LPCC group about light ion possibilities**
- **Clear synergies with EIC both in terms of physics and timelines**
- **Expected that many studies/material for planned Forward Physics white paper will also be relevant for New Ions @ LHC effort**

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Backup