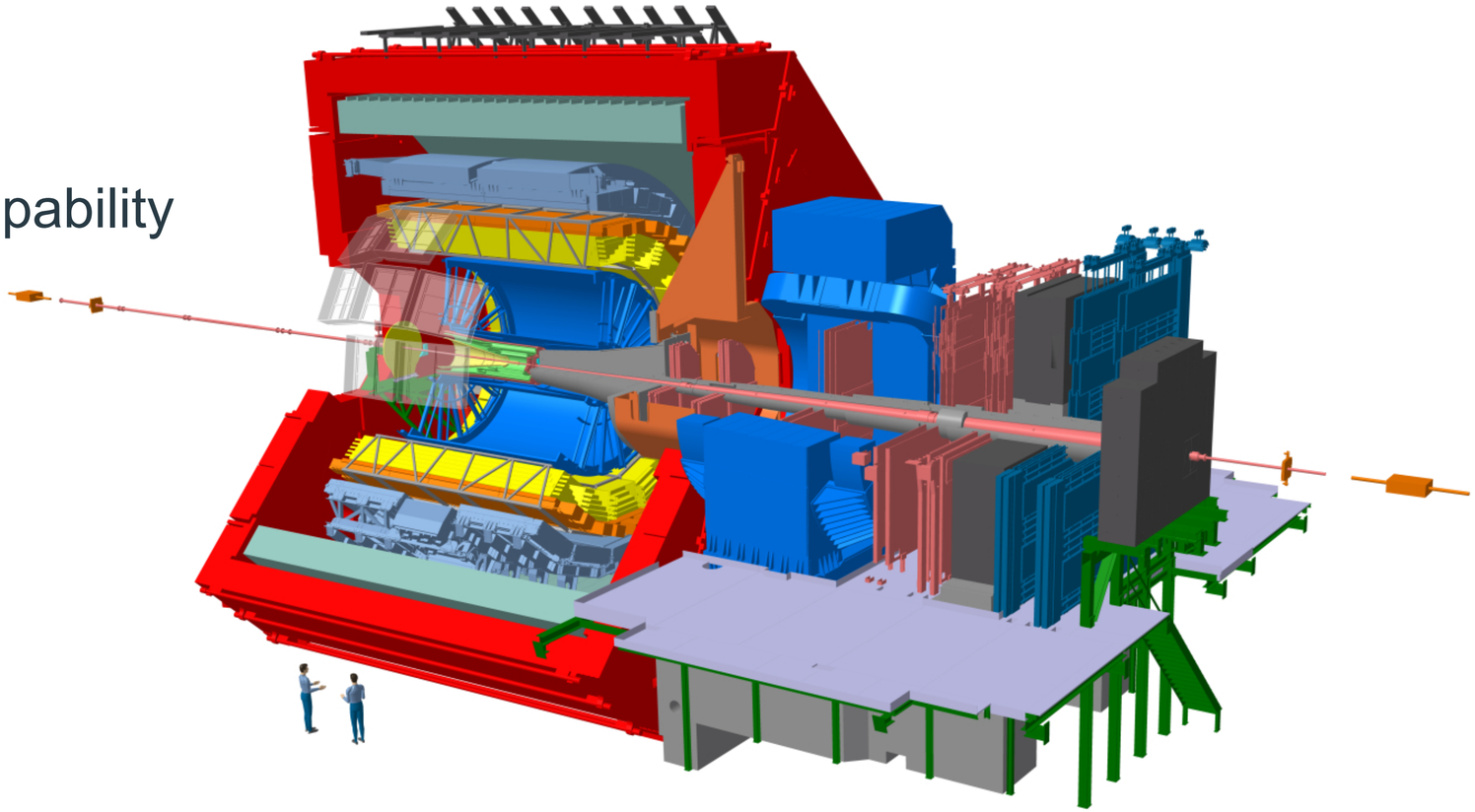
A Large Ion Collider Experiment

ALICE Update

Lee Barnby on behalf of UK ALICE Collaborators

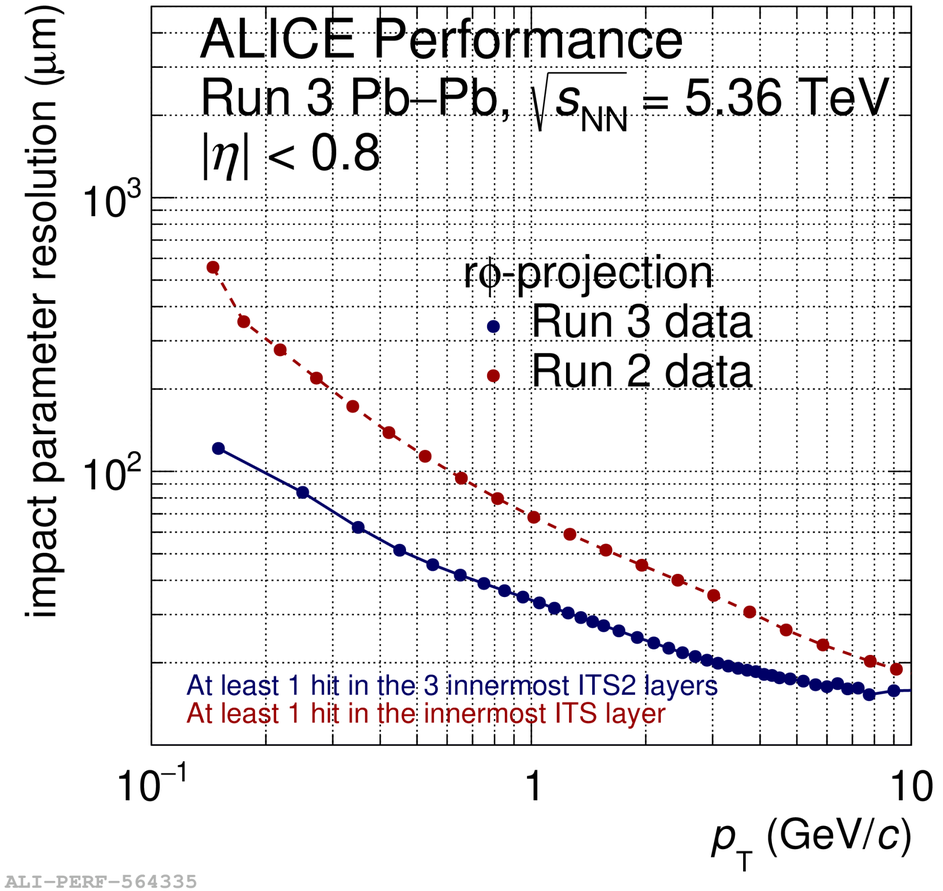
Outline

- Introduction/Reminder
  - ALICE Upgrade Project
  - LHC Run 3
    - Performance plots ITS, PID Capability
- 2024 Experiment Operations
  - Proton-proton programme
  - Pb-Pb
- Physics highlights
  - Isolated photons
- LHC Schedule News
- 2025 Programme
- ALICE 3



ALICE Upgrade Project

- Major upgrade during Long Shutdown 2 (-2021)
- Introduce continuous detector readout, replace time projection chamber (TPC) electronics
  - Data rates up to 1MHz for pp and 50 kHz for Pb-Pb
- Brand new inner Si pixel tracker (ITS) with MAPS technology
  - Improved pointing resolution for charm and beauty decays
  - New capabilities to track short-lived (O cm) weakly-decaying particles



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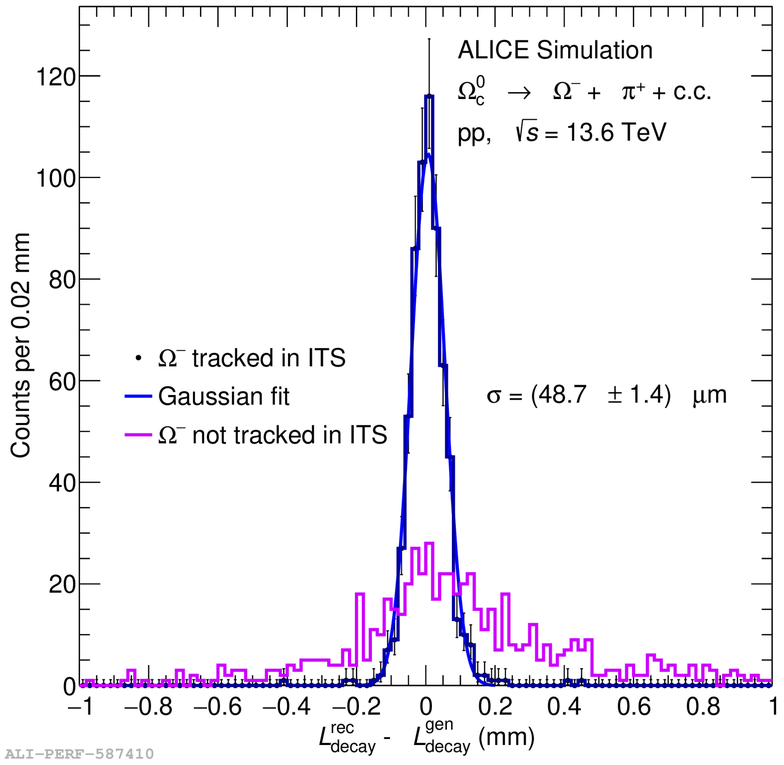
Run 3 Performance and capability

- TPC and TOF Pb-Pb
- Omega from charm baryon decay
  - Ω_C -> Ω^- + π^+



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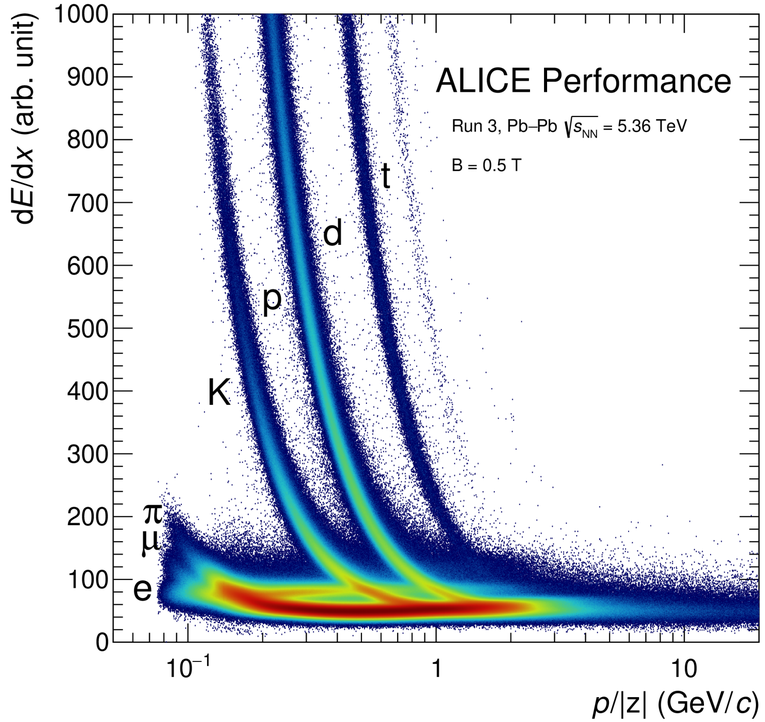

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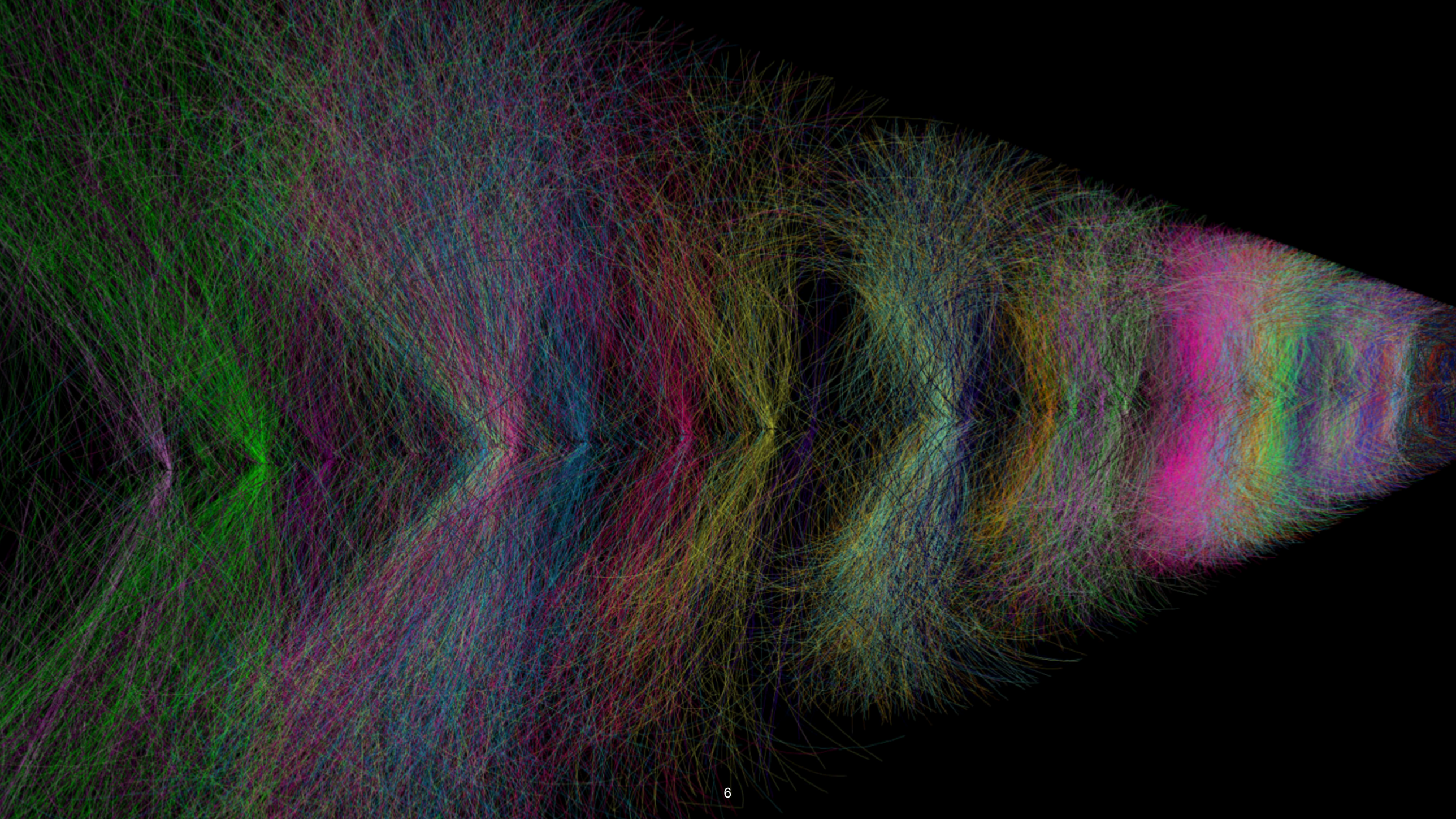
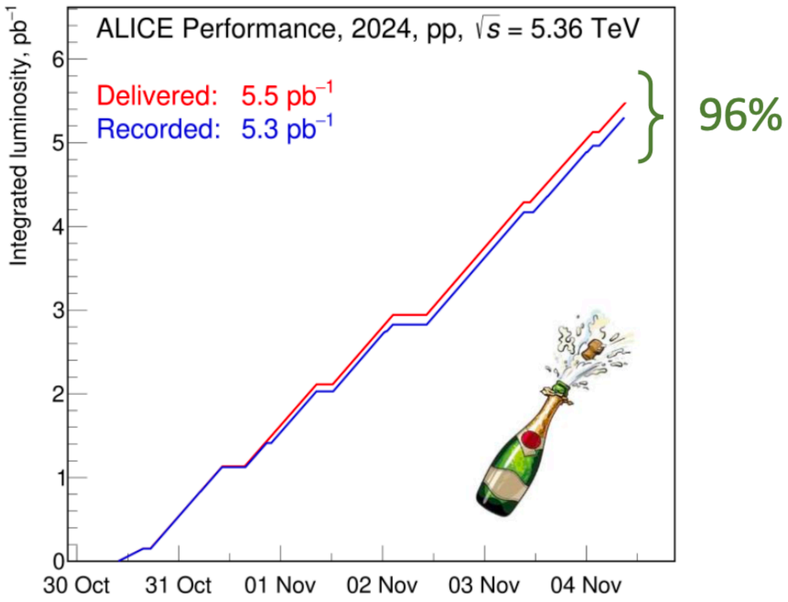
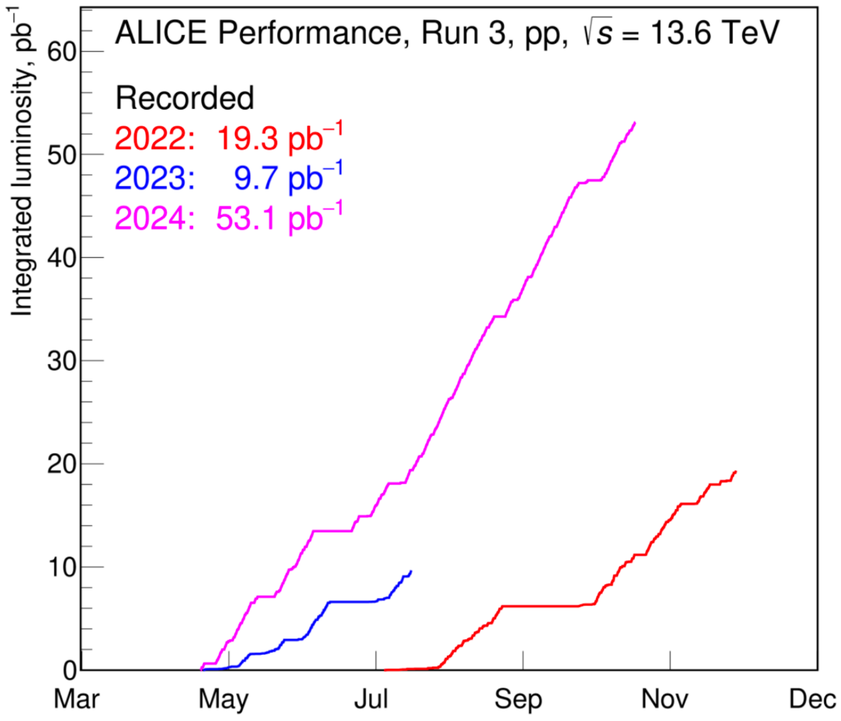


2024 Experiment operations

- Three major goals
  - Large sample of proton-proton (pp) collisions at top energy √s = 13.6 TeV
  - *Reference* energy pp collisions at √s = 5.36 TeV
  - Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.36 TeV

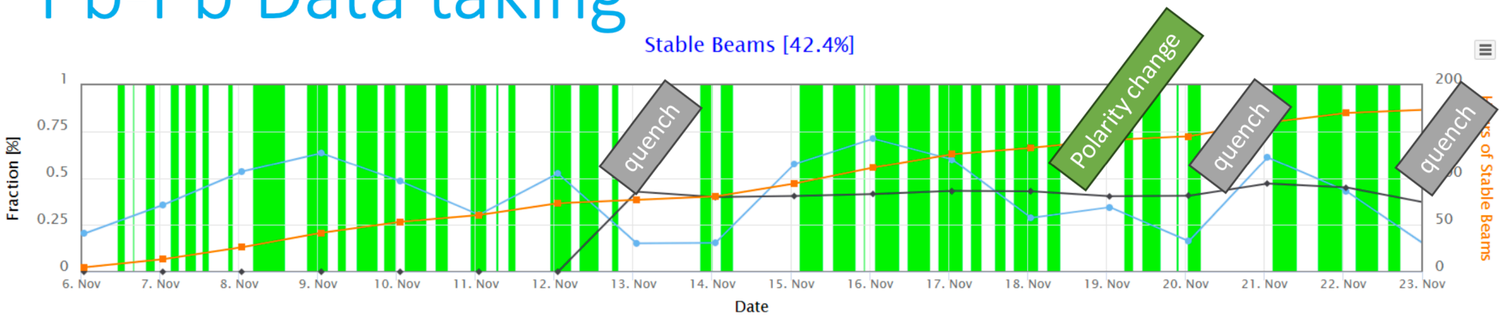


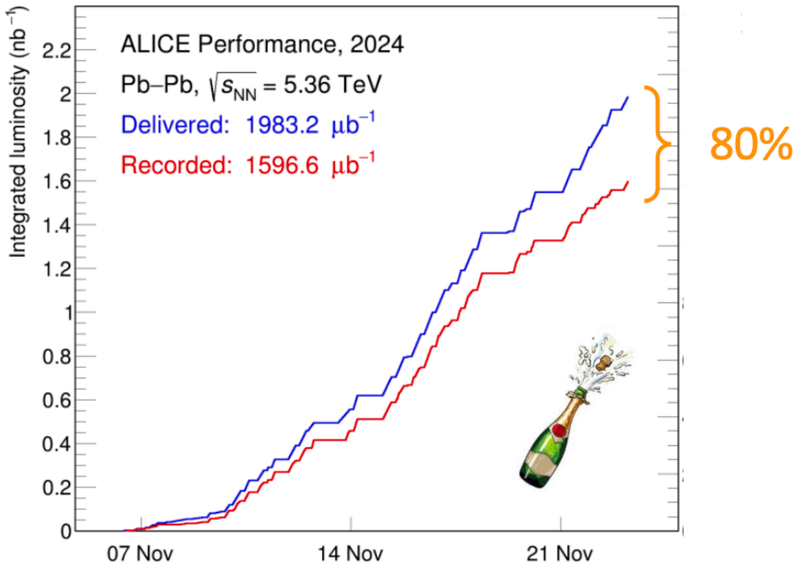


Pb-Pb data taking

- 2.5 week campaign in November
- Improved machine performance
- Total of 12 billion Pb-Pb events collected

Pb-Pb Data taking

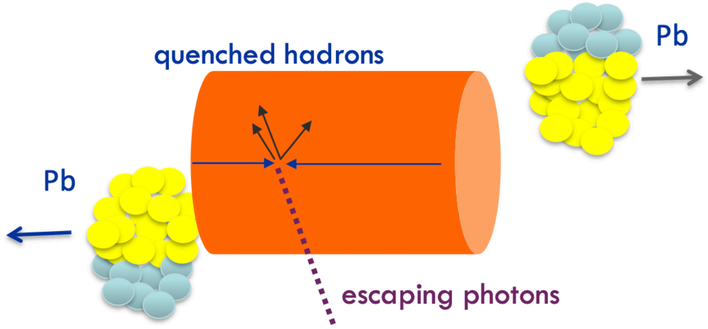


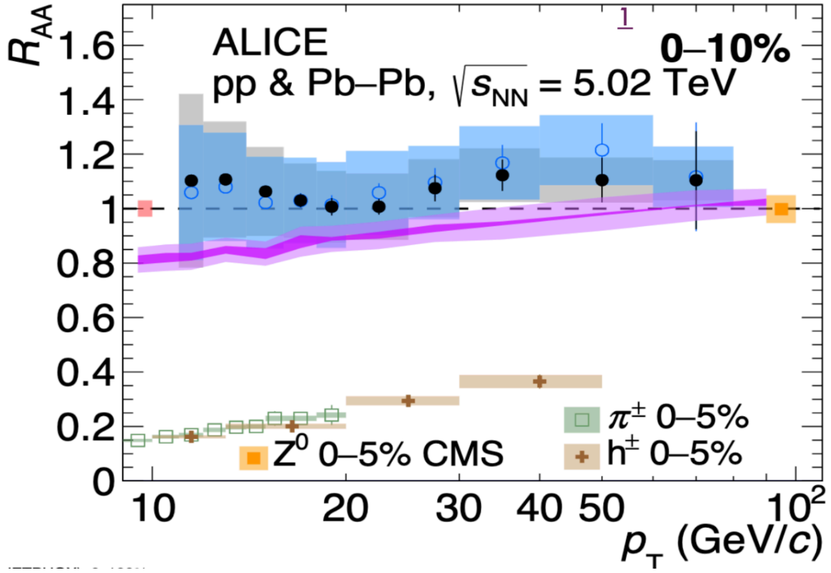


Physics highlights

- *Over 40 papers published this year with a similar number submitted, so just one selected highlight here*
- Isolated-photon production cross section in pp and Pb-Pb collisions
  - Select photons without any other particle in asurrounding cone (R) to suppress decay andfragmentation photons
  - Divide by the production in pp collisions scaled by the number of binary nucleon-nucleon collisions (R_{AA})
  - Color insensitive probes do not show any nuclear modification (R_{AA} ~ 1) in contrast to coloured probes (hadrons)

– https://arxiv.org/abs/2409.12641



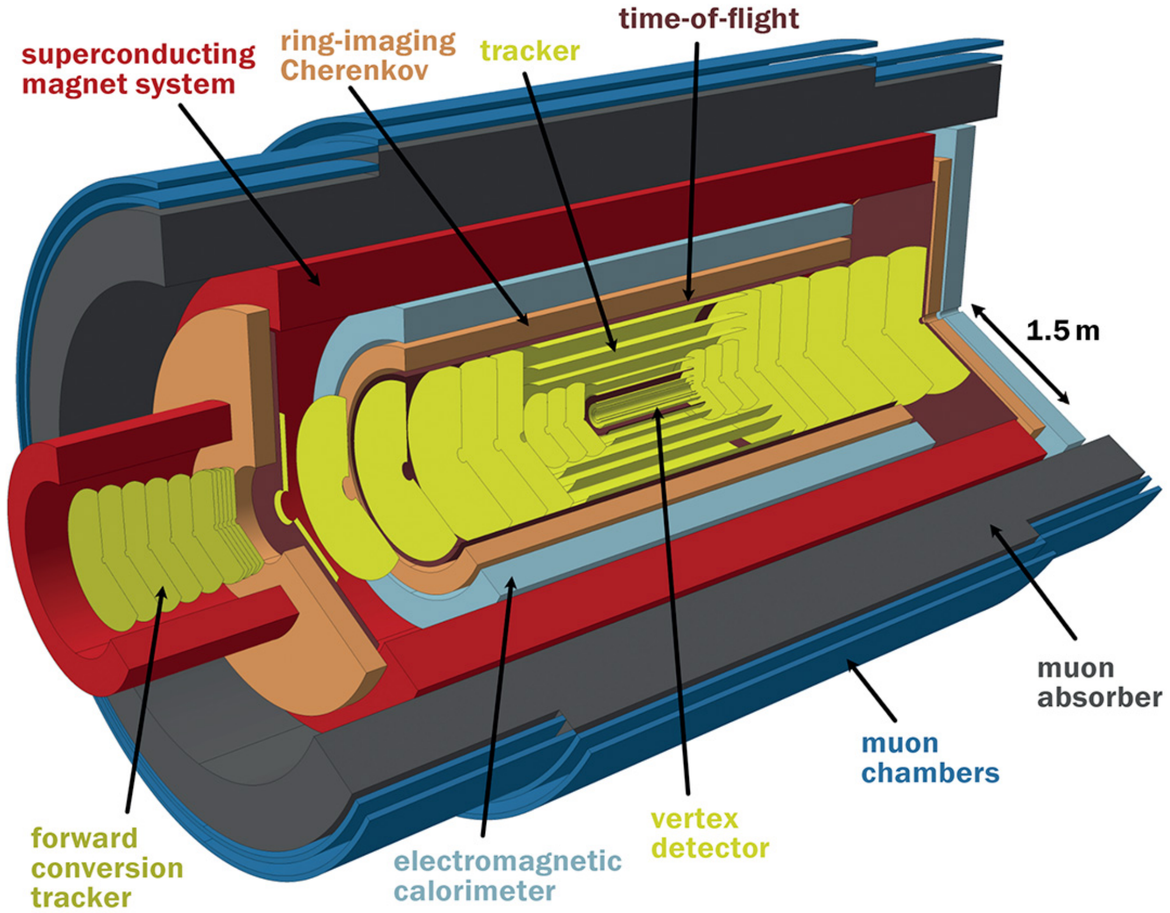


LHC Schedule News

- Run 3 has been extended into 2026
- Resumption for Run 4 also pushed back to 2030
- In 2025 there will be **test beams for O-O and p-O collisions** in the middle of the year, as well as usual heavy-ion run in November

ALICE 3

- Collaboration is working on performance studies with variations on original design
  - Magnet with 2T, 1.5 T, 1T
  - Number of inner/outer layers of barrel tracker
- Motivated by requests from RRB for scoping
- Results not released in public forum at the moment but document in preparation
- In parallel detector R&D work has begun



Conclusion

- Upgraded ALICE detector being fully exploited in Run 3 (2022-2026)
- UK teams represented in various co-ordination and management roles
  - *M. Chartier - Collaboration board chair to 7/25*
  - *D. Evans - Management board member*
  - *R. Lietava - Trigger co-ordination and physics board member*
  - *J. Liu - ITS Deputy technical co-ordinator and data QA*
  - *J. Norman - Editorial board member*
  - *Plus 6 PhD students*
- Exploitation should continue in Run 4 (2030-2033) with ITS3 inner barrel upgrade installed
- Collaboration continues work on ALICE 3 proposal for longer term