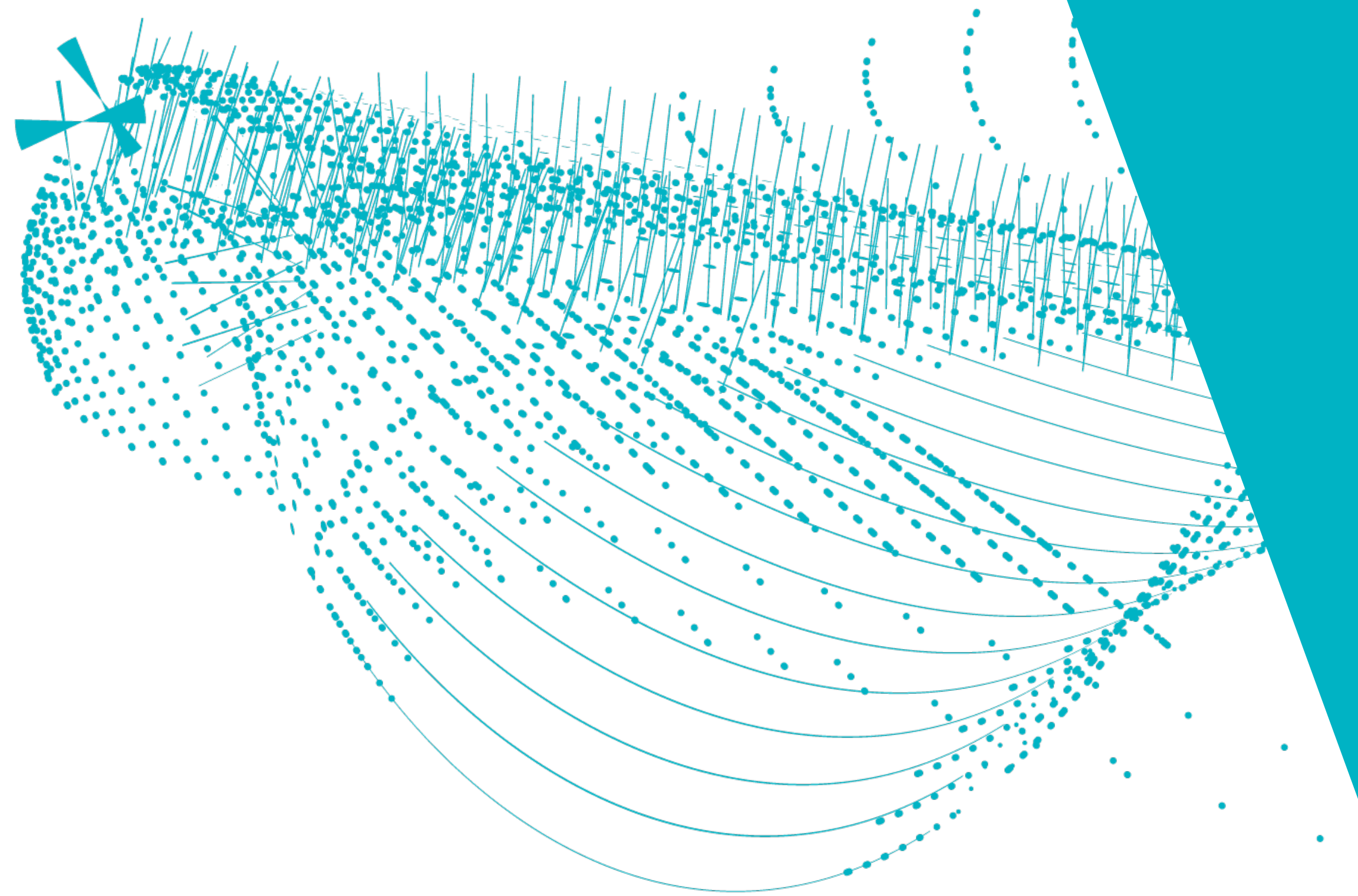


Nikhef



ALICE IN THE NETHERLANDS

Pierfrancesco Butti (PF)

THE DUTCH ALICE GROUP

Scientific Staff



PhD Students and Postdocs



Support Staff



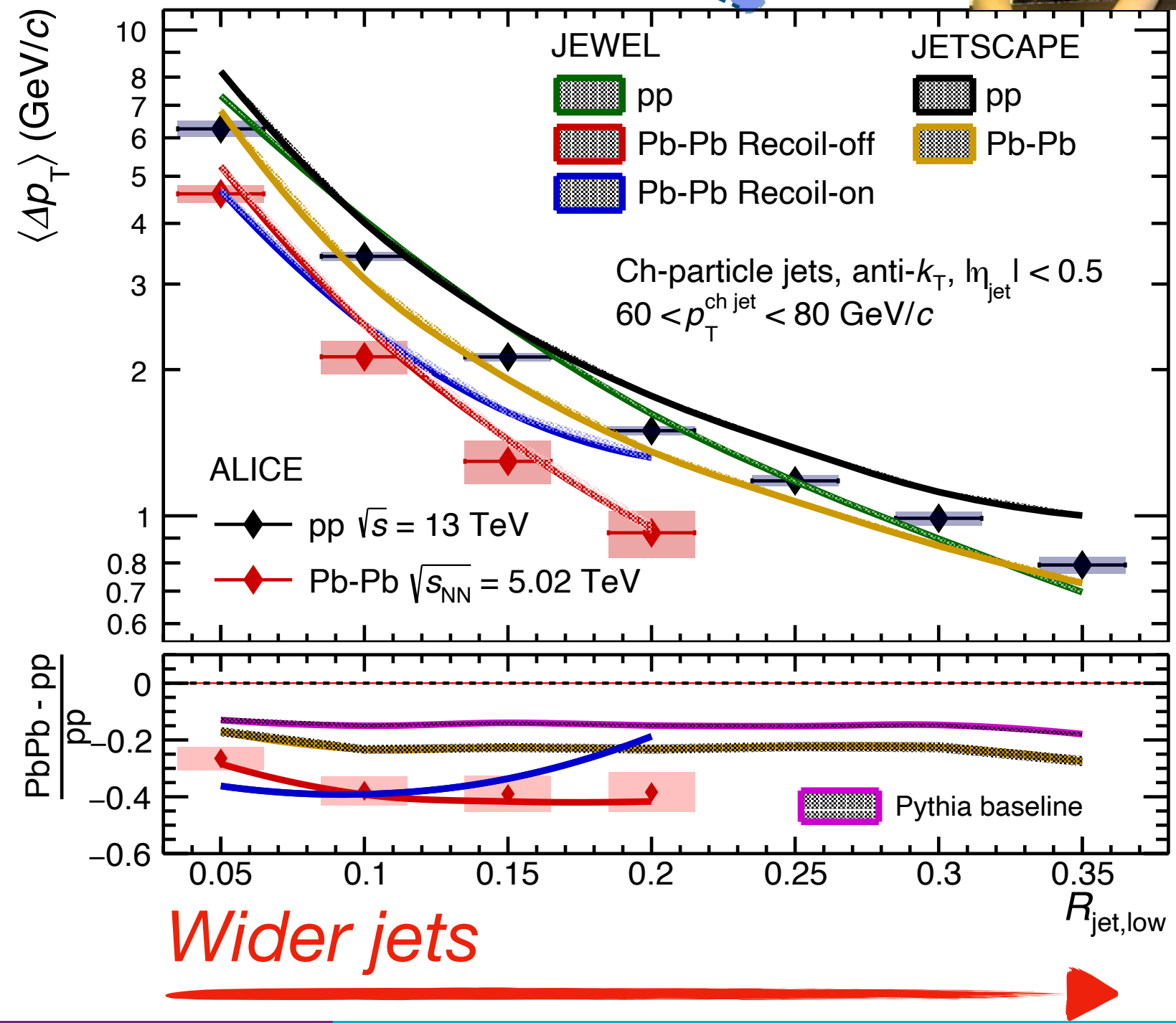
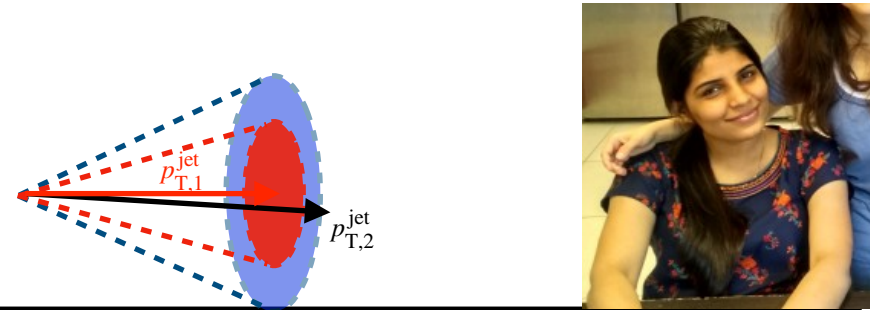
External funding (PI and/or co-PI)

- 2 NWO M1 grant
- NWO VICI
- NWO-ENW XL grant: FASTER (co-PI)
- NWO-ENW XL grant: Probing the phase diagram of QCD (co-PI)
- NWA-ORC grant: Emergence at all scales (co-PI)
- NWO Roadmap FASTTRACK (co-PIs)

SOME HIGHLIGHTS OF ONGOING ANALYSES

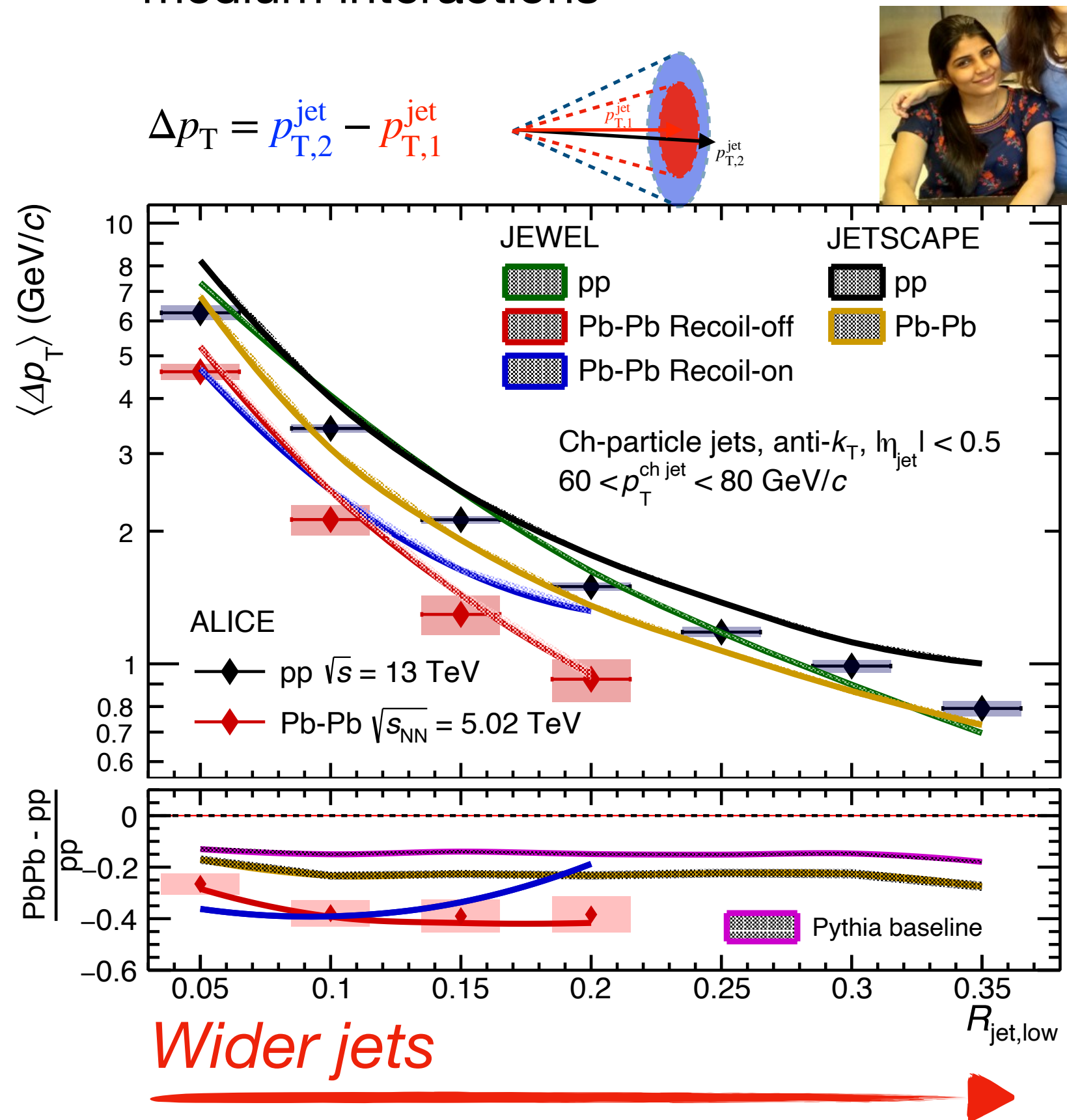
- **Jets are robust probes to QGP**
 - Jet energy flow suppression in heavy-ion collisions → narrowing jet energy profile
 - Compared to predictions to infer jet-medium interactions

$$\Delta p_T = p_{T,2}^{\text{jet}} - p_{T,1}^{\text{jet}}$$

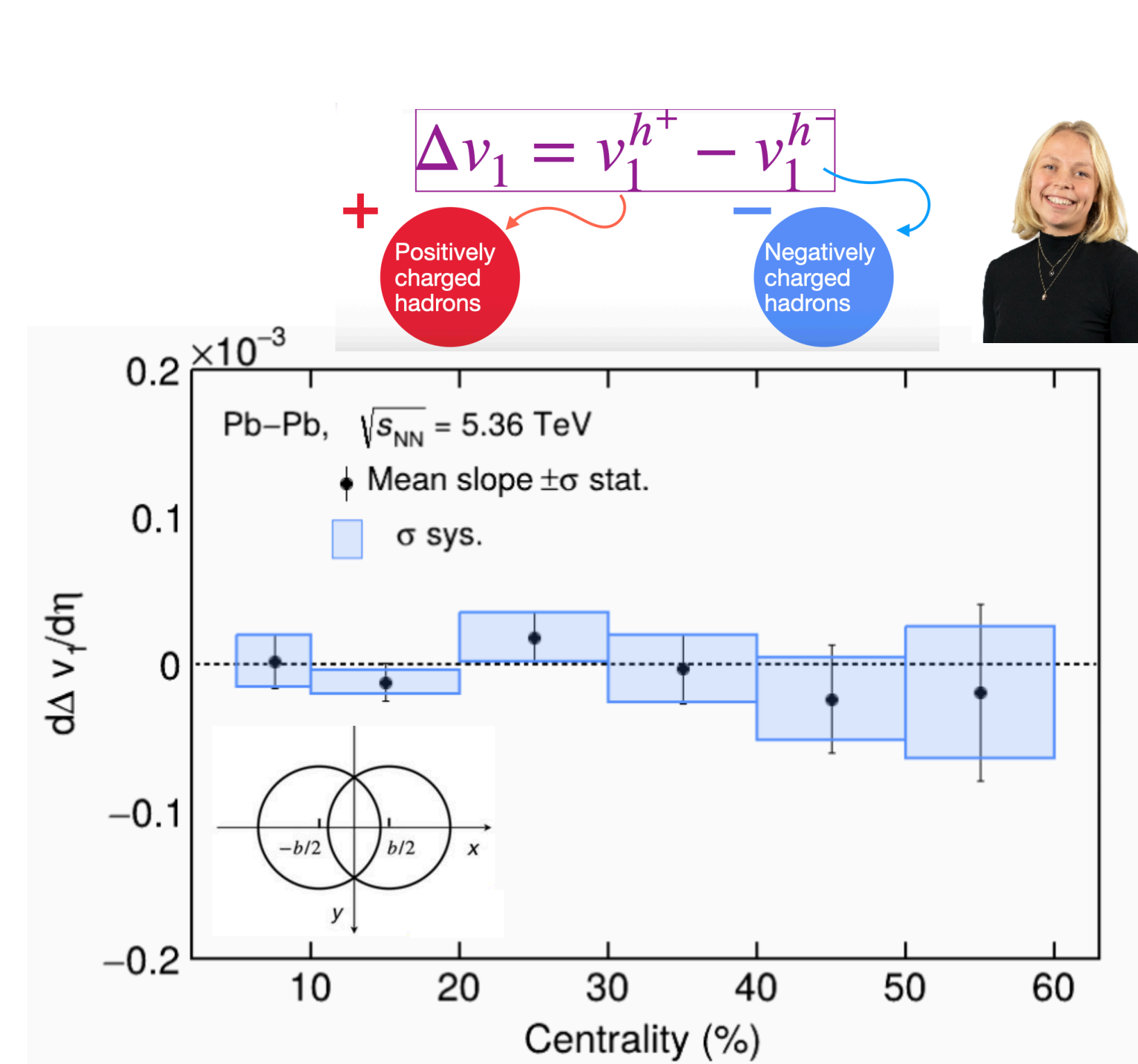


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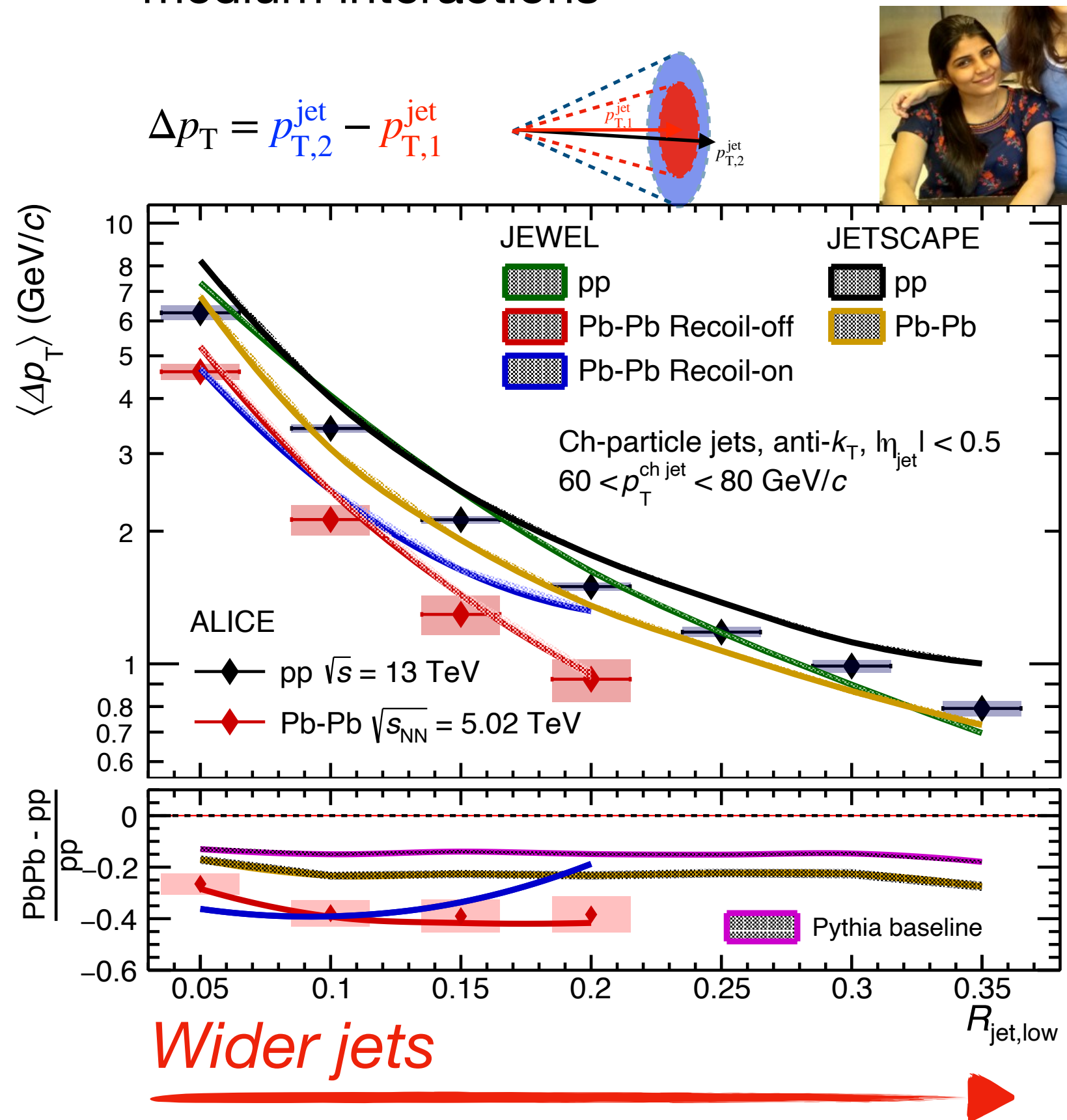


- **Probing early stage EM field of QGP**
 - Charge dependent directed flow
 - No significant splitting observed at different centralities
 - New constraints on EM fields effects

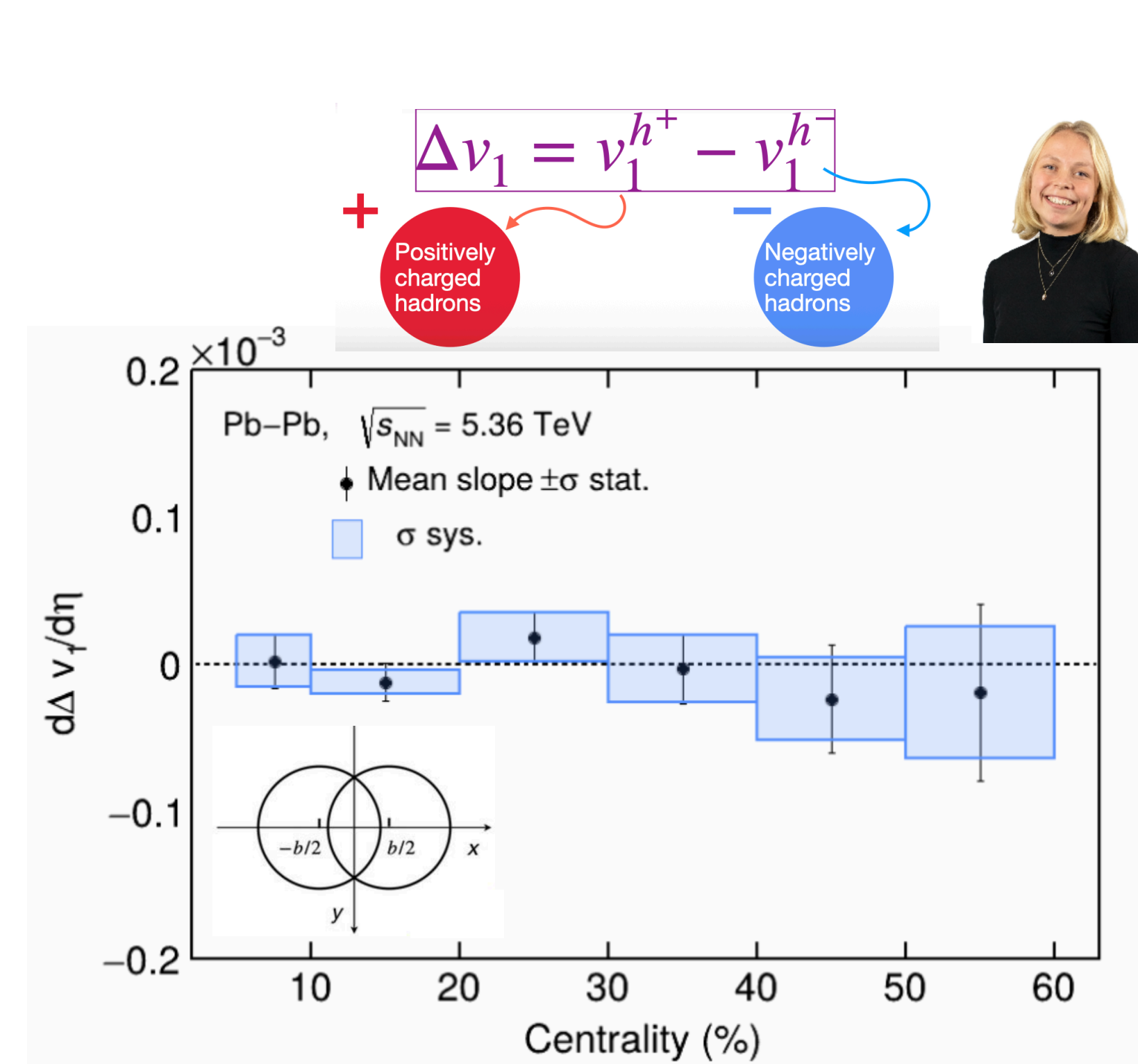


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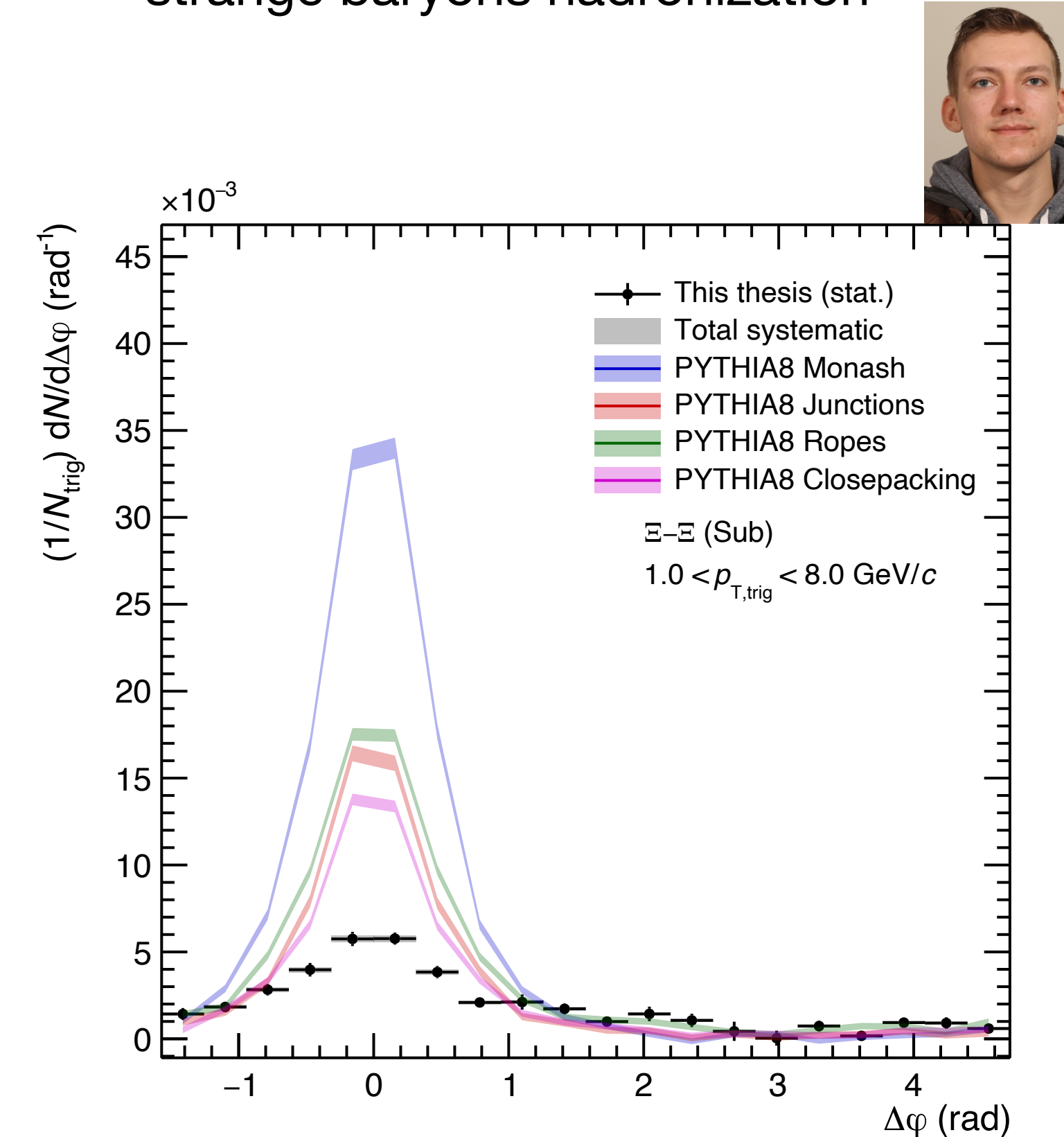
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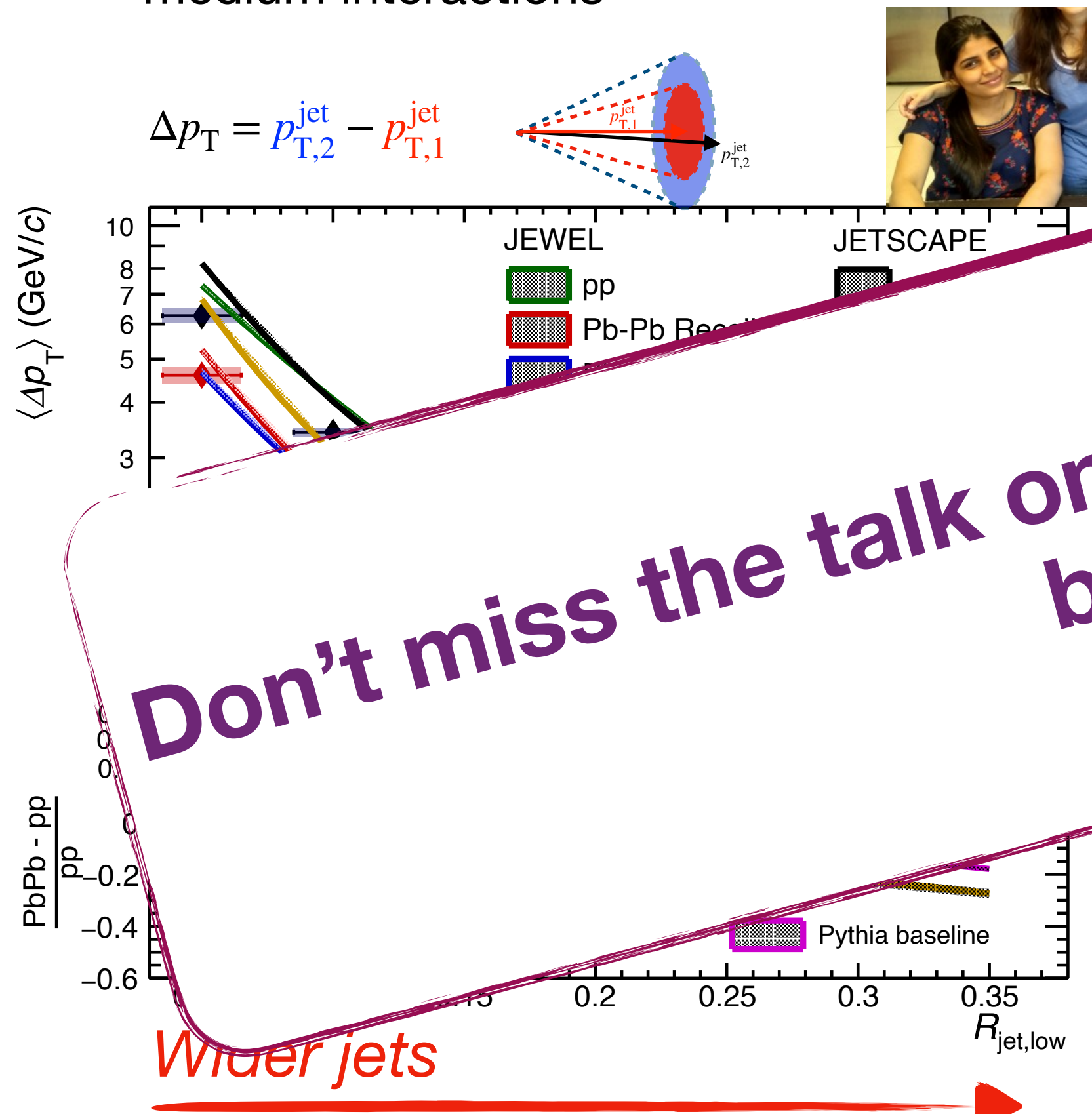
- **$\Xi - \bar{\Xi}$ angular correlations in Run3 pp**
 - Probe for hadronization mechanism described by Lund string model
 - Current models can't still describe strange baryons hadronization



SOME HIGHLIGHTS OF ONGOING ANALYSES

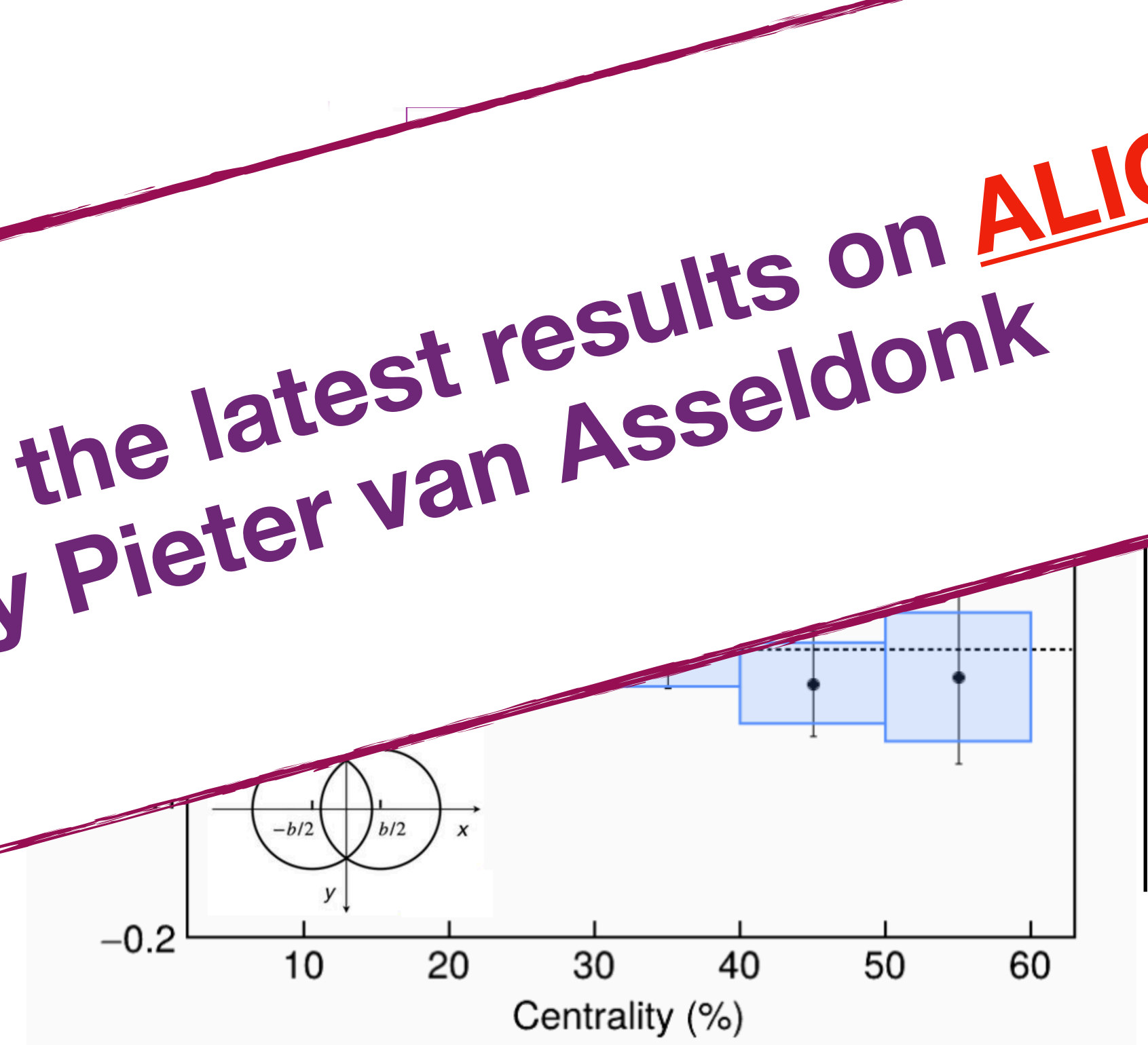
○ Jets are robust probes to QGP

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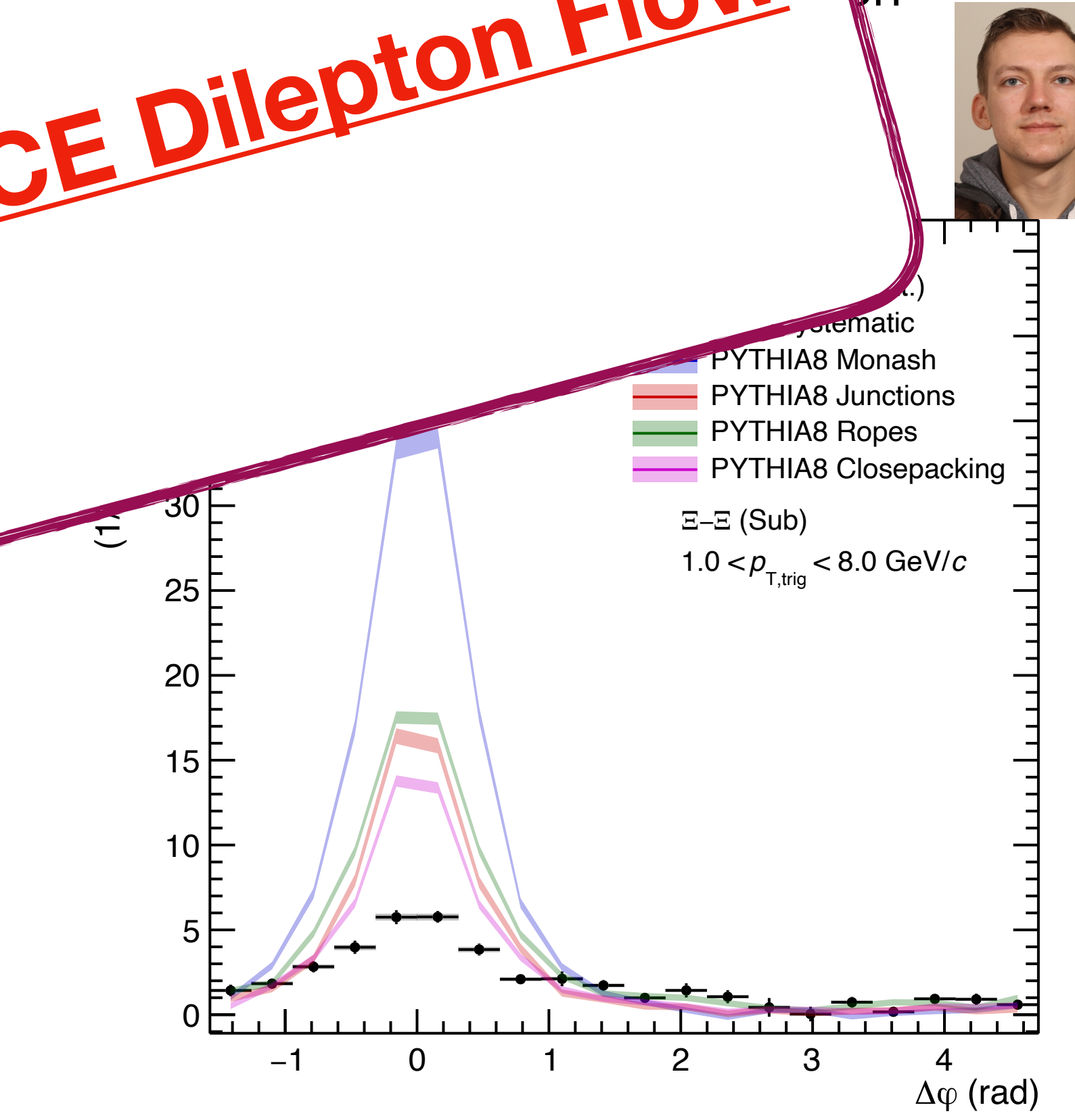
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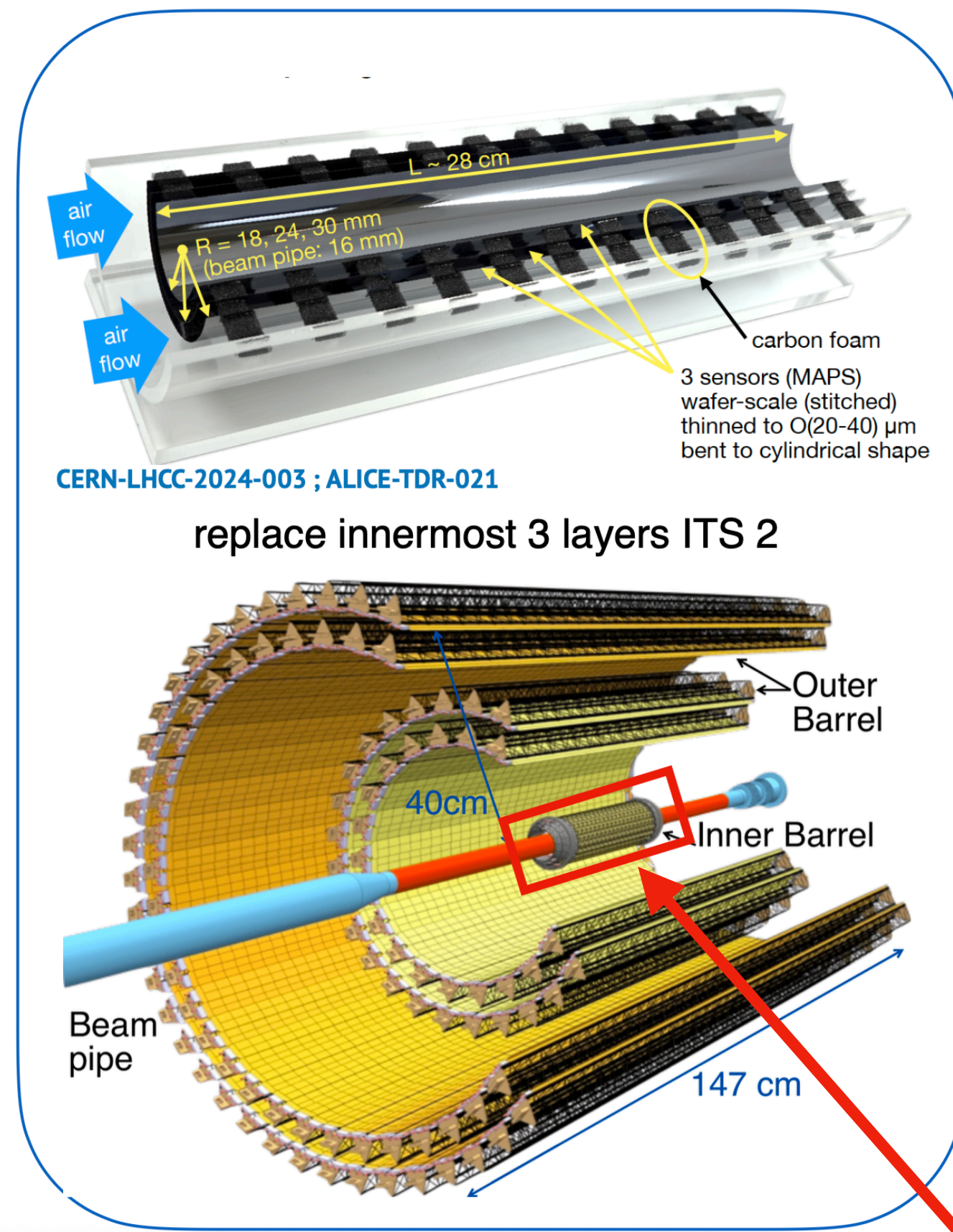
- Probe for hadronization mechanism
- deconfinement model
- describe
- on



Don't miss the talk on the latest results on ALICE Dilepton Flow by Pieter van Asseldonk

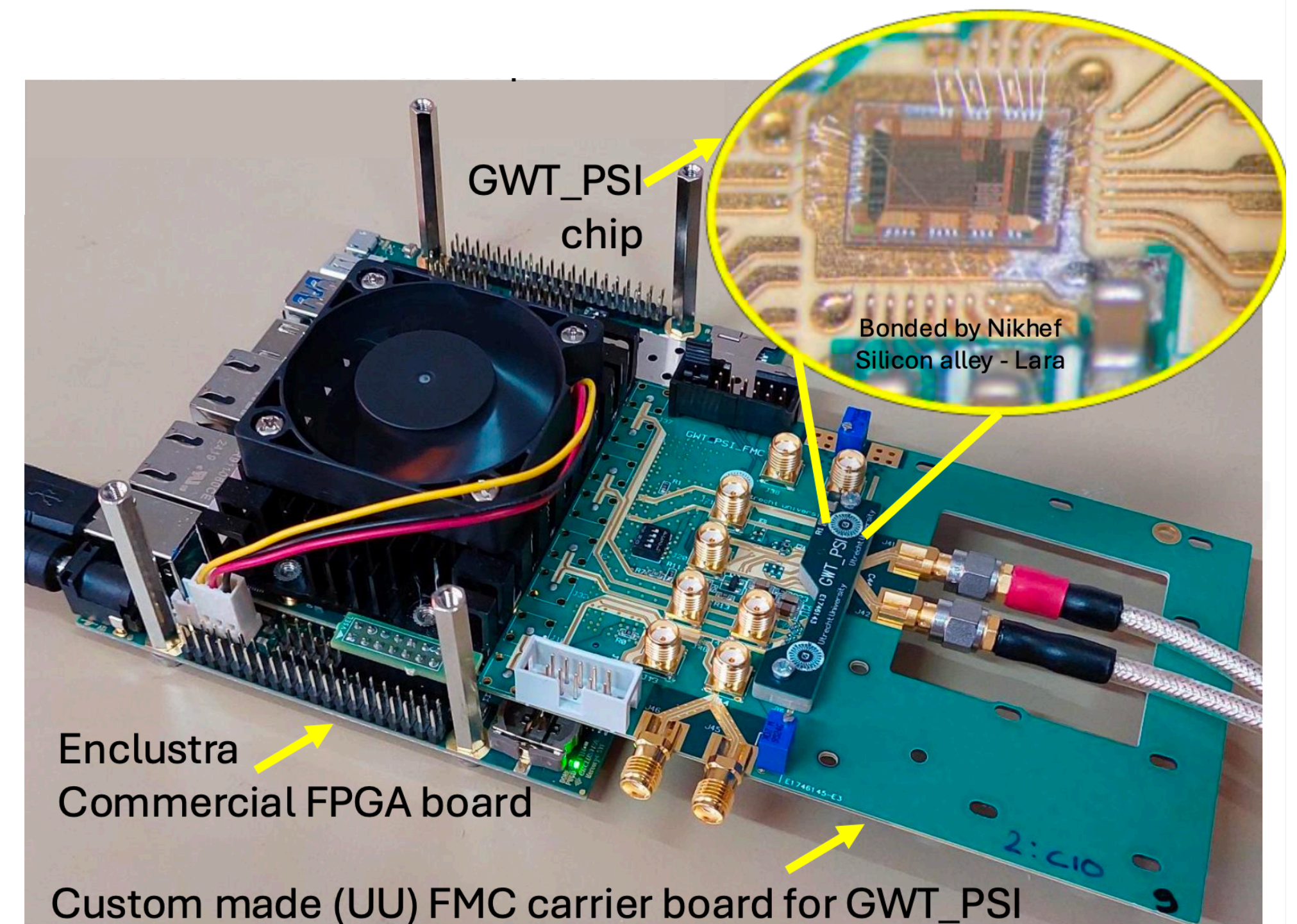
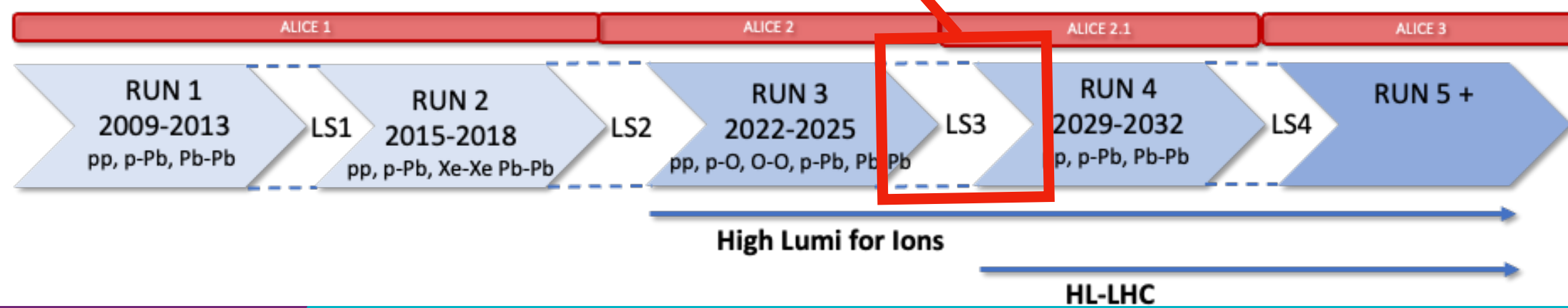
ITS3 10.24 GB/S SERIALIZER AND FAST LINK

- Nikhef ET designed the 10.24 Gb/s serializer circuit for high-speed data transmission
 - Crucial component for the ITS3 sensor
- **Many thanks for the excellent work to the ET team!!**
- **Has been produced within the second wafer Engineering Run and now bonded on the carrier-board**
 - Ready to be tested



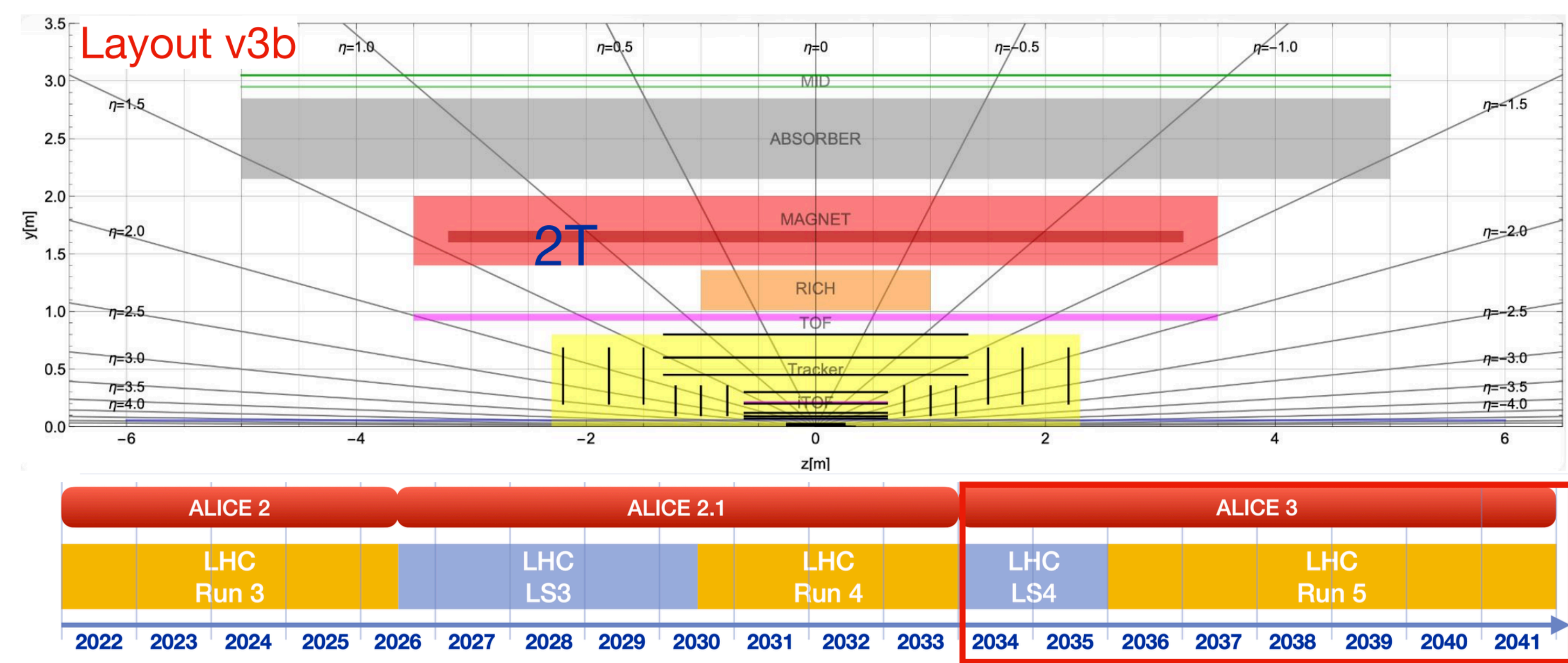
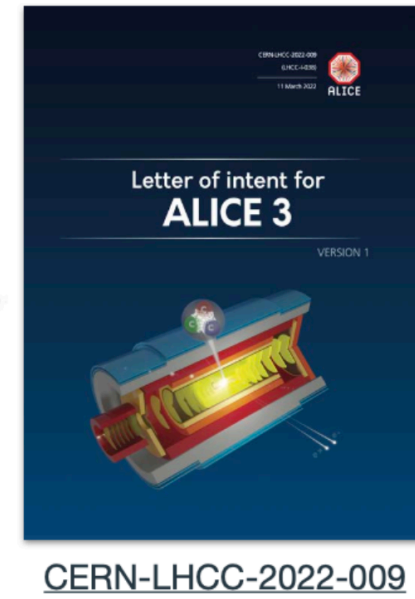
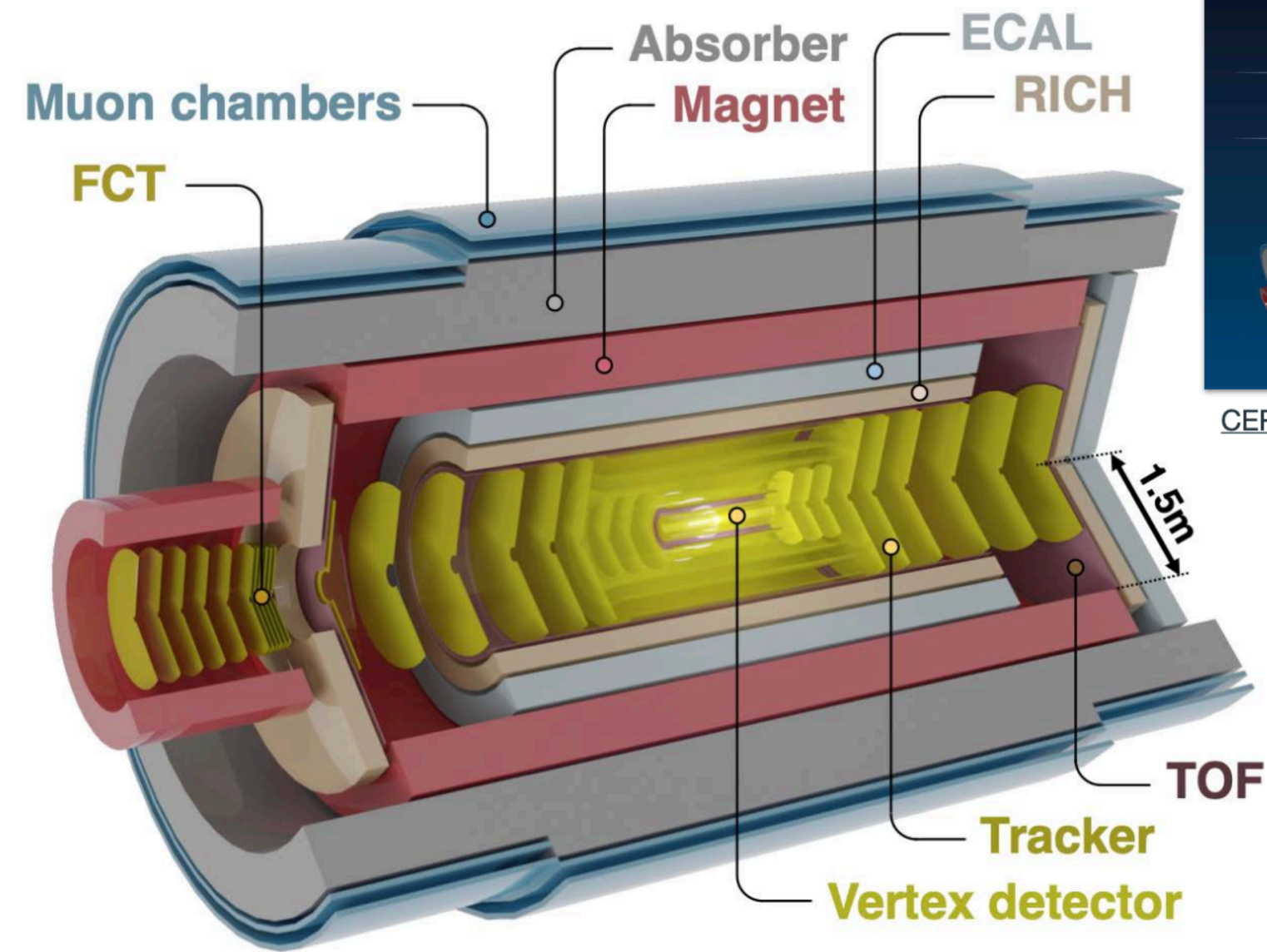
CERN-LHCC-2024-003 ; ALICE-TDR-021

replace innermost 3 layers ITS 2



** More details were presented in the techno-tour on Monday*

ALICE3 (2036 -)



- **Mechanics:**

- Design, simulation, tooling and later production

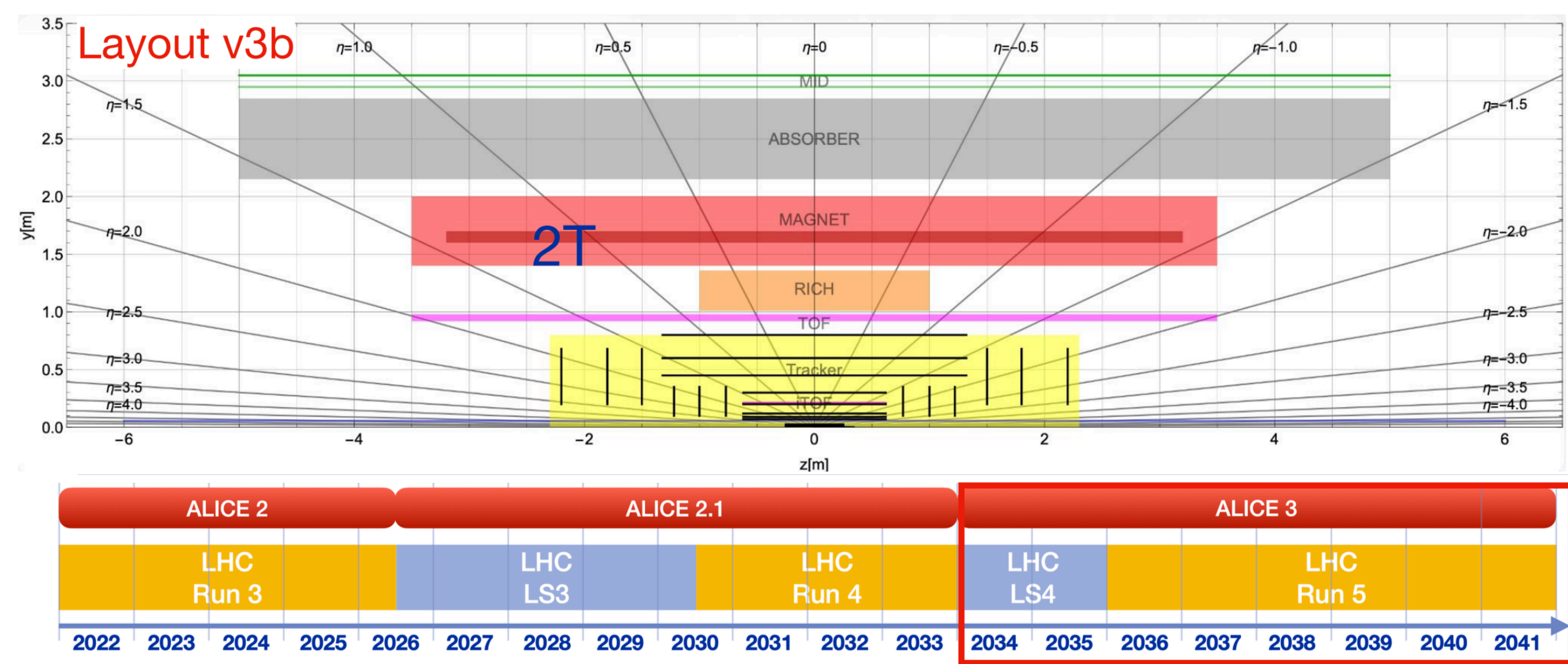
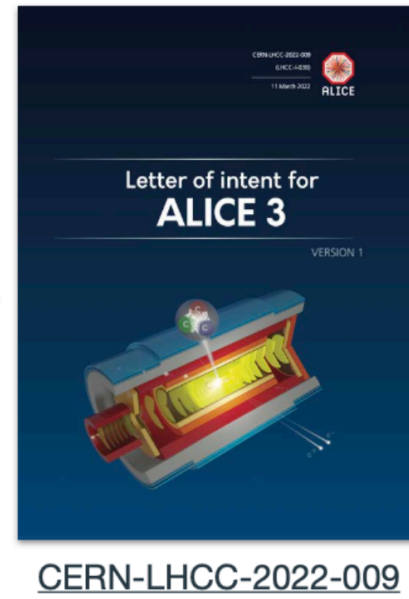
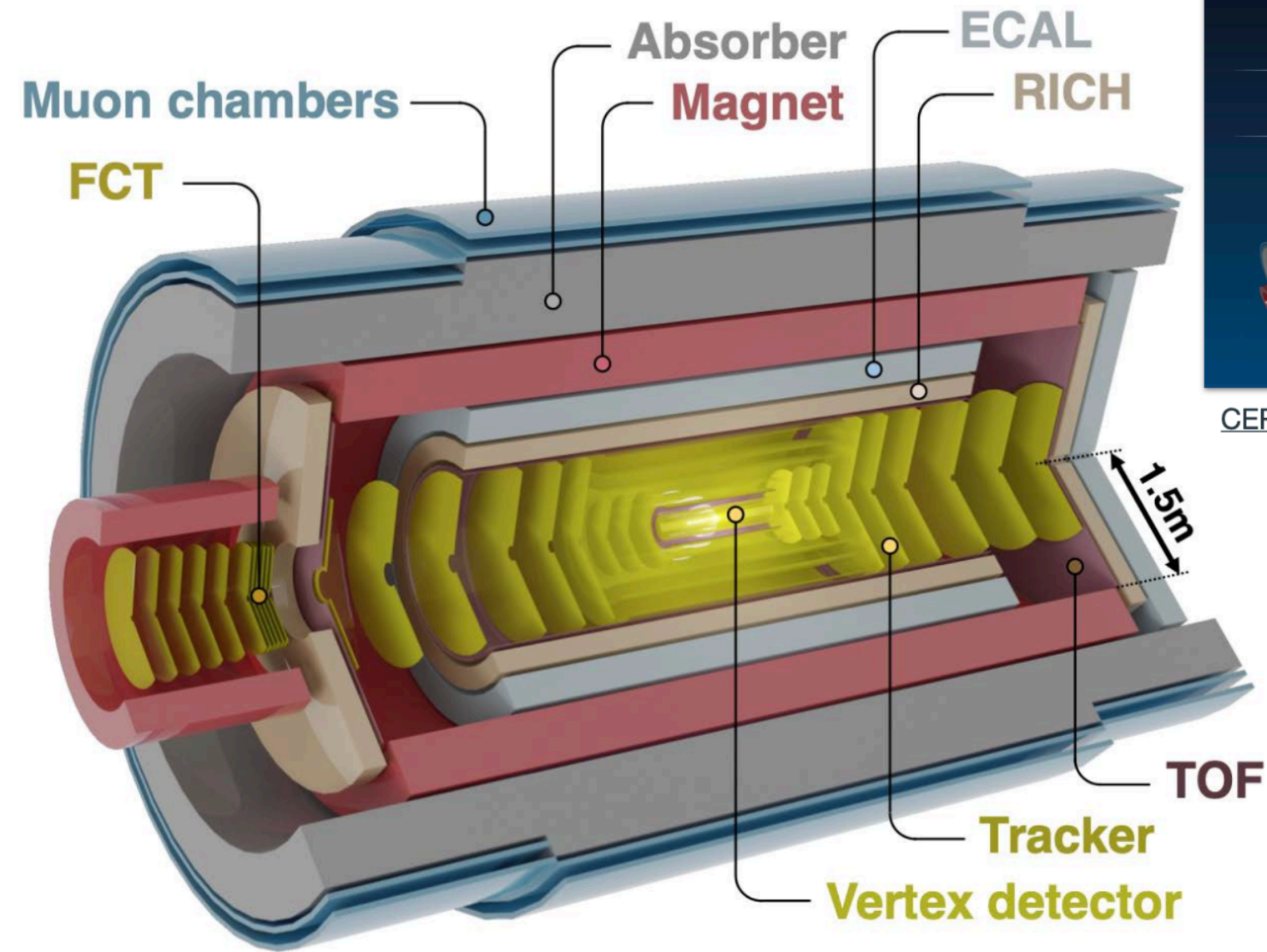
- **Micro-electronics:**

- Sensor design (analog + digital) simulation and characterization
- DAQ and readout

- **Reconstruction:**

- ACTS based software for performance studies for the TDR

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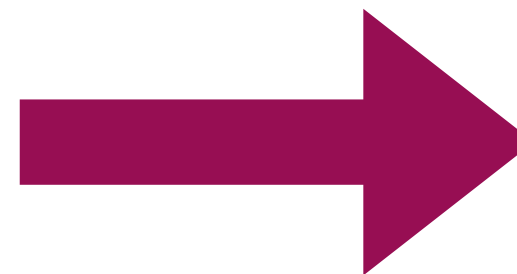
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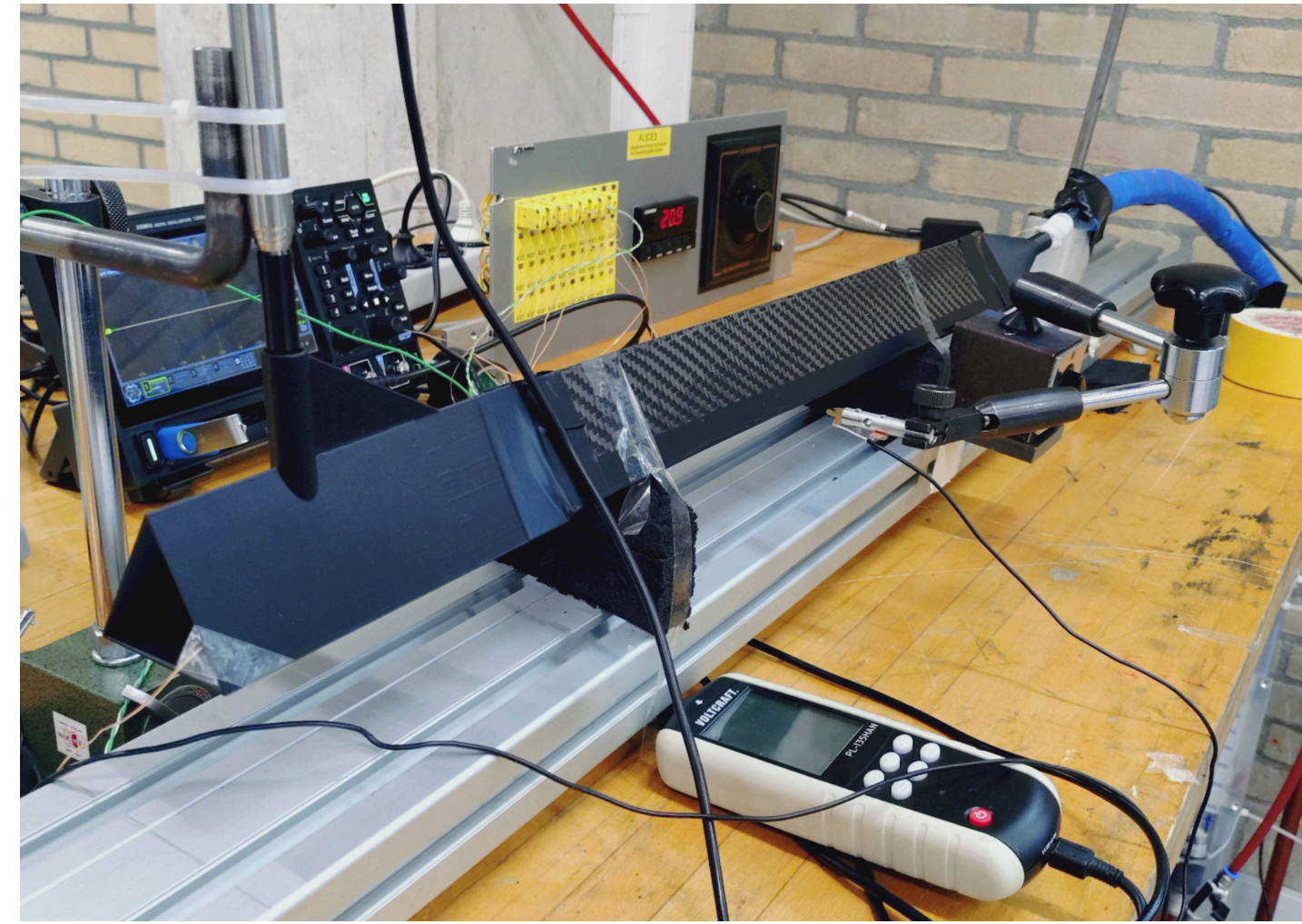
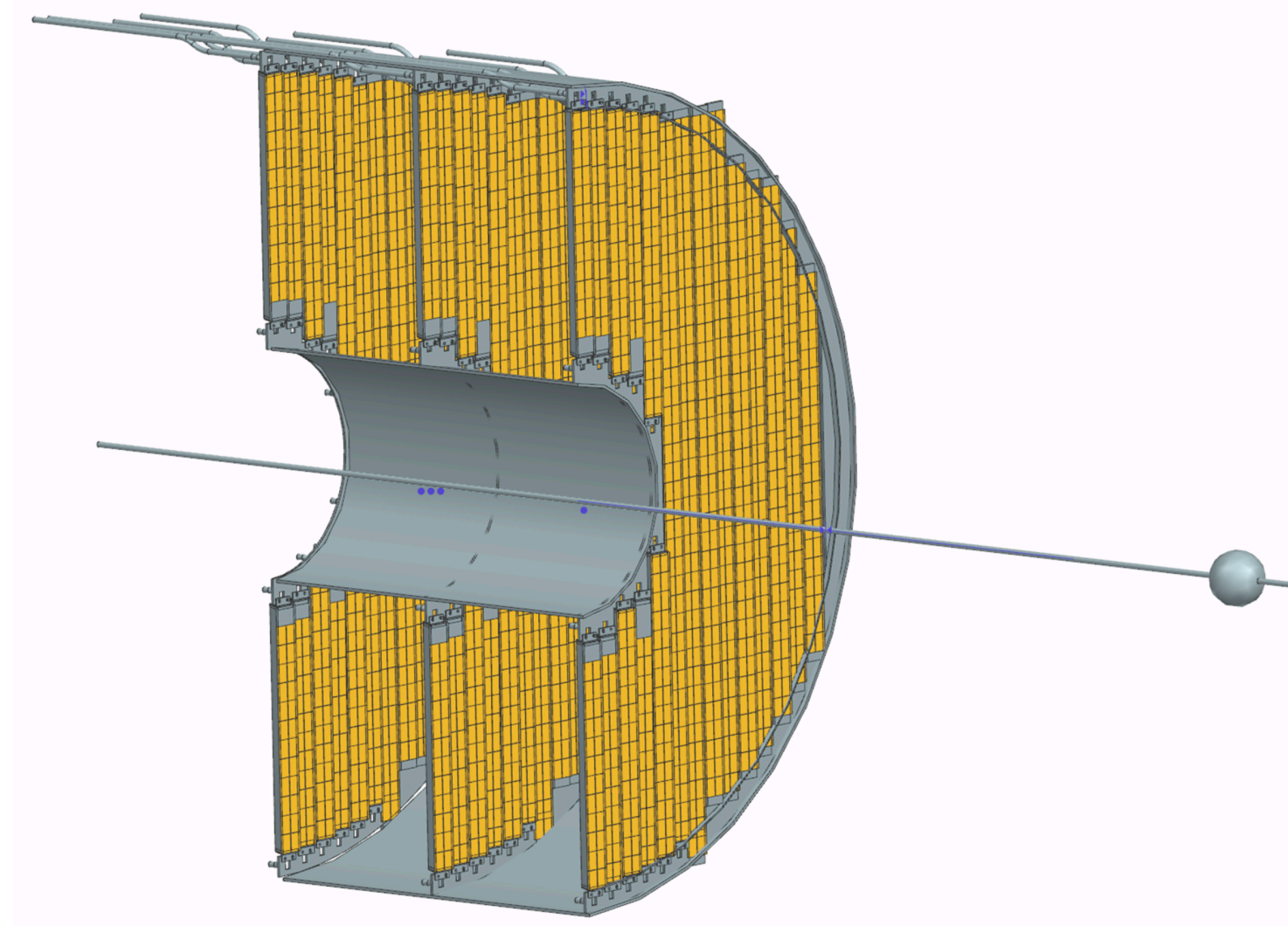
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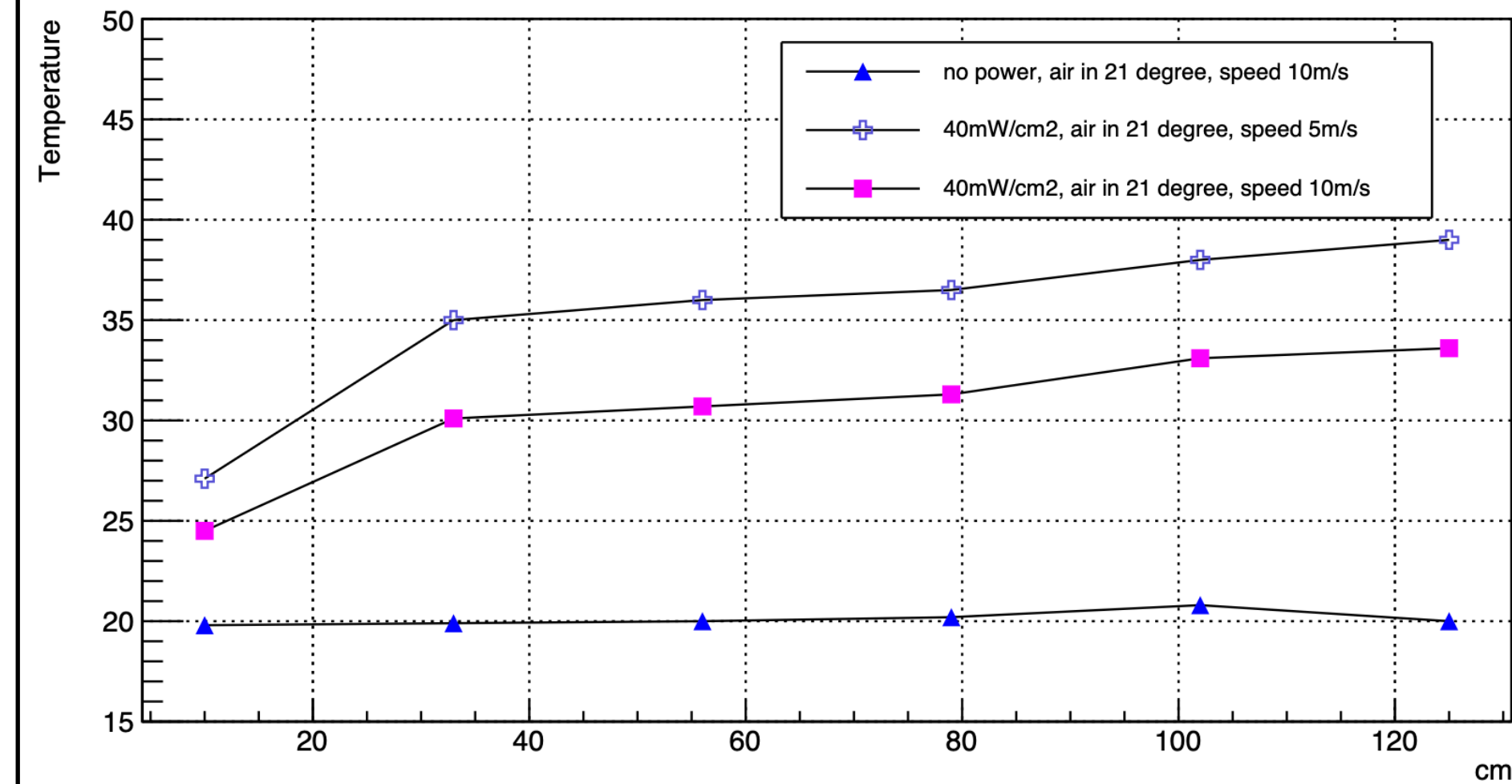


Broad involvement across all domains, with a coherent and synergistic effort

ALICE3: OUTER DISKS DESIGN AND COOLING



Measured temperature along stave



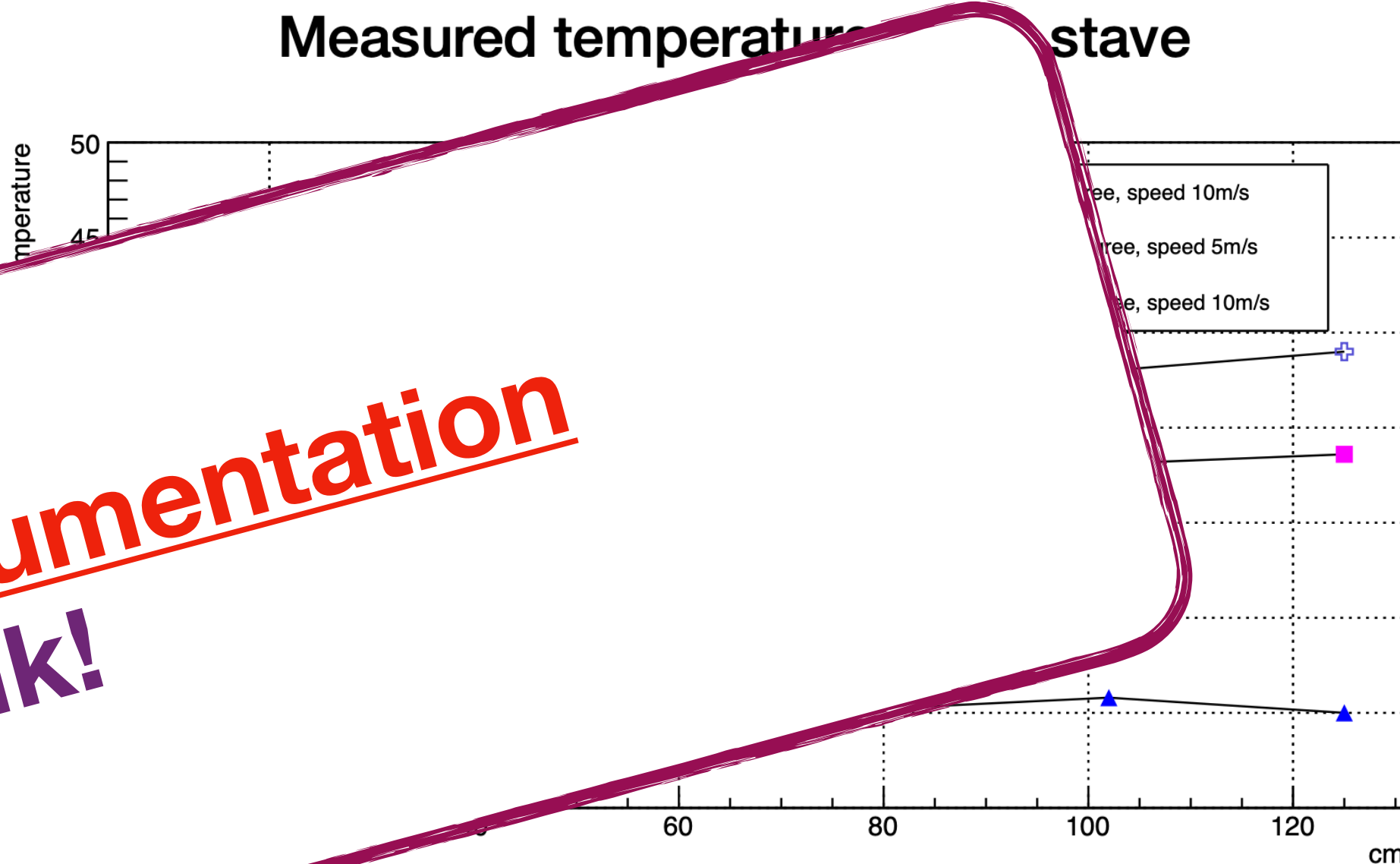
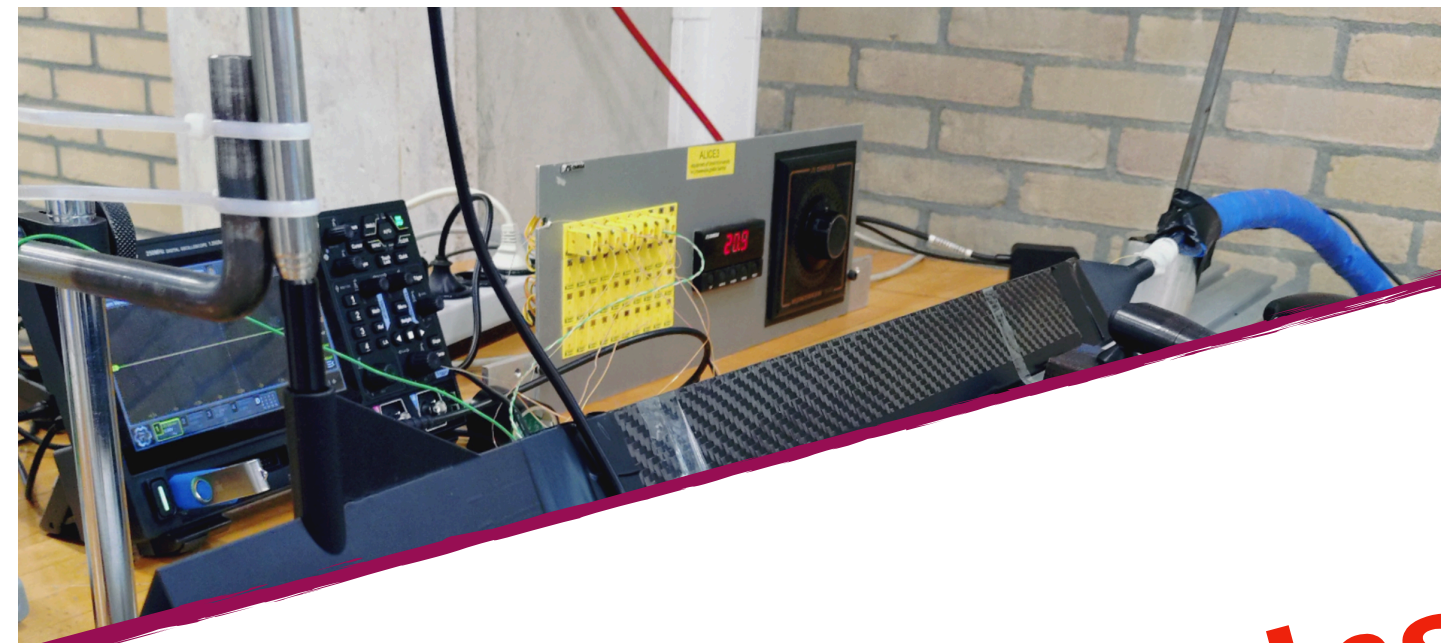
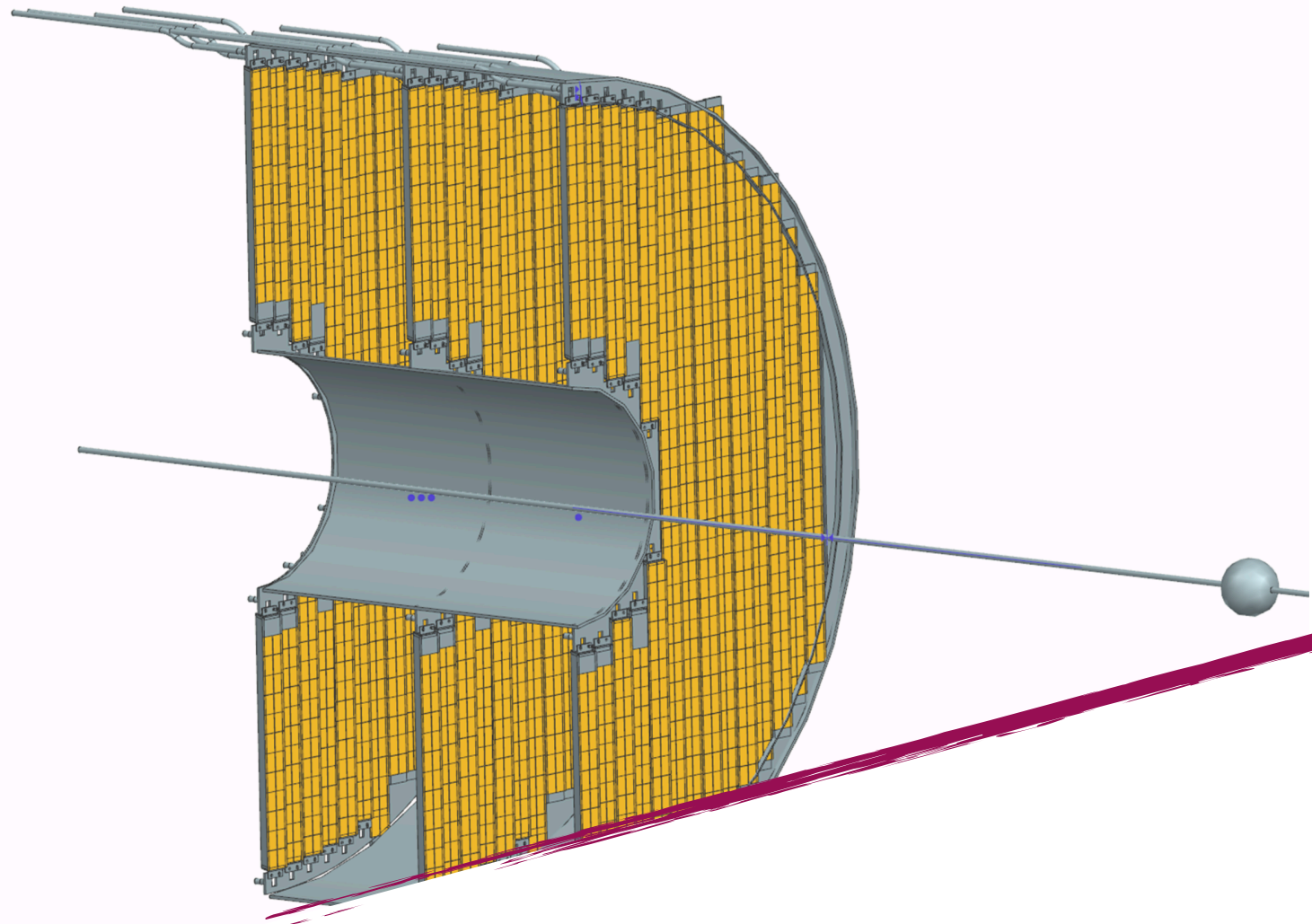
- **Mechanical design progressing well**
 - Vertically mounted staves

○ **Many thanks to the MT for the results!!**

- **Test setup deployed at Nikhef**
 - Test air inflow configurations for heat transfer optimization

- **Positive first results:**
 - Module temperature at end of stave of 33 C achievable

ALICE3: OUTER DISKS DESIGN AND COOLING



For the latest news on **ALICE** Instrumentation see Elena Dall'Occo's talk!

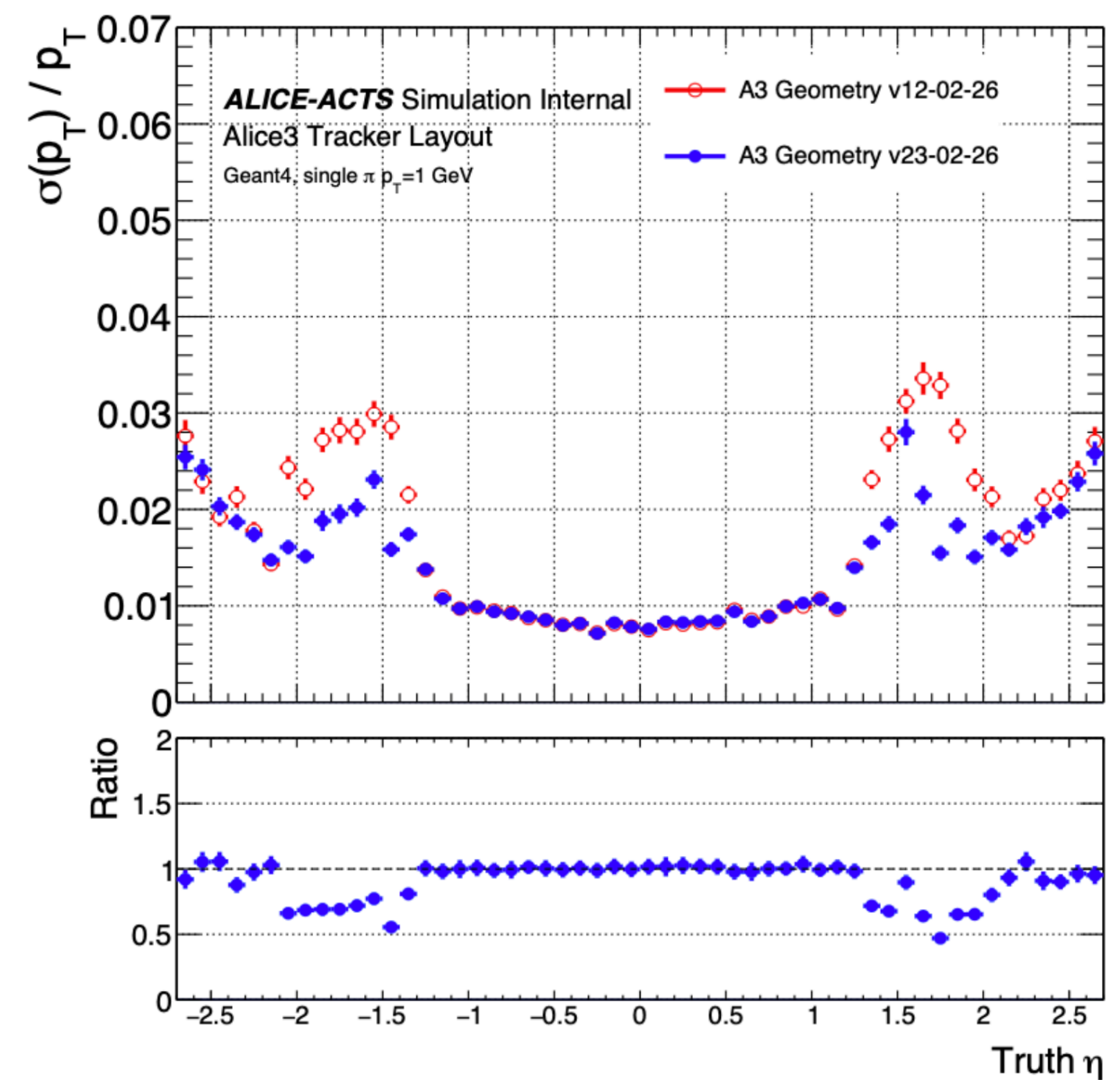
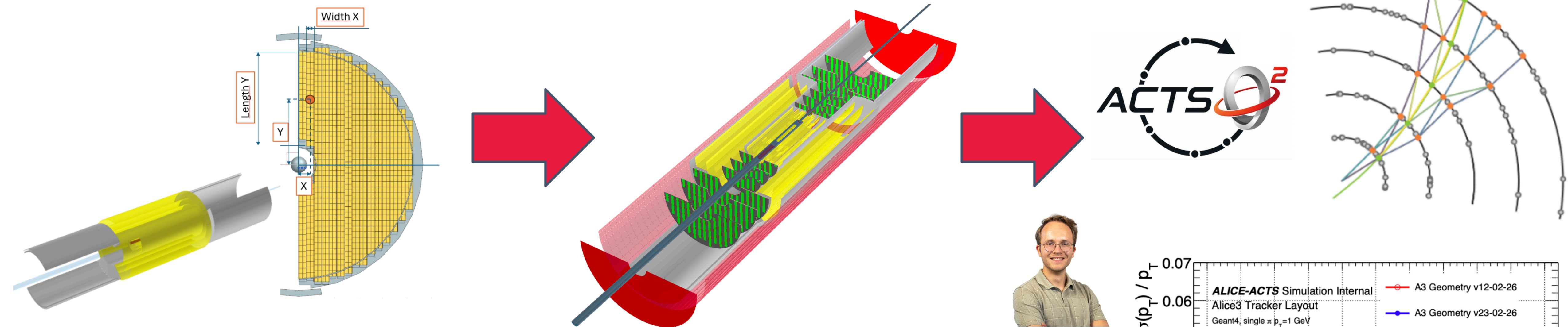
results!!

- M...
- pr...
- ...nted staves

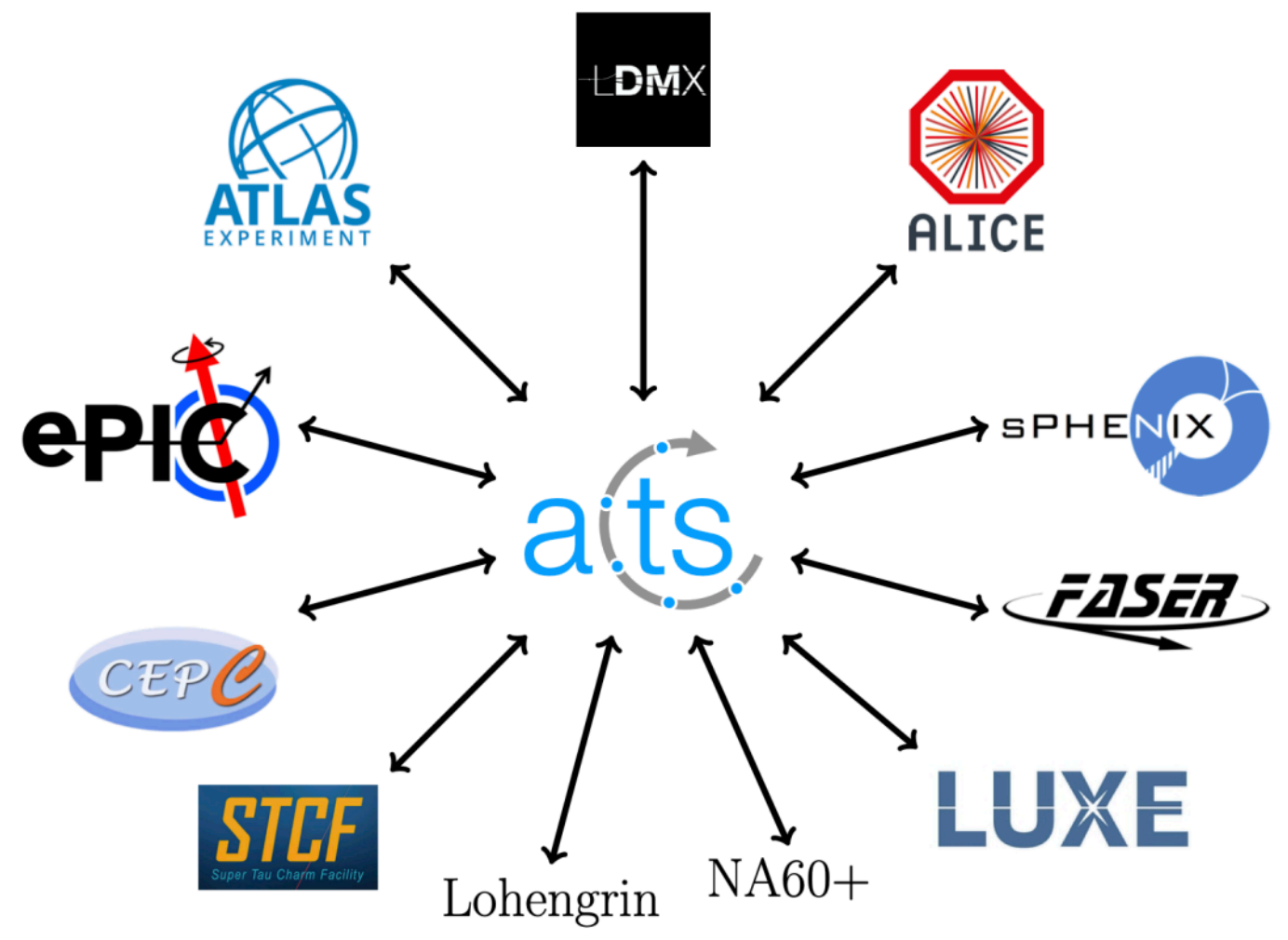
- Test setup deployed at Nikhef
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ALICE3: SIMULATION AND TRACKING



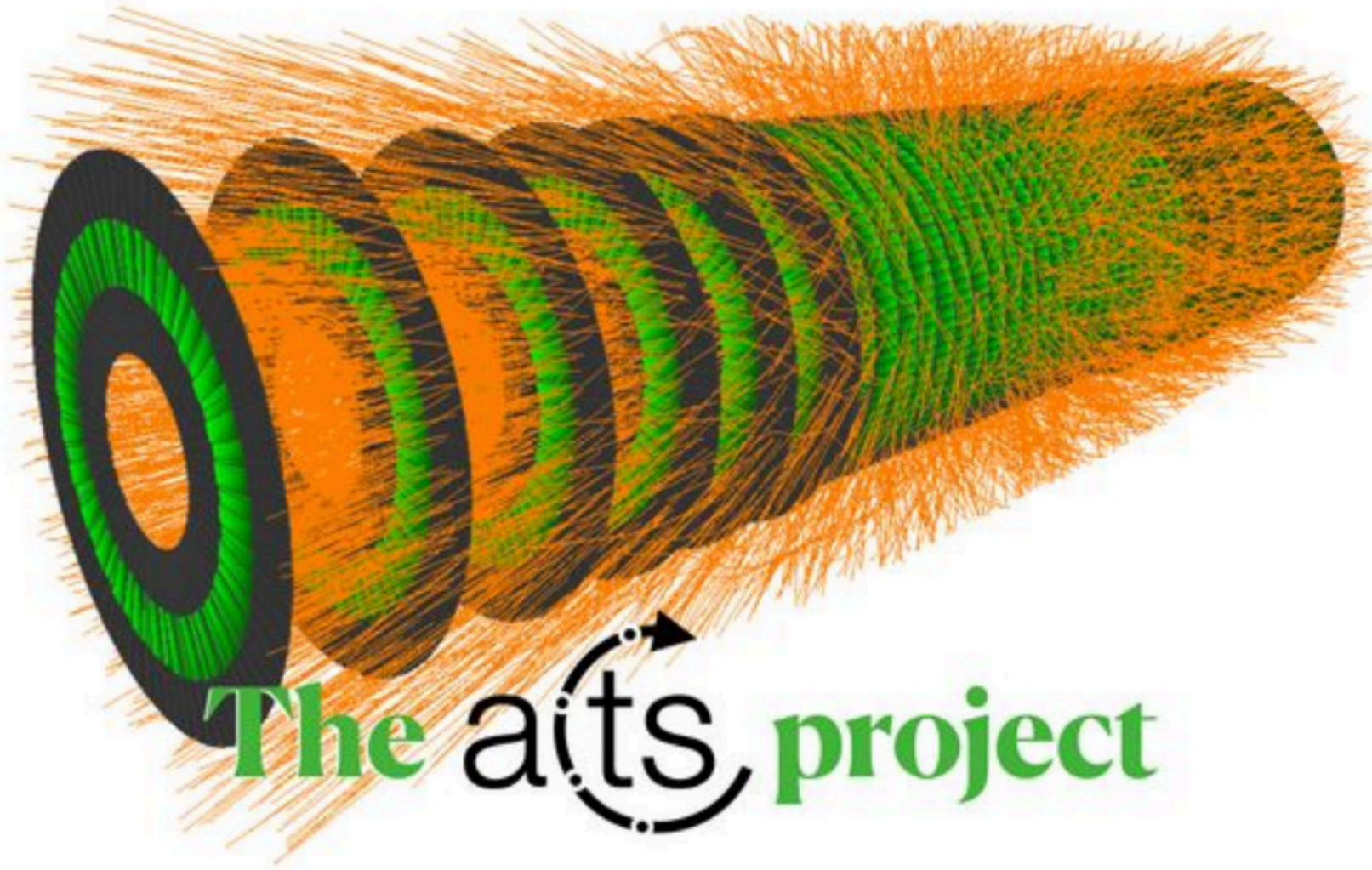
- Integration of design in ALICE O2 simulation
- Developed a set of tools, tracking recipes and algorithms for ALICE 3 and TDR
- Integration of ACTS (“A Common Tracking Software”) library in O2



ALICE3: SIMULATION AND TRACKING

- 2026 ACTS Developer Workshop hosted at Nikhef
- Strong tracking expertise and active engagement with the international tracking community.

<https://indico.cern.ch/event/1577742/>



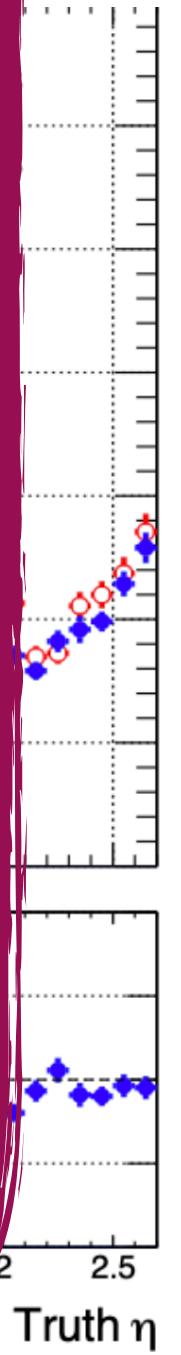
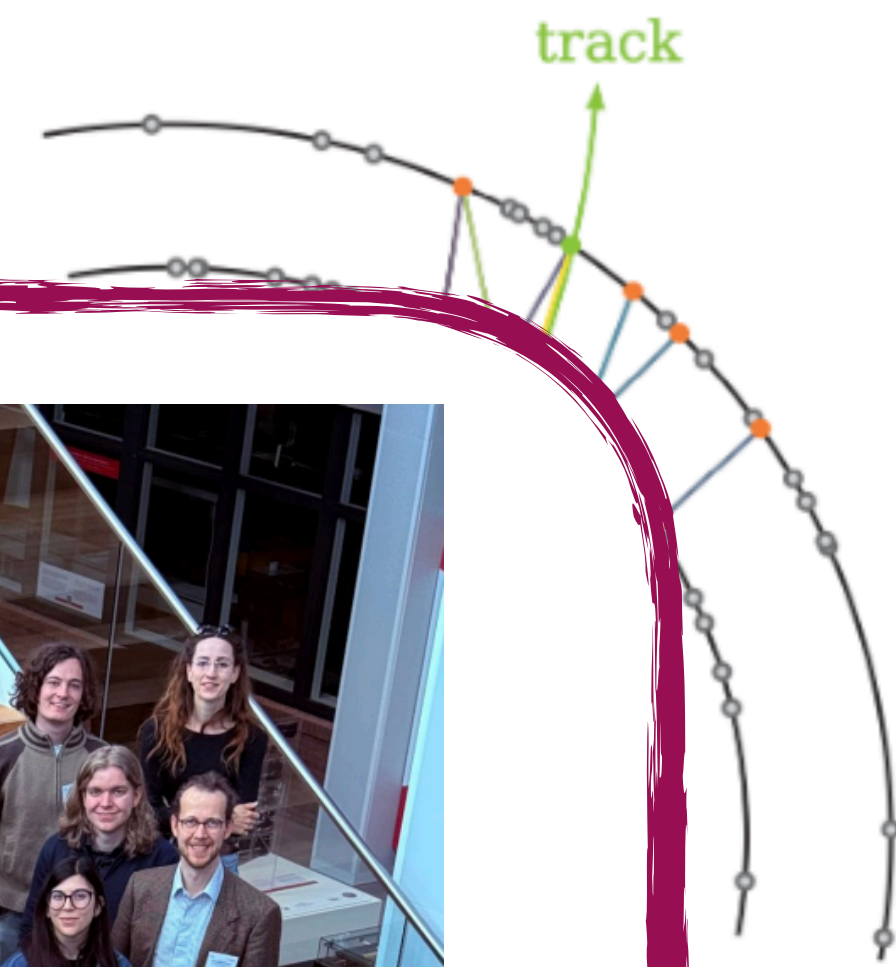
supported by



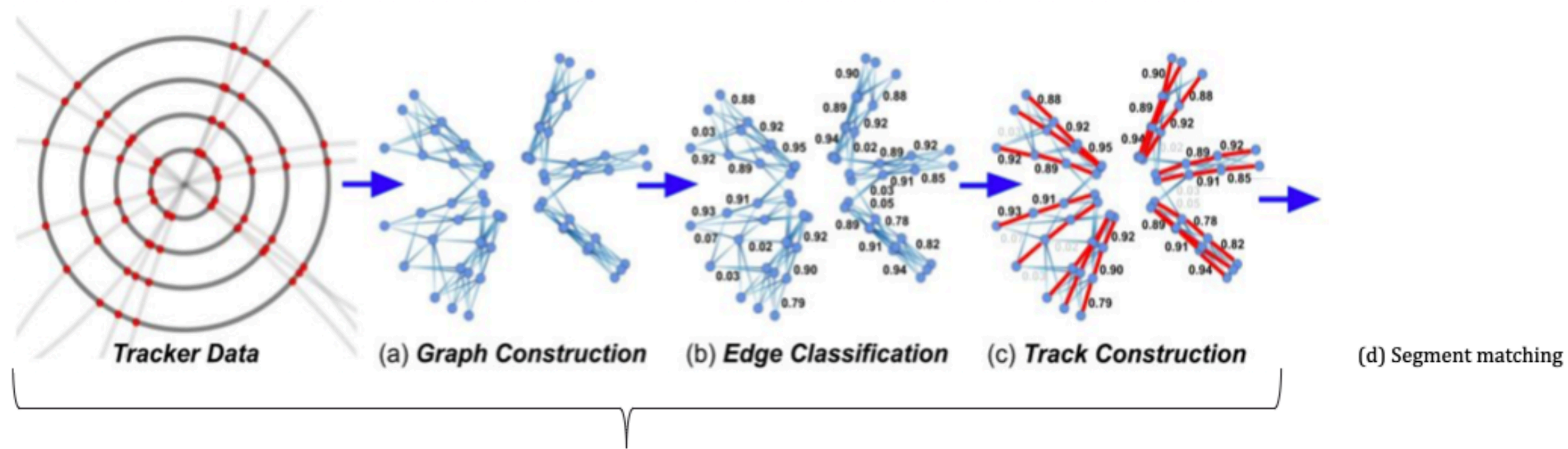
cooperations



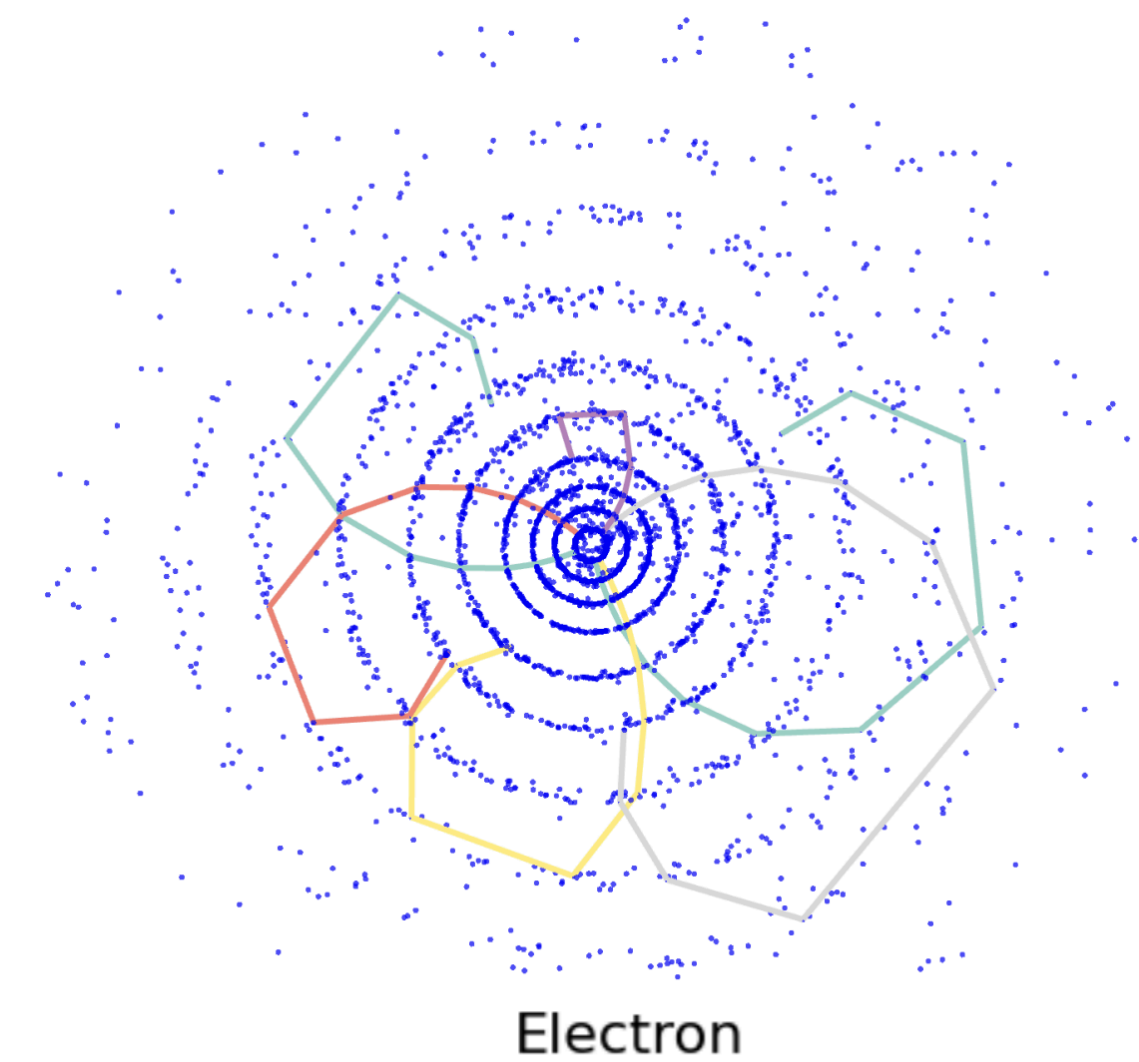
The 2026 Edition of the ACTS Workshop! will take place at NIKHEF from April 20th to April 23rd, followed by a hackathon-style April 24th.



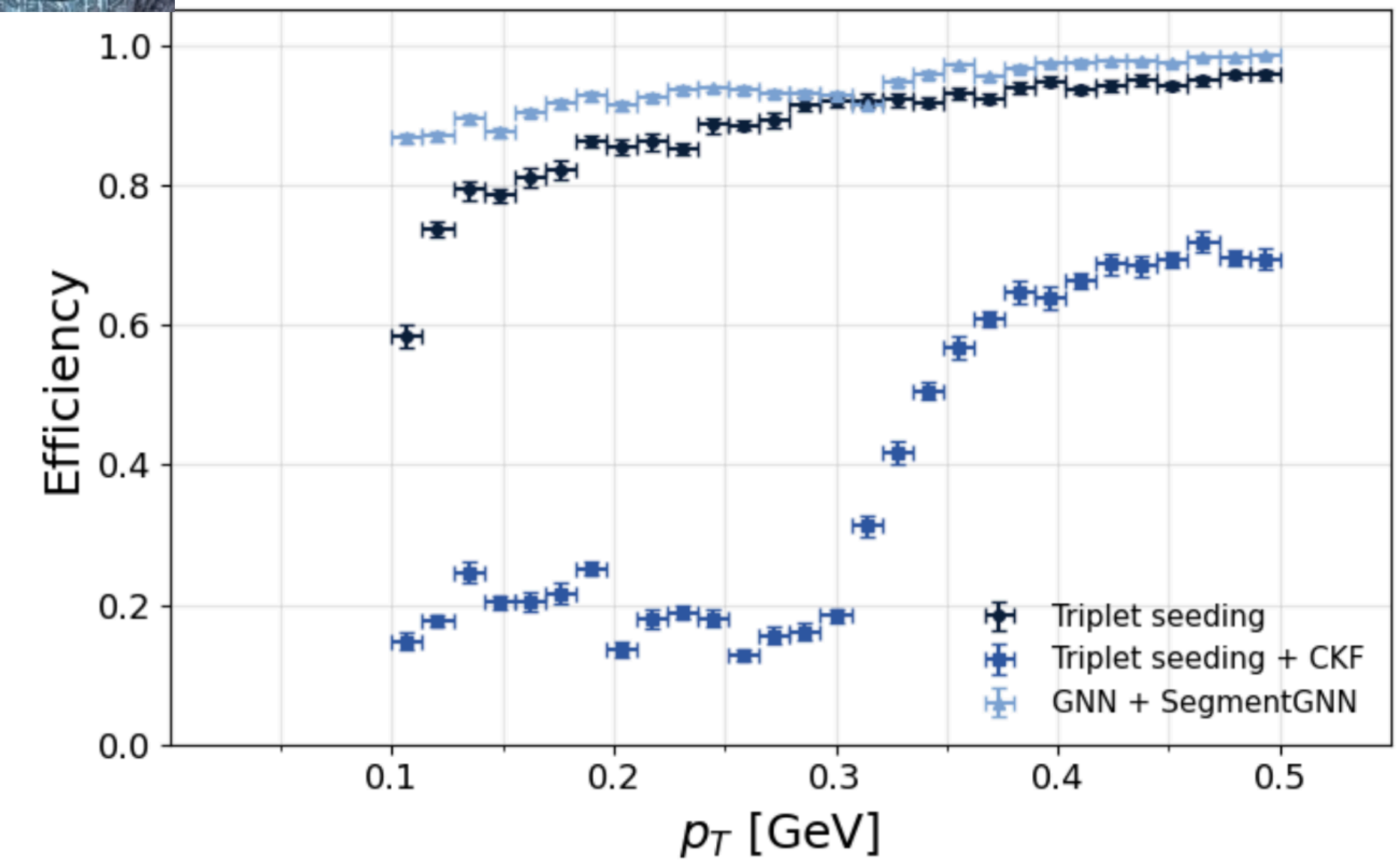
ALICE3: ML-BASED LOW MOMENTUM TRACKING



Typical GNN pipeline (Figure from IRIS-HEP webpage)



- First studies of ML-based low- p_T tracking in silicon detectors
- Highly challenging signatures with strong material interactions, where conventional algorithms become inefficient and computationally intensive
- Promising early results with high track-finding efficiency for strongly spiraling electrons

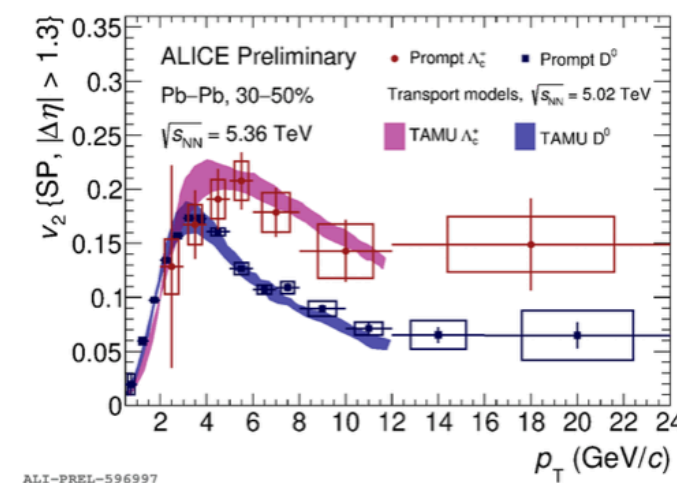


CONCLUSIONS

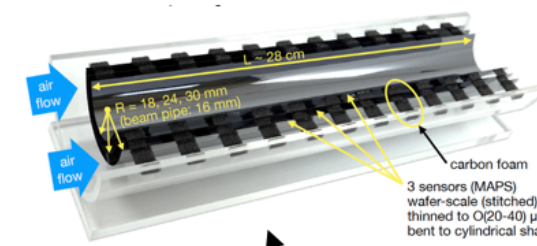
- 2025 was a productive year for the group
- Physics analyses are very mature and are in paper proposal stage
- Mechanics, Hardware and R&D activities progressed well and cover many crucial areas in the ALICE upgrades
- Several new activities covering ALICE3 design and performance studies have started targeting the Outer Tracker TDR



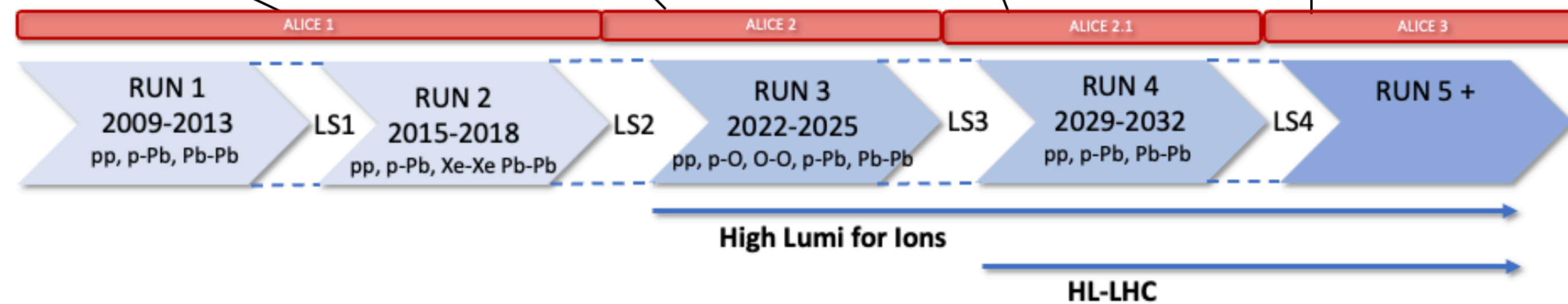
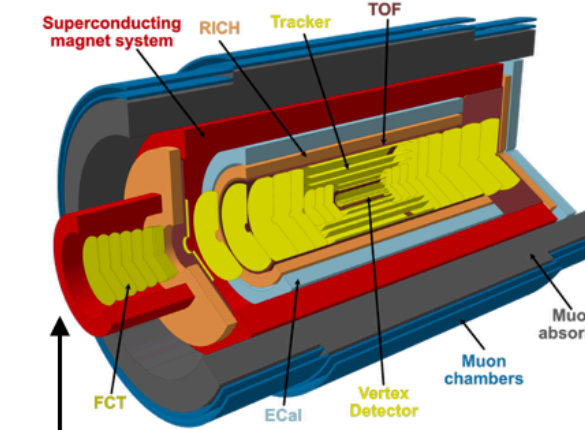
Eur. Phys. J. C 84, 813 (2024)



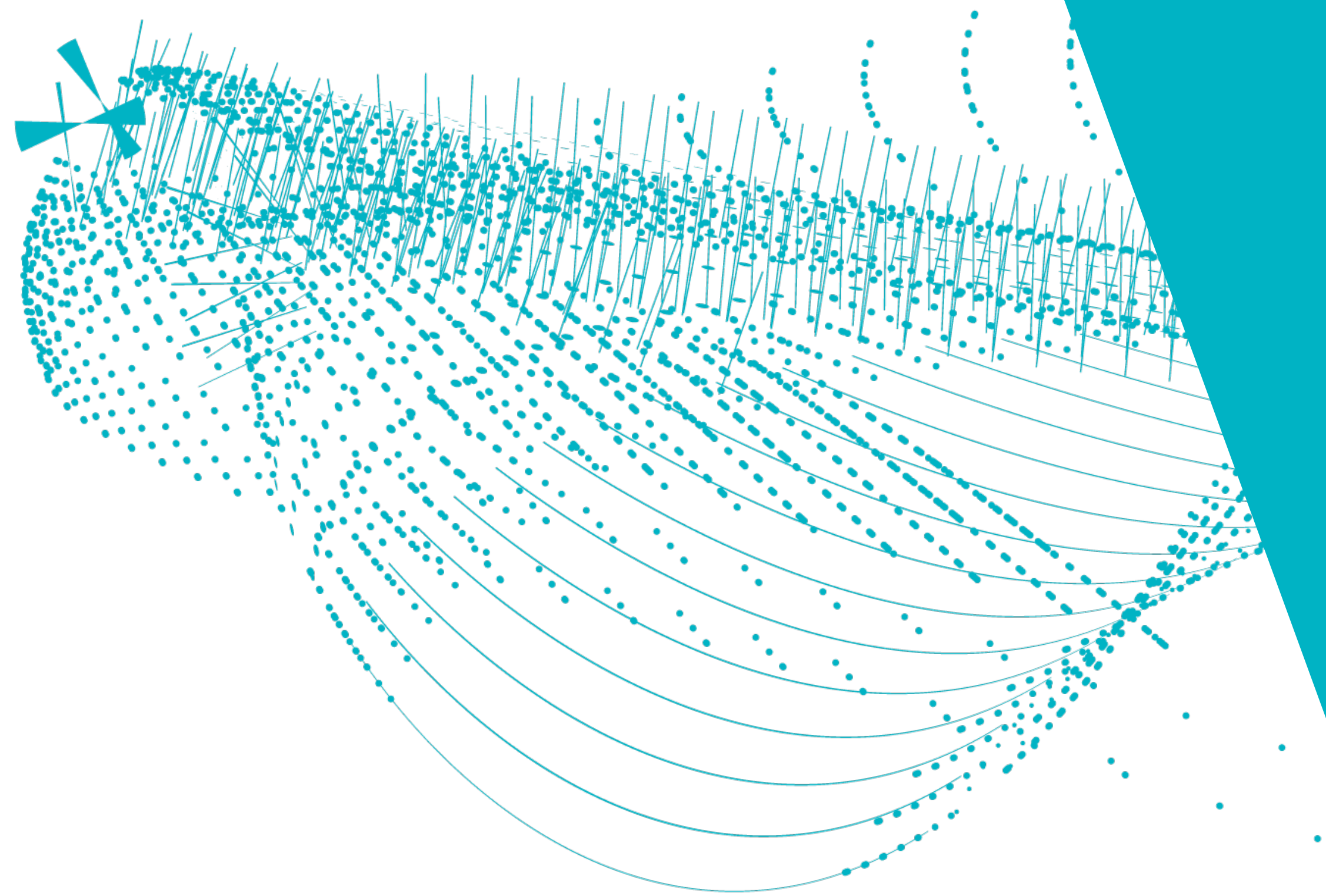
ITS3



ALICE 3



Nikhef



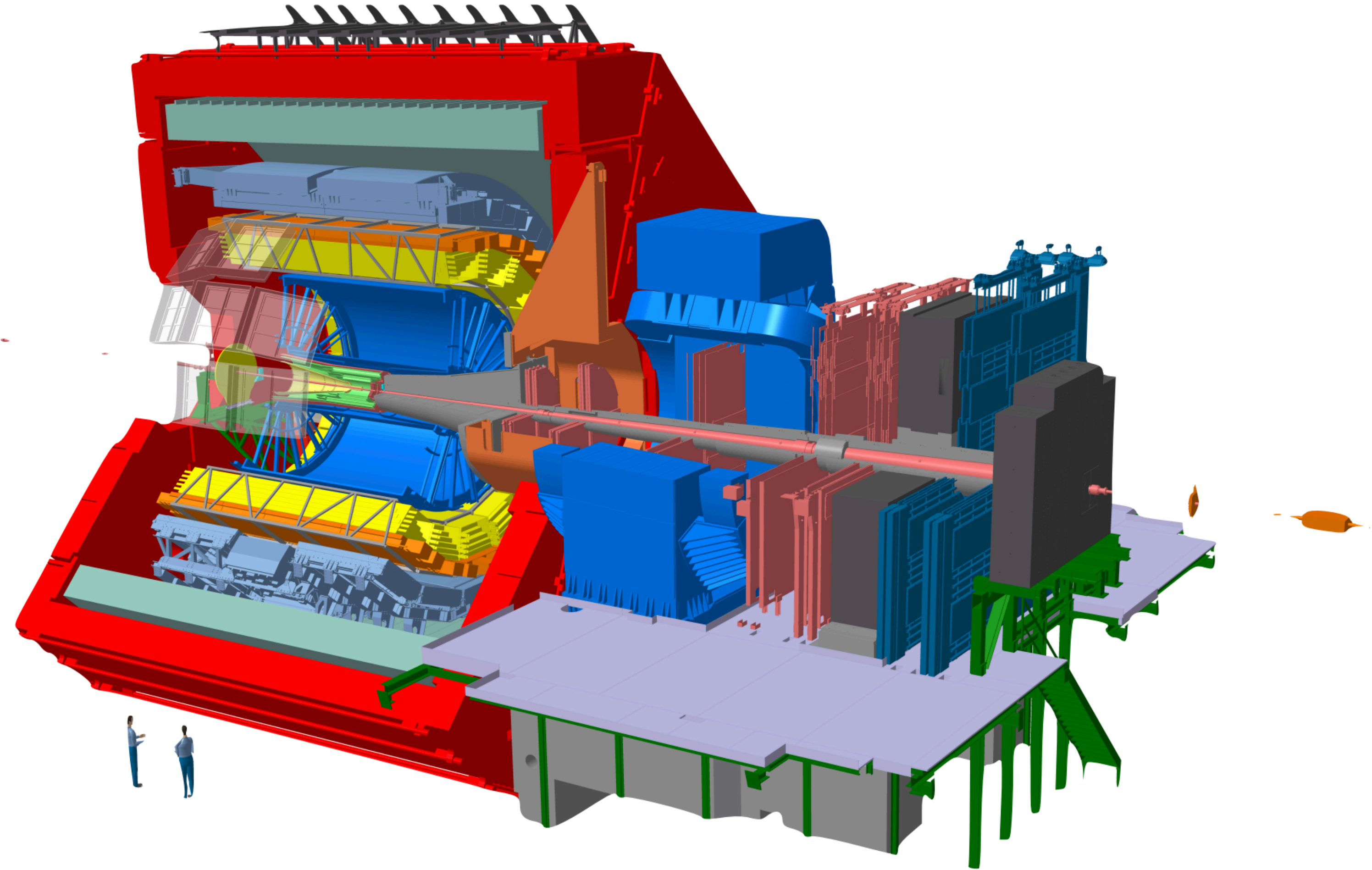
THANKS FOR THE
ATTENTION TO THIS
MATTER

Pierfrancesco Butti (PF)

THE ALICE PROGRAM (TBD)

- **Dutch ALICE group (Nikhef+UU) is participating in the ALICE experiment at the LHC as a leading group**

- Leading positions in ALICE
 - Very productive in data analysis using different probes of the quark-gluon plasma:
 - our group produced the most cited publications
 - Significant and visible contribution to the detector hardware
 - Successful in obtaining grants



The ALICE Collaboration: 40 countries, 163 institutes, ~1900 members

The heavy ion collision

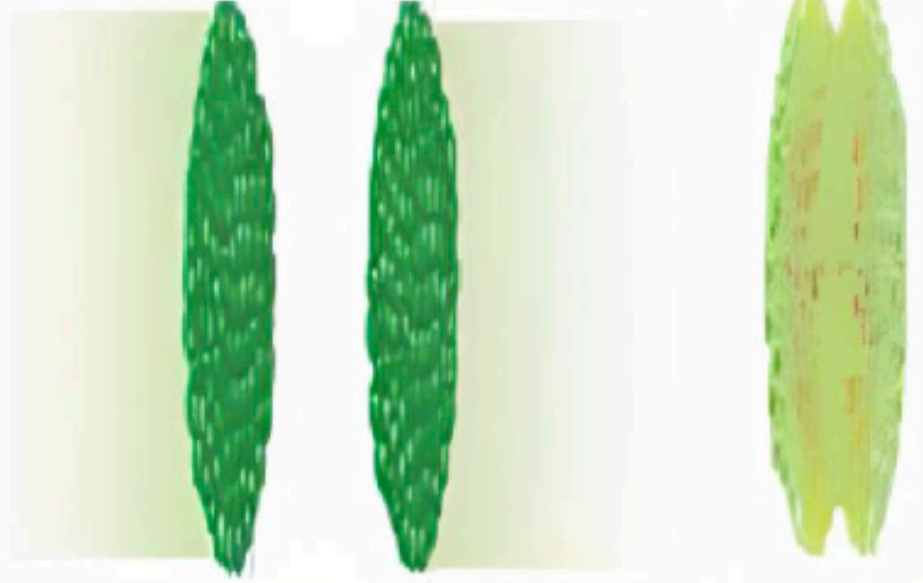
$\tau \sim 0 \text{ fm}/c$

$\tau \sim 1 \text{ fm}/c$

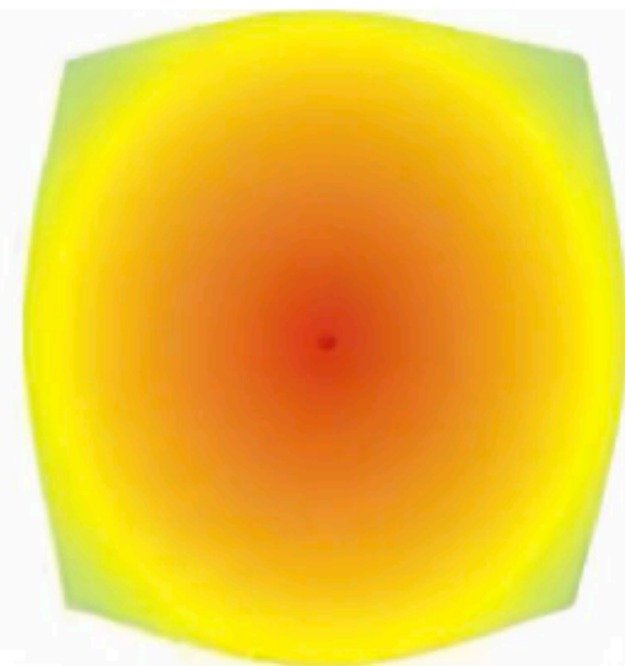
$\tau \sim 10 \text{ fm}/c$

$\tau \sim 10^{15} \text{ fm}/c$

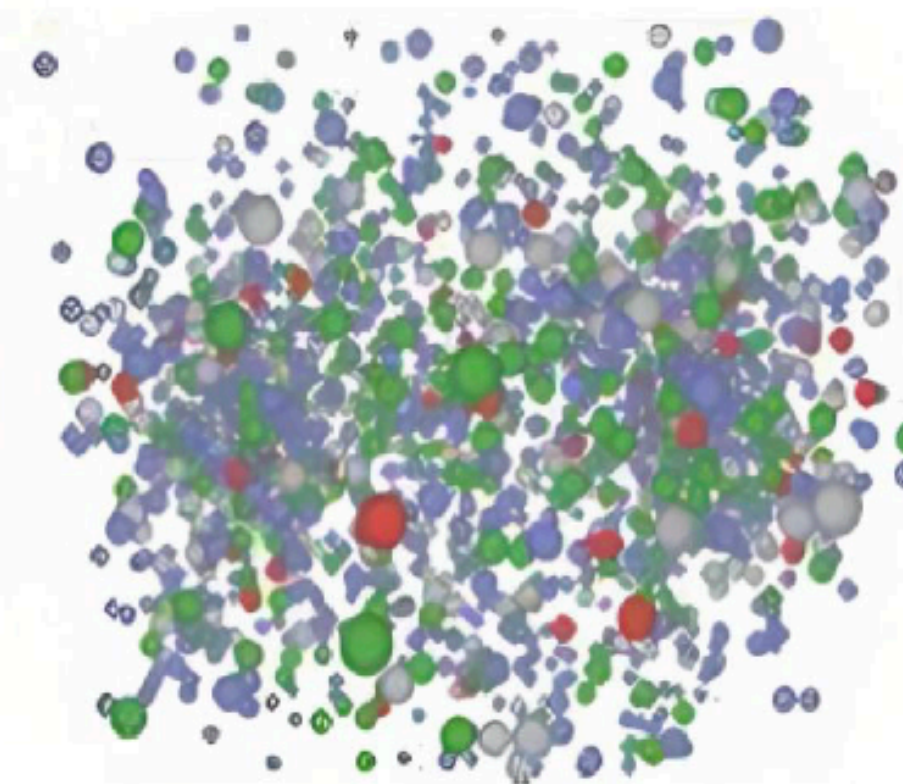
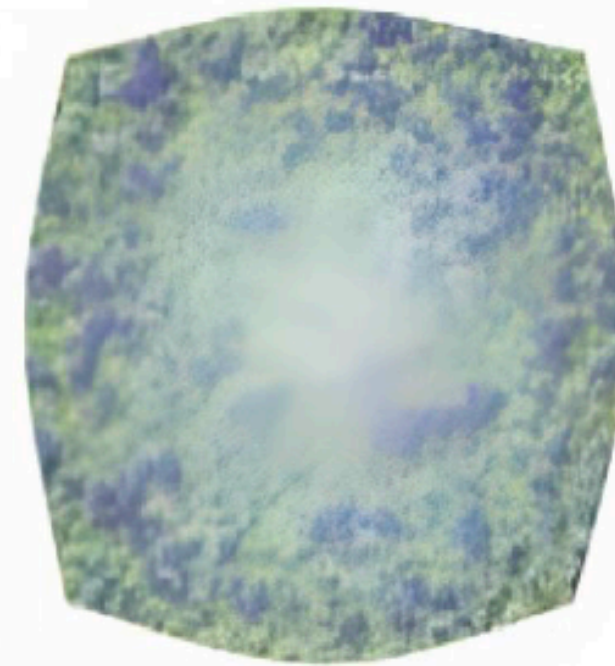
Initial and pre-equilibrium
phase



Hadronisation

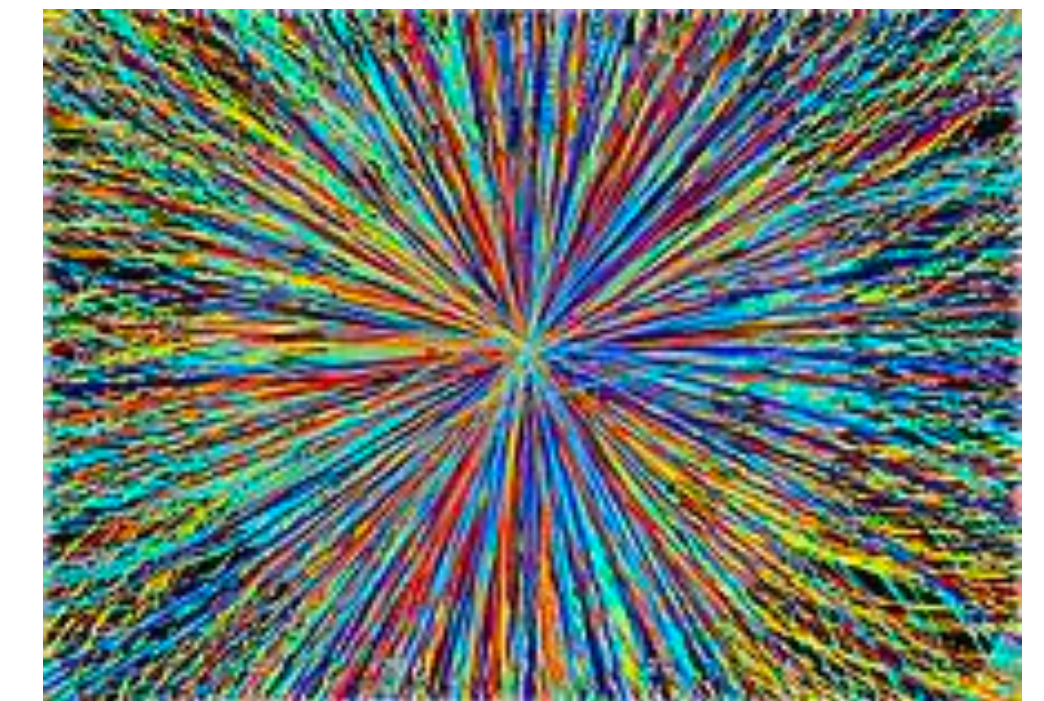


QGP phase

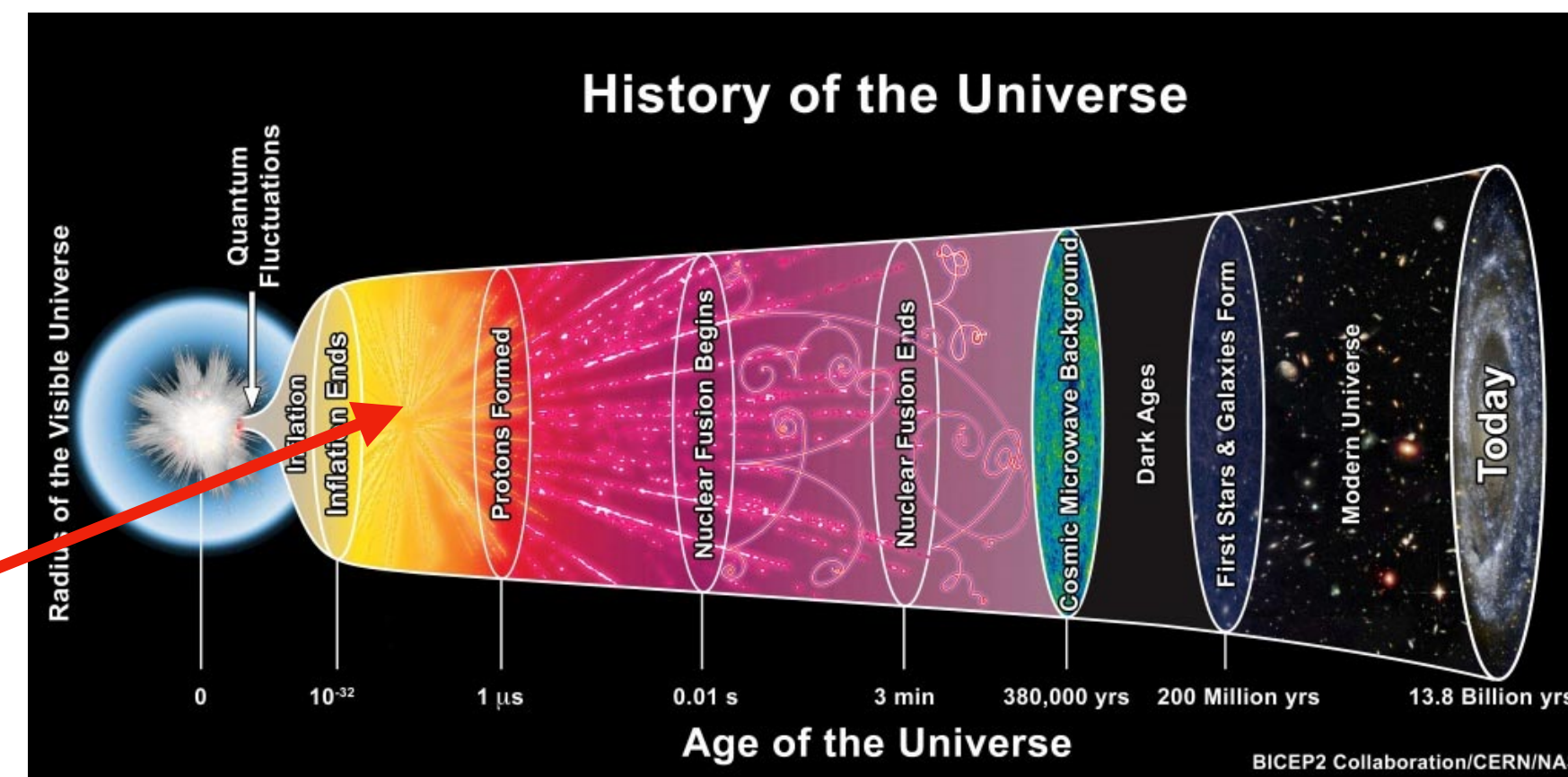


Hadronic phase
and rescattering

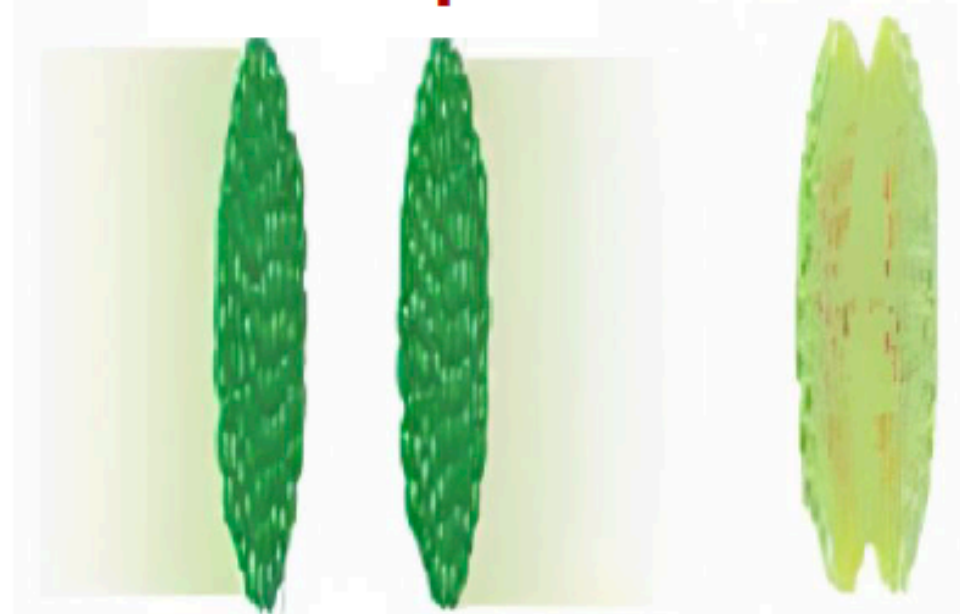
ALICE



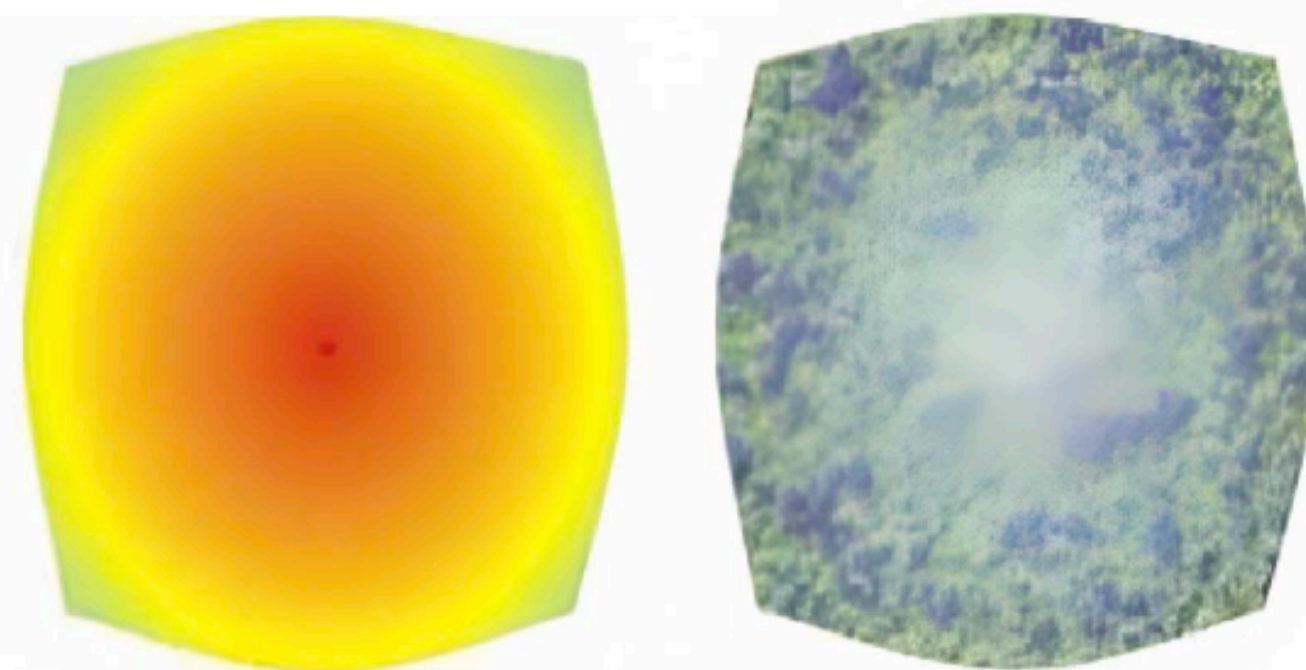
The heavy ion collision



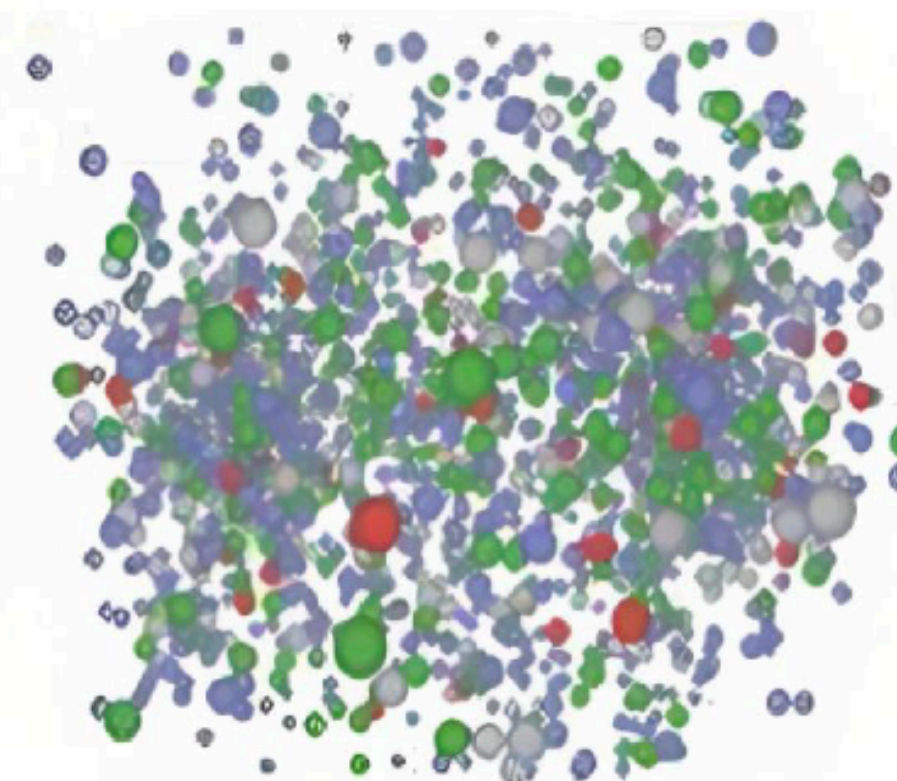
Initial and pre-equilibrium phase



Hadronisation



QGP phase



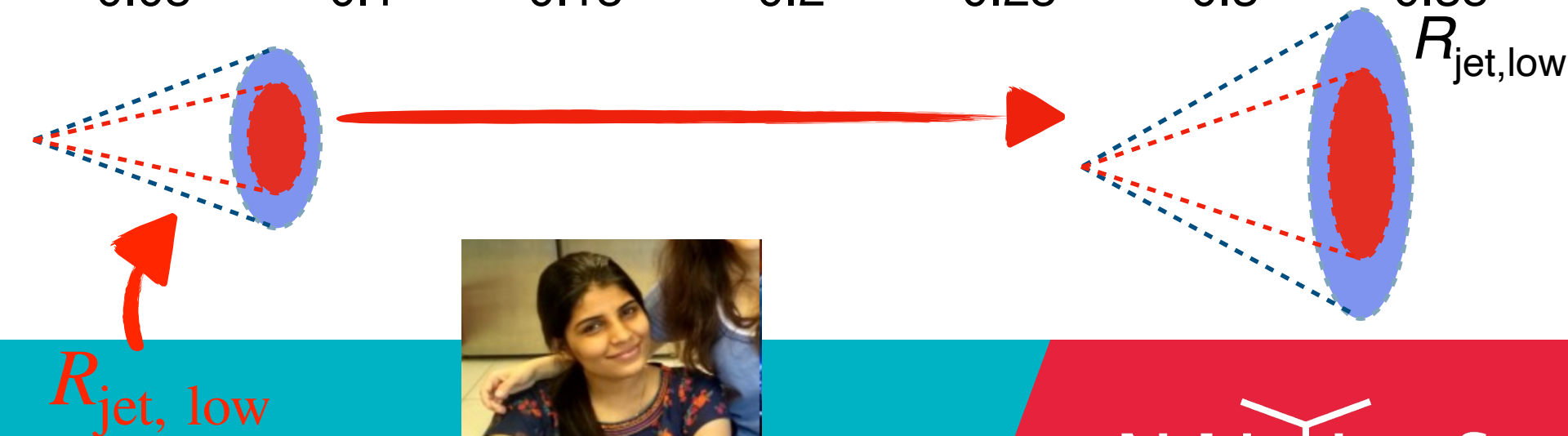
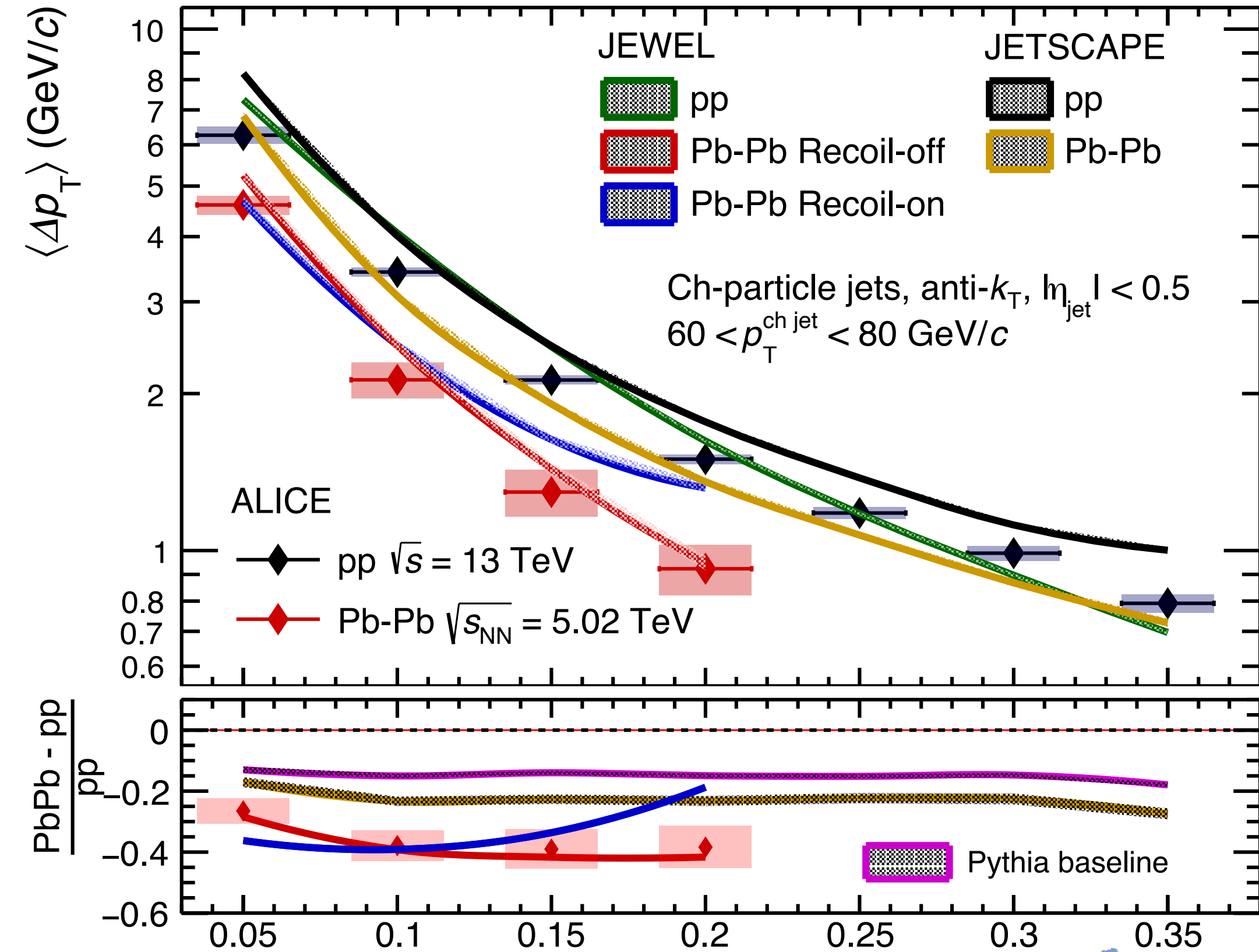
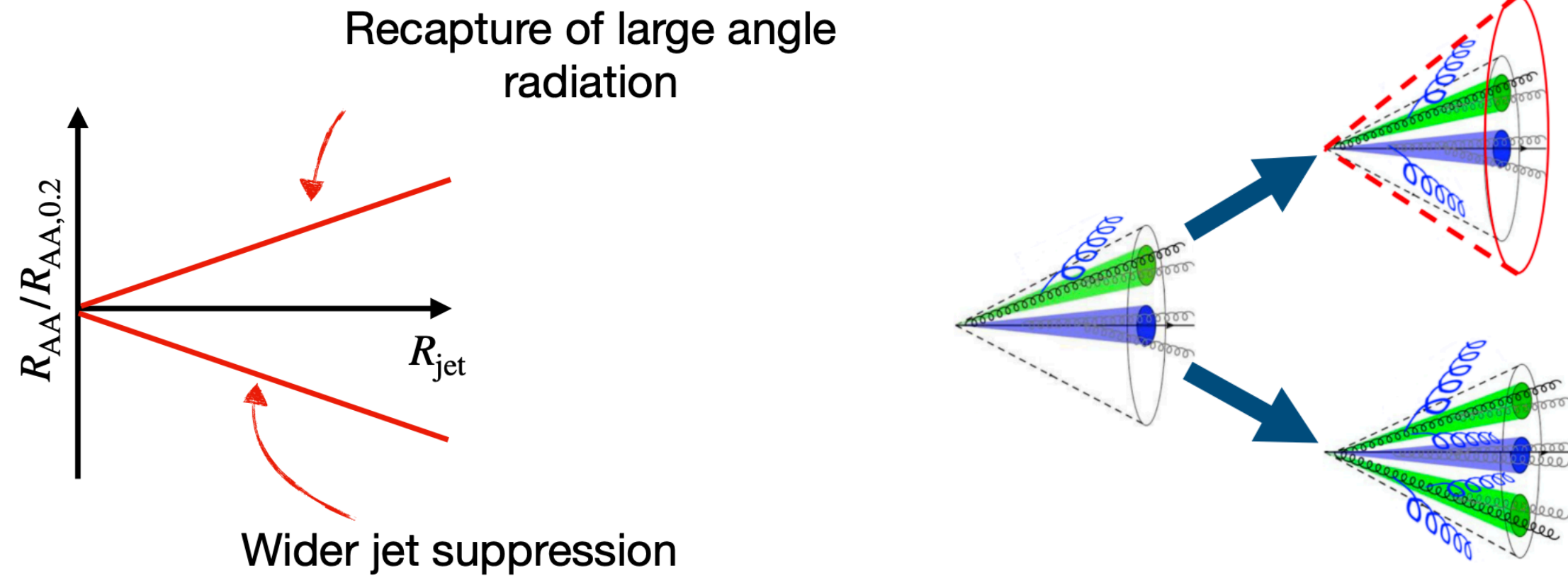
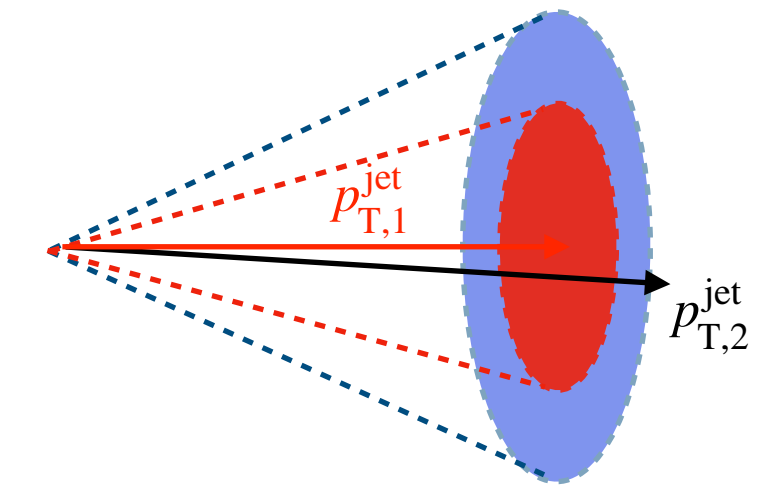
Hadronic phase and rescattering

ALICE



PROBING QGP USING JETS (WIP)

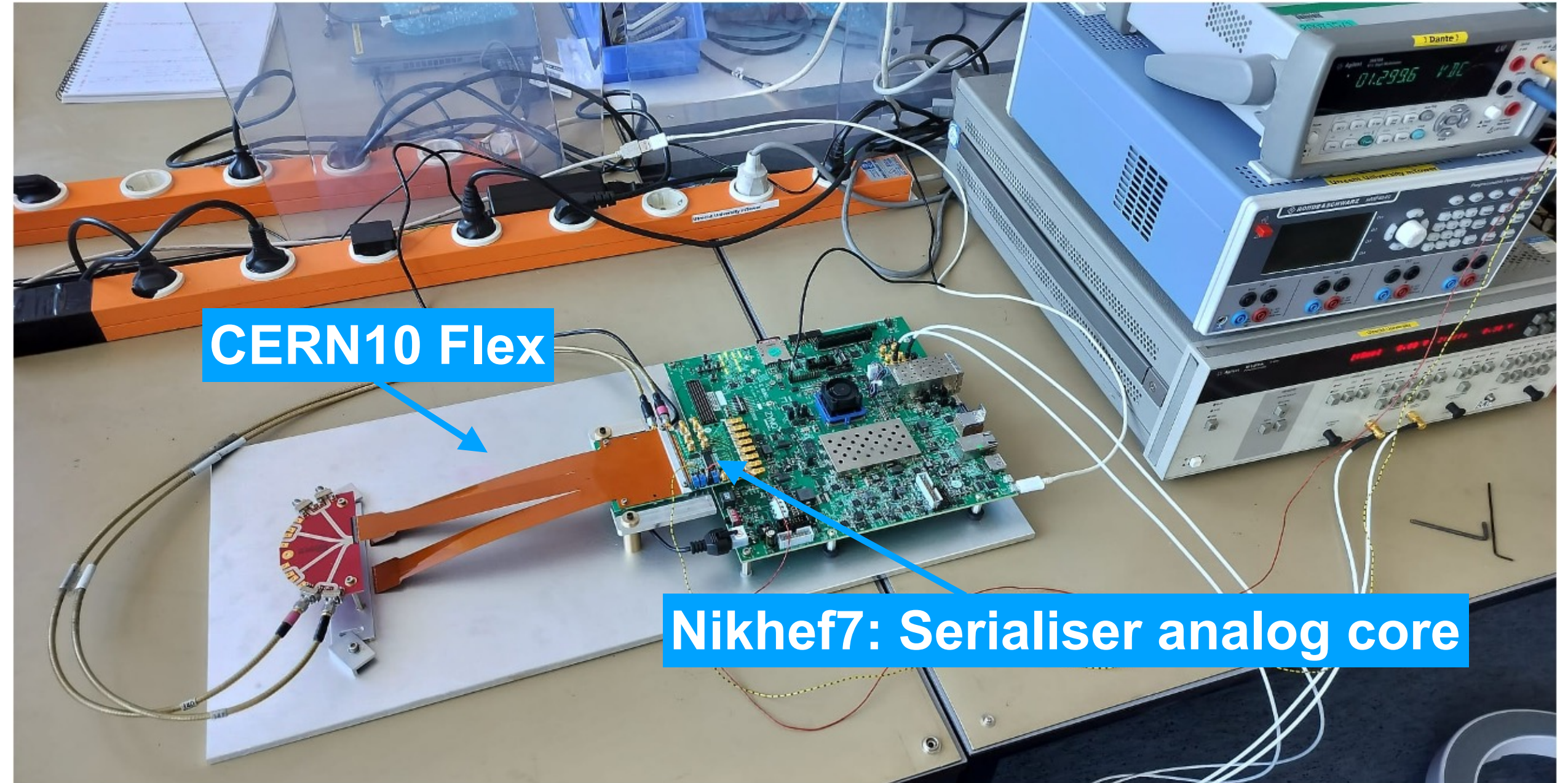
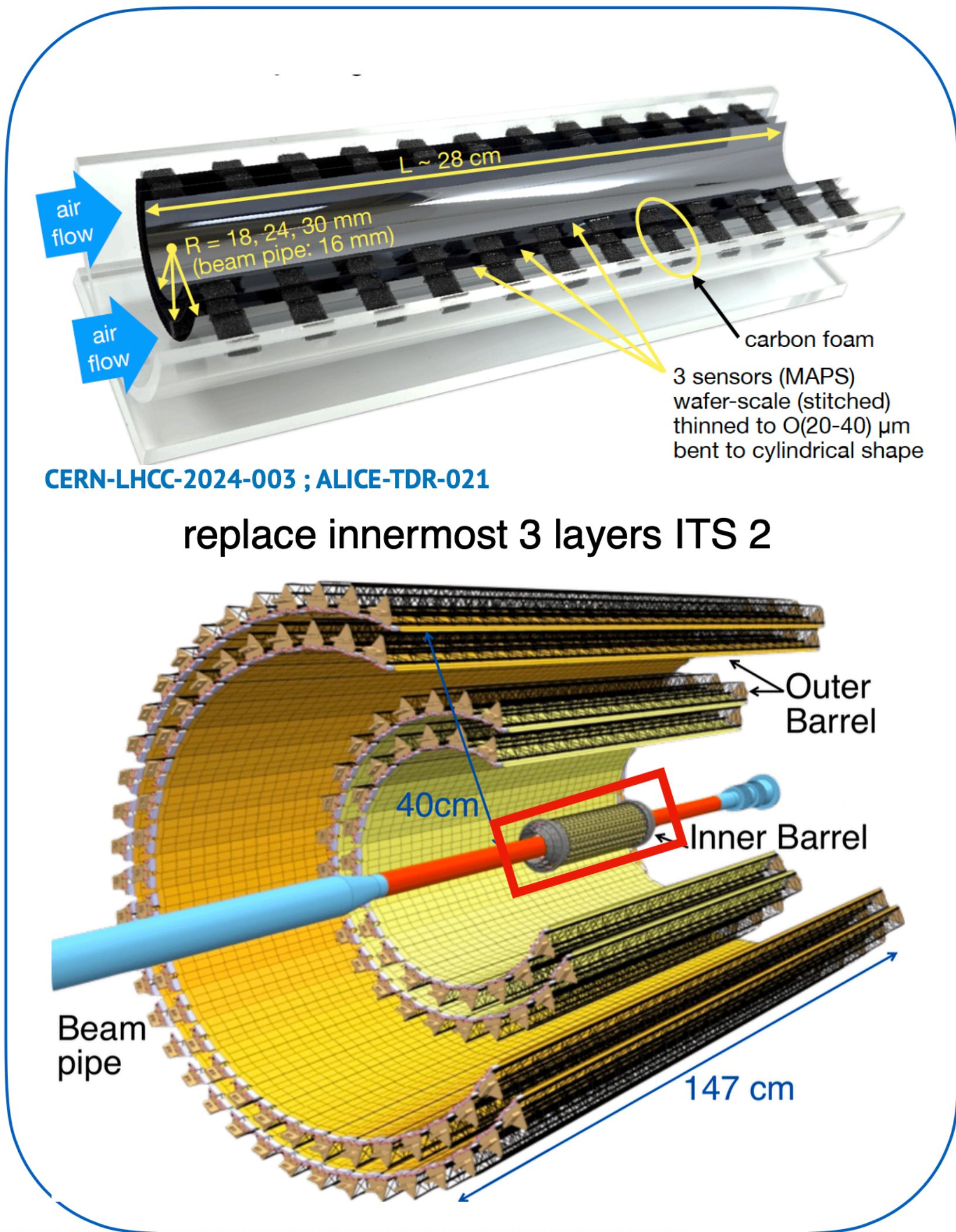
$$\Delta p_T = p_{T,2}^{\text{jet}} - p_{T,1}^{\text{jet}}$$



- Jets (collimated spray of particles): produced early by hard scattering and robust probes to QGP properties
- Mean jet energy flow suppression in heavy-ion collisions increases with jet radii.
→ narrowing of jet energy profile
- Compared to predictions which model properties of the medium, its evolution, and the jet-medium interaction



ITS3 (VERY WIP)

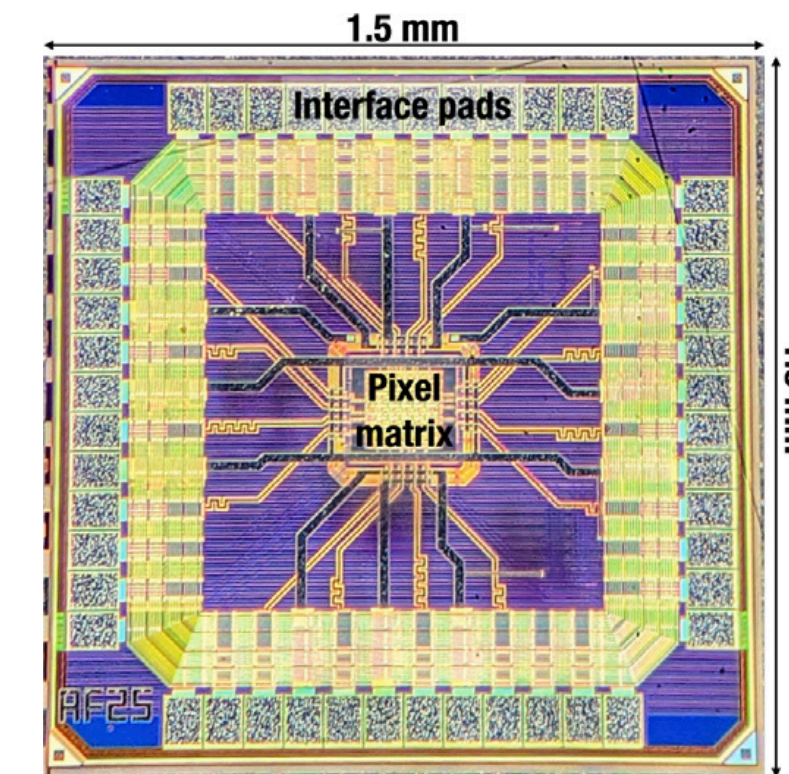


Marcel provides bullets / photo of the new setup
Add some bullets of explanation

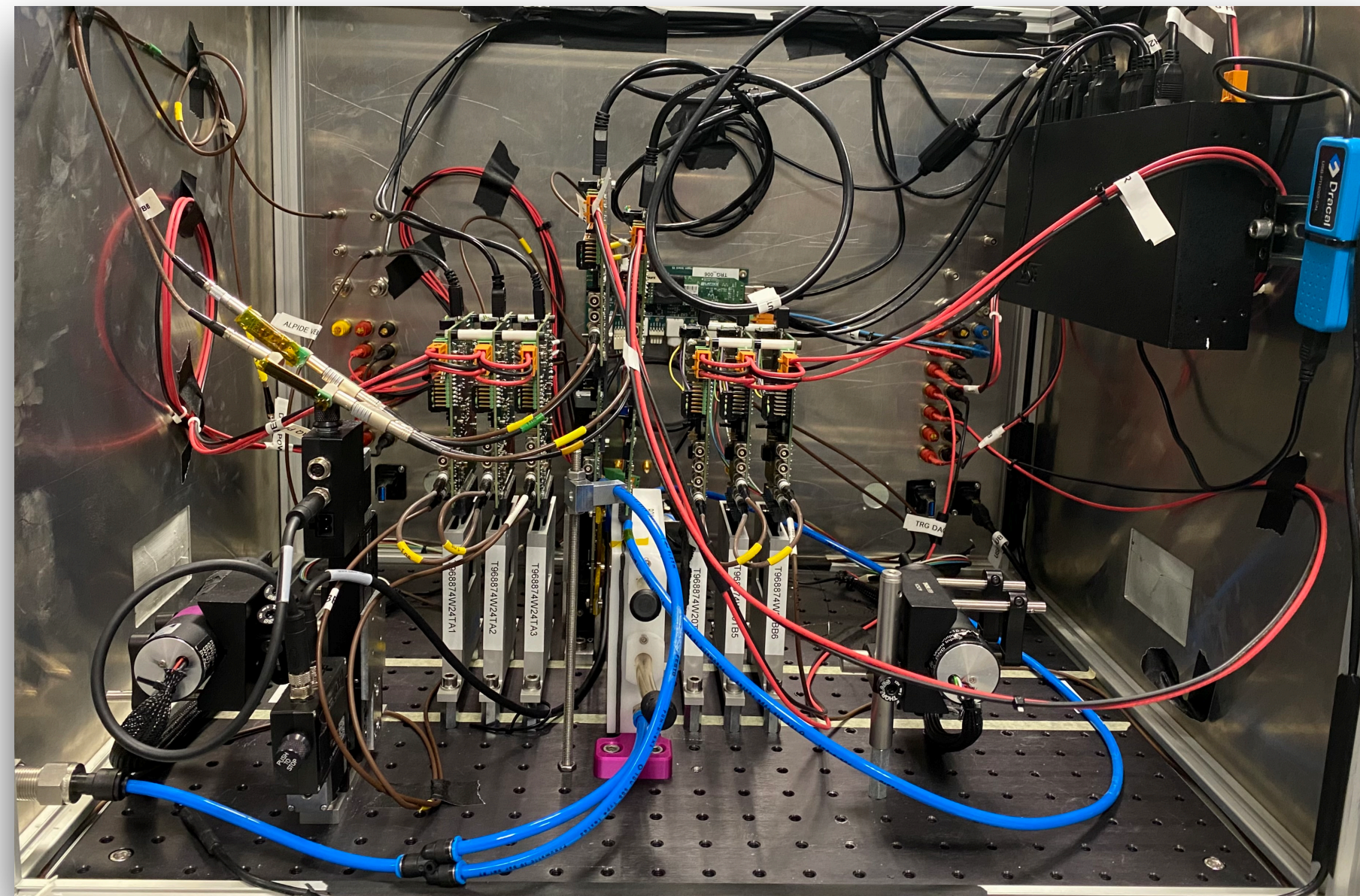
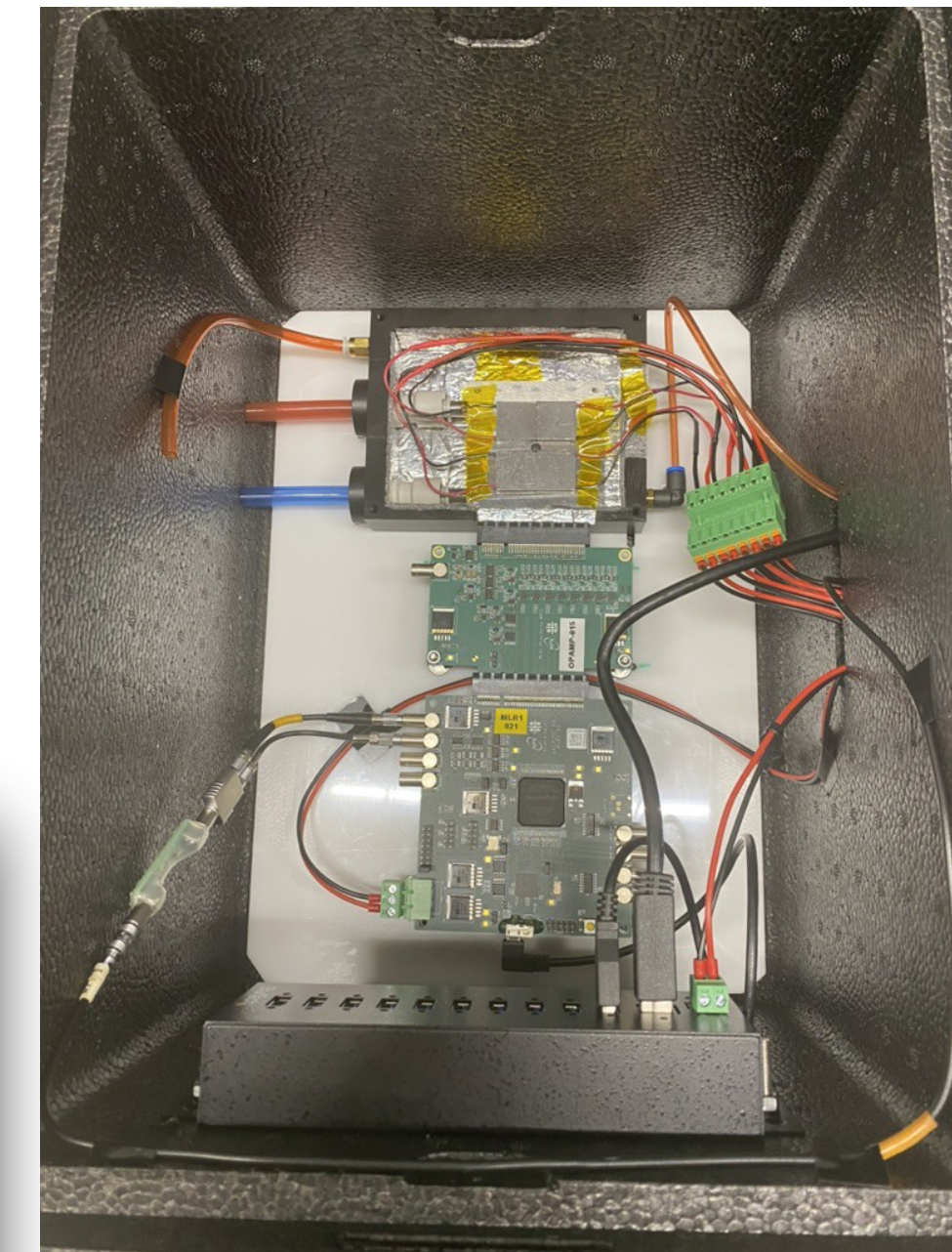
ALICE3: INSTRUMENTATION

- First sensors targeting ALICE3 Inner and Outer Tracker are being delivered
- Setup at Nikhef being completed / in commissioning phase
- Strong involvement in testbeams at PS / SPS
- Massive test campaign of more than 100 sensor variants ahead!

analog pixel test structure



cold setup at Nikhef



telescope with cold box for Device Under Test

ALICE

in The Netherlands



ALICE



Nik|hef