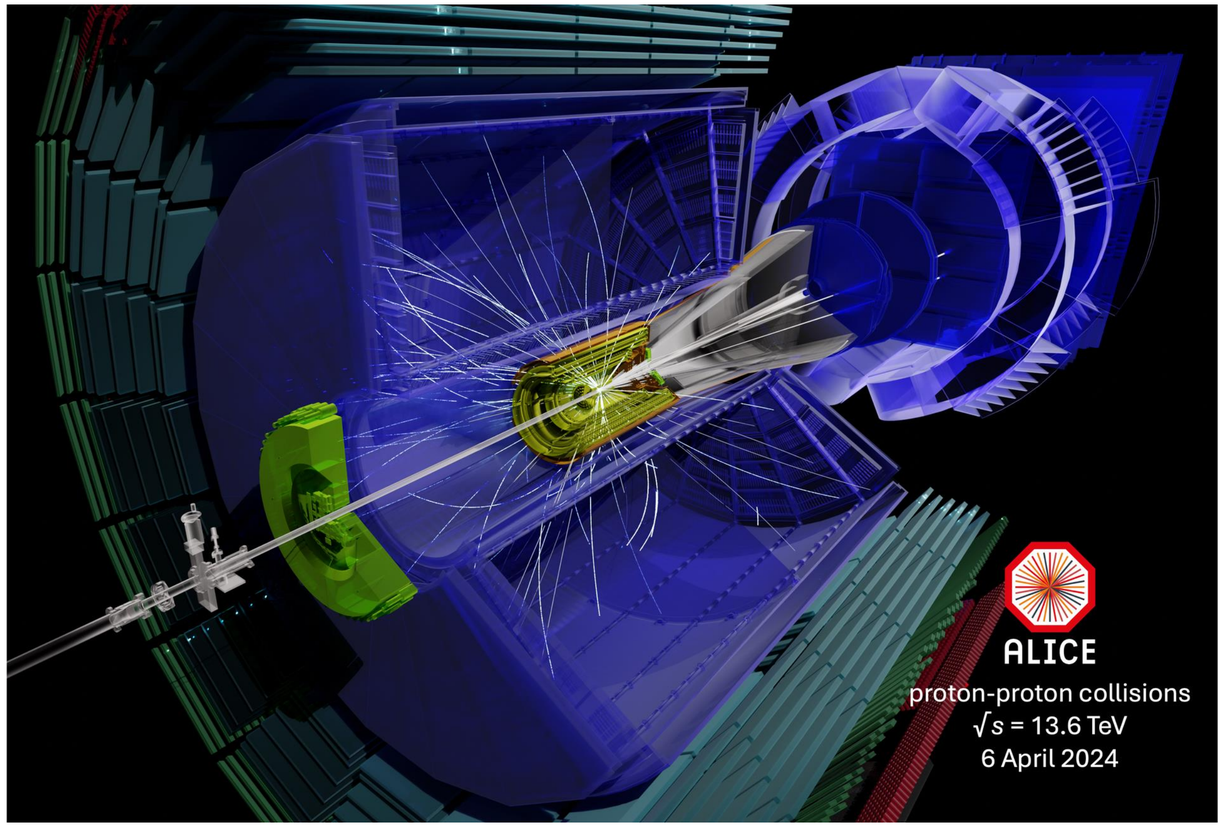
ALICE status update

Marco van Leeuwen,
Nikhef and CERN

CERN-Korea Committee meeting
22 April 2024



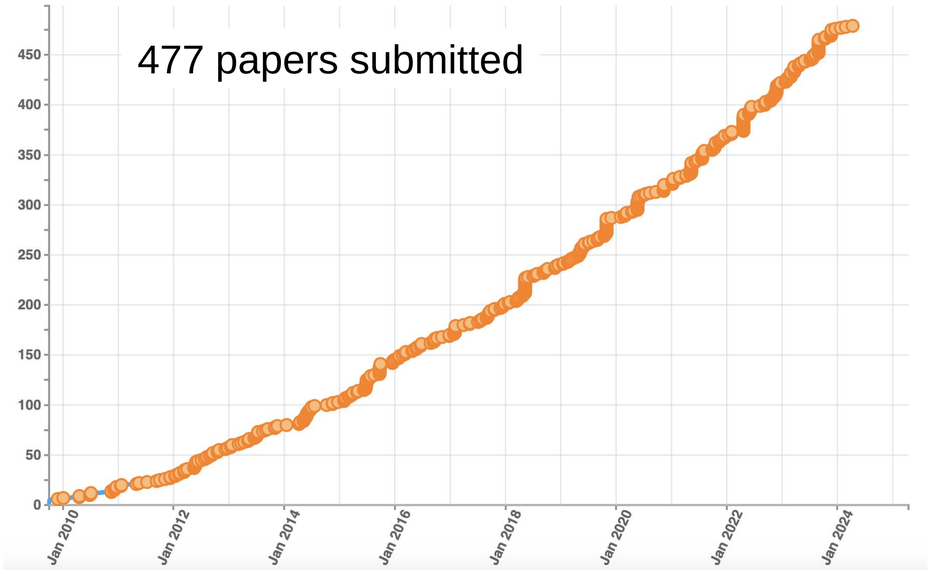
ALICE collaboration updates

ALICE collaboration:
- 1069 authors
- 173 institutes in 40 countries

New associate member institutes
- MCAST, Malta
- CHPC, South Africa
- Dhaka, Bangladesh

9 Korean Institutes,
45 active members
33 authors

ALICE Week, March 2024

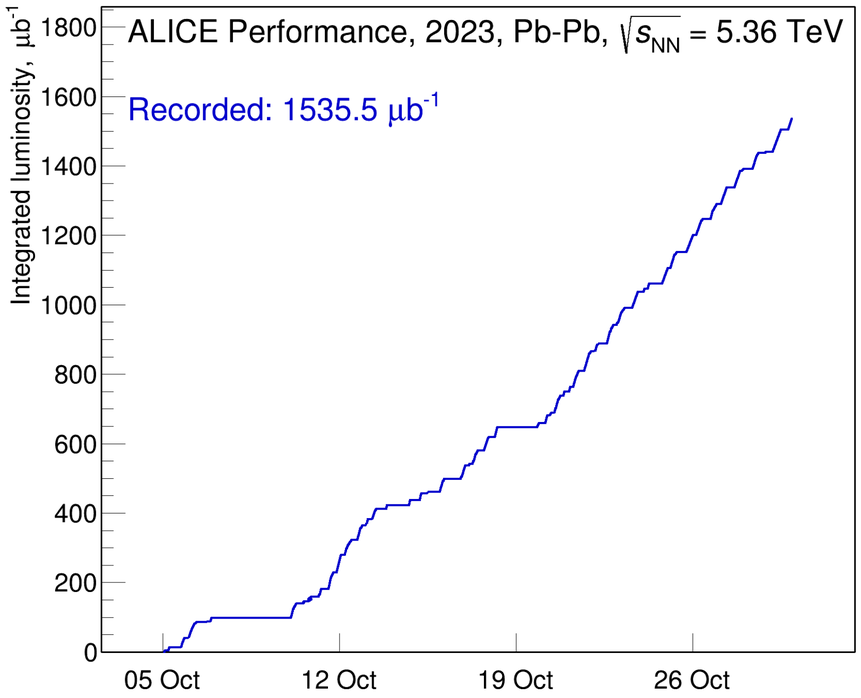


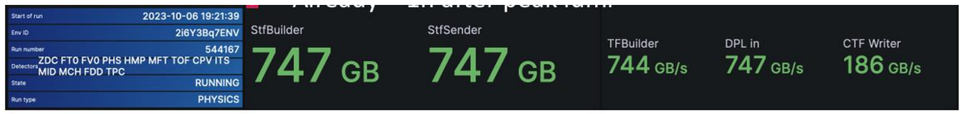
Run 3 heavy-ion data taking

- Successful heavy-ion run
  - Total recorded luminosity: 1.5 nb^{-1} — 11.5 G events
  - 40x more minimum bias events than in run 2
  - Total run time: about 6 weeks
- Reconstruction in progress:
  - Test pass on 20% of data sample to verify reconstruction performance and refine calibrations
  - Second pass in progress
- Aim to collect similar size data sample in three-week run in 2024

  4.5 pb^{-1} pp collisions at same energy for reference

Recorded Pb-Pb luminosity



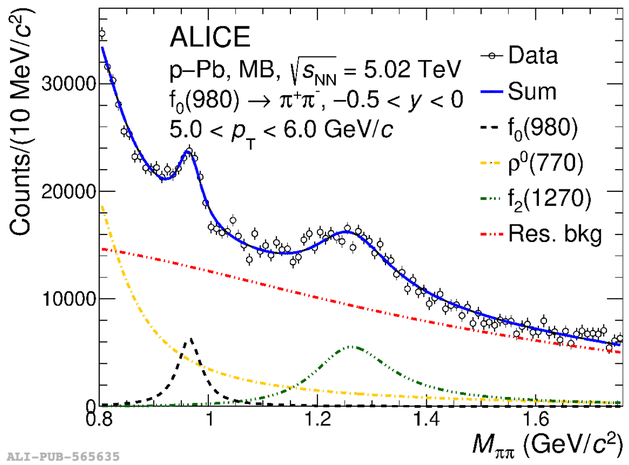


full system validated up to target interaction rate (50 kHz)

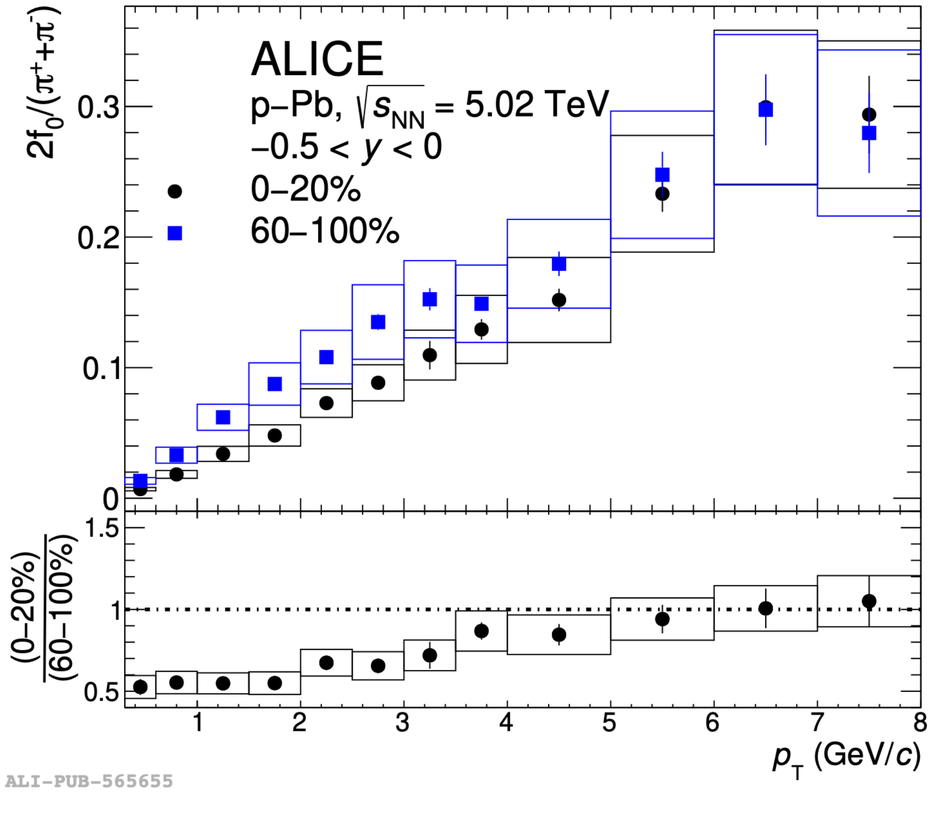
data rates: 600-800 GB/s input to FLPs, 160-190 GB/s to EOS

$f_0(980)$ production in p-Pb collisions

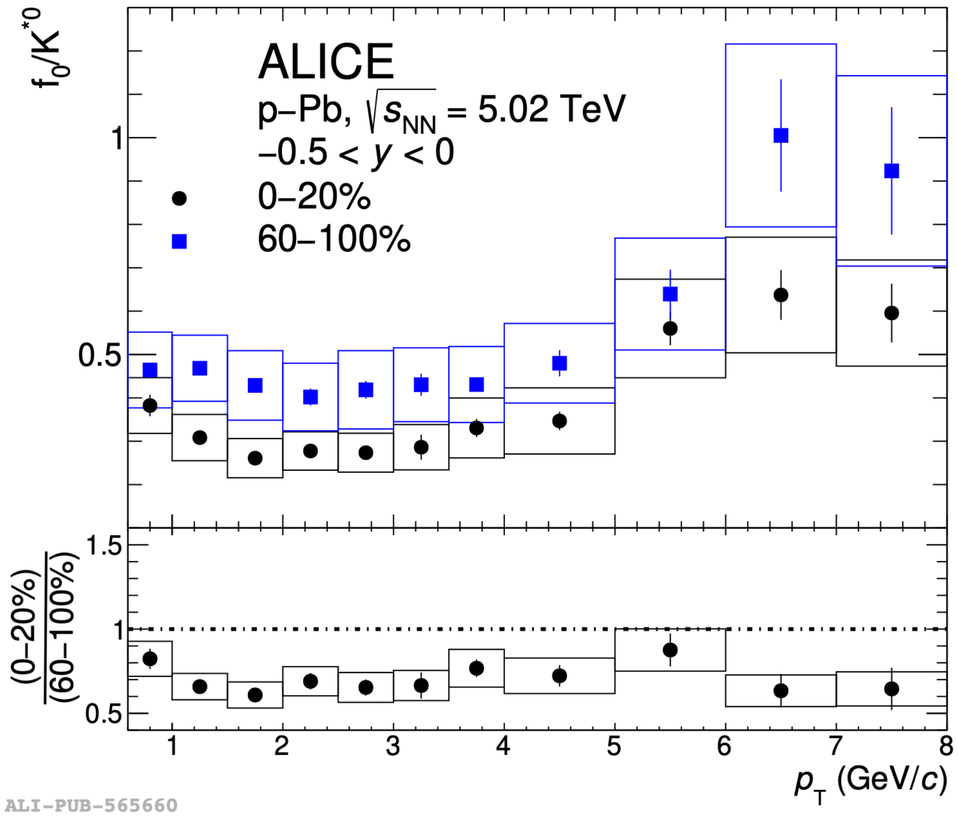
arXiv:2311.11786, accepted by PLB



f_0/π ratio



f_0/K^{*0} ratio

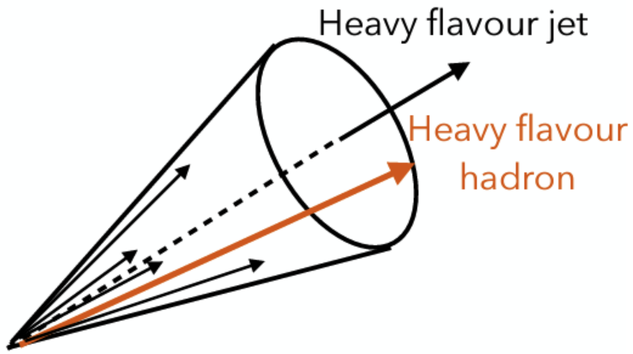


Unexpected suppression of $f_0(980)$ production in central p-Pb collisions — rescattering of decay products ?

Paper committee member: Junlee Kim (Jeonbuk Nat Univ, now CERN)

Charm baryon production in jets

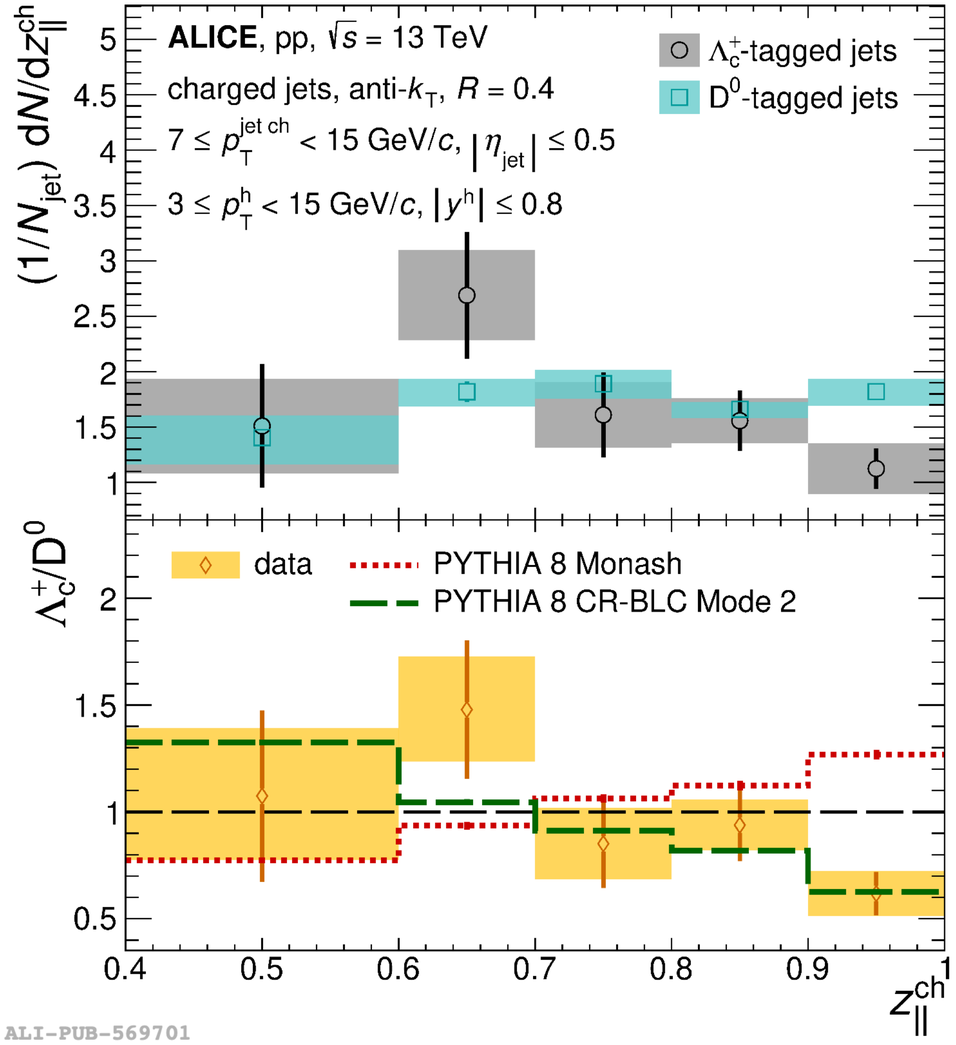
Phys. Rev. D 109 (2024) 072005



- Production of charm baryons in pp collisions larger than expected from e^+e^- collisions (breaking of factorisation)
- New measurement of charm baryon production in jets:
  - Baryon distribution softer than mesons
  - Matches well with a model that includes color recombination and baryon junctions

Paper Committee member: Vit Kucera (Inha University)

Momentum fraction Λ_c^+ and D mesons in jets



11th annual ALICE Tier1/Tier2 workshop

16-18 April 2024 in Seoul

Organized by KISTI-GSDC,
co-sponsored by KSHEP

45 participants from Asia, Europe,
North and South America

Computing centre managers, network experts,
Grid software developers and security

Global Science experimental
Data hub Center

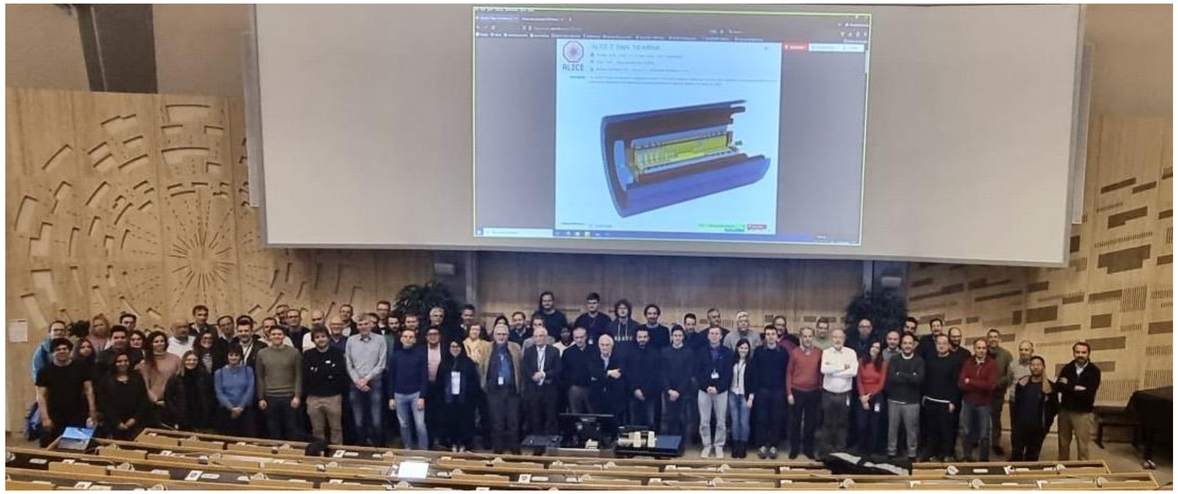
Thank you for hosting
this important event!

Discussions on

- Status and future development of the Grid middleware
- Network infrastructure
- Site operation and resources planning
- Integration of HPC systems, e.g. NURION at KISTI
- Grid and site computing security

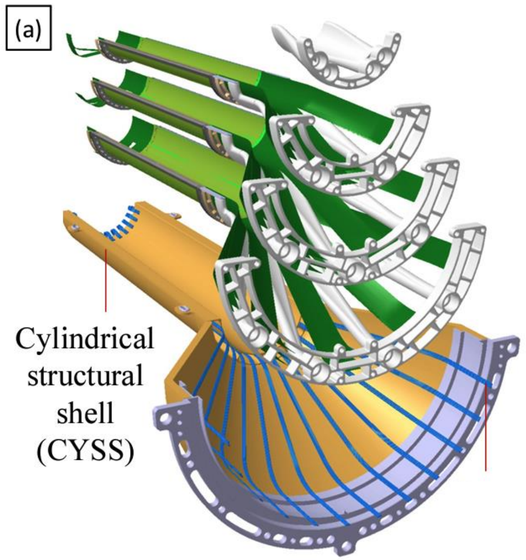
Upgrades: ITS3, FoCal and ALICE 3

ALICE Upgrade week, [4-7 December 2023, Torino]

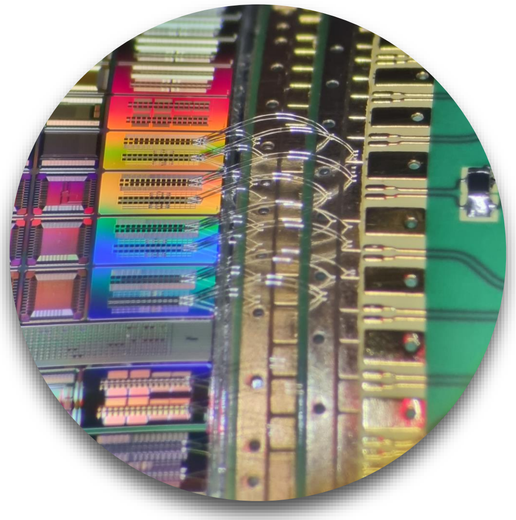


ALICE 3 Days, 25-27 March, CERN

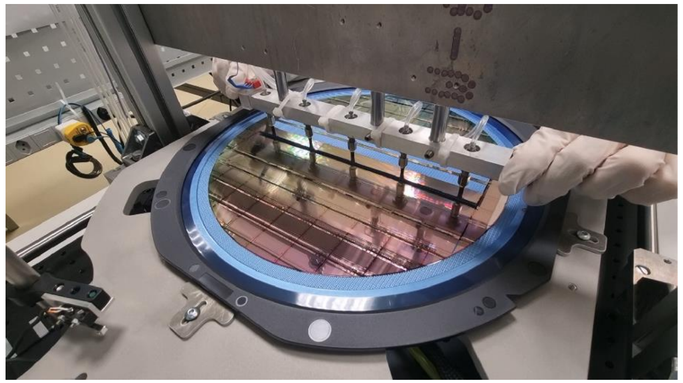
LS3 upgrades: ITS 3 — ultra-light fully cylindrical tracking layers



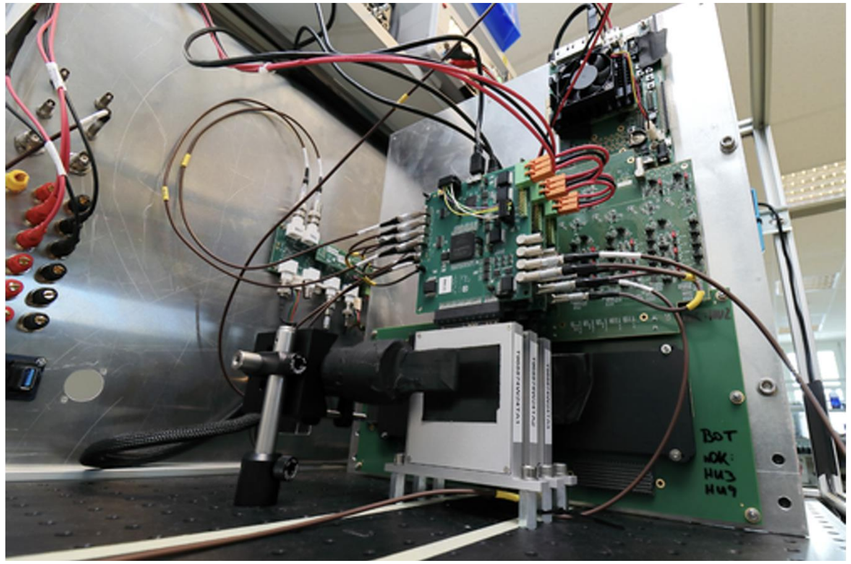
Wire bonding of curved sensors



Handling of stitched structures



Beam tests



ITS3: replace inner three layers of ITS with ultralight tracker

- Large-area curved sensors (stitched CMOS)
- Air cooling — low power
- Improve performance for heavy flavour, dielectrons (thermal radiation) — physics performance note

New Engineering Run 1 stitched sensors being tested

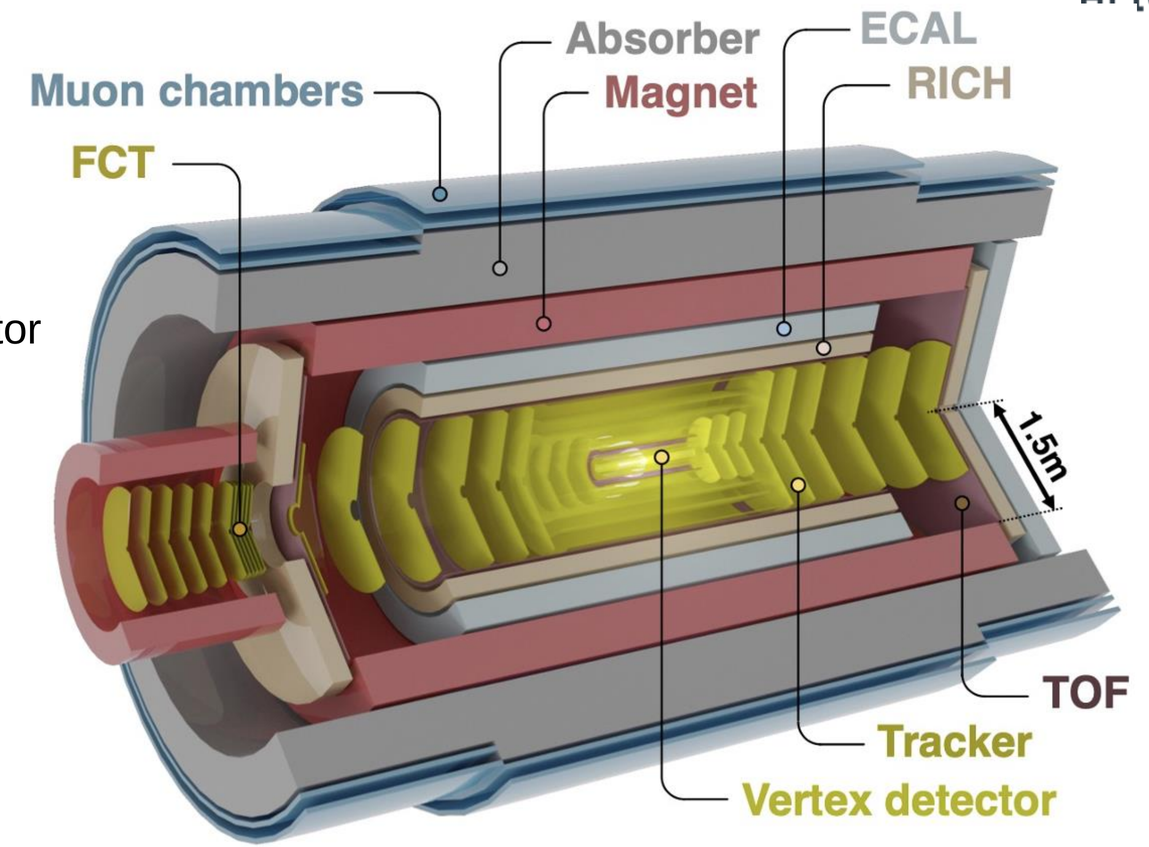
TDR approved (CERN-LHCC-2024-003)

ALICE 3 upgrade

ALICE 3 design:

- Compact and lightweight all-silicon tracker
  - Excellent pointing resolution with a retractable vertex detector
- Extensive particle identification: TOF, RICH
- Large acceptance

Sensor R&D started: test beams for MID, ECal, RICH TOF



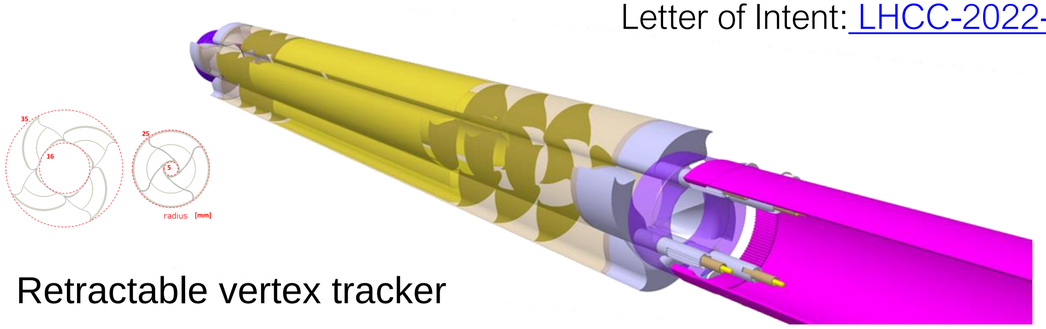
Letter of Intent: LHCC-2022-009

Cost and schedule: Scoping Document

- Two main scoping options defined:
  - Setup without ECal
  - Reduced magnetic field: ~ 1 T

Scoping Document
reviewed by editorial committee

Measurement
ALPs searches in $\gamma\gamma \rightarrow \gamma\gamma$
$\chi_{c1,2} \rightarrow J\psi\gamma$
$\chi_{c1}(3872) \rightarrow J\psi\pi\pi$
Ξ_{cc}
B^+ yield and flow
Λ_c flow
Λ_b flow
D^0–$\overline{D^0}$ vs. $\Delta\varphi$

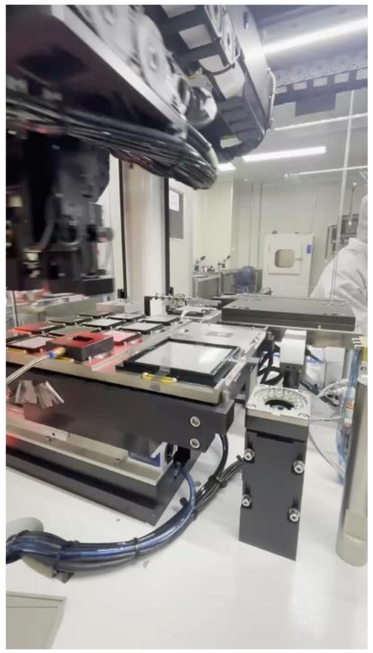


Retractable vertex tracker

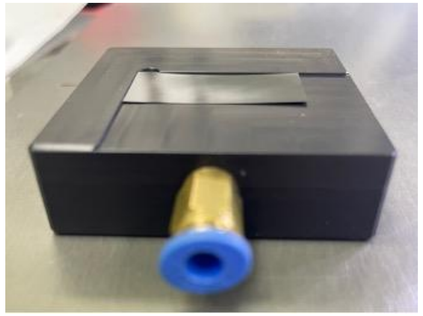
Outer tracker R&D: module production

Commercial general purpose die attach machine

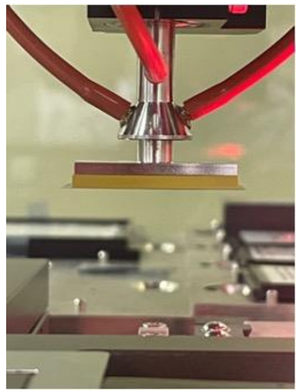
Tests with Korean company: MEMSPACK



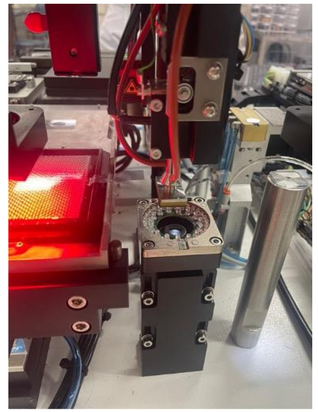
Chip holder



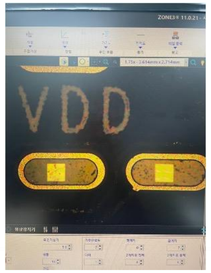
Chip gripper



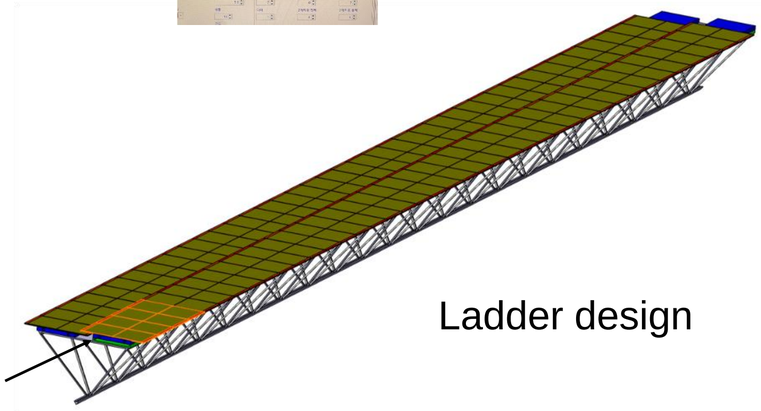
Marker scan



Position reproducible with 5 µm level accuracy



- **Large area: automated industrial production** of multi-chip modules
- First tests with dummy modules in collaboration with industry



Ladder design

R&D for ALICE 3: module production

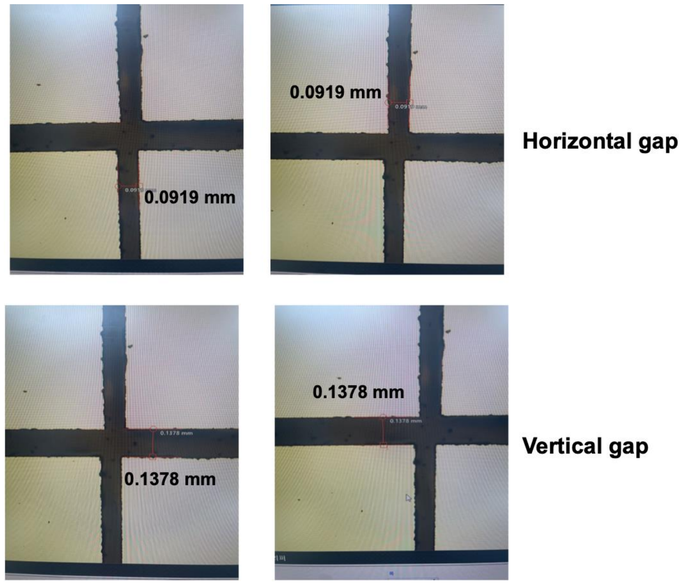
Key R&D item for ALICE 3: automated module assembly

Multi-chip modules to assembly large area

Dispenser

Automatic glue dispensing

Test sensor positioning



Horizontal gap

Vertical gap

R&D with MEMSPACK to develop assembly process

- First tests of position accuracy very promising
- Next step: test with glueing
  - Determines production throughput
- Important input for module design, schedule and cost estimates

Conclusion

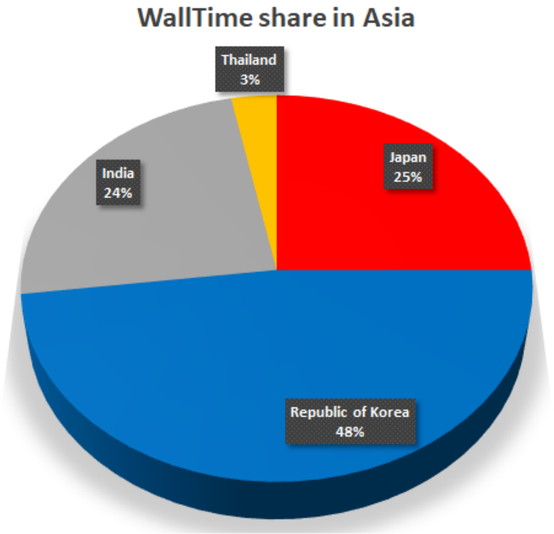
- Run 2 data continues to produce new results
- Processing of Pb-Pb data is advancing — aim for first results in summer
- ALICE Tier-1/2 workshop hosted by KISTI
- R&D for ITS3 and ALICE 3 progressing well

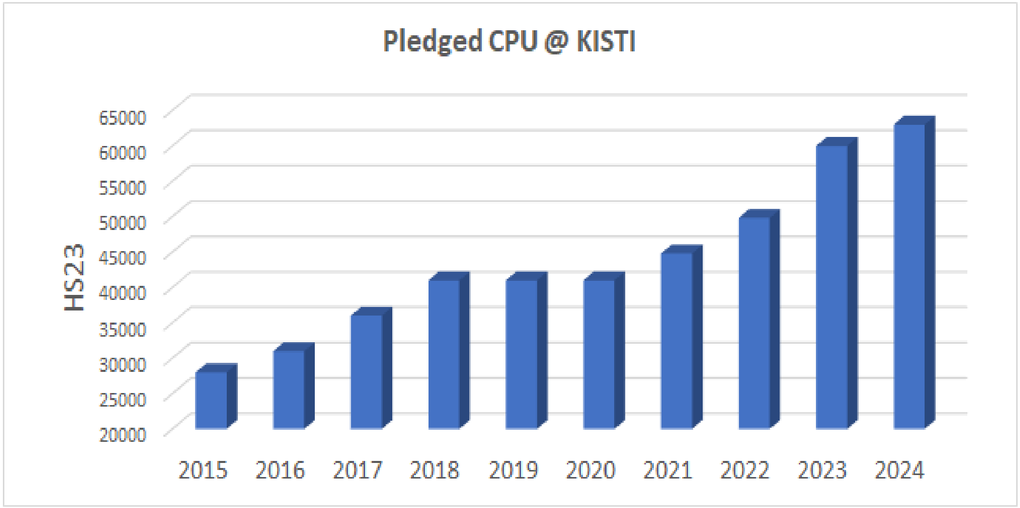
Thank you for your support and attention

Extra slides

KISTI contribution to ALICE computing

- Joined ALICE Grid in 2007
- Substantial contribution to ALICE computing
- Only Tier 1 in Asia: very reliable operation
- Important regional function





- KISTI provides 15% of the ALICE T1 resources and 50% of the computing capacity in Asia
- Robust growth over the past 11 years, today more than 3500 CPU cores and about 20 PB of storage