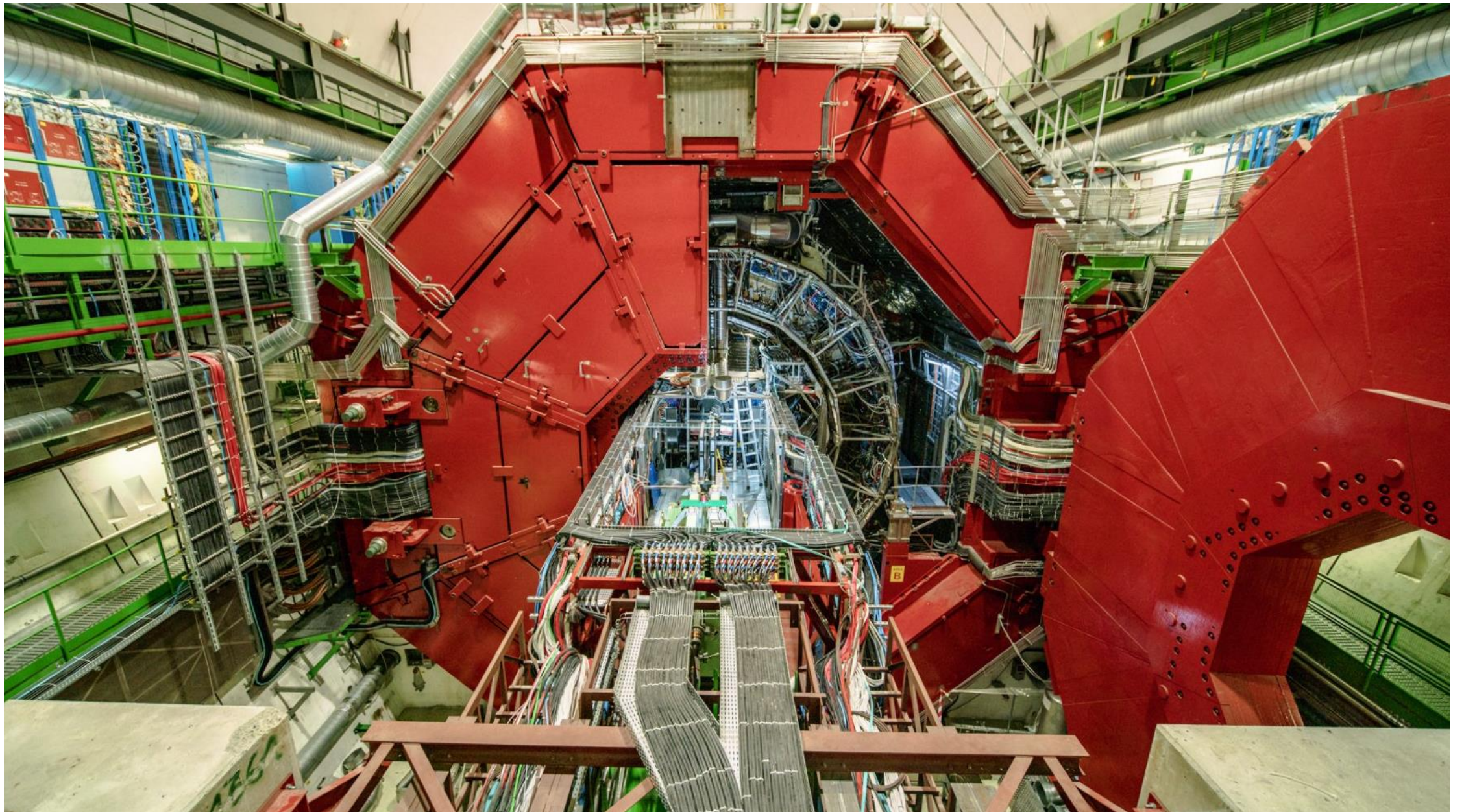




News from ALICE at the start of Run 3

Yury Melikyan

Helsinki Institute of Physics



One year ago: ALICE magnet doors were closed upon the end of LS2

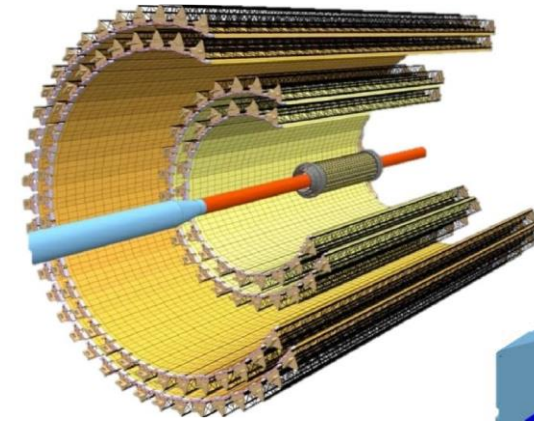
Brand new hardware of the upgraded ALICE

- **New beampipe;**
 - $\text{Ø}36.4 \text{ mm (!)}$ | 0.8 mm-thick | 870 mm-long beryllium section



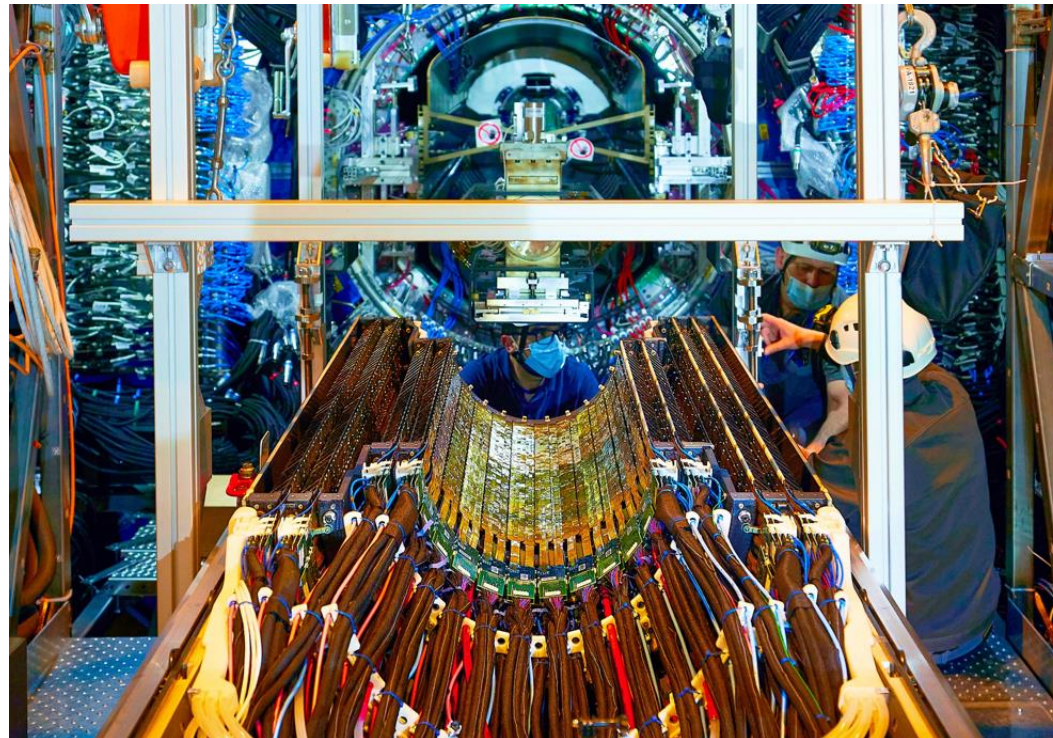
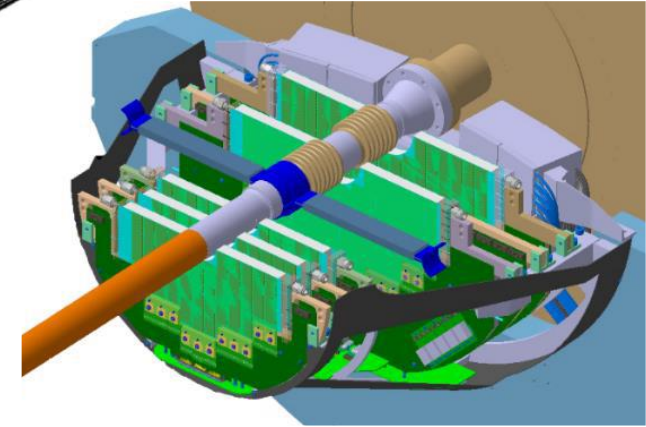
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- New beampipe;
 - $\text{\O}36.4$ mm (!) | 0.8 mm-thick | 870 mm-long beryllium section
- **New Inner Tracker System + Muon Forward Tracker**
 - 10 m² active area – largest pixel detector ever built!
 - 12.5+0.5 Gpixel “high-speed camera” with ultra-low material budget.

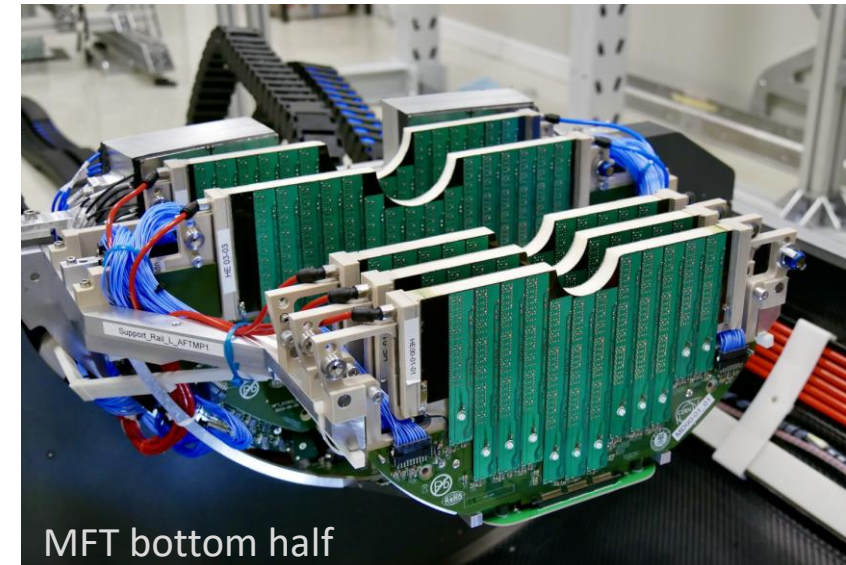


ITS schematic

MFT schematic



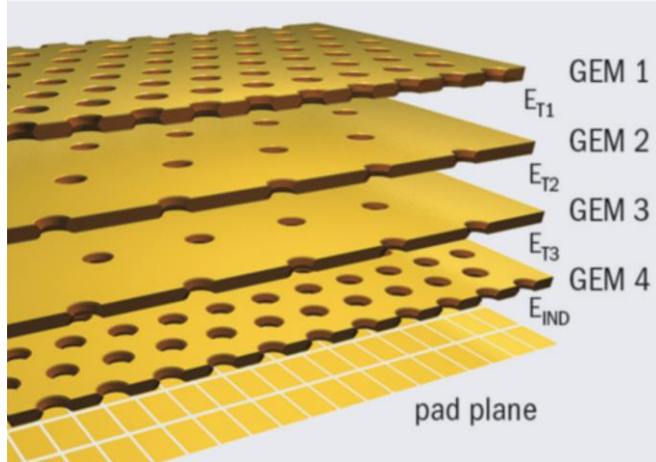
ITS outer barrel



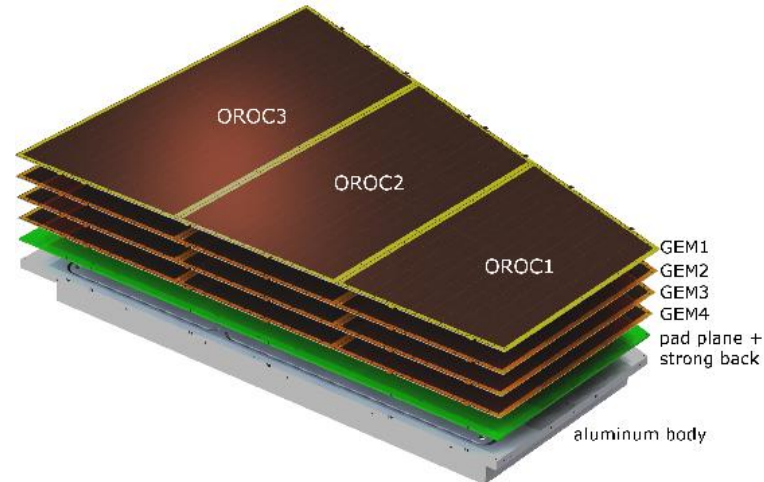
MFT bottom half

Brand new hardware of the upgraded ALICE

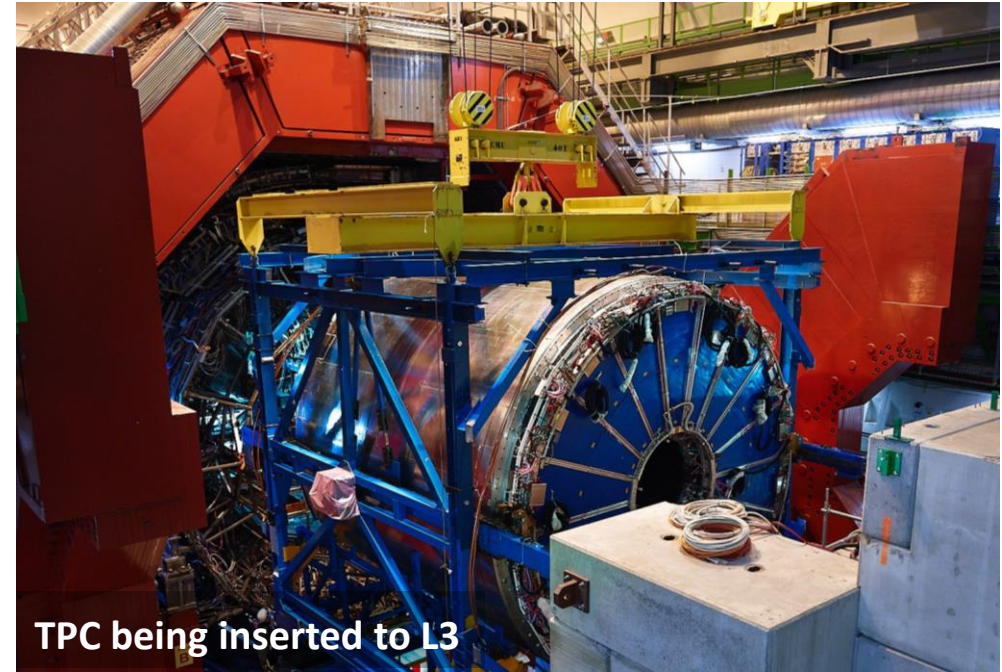
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 - 12.5+0.5 Gpixel “high-speed camera” with ultra-low material budget
- **New Gaseous Electron Multipliers-based TPC readout**
 - x100 increase in signal rate w.r.t. the old MWPC readout;
 - 88 m³ gas volume | 4x32 m² GEM active area | 524k readout channels;
 - largest GEM-based TPC ever built.



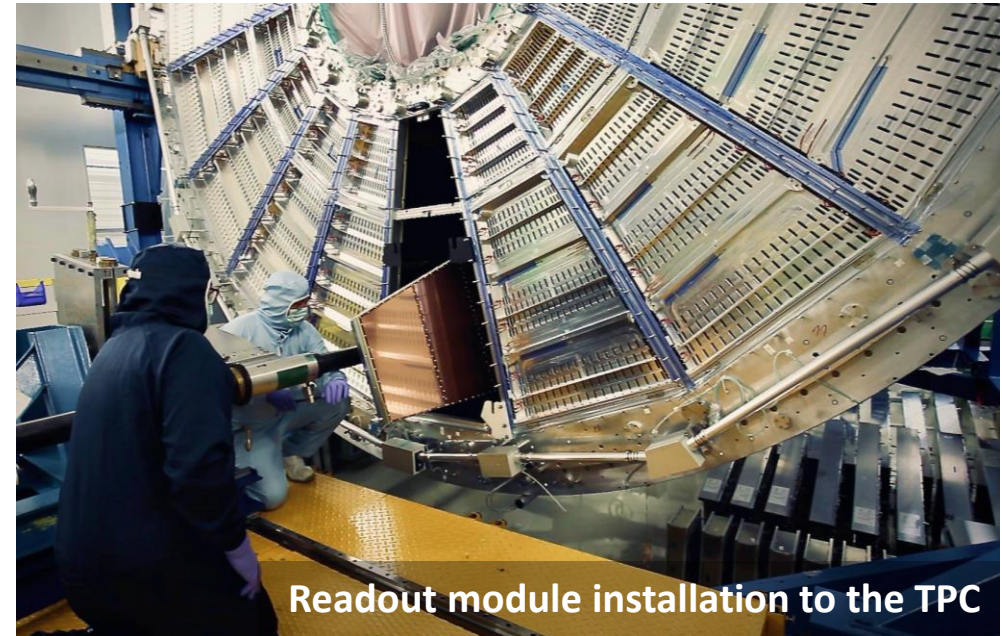
Structure of GEMs custom for ALICE TPC



TPC readout module



TPC being inserted to L3

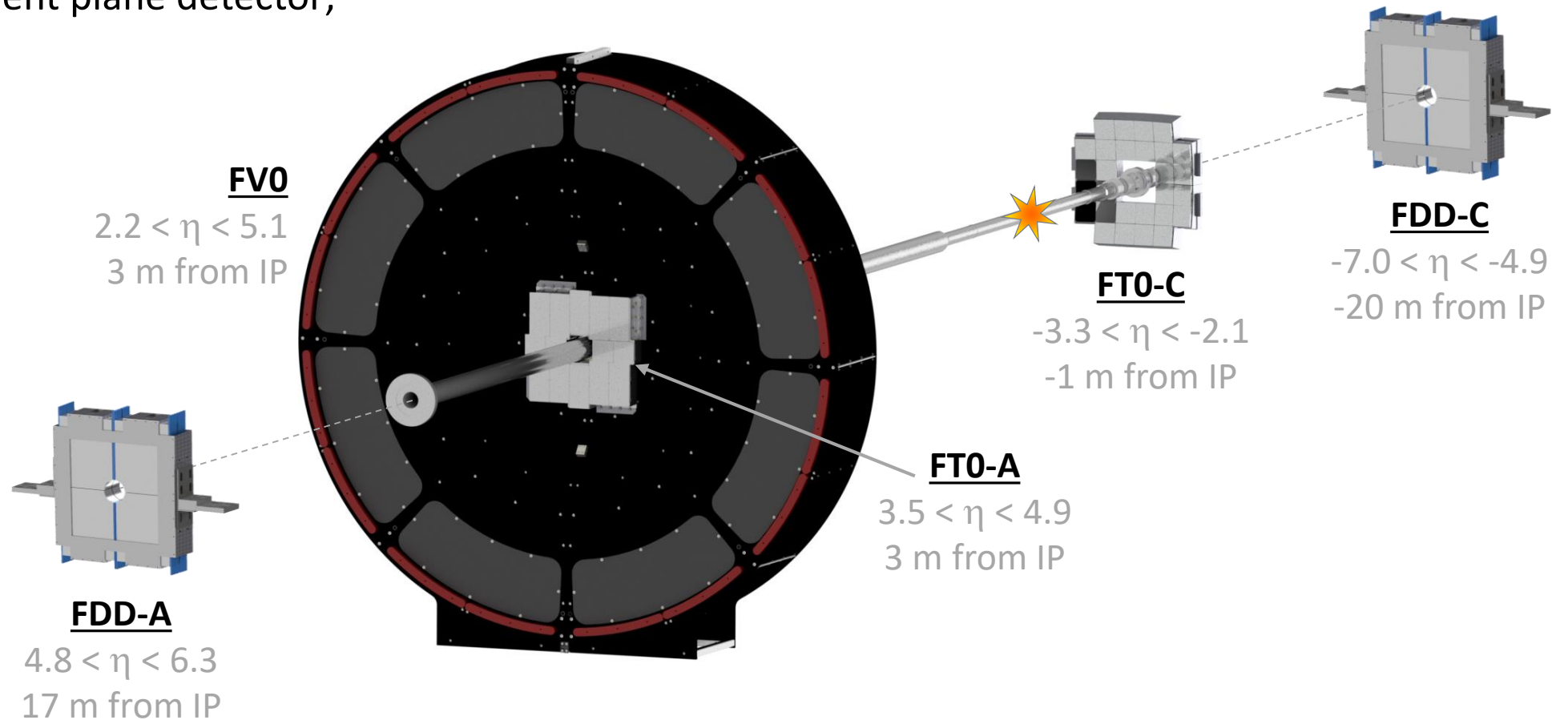


Readout module installation to the TPC

Brand new hardware of the upgraded ALICE

- New Fast Interaction trigger detector!

- Real-time trigger;
- Precise time-zero detector;
- Centrality & event plane detector;
- Key ALICE luminometer;
- Key tool for diffractive physics.

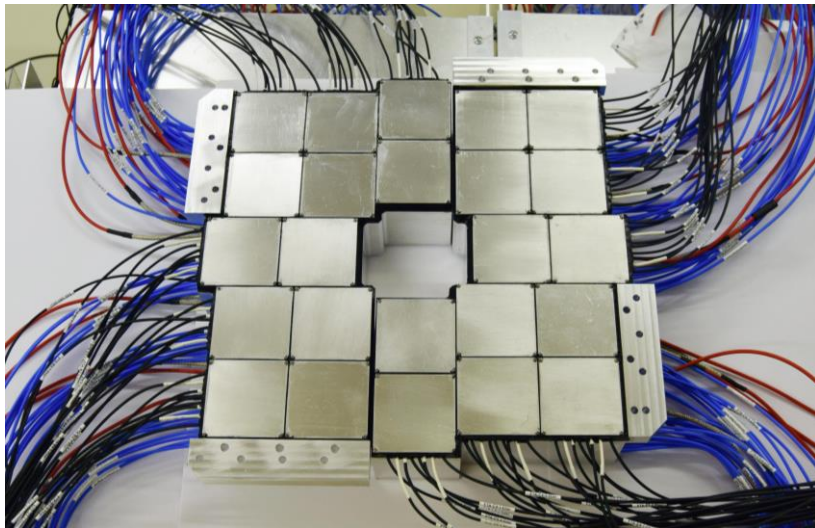
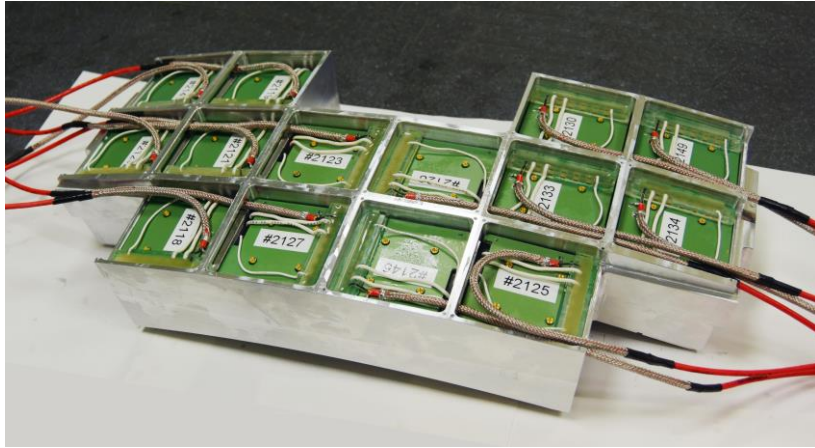


The Fast Interaction Trigger of ALICE



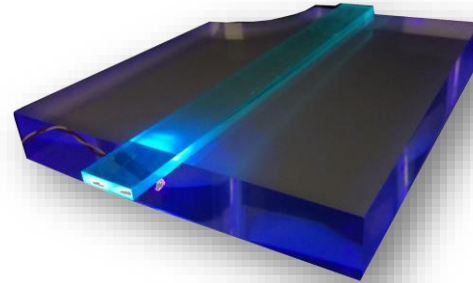
FTO

Cherenkov radiators directly coupled to microchannel plate-based PMTs



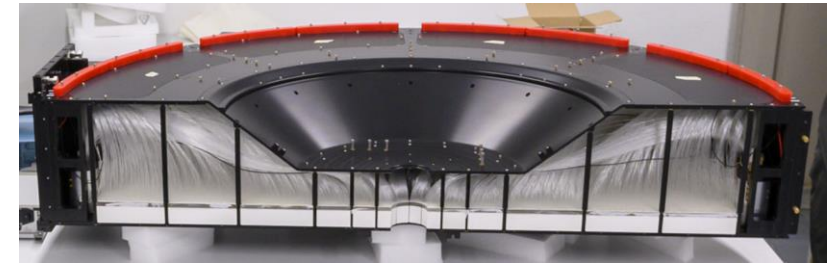
FDD

Plastic scintillator with a wavelength-shifting readout to fine-mesh PMTs

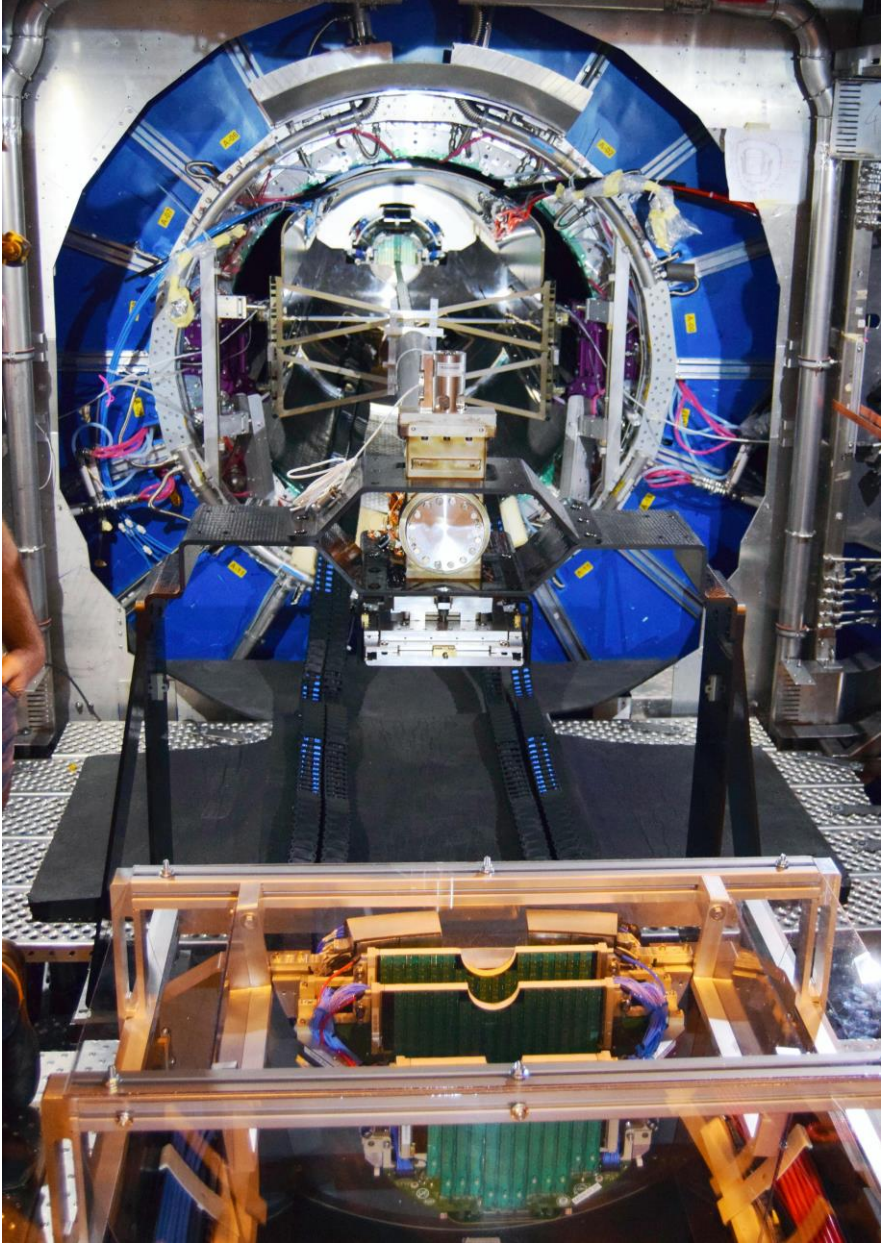
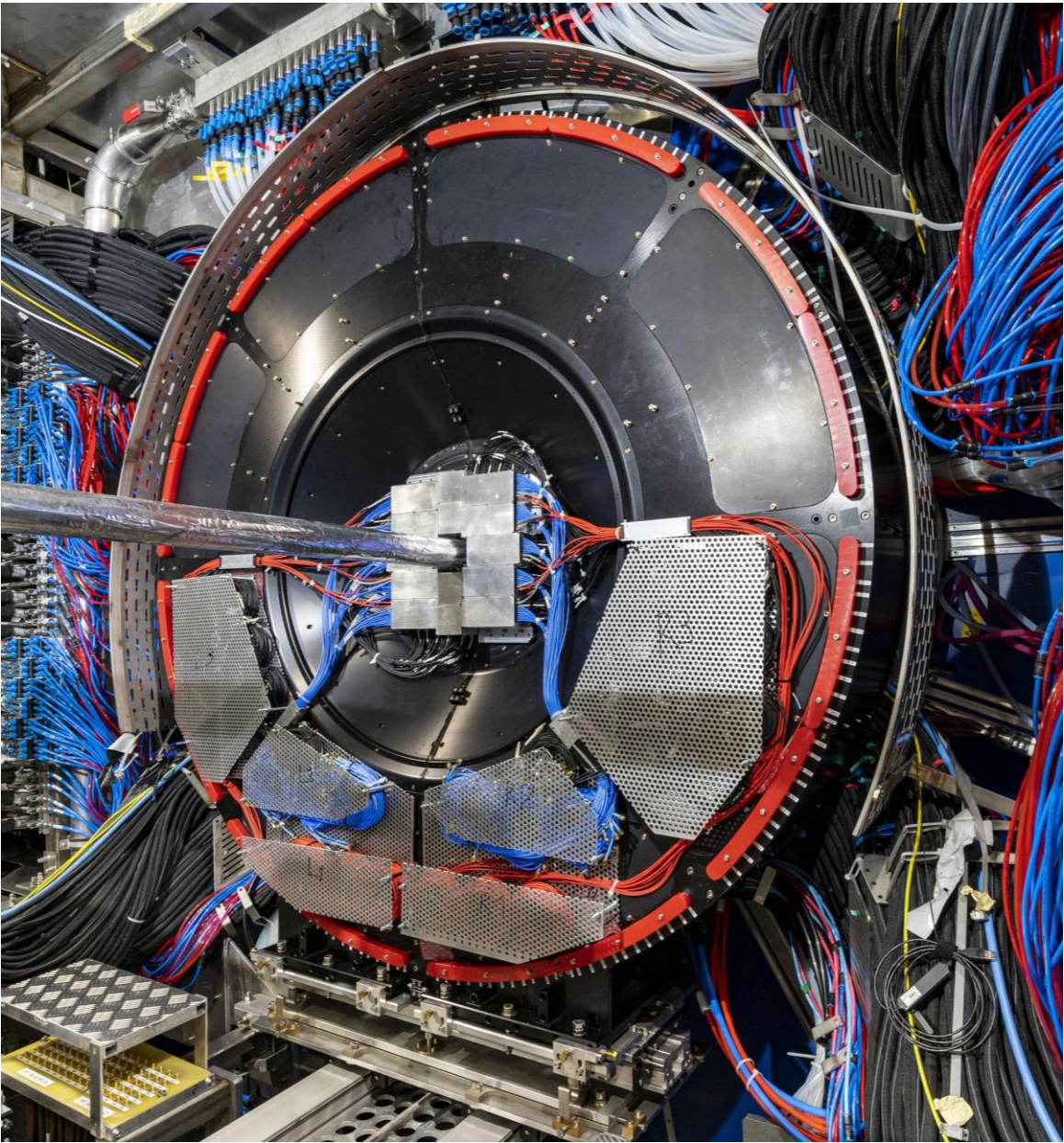


FVO

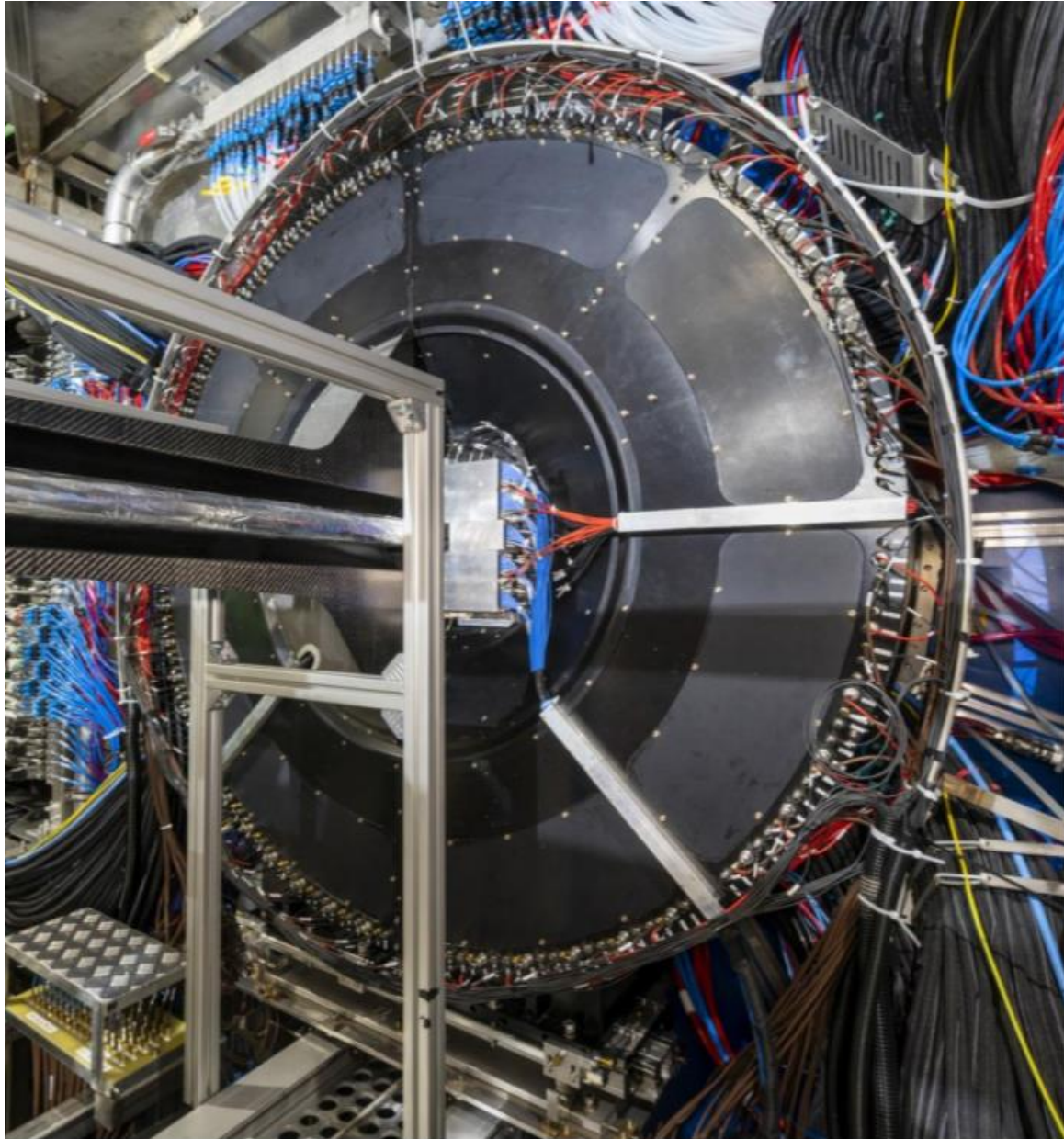
Plastic scintillator with novel light readout through clear fibers to fine-mesh PMTs



The Fast Interaction Trigger of ALICE



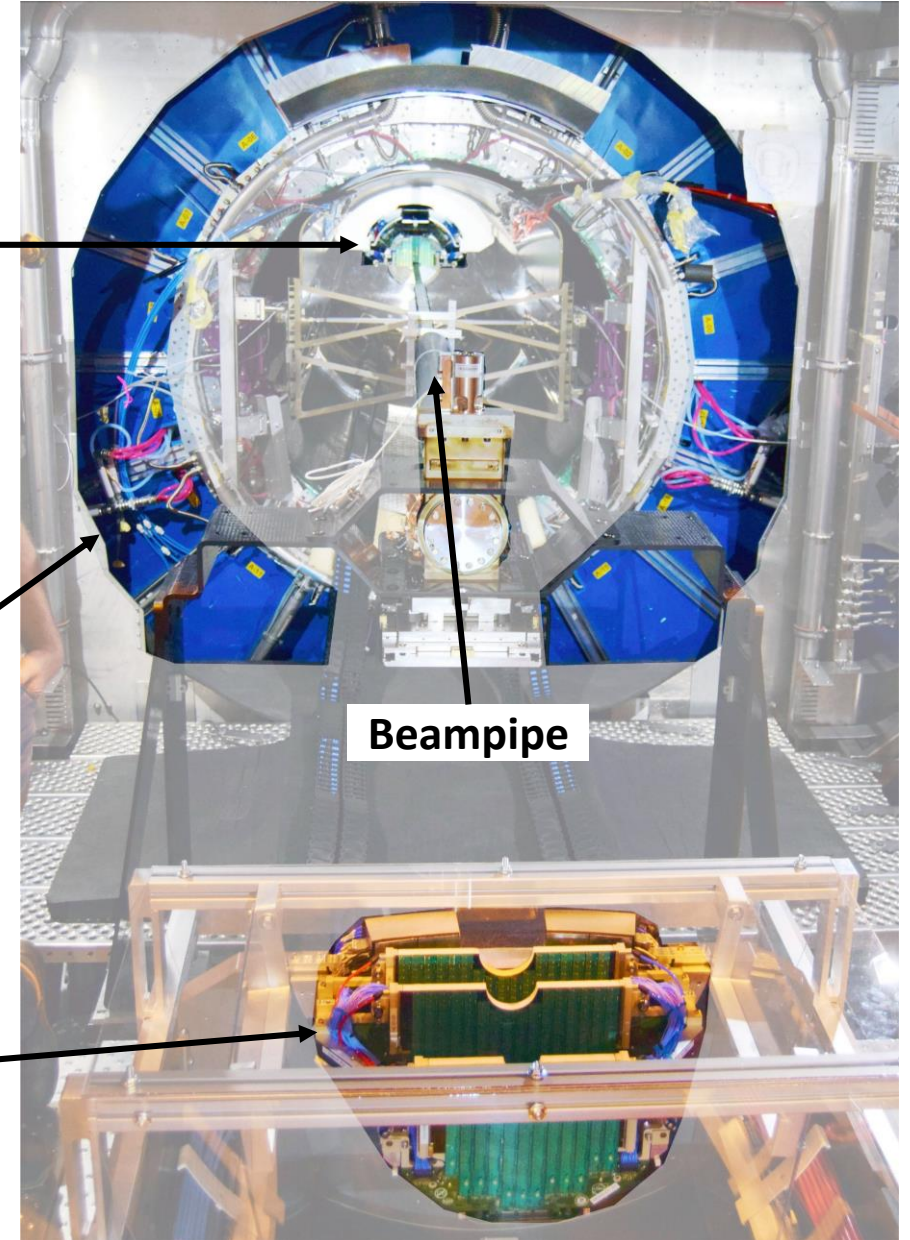
The Fast Interaction Trigger of ALICE



MFT top half +
FTOC top half
(at final position)

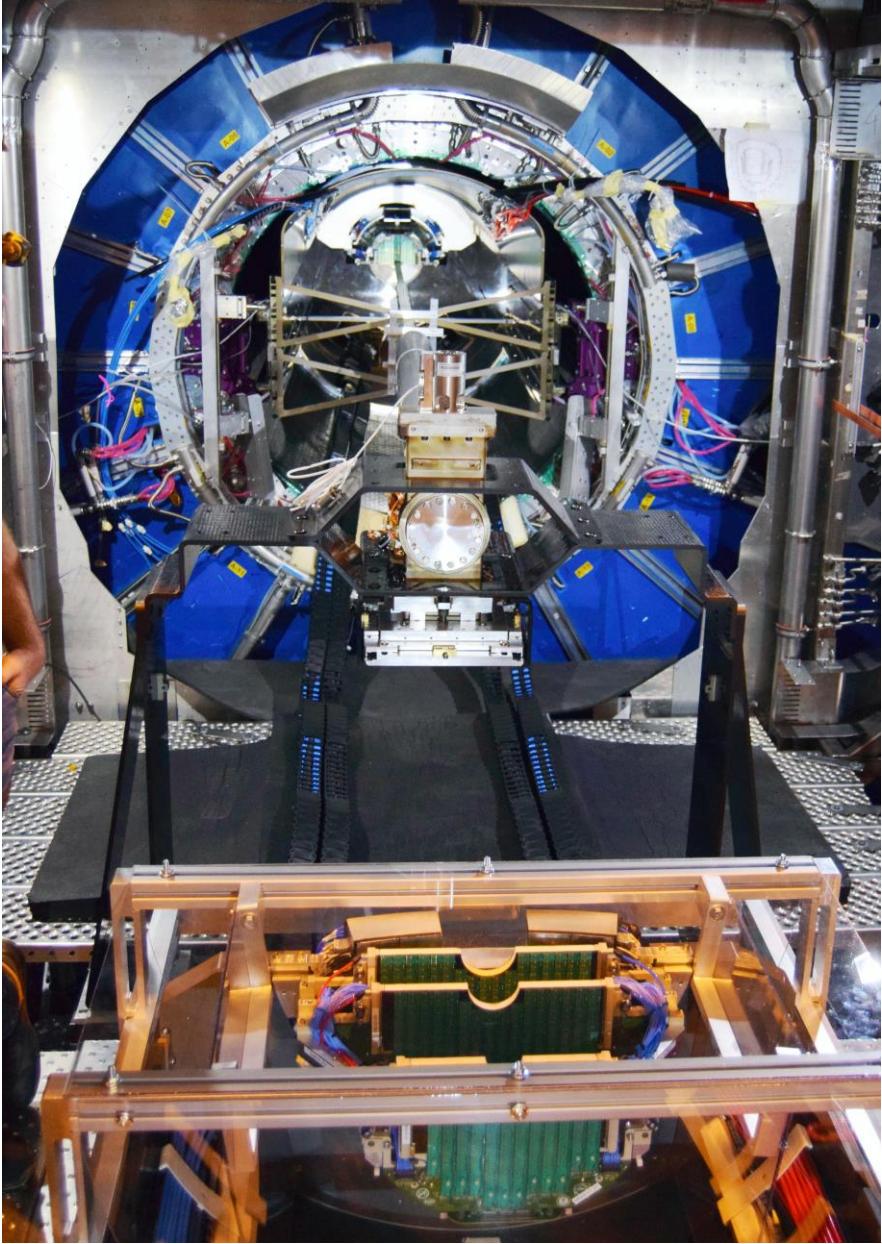
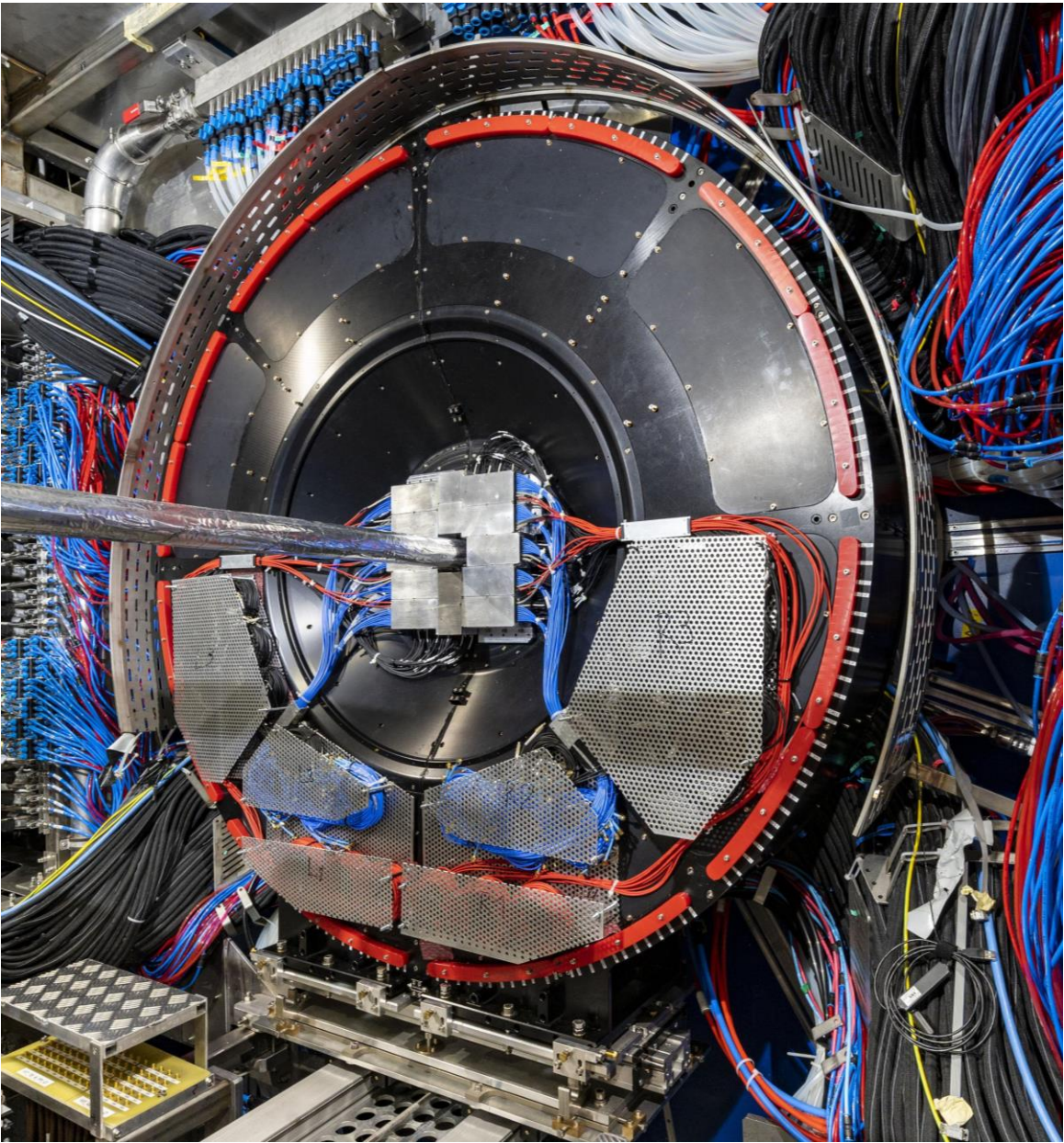
TPC end face

MFT bottom half +
FTOC bottom half
(before insertion)



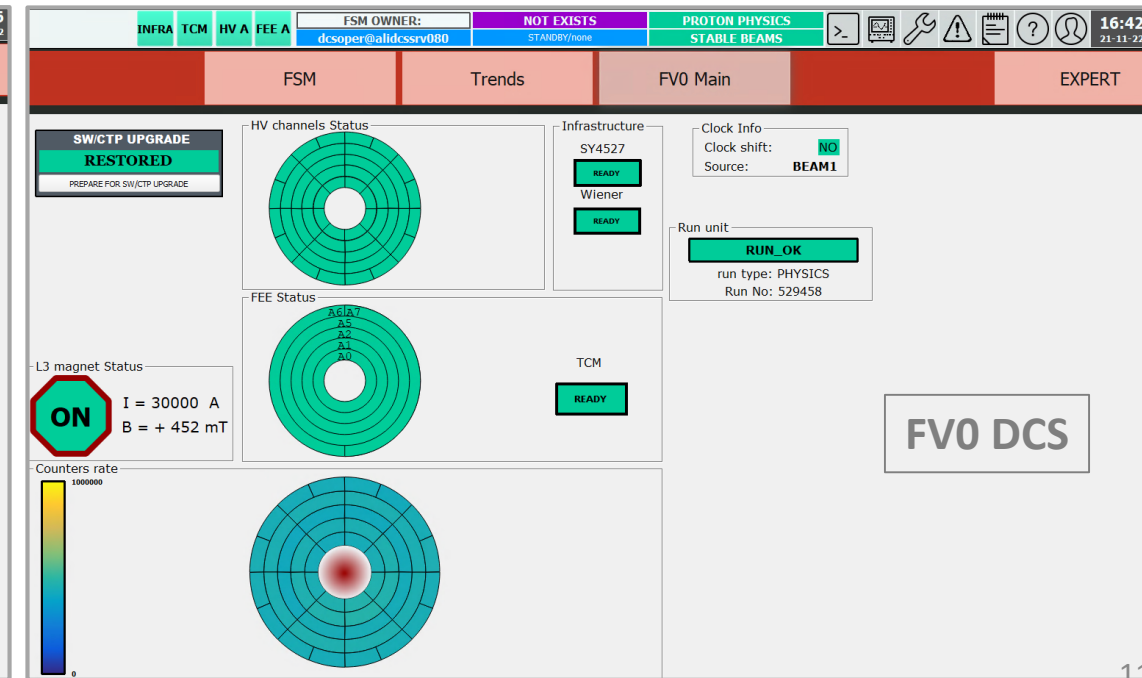
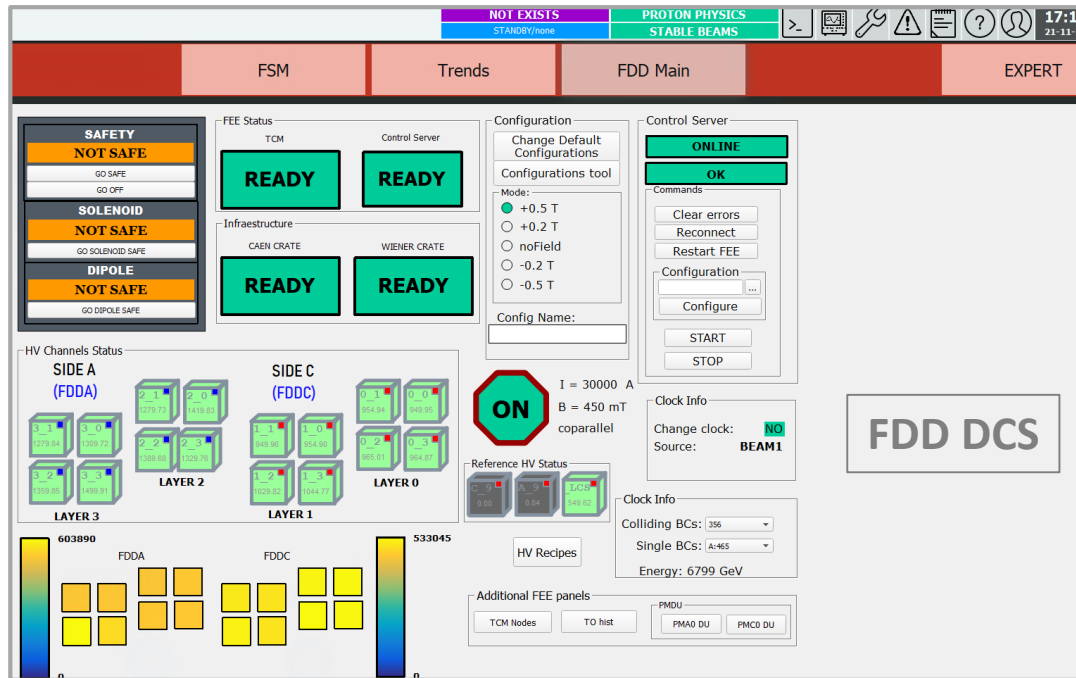
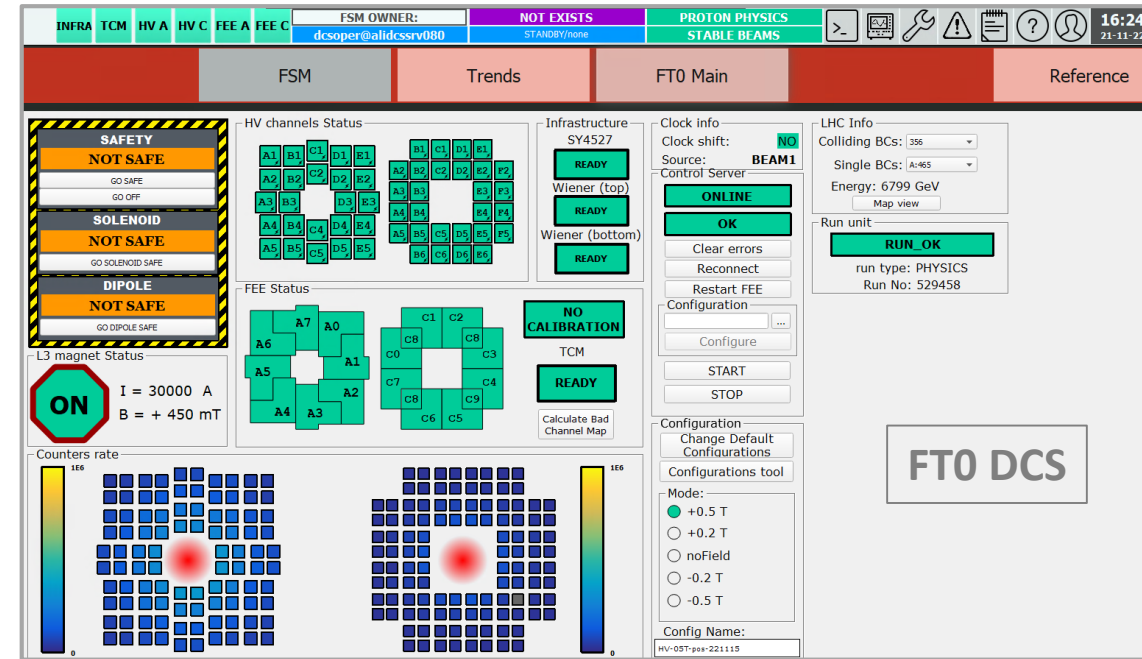
Beampipe

The Fast Interaction Trigger of ALICE



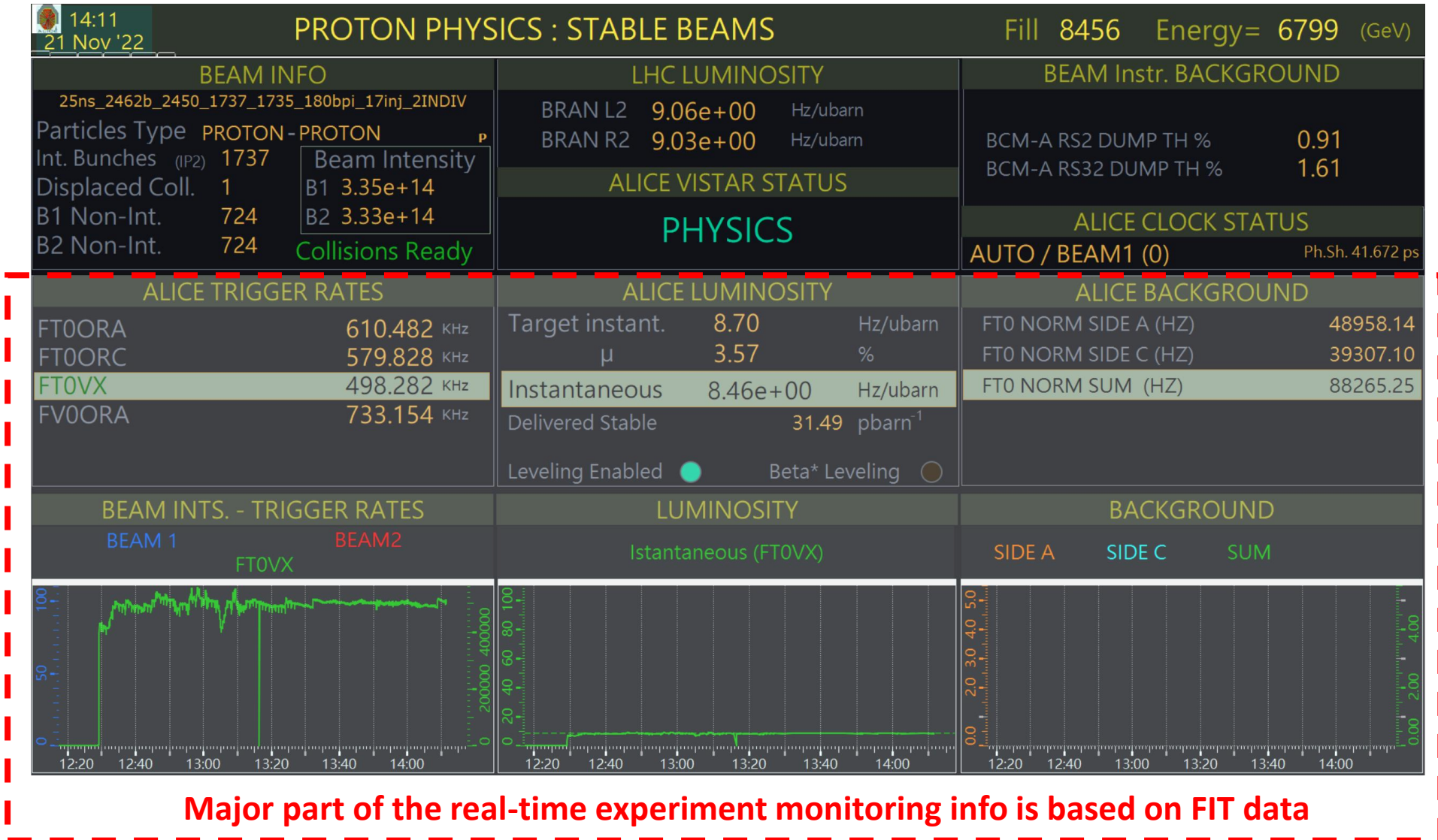
The Fast Interaction Trigger of ALICE

- ~One year of ~smooth operation as an integral part of ALICE;
- Permanent progress in usability of the control systems;
- Rare data processing bugs still being discovered and fixed.



The Fast Interaction Trigger of ALICE

- Key service detector of the experiment - ALICE can not collect data without FIT



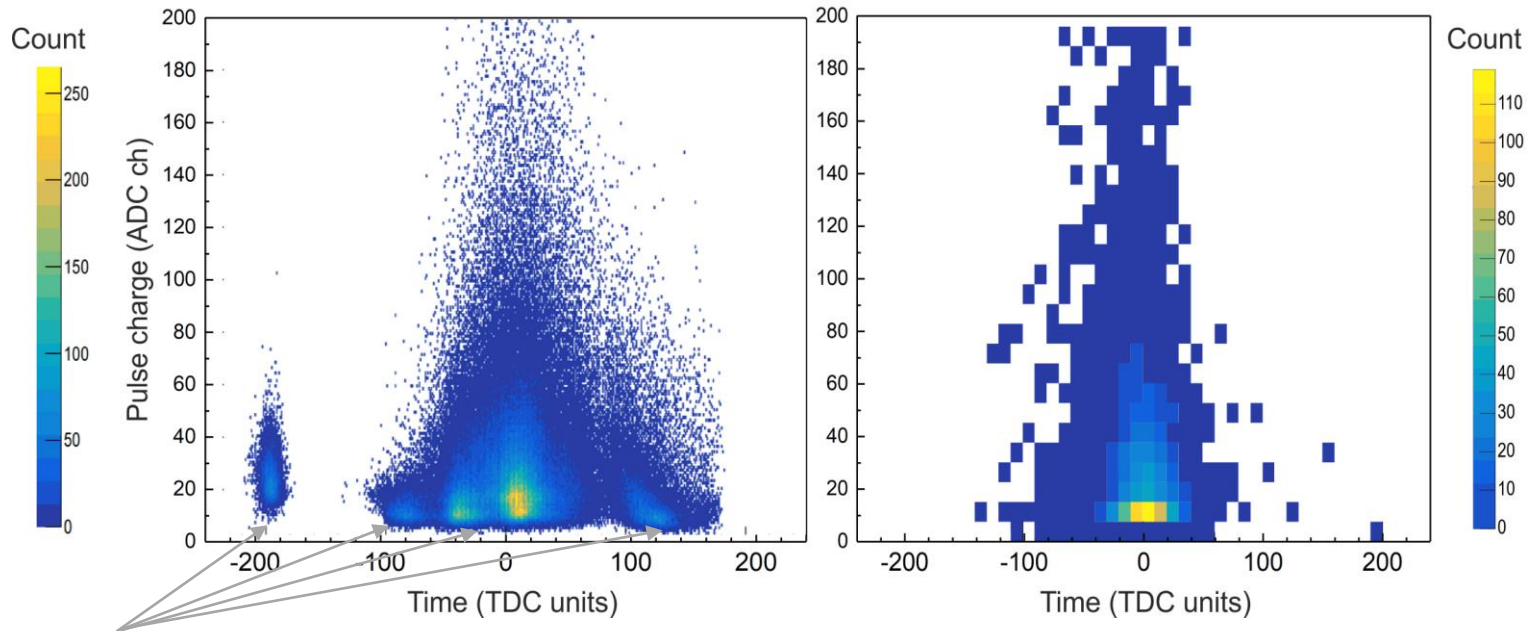
The Fast Interaction Trigger of ALICE

- FIT Processing Module – custom readout solution common for all three subsystems
- Few hardware fixes so far:
 - Replaced mezzanines in FV0 and FDD PMs to better match the bandwidth and accommodate a wider dynamic range;
 - Some cabling rework to minimize electrical reflections.

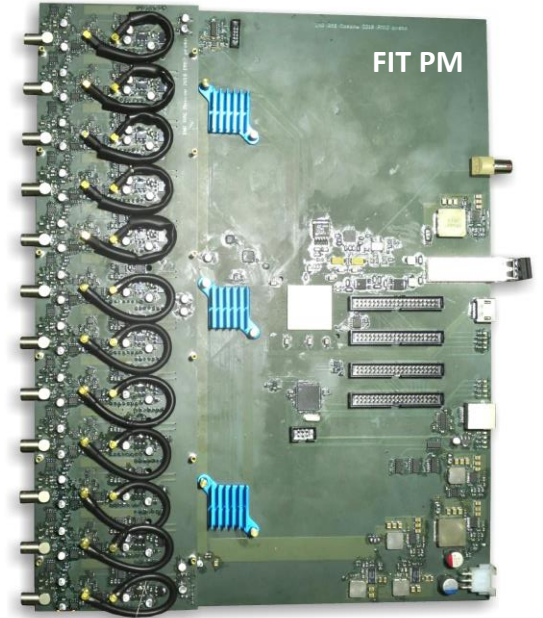
FV0 amp vs time spectra:

Default mezzanine

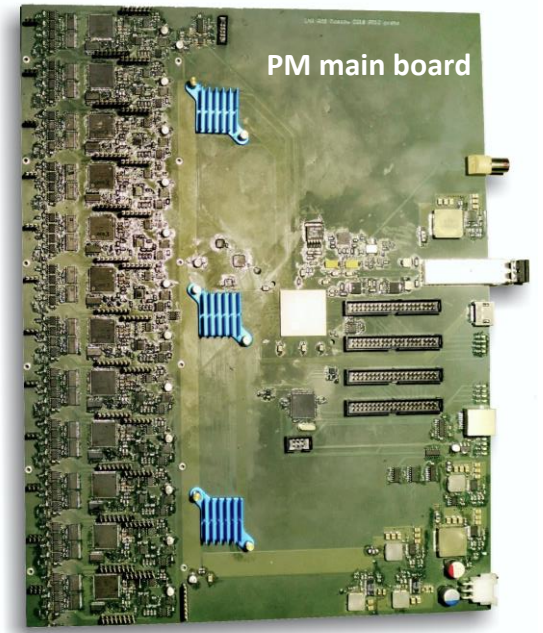
New mezzanine



Modulation caused by mismatch between the voltage comparator bandwidth with FM-PMT timing

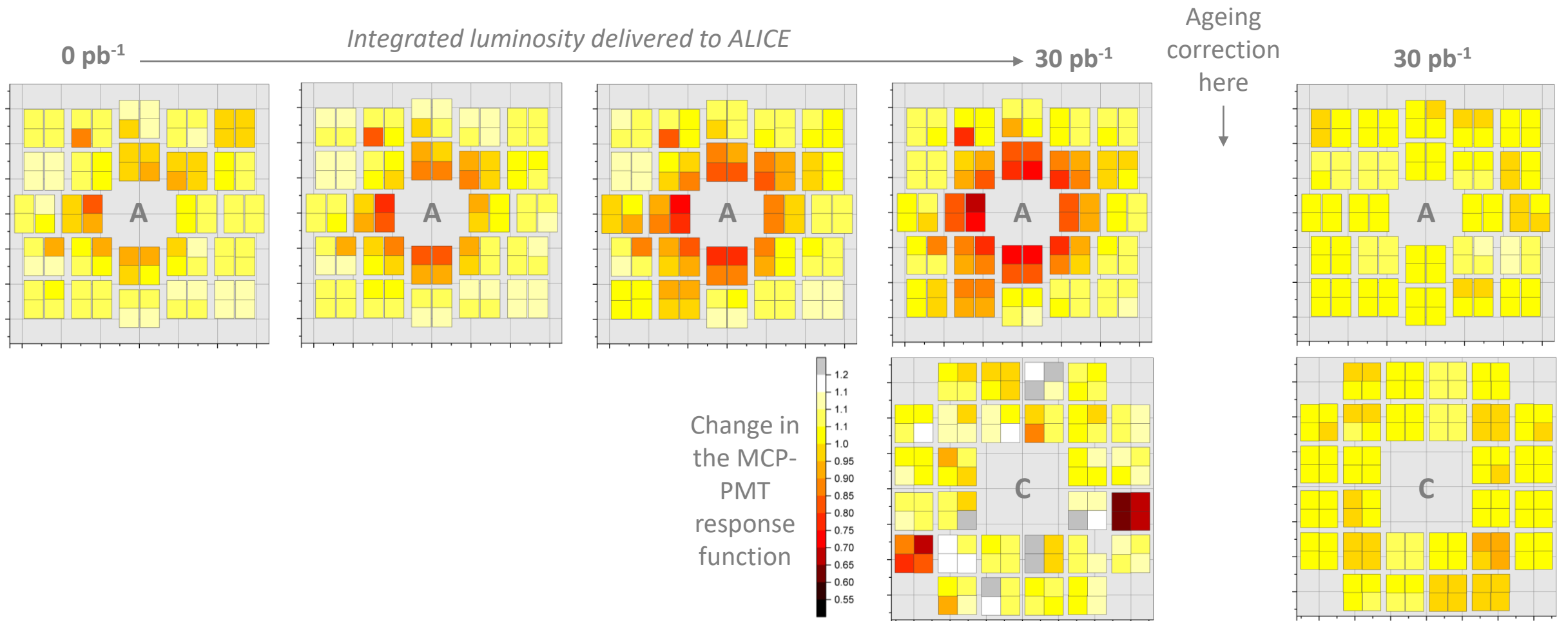


Mezzanine



The Fast Interaction Trigger of ALICE

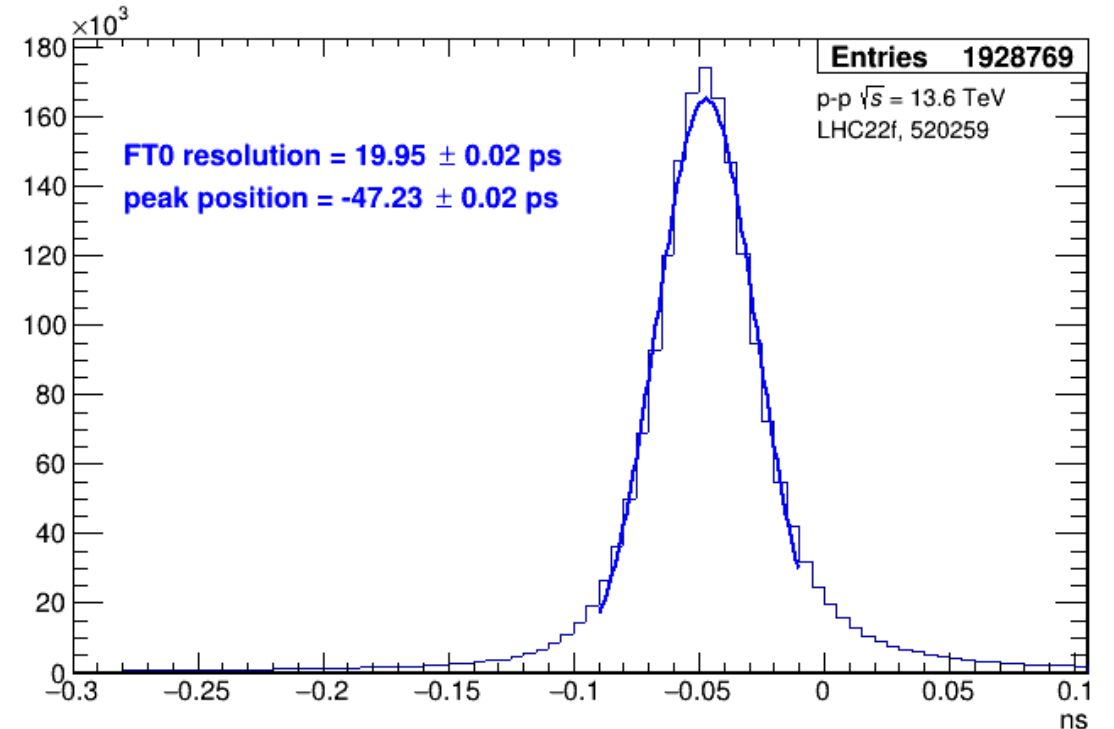
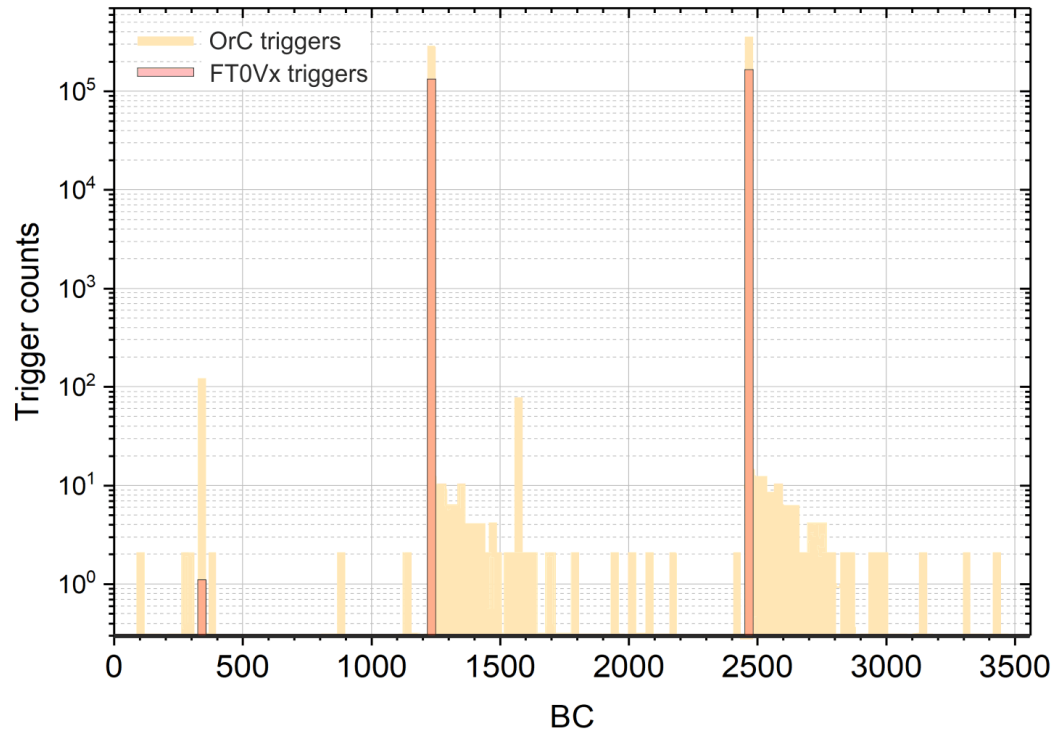
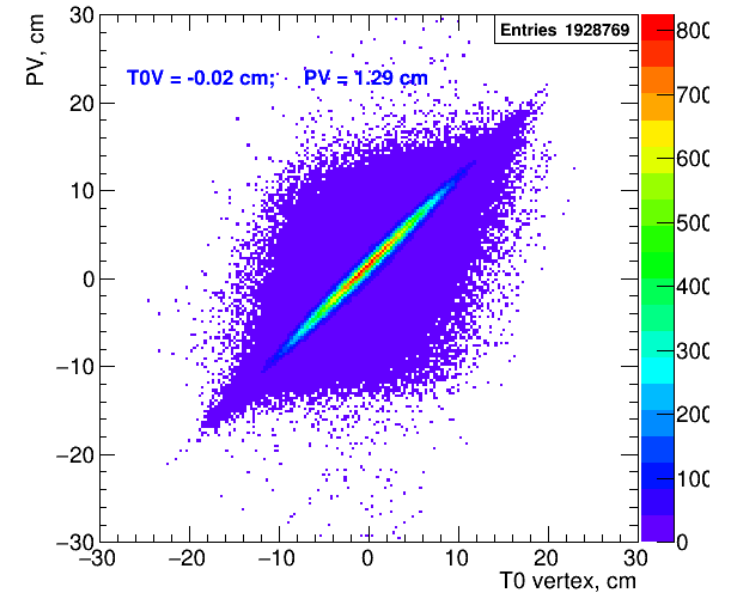
- ALICE operation at increased luminosity w.r.t. the planned one → **accelerated ageing of FT0 photosensors**:
 - Ageing correction techniques developed (tuning of 52 groups of 14 interdependent parameters);
 - First correction already performed;
 - Innermost photosensors to be replaced by spare units in few years from now.



The Fast Interaction Trigger of ALICE

Few values on FT0 performance:

- FT0Vx signal-to-noise ratio - better than **$1:10^5$** ;
- Time-zero resolution **$\sigma = 20$ ps** in *pp*, **$\sigma = 8$ ps** in *Pb-Pb*;
- Unambiguous correlation with the post-processed vertex position served by ITS.

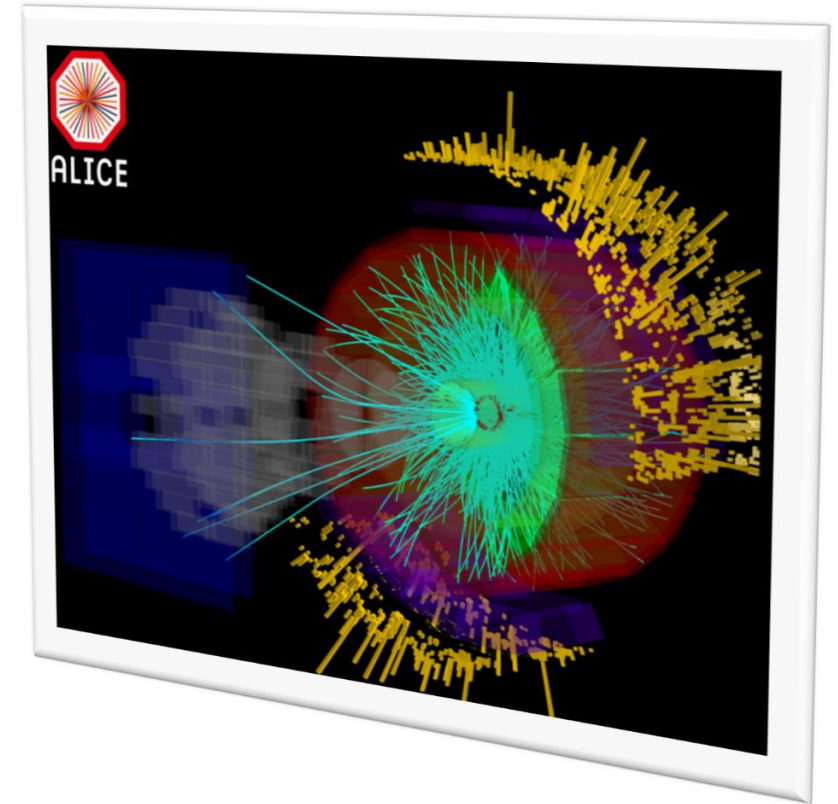


ALICE status and plans

- Target $\int L_{14 \text{ TeV } p-p}$ for 2022 achieved: **16.5 pb⁻¹** collected in spite of serious problems in LHC beam availability;
 - More pp data collected by ALICE in 2022 than in RUN1+2;
- **First VdM scan** of RUN3 successfully performed early in November;
- Inefficient LHC operation in August-September & December power savings → Pb-Pb run cancelled for 2022;
 - Instead, **Pb-Pb test beam** was held last week;
 - Target $\int L_{14 \text{ TeV } Pb-Pb} = \mathbf{13 \text{ nb}^{-1} \text{ still unchanged}}$ – longer Pb-Pb running time allocated in 2023, 2024 and 2025;
 - **No change** in plans for oxygen collisions in RUN3 (p-O & O-O);
- YETS starts in four days from now, first beam of 2023 – April 27th. Stay tuned!

First Pb-Pb collisions since 2018

- 2 fills-long test beam for the **detector commissioning** in real conditions;
- **all 15 ALICE detectors** taking data (ZDC commissioning finished just in time);
- **~50 Hz collision rate** only (x1000 lower than the target Pb-Pb collision rate);
- ~12h of stable beams, **~2 million collisions delivered**;



Conclusions

- **A remarkable year of ALICE operation came to its end:**
 - Hardware/firmware/software optimization and debugging throughout the entire year;
 - Still, pp data sample of a record size was successfully collected;
 - No $Pb-Pb$ data this year, but a good occasion for $Pb-Pb$ commissioning was provided.
- **A number of expectation vs reality discrepancies observed in the detectors performance (*average load, radiation damage, ageing, data size etc.*), but no show-stoppers so far;**
 - Looking forward to see some expectation vs reality discrepancies in data!
- **FIT was the last ALICE detector deployed in 2021. Still, successfully commissioned in time – serving the entire ALICE from the very first beams;**
 - Highest running efficiency from the very beginning;
 - Few successful hardware fixes to improve performance;
 - Plans for the detector activities in the next years being cleared up with the ageing observed.



Thank you for
your attention!



Part of FIT team at the latest ALICE week



Back-up slides

