

The ALICE Fast Interaction Trigger Upgrade

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on behalf of the ALICE Collaboration



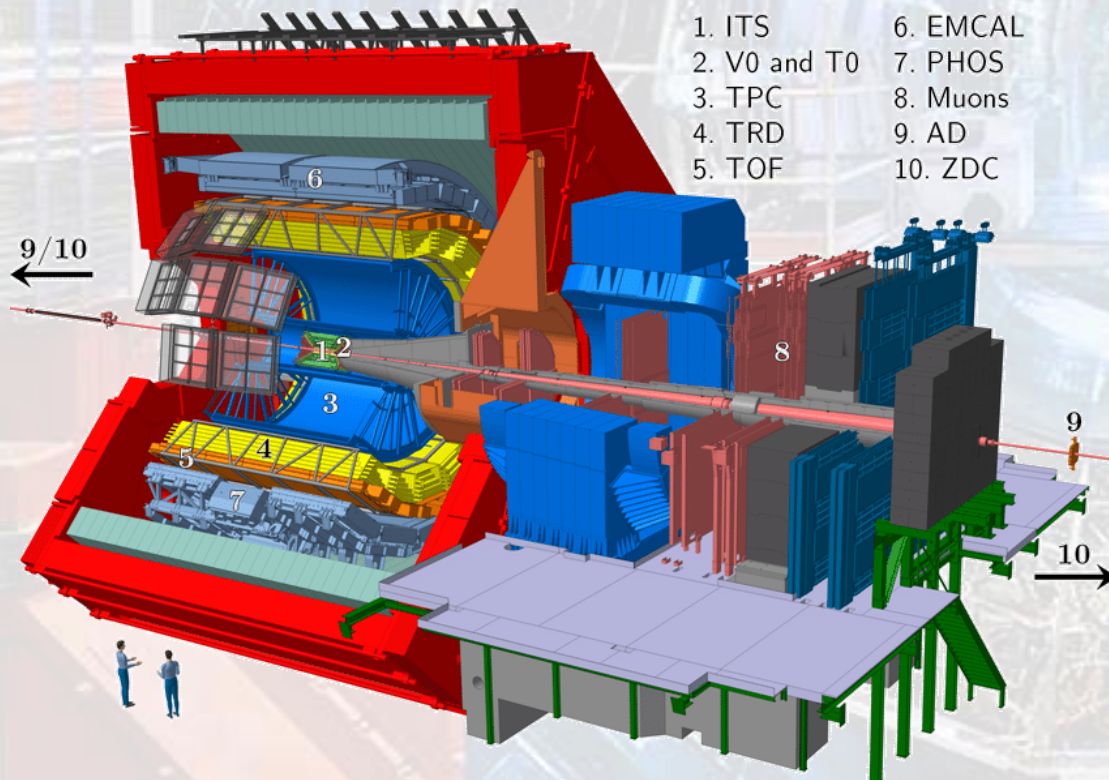
ALICE



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Challenges and upgrades

- Run 3 will start in the spring of 2022
- Expected maximal luminosity 10 times higher compared to Run 2
- Interaction rate: pp at 1 MHz, Pb-Pb at 50 kHz (3 TB/s data readout)
- Continuous readout operation or fast trigger needed for ALICE detectors
- Fast and efficient online event selection important



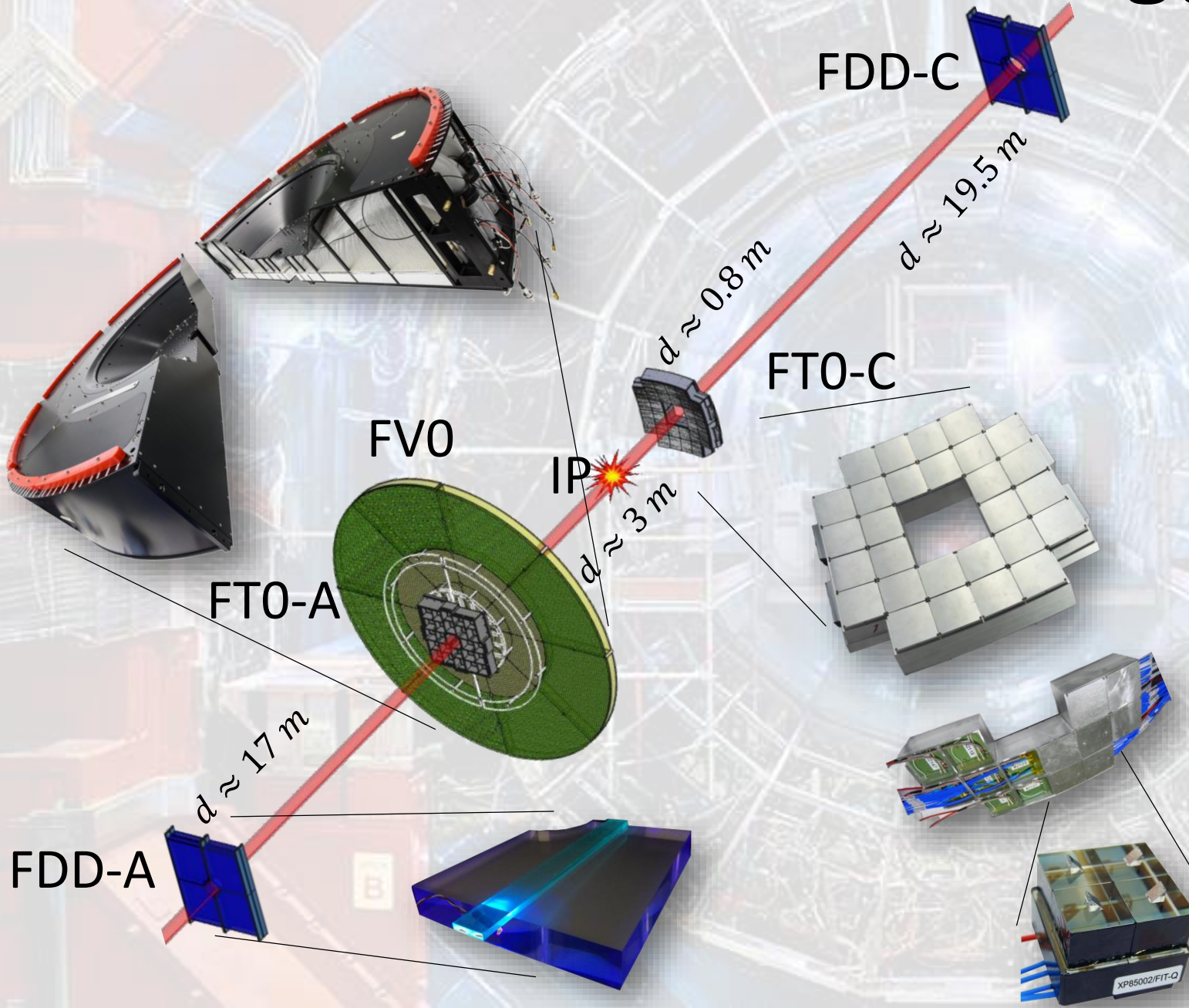
New and upgraded detectors:

- Inner Tracking System (ITS)
- Muon Forward Tracker (MFT)
- TPC: new GEM-based readout
- Fast Interaction Trigger (FIT)

Aim of the ALICE upgrade:

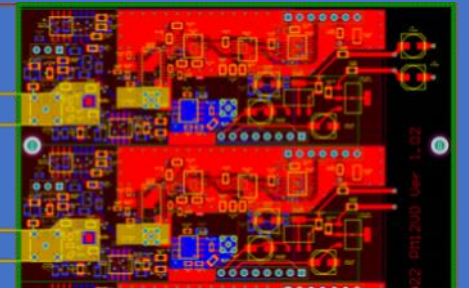
- Record min. bias Pb-Pb events
- Precise luminosity monitoring, feedback to LHC
- Enhanced tracking performance, centrality and event-plane determination
- Extended low- p_T reach (down to $p_T \approx 0$)

The Fast Interaction Trigger

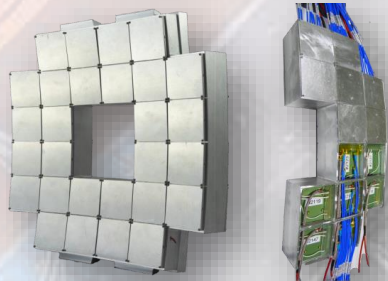


- Replacement for V0, T0, FMD, AD
- Main fast trigger
- Luminometer
- Measure the collision time for ToF based PID
- Multiplicity, centrality, reaction plane determination
- Large pseudorapidity coverage

Front-end electronics



FT0



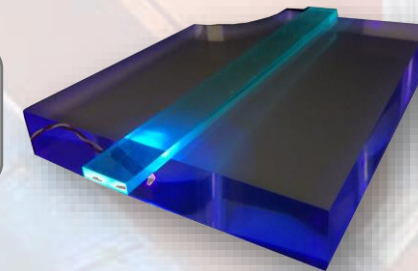
- ~ 0.8 m and ~ 3 m from IP
- 24 and 28 Cherenkov modules
- $3.8 < \eta < 5.0$ and $-3.4 < \eta < -2.3$
- Time resolution: ~ 33 ps
- Min. bias trigger, luminometer, online vertex determination
- Collision time for ToF PID

FV0



- ~ 3 m from IP, ~ 1.5 m diameter
- Divided into 5 rings and 8 segments
- 40 plastic scintillators, 48 readout
- $2.2 < \eta < 5.1$ equally divided rings
- event plane and centrality determination
- 1 MIP resolution **150 – 300 ps**
- Dynamic range: 1 – 300 MIP

FDD

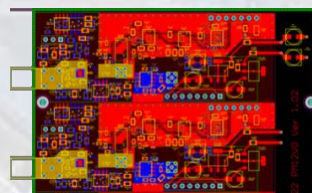


- +17 and -19.5 m from IP
- 2 arrays of double-layered scintillators
- $4.7 < \eta < 6.3$ and $-4.9 < \eta < -6.9$
- Trigger, luminosity, beam monitoring, physics tagging (diffractive, photo-induced reactions)
- 1 MIP resolution **300 – 400 ps**

PM: process detector signals

- Amplitude
- Time information
- # active channels

FEE



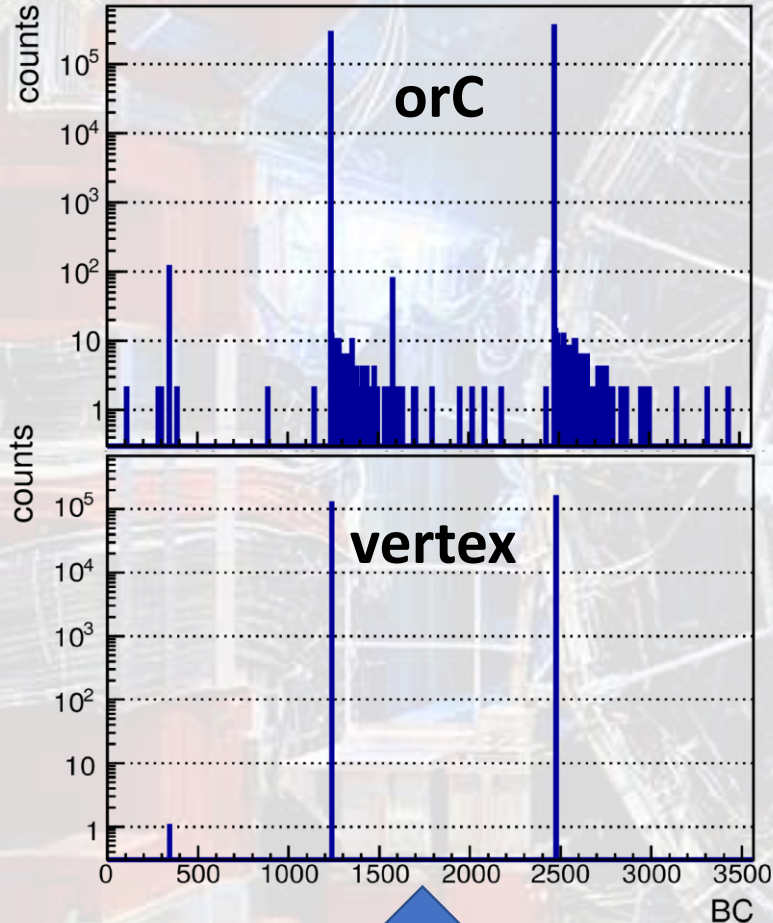
TCM: form trigger signal

- Mult. trigger based on sum/side
- At least one hit / side: orA and orC
- Vertex trigger use additional timing info

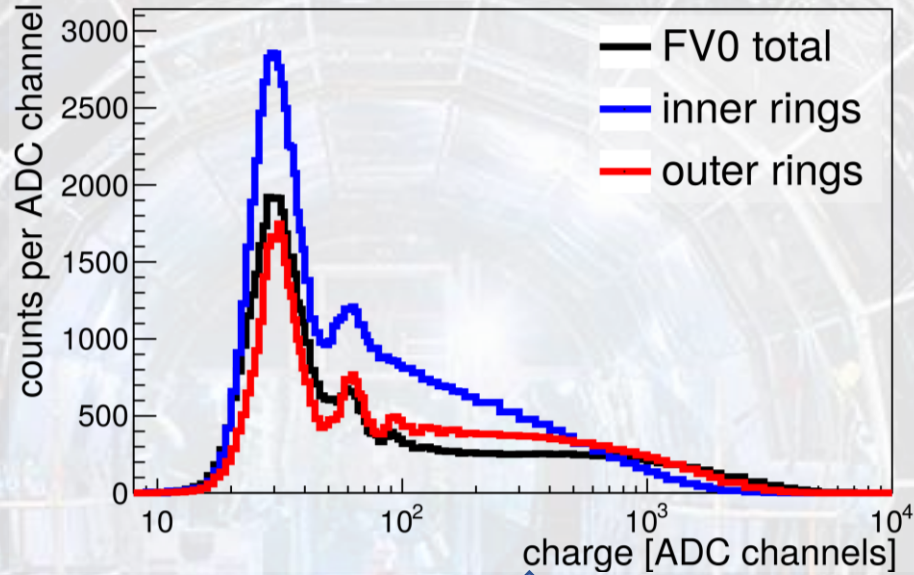
Central Trigger Processor

- MB in p-p and p-Pb trigger with forward particles
- multiplicity trigger
- vertex trigger/selection
- rejection of beam gas events
- UPC diffractive event selection

FIT pilot beam results (2021)

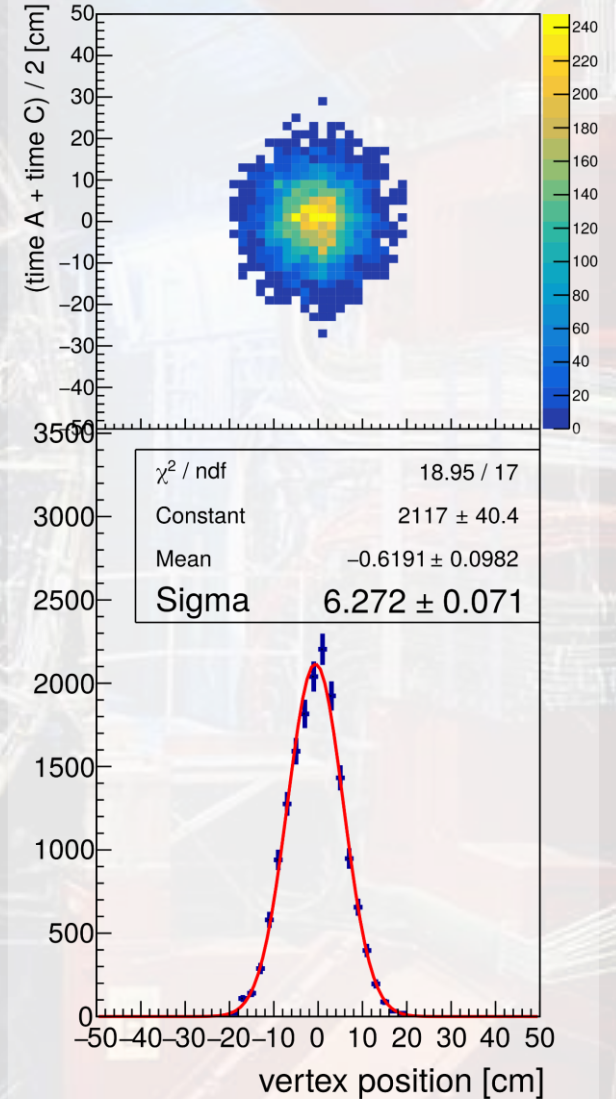


orC: at least one hit on side C
 vertex: in a predef. vertex range & orA & orC
 vertex trigger is stricter → better performance



FV0 total, inner- and outer-ring charge amplitudes

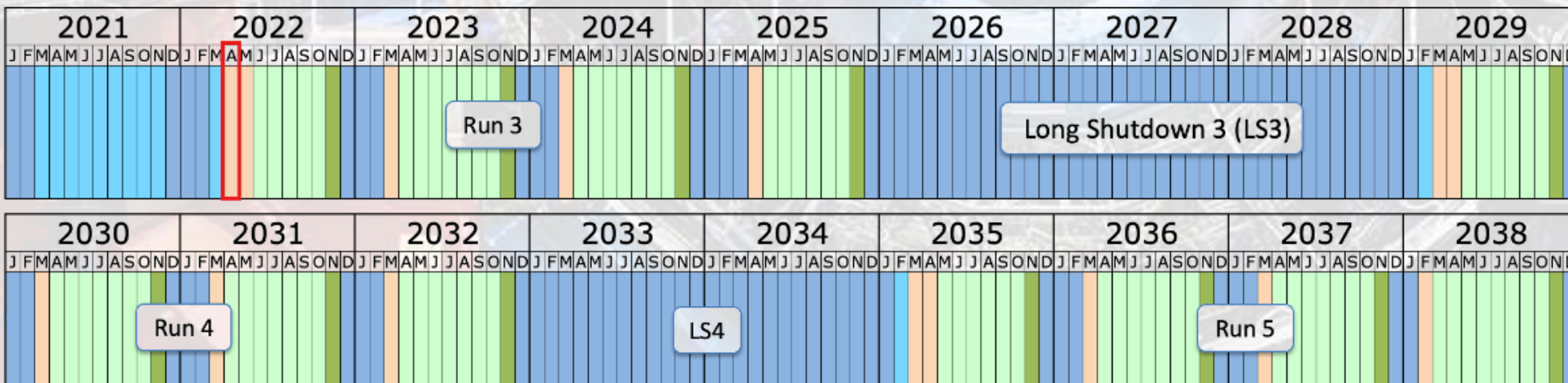
FT0 vertex position and time resolution



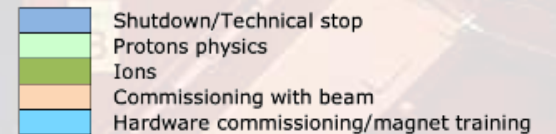
Summary

- Challenging Run 3 conditions
 - Major upgrade of ALICE
 - Four new/upgraded detectors: FIT, TPC, ITS, MFT
- Pilot beam results: FIT works as expected
 - FIT role in trigger, monitoring and physics analysis
 - Preparations for Run 3 continue, busy months ahead

Thank you for
your attention!



LHC running schedule



Last updated: January 2022