

ALICE Upgrade and Latest Data Analysis

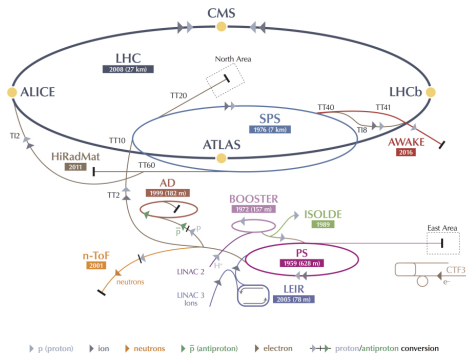
Hesounová

FNSPE CTU, June 2022

Table of Contents

- LHC and ALICE
- ALICE Upgrade
 - ITS
 - TPC, FIT, MFT
 - O²
- First Data of LHC Run3
- Data Analysis
 - Z_{vtx} Reconstruction
 - Charge of the Detected Particles
 - Phi-eta Distribution
 - Multiplicity
- Conclusion

CERN's Accelerator Complex



LHC Large Hadron Collider SPS Super Proton Synchrotron PS Proton Synchrotron

AD Antiproton Decelerator CTF3 Clic Test Facility AWAKE Advanced WAKEfield Experiment ISOLDE Isotope Separator OnLine DEvice

LEIR Low Energy Ion Ring LINAC Linear ACcelerator n-ToF Neutrons Time Of Flight HiRadMat High-Radiation to Materials

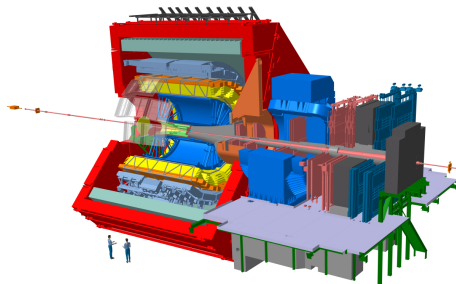
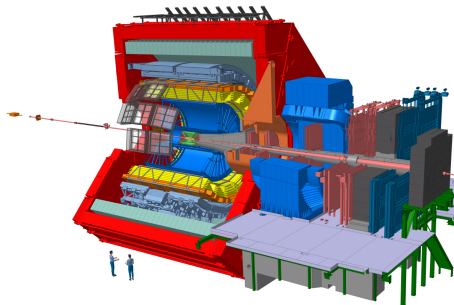
© CERN 2019



ALICE Upgrade

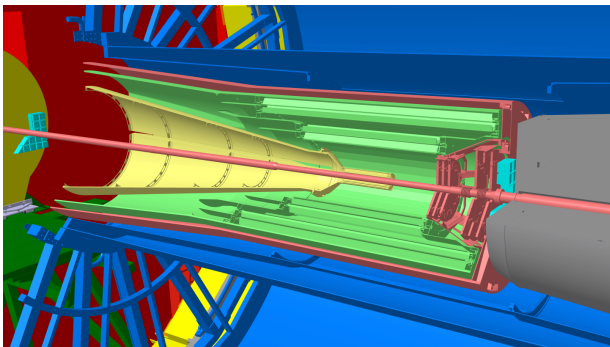
- Long Shutdown 2 (2019-2021)
- Increase in interaction rate: from 8 kHz to 50kHz for lead-lead
- Continuous readout, new software for analysis: Online-Offline (O^2)
- Upgrade of old detectors, adding the Muon Forward Tracker (MFT)

[2],[3]



ALICE Upgrade: ITS

- Inner Tracking System
- Whole structure changed: 3 inner, 4 outer layers of pixel detectors
- Improved vertex reconstruction and determination of the DOCA
- New measurements of charm and beauty production: low p_T region
- Whole tracks reconstructed from ITS information



ALICE Upgrade: TPC, FIT, MFT

[4],[5]

Time Projection Chamber

- Continuous readout
- MultiWire Proportional Chambers replaced with Gas Electron Multipliers

Fast Interaction Trigger

- Improved trigger efficiency
- Minimum bias trigger and multiplicity-based trigger

Muon Forward Tracker

- Higher spatial resolution of tracks
- Stronger background muons rejection

ALICE Upgrade: O²

[6]

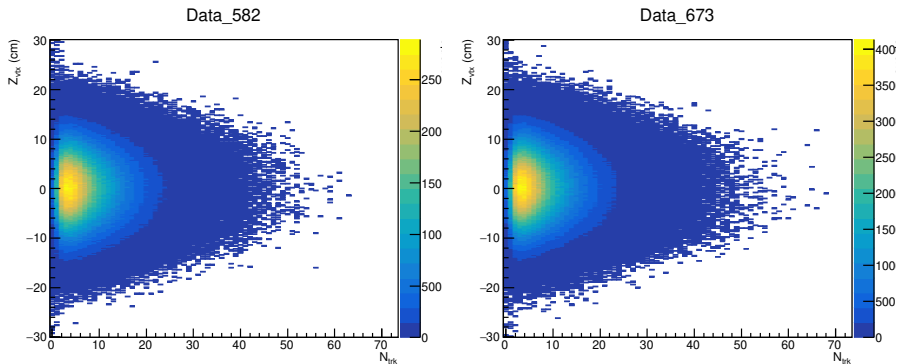
- Continuous readout and higher interaction rate
- Replacement of High Level Trigger and offline analysis software
- In collaboration with GSI
- Data compression and partial event reconstruction
- Transport Layer FairMQ: communication among devices
- O² Data Model: description of sent messages
- Data Processing Layer: creation of optimized topology for a given process
- The complexity of the software is hidden from the end user

First Data of LHC Run3

- Pilot beam $\sqrt{s} = 0.9$ TeV (September 2021)
- Two runs with different polarity of the L3 magnet (run505582 -, run505673 +)
- Analysis is a work in progress
- Data acquired for calibration and testing
- No special effort to make collisions, yet about 10^5 detected for each polarity of the L3 magnet

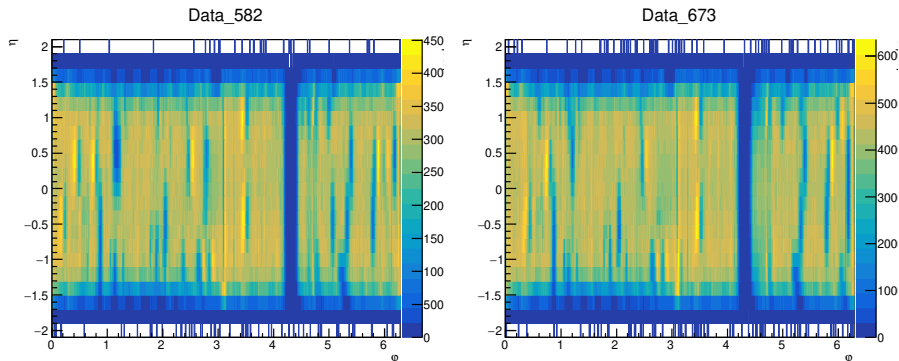
Data Analysis: Z_{vtX} Reconstruction

- Exact efficiency yet to be determined, dependent on vertex position and on event multiplicity
- Only difference is density: more events detected and selected



Data Analysis: Phi-eta Distribution

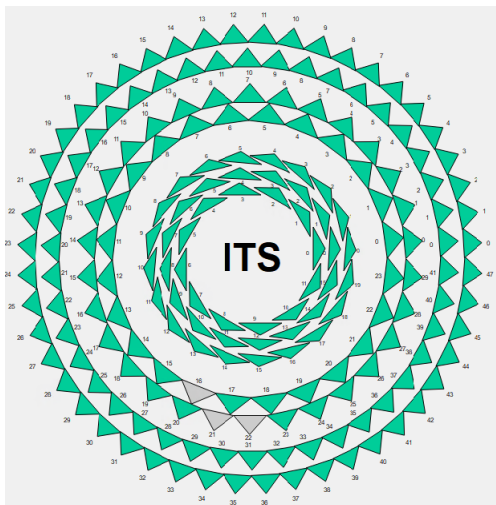
- Only significant difference is density: more events detected and selected
- Unexpected hole around 4.5 in φ : detector deficiency



Data Analysis: ITS deficiency

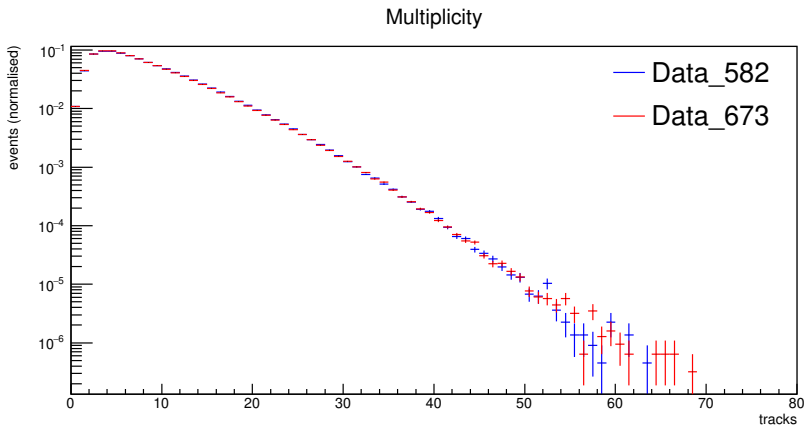
- Some staves off: inconclusive measurements
- Problem with flash memory and misalignment

[7]



Data Analysis: Multiplicity

- Perfect validation tool for detectors and software: smooth evolution
- The number of events decreases with increasing multiplicity
- No significant difference between runs



Conclusion

- No significant differences between runs with different L3 polarity
- A misalignment problem with the ITS detected
- New detectors and new software calibrated
- Final results on efficiencies are yet to be determined
- Acquired data are in agreement with MC simulations and with expectations

Sources

- [1] The CERN accelerator complex, [online], URL: <http://cds.cern.ch/images/OPEN-PHO-ACCEL-2013-056-1>, (visited on 03/12/2022).
- [2] A Large Ion Collider Experiment, [online], URL: <https://alice-collaboration.web.cern.ch/>, (visited on 03/12/2022).
- [3] ALICE Schematics, [online], URL: <https://cds.cern.ch/record/2263642>, (visited on 03/12/2022).
- [4] Maciej Slupecki, The Fast Interaction Trigger for the ALICE Upgrade, In: JYU dissertations (2020), URL <https://jyx.jyu.fi/handle/123456789/69664>.
- [5] Adolfosson, J. et al, The upgrade of the ALICE TPC with GEMs and continuous readout, [online], URL: <https://cds.cern.ch/record/2758225/>, (visited on 03/12/2022).
- [6] Giulio Eulisse, Piotr Konopka, Mikolaj Krzewicki, Matthias Richter, David Rohr, Sandro Wenzel1, Evolution of the ALICE Software Framework for Run 3, In: EPJ Web of Conferences 214, 05010 (2019), DOI: 10.1051/epjconf/201921405010.
- [7] Jian Liu, ITS pilot beam test and upcoming plans, (RC meeting 09/11/2021)

Thank you for your attention.