First results with Muon Forward Tracker in pilot pp collisions at LHC ALICE

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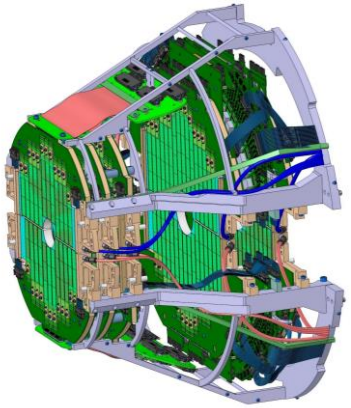
Quark matter 2022

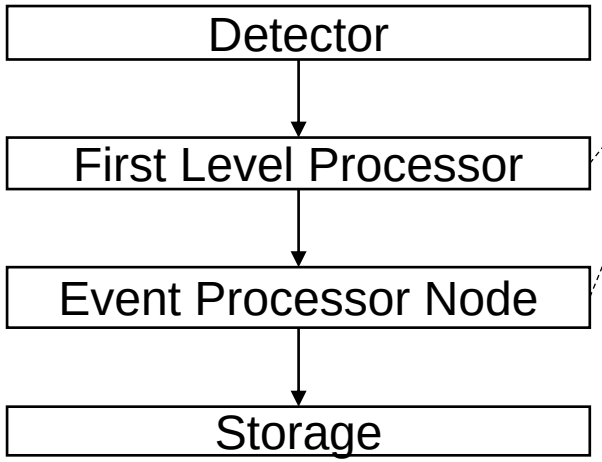
8th April

First Data Taking of pp collisions with new Detector and new computing system

New



Muon Forward tracker (MFT)

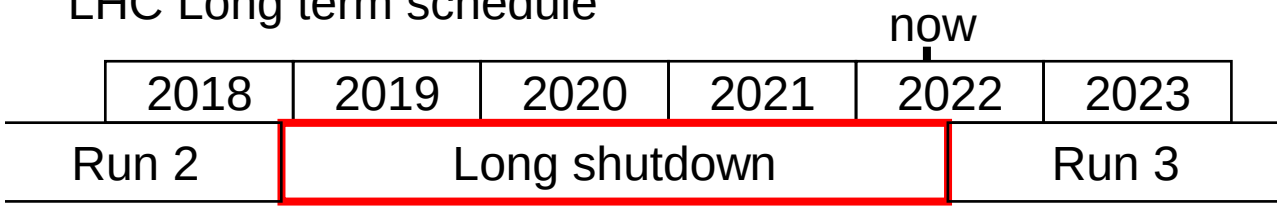


Online-Offline computing system (O^2)

Online data reduction

- Data processing like calibration and reconstruction are performed online, and raw data not stored
- Continuous readout (triggerless)

LHC Long term schedule



Outline of Pilot beam

October 2022

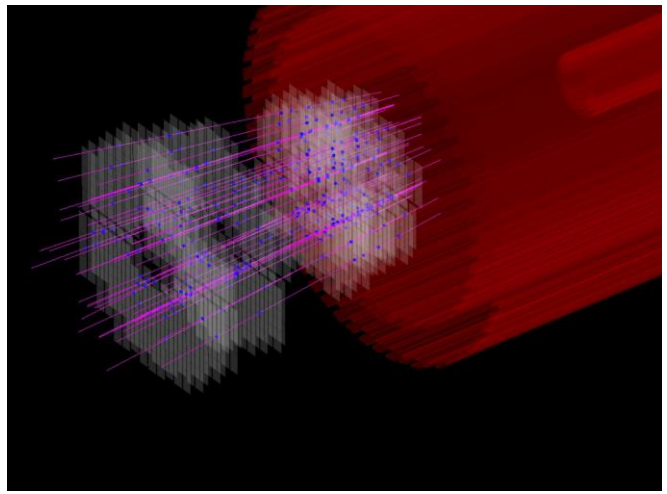
pp collisions $\sqrt{s} = 0.9\ \mathrm{TeV}$

Total Time : ~ 28 hours

Readout rate : ~ 5 GB/s

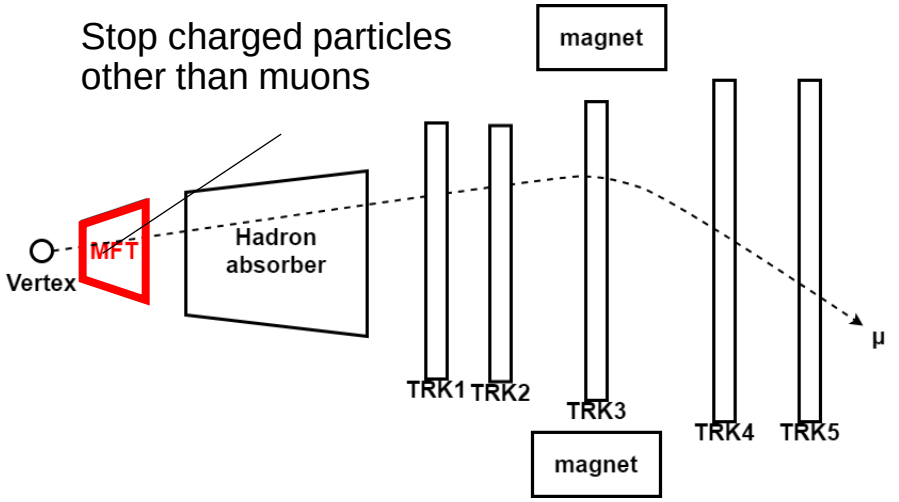
Readout Strobe : 202 kHz (length = 4.8 μs) → Continuous

Event display with MFT tracks



ALICE Upgrade

Muon Forward Tracker (MFT)



Installed in the forward area near the interaction point

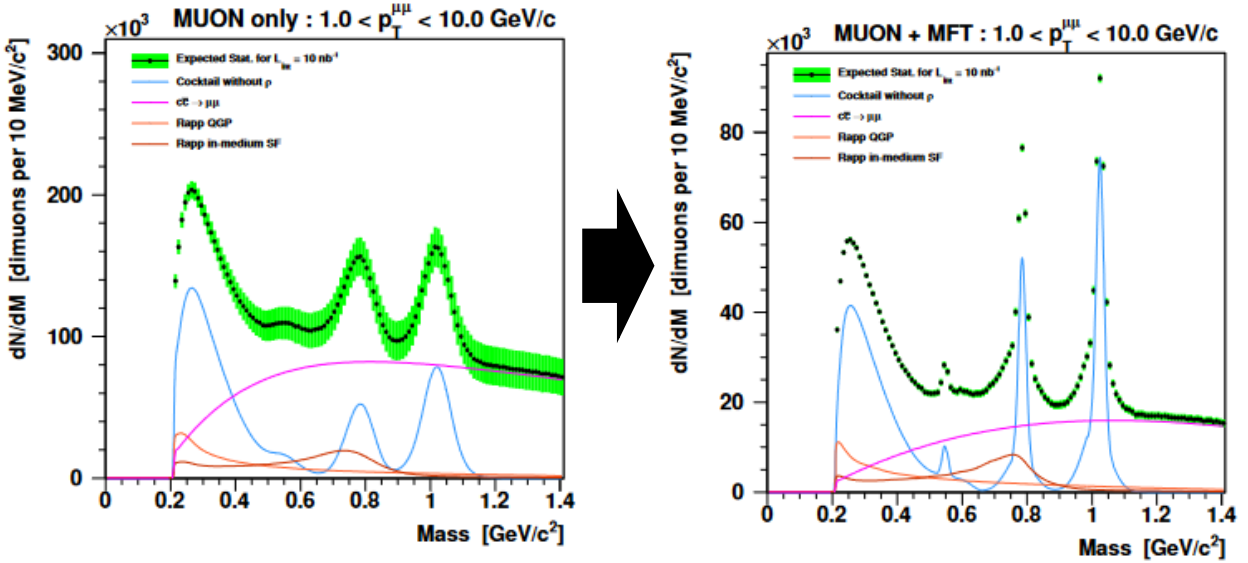
- Measure muons before they enter the hadron absorber
- Improve the pointing resolution and secondary vertex separation

New silicon chips with MAPS technology (ALPIDE)

- Pixel size= 27 x 27 μm^2
- Position resolution ~ 5 μm

Physics motivations

- Identification of prompt J/ψ and B-decayed J/ψ
- Separate charm and bottom
- Improve low-mass dimuon measurement



Expected low-mass dimuon spectrum

Ref. CERN-LHCC-2013-014;LHCC-I-022-AOD-1

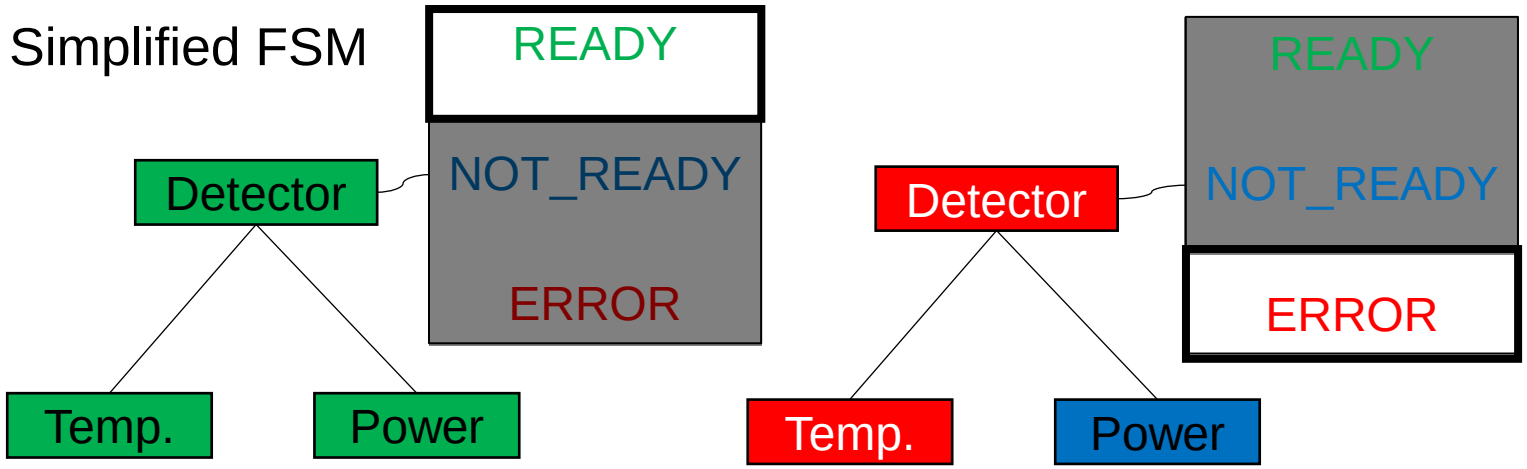
Detector Operation

Stable detector operation was guaranteed by Detector Control System (DCS)

- MFT DCS is integrated into the O^2
- SCADA: Collect all information for detector control
- Comprehensive control by Finite State Machine (FSM)

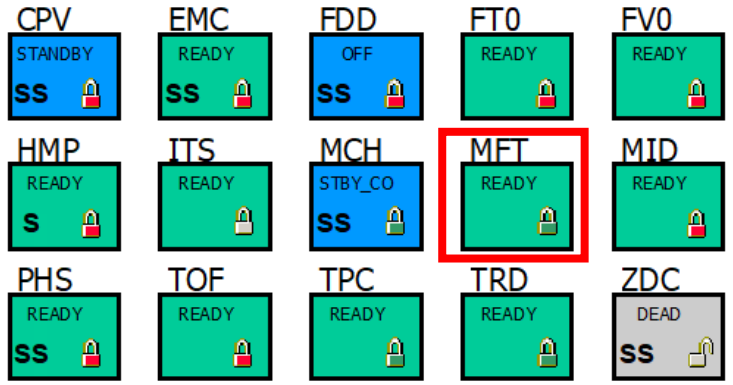
Simultaneous communication of physical data, control data, and timing information

Simplified FSM



Temp. is OK & Power is ON -> READY

Temp. is ERROR -> ERROR -> Power goes OFF



MFT DCS is integrated to the ALICE central system

Operation and condition monitoring during pilot beam was performed using FSM.

- FSM made detector operation easy and reliable during pilot beam
- The detector status data is saved and used to process physics data

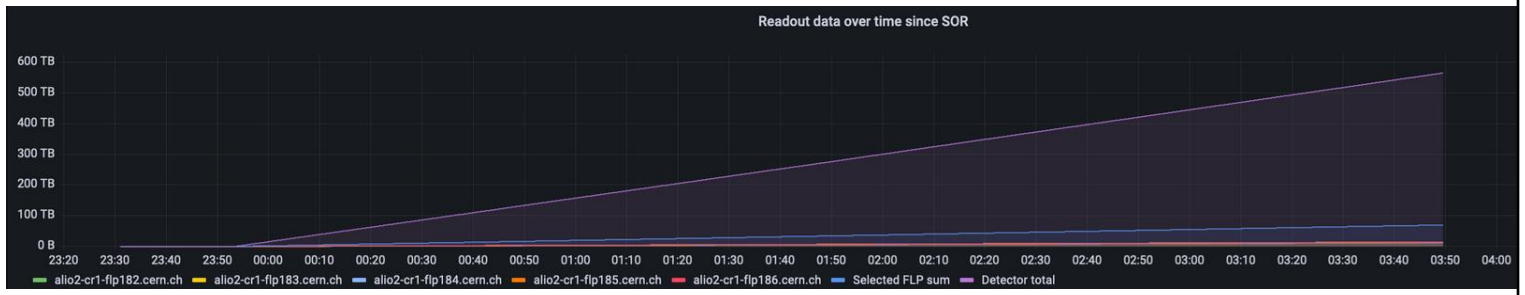
Ref. K. Yamakawa et al 2020 JINST 15 T10002

Readout

Stable readout was confirmed in various settings

- 3 magnetic configuration (L3/Dipole = +/+,-/-,0/0)
- MFT standalone run, global run with other detectors
- Readout configuration (noise masking, bunch crossing selection)

Integrated data readout

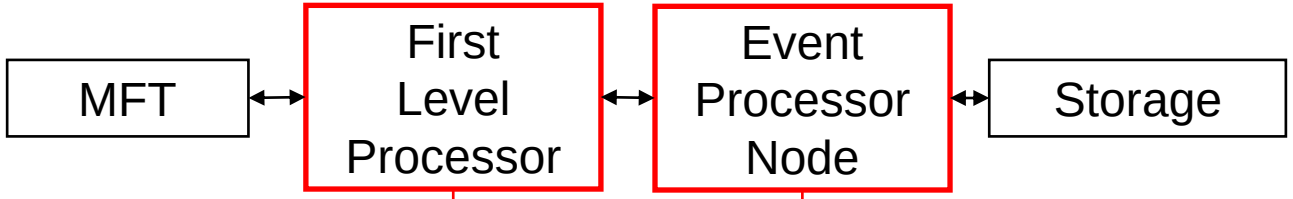


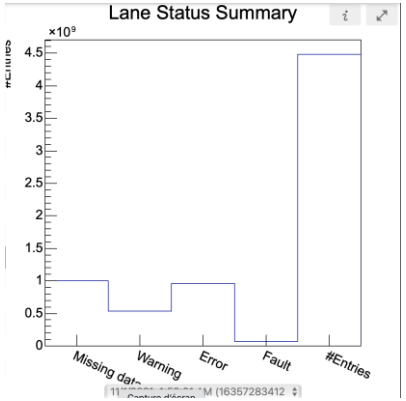
~ 4 hours（the longest single run）

MFT represented about 1/8 of total data readout

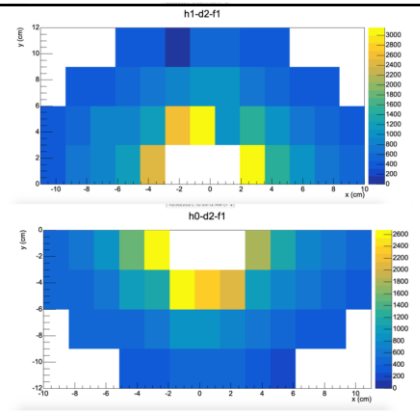
Quality Control

Sampled of acquired data in O^2 workflow, then processed online or offline





Status of readout lane

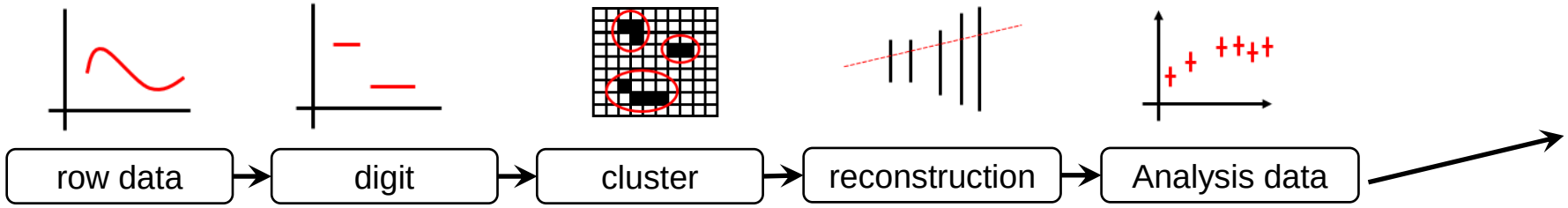


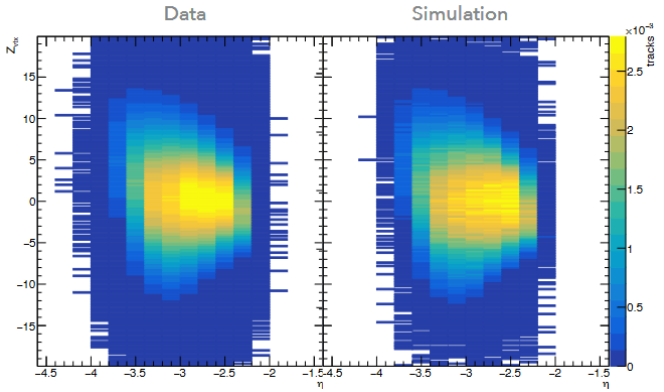
Chip occupancy

Analysis for the performance check

Data processing and analysis acquired with the pilot beam

➢ Online data processing through O^2 workflow and it outputs analysis data





Z Vertex vs pseudorapidity

Summary

For the next run starting on May 2022,
MFT was commissioned through pilot pp collisions

- Confirmed the detector operation and data processing with MFT and O^2
- Final adjustments and missing parts are being developed