

Look-see at pilot data for Run 3 at ALICE

Miles Kidson

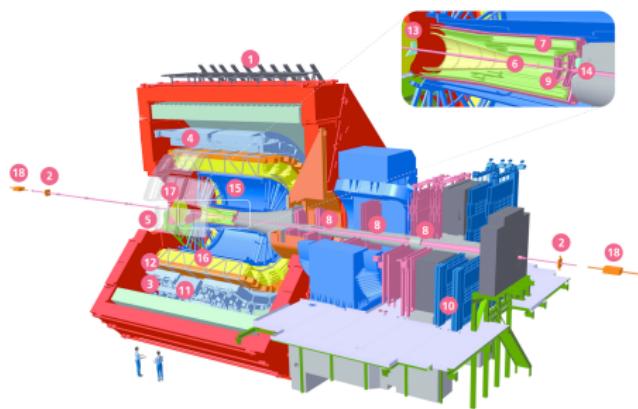
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Honour's Research Project
2022



ALICE Run 3 Detector Array

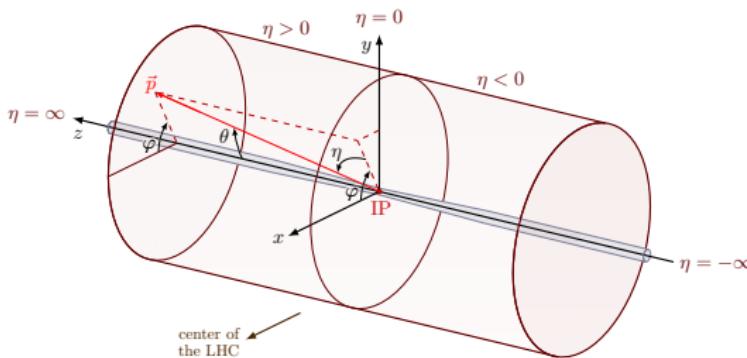


- Run 3 added the MFT and upgraded the ITS, as well us upgrading the readout electronics for many detectors
- The analysis framework was upgraded to handle increased energy, luminosity, and continuous data capture
- The MFT (9), ITS (6, 7), and Muon Spectrometer (8) are of interest to us



Coordinate System

- φ : Azimuthal angle around beam axis
- Z : Distance along Z -axis (cm)
- θ : Polar angle



- p_T : Transverse momentum (GeV/c)

$$p_T = \sqrt{p_x^2 + p_y^2}$$

- y : Rapidity

$$y = \frac{1}{2} \ln \frac{E + p_z}{E - p_z}$$

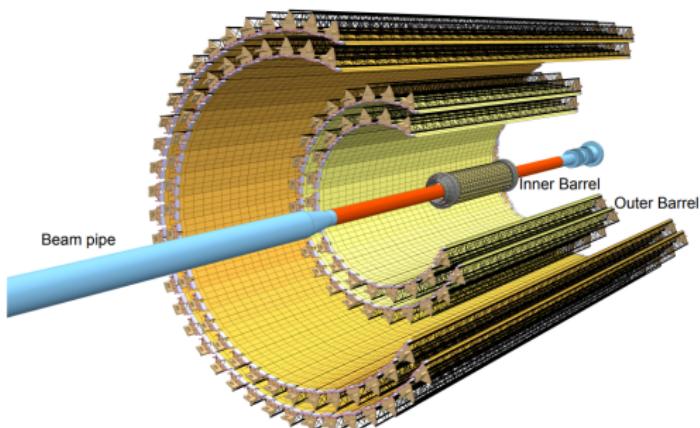
- η : Pseudorapidity

$$\eta = -\ln \tan \frac{\theta}{2}$$



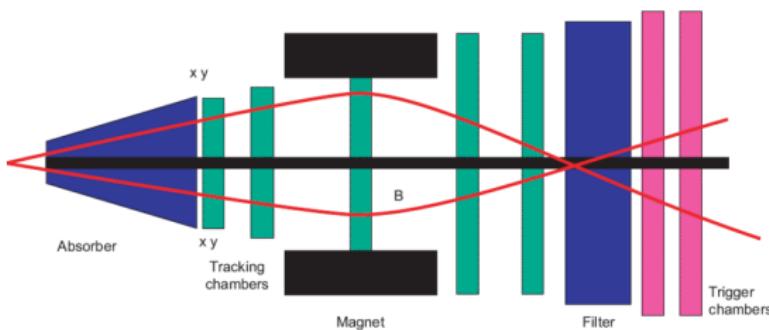
Inner Tracking System (ITS)

- Upgraded for Run 3
- Innermost layer half the distance from the IP compared to previous ITS
- Si-based tracking detector. Determines primary vertex for an interaction
- 22.4 mm to 391.8 mm radial extension from IP
- Covers $|\eta| < 1.22$



Muon Spectrometer (MCH)

- Used to study heavy quarkonia (J/Ψ , Ψ' , Υ , Υ' , Υ'') via their $\mu^+ \mu^-$ decay channel, Z^0 bosons via high p_T dimuon decays, and single muon decays from quarks and W^+ bosons

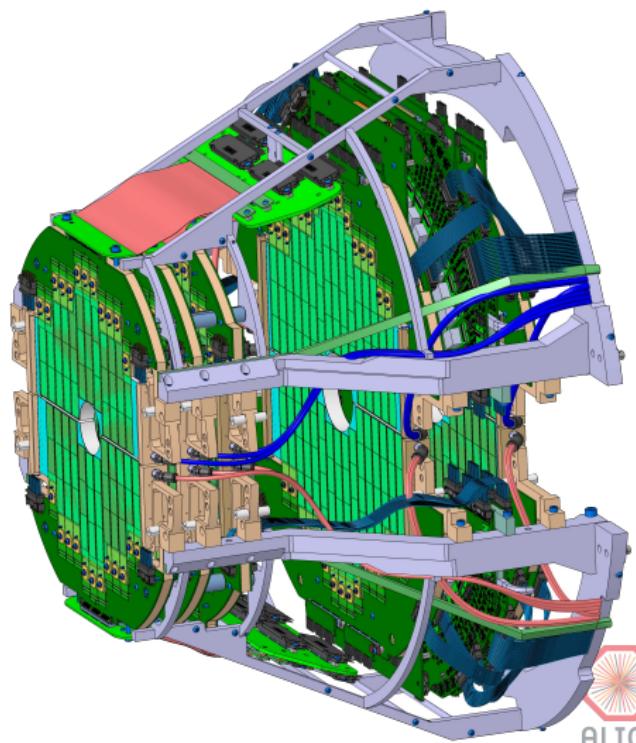


- Covers $-4 \leq \eta \leq -2.5$
- Outside the range of the ITS so in Run 2 had to perform its own tracking and vertexing
- Run 3 added the MFT before the absorber to fill this role



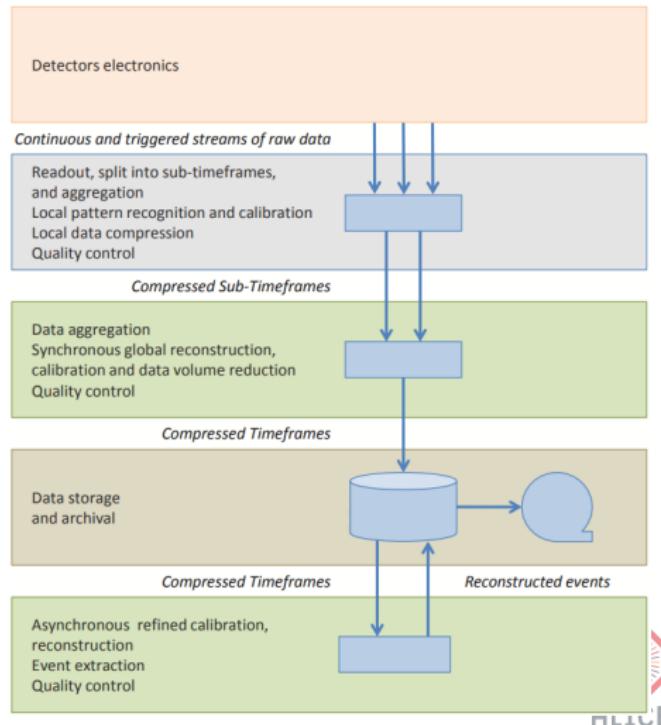
Muon Forward Tracker (MFT)

- High resolution Si-based tracking detector added for Run 3
- Uses the same pixel detector technology as the ITS in a better-suited geometry
- Sits before the hadronic absorber, with 5 double-sided layers between -46 cm and -76.8 cm
- Covers $-3.6 \leq \eta \leq -2.45$

 ALICE

Online-Offline Analysis Framework (O2)

- Created for Run 3 to deal with untriggered data capture, splitting it into 10 ms “timeframes”
- Raw data converted to usable data with “reconstruction passes”
- Then analysed with C++ and ROOT for efficient memory and CPU usage
- Don’t breathe near O₂, or it might break

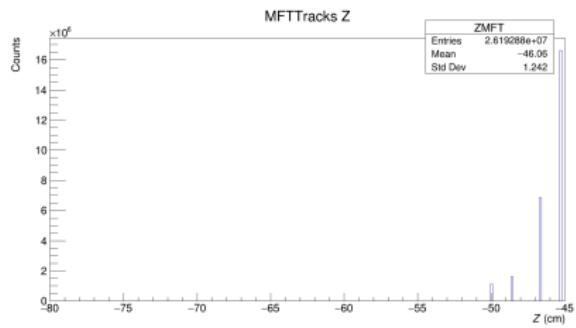
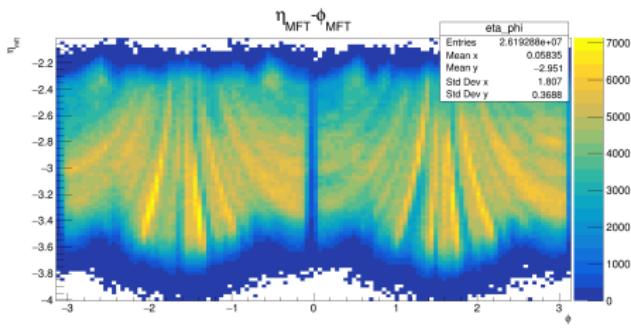
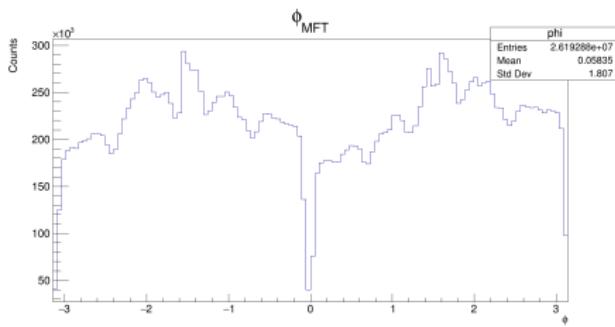
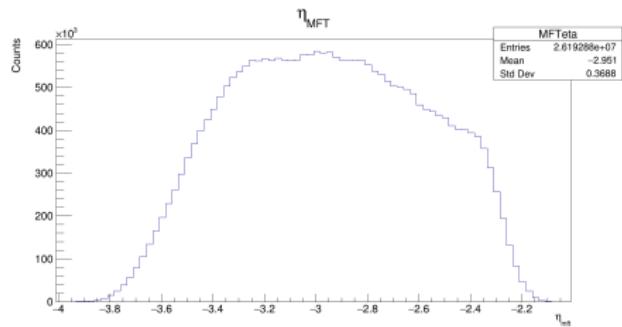


What data are we using?

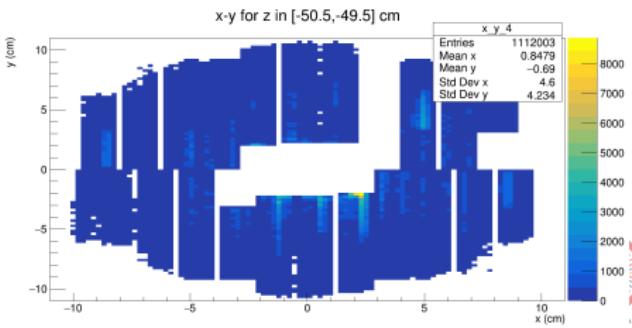
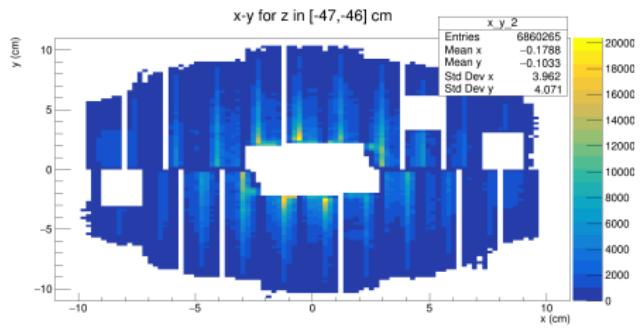
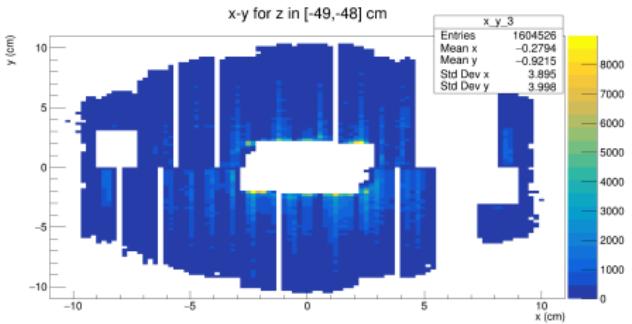
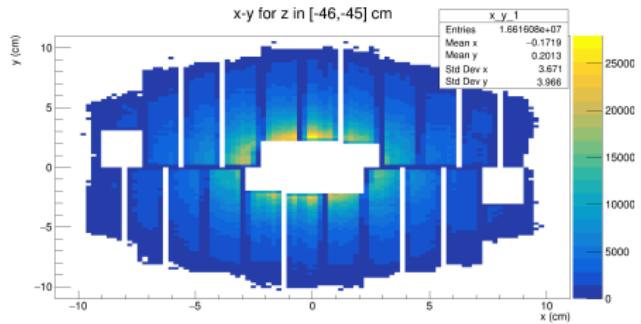
- Using pilot beam data from October 2021
- Non-nominal centre of mass energy $\sqrt{s} = 900 \text{ GeV}$
- Runs 505548 and 505645
- Detectors running: ITS, MCH, MFT, MID, TOF, TPC, TRD



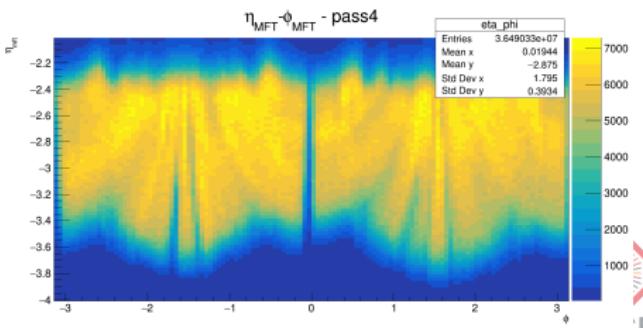
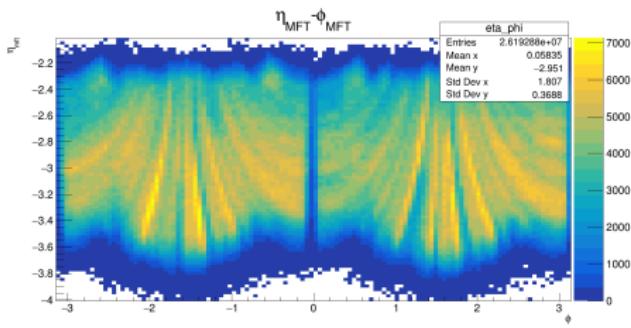
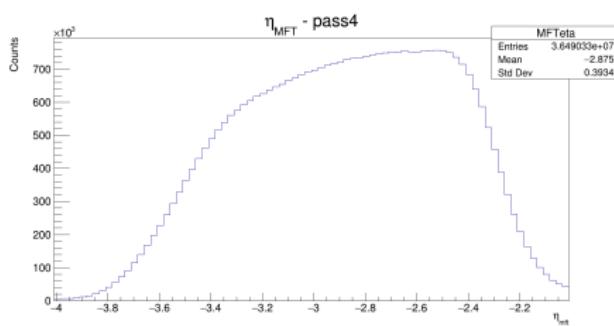
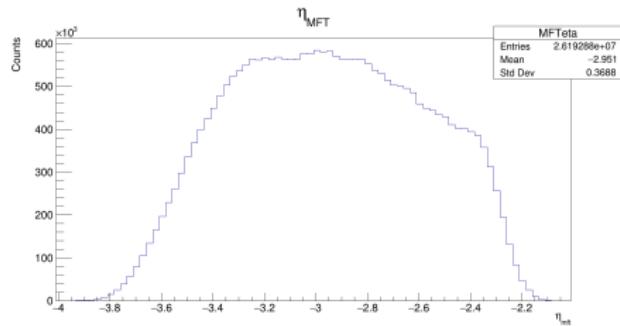
MFT Kinematics (pass3)



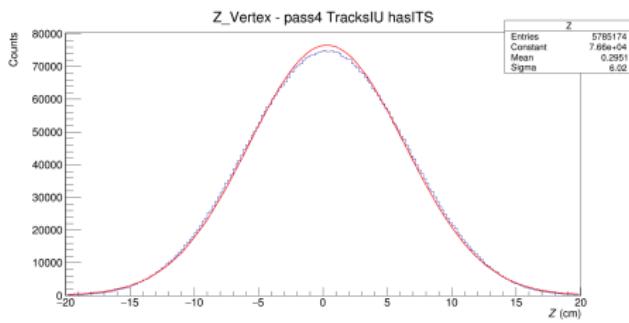
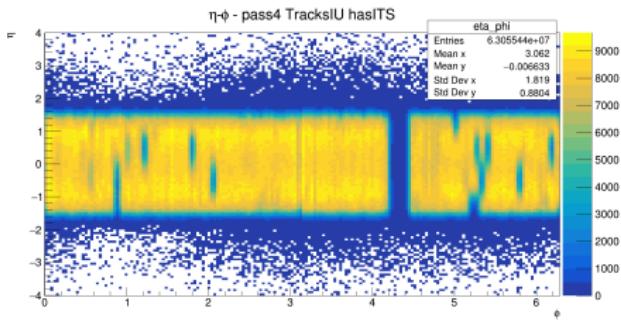
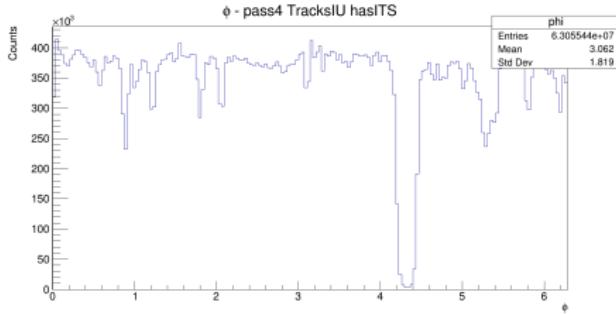
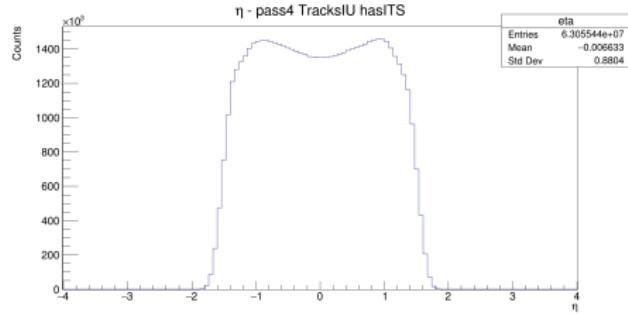
MFT x-y plots



MFT Kinematics pass3 vs. pass4



ITS Kinematics



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Next Steps

- Why does Z_{MFT} only show the first two disks?
- What is different about pass4?
- Was ITS working properly/what is that gap in the data?
- Write my silly little report

