

A preliminary analysis of data from ALICE's new ITS and MFT detectors

Miles Kidson

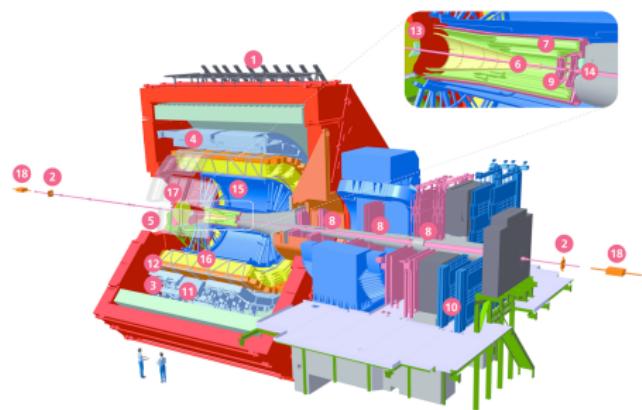
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Honour's Research Project
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ALICE Run 3



- LHC Run 3 aims to increase \sqrt{s} and luminosity of collisions
- At ALICE, the MFT (9) was added and ITS (6, 7) was upgraded
- Readout electronics for many detectors were also upgraded
- To manage Run 3 and ALICE's new untriggered data capture, the analysis framework was overhauled entirely



Coordinate System

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

- p_T : Transverse momentum (GeV/c)

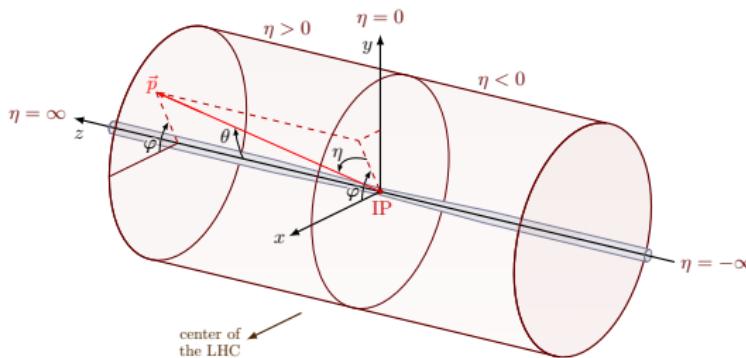
$$p_T = \sqrt{p_x^2 + p_y^2}$$

- y : Rapidity

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

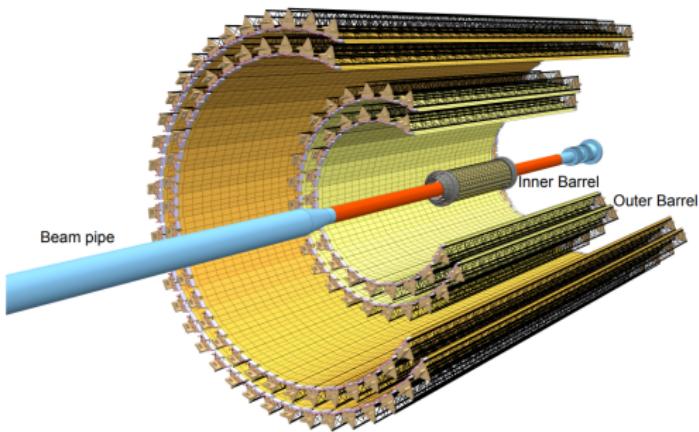
- η : Pseudorapidity

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



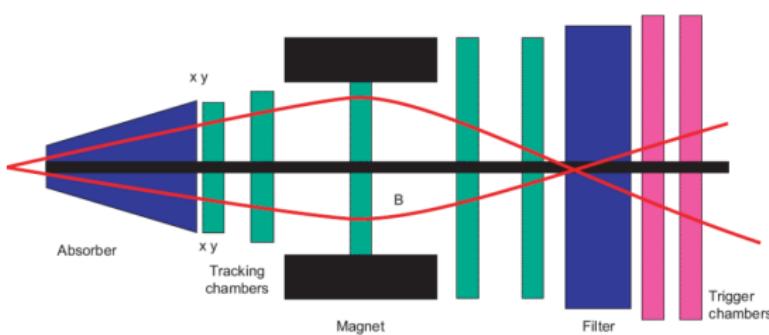
Inner Tracking System (ITS)

- Fully revamped for Run 3 with new pixel detectors
- Used to determine position of the primary vertex and help with particle tracking
- 22.4 mm to 391.8 mm radial extension from IP
- Covers $|\eta| < 1.22$



Muon Spectrometer (MCH)

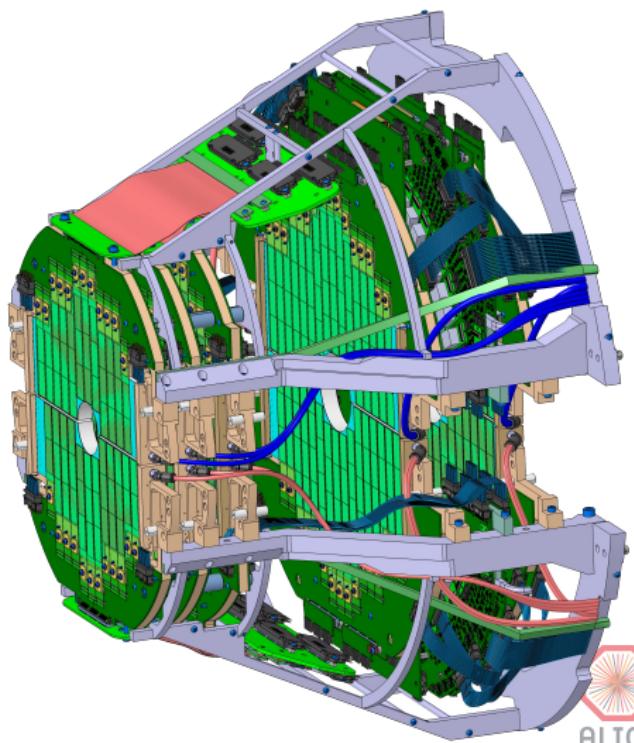
- Used to study heavy quarkonia (J/Ψ , Ψ' , Υ , Υ' , Υ'') via their $\mu^+\mu^-$ decay channel, Z^0 bosons via high p_T dimuon decays, and single muon decays from quarks and W^+ bosons



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

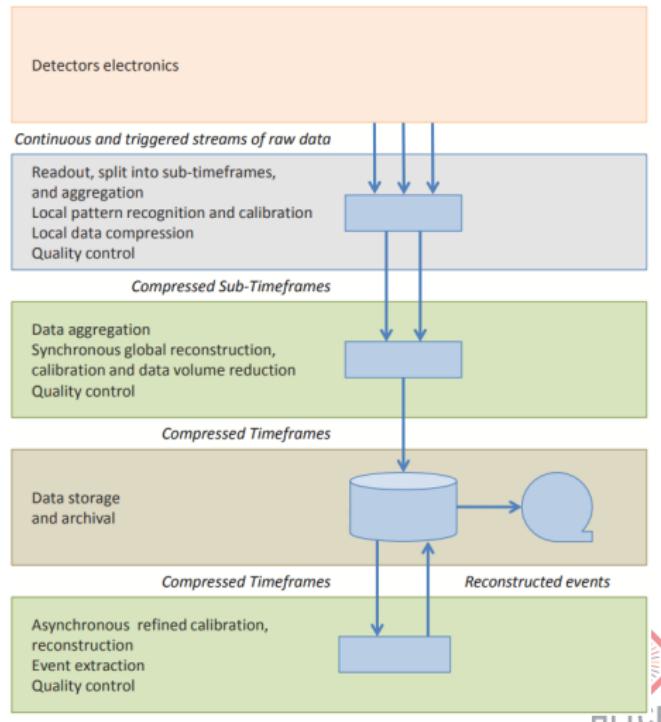
Muon Forward Tracker (MFT)

- Uses the same pixel detector technology as the ITS in a better-suited geometry
- Sits in front of the hadronic absorber, with 5 double-sided disks between -46 cm and -76.8 cm
- Each disk is 1.4 cm thick
- Covers $-3.6 \leq \eta \leq -2.45$



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

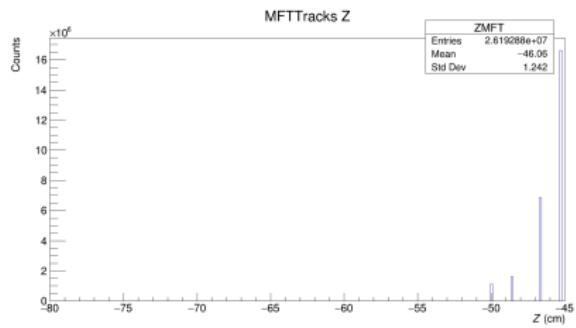
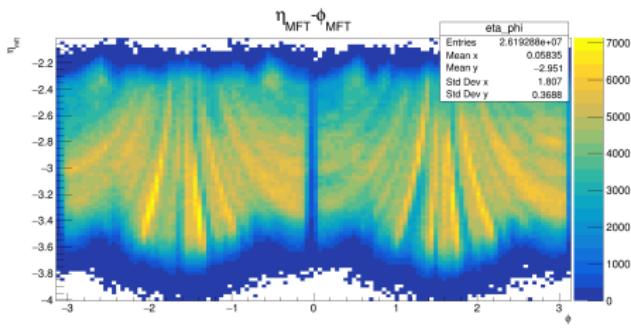
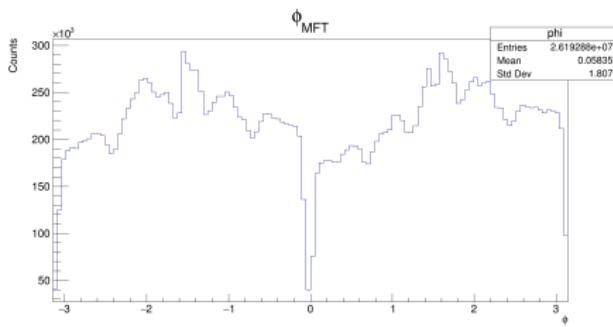
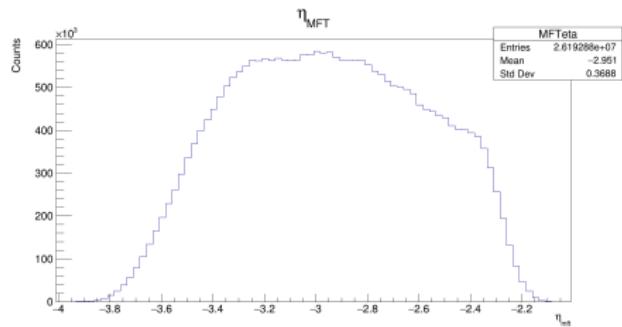


What data are we using?

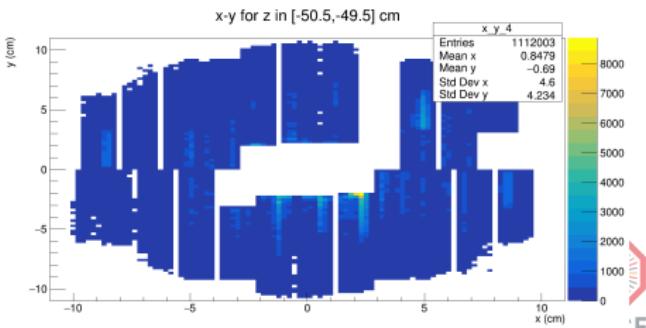
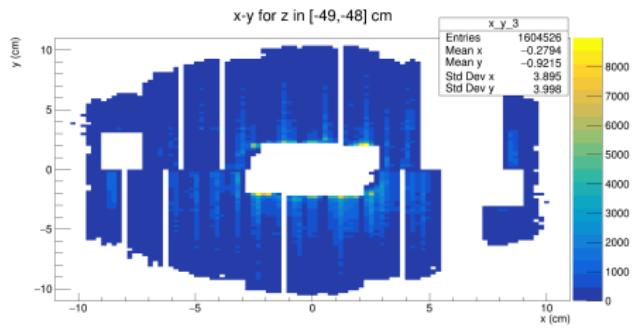
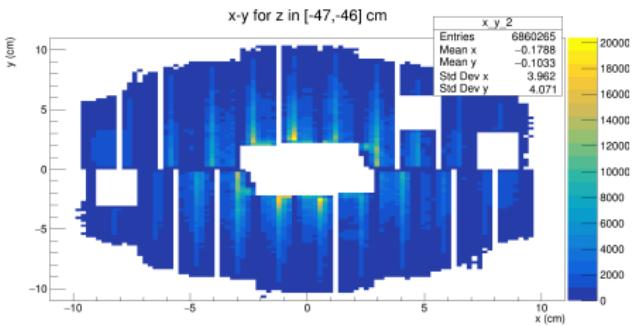
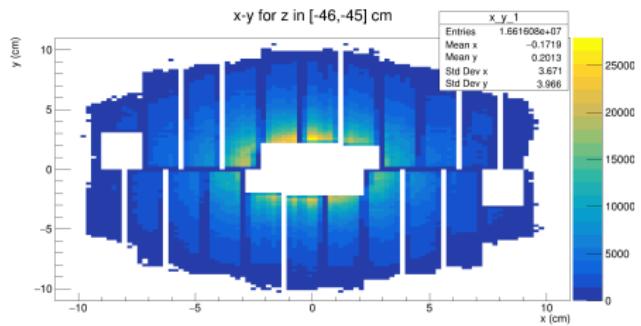
- Pilot beam runs 505548 and 505645 from October 2021
- Non-nominal centre of mass energy $\sqrt{s} = 900 \text{ GeV}$
- Detectors running: ITS, MCH, MFT, MID, TOF, TPC, TRD



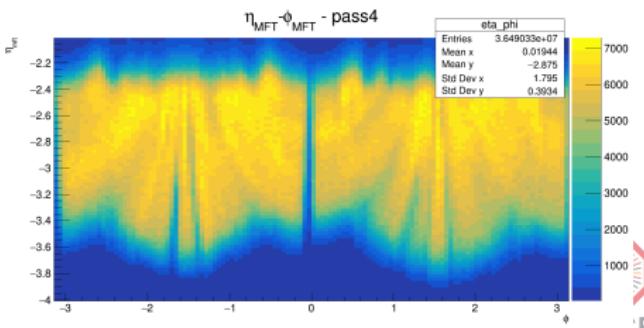
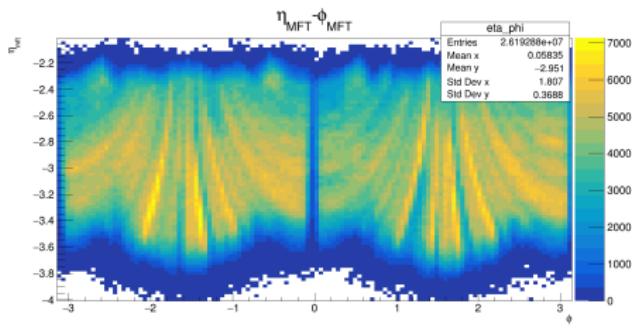
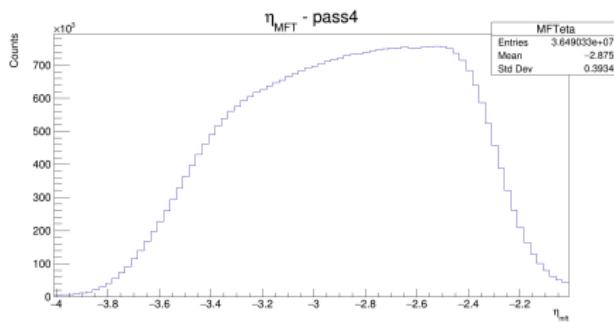
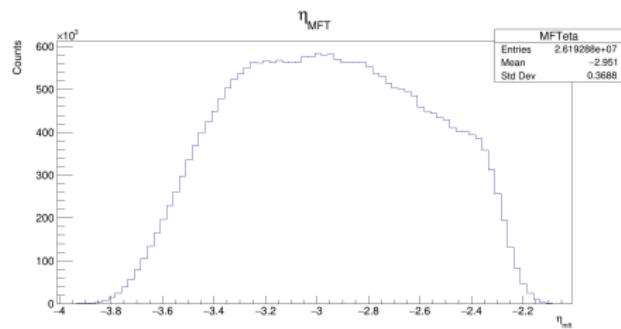
MFT Kinematics (pass3)



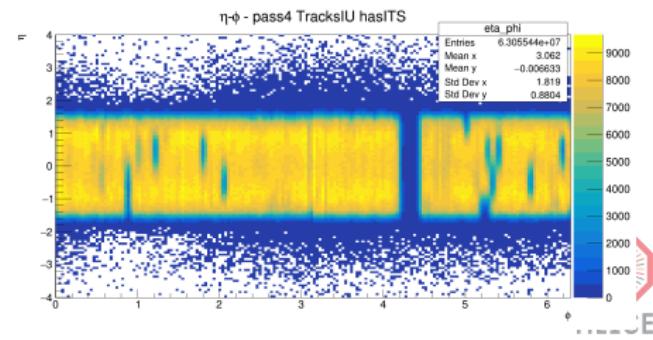
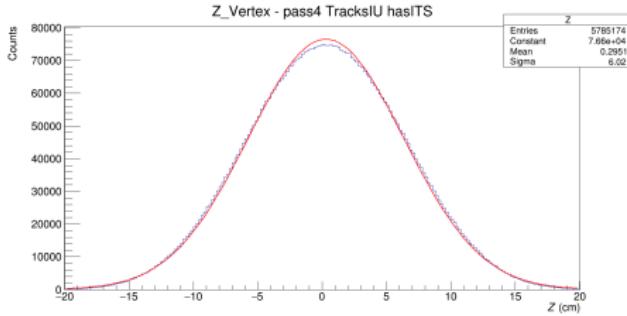
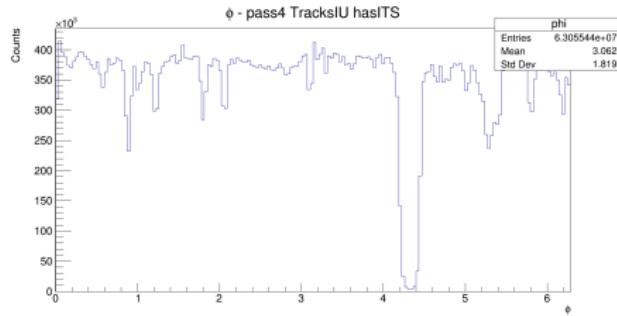
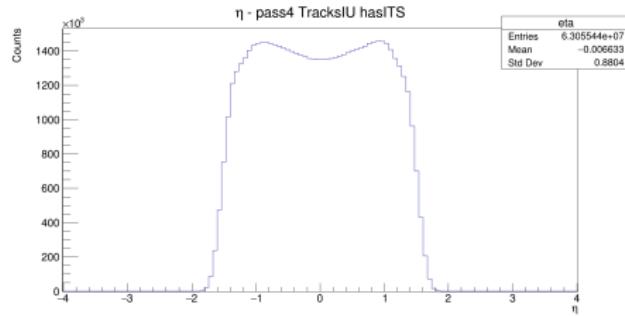
MFT x-y plots



MFT Kinematics pass3 vs. pass4



ITS Kinematics



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?
- James mentioned a report but it's probably not that important



Thank you!

