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Charged particle pseudorapidity density in proton-proton collisions at $\sqrt{s} = 0.9$ TeV with the ALICE MFT and ITS

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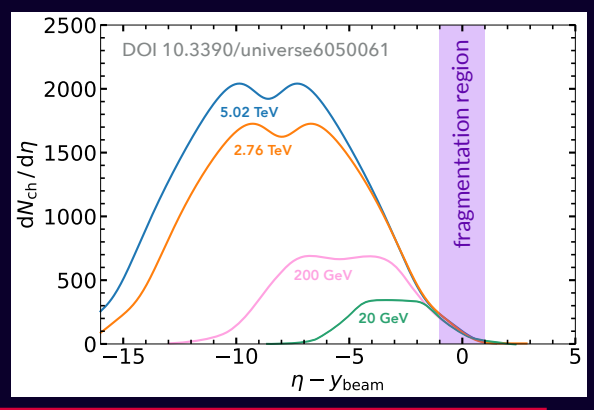
PHYSICS MOTIVATIONS

Charged-particle pseudorapidity density: number of primary charged particles per collision and unit of pseudorapidity

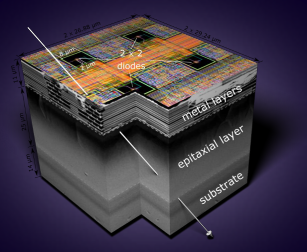
- Helps in understanding particle production mechanisms in high-energy hadronic collisions, from proton-proton to heavy-ion systems
- Shapes the understanding of the strong interaction by allowing the study of QCD in the non-perturbative regime
- Provides constraints on phenomenological models and event generators

Performing such measurements at **forward rapidity**, in particular, allows one to access the details of the phenomena associated with particle production in the fragmentation region.



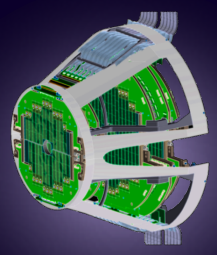
DETECTOR TECHNOLOGY

The ALPIDE chip: CMOS MAPS TowerJazz 0.18 µm technology



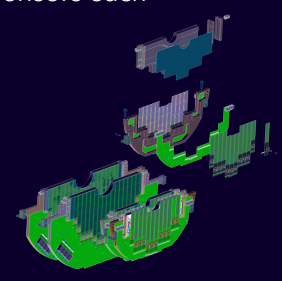
- Sensor size: 15 mm x 30 mm
- Pixel size: 29 µm x 27 µm
- Detection efficiency: > 99%
- Event time resolution: < 4 µs
- Space resolution: 5 µm

The Muon Forward Tracker (MFT), a vertex tracker for the Muon Spectrometer

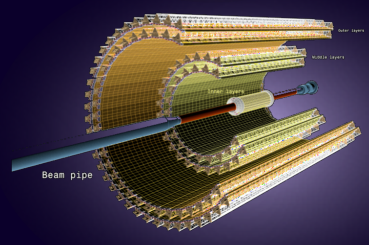


- Brand new detector installed in the ALICE cavern in 2020
- 936 ALPIDE chips (0.4 m²) in 280 ladders made of 2 to 5 sensors each
- 5 disks, 0.7% X/X_0 and 2 detection planes each
- Inner radius limited by the beam pipe

→ Nominal acceptance: -3.6 < η < -2.5, full azimuth



The new Inner Tracking System (ITS 2), improving tracking performance



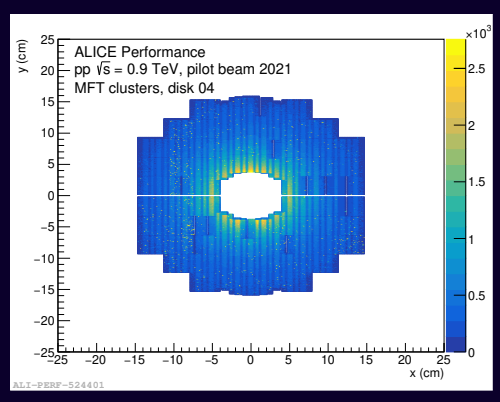
- 7 layers from R = 22 mm to R = 400 mm
- ~24 000 ALPIDE chips, 12.5 Gigapixels (binary readout)
- Large area (10 m²) silicon pixel (MAPS) sensor tracker ($|\eta| < 1.22$)
- 0.3% X/X_0 for each of the 3 innermost layers (light structure)

CERN-LHCC-2013-024, CERN-LHCC-2015-001

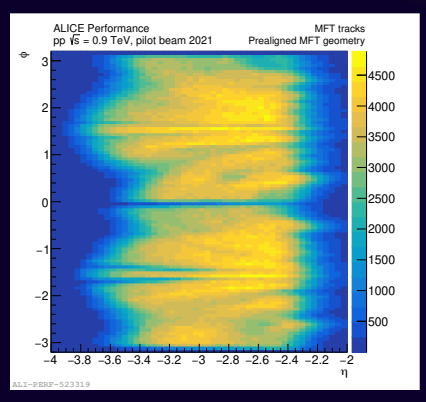
PERFORMANCE PLOTS

NEW DATA

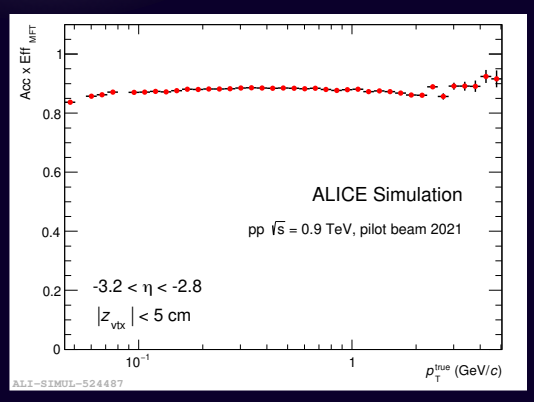
Pilot beam, October 2021 : first test run after LS2, foreseeing Run 3 data taking period



- (x,y) position of MFT clusters in the farthest disk from the interaction point
- Very few and small dead zones

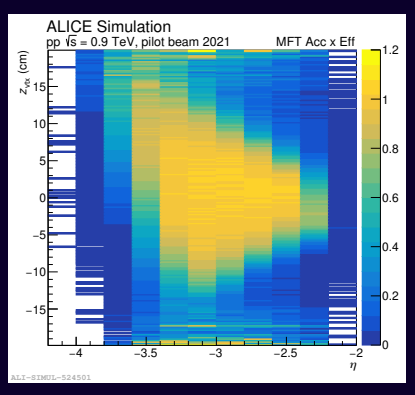


- (η, ϕ) distribution of MFT tracks
- η and ϕ as expected : full azimuth and -3.6 < η < -2.5
- Prealigned MFT geometry

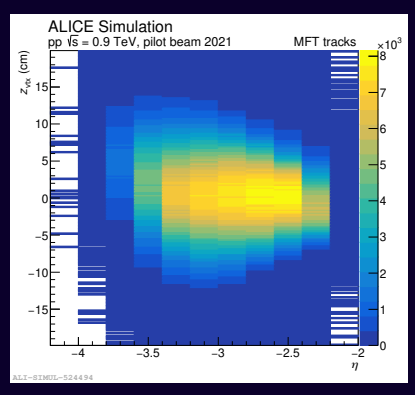


- *Acc x Eff* for MFT tracks > 80% in the whole p_T range

The MFT is **working as expected**, the only step left is the alignement of disks and chips



- The *Acc x Eff* of MFT is used to correct the number of reconstructed tracks to obtain a number of particles: track-to-particle correction

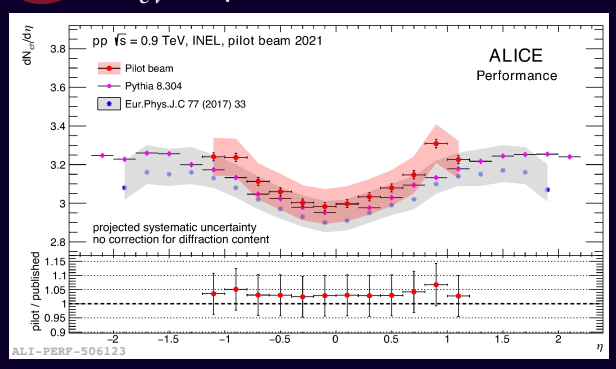


- (η, z_{vtx}) distribution of reconstructed MFT tracks (MC simulated)

→ When the corresponding plot for data is available the final MFT $dN/d\eta$ result will be derived

NEW RESULT

$\frac{1}{N_{ev}} \frac{dN_{ch}}{d\eta}$ measurement at mid rapidity



- First pseudorapidity density measurement in pilot Run done with ITS 2 at midrapidity
- Comparison with previously published Run 2 data: the measurements are compatible within error bars
- Provides a reliability check on the performances of the ITS2 and of the new O² analysis framework

The full measurement including the MFT points is expected in the coming months, extending the results in the forward region -3.6 < η < -2.5

Optimal performance of the MFT and of the O² analysis framework
The MFT is **ready for Run 3**