Construction and status of the MFT

Diana Krupova

UPC Workshop Decin September 14, 2021





ALICE at forward rapidities

Muon Spectrometer (absorber wall + muon chambers): $2.5 < \eta < 4.0$









Muon Spectrometer limitations

Charm/beauty separation

- determination of the muon production vertex impossible,
- limited mass resolution for resonances,

Background

• high background coming from π and K meson decays

I. poor spatial resolution around the IP region

2. need of a high spatial resolution tracker in front the muon absorber









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MFT characteristics

first disk: closest to the IP

z = -460 mm

last disk: closest to the absorber z = -768 mm



- two half-cones containing five detection halfdisks along the beam axis
- silicon pixel sensors on 280 ladders of 2,3,4 or 5 ladders
- fast electronic readout
 - Run 3: Pb-Pb rate 50 kHz, p-p rate 200 kHz
- noise rate $< 10^{-5}$
- low material budget per disk: $0.7 \% X_0$



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MFT characteristics

- 936 active sensors in ALICE inner barrel
- 10 half-disks, 2 detection planes each
- -3.6 < η < -2.45









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MFT sensors & ladders

- sensor size 15×30 mm,
- 524 288 pixels per sensor,
- low power consumption $< 50 \text{mW/cm}^2$ slow control and readout





- 4 types: 2, 3, 4 and 5 sensors
- power distribution: analog, digital, back bias,









MFT ladder assembly

• picking ALPIDE chips from chip positioning the silicon wafer





• interconnections between the flexible printed circuit to the ALPIDE chip via the wire bonds



















gluing chips to FPC





MFT surface commissioning

• detector assembly and surface commissioning

performing functional tests







two half barrels of the MFT detector





MFT tests on surface: results

- execellent signal (Eye Diagram)
- MFT working with uniform threshold over all pixels
- feasible to run the detector at fake-hit rate of 10^{-10} /event/pixel





EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH





ALICE-INT-2021-????

Statistical results on ALPIDE sensors of the Muon Forward Tracker during the detector surface commissioning

Lucrezia Camilla Migliorin

March 15, 2021

https://alice-notes.web.cern.ch/node/1141







• December 2020

transport to P2

• HI rotation, HI insertion

• H0 transfer to mini-frame, H0 insertion

 installation in ALICE cavern, channels qualification, readout cabling, first readout tests

MFT installation



ALICE

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- December 2020
 - transport to P2
 - HI rotation, HI insertion
 - H0 transfer to mini-frame, H0 insertion
 - tests



installation in ALICE cavern, channels qualification, readout cabling, first readout





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- H0 transfer to mini-frame, H0 insertion
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MFT in its final position inside the ALICE cage

• installation in ALICE cavern, channels qualification, readout cabling, first readout







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MFT: first PRBS diagnoses

- done in January 2021
- first PRBS scan of entire MFT
- results compared to PRBS results on surface
- MFT missing 12 chips in total
- tests repeated after









MFT standalone commissioning MFT

- 21 January 28 April 2021
 - long PRBS

 - full DTU scan
 - noise occupancy
 - threshold scans



• eye diagrams with more points



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MFT: X-ray data taking

- performed in March 2021
 - first data recorded by the MFT
 - MFT stable during data taking
 - no latch up
 - currents as expected
 - thresholds with back-bias adapted at P2 setup (cable length)





isotropic source max. flux $F = 12 \times 10^8$ particles/s/chip



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isotropic source max. flux $F = 12 \times 10^8$ particles/s/chip

in 1 central Pb-Pb expected 58 particles/chip on Disk-0 ntegrated Pb-Pb data taking gives 4.6×10^{12} particles/chips

max. flux $F = 12 \times 10^8$ particles/s/chip corresponding to ~1h data taking









- during the global ALICE commissioning:
 - noise in cavern
 - Pb-Pb pattern
- cosmics with B field (L3 magnet/L3+dipole)
- preparation for TED shots / pilot beam



MFT: more data











LS2: status

- all forward detectors have been installed
- 18 weeks global commissioning
- LHC pilot beam test: end October 2021
- II weeks YETS from mid November to end January 2022
 - interventions on cooling, electricity (primary infrastructure)
- LS2 end date 21 February 2022

	oject	4	2021							
Begin date	End date	Dur	ril	May		June	J	uly	August	
25/1/21	12/5/21	78		h	Install ITS	5				
13/5/21	18/6/21	27		L L			ITS sta	ndalon	e commissioning	Τ
21/6/21	25/6/21	5					ĒFI	T-A		Τ
28/6/21	9/7/21	10					Ļ		TS-MFT-FIT commissio	oni
28/6/21	3/8/21	27					Ľ		Close E	хр
12/7/21	12/11/21	90						Ľ		
18/10/21	29/10/21	10								
22/11/21	28/1/22	50								
1/2/22	1/2/22	0								
21/2/22	21/2/22	0								



					2022			
ļ	September	October	November	December	January	February	March	A
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erime	t (vacuum, L3 do	ors)						
			Global	commissioning				
			Pilot beam test					
						YETS		
						🕹 Restart gl	obal commissioni	ng
						•	LS2 end 21st Fe	ebruary





MFT: 2021-2022 planning



SRC period MFT On-call Period		Calendar	Major Operations		
1 st July 2021 31 Dec. 2021 Sarah	2021 week 27-41 5 th July – 17 th September		 Integration into Global commissioning Preparation of Pilot Beam Pilot Beam week 39-40 		
	2	2021 week 42 - week 50 18th October - 19th December			
	2	2022 week 1-4 3th – 30 th January 22	Global commissioning		
1 st January 2022 30 June 2022 ?	3	2022 week 5-17 31th January – 1 st May	First RUN 3 beam / pp collisions		
		2022 week 18-26 2 nd May – 3 July.			
1 st July 2022 31 December	4	2022 week 27-39 4 th July – 2 Oct.	 pp data taking 		
2022 ?	5	2022 week 40-52 Oct. – 18 th December	Heavy ion collisions		











