Status Barrel EMC of the



Target Spectrometer







Helmholtz International Center

2nd Physics Institute, Giessen University, Germany

PANDA CM, October 2021

Status Overview

Envisaged milestone (M8): Assembly of 1st full Barrel EMC slice

- Infrastructure
- Mechanics
- 710 detectors
 - 710 crystals in 11 different geometries ✓
 - 1420 APDS
 - Screening including irradiation ✓
 - Matching
 - Glueing
 - Capsules
 - Wrapping
- Assembly of 18 modules
- Assembly of Supermodules
 - 360 left and 360 right handed APFEL-ASIC with flex PCBs
 - ASIC housing or fixtures
- Assembly of full 1st slice
 - (Re-)design supportbeam
 - Mod. preseries supportbeam
 - Cooling & thermal insulation
 - Backplanes
 - Light pulser fiber coupling







87 87 87 8



Cooling

- With much help from the russian colleagues the slice was moved into the rotation frame and the insulation box was mounted
- Main cooling lines and insulation are installed, front cooling and dry air support are ready to be installed
- Cooling the whole slice and taking temperatures with the PANDA THMP will start <u>next</u> week







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Cooling



white silicon Insulation needs slight redesign to accept the latest Flex PCB Routing

main cooling lines were leak tested and are operational



40 mm Vacuum Insulation Panels instead of 60 mm for easier installation to reduce risk of damages during installation. According to simulations, thickness is still fine





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Cooling

- The support beam cover was not installed
 - Only the technological beam
 - Allows to inspect the flex PCB windows while cooling and access to the PT100-connectors
- Different versions for the Flex PCB window sealing have been tested for ease of installation and sealing the overpressure of the cold volume.





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Integration Front-End





Elevation due to trapezoidal side walls

to

Grouped to three lengths:

	short	standard	long
pre-series	105	121	162
series	108	124	183

Flex-PCB delivery in February 2022

First slice final Front-End mounting Spring 2022

Backplanes - Reminder

3 Layers

- Top: HV distribution & regulation
 - Adjust bias voltage of 8 APDs
 - 50V from HV input downwards in < 0,1V steps
 - All channels fed from the same HV source
 - \rightarrow safes space inside support beam
 - Online measurement of APD voltage and current
- Middle: Connector board for signal cables
- Bottom: Board for FlexPCBs / ASICS
 - Connectors to FEs
 - 8x2 Diff. Line drivers
 - APFEL I/F buffers
 - Temp/Humidity sensors



HV distribution prototype



APD

N-Mosfet



HV Board

- HV PCBs for first slice are in production
- Remaining Serial Adapter ASICs shipped to assembly
- Final Prototype is currently used for tests to further develop calibration algorithm
- Calibration and test environment prototype foreseen to be installed within this year
- Most components are purchased due to global shortages shipping varies



HV Board Mass Screening



HV Board Mass Screening



HV Board Mass Screening Calibration



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HV Board Mass Screening Calibration



Crystal Status

- Produced by CRYTUR: 747
 - Rejected due to dk limit: 15
- Current production: 59 for excess raw material
 - Delivered and accepted: 18

160

140

Number of crystals ⁰⁰ Number of crystals

20

0

180 limit limit 180 160 160 140 120 100 80 60 40 20 20 0 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 Light Yield at T = +18° C / phe/MeV dk(420 nm) / m⁻¹ 250 180 imit imit 160 200 140 120 150 100 80 100 60 40 50 20

69 70 71 72 73 74 75 76 77

Transmittance @420 nm / %

200

A

70 71 72

73

Transmittance @360 nm / %

41 42 43 44 45 46 47 48 49 50 51 52 53 54 55

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74 75 76 77 78 79

Transmittance @620 nm / %

80 81 82

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65 66 67

68

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35 36 37 38 39 40

Crystal Status

- Produced by CRYTUR: 747
 - Rejected due to dk
 limit: 15
- Current production: 59 for excess raw material
 - Delivered and accepted: 18

- Missing crystals:
 - 3rd slice: 199
 - Day-1 (12 slices): 4152-4182
 - Full barrel: 6168

Statu																									
					Left			Right					Mis	sing	already financed		To be ordered		after	SLice1	aft				
Туре	type	total	total+spare	LR	втср	PreProd	Proto60	SICCAS	CRYTUR	Tot	втср	PreProd	Proto60	SICCAS	CRYTUR	Tot	Left	Right	Left	Right	Left	Right		L	R
1	1	1280	1310	655 655	629	36				665	668	35				703	-10	-48			0	0	1	624	662
2	2	1280	1310	655 655	402	34				436	668	38				706	219	-51			219	0	2	395	665
3	3	1280	1310	655 655		40			62	102	628	37			1	666	553	-11			553	0	 3	61	625
4	4	1280	1310	655 655		40			61	101	1	39			61	101	554	554			554	554	4	60	60
5	5	1280	1310	655 655		39			60	99		39			62	101	556	554			556	554	5	58	60
6	6	1280	1310	655 655		29	30		47	106		28	30		42	100	549	555			549	555	6	65	59
7	7	1280	1310	655 655		39			61	100		39			61	100	555	555			555	555	7	59	59
8	8	640	660	330 330		19			42	61		17			48	65	269	265			269	265	8	40	44
9	9	640	660	330 330	325	20				345	328	19				347	-15	-17			0	0	9	324	326
10	10	640	660	330 330	95	19			4	118	285	17				302	212	28			212	28	10	97	281
11	11	480	490	245 245		15		62	88	165	88	15			32	135	80	110			80	110	11	149	119
										2298						3326									
	total	11360	11640		1451	330	30	62	425		2666	323	30	0	307		3547	2621			3547	2621			
			280					CRYTUR	732																
									Produced	5624					5624										
																Needed	6168				6168				
		spare : 30 crystals			type 1 - 7																5472	2			
			20 crystals		type 8	B - 10				11792						8520									
			10 crystals			11				6016						72.39437							To b	e or	dere
_																									

Summary

Cooling

- Thermal insulation installed
- First cooling tests scheduled for next week
- Front End
 - APFEL FlexPCBs delivery in February 2022
 - Final Front-End mounting Spring 2022
 - PCB assembly (1000) directly after delivery needed
- HV backplane
 - Temperature dependent HV calibration will be repeated with 4 h steps
- Crystal status
 - More than 50% of the crystals for 3rd slice available
 - Compensation for raw material almost finished

Backup