



# ECAL Mass Production

## Status Report

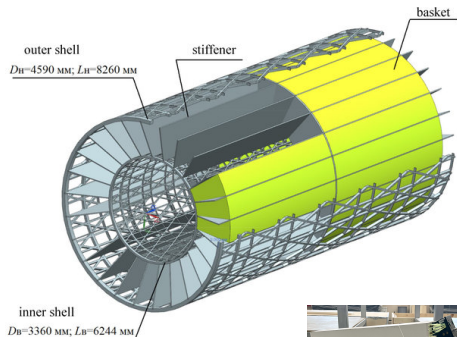
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presented by:

Maharnab Bhattacharjee

*(on behalf of MPD-ECAL team)*

**XI Collaboration Meeting of the MPD Experiment at the NICA Facility**  
VBLHEP, JINR, Dubna



MPD-ECAL barrel is composed of 25 sectors  
or 50 half-sectors (baskets)

X

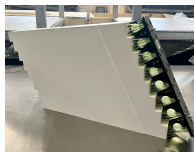
Each basket contains 48 modules of  
8 different types

X

Each module has 16 towers (channels)

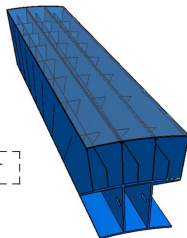
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Total of 38400 channels in ECAL  
(2400 modules)

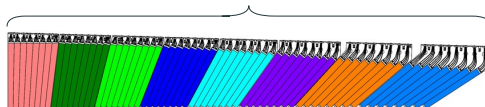


*module*

*8 different types of modules  
due to the projective geometry*



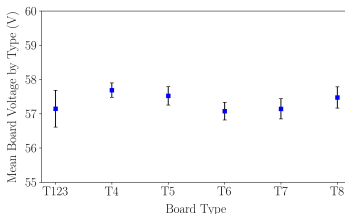
*half-sector*



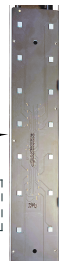
# ECAL: HV READOUT BOARD CALIBRATION

- ★ Calibration time is  $\sim 30$  min for single HV board using LED in a dark box.
- ★ 588 boards calibrated till date (10.04.2023).
- ★ 384 boards are installed in half-sectors.
- ★ Calibrated boards by Types:

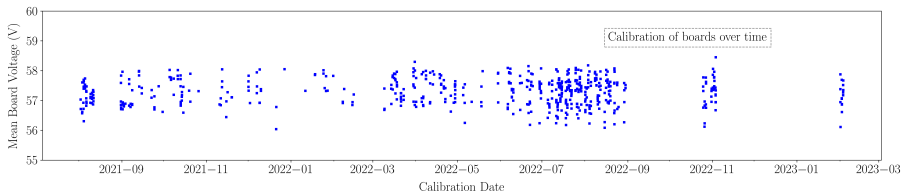
Type_123	217
Type_4	74
Type_5	75
Type_6	73
Type_7	75
Type_8	74



LED calibration setup



HV readout board with 16 MAPDs



- ★ 1600 or 66% of total modules already produced
- ★ Production started with Russian Wavelength Shifters (Tver fibers) for another 400 modules: +200 Armul, +200 Protvino
- ★ This completes 83% of total production
- ★ Testing capacity is 32 modules/day in 8 test-stands using cosmics in self-trigger mode
- ★ 1009 modules tested till date (10.04.2023)
- ★ Tested modules by Types:

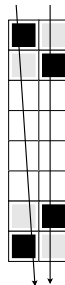
Type_1	134
Type_2	130
Type_3	126
Type_4	122

Type_5	130
Type_6	123
Type_7	118
Type_8	126

- ★ Tested modules' break-up by producers:

China	Prototypes	8
	Tsinghua University	162
	Shandong University	36
	Fudan University	16
	University of South China	20
Total		242

Russia	Armul	149
	Protvino	413
	Tenzor	205
Total		767

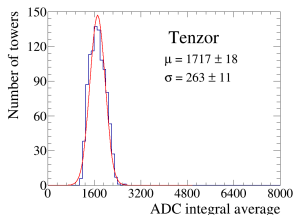
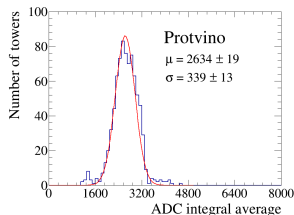
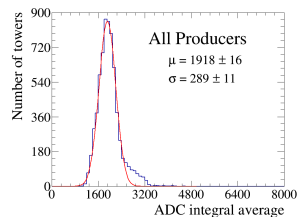
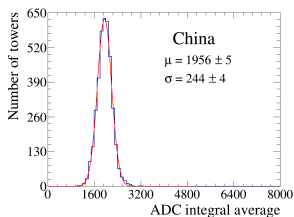
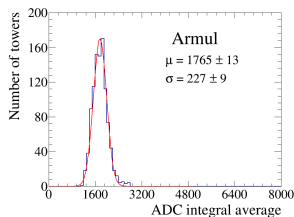
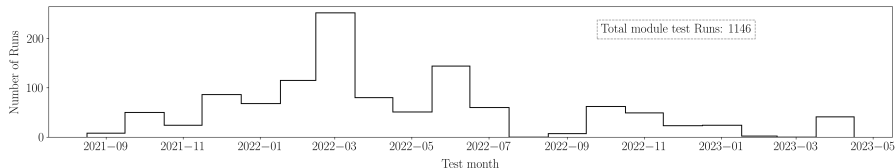


cosmic muon selection

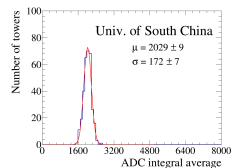
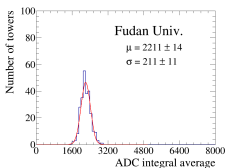
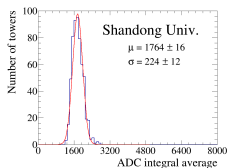
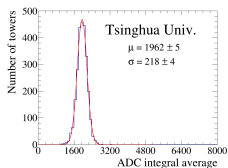
Participation from China  
in module production



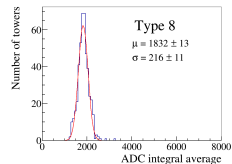
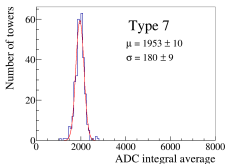
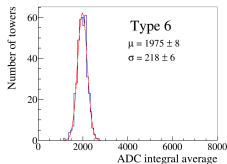
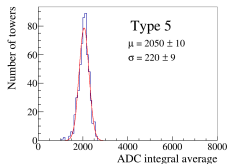
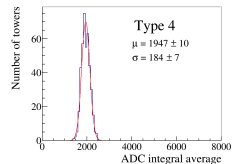
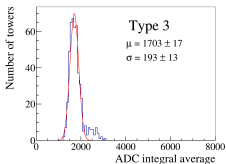
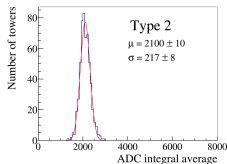
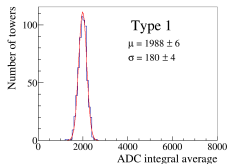




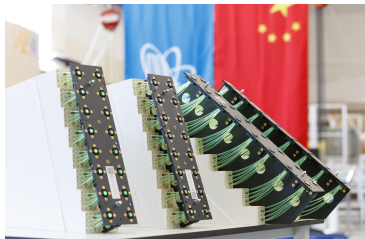
- ★ last 12 months of test results
- ★ modules from Armul & Tensor have to be calibrated up with coefficients
- ★ modules from Protvino & China have to be calibrated down



## All modules from China (by Type):



- ★ 16 modules are glued together to produce a single cluster.
- ★ 59 clusters produced using the tested modules
- ★ Cluster production rate is 10 clusters/month.
- ★ Estimated completion of cluster production by September 2023.



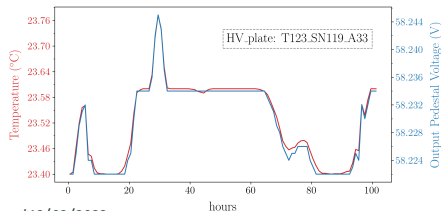
*recent modules from China being used in clusters*

*stored clusters before basket assembly*

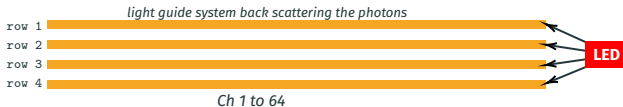
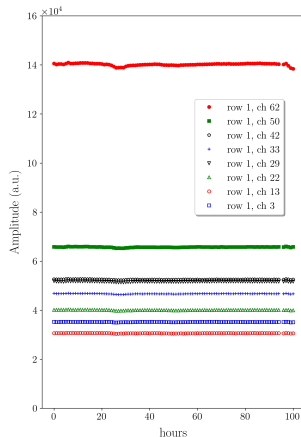
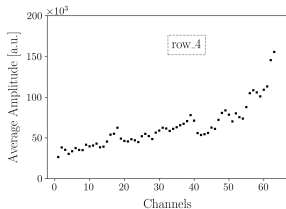


*gluing procedure of cluster production*

- ★ Cluster no. 19 assembled with ADC and cooling systems for stability test using LED

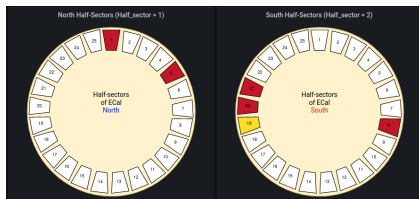


\*16/02/2023

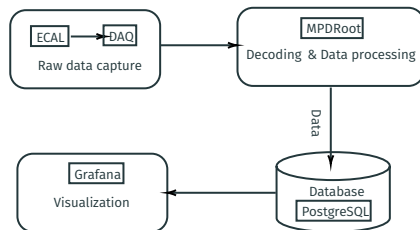
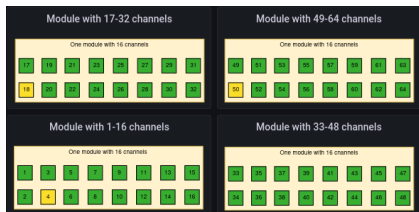


\*performance was found to be normal

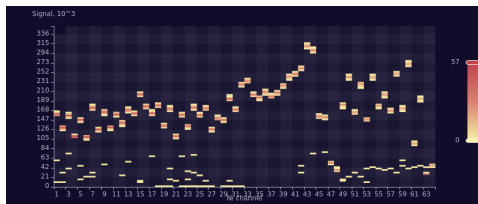
- ★ Development of software packages started for ECAL operation (using MPDRoot)
- ★ A monitoring system of ECAL half-sectors, ADC & plates is under development



Monitoring by sectors, ADCs, HV boards

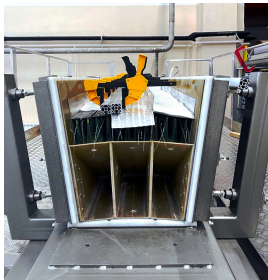


Simplified schema of monitoring system

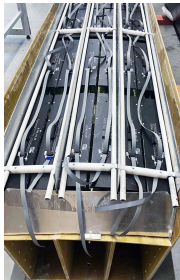


simulated example of plots of the system working

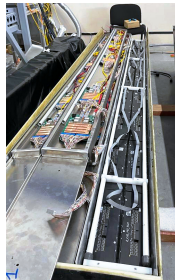
- ★ 18 half-sectors (baskets) assembled from 54 of the 59 clusters that were produced
- ★ 8 of the half-sectors have the HV readout boards installed
- ★ Readout electronics box installation with ADCs, optical fibres, ventilation pipes, connections & cables, etc for each cluster of the baskets are underway
- ★ 1 of the half-sectors are installed with 3 such readout electronics system and being prepared for testing



*gluing of half-sector*



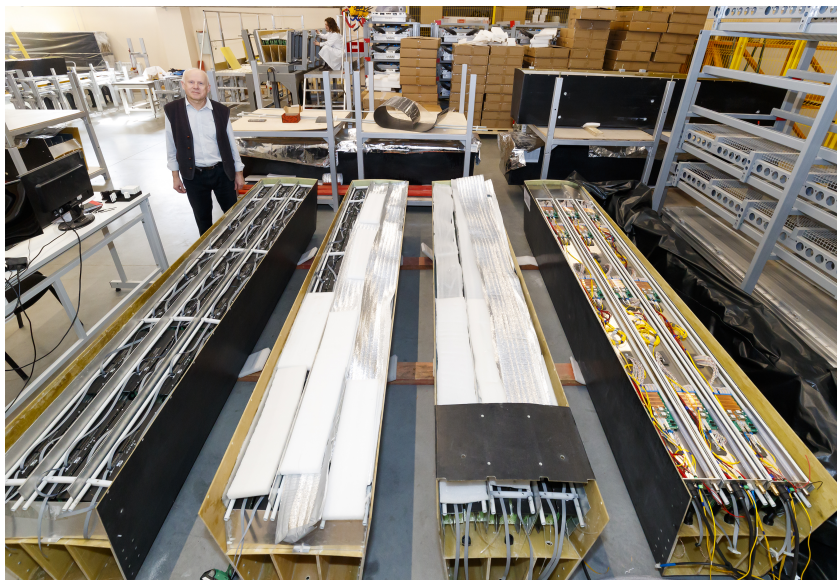
*HV boards installed*



*ADC assembly*



*Connections & cabling*



*Stored half-sectors in different stages of assembly*

- ★ 588 HV boards are calibrated and ready for installation.  
2000 HV boards in production: +1000 in Russia, +1000 in China.
- ★ Mass production of 1600 modules or 66% completed.  
Another 400 under production in Russia, will take total to 83%.
- ★ 1009 modules tested using cosmics and 944 glued to make clusters.
- ★ Production of 59 clusters completed. Current cluster production rate is 10 clusters/month.  
Estimated completion of cluster production before September, 2023.
- ★ Stability tests of electronics were conducted with a cluster,  
performance was normal for test of 100+ hours.
- ★ Software package development for ECAL operation has started.  
Monitoring software system for ECAL status using LEDs is under development.
- ★ Production of 18 half-sectors completed using 54 clusters.  
Installation of 384 HV boards on 8 half-sectors also completed
- ★ Assembly of readout-electronics systems comprising of ADCs, fibres, cooling, etc are underway
- ★ 1 half-sector under preparation for testing with 3 readout electronics systems installed

**Half-sector production for the Electromagnetic Calorimeter may be completed in the beginning of 2024. Estimate is without taking into account the installation of readout-electronics system.**



Thank You