Status Of Prototype Electromagnetic Module Preparation Dual-readout Calorimetry

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Content

- Geometry of the detector
- o Dimension of the detector
- Fiber Insertion in Tubelets, Fiber Gluing @rear ends and Machining
- Current Status of the Module
- Conclusion

Geometry



- Total 9 towers -60 rows X 48 capillary tubes (per row)
- Front face: ~10 cm x 10 cm
- Material: Brass (CuZn37)
- Capillary: 2 mm outer diameter, 1 mm inner diameter
- o Module constructed by RBI group, Zagreb, Croatia
- Delivered to Pavia in August 2020







Front Face

- Central tower read by 320 SiPMs
- Eight surrounding towers read by 16 PMTs (two PMTs per tower):
 - One for 160 Scintillation fibers
 - One for 160 Cherenkov fibers

Measurements of Dimensions



Measured

- In Pavia
- With high-performance Height Gauge
- At 48 points per tower

Thickness (in mm)				
Mean	RMS			
34.95	0.05			
35.00	0.05			
34.98	0.04			
34.96	0.04			
34.92	0.05			
34.95	0.05			
35.08	0.04			
35.08	0.03			
35.14	0.05			
	kness (in m Mean 34.95 35.00 34.98 34.98 34.92 34.92 34.95 35.08 35.08 35.08			

Distribution of mean thicknesses (mm)



Measurements of Dimensions

Width (in mm)				
Module/ Tower	Mean	RMS		
MO	33.01	0.03		
M1	33.07	0.02		
M2	33.07	0.04		
M3	33.06	0.02		
M4	33.25	0.05		
M5	33.23	0.10		
M6	33.18	0.04		
M7	33.19	0.04		
M8	33.21	0.05		

Distribution of mean widths (mm)



- 1. Fiber insertion from front face (IP)
- Little amount of instant adhesive (for precision application) at the end-points of the fibers
- 3. Managing bunches of fibers at rear end
 - a) Separating S and C fibers row by row
 - b) Finally, two bunches
 - c) Extra fibers are cut









Bunch of Scint. fibers

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Loaded Towers: Fibers illuminated from rear end





Scintillation fibers

Cherenkov fibers





Cut edges of bunch of fibers inserted in a Teflon Container





Due to viscosity glue rises above 3d printed black holder



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in containers with

syringes



Syringe removed



Teflon containers removed



Grouped glued fibers outside 3d printed holder are cut off and polished by milling machine

Current Status

- Fiber insertion, fiber grouping and gluing @ rear ends are done for eight towers
- Central tower (M0) stand by has been awaited a tool (plate with 320 holes) to keep all fibers separated for SiPM readouts
 - The tool has been constructed now







Conclusion

- Test beam at DESY planned in the second half of February, 2021 (situation due to Covid-19 may apply some delay!)
- Central tower under construction
- We are testing the PMTs (photon detection, linearity tests) in Pavia
- Coupling the module to the readouts will start soon (in collaboration with The University of Insubria, Como, IT)
- Mechanical supports have been prepared partially:
 - Support for the module has been constructed
 - Supports for electronics have to be prepared

Thank You!



Mapping of Thickness: Central Tower (M0)

M0



Bending Along Thickness, Torsion			
Module	b	t (micron)	
	(micron)		
M0	160	6	
M1	154	20	
M2	121	-28	
M3	113	2	
M4	149	62	
M5	158	-15	
M6	161	-14	
M7	148	54	
M8	265	81	



Bending (micron)



Bending Along Width, Torsion			
Module	b (micron)	t (micron)	
MO	119	51	
M1	128	-26	
M2	159	-1	
M3	129	-9	
M4	285	27	
M5	288	-104	
M6	121	6	
M7	125	24	
M8	136	10	

Glue BC 600

- ✓ Optical Cement clear epoxy resin
- ✓ Formulated specially for making optical joints with plastic scintillators
- ✓ Refractive index close to 1.59
- ✓ Is a Two part
 - Low viscosity adhesive, cured at room temperature
 - Hardener
 - 100 : 28 (by weight) -> 12g : 3.4g (for single tower)

BC 600 <u>Optical Properties</u> Transmittance value of 125 micron thick layer		
Wavelength (nm)	Transmission	
Above 400	> 98%	
340-400	> 95%	
308-340	> 90%	

READOUT





Calorimeter