High granularity SIPM channels for the first test beam of the dual-readout calorimeter for future e+e- colliders

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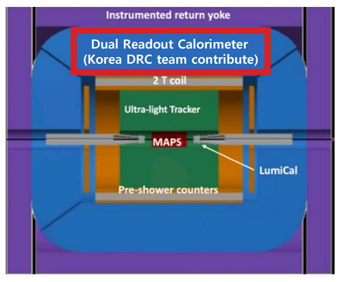
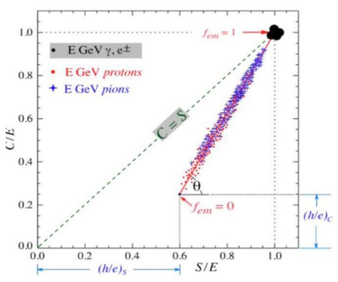
Dual-readout calorimeter

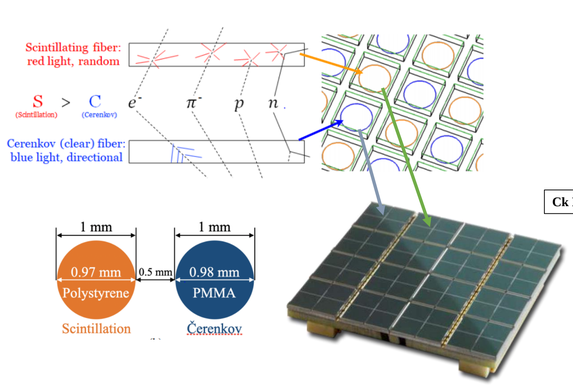


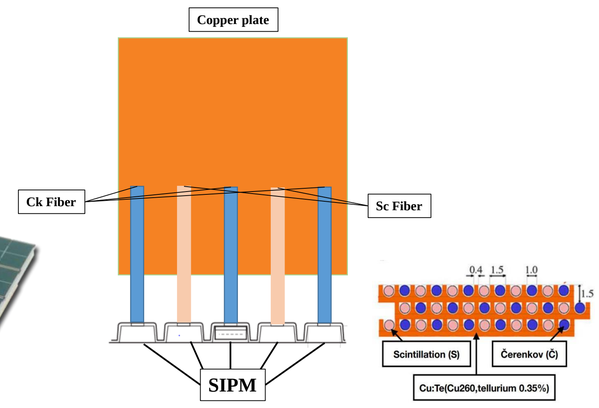


- Dual-readout calorimeter has been proposed in IDEA detector conceptual design report (CDR) for future e+e- collider.
- Stacked copper plates are consist of two different channels scintillation and Cherenkov fibers on copper plates.
- Dual-readout calorimeter is high-quality energy measurement for both EM particles and hadrons.

SIPM for dual-readout calorimeter

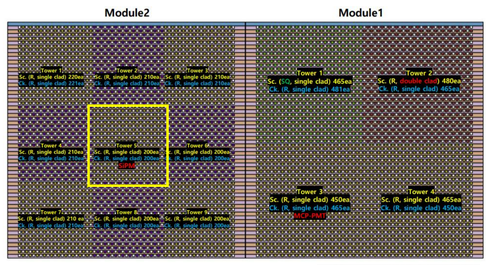
- The compact size of SiPM makes it possible to couple individual fibers in the calorimeter and the excellent position and energy resolution can be obtained.

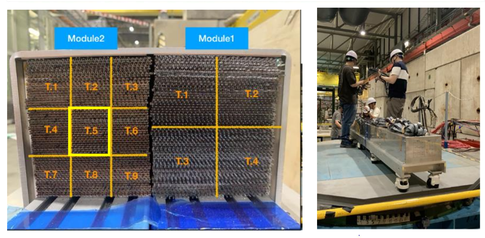




SIPM Channels for TB2022 DRC module

- Two DRC modules for Test Beam 2022 & SIPM channels configuration



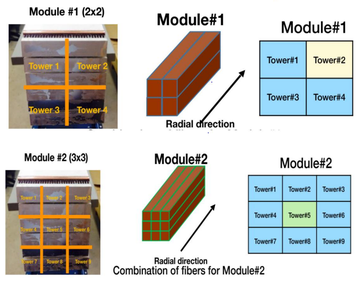


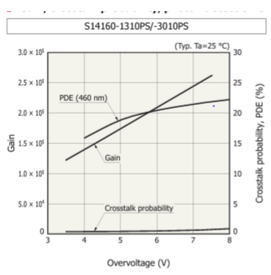
Details : Module Assembly presented by Guk Cho (C09)

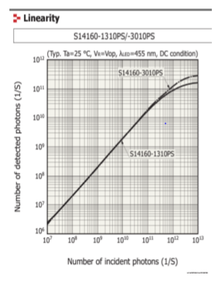
Module#2

	Tower #1~4 and #6~9	Tower #5	Remarks
Scintillation fibers	Round / Single cladding	Round / Single cladding	They will be mounted in the 4th quarter of this year.
Cherenkov fibers	Round / Single cladding	Round / Single cladding	
Readout detector (416 ch)	16 PMTs	400 SiPMs	All PMTs have been delivered.
Model name	R11265-100	S14160-1310PS	

SiPM	Photo-sensitive area	pixel size	photo detection efficiency (PDE)		number of pixels	photo
S14160-1310PS	1.3x1.3 (1.69 mm²)	10 μm	~15% at 400 nm	~17% at 550 nm	16675	





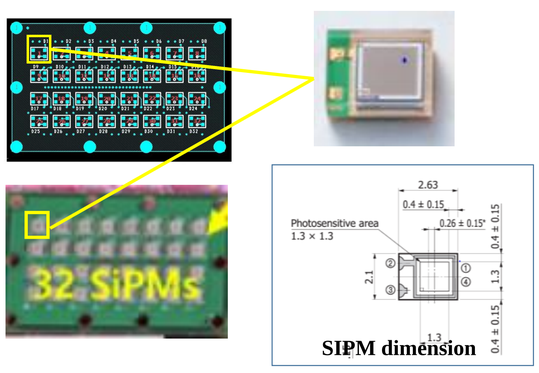


S14160- 1310PS SIPM

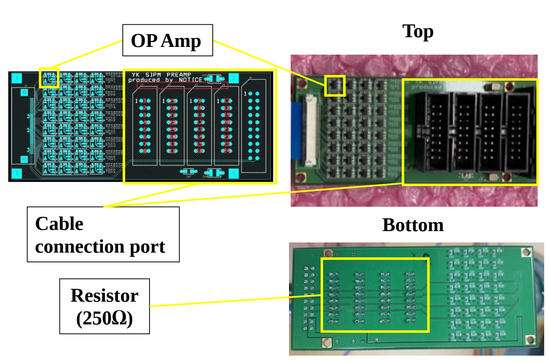
Electronics board for SIPM

- Lower operating voltage and uniformity of gain, noise for simple electronics & control multi channels.
- There are 13 SIPM board and PreAmp board each & It can handle a total of 416 channels.
- Electronics board consist SIPM board (32 SIPM) & SIPM PreAmp board (32 OP Amps & resistors

SIPM sensor board

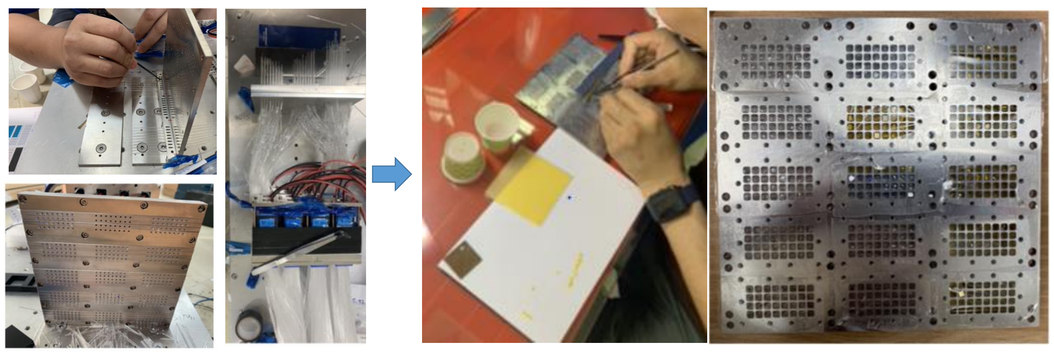


SIPM PreAmp board

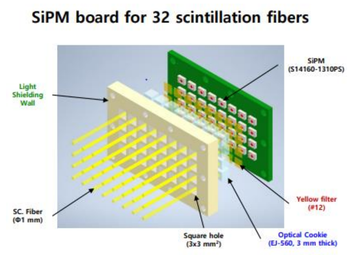


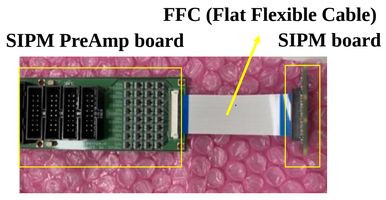
SIPM Assembly with DRC Module

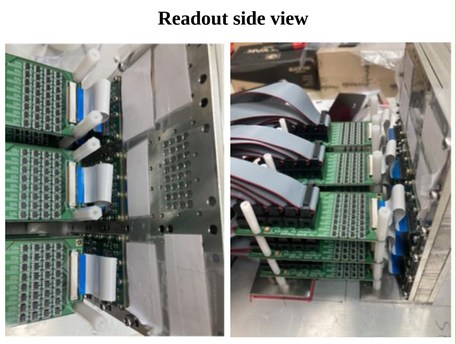
- Assembly the Fibers & SIPM Frame using epoxy, Cut & put the optical sheet & yellow Filter.

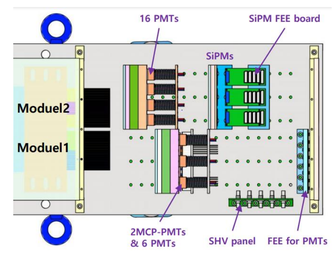


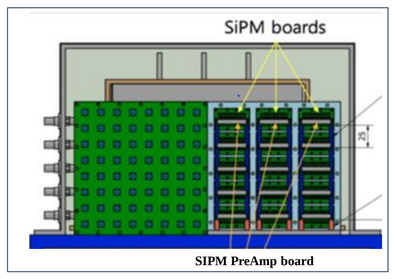
- Attached SIPM & Fibers using Supporter











Connection of SIPM & DAQ system

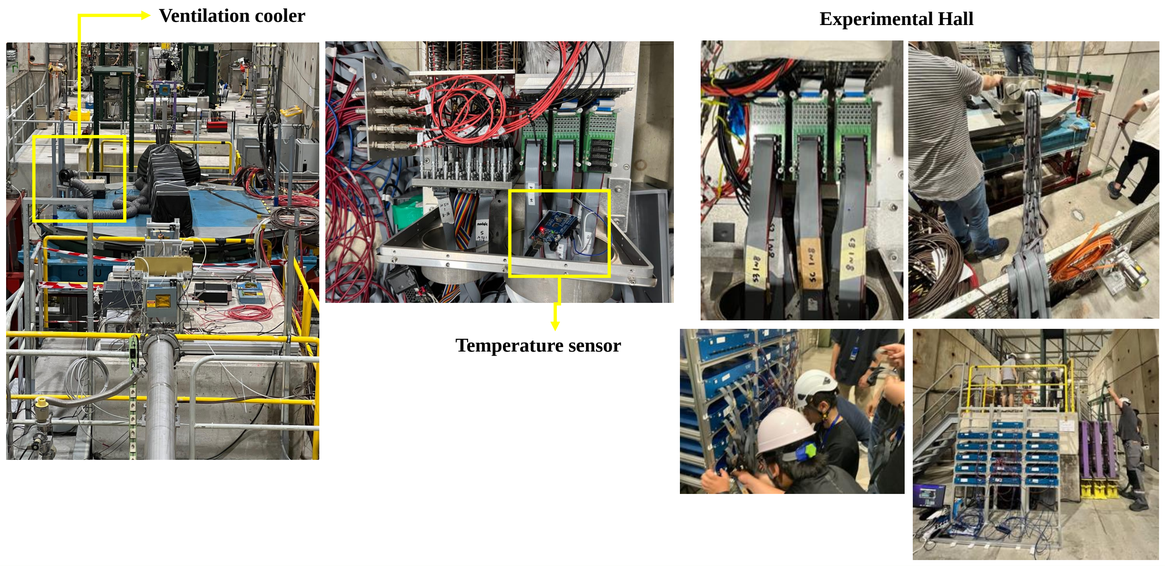
- We connected the SIPM electronics boards & DAQ system using cables
- 16pin cable is signal line & 20pin cable is SIPM Power apply & Temperature sensor line

1 DAQ board have 32 channels matching 1 SIPM
Connection 4 16pin cables & 1 20pin cable.

DAQ board

Details : DAQ system presented by Yun EO (C05) & Haeun Jang (C07)

- Connection for DAQ board & SIPM, operation & Data taking for SIPM Tower



Conclusions & Future Plan

- The dual-readout calorimeter(DRC) has been proposed in the IDEA detector concept for CEPC & FCC-ee.
- SiPM makes it possible to couple individual fibers in the calorimeter and the excellent position and energy resolution can be obtained
- We designed the electronics board for SIPM channels, Assembled & connect SIPMs with DRC module
- SIPM operation & taking Data at TB2022 & We need SIPM Data analysis for TB2022 .