The Status of the HCAL

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Qian Sen, on behalf of the HCAL Group

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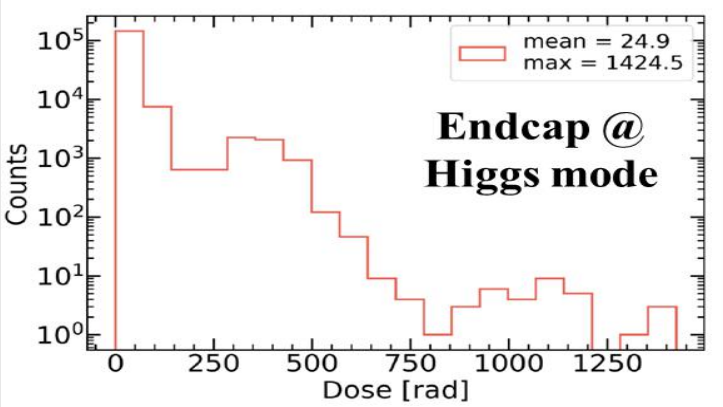
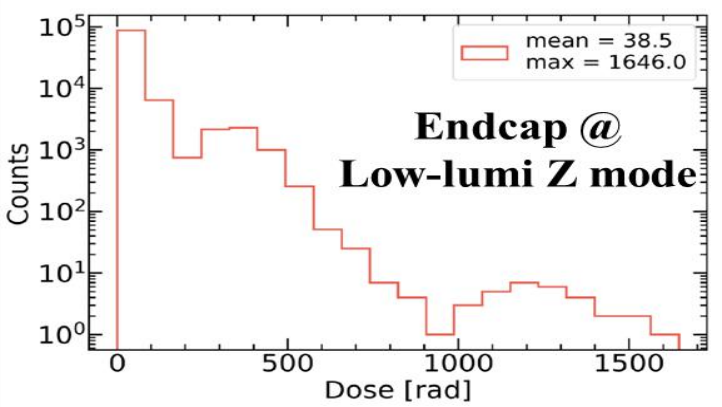
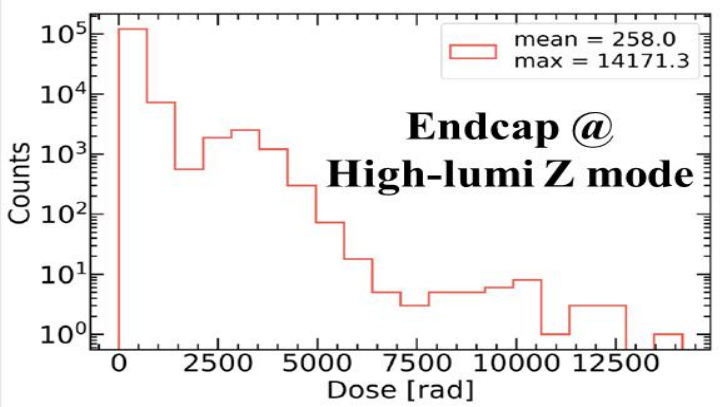
Current status of the GS-HCAL Simulation

--by Weizheng Song

Beam induced background simulation （V2）







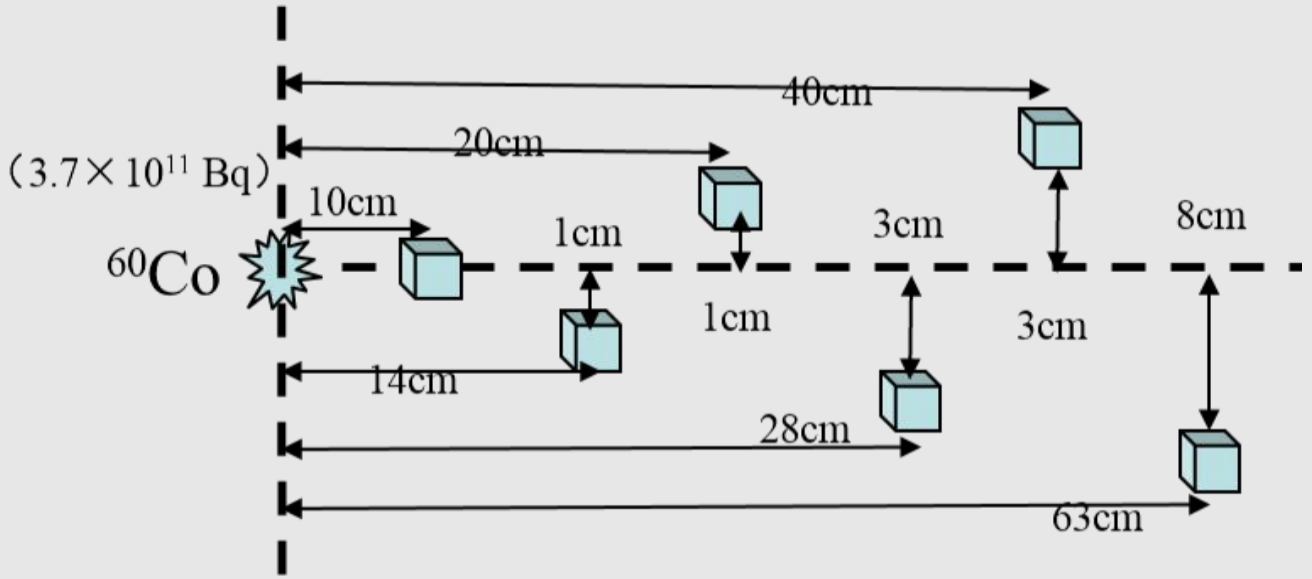
Running Mode	Endcap @ Higgs mode	Endcap @ Low-lumi Z mode	Endcap @ High-lumi Z mode
Dose of 99% cells/year	< 5 Gy	< 5 Gy	< 50 Gy
Dose Mean/year	0.25 Gy	0.39 Gy	2.6 Gy
Dose Max/year	14.2 Gy	16.5 Gy	142 Gy

- Beam background for GSHCAL is mainly induced by gamma-rays and electrons
- The irradiation dose in different running modes for the Endcap has been obtained from the simulation and statistical parameters were summarized

Current status of the GS-HCAL Glass Scintillator

--by Hupeng

Irradiation Test of GS with ^{60}Co



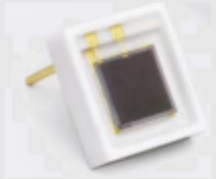
Distance (cm)	Dose rate (Gy/h)	Total dose (Gy@37.5h)
~10	~10	~375
~14	~5.1	~191.3
~20	~2.5	~93.8
~28	~1.26	~47.3
~40	~0.624	~23.4
~63	~0.25	~9.4

- 6 glass samples ($5 \times 5 \times 5$ mm^3) were irradiated with a ^{60}Co source of 3.656×10^{11} Bq and were placed with different distance to obtain different dose
- Significant discoloration (color centers) can be observed in #1 and #2, and detailed performance tests will be finished this week

Current status of the GS-HCAL SiPM

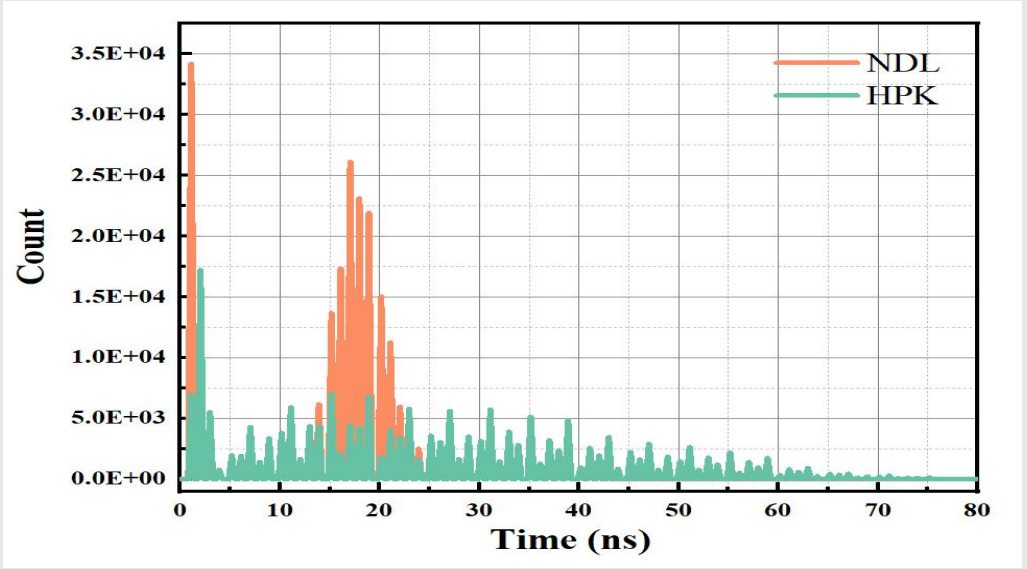
--by Yuguang Xie, Xiaolong Wang

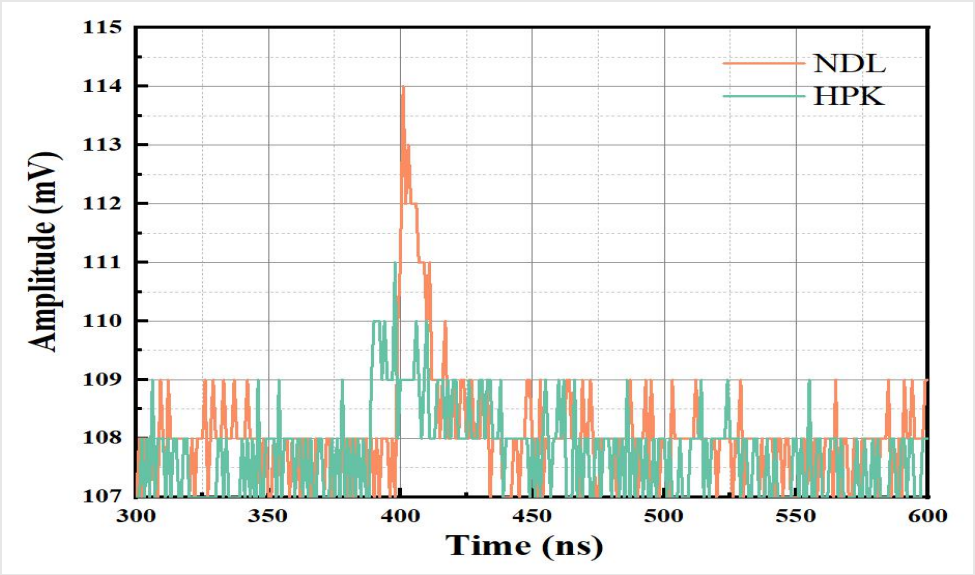
NDL EQR20



HPK S13360-3025CS

	NDL	HPK
Photosensitive area (mm)	3×3	3×3
Operation Voltage (V)	32.3	56.64
Gain	8×10^5	7×10^5
SPE channel	99	61
PDE @390nm (%)	42	22

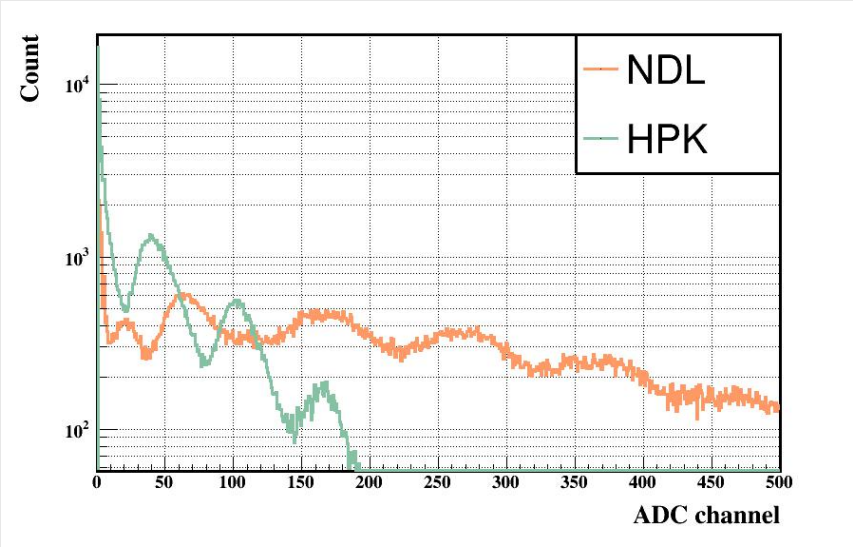




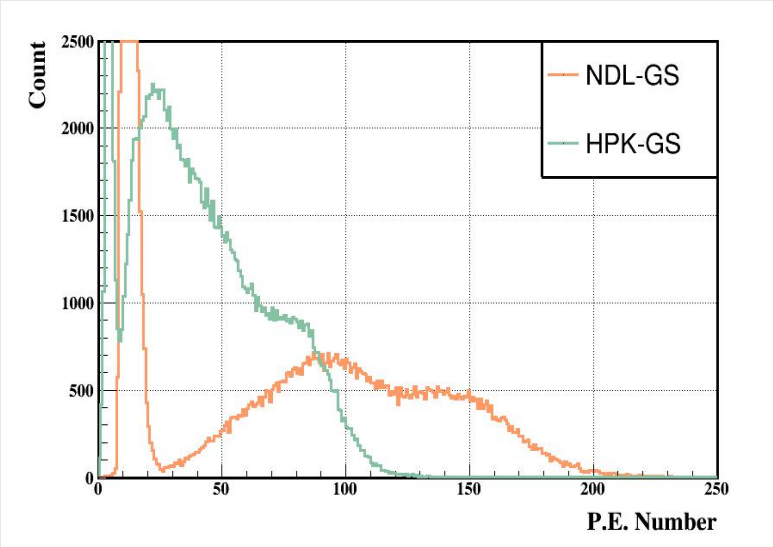
Current status of the GS-HCAL SiPM+GS

--by Hua Zhehao

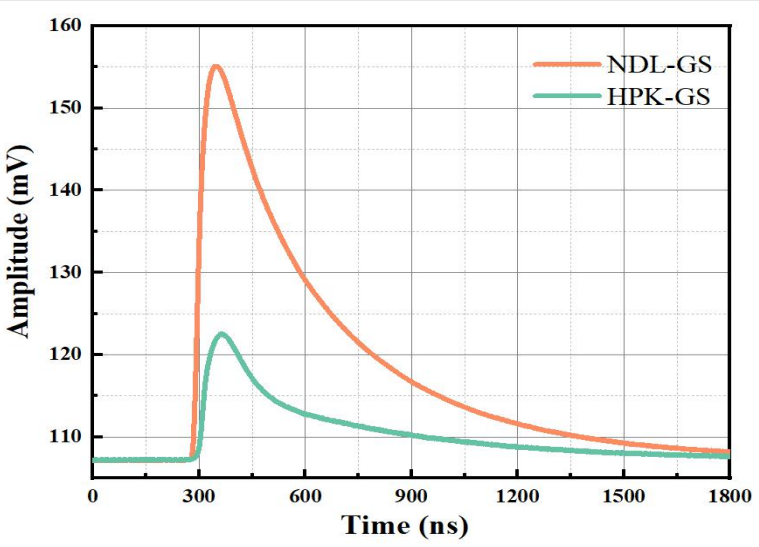
SPE spectra



137Cs Energy spectra



Average waveform



	FDU-NDL	HPK
P.E. Number	138	75
Energy resolution (%@662keV)	40.9	44.2
Scintillation decay (ns)	78.0 (7.8%), 487.6	84.5 (12.7%), 594.4

Current status of the GS-HCAL Mechanics

--by Yatian Pei， Bofeng Shang

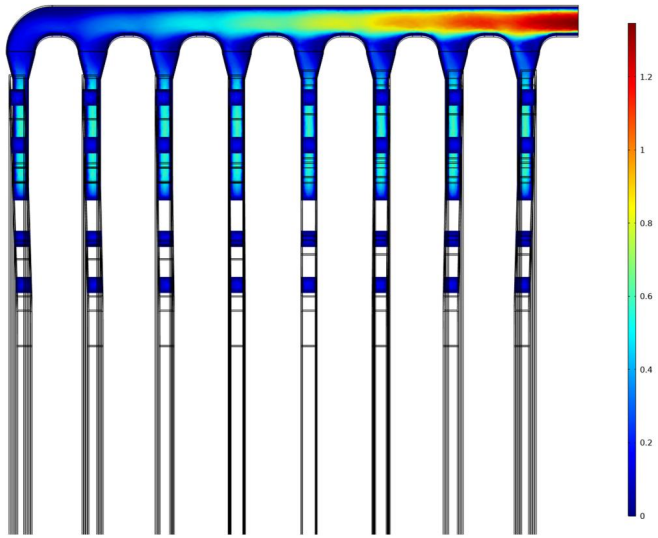
1. Optimization of cooling scheme

- Last version: parallel connection of 4 layers
- New version: parallel connection of 8 layers

Advantage: saving space

➢ 管路并联设计（八层共用一入口）

入口流量 (kg/s)	0.08
Layer1 (kg/s)	0.0054
Layer2 (kg/s)	0.0052
Layer3 (kg/s)	0.0050
Layer4 (kg/s)	0.0051
Layer5 (kg/s)	0.0048
Layer6 (kg/s)	0.0049
Layer7 (kg/s)	0.0050
Layer8 (kg/s)	0.0050



Current status of the GS-HCAL Detector

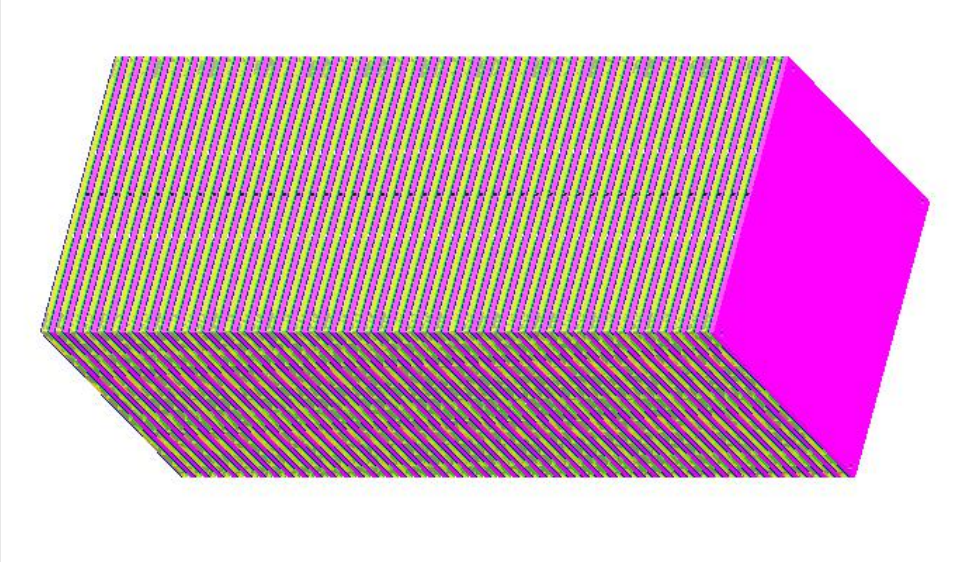
--by SenQIAN Boxiang Yu

- The Plan of the Prototype of GS-HCAL in the next two years (2025-2026).

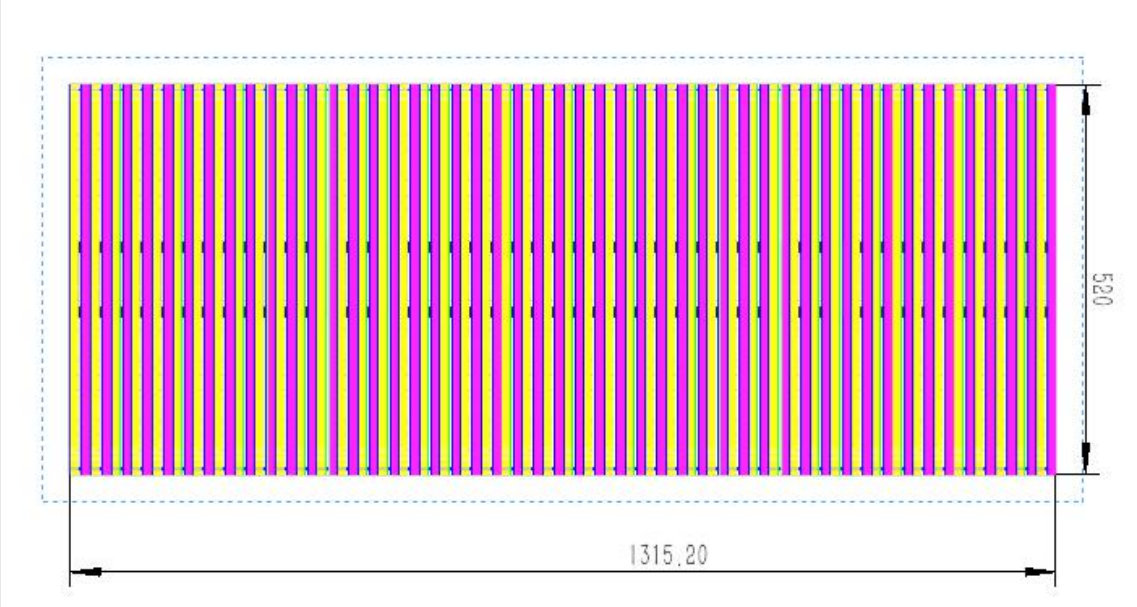
  the CPM plan will be finishd by Boxiang Yu and Jiawen Zhang.

- The Prototype of the HCAL was designed right now.

Prototype design



- Total: 48 layers
- Each layer: 13*13 glasses



- Verifying cooling scheme

The new group mumber

1. IIHE group： Inter-University Institute For High Energies (IIHE), Université libre de Bruxelles (ULB)

https://iihe.ac.be

Manpower leader: Barbara Clerbaux

Participant Member: Yifan Yang, Feng Gao

2. ISPM RAS group： The Institute of Synthetic Polymeric Materials (ISPM):

https://old.ispm.ru/en/index.html

Ponomarenko Sergey, Prof., Dr., ditrector

Borshev oleg, Prof., Dr., PhD, Head of department

Surin Nikolay, Dr., PhD., Senior scientific researcher

3. INR RAS group: The Institute for Nuclear Research (INR) of the Russian Academy of Sciences

https://www.inr.ru/english.html

Lubsandorzhiev Bayarto, Prof., Dr., PhD；

+ 9 person

4. BINP SB RAS： Budker Institute of Nuclear Physics of the Siberian Branch of the RAS

https://www.sbras.ru/en/organization/2376

Banyakov Mikhail, Dr., PhD.

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Backup

The Manpower of the HCAL

- 1. The PS-HCAL
  - **Jianbei Liu,** Haijun Yang, Boxiang Yu，Yunlong Zhang，……，
- 2. The GS-HCAL： Sen Qian （IHEP）
  - Sub-system: 2 Conveners + others
  - Physics：**Manqi Ruan(IHEP)，Haijun Yang(SJU)，**
  - Software: Sengsen Sun(IHEP)；
  - Design: **Fangyi Guo(IHEP), Hengne Li(SCNU)，**
  - Glass Scintillator: **Sen Qian(IHEP), Jing Ren(HEU)，** the GS collaboration Group
  - SiPM: **Yuguang Xie(IHEP), Jifeng Han(SCU)，**
  - Electronics: **Jingfan Chang(IHEP)，**
  - DAQ：**Chen Boping(IHEP),**
  - Mechanics: **Yatian Pei(IHEP), Junsong Zhang**
  - Detector：**Boxiang Yu(IHEP), Yunlong Zhang (USTC)，**

The Manpower of the subsystem of GSHCAL

Physics：Manqi Ruan(IHEP)，Haijun Yang（SJTU），

Software: Sengsen Sun(IHEP)；

Design: Fangyi Guo(IHEP), Hengne Li(SCNU), Qingming Zhang(XJTU), Weizheng Song(IHEP), Peng Hu(261) Dejing Du(IHEP), Hongbing Diao(SUTC), Jiyuan Chen(SJTU), ……

--to design the GS-HCAL detector based on the CEPCSW;

Glass Scintillator: Sen Qian(IHEP), Jing Ren(HEU)， the GS collaboration Group;

--R&D of the GS for CEPC-HCAL, a special group independent of CEPC;

SiPM: Yuguang Xie(IHEP), Jifeng Han(SCU), Guang Luo(SYSU),

--to do the research of SiPM for CEPC-HCAL, the electronics of SiPM for the GS performance test;

Electronics: Jingfan Chang(IHEP),

--to design the ASIC and FEE for CEPC-HCAL; the power supply, the cables and so on;

DAQ: Chen Boping(IHEP),

Mechanics: Yatian Pei(IHEP), Junsong Zhang(IHEP), Shang Bofeng(ZZU)

--to design the Mechanics of the GS-CEPC-HCAL; also the cell, the module, the cooling system;

Detector：Boxiang Yu(IHEP), Yunlong Zhang (USTC)

--to study the module of the GS-HCAL with GS and SiPM, the cosmic ray test, the beam test;