CMS-HGCAL project at IHEP and the Postdoc Position

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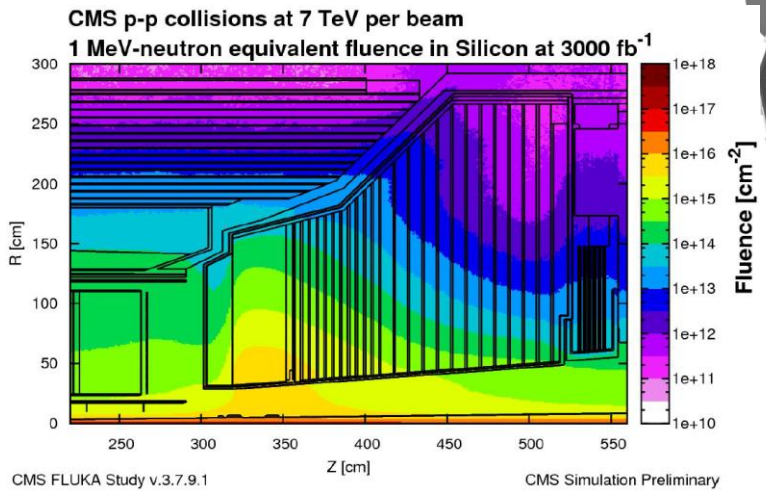
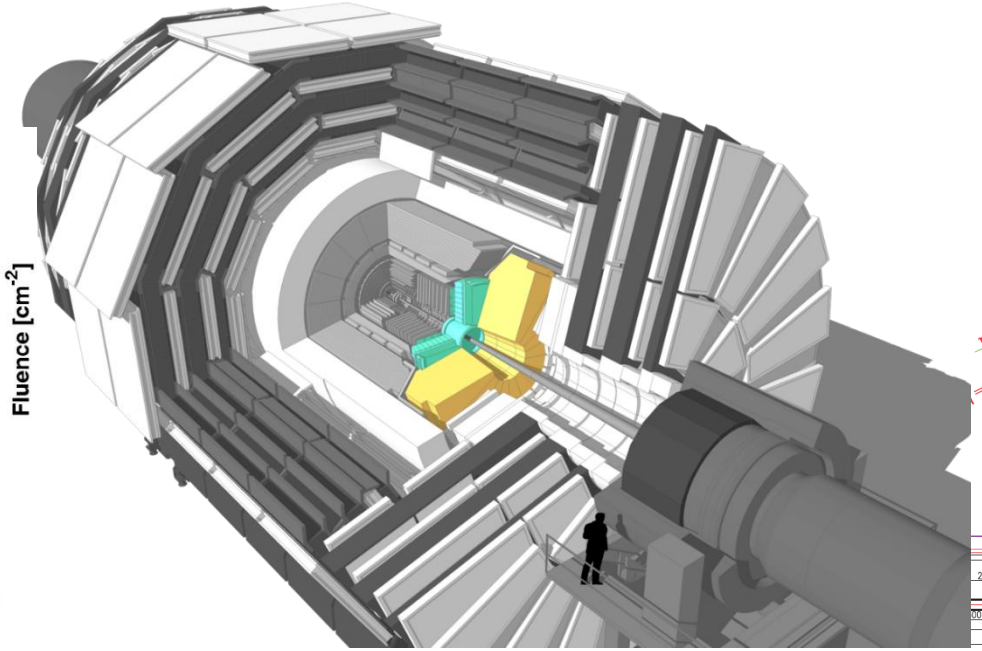
About IHEP

More details at http://english.ihep.cas.cn/

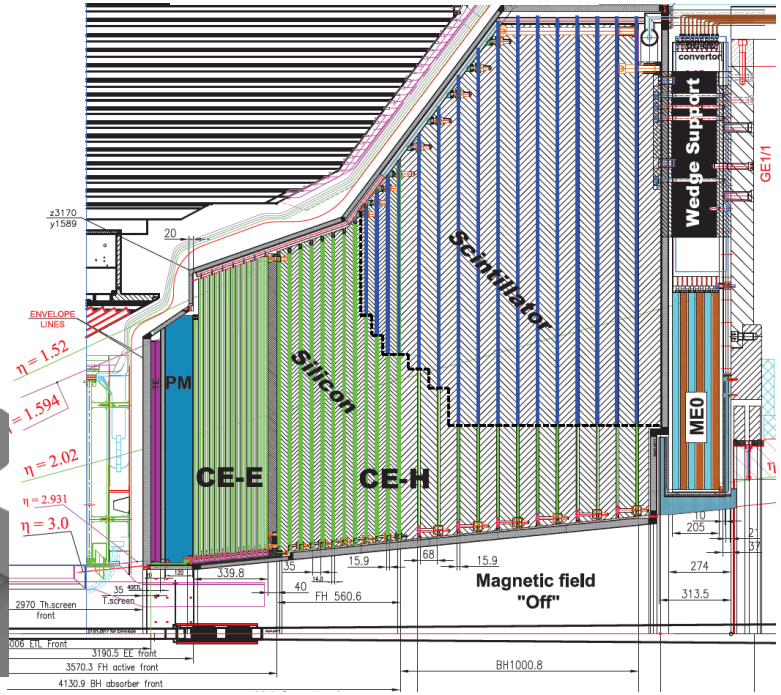
- IHEP as a pilot institution in high energy physics in China
  - Host a tau-charm factory (BEPC-II/BES-III), a neutron source (CSNS), neutrino experiments (Daya Bay, JUNO), space and ground telescopes/observatories, etc.
  - Collaborations with LHC experiments since 1990s
- Where is IHEP?
  - ~12km (west) from the Central Axis of Beijing (e.g. Forbidden City, Tian'anmen Square)
  - ~10-hour direct flight between Beijing and Geneva

Introduction: HGCAL project





Longitudinal View

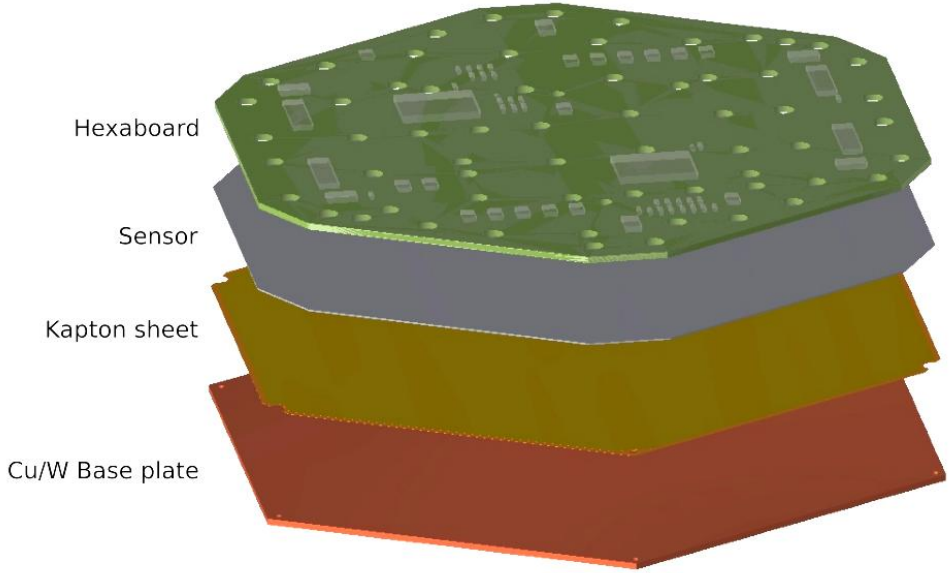


- CMS endcap calorimeters: Phase-2 upgrade project
  - Hash environment at HL-LHC: high pile-up, high radiation
  - Replaced with high-granularity calorimeters
- CE-E sampling calorimeter with silicon-only layers
  - Silicon sensors, Cu-W baseplate and lead as absorber

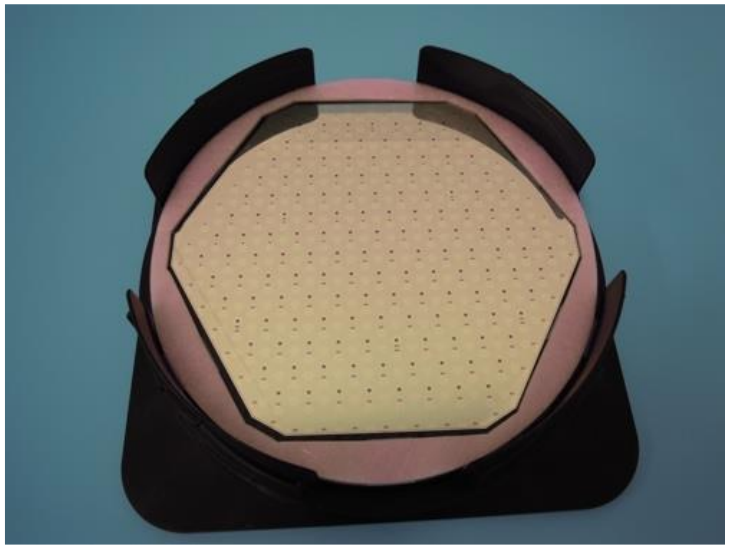
~640 m² silicon sensors
~370 m² scintillator tiles
~31k 8-inch modules in total (full, partial and spares)

Introduction: silicon modules in HGCAL

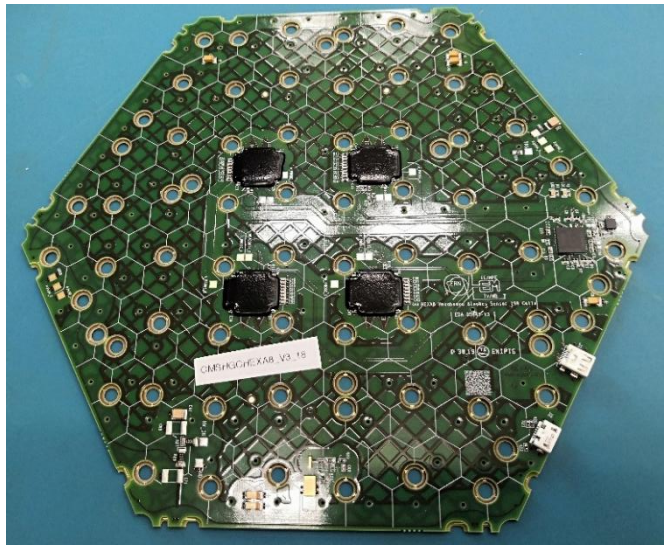
Schematics of a silicon module



8-inch silicon sensor (low-density)



8-inch readout PCB (low-density)



- Stacking different component layers
  - Silicon sensor wire-bonded to PCB equipped with readout ASICs

Major research activities

- Development of a silicon lab: almost done now
- For the CMS HGCAL project
  - The silicon lab will serve as one Module Assembly Center (MAC) (1 out of 6)
  - Responsible for mass assembly and quality control of silicon modules (~20%)
- Other detector R&D activities
  - Silicon sensor: development and characterisation
  - Development of high-granularity calorimeters for CEPC
- CMS physics programs
  - Higgs precision measurements
  - Searches for new particles beyond the Standard Model
  - Precision testing of the Standard Model, reconstruction of tau pairs …

Working group members

- Staff physicists: silicon sensors/modules
  - Xuelei Cao, Hongbo Liao, Yong Liu, Huqiao Zhang
- Staff engineers: technical support for various instruments
  - Yudong Gu (bonding), Liang Sun (OGP), Feng Wang (gantry)
- Visiting scholar
  - Huajie Cheng (module testing)
- PhD students
  - Baohua Qi, Chaochen Yuan

Infrastructure for silicon detectors

- Lab and instruments: completed within 2019-2020
  - 140 m^2 clean rooms
  - Gantry, bonding machine, optical gauging product

About this postdoc position

- Hardware-oriented research activities: major focus
  - Deep involvement with the mass assembly of HGCAL silicon modules and QC
  - Cosmic-ray and beam tests with silicon modules
  - R&D of large-area silicon sensors, performance characterization

- Software-oriented research (if candidate's background matches)
  - Reconstruction of high granularity calorimeters
  - Development of particle-flow algorithms