# Status of International Collaboration for CEPC Detectors R&D

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**CEPC International Workshop**

**IHEP, Beijing, November 8, 2017**

# Collaboration on Silicon Strip

- Intended contribution of ~1000 barrel strip modules for the **ATLAS Phase II ITk upgrade**

- **IHEP** established strong collaboration with **STFC-RAL**

  o Have started staff rotation plan (2 FTE) toward the end of module mass production → 500 modules with RAL's support

  o Dedicated training for wirebonding technician

  o Financial contribution to international fellowship



Group visit in September 2016 and meeting the UK ATLAS-ITk project management

IHEP-RAL MoU in preparation

# Collaboration on Silicon Strip

**IHEP/DESY/SLAC**

■ Collaboration with **DESY**

  o Funded CAS-Helmholtz joint research group on advanced silicon detectors for HL-LHC (2015-2017)

  o China and Germany Postdoctoral Exchange Program → **2 postdocs** as main developers of EUDAQ and EUTelescope and provide technical support of EUDET beam telescopes

  o Student exchanges via the DESY summer student program

■ Collaboration with **SLAC**

  o Joint R&D effort on CHESS 2 (HV-CMOS strip sensor), in particular on sensor characterization

  o Joint postdoctoral positions (topics of common interests)

# Collaboration with IPHC, Strasbourg

■ R&D on a pixelated tracker using CMOS pixel sensors (CPS)

  ▫ a project originally aimed at the upgrade of BES3 inner drift chamber, building a 1/10 prototype

  ▫ based on MIMOSA-28, chips used for STAR-PXL

  ▫ investigating design of large-dimension pixels

**IHEP+CCNU+SDU**
**IPHC, Strasbourg**
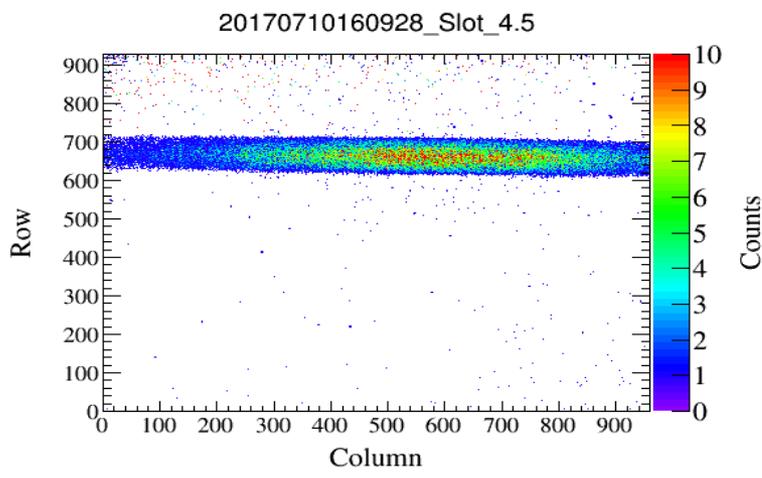


pixel response tested with $^{55}$Fe
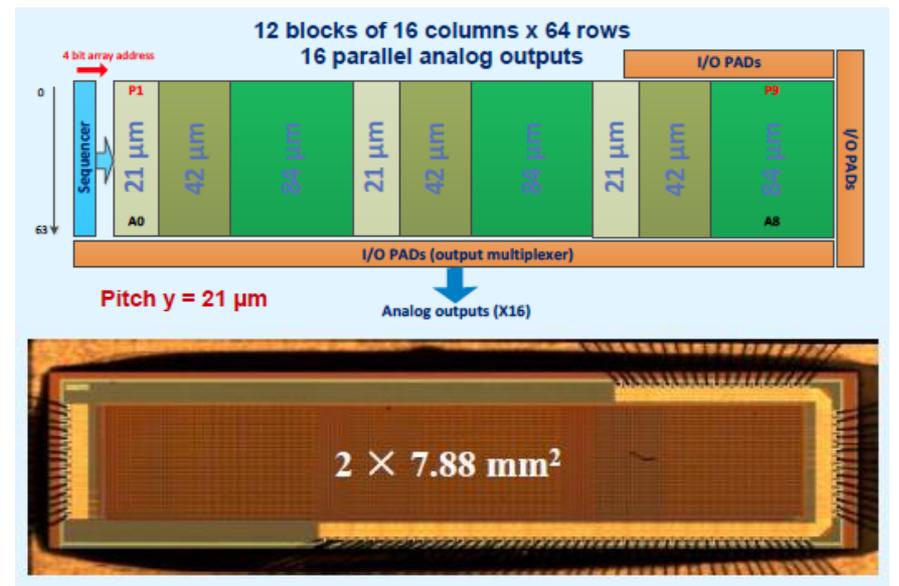
# Collaboration with IPHC, Strasbourg

■ Electron collider oriented pixelated CMOS sensor development

- ☐ aimed at the future CEPC and ILC colliders
- ☐ exploit the potential of CPS technology
    - ■ readout < 1 μs
    - ■ pixel dimensions small enough to reach a spatial resolution < 3 μm
    - ■ power consumption compatible with a low mass cooling system
- ☐ tape-out in May 2017 with digital pixels

**IHEP+CCNU+SDU**
**IPHC, Strasbourg**
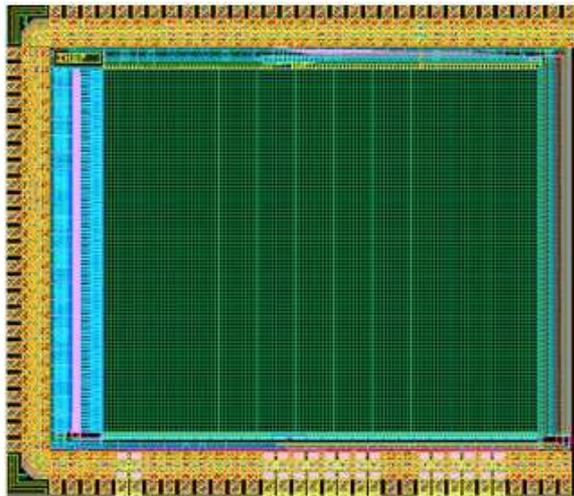
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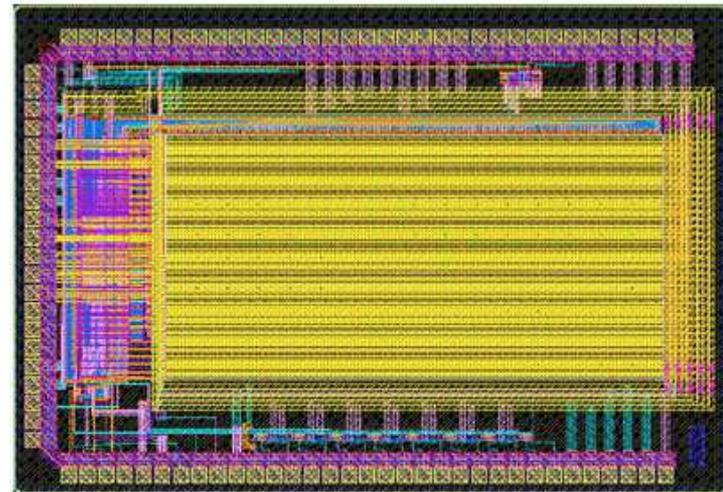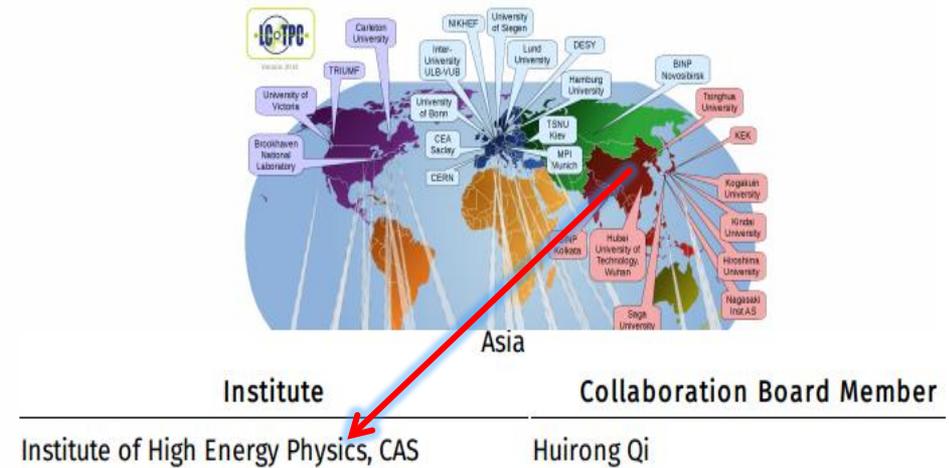
# Collaboration of LC-TPC R&D

- ❑ LC-TPC international collaboration group (LCTPC)
  - ❑ Singed MOA and joined in LC-TPC collaboration @Dec. 14,2016
  - ❑ As coordinator in ions test and the new module design work package
  - ❑ Regular meeting bi-weeks
  - ❑ Plan to beam test in DESY with our TPC prototype with 266nm laser calibration and the hybrid gaseous detector in 2018

**IHEP/LC-TPC**

**Joint LCTPC international collaboration**



LCTPC Collaboration Members

The map below shows the LCTPC collaboration member institutes as listed in the second Addendum of the Memorandum of Agreement from 2008.

| Institute | Collaboration Board Member |
|---|---|
| Institute of High Energy Physics, CAS | Huirong Qi |

# Collaboration of LC-TPC R&D

- ❑ **CEA-Saclay IRFU group (FCPPL)**
  - ❑ Three vidyo meetings with Prof. Aleksan Roy/ Prof. Yuanning/ Manqi and some related persons (2016~2017)
  - ❑ Exchange PhD students: Haiyun Wang participates Saclay's R&D six months in 2017~2018
  - ❑ Bulk-Micromegas detector assembled and IBF test
  - ❑ Optimized designed Micromegas module with more 590 LPI

- ❑ **LC-TPC collaboration Japan group (KEK)**
  - ❑ Joint dE/dx analysis of the beam test data@2016
  - ❑ Regular meeting every week
  - ❑ Optimized designed wider hole GEM module with 90-70-90

# Collaboration of LC-TPC R&D

## Collaboration with CEA-Saclay



## Collaboration with KEK/DESY
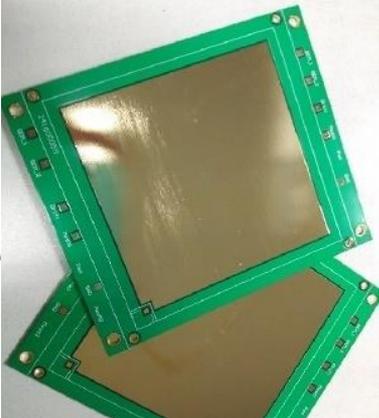


- **Joint meeting with Saclaty/THU/IHEP**
- **Design the Micromegas PCB boards**
- **Prepare to assemble the R/Micromegas**
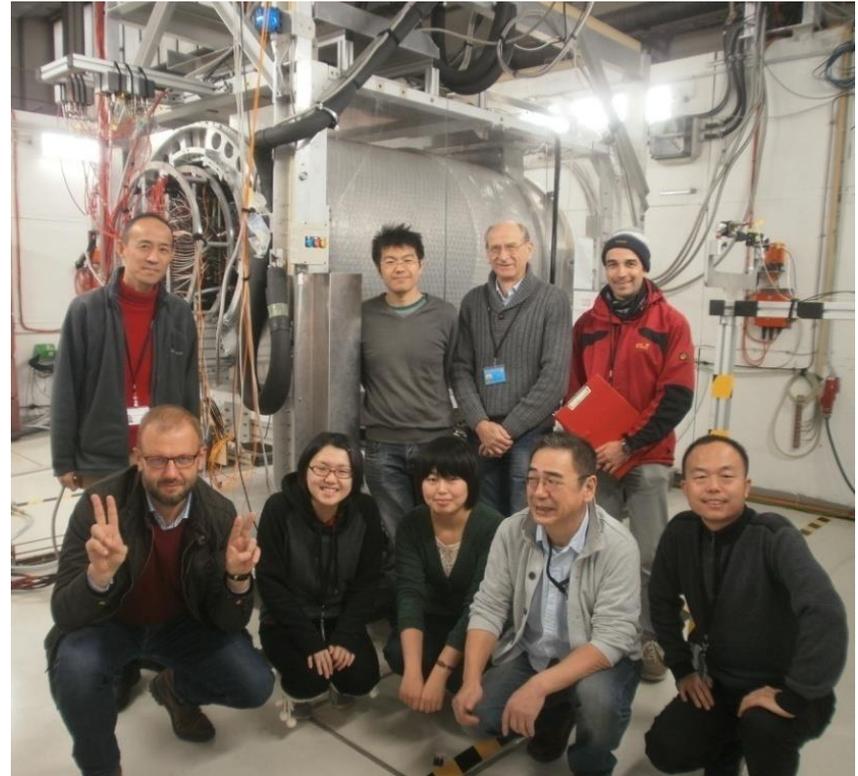
- **GEM module with gate GEM in 1.0 Tesla**
- **5.0Gev electron beam test**
- **Join in group and participate in analysis**

# Join the CALICE Collaboration

- THU and SJTU joined the CALICE Collaboration  **THU/SJTU/CALICE**

- Collaborating with Imad Laktineh (IPNL) on SDHCAL R&D.

- We have a joint Ph.D student via CSC program (2years). CAN-059 about using BDT to improve pi/e/mu separation is under review process.

- SJTU will host the CALICE collaboration meeting on Sept. 19-21, 2018. https://agenda.linearcollider.org/event/7799/
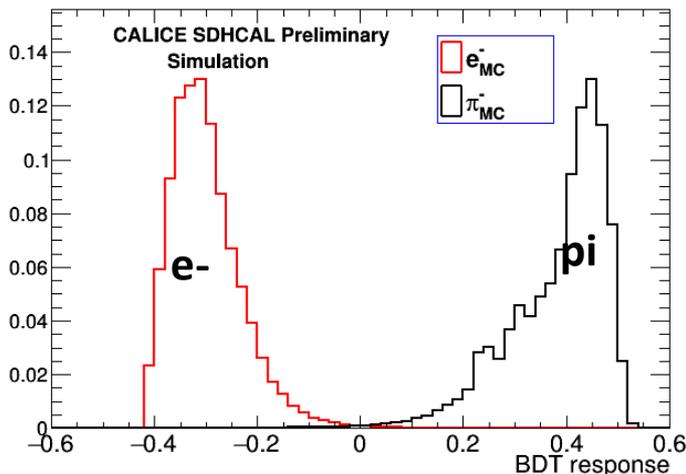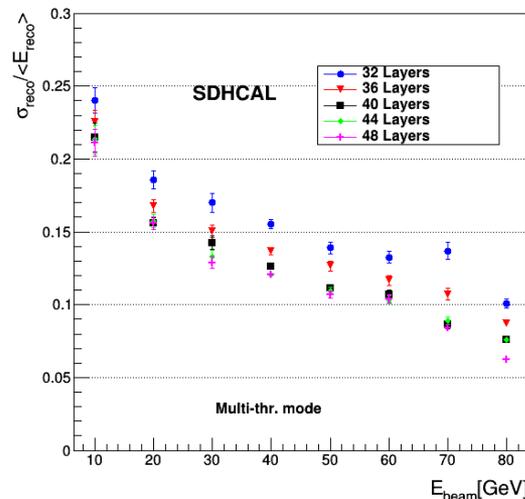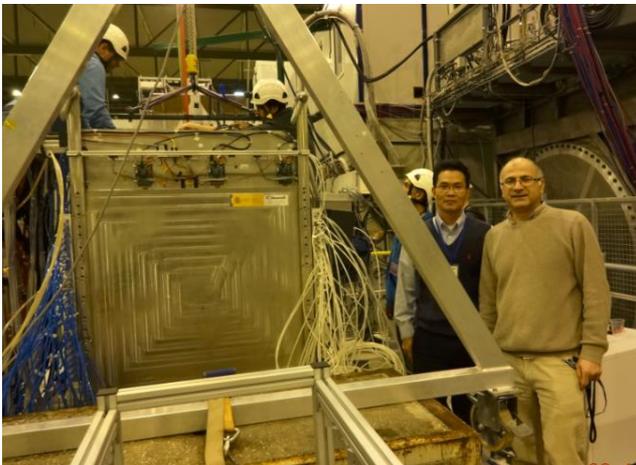


➔ **IHEP and USTC plan to join the CALICE to work on ScW ECAL and AHCAL**

# Collaboration on Detector Design & Optimization

- PFA Oriented Reference Design (CEPC_v4): TPC/Si + High Granularity Calorimeter

  - Fully established at simulation, reconstruction and analysis

  - Geometry adapted to CEPC collider

  - Parameters optimized w.r.t Physics Objects

  - Domestic task force: IHEP + PKU + SJTU

  - Collaborations

    - LCTPC: feasibility study on TPC usage

    - CALICE: Calorimeter geometry optimization

    - ISU: TPC dEdx performance study

    - LLR, NTU, Chicago U, INPL, CERN: PFA reconstruction & Analysis

    - LBL, ANL: Si Tracker Simulation/Reconstruction

- Alternative Concept using wire Chamber + Dual readout

  - Conceptual detector implemented in Geant 4

  - Domestic task force: IHEP + NKU

  - Collaborations

    - RD52: Dual Readout Test beam & digitization study

    - INFN: Sub detector design

    - Kyungpook National University (KNU): Implementation of simulation
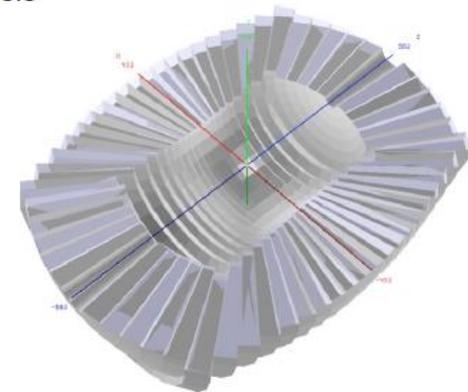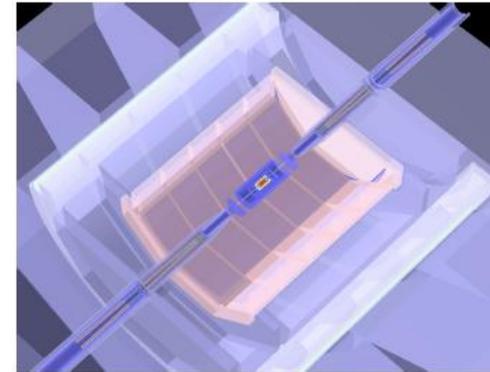
# Some Suggestions

- Fruitful discussions and suggestions:
    - join existing workshop groups (eg. ILC, FCC-ee)
    - have joint group meetings on specific topics
    - invite international colleagues to join CEPC working group
    - work closely and be a part of detector R&D
    - seek funding via joint proposal (eg. IHEP/USTC - INFN)
    - joint Ph.D students via CSC program
    - joint postdoc to work on CEPC R&D
    - ......