High Energy Physics Report from IHEP/China

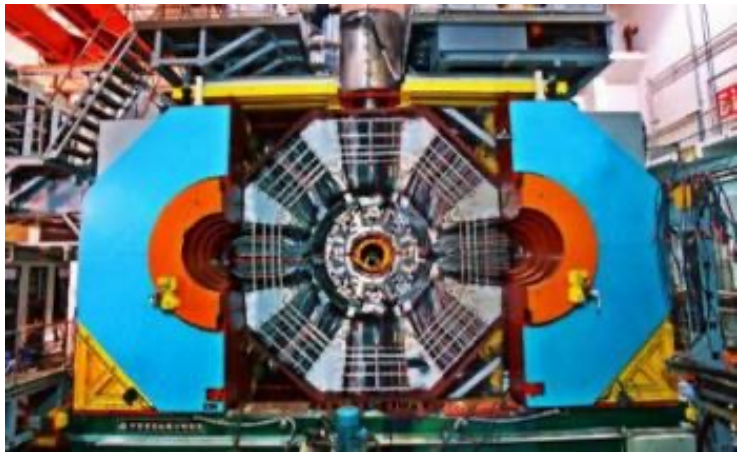
Jun Cao (IHEP)

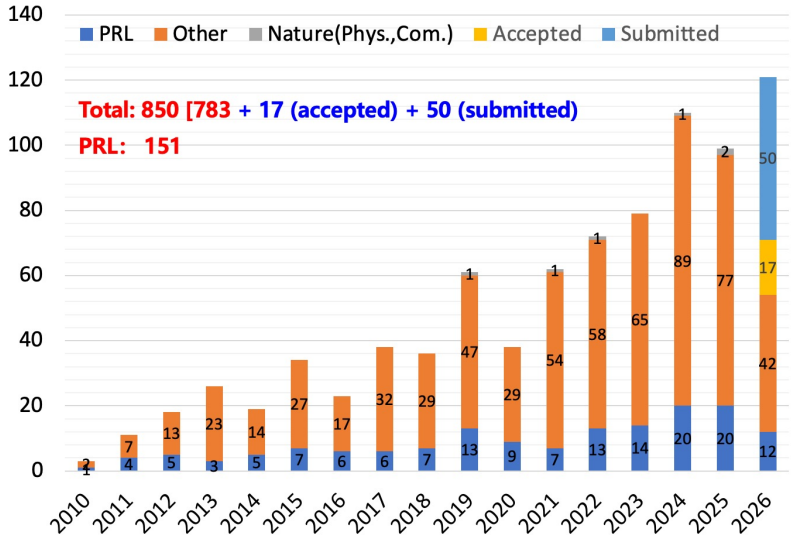
ACFA-HEP, Shanghai, Oct. 13, 2026

BEPCII / BESIII

- **BEPC/BES (1980s) → BEPCII / BESIII (2009-now) → BEPCII-U → BEPCII-UP**
  - ⇨ **Hadron spectroscopy and exotic states, XYZ particles, R value and QCD, form factors, hyperon, charmed meson and baryon decays with data near thresholds.**
- **BESIII Collaboration: 700+ scientists from 98 institutions in 15 Countries**
- **130 international collaborators. 15 from Asia: Thailand, India, Pakistan, Korea, Mongolia**
- **Very productive. 101 papers published in past year (July 2026), 23 in PRL**



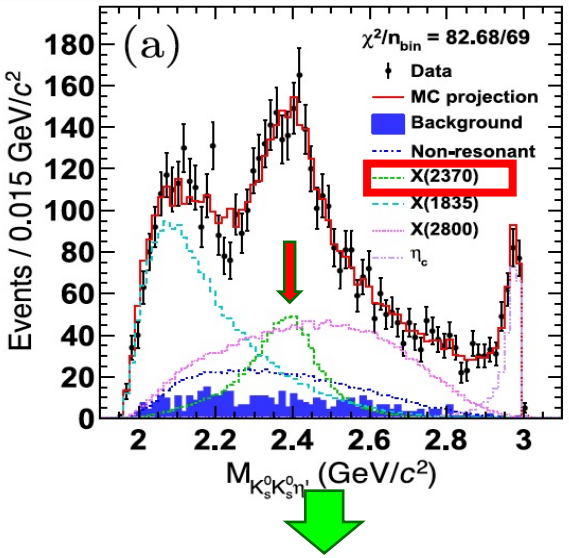




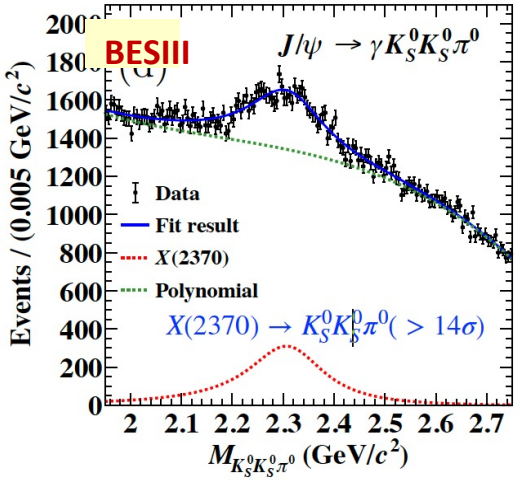
Lightest 0^{-+} Glueball as Dominant Constituent of X(2370)

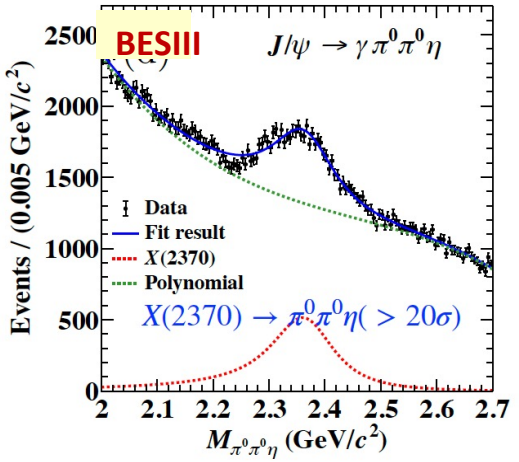
Spin parity determined in 2024

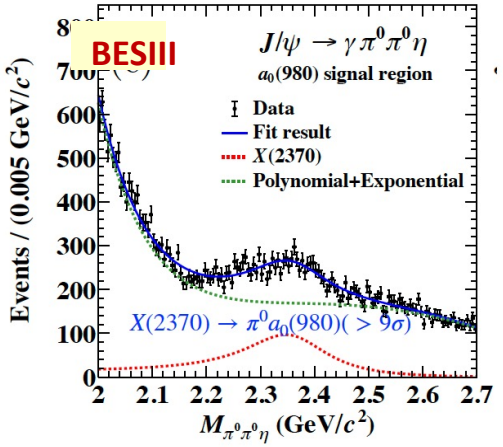
PRL 132 (2024) 181901



Mode decay modes discovered in 2026, arXiv: 2605.26495







- Mass and spin parity consistent with LQCD prediction of a pseudoscalar glueball
- Similar to hc decays, a signature of glueball
- Flavor singlet: no dominant channel
- Partial widths are all very narrow → all OZI suppressed decays
- Not seen decaying to γϕ, γω (no γ-glue direct couplings)
- Not seen in $K^*\bar{K}$ decay mode due to generalized G parity conservation

$J^{PC} = 0^{-+}$ with significance $> 8.9\sigma$

$M = 2395 \pm 11^{+26}_{-94}$ **MeV**

$\Gamma = 188^{+18}_{-17}{}^{+124}_{-33}$ **MeV**

$B(J/\psi \to \gamma X(2370))B(X(2370) \to f_0(980)\eta')B(f_0(980) \to K^0_S K^0_S)$

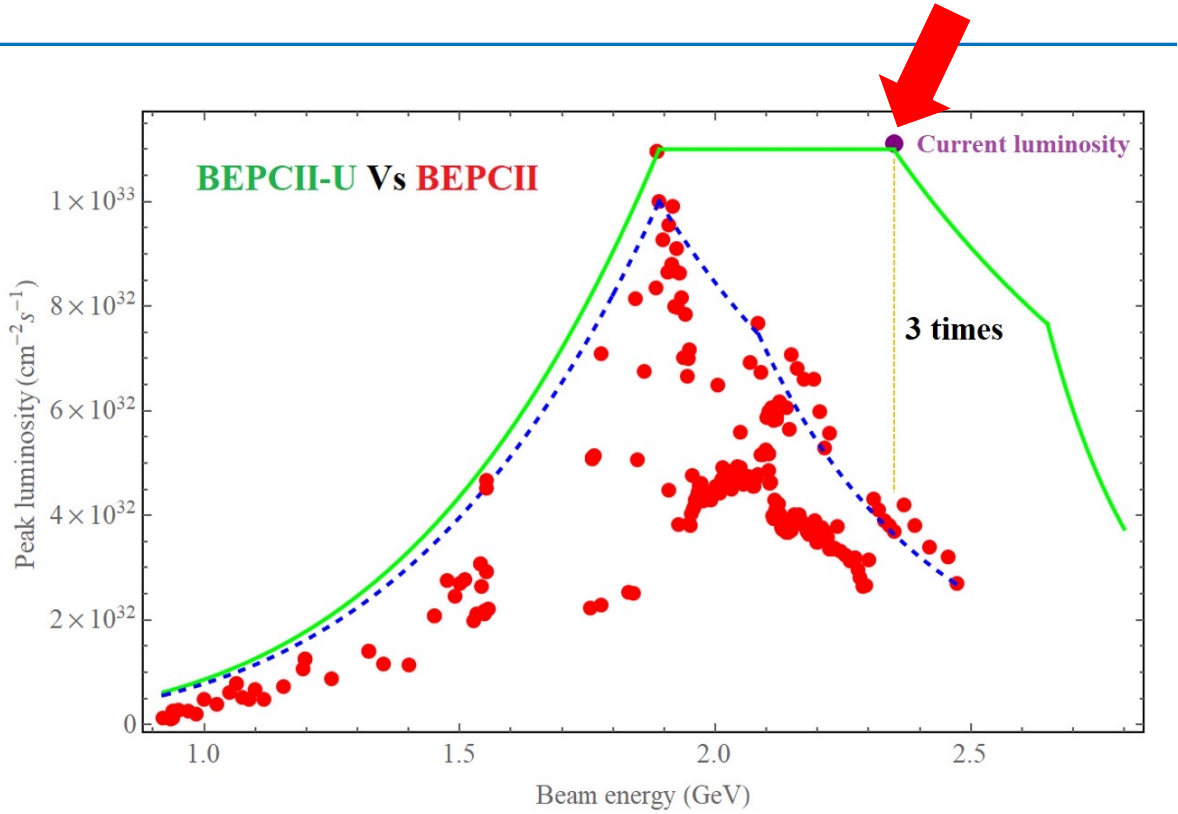
$= (1.31 \pm 0.22^{+2.85}_{-0.84}) \times 10^{-5}$

arXiv:2607.20366 (submitted to PRL), special talk at ICHEP2026

News and comments on scientific magazines such as *Nature, Science*

BEPCII-U Status

- **BEPCII-Upgrade: Increase luminosity by a factor of 3 at E_{cm}>4 GeV and increase max beam energy from 2.5 to 2.8 GeV** by adding two RF cavities and two SC magnets
- **Installation from July 2024 to Feb. 2025. Commissioning started on Mar. 1, 2025.**
- May 17, 2025 BESIII data taking started. July 29, 2025 Summer shutdown. Sep. 13, 2025 BESIII data taking @ E_{beam} = 1.843 GeV.
- Feb. 26, 2026 BESIII data taking @ E_{beam} = 2.34 GeV
- **Apr. 28, 2026 Peak luminosity reached design value**
- **Jul. - Sep., 2026 Summer shutdown**
- **Sep., 2026 – Jul., 2027, BESIII data taking @ E_{beam} = 2.34 - 2.52 GeV,** for charmed baryon weak decay and four quark state Zcs(3985).



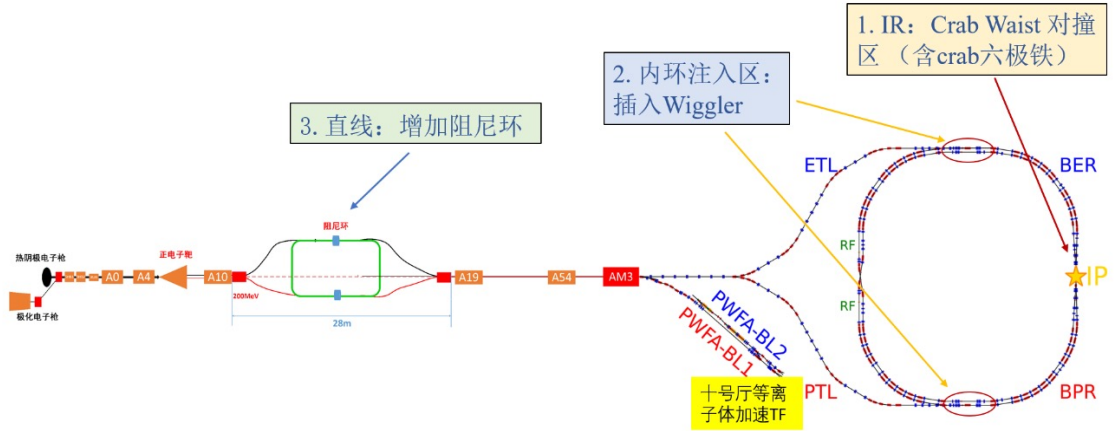
BEPCII-U has achieved high-efficiency operation at beam energy of 2.34 GeV

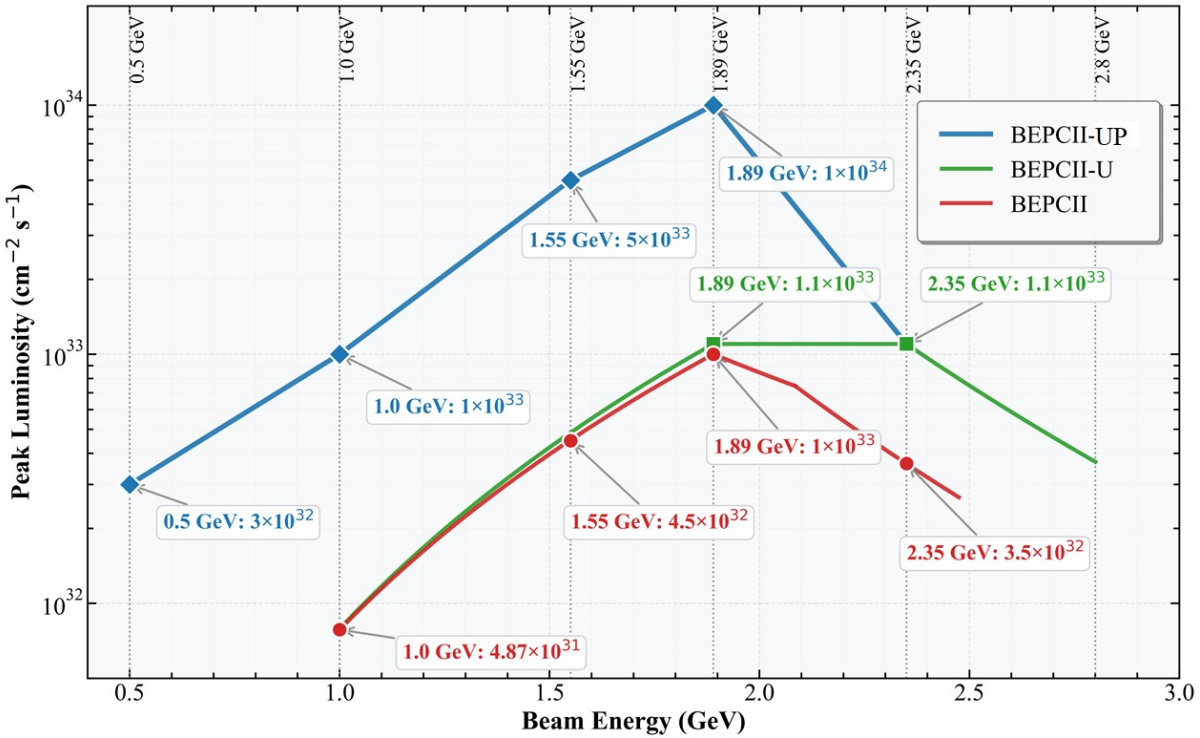
Peak luminosity $1.112\times10^{33}cm^{-2}s^{-1}$

3.2 times higher than before the upgrade

BEPCII – Further Upgrade （ BEPCII-UP ）

- **Upgrade Plan: Increase lumi by 10 times at low-energy region with Crab-Waist**
  - ⇨ **R-value** in 1.0-2.0 GeV for **muon g-2**
  - ⇨ 30 billion $\psi(2S)$ for **glueball** and **hybrid.** ……
  - ⇨ Verify the Crab-Waist
- **Accelerator upgrade (cost 25M Euro)**
  - ⇨ **Damping ring** in the LINAC
  - ⇨ **Wiggler** in the storage ring
  - ⇨ **Crab-Waist**
- **Timeline**
  - ⇨ TDR in 2027, Production in 2028-2029
  - ⇨ **Installation ~2030**
- An advisory meeting in May, 2026
- Discussed at the Symposium on the Chinese Strategy for HEP in July, 2026 in Guangzhou

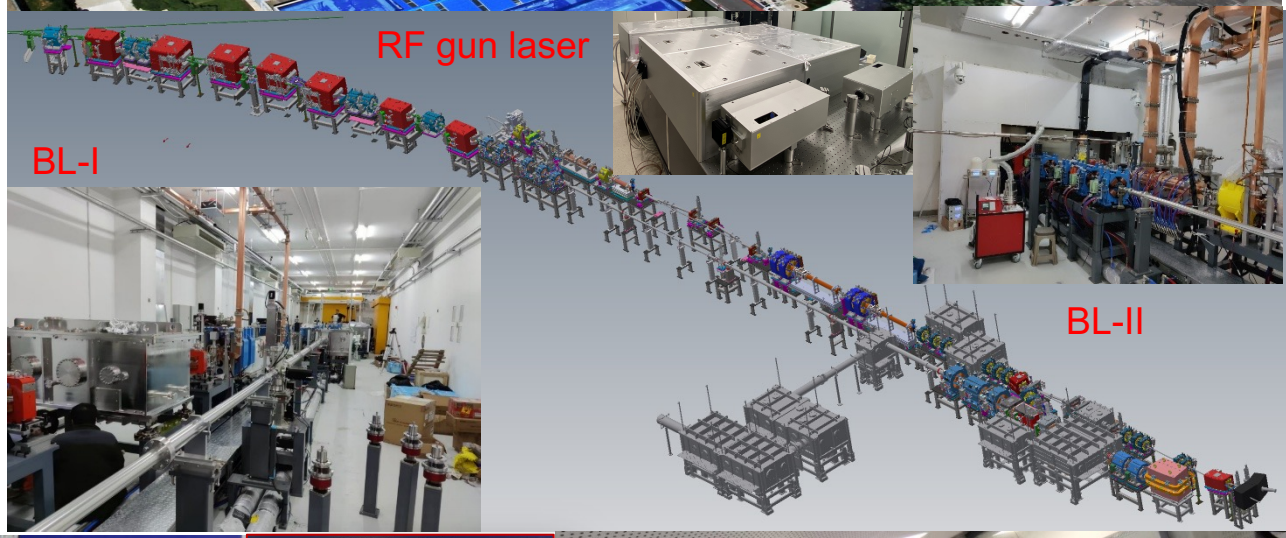




BEPCII-based Plasma Wake Field Acc. Test Facility

- **Unique facility for PWFA/LWFA research**
  - ⇨ BL-I: 2 GeV e-/e+ beams from BEPCII
  - ⇨ BL-II: new 150MeV 1-5 nC e-Linac with 2 IPs
  - ⇨ PW laser: **1 petawatt 30-fs** compact laser
  - ⇨ Three systems synchronized in IP1
- **World leading research opportunities**
  - ⇨ Positron acceleration in e- driven PWFA
  - ⇨ PWFA staging
  - ⇨ External injection to a PWFA
  - ⇨ External injection to a LWFA (e-/e+)
- **Current Progress**
  - ⇨ Beamlines and experimental stations **fully installed by Feb. 2026**
  - ⇨ BL-I beam commissioning
    2 GeV e-/e+ beams available at IP1
  - ⇨ BLII beam commissioning
    3.2 nC beam charge achieved at BL-II RF gun



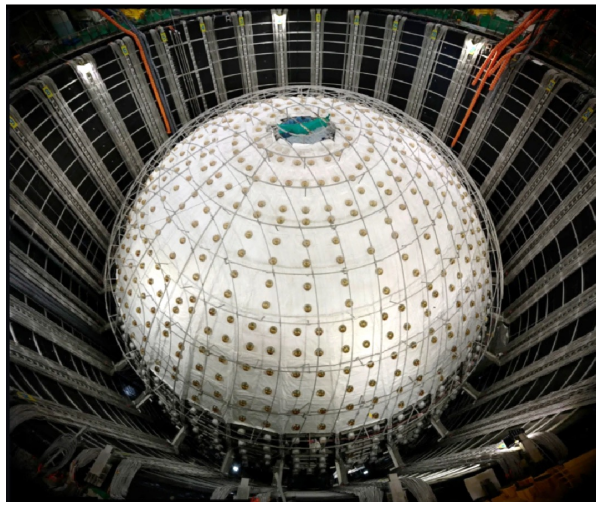




Jiangmen Underground Neutrino Observatory

- **JUNO, a 20 kton liquid scintillator detector at 700 m underground**
  - ⇨ Aug. 26, 2025 data taking; Nov. 19 first results → most precise $\sin^2\theta_{12}$, Δm^2_{21}
  - ⇨ **Most precise $\sin^2\theta_{12}$, Δm^2_{21}, $|\Delta m^2_{31}|$, and normal ordering at 2.1σ in June 2026 (Neutrino2026)**
- **JUNO-TAO, a ton-level low-temp liquid scintillator detector in the Taishan Power Plant**
  - ⇨ Data taking started since Feb. 15, 2026, light yield ~ 4,000 p.e./MeV (JUNO 1780 p.e./MeV)
  - ⇨ **First Results reported at Neutrino2026. Provided reference spectrum for JUNO**
- **620 collaborators from 67 institutions in 14 countries and regions**
- **250 international collaborators, 15 from Thailand and Pakistan**







Participation in LHC & ATLAS, CMS, LHCb

- IHEP started cooperation with CERN in 1970s
- China authors/members: ATLAS 112 / 273, CMS 57 / 249, LHCb 131 / 238 in total: 300 / 760
- IHEP authors/members: ATLAS 30 / 81, CMS 17 / 45, LHCb 21 / 29 in total: 68 / 155

HL-LHC CCT magnet

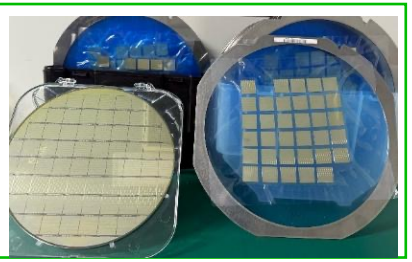
- Production going well
- All the 10+2 magnets shipped to CERN



ATLAS HGTD

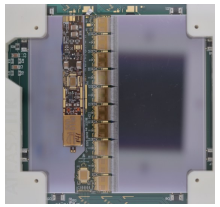
- China will produce all LGAD chips.

~10k sensors fabricated (~40% of total)



ATLAS ITK strip upgrade (10% barrel modules)

- Qualified sensor QA site
- ~150 modules assembled at IHEP and RAL



ATLAS muon by USTC, Shandong U.

CMS GEM by PKU, MiP Timing detector by PKU, USTC

LHCb calorimeter upgrade led by PKU

CMS HGCAL

- IHEP will produce >100 m^2 (~20%) HGCal silicon modules
- Providing ~90% (in area) of CuW baseplates (~20% done)

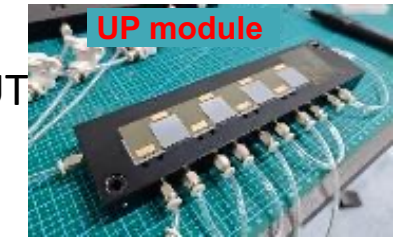


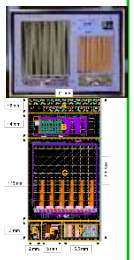
CMS RPC Backend Trigger electronics

- IHEP Leading Endcap RPC BE/TRG construction
- BE Demo successfully designed and validated in P5

LHCb UT/UP

- Leading operation of the UT detector, and R&D of the pixel-based UP upgrade

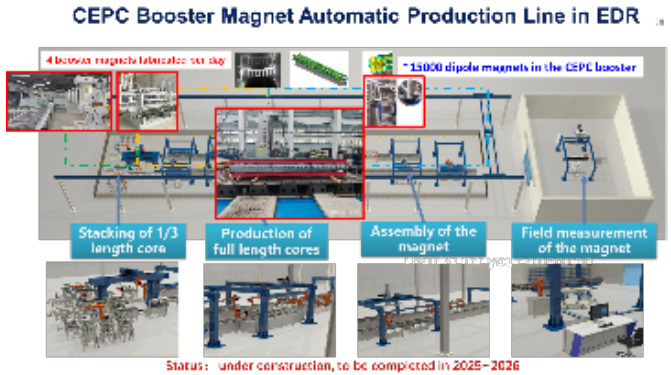




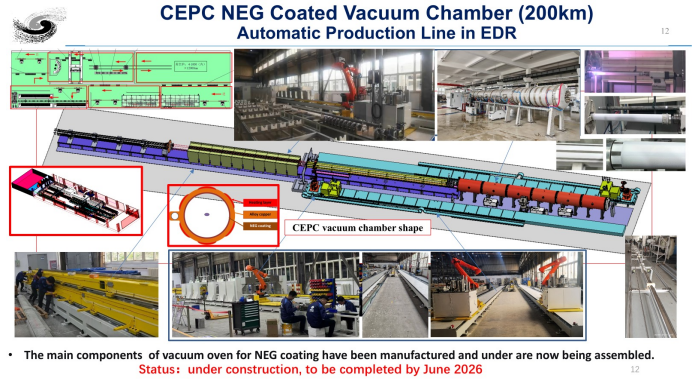
CEPC

- CEPC will continue to carry out critical accelerator EDR and detector R&D
- Will apply for approval for the CEPC project for the 16th Five-Year-Plan ~ 2030, if FCC is not yet approved at that time
- Or, IHEP will join CERN's FCC if it is approved for construction before 2030
- CEPC will seek to cooperate with CERN on FCC, and with DRD Collaborations

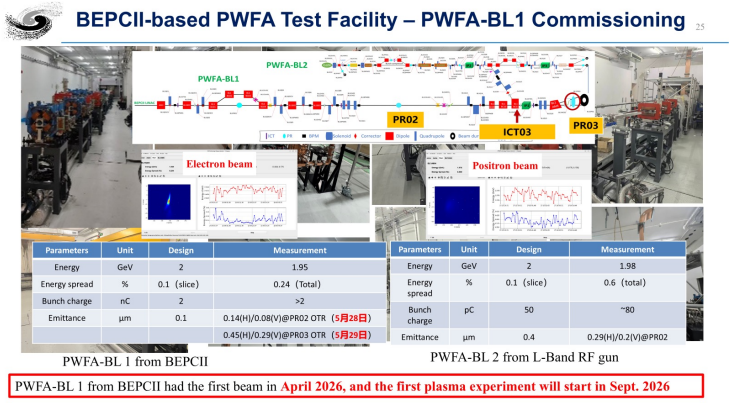
- **Accelerator EDR (2024-2027). IARC2026 meeting in Sep. 22-24, 2026.** Expected progress includes
  - ⇨ plasma wakefield accelerator, Vac chamber NEG coating and magnet automatic fabrication line, high efficiency energy recovery klystron, Iron-Based Superconducting



CEPC booster magnet Automatic fabrication line will be completed by Nov. 2026



CEPC vacuum chamber NEG coating fabrication line Has been completed by June 2026, to be tested



IHEP plasma test facility based on BEPC-II has Both electron and positron beams started in April 2026, commissioning plasma acceleration

CEPC Detector (AGORA)

- The CEPC detector is continuing key technologies verification and prototyping.
- A new name AGORA (Advanced Glass Optimized Research Apparatus) was selected, describing a next-generation experiment at a lepton collider (CEPC/FCC).
- AGORA has been proposed to FCC-ee as a detector concept.
- Two new ideas in AGORA
  - ⇨ An integrated design for EM and hadron calorimeters based on **glass scintillator** (GS)
  - ⇨ A Ring-Imaging Cherenkov (**RICH**) detector in the forward region to improve PID

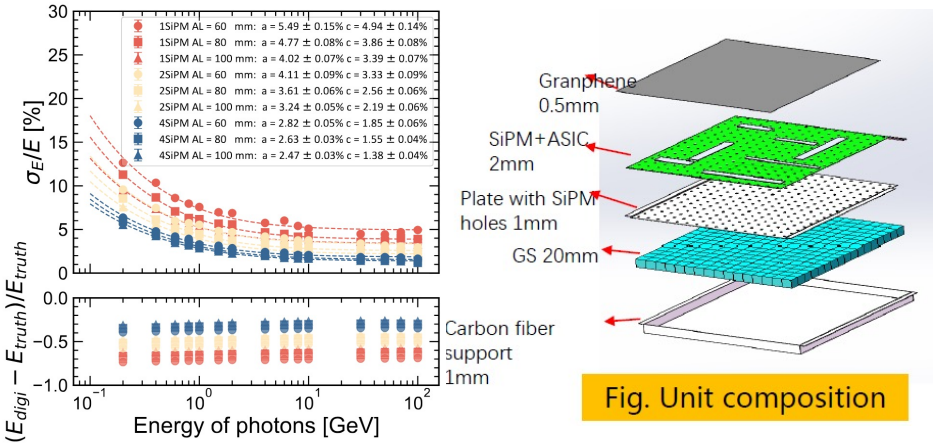
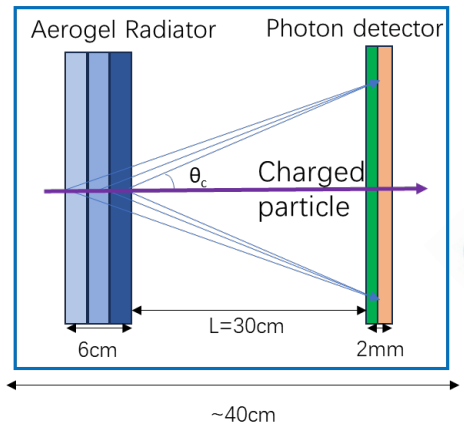
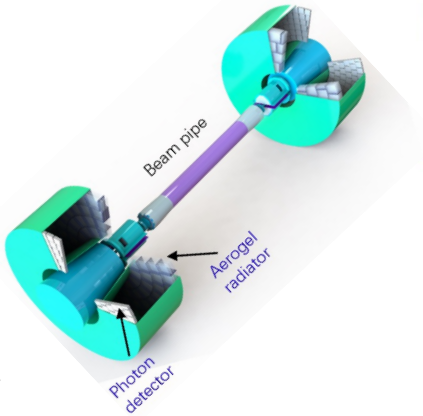


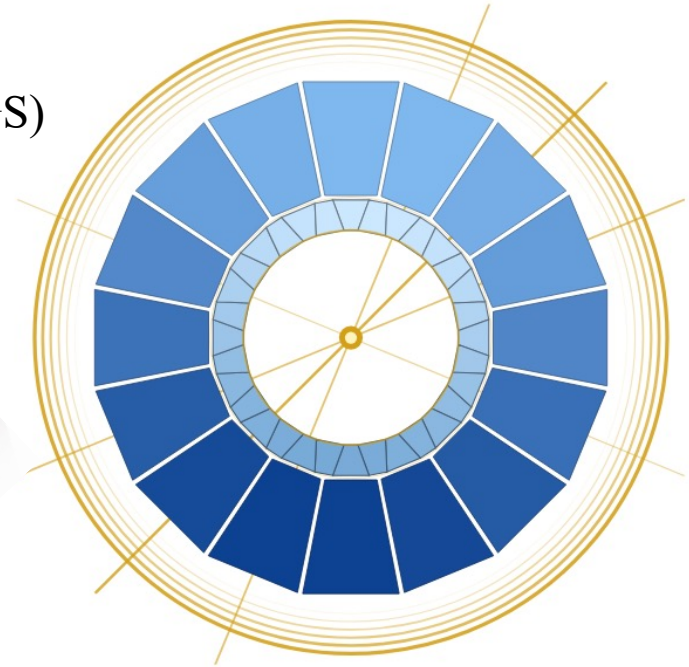
Fig. Unit composition

Simulation study and preliminary design of a unit of GS-ECAL





Conceptual design of RICH detector ongoing



AGORA

ADVANCED GLASS OPTIMIZED RESEARCH APPARATUS

CEPC International Collaborations

CEPC2026 workshop, Shanghai Oct.22-26, 2026

https://indico.ihep.ac.cn/event/cepc2026



- Enhanced collaborations through continuous international workshops/meetings.
- In-person discussions between CEPC and FCC management teams.
- CEPC workshop EU, 2027, Belgrade, Serbian

CEPC Workshop EU, April 7-10, 2026, Lisbon, Portugal



FCC Week, June 8-12, 2026, Helsinki, Finland



FCPPN Workshop, Jun.29- Jul.3, 2026, Lyon, France



Summary

- **HEP researches in China focus on Hadron physics, Neutrino Physics, and High Energy Frontier Physics**
- **Not covered in this talk: dark matter exp. PandaX and CDEX**
  - ⇨ and many R&D on dark matter, 0νββ, STFC, etc
- **We host large facilities, and also actively participate in international collaboration**
  - ⇨CERN LHC, HL-LHC, and future FCC-ee
  - ⇨ AMS, Darkside, EXO, PANDA, GlueX, …
  - ⇨ Belle-II, Super-K, and COMET (Japan)

Thanks!