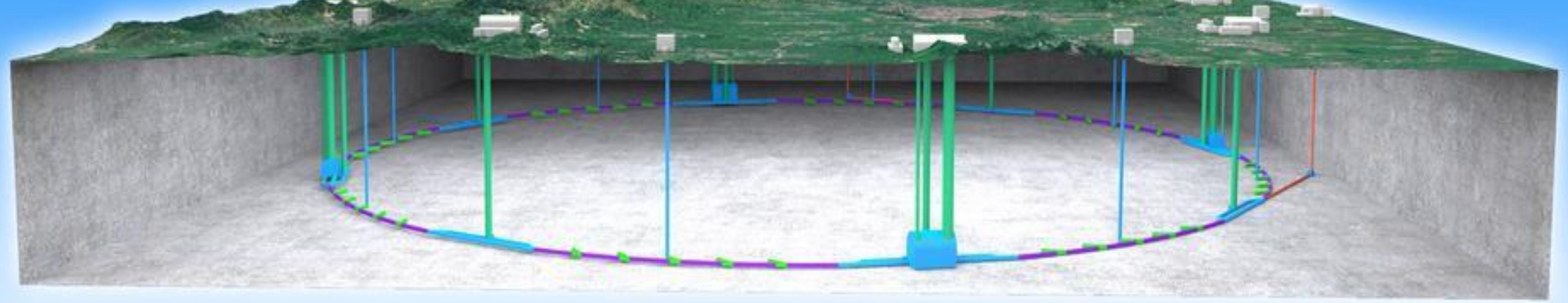
Status and Perspective of The CEPC

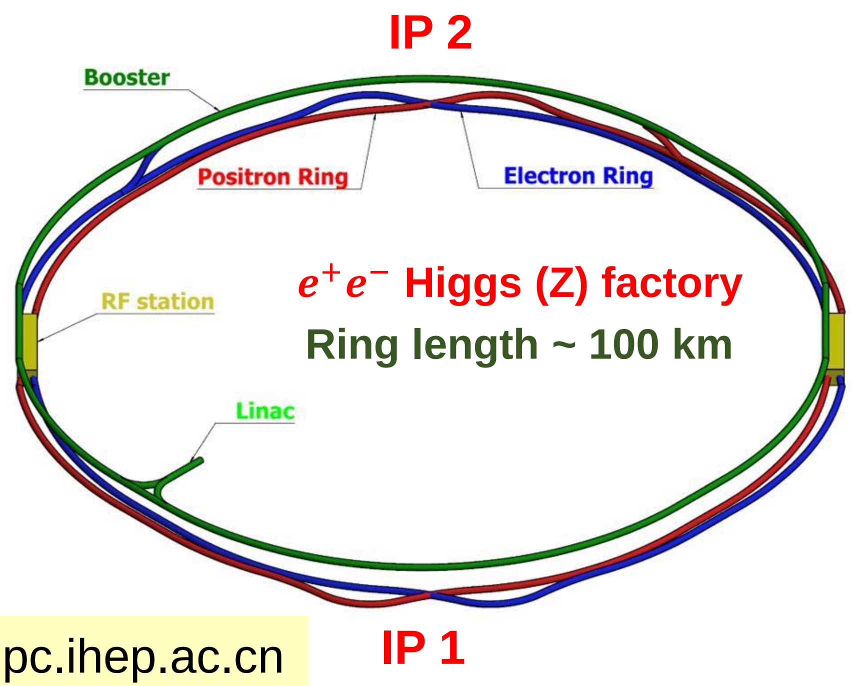
Jianchun Wang (IHEP, CAS)
For the CEPC Study Group

CLHCP, Nov 14-17, 2024, Qingdao



The Circular Electron Positron Collider (CEPC)

- The Higgs boson was discovered in 2012 by ATLAS & CMS, with a mass ~125 GeV.
- The CEPC was proposed right after the discovery, as an e^+e^- Higgs / Z factory, aiming to start operation in 2030s.
- To produce Higgs / Z / W / top for high precision Higgs, EW measurements, studies of flavor physics & QCD, and probes of physics BSM.
- It is possible to upgrade to a *pp* collider (SppC) of $\sqrt{s}$ ~ 100 TeV in the future.



http://cepc.ihep.ac.cn

Global HEP Consensus on Higgs Factories

The scientific importance and strategical value of e^+e^- Higgs factories is clearly identified.

*2013/2016:China Xiangshan Science Conference concluded that **CEPC is the beat approach** and a major historical opportunity for the national development of accelerator-based high energy physics program.*

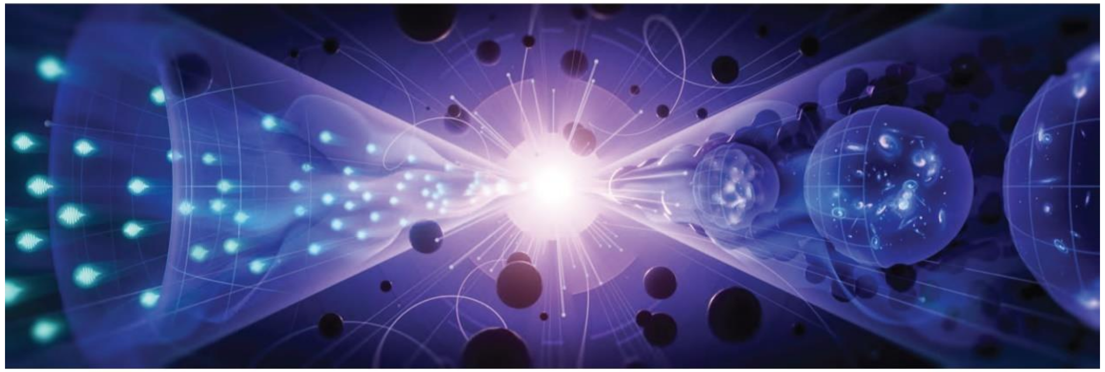
*2020: European Strategy for Particle Physics, **An electron-positron Higgs factory is the highest priority next collider.** For the longer term, the European particle physics community has the ambition to operate a proton-proton collider at the highest achievable energy*

*2022: ICFA "reconfirmed the international consensus on the importance of **a Higgs factory as the highest priority for realizing the scientific goals of particle physics**", and expressed support for the above-mentioned Higgs factory proposals*

Exploring the Quantum Universe

Pathways to Innovation and Discovery in Particle Physics

Report of the Particle Physics Project Prioritization Panel 2023



Exploring the Quantum Universe

Recommendation 6

Convene a targeted panel with broad membership across particle physics later this decade that makes decisions on the US accelerator-based program at the time when major decisions concerning an off-shore Higgs factory are expected, and/or significant adjustments within the accelerator-based R&D portfolio are likely to be needed. A plan for the Fermilab accelerator complex consistent with the long-term vision in this report should also be reviewed.

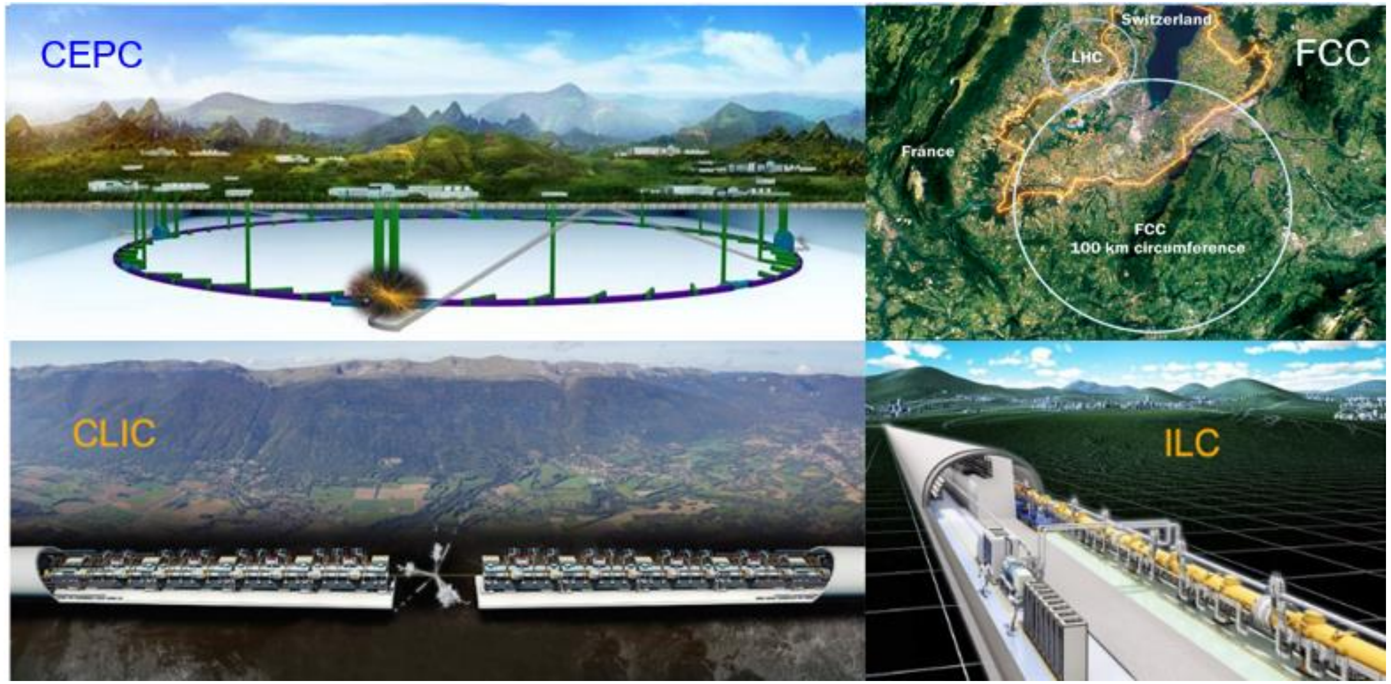
The panel would consider the following:

1. The level and nature of US contribution in a specific Higgs factory including an evaluation of the associated schedule, budget, and risks once crucial information becomes available.
2. Mid- and large-scale test and demonstrator facilities in the accelerator and collider R&D portfolios.
3. A plan for the evolution of the Fermilab accelerator complex consistent with the longterm vision in this report, which may commence construction in the event of a more favorable budget situation.

US contribution in a specific Higgs factory

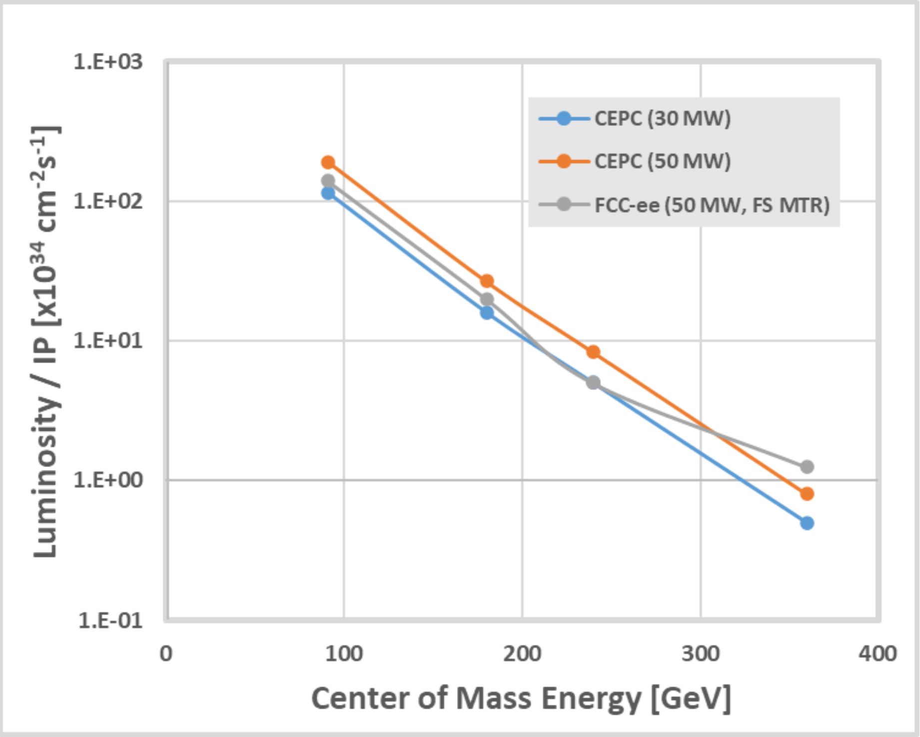
P5 report, USA, 2023

Higgs Factory Proposals



CEPC has strong advantages among the mature e^+e^- Higgs factories

Luminosity / IP (CEPC vs FCC-ee)



Versus FCC-ee

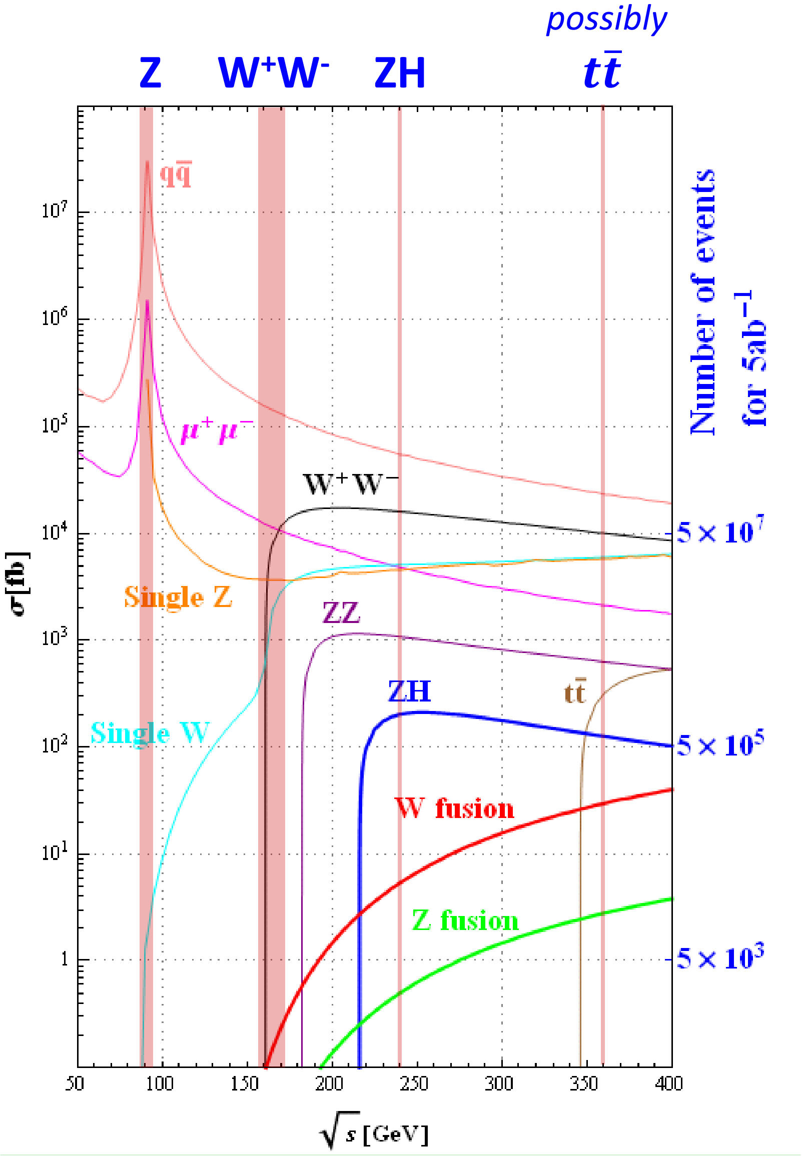
- Earlier data: (~ 5-10 years)
- Better quality, flexible for ee / pp
- Lower construction cost

Versus LC

- Higher luminosity ~ ×(5-10)
- Operate at Z energy
- Upgradable to pp collider

	CEPC	FCC	ILC	CLIC
Constr. starts	2027	2032	2030	2035
L / IP ($10^{34} cm^{-2}s^{-1}$)	5-8	8	~1	~1
Cost (GCNY)	36	150	50	522

CEPC Operation Plan



CEPC accelerator TDR (Xiv:2312.14363)

Operation mode		ZH	Z	W⁺W⁻	$t\bar{t}$
$\sqrt{s}$ [GeV]		~240	~91	~160	~360
Run Time [years]		10	2	1	5
30 MW	L / IP [$\times10^{34}$ cm^{-2}s^{-1}]	**5.0**	**115**	**16**	**0.5**
	$\int L\,dt$ [ab^{-1}, 2 IPs]	13	60	4.2	0.65
	Event yields [2 IPs]	2.6×10^6	2.5×10^{12}	1.3×10^8	4×10^5
50 MW	L / IP [$\times10^{34}$ cm^{-2}s^{-1}]	**8.3**	**192**	**26.7**	**0.8**
	$\int L\,dt$ [ab^{-1}, 2 IPs]	21.6	100	6.9	1
	Event yields [2 IPs]	4.3×10^6	4.1×10^{12}	2.1×10^8	6×10^5

The first 10 years will be Higgs production

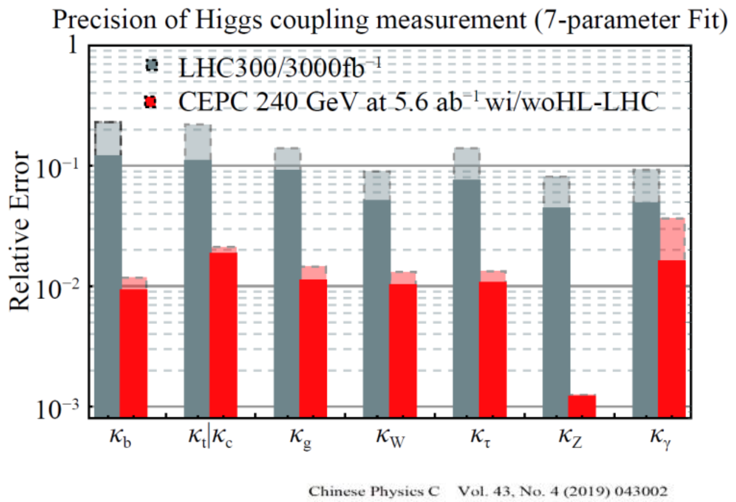
+ Low-Luminosity Z (for calibration and physics)

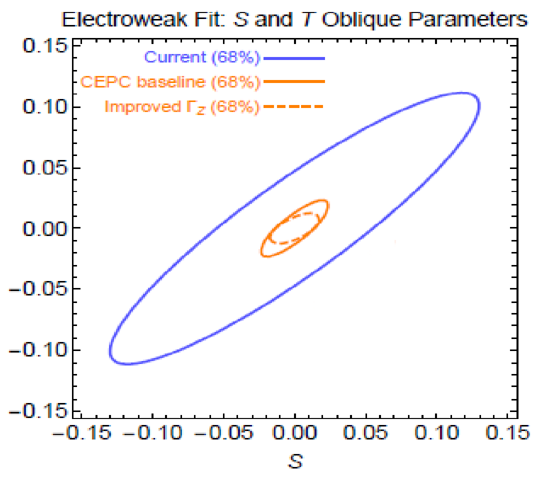
Opportunity for Precision Measurements and Discoveries

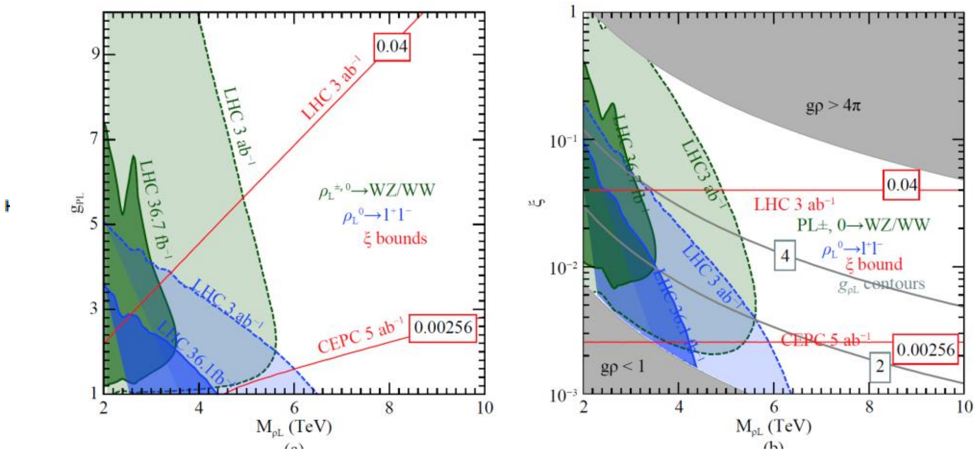
Higgs: Precisions exceed HL-LHC by ~ 1 order of magnitude

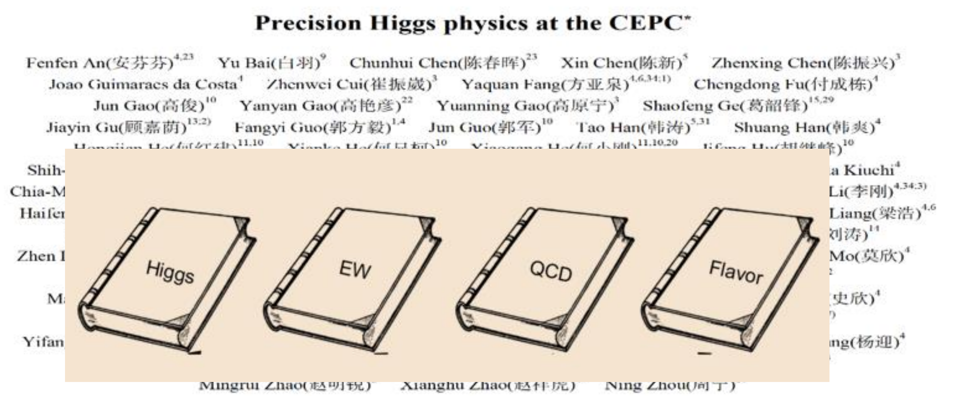
EW: precision improves by 1-2 orders of magnitude

Sensitive to NP of 10 TeV or even higher



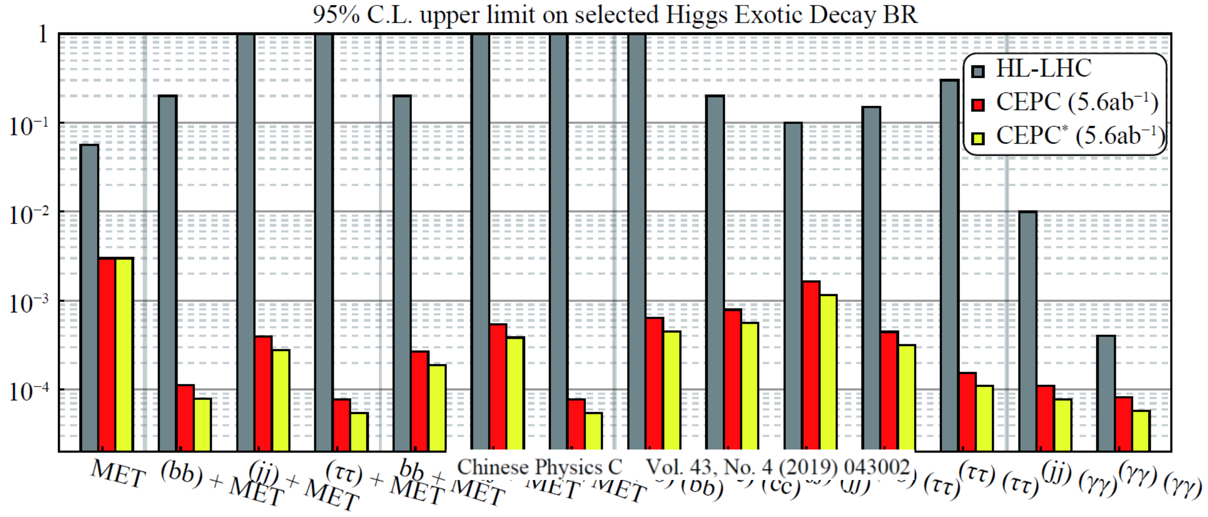






Higgs white paper was published in 2019

White papers on flavor, EW, QCD are in process



CEPC Design Reports

IHEP-CEPC-DR-2015-01
IHEP-AC-2015-01

CEPC-SPPC

Preliminary Conceptual Design Report

Volume II - Accelerator

The CEPC-SPPC Study Group

March 2015

IHEP-CEPC-DR-2015-01
IHEP-EP-2015-01
IHEP-TH-2015-01

CEPC-SPPC

Preliminary Conceptual Design Report

Volume I - Physics & Detector

The CEPC-SPPC Study Group

March 2015

Accelerator TDR Released (2023.12)

IHEP-CEPC-DR-2023-01
IHEP-AC-2023-01

CEPC

Technical Design Report

Accelerator

arXiv:2312.14363

1114 authors
278 institutes (159 foreign)
38 countries

The CEPC Study Group

December 2023

CEPC

Technical Design Report

TDR

Reference Detector

2025.06

CDR Released (2018.11)

Pre-CDR Released (2015.03)

Kick-off Meeting (2013.09)

Proposed (2012.09)

IHEP-CEPC-DR-2018-01
IHEP-AC-2018-01

CEPC

Conceptual Design Report

Volume I - Accelerator

arXiv: 1809.00285

The CEPC Study Group

August 2018

IHEP-CEPC-DR-2018-02
IHEP-EP-2018-01
IHEP-TH-2018-01

CEPC

Conceptual Design Report

Volume II - Physics & Detector

arXiv: 1811.10545

The CEPC Study Group

October 2018

1143 authours
222 institutes (140 foreign)
24 countries

CEPC

Engineering Design Report

EDR of

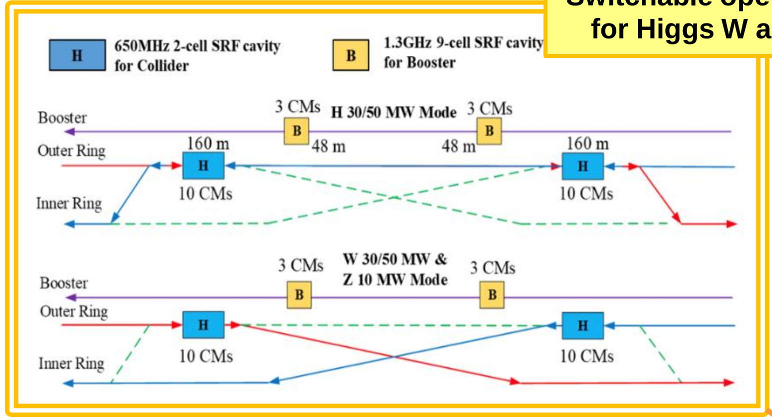
Accelerator

2027

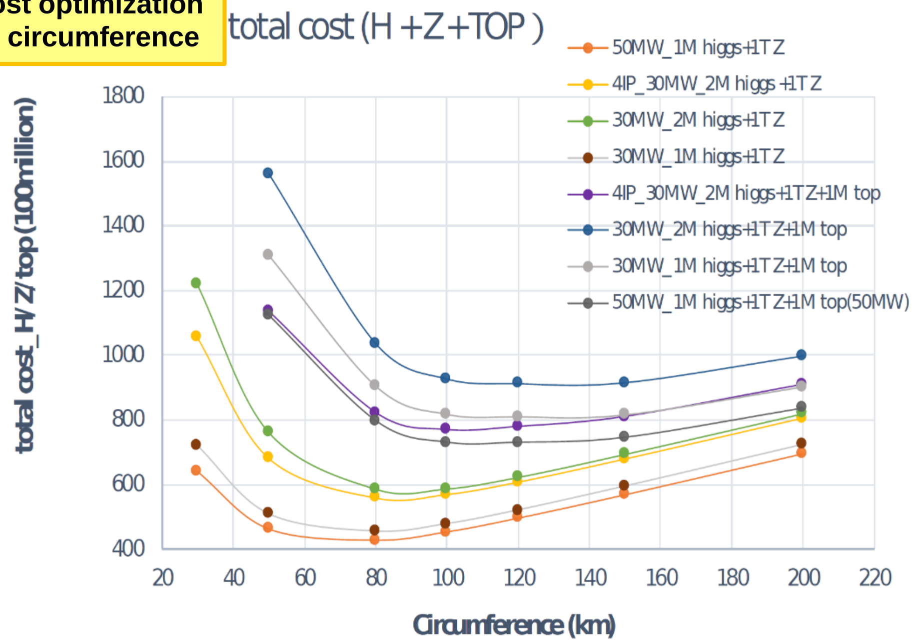
CEPC Layout and Design Essentials

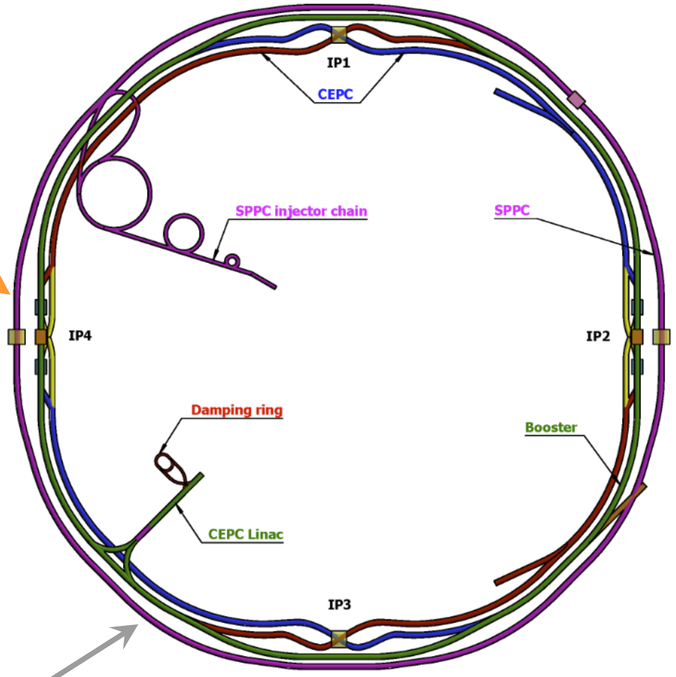
D. Wang *et al* 2022 *JINST* **17** P10018

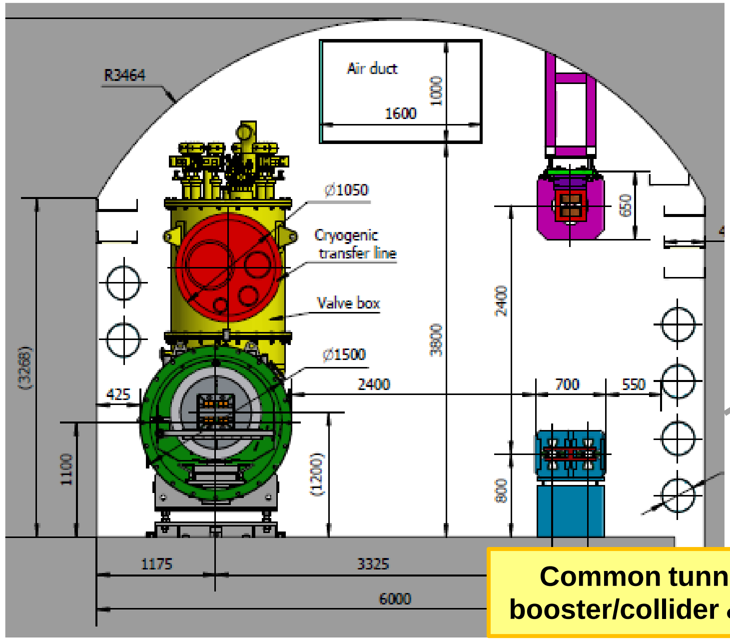
Switchable operation for Higgs W and Z



Cost optimization vs circumference



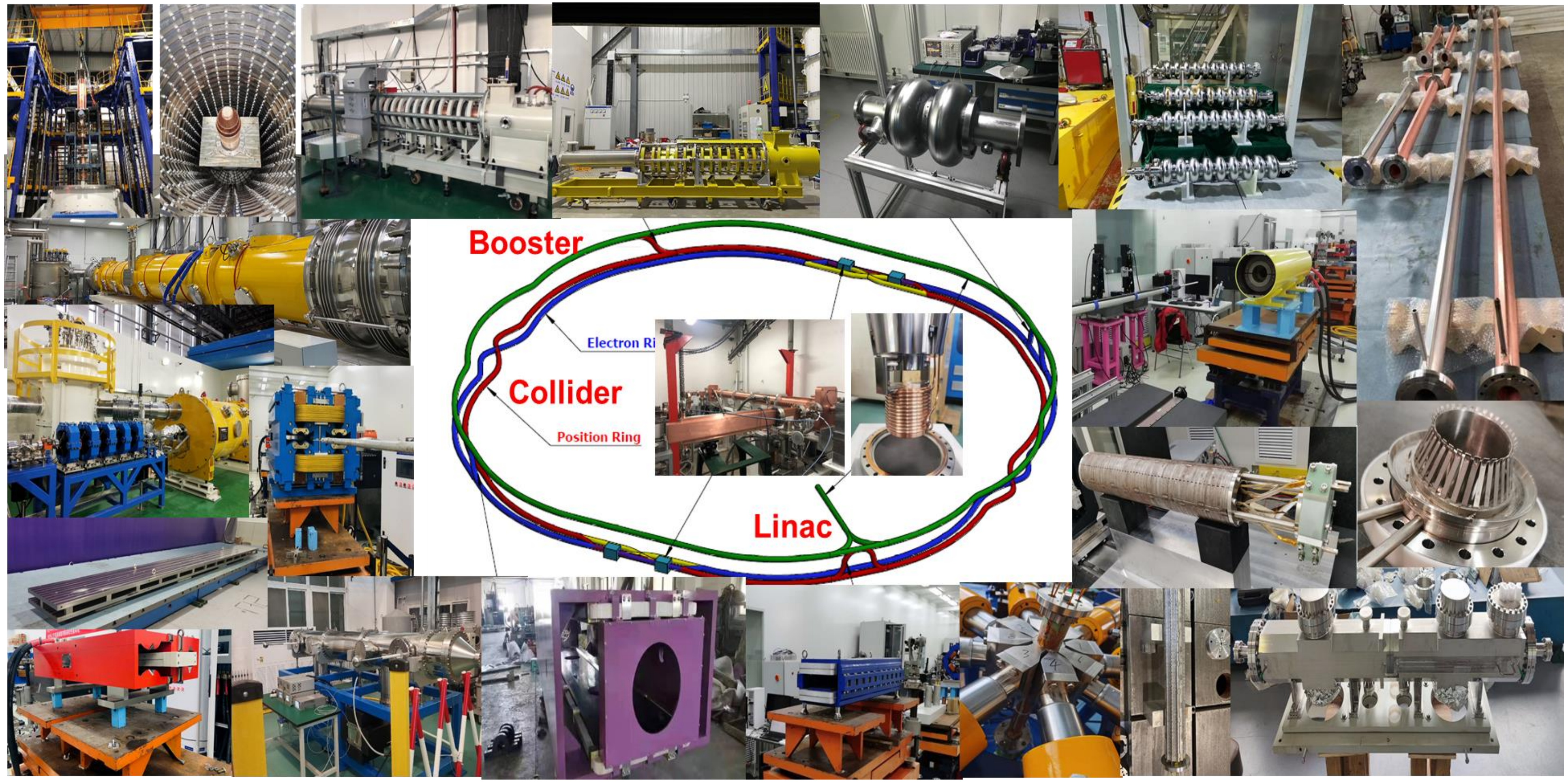




Common tunnel for booster/collider & SppC

- Optimal **100 km circumference**
- **Shared tunnel** for booster, collider and SppC
- Baseline: 30 MW, **upgradable** to 50 MW and $t\bar{t}$
- **Switchable** between Higgs, W/Z, and top modes

Key Components and Prototype R&D



- ✔ Specification Met
- ✔ Prototype Manufactured

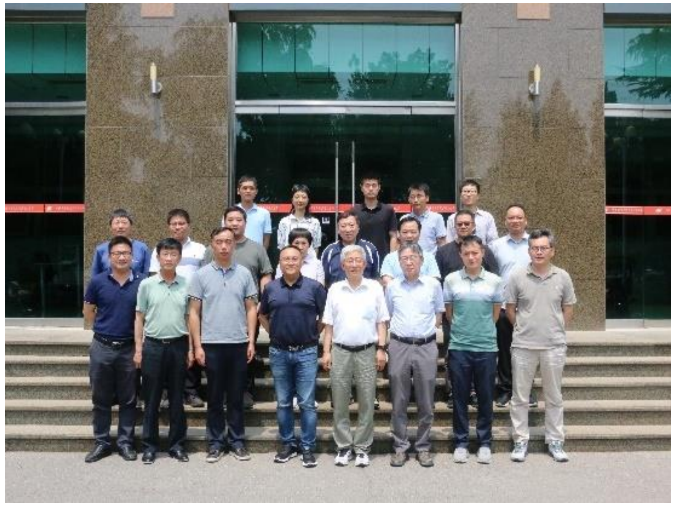
Accelerator	Fraction
✔ Magnets	27.3%
✔ Vacuum	18.3%
✔ RF power source	9.1%
✔ Mechanics	7.6%
✔ Magnet power supplies	7.0%
✔ SC RF	7.1%
✔ Cryogenics	6.5%
✔ Linac and sources	5.5%
✔ Instrumentation	5.3%
✔ Control	2.4%
✔ Survey and alignment	2.4%
✔ Radiation protection	1.0%
✔ SC magnets	0.4%
✔ Damping ring	0.2%

Benefit from BEPC II, HEPS, and accelerator key technology R&D platform
Key technology R&D spans over all components listed in the CEPC CDR

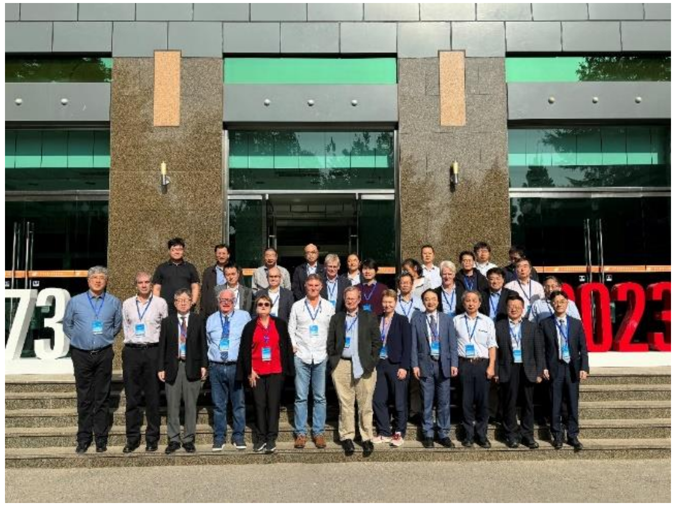
CEPC Accelerator TDR

International Technical Review @ HK, Jun 12-16, 2023

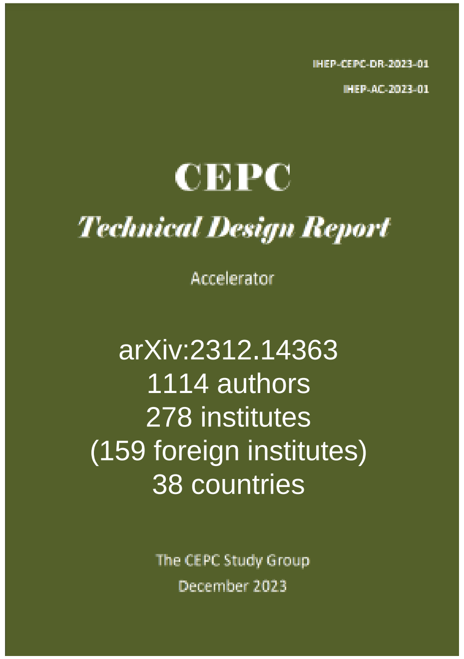
International Cost Review @ HK, Sept 11-15, 2023



Domestic Civil Engineering Cost Review, June 26, 2023



Endorsed by CEPC IAC Oct 29-31, 2023



IHEP-CEPC-DR-2023-01
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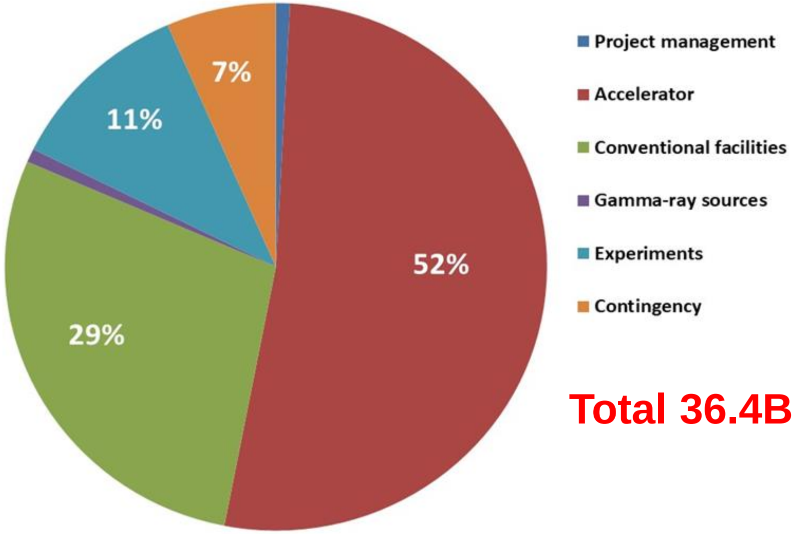
CEPC
Technical Design Report
Accelerator

arXiv:2312.14363
1114 authors
278 institutes
(159 foreign institutes)
38 countries

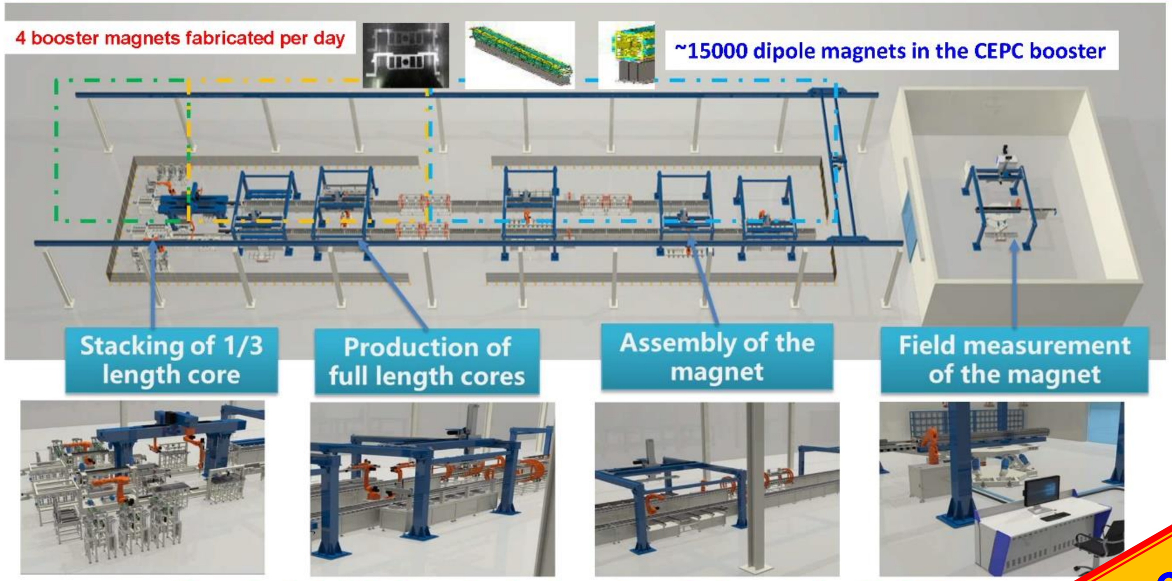
The CEPC Study Group
December 2023

Accelerator TDR officially released on Dec 25, 2023



Total 36.4B CNY

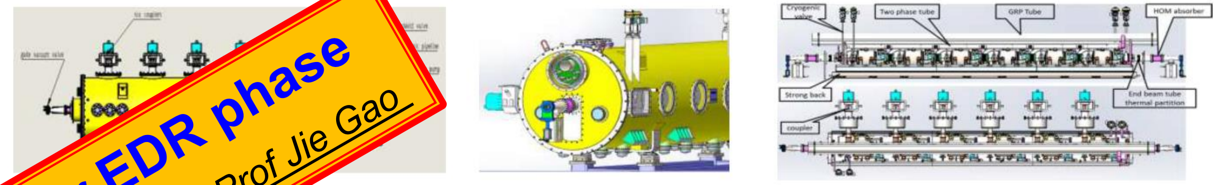
CEPC Magnet Automatic Production Line in EDR



Plan： Technical design review has been done. To be completed in 2025

CEPC Accelerator SRF Development in EDR

CEPC collider ring 650MHz 2*cell short test module has been completed in TDR phase



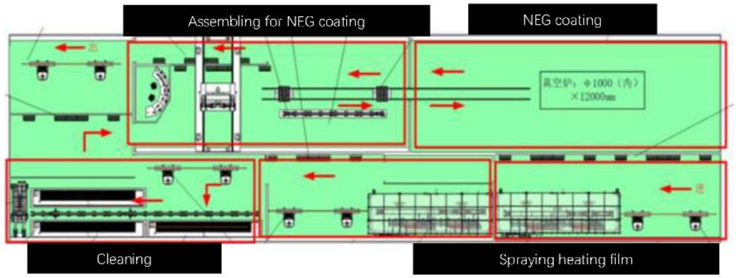
...mode for 30 MW SR power per beam will use 32 units of 11 m-long collider cryomodules will ...50 MHz 2-cell cavities, and therefore, a full size 650 MHz cryomodule will be developed in EDR

Plan： Technical design review has been done. To be completed in 2025

CEPC enters accelerator EDR phase

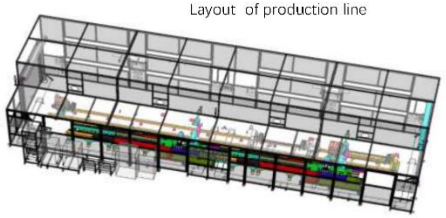
Ref: Presentation at CEPC2024 workshop by Prof Jie Gao

CEPC NEG Coated Vacuum Chamber (200km) Automatic Production Line in EDR



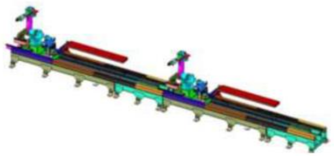
Layout of production line

NEG coating facility by horizontal method



Production line of NEG coating, spraying

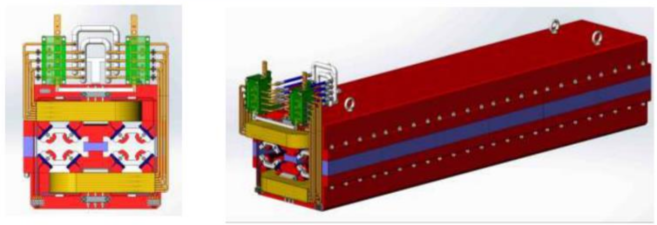
AGV(Automatic Guided Vehicle) transport



7-axis robot for assembling

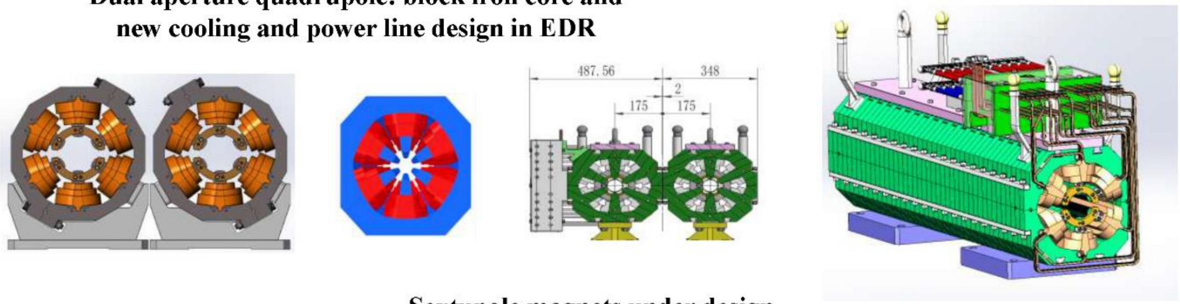
Plan： Technical design review has been done. To be completed in 2025

CEPC Collider Ring Magnets in EDR



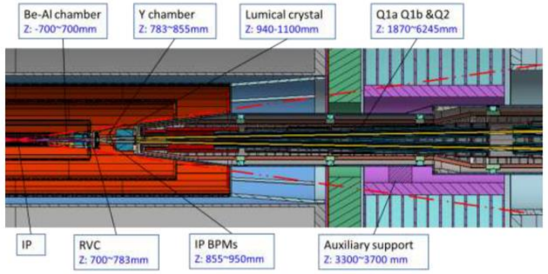
Dual aperture quadrupole: block iron core and new cooling and power line design in EDR

Correctors: mechanical design completed



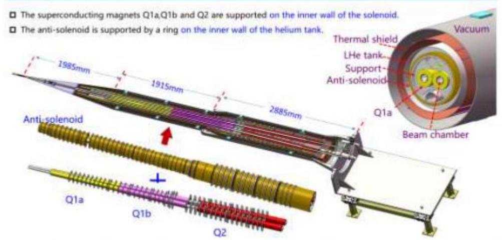
Sextupole magnets under design

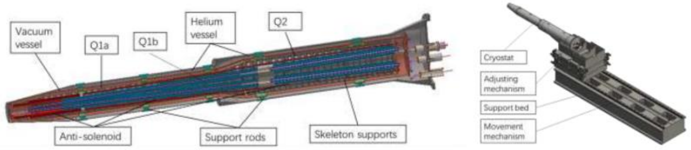
CEPC MDI Development in EDR



Structural Design of the SC Quadupole Cryostat and Support

- The superconducting magnets Q1a,Q1b and Q2 are supported on the inner wall of the solenoid.
- The anti-solenoid is supported by a ring on the inner wall of the helium tank.



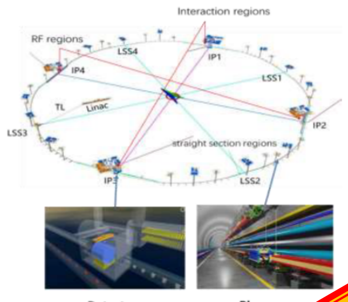


CEPC SC Quadrupole Magnet Design with CCT Coil

Design parameters of Q1a, Q1b, Q2 magnet with CCT coil @ Higgs mode

Magnet name	Q1a	Q1b	Q2
Field gradient (T/m)	142.3	85.4	96.7
Magnetic length (mm)	1.21	1.21	1.5
Excitation current (A)	780	650	770
Conductor (HTS or LTS)	0.8 or 0.7mm in diameter		
Maximum dipole field in aperture (Gs)	226	124	127
Stored energy (KJ)	16.7	15.2	22.9
Peak field in coil (T)	4.3	3.4	4.5
Integrated field harmonics	$<2\times10^{-4}$		
(Single aperture) Coil inner radius (mm)	20	26	31
(Single aperture) Coil outer diameter (mm)	30.5	39	44
Magnet mechanical length (m)	1.22	1.23	1.53
Net weight (kg)	25	32	43
Total weight of Q1a, Q1b, Q2 (kg)	100		
(For comparison, old net weight with iron option (kg))	Q1a: 93, Q1b:124, Q2: 235 Total weight of Q1a, Q1b, Q2: 452		

CEPC Installation Strategy Study in EDR



Linac: 1.6km
TL:1.5km
Circumference of ring tunnel:100

Tunnel cross section

CEPC component list and quantities

Component	Collider Ring	Booster	Linac, DR, TL	Total
Dipole	16258	14866	135	31259
Quadrupole	4148	3458	714	8320
Sextupole	3176	100	72	3348
Corrector	7088	2436	275	9799
BPM 、PR 、DCCT 、kicker	3544	2408	180	6132
Septum Magnet	68	32	2	102
Kicker	8	8	2	18
Cryomodule	32	12		44
Electrostatic separator	32			32
Collimator dump	36		8	44
Superconducting Magnets	4			4
Solenoid			37	37
Accelerating structure			577	577
Cavity			4	4
Electron Source			1	1
Positron Source			1	1
Detector	2			2
Total	34396	23320	2008	59724

CEPC enters accelerator EDR phase

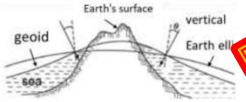
Ref: Presentation at CEPC2024 workshop by Prof Jie Gao

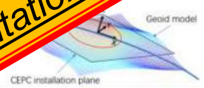
CEPC Alignment and Installation Plan i

- Alignment accuracy requirement

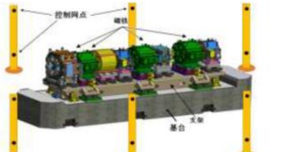
Component	Δx (mm)	Δy (mm)	$\Delta\theta_z$ (mrad)
Dipole	0.10	0.10	0.10
Arc Quadrupole	0.10	0.10	0.10
IR Quadrupole	0.10	0.10	0.10
Sextupole	0.10*	0.10*	0.10

*implement beam-based alignment

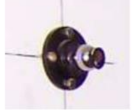




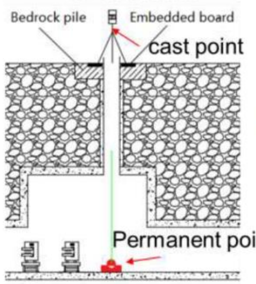
Compo
Pre-align



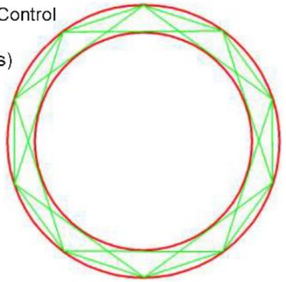
Wall Control Point



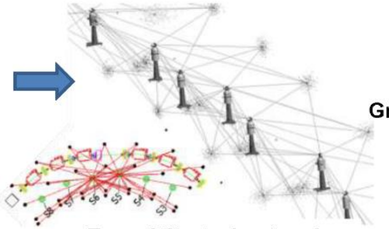
Ground Control Point



Surface Control network (14Points)

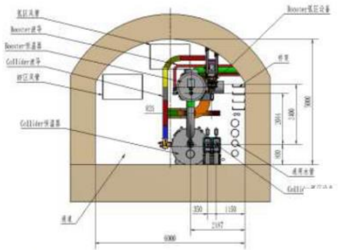


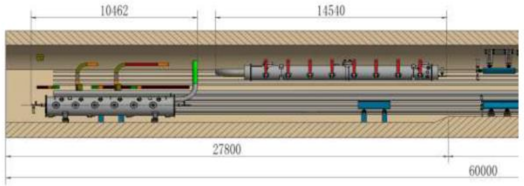
Backbone Control network
(short line:300m, long line:600m)

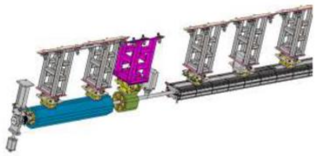


Tunnel Control network
(interval of 6 meters)

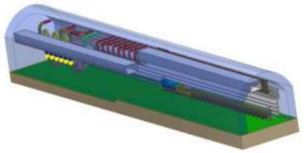
CEPC Tunnel Mockup for Installation in EDR

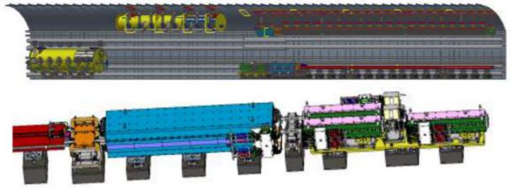


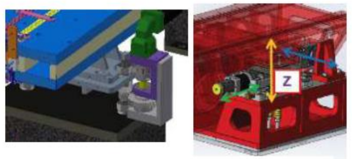




Booster magnets installation







Collider ring magnets supports

A 60 m long tunnel mockup, including parts of arc section and part of RF section

To demonstrate the inside tunnel alignment and installation, especially for booster installation on the roof of the tunnel

Plan： Technical design review has been done. To be completed in 2025

From CEPC Accelerator TDR to EDR

2012.09	2015.03	2018.11	2023.12	2025	2027	15th FYP
CEPC proposed	Pre-CDR	CDR	TDR	CEPC Proposal	EDR	Start of construction

Ref-Detector TDR by June 2025

Accelerator EDR by 2027

Construction starts during the 15th FYP

The goal, scope and plan of the CEPC accelerator EDR were reviewed by the IARC on Sept 18-20, 2024

International Accelerator Review Committee

- Phillip Bambade, IJCLab
- Maria Enrica Biagini (chair), INFN
- Brian Foster, Oxford/DESY
- Kazuro Furukawa, KEK
- Xiaoye He, USTC
- Roberto Kersevan, CERN
- In-Soo Ko, Postech
- Michael Koratzinos, CERN
- Gero Kube, DESY
- Eugene Levichev, BINP
- Hiroyuki Nakayama, KEK
- Norihito Ohuchi, KEK
- Katsunobu Oide, KEK/CERN
- Carlo Pagani, INFN-Milano
- Paolo Pierini, ESS
- Anatoly Sidorin, JINR
- Steinar Stapnes, CERN
- Makoto Tobiyama, KEK
- Akira Yamamoto, KEK
- Zhentang Zhao, SINAP

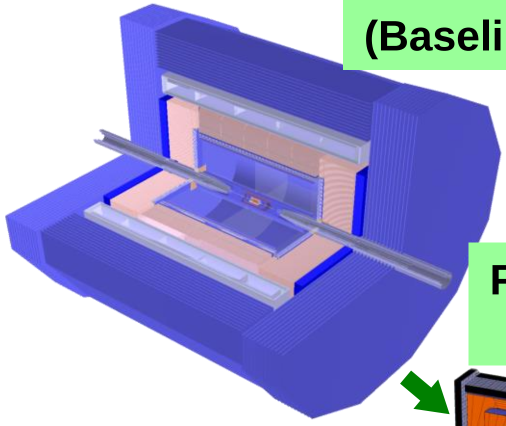
Requirements on Detector Design

- **Lifespan**: 10 years for Higgs + LowLum Z; It would be better ~18 years of HZ, Z, W^+W^-, $t\bar{t}$
- The detector system should be able to handle **event rates**:
  - Higgs mode @ L = 8.3 ×10^{34} $cm^{-2}s^{-1}$: beam-beam crossing ~ 1.34 MHz, ZH ~16.6 mHz, $q\bar{q}$ ~ 5.0 Hz
  - Z mode @ L = 1.92 ×10^{36} $cm^{-2}s^{-1}$: beam-beam crossing ~ 39.3 MHz, visible Z ~ 66 kHz
- Endure **radiation damage** and **noise hit** rates:
  Max noise hits ~ 0.6 MHz / cm^2, Max TID ~2.1 Mrad/year in Higgs mode

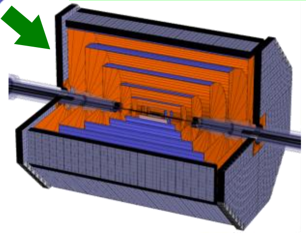
Sub-system	Key technology	Key Specifications
Vertex	6-layer CMOS SPD	$\sigma_{r\phi}$ ~ 3 μm, X/X_0 < 0.15% per layer
Tracking	CMOS SPD ITK, AC-LGAD SSD OTK, TPC + Vertex detector	$\sigma\left(\frac{1}{P_T}\right) \sim 2\times10^{-5} \oplus \frac{1\times10^{-3}}{P\times \sin^{3/2}\theta}\left(GeV^{-1}\right)$
Particle ID	dN/dx measurements by TPC Time of flight by AC-LGAD SSD	Relative uncertainty ~ 3% σ(t) ~ 30 ps
EM Calorimeter	High granularity crystal bar PFA calorimeter	EM resolution ~ $3\%/\sqrt{E(GeV)}$ Granularity ~ 1×1×2 cm^3
Hadron Calorimeter	Scintillation glass PFA hadron calorimeter	Support PFA jet reconstruction Single hadron $\sigma_E^{had} \sim 40\%/\sqrt{E(GeV)}$ Jet $\sigma_E^{jet} \sim 30\%/\sqrt{E(GeV)}$

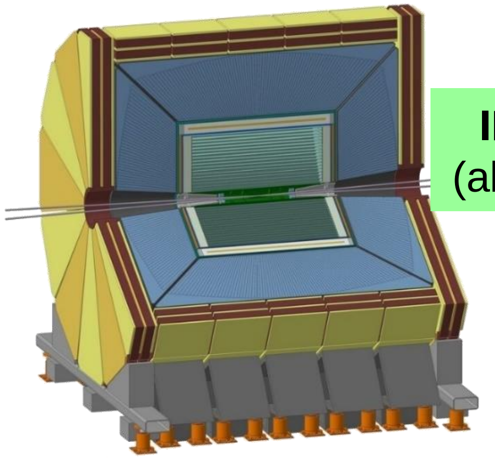
Configuration of A Reference CEPC Detector

(Baseline Design)



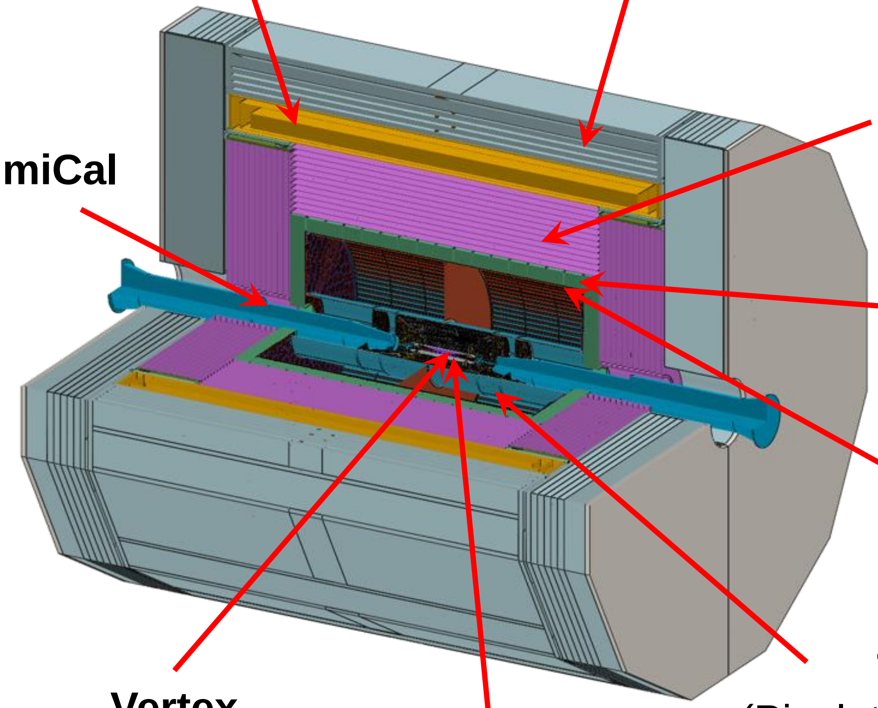
Full Silicon Tracker





IDEA concept
(also for FCC-ee)

The 4th Concept



TDR of A Reference CEPC Detector

- Demonstrate readiness and feasibility of detector technologies
- Provide a realistic detector cost estimation
- Assess requirements and availabilities of people power

System	Technologies	
	Baseline	Backup / Comparison
BeamPipe	Φ20 mm	
LumiCal	SiTrk + Crystal	
Vertex	CMOS + Stitching	CMOS Si Pixel
Tracker	CMOS Si Pixel ITK	SSD+RO Chip, CMOS SSD
	Pixelated TPC	PID Drift Chamber
	AC-LGAD OTK	SSD / SPD OTK
		LGAD ToF
ECAL	4D Crystal Bar	Stereo Crystal Bar, GS+SiPM PS+SiPM+W, SiDet+W
HCAL	GS+SiPM+Fe	PS+SiPM+Fe, RPC+Fe
Magnet	LTS	HTS
Muon	PS bar+SiPM	RPC
TDAQ	Conventional	Software Trigger
BE electr.	Common	Independent

Performance

Cost

R&D efforts

Tech maturity

…

TDR of A Reference Detector

(Ready by June 2025)

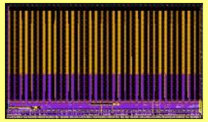
1) Physics Goal and Requirements
2) Concept Introduction
3) MDI and Luminosity Detectors
4) Vertex Detector
5) Silicon Trackers
6) Gaseous Trackers
7) Electromagnetic Calorimeter
8) Hadron Calorimeter
9) Muon Detector
10) Superconducting Solenoid Magnet
11) General Electronics
12) Trigger and Data Acquisition
13) Software and Computing
14) Mechanics and Integration
15) Physics Performance
16) Overall Cost and Project Timeline

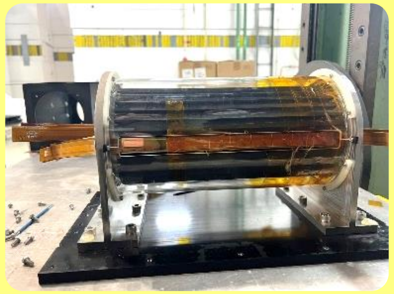
Continue pursuing better technologies

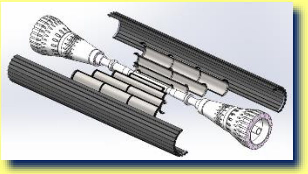
Detector R&D (I)

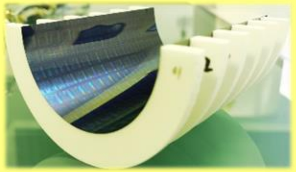
Pixel Vertex

JadePix4 TaichuPix3



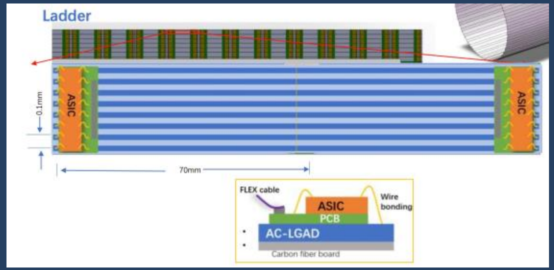




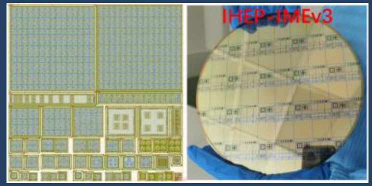


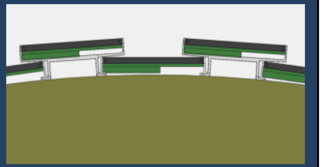
Prototype VTX Curved MAPS

AC-LGAD Tracker

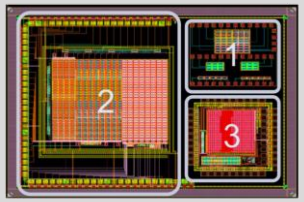


LGAD

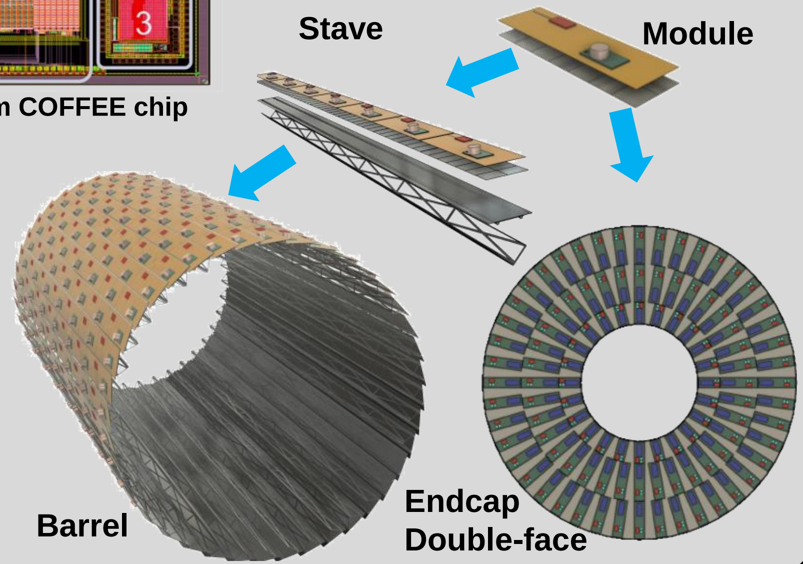




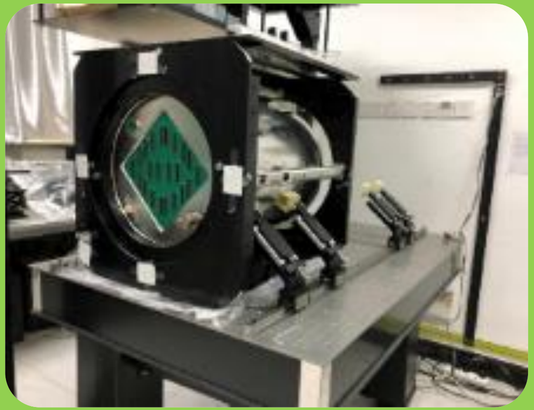
HV-CMOS Inner Tracker

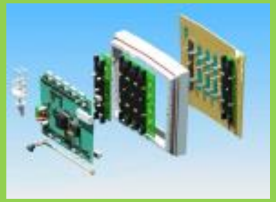


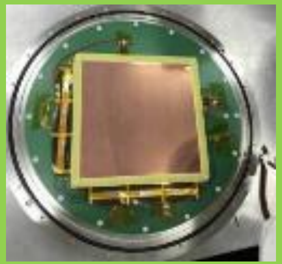
55nm COFFEE chip



Time Projection Chamber

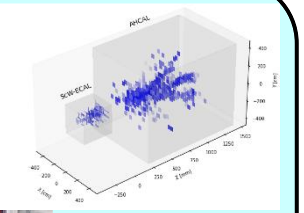




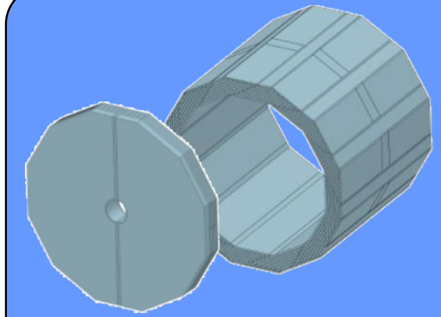


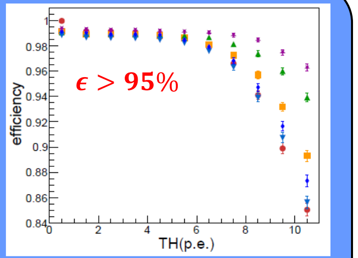
Detector R&D (II)

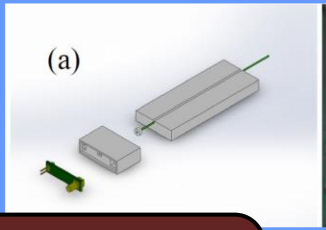
Prototype sampling ECAL & HCAL

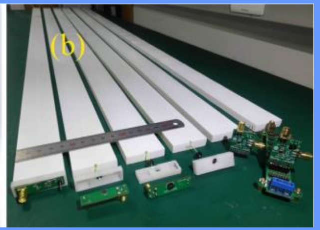


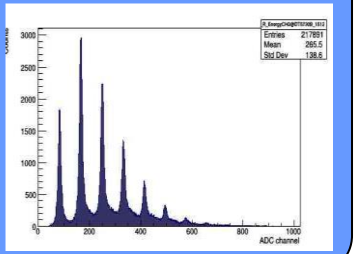
Scintillator Bar Muon



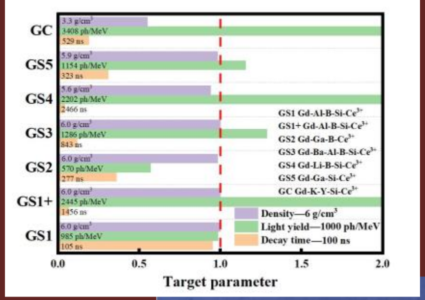


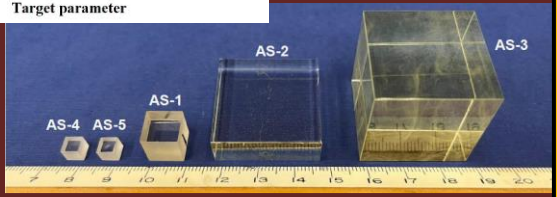




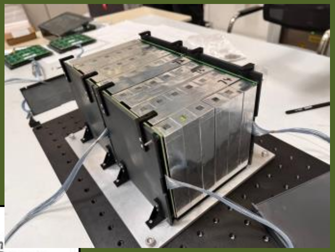


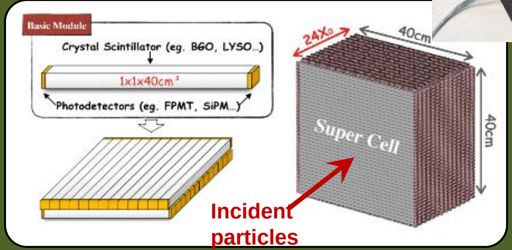
Glass Scintillator



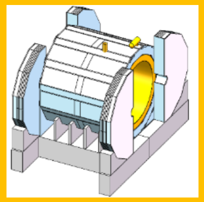


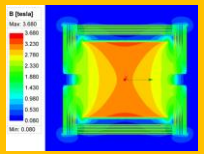
4D Crystal Bar ECAL



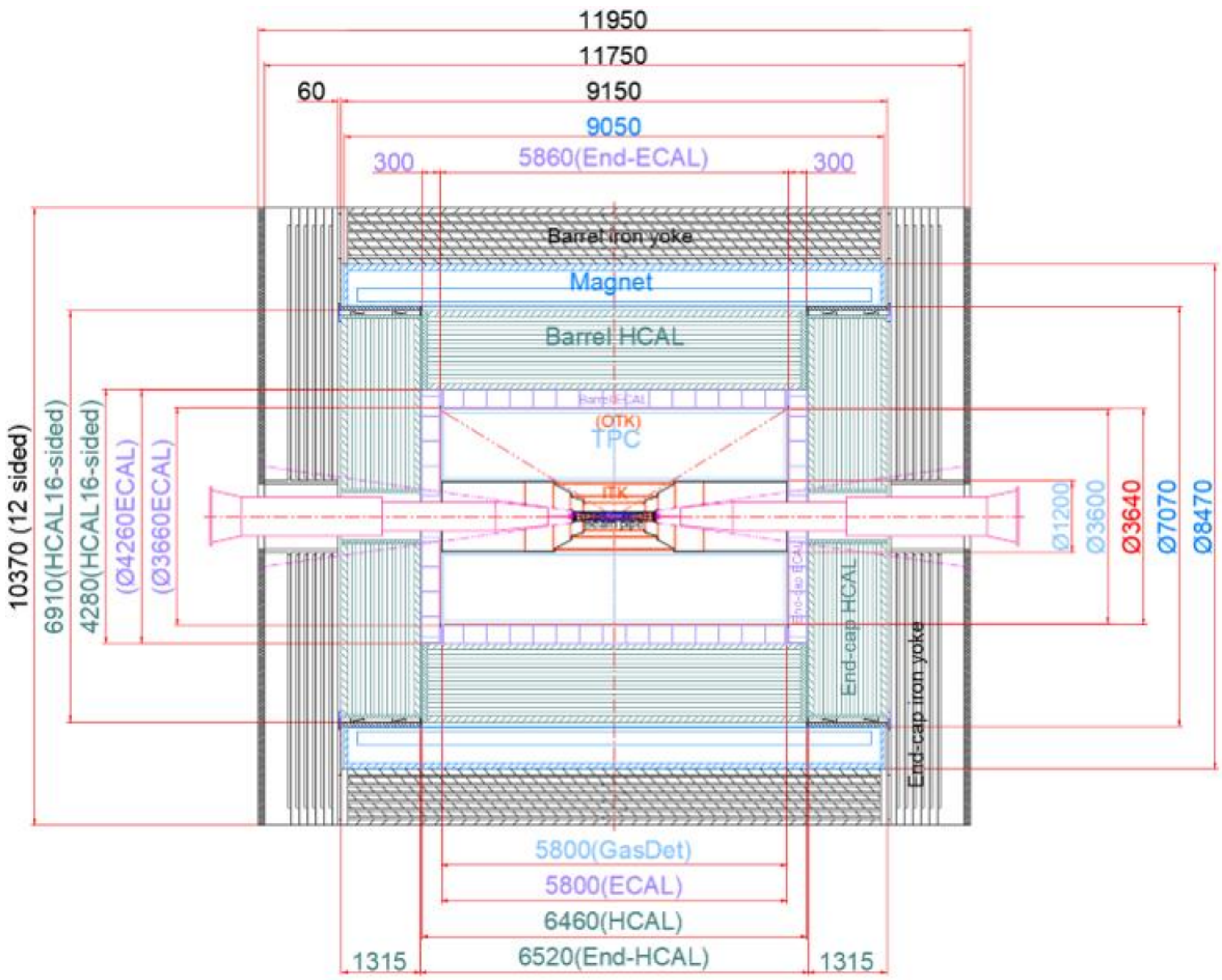


LTS Solenoid Magnet





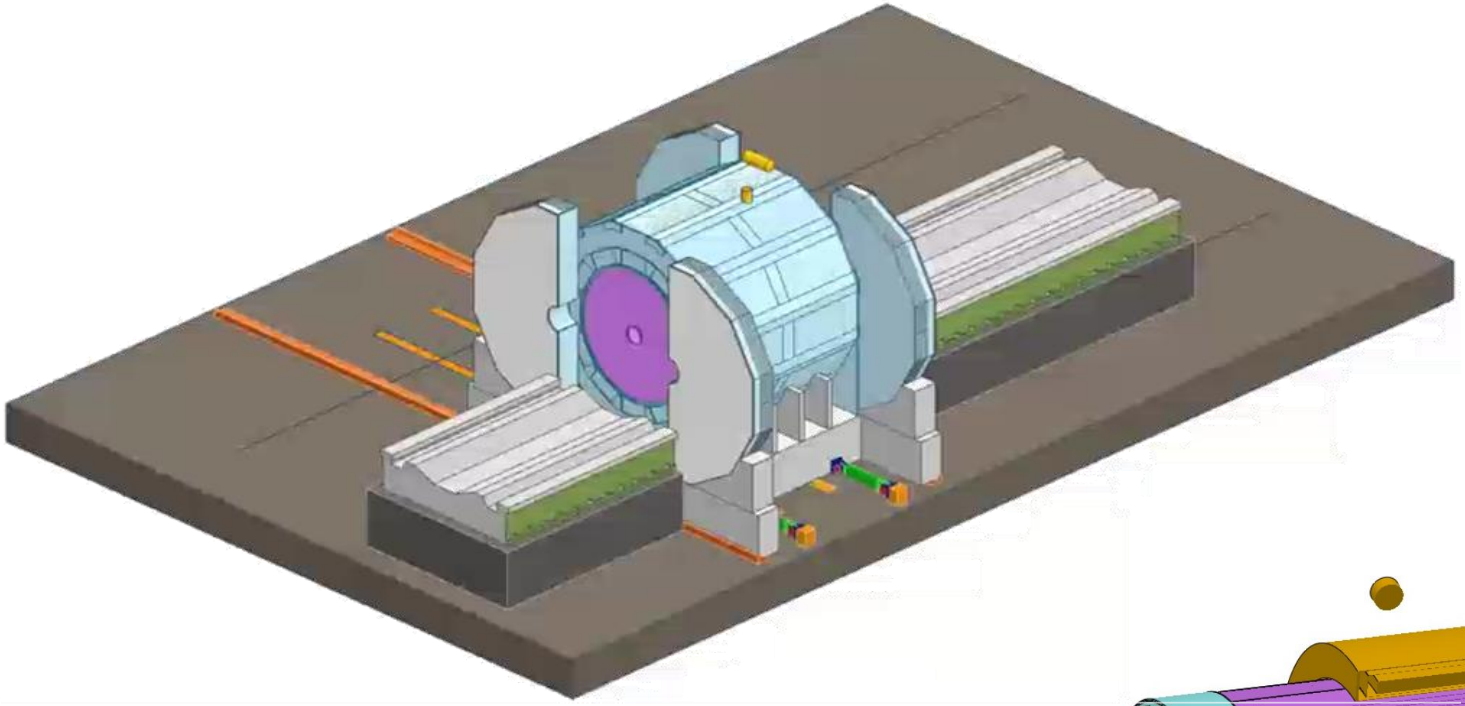
Geometry and Mechanical Support

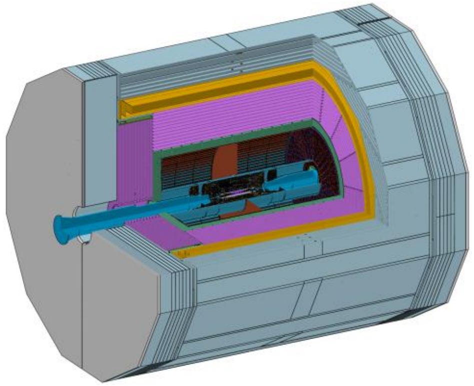


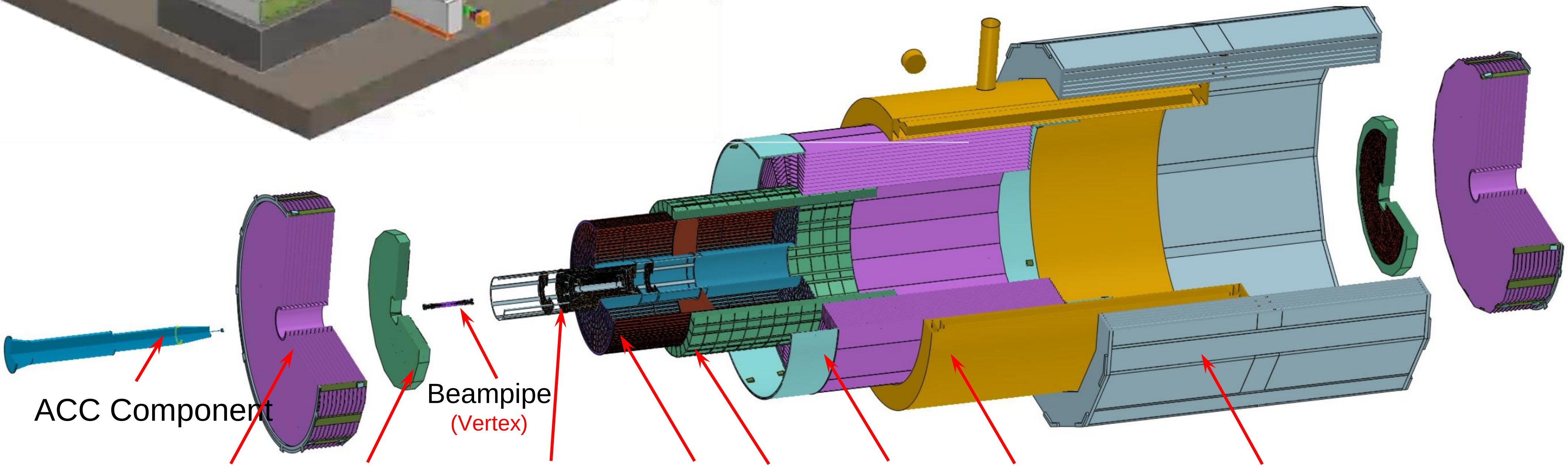
Subsystem	Supported By
Barrel Yoke	Base
Magnet	Barrel Yoke
Barrel HCAL	Barrel Yoke
Barrel ECAL	Barrel HCAL
TPC+ Barrel OTK	Barrel ECAL
ITK	TPC
Beampipe+VTX+LumiCal	ITK
Endcap Yoke	Base
Endcap HCAL	Barrel HCAL
Endcap ECAL+OTK	Barrel HCAL

Planning: detector installation, order of mechanical support, layout of the experimental hall

Detector Installation Design







Review By The CEPC IDRC

Ivan Villa Alvarez	IFCA
Daniela Bortoletto (Chair)	U. Oxford
Jim Brau	U. Oregon
Anna Colaleo	INFN/Bari
Paul Colas	CEA Saclay
Cristinel Diaconu	CPPM
Frank Gaede	DESY
Colin Gay	UBC
Liang Han	USTC
Gregor Kramberger	IJS
Bob Kowalewski	U. Victoria
Roman Poeschl	IJCLab
Burkhard Schmidt	CERN
Maxim Titov	CEA Saclay
Tommaso Tabarelli de Fatis	INFN/Milano-Bicocca
Roberto Tenchini	INFN/Pisa
Christophe De La Taille	OMEGA/CNRS
Hitoshi Yamamoto	Tohoku U.
Akira Yamamoto	KEK

The CEPC International Detector Review Committee Meeting

Oct 21-23, 2024, IHEP

- The CEPC IDRC (International Detector Review Committee) reviewed the status and plan of the Ref-TDR Oct 21-23, 2024 at IHEP
- No showstopper was found. Recommendations to be implemented

International Collaborative Efforts on Detector R&D

- Some detector R&D efforts were within the international detector R&D collaborations, e.g. CALICE, LCTPC, & RD*
- Now much broader participation in the ECFA DRD program

Sub-system	DRD	Sub-system	DRD
Pixel Vertex Detector	**3**	Electromagnetic Calorimeter	**6**
Inner Silicon Tracker	**3**	Hadron Calorimeter	**1, 6**
Outer Silicon Tracker	**3**	Machine Detector Interface	***(8)***
Gas Tracker	**1 (TPC/DC)**	Mechanical and Integration	***(8)***
Muon Detector	**1 (RPC)**	General Electronics	***(7)***
Electromagnetic Calorimeter	**6**	Trigger and DAQ	***(7)***
Hadron Calorimeter	**1, 6**	Offline Software	
Super Conducting Magnet			

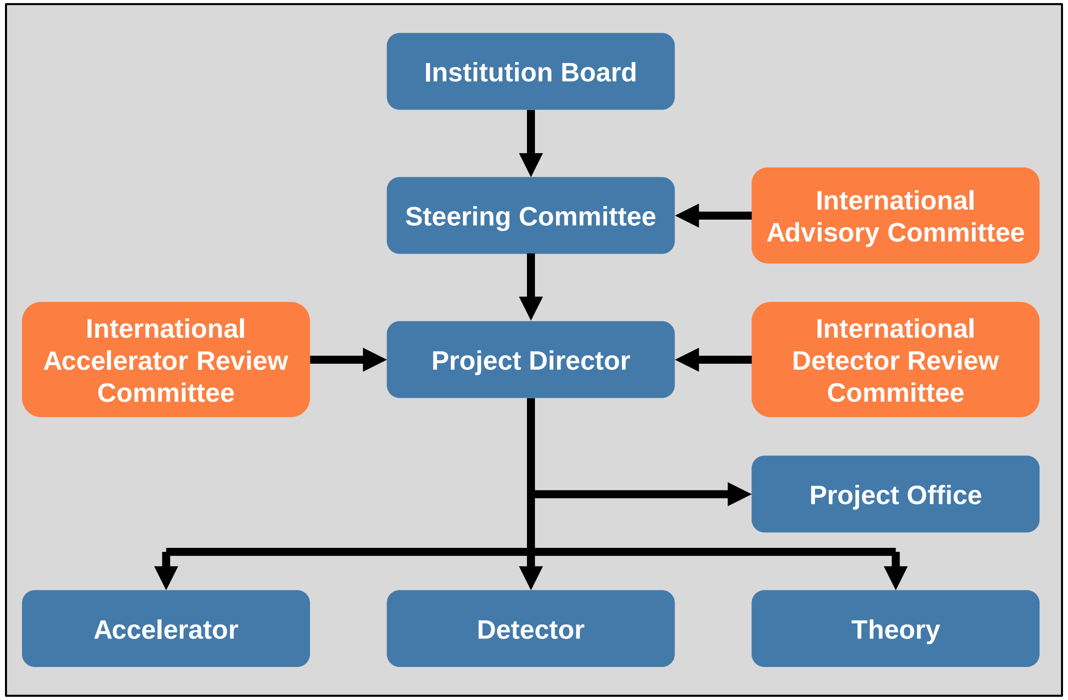
R&D Teams on CEPC Detector

- Researchers from ~**48 major domestic research institutes** actively participate in the CEPC detector R&D projects. More are joining.
- Currently, about **90** staff members from IHEP are working on the CEPC detector and physics, and about **200** from other institutes.

- Many of them were **key members** in building major China-based successful experiments: BES, DayaBay, JUNO, LHAASO, …
- Some take fast rising roles in major experiments abroad: ATLAS, CMS, LHCb, ALICE, AMS, …
- JUNO will switch to operation mode soon. More researchers, especially engineers, will shift their focus onto CEPC.

- **International participations (~30 institutes)** in subdetector R&Ds, e.g. MAPS detector, TPC, PID Drift chamber, …
- When CEPC receives official endorsement, these are seeds of the two international collaborations.

International Efforts Towards Collaborative Experiments



- Institution Board: 32 top domestic universities/institutes
- The International Advisory Committee (IAC) started in 2015, and held meeting yearly.
- Two international review committees for R&D: IARC and IDRC started in 2019.
- The CEPC study group consists of ~1/4 international members. We hope to boost up the rate.

Table 7.2: Team of Leading and core scientists of the CEPC

Name	Brief introduction	Role in the CEPC team
Yifang Wang	Academician of the CAS, director of IHEP	The leader of CEPC, chair of the SC
Xinchou Lou	Professor of IHEP	Project manager, member of the SC
Yuanning Gao	Academician of the CAS, head of physics school of PKU	Chair of the IB, member of the SC
Jie Gao	Professor of IHEP	Convener of accelerator group, vice chair of the IB, member of the SC
Haijun Yang	Professor of SJTU	Deputy project manager, member of the SC
Jianbei Liu	Professor of USTC	Convener of detector group, member of the SC
Hongjian He	Professor of USTC	Convener of theory group, member of the SC
Shan Jin	Professor of NJU	Member of the SC
Nu Xu	Professor of IMP	Member of the SC
Meng Wang	Professor of SDU	Member of the SC
Qinghong Cao	Professor of PKU	Member of the SC
Wei Lu	Professor of THU	Member of the SC
Joao Guimaraes da Costa	Professor of IHEP	Convener of detector group
Jianchun Wang	Professor of IHEP	Convener of detector group
Yuhui Li	Professor of IHEP	Convener of accelerator group
Chenghui Yu	Professor of IHEP	Convener of accelerator group
Jingyu Tang	Professor of IHEP	Convener of accelerator group
Xiaogang He	Professor of SJTU	Convener of theory group
Jianping Ma	Professor of ITP	Convener of theory group

International Workshops

- International workshops (with emphasis on the CEPC):
  - In China: Beijing (2017.11, 2018.11, 2019.11), Shanghai (2020.10 / hybrid), Nanjing (2021.11 / online, 2022.11 / online, 2023.10), **Hangzhou (2024.10), xxxxx(2025.10)**
  - In Europe: Rome (2018.05), Oxford (2019.04), Edinburgh (2023.07), Marseille (2024.04), **Barcelona (2025.05)**
  - In USA: Chicago (2019.09), DC (2020.04 / online)
  - Annual IAS program on HEP (HKUST) since 2015. The upcoming one is between **Jan 13-17, 2025**
- Many topic-specific workshops at various sites

Participating and Potential Collaborating Companies

CEPC Industrial Promotion Consortium (CIPC, established in Nov. 2017)

LEIKE 雷科电子; KAITENG SIFANG; 汉光科技; 北广科技 BBEF; 统力电工 TOLY ELECTRIC; 高能锐新 HE-RACING TECHNOLOGY; 苏州八匹马超导科技有限公司; PUSU; VACREE; 慧宇 HUI YU; 上海超导 SHANGHAI SUPERCONDUCTOR; 地矿建设 DIKUANG CONSTRUCTION; 昆山国力电子科技股份有限公司 Kunshan Guoli Electronic Technology Co., Ltd.; Western Superconducting Technologies Co.,Ltd.; 中科富海 FULLCRYO; 上海辰光医疗科技股份有限公司 Shanghai Chenguang Medical Technologies Co. Ltd; 中船重工鹏力(南京)超低温技术有限公司; 爱科赛博 ACTIONPOWER; 江苏克劳特低温 JiangSu Cryote Co., Ltd.; JJvac; 三井真空; 普达迪泰 PRODETEC; 北京航天广通科技有限公司 Beijing Grantel Technology Co., Ltd.; 中铁装备 CREG; 正帆科技 GENTECH; VACUUM PRODUCTS; SEALTECH; SKY; 北京鼎荣达; HUALUN; 瑞隆 Rui Long; RA BRARC; HDKY浩德科仪; RuiYuan; 天合精机; 中国铁建; 东方钽业 OTIC 中国有色集团成员企业; NVT; 冰轮环境 MOON-TECH; JST; 金盘科技; 东方晨景 East Changing; EDWARDS; CBVAC; 黄河勘测规划设计研究院有限公司 Yellow River Engineering Consulting Co., Ltd.; 华东勘测设计研究院 HUADONG ENGINEERING CORPORATION; 中国电建 中国电建集团昆明勘测设计研究院有限公司; 海南展创光电技术有限公司 HZC PHOTONICS; 中国电建 POWERCHINA

Potential international collaborating suppliers

DANFYSIK; SCANDITRONIX; TOKINARC TOKIN CORPORATION; nichicon; HEINZINGER; DAWONSYS; CAEN Technologies Inc.; Kudos Electrical Contracting; PFEIFFER VACUUM; Leybold; VAT; EDWARDS; mks; Sanei-Kikai Co.,Ltd; CPI Communications & Power Industries; VIC INTERNATIONAL; Fujikin; MPC; MIRAPRO; Canon; THALES Building a future we can all trust; Air Liquide Engineering & Construction; GL research; Linde; Lake Shore CRYOTRONICS; Osprey Distributed Control Systems; bergoz Instrumentation; Instrumentation Technologies; COSYLAB; dimtel; Thermo Fisher Scientific; ELSE NUCLEAR; HEXAGON

The 8th CEPC IAC Meeting 7

Ideal Timeline of CEPC

Completion of Accelerator EDR

TDR of a Ref-Detector @ June 30, 2025

Completion of Detector TDR

International Collaborations