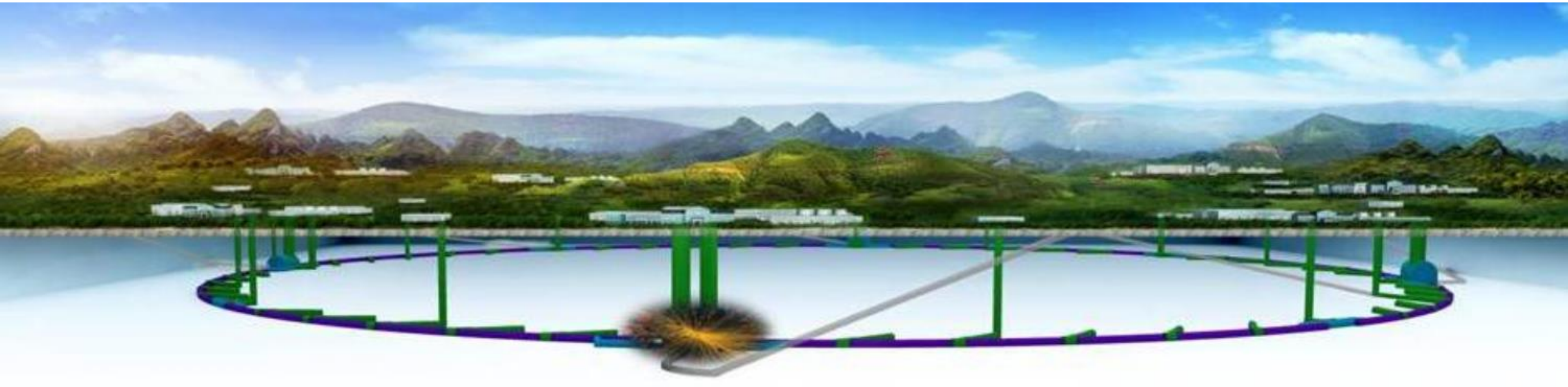
Overview & Objectives

XinChou Lou
Institute of High Energy Physics, Beijing

International Workshop on Circular Electron-Positron Collider



Outline

Overview

- Progress and updates
- Plan and goals
- Issues

Objectives

- This meeting
- Near future

Summary

Reminder about the CEPC-SppC

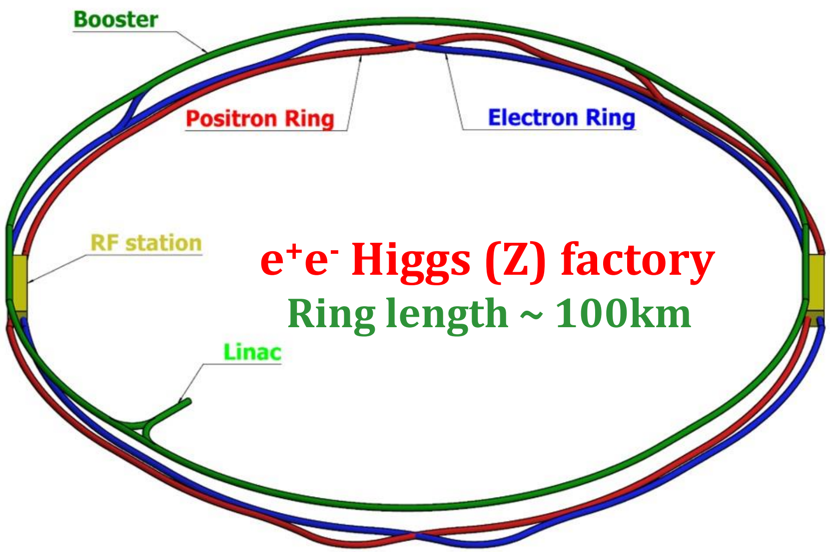
e^+e^- Higgs (Z) factory

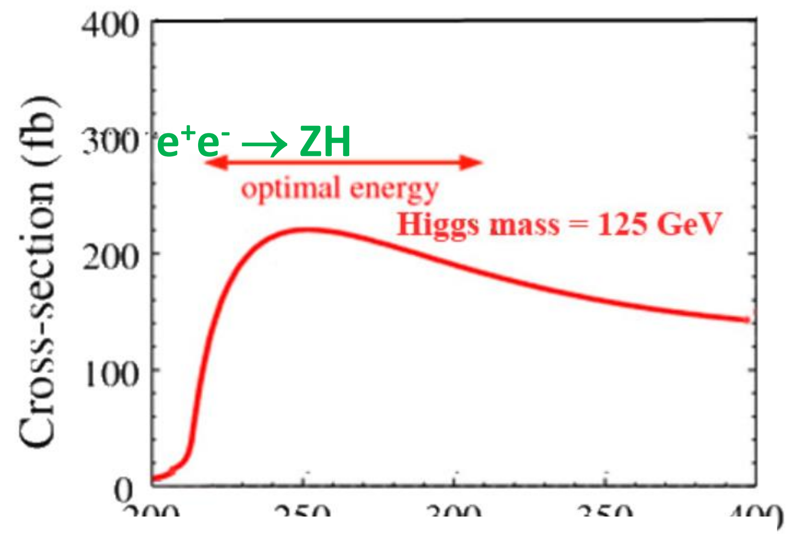
E_{cm}≈240GeV, luminosity ~2×10^{34} $cm^{-2}s^{-1}$, 2IP, 1M H in 10 years
at the Z-pole 10^{10}Z bosons/yr
Precision measurement of the Higgs boson (and the Z boson)

Higgs precision 1% or better

Upgradable to pp collision with E_{cm} ≈ 50-100 TeV (with ep, HI options**)**

A discovery machine for BSM new physics





BEPCII will likely complete its mission ~2020s;
CEPC – possible accelerator based particle physics program in China after BII

Current (temporary) CEPC Organization

Only for Chinese

Since Sept. 2013

Institutional Board
Y.N. GAO
J. GAO

Steering Committee
Y.F. WANG (IHEP),….

IAC
Young-Kee Kim, ….

Project Director
XC LOU
Q. QIN
N. XU

tasks：
Intl Relation– J GAO
PR – YN GAO
Conf. – J.Shan
CDR – XC Lou et al.
……

CDR Editors

theory	LT Wang et al
accelerator	W Chou et al
detector-simu.	TC Chao et al

Theory
HJ HE(TH)
JP MA(ITP)
XG HE(SJTU)

Accelerator
J. GAO(IHEP)
CY Long(IHEP)
JY TANG(IHEP)

Detector
JoaoCosta(IHEP)
S. JIN(NJU)
YN GAO(TH)

at this workshop

International Advisory Committee

Young-Kee Kim, U. Chicago (Chair)
Barry Barish, Caltech
Hesheng Chen, IHEP
Michael Davier, LAL
Brian Foster, Oxford
Rohini Godbole, CHEP, Indian Institute o
David Gross, UC Santa Barbara
George Hou, Taiwan U.
Peter Jenni, CERN
Eugene Levichev, BINP
Lucie Linssen, CERN
Joe Lykken, Fermilab
Luciano Maiani, Sapienza University of
Michelangelo Mangano, CERN
Hitoshi Murayama, UC Berkeley/IPMU
Katsunobu Oide, KEK
Robert Palmer, BNL
John Seeman, SLAC
Ian Shipsey, Oxford
Steinar Stapnes, CERN
Geoffrey Taylor, U. Melbourne
Henry Tye, IAS, HKUST
Yifang Wang, IHEP
Harry Weerts, ANL

Scientific Committee

CEPC accelerator

- Philip Bambade (LAL)
- Anton Bogomyagkov (BINP)
- Yunlong CHI (IHEP)
- Jie GAO (IHEP)
- Sergei Nikitin (BINP)
- Carlo Pagani (Milano U. & INFN-LAS
- Guoxi Pei (IHEP)
- Chenhui YU (IHEP)

SppC accelerator

- Kazuhito Ohmi (KEK)
- Robert Palmer (BNL)
- Jingyu Tang (IHEP)
- Davide Tommasini (CERN)
- Qingjin Xu (IHEP)

Theory

- Qing-Hong Cao (PKU)
- Nathaniel Craig (UCSB)
- Hongjian He (SJTU)
- XiaoGang He (SJTU)
- JianPing Ma (ITP)
- Maxim Perelstein (Cornell U.)
- Tilman Plehn (Heidelberg U.)
- Matthew Reece (Harvard U.)
- German Valencia (Monash U,)
- Liantao Wang (Chicago U.)

Detector

- Patrizia Azzi (INFN Padova)
- Daniela Bortoletto (Oxford)
- Massimo Caccia (INFN)
- Joao Guimaraes da Costa (IHEP)
- Yaquan Fang (IHEP)
- Roberto Ferrari (INFN)
- Yuanning Gao (THU)
- Sasha Glazov (DESY)
- Imad Laktineh (IPNL)
- Jianbei Liu (USTC)
- Wang Meng (SDU)
- Soeren Prell (Iowa State U.)
- Manqi Ruan (IHEP)
- Charlie Young (SLAC)

Global contribution to this workshop

CEPC Schedule (ideal)

design issues
R&D items
preCDR

design, funding
R&D program
Intl. collabration
site study

seek approval, site decision
construction during 14th 5-year plan
commissioning

- CEPC data-taking starts before the LHC program ends
- Possibly con-current with the ILC program

Baseline CEPC

Baseline CEPC

- Baseline design & options for the Conceptual Design Report

  circumference=100km， E_{cm}=240 GeV, power per beam≤30MW，

  design luminosity ~$2\times10^{34}cm^{-2}s^{-1}$ (240 GeV)

  $1\times10^{34}cm^{-2}s^{-1}$ (91 GeV)

  two layouts:

  double ring as the default;

  advanced local double ring as an option

  two independent detectors

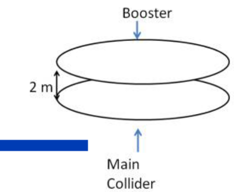
- Benefits

  mature technologies, Z+ZH program

  high energy pp option beyond the Higgs(Z) factory

  γ synchrotron light source (?)

CEPC Accelerator Chain



10 GeV

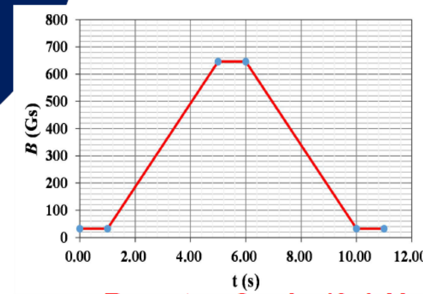
Injector

Electron

Positron

Booster

Energy Ramp
10 ->45/120GeV



Booster Cycle (0.1 Hz)

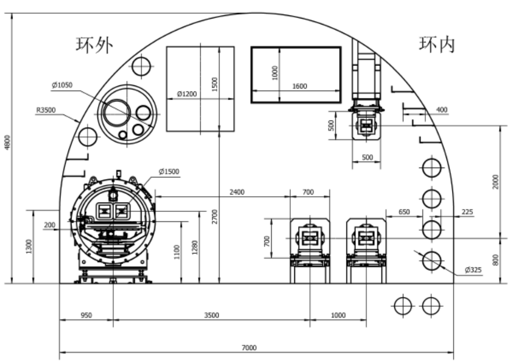
Three rings in the sane channel:

- ➢ CEPC & booster
- ➢ SppC

- Double Ring
- Common cavities for Higgs
- Two RF sections in total
- Two RF stations per RF section
- 14 modules per RF station
- 28 modules per RF section
- 56 modules in total
- Six 2-cell cavities per module
- One klystron for two cavities

对撞环

45/120 GeV



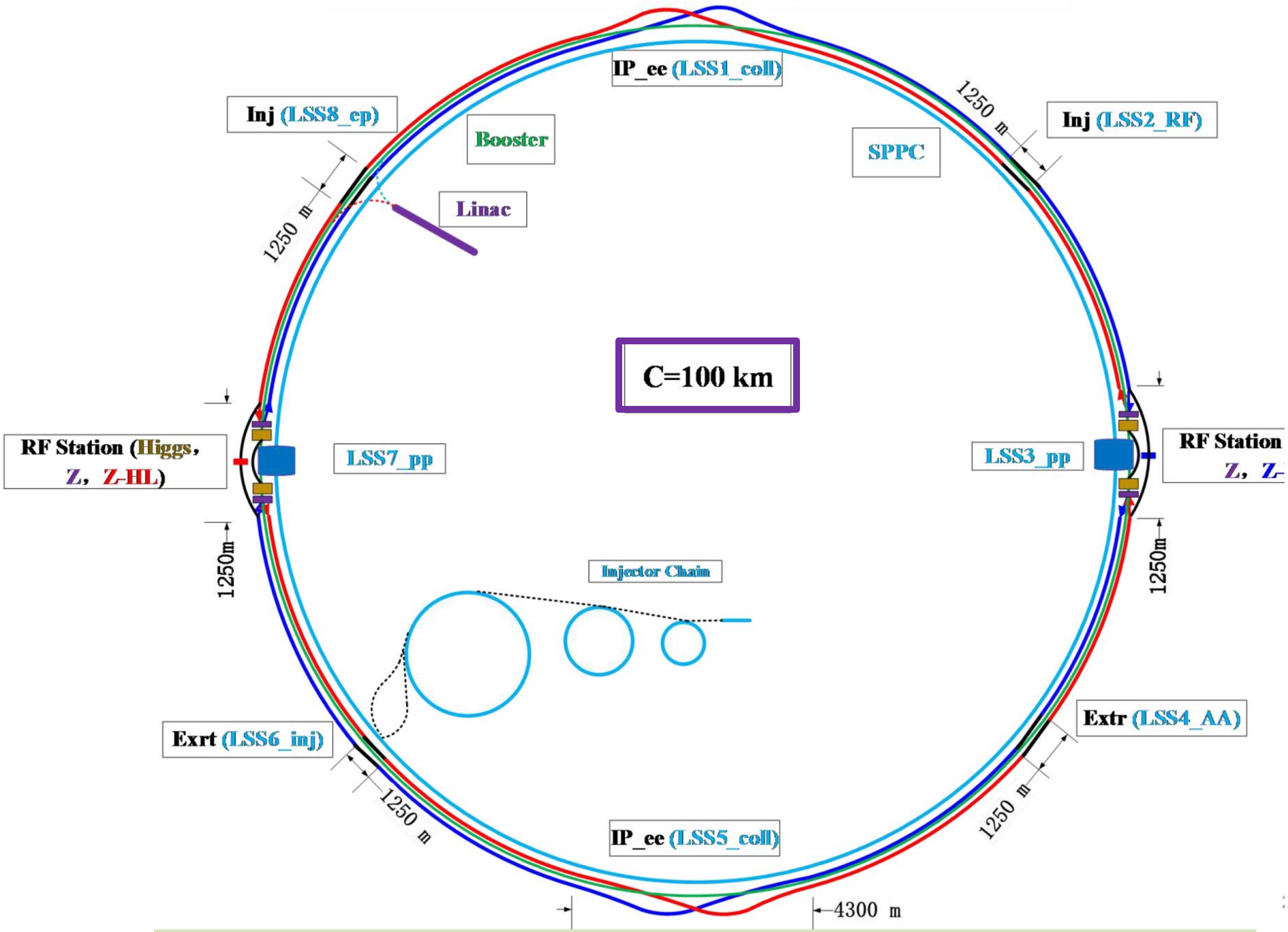
The Conceptual Design Report

- The CEPC accelerator design
- The CEPC detector design
- Theory and physics performance

CDR drafts by end of 2017, reviews and finalization in Spring 2018

Layout of CEPC-SPPC

CDR 2017



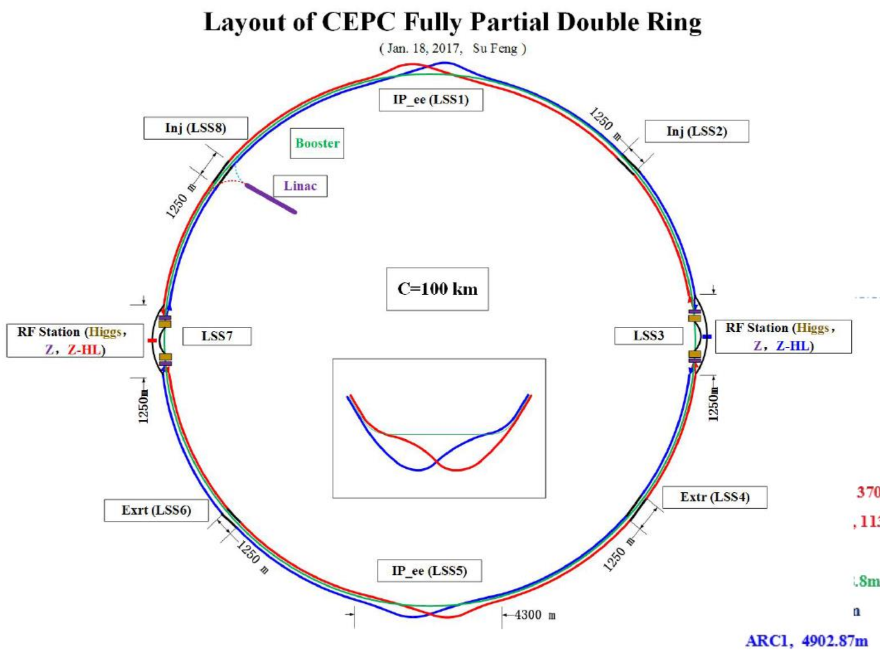
Layout and hardware satisfying both the Z and the H programs

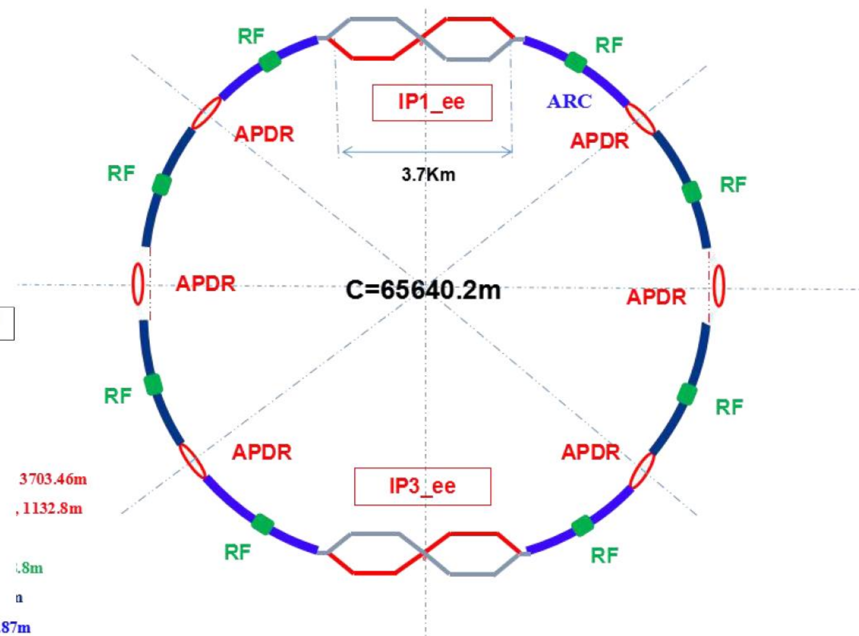
$L = 2\times10^{34} cm^{-2}s^{-1}$ (at E_{cm}=240 GeV)

$L = 1\times10^{34} cm^{-2}s^{-1}$ (at E_{cm}=91 GeV)

CEPC two shcemes towards CDR

CEPC Advanced Partial Double Ring Option II





CEPC Baseline Design

Better performance for Higgs and Z compared with alternative scheme, without bottle neck problems, but with higher cost

CEPC Alternative Design

Lower cost and reaching the fundamental requirement for Higgs and Z luminosities, under the condition that sawtooth and beam loading effects be solved

Parameters for CEPC double ring for CDR Goal

preliminary

（wangdou20170426-100km_2mmβy）

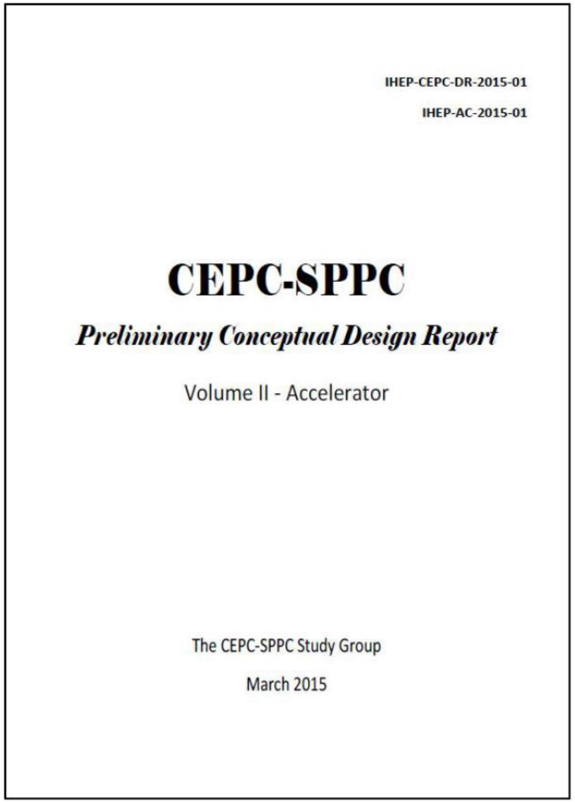
	Pre-CDR	Higgs	W	Z	
Number of IPs	2	2	2	2	
Energy (GeV)	120	120	80	45.5	
Circumference (km)	54	100	100	100	
SR loss/turn (GeV)	3.1	1.67	0.33	0.034	
Half crossing angle (mrad)	0	16.5	16.5	16.5	
Piwinski angle	0	3.19	5.69	4.29	11.77
N_e/bunch (10^{11})	3.79	0.968	0.365	0.455	0.307
Bunch number	50	412	5534	21300	2770
Beam current (mA)	16.6	19.2	97.1	465.8	408.7
SR power /beam (MW)	51.7	**32**	**32**	**16.1**	**1.4**
Bending radius (km)	6.1	11	11	11	11
Momentum compaction (10^{-5})	3.4	1.14	1.14	4.49	1.14
β_{IP} x/y (m)	0.8/0.0012	0.171/0.002	0.171 /0.002	0.16/0.002	0.171 /0.002
Emittance x/y (nm)	6.12/0.018	1.31/0.004	0.57/0.0017	1.48/0.0078	0.18/0.0037
Transverse σ_{IP} (um)	69.97/0.15	15.0/0.089	9.9/0.059	15.4/0.125	5.6/0.086
ξ_x/ξ_y/IP	0.118/0.083	0.013/0.083	0.0055/0.062	0.008/0.054	0.006/0.054
RF Phase (degree)	153.0	128	126.9	165.3	136.2
V_{RF} (GV)	6.87	**2.1**	**0.41**	**0.14**	**0.05**
f_{RF} (MHz) (harmonic)	650	650	650 (217800)	650 (217800)	
Nature σ_z (mm)	2.14	**2.72**	**3.37**	**3.97**	**3.83**
Total σ_z (mm)	2.65	2.9	3.4	4.0	4.0
HOM power/cavity (kw)	3.6 (5cell)	0.41(2cell)	0.36(2cell)	1.99(2cell)	0.12(2cell)
Energy spread (%)	0.13	0.098	0.065	0.037	
Energy acceptance (%)	2	1.5			
Energy acceptance by RF (%)	6	2.1	1.1	1.1	0.68
n_γ	0.23	0.26	0.15	0.12	0.22
Life time due to beamstrahlung_cal (minute)	47	52			
F (hour glass)	0.68	0.96	0.98	0.96	0.99
L_{max}/IP (10^{34}cm^{-2}s^{-1})	2.04	2.0	5.15	11.9	1.1

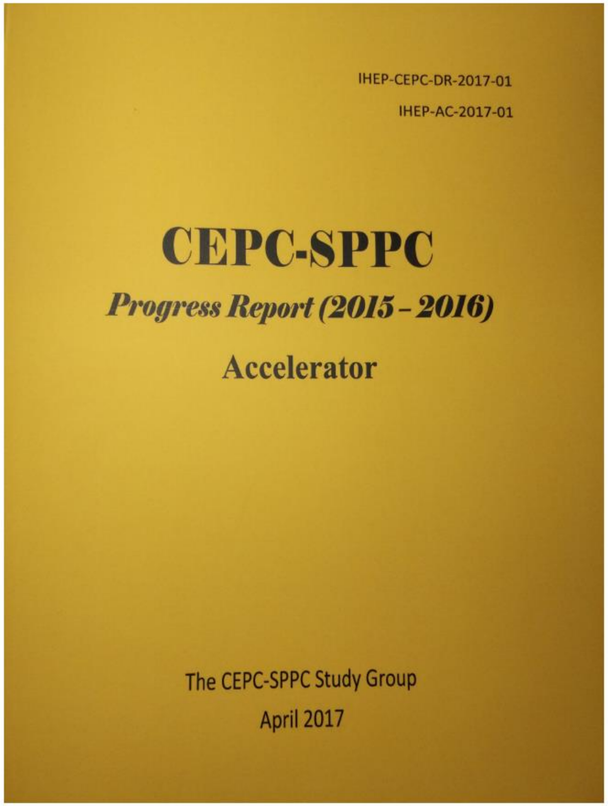
Preliminary results shows co-existence of Z/H programs are possible

Reconfiguration of CEPC can lead to much better luminosity at the Z pole → Z factory

Progress report, along with the preCDR, is available at

http://cepc.ihep.ac.cn

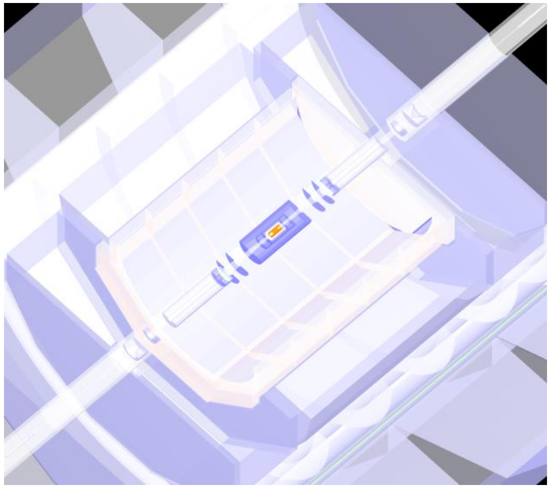


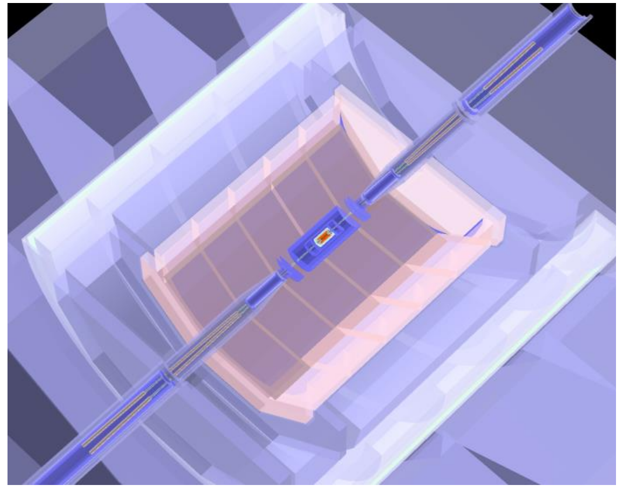


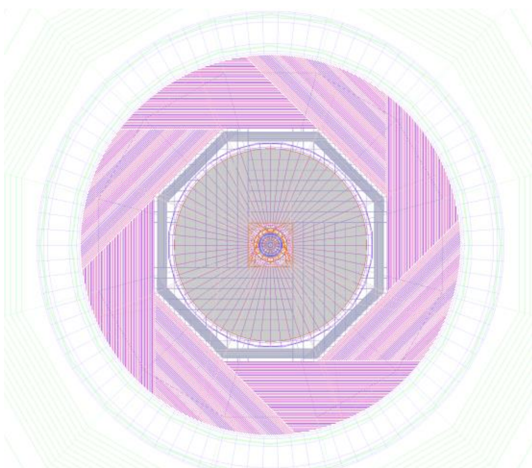
CEPC CDR will be completed at the end of 2017

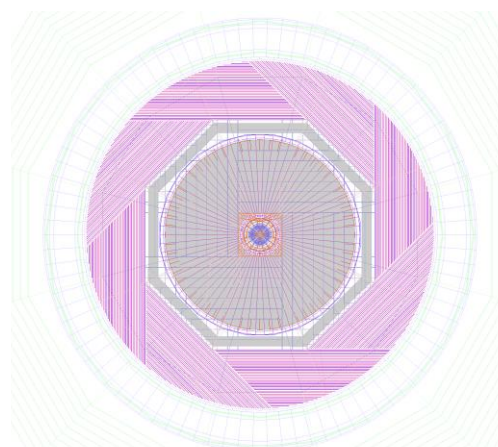
CEPC Detector: more compact & updated for CDR

preCDR (2015) → **CDR (2017)**

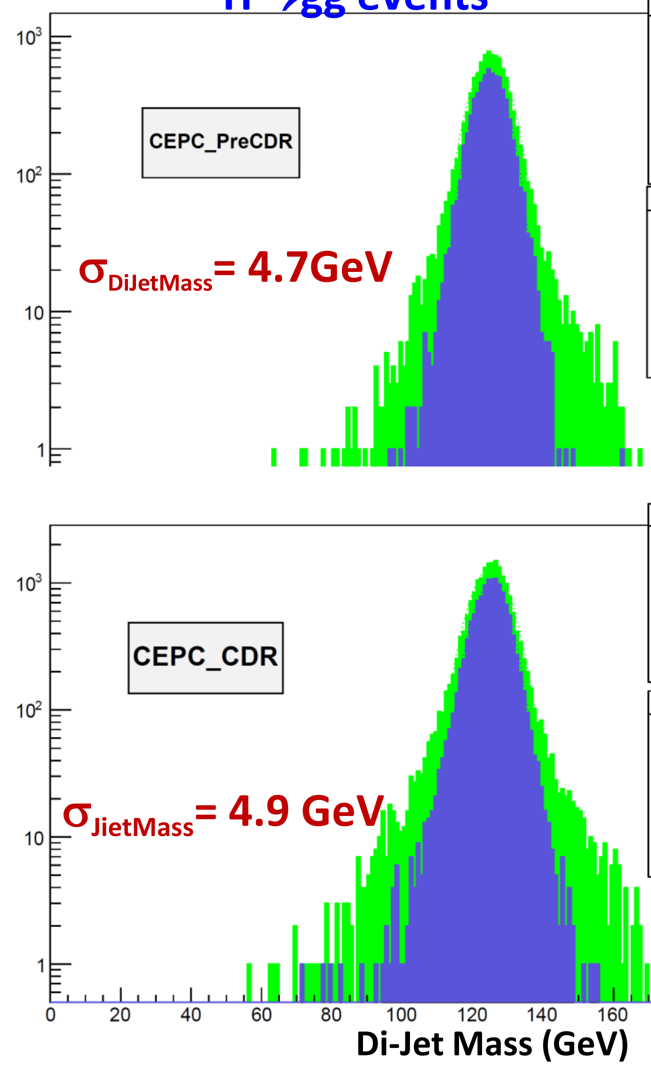








H→gg events



CDR CEPC detector:

Double ring geometry & MDI design implemented

HCAL reduced to 40 layers (from 48 in preCDR)

No visible impact on physics performance

CEPC Detector: more compact & updated for CDR

Feasibility & Optimized Parameters

Feasibility analysis: TPC and Passive Cooling Calorimeter is valid for CEPC

	CEPC_v1 (~ ILD)	Optimized (Preliminary)	Comments
Track Radius	1.8 m	>= 1.8 m	Requested by Br(H->di muon) measurement
B Field	**3.5 T**	**3 T**	**Requested by MDI**
ToF	**-**	**50 ps**	**Requested by pi-Kaon separation at Z pole**
ECAL Thickness	84 mm	84(90) mm	84 mm is optimized on Br(H->di photon) at 250 GeV;
ECAL Cell Size	5 mm	10 – 20 mm	Passive cooling request ~ 20 mm. 10 mm should be highly appreciated for EW measurements – need further evaluation
ECAL NLayer	30	20 – 30	Depends on the Silicon Sensor thickness
HCAL Thickness	**1.3 m**	**1 m**	-
HCAL NLayer	**48**	**40**	Optimized on Higgs event at 250 GeV;

Status and major development

- The R&D program
- Funding and support
- Site selection
- IAC and International collaboration
- Reach-out & engagement with the public

CEPC "R&D"

preCDR identified: designs issues, site, key technologies and development plan

加速器、探测器的概念设计，工程设计

土建方面的选址、规划、地质勘探、设计、评估、评审等

关键技术预研、验证

超导射频加速腔
- 用于各种加速器，国内有样机但尚未实用，指标需提高，没有生产能力
- 目标：达到高性能(Q值2×10^{10}，、加速梯度等)，实现国产化，批量生产能力

微波功率源（大功率速调管、固态功率源）
- 广泛用于加速器、广播、通讯、雷达等。大功率速调管依赖进口
- 目标：达到高性能(效率>80%、功率800kW、寿命等), 国产化，批量生产

大型低温制冷机
- 广泛用于民用、科研、航天等。基本依赖进口, 大型制冷机禁运。国内有样机
- 目标：达到高性能(功率12kW@4.5K/2.5kW@2K)、高可靠性，国产化

高温超导线
- 广泛用于民用、科研等。国内水平较好，性能与价格有待大幅度提高
- 目标：大大提高性价比，实现输电等民用领域的应用

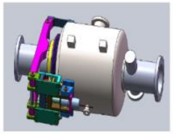
抗辐照半导体径迹探测器及读出芯片　国内高能加速器物理实验上的硅径迹探测器是空白
- 目标：自主设计芯片，工业流片，建造CEPC顶点探测器部件单元

成像型高精度量能器及前端电子学　国内高能加速器物理实验上的此类量能器是空白
- 目标：选型、优化探测器，自主设计ASIC芯片，建造量能器部件单元

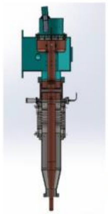
高场超导磁铁，束流测量与诊断，自动控制、计算机, 精密机械，…

……

Key Components



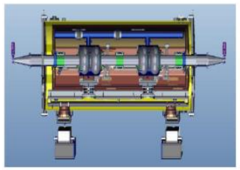
650 MHz
2-cell cavity & tuner
5-cell cavity
Q > 2E10 @ 20 MV/m



650 MHz
variable coupler
300 kW

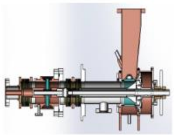
HOM coupler
1 kW

HOM absorber
5 kW



650 MHz & 1.3 GHz cryomodul
< 5 W @ 2K

1.3 GHz TESLA cavity (high Q high gradient study)



1.3 GHz
variable coupler
20 kW

✓to learn, develop and master the processing and production skills for making CEPC components;

✓enhance quality and cost-reduction of elements

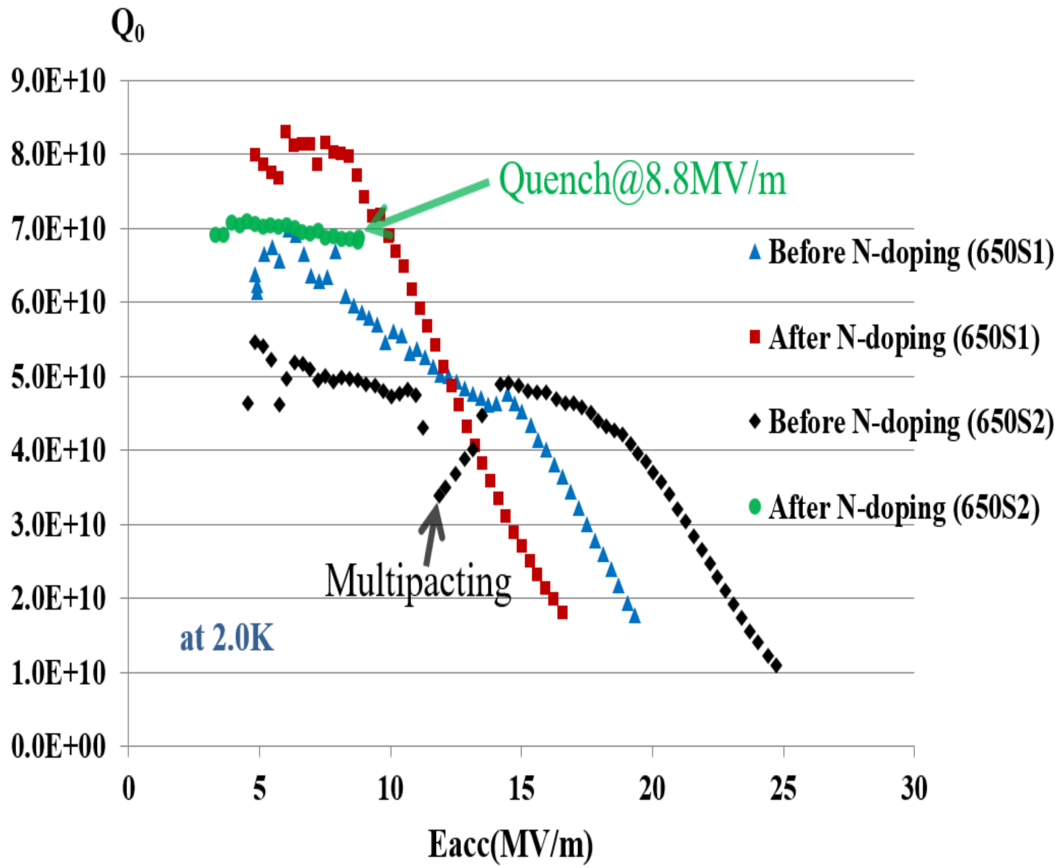
Main CEPC Ring SCRF Hardware Specification

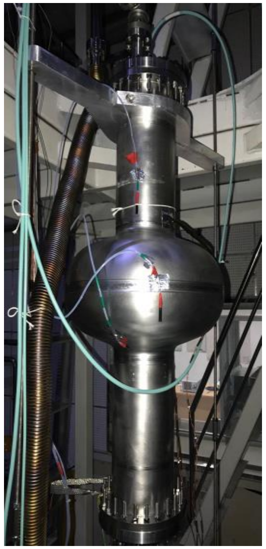
Hardware	Qualification	Normal Operation	Max. Operation
650 MHz 2-cell Cavity	VT 4E10 @ 22 MV/m HT 2E10 @ 20 MV/m	1E10 @ 16 MV/m (long term)	2E10 @ 20 MV/m
1.3 GHz 9-cell Cavity	VT 3E10 @ 25 MV/m	2E10 @ 20 MV/m	2E10 @ 23 MV/m
650 MHz Input Coupler	HPT 400 kW sw	300 kW	400 kW
1.3 GHz Input Coupler	HPT 20 kW peak, 4 kW avr.	< 15 kW peak	18 kW peak
650 MHz HOM Coupler	HPT 1 kW	< 0.2 kW	1 kW
650 MHz HOM Absorber	HPT 5 kW	< 2 kW	5 kW
650 MHz Cryomodule (six 2-cell cavities)	static loss 5 W @ 2 K	static loss 8 W @ 2 K	static loss 10 W @ 2 K
Tuner (MR & Booster)	tuning range and resolution 400kHz/1Hz	200 kHz / 1 Hz	400 kHz / 1 Hz
LLRF (MR & Booster)	amp & phase stability 0.1%, 0.1 deg	amp & phase stability 1%, 1 deg	amp & phase stability 0.1%, 0.1 deg

- ✓ **benefit from the ILC development;**
- ✓ **“R&D” will in turn contribute to the ILC construction**

N-doping - vertical test of CEPC 650MHz single-cell cavities at IHEP

- Post N-doping Q_0 increased obviously at low field for both cavities650S1: Q_0=7e10@Eacc=10MV/m. But Q_0 decreased quickly at high field (>10 MV/m).
  - 650S2: Quench at Q_0=6.9e10@Eacc=8.8MV/m.
- Next, increase Q_0 at high field by improving N-doping technology.



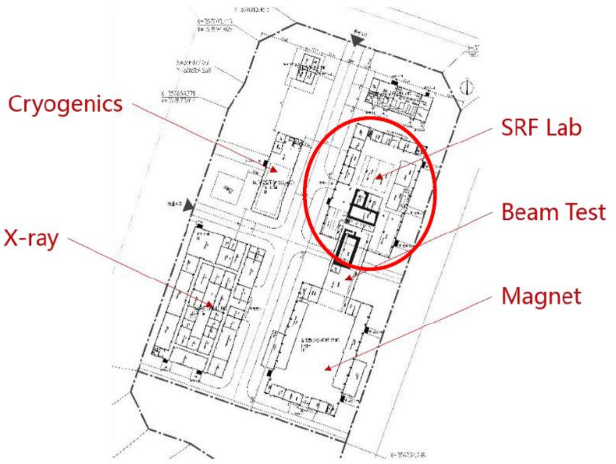


CEPC 650MHz single-cell cavity for vertical test

A New SRF Facility

Platform of **A**dvanced **P**hoton **S**ource Technology R&D, Huairou Science Park, Huairou, Beijing

Construction: 2017 - 2019
Ground Breaking: May 31, 2017

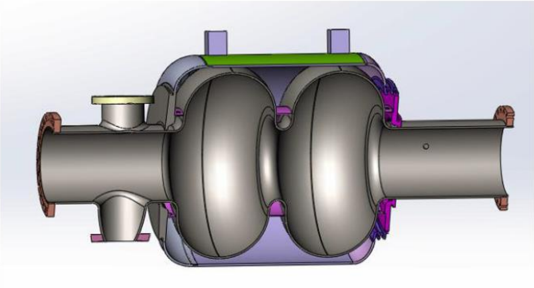


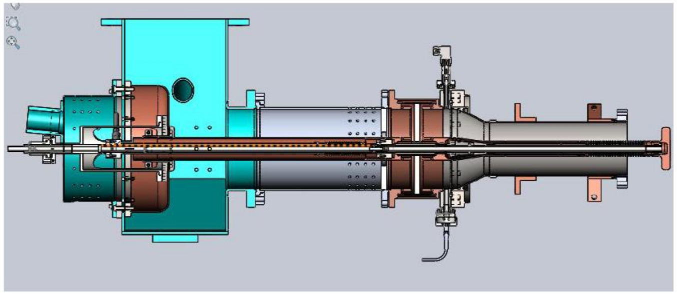
4500 m^2 SRF lab

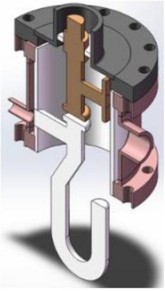
- **500M RMB funded by city of Beijing**
- **Construction: May 2017 – June 2020**
- **Include RF system & cryogenic systems magnet technology, beam test, etc.**

CEPC SRF R&D and Test at the PAPS Facility

- **Advanced Superconducting RF Technology R&D for CEPC**
  - **Preparation, diagnostics and test tools for high performance cavity**
    - **Nitrogen-doping & infusion**, Nb_3Sn thin film for high Q and high gradient
    - High resolution optical inspection, temperature and X-ray mapping, second sound quench detection, defects local grinding …
  - **Test facilities for key components of SRF accelerator**
    - **Very high power variable input coupler** with low heat load
    - **High power HOM coupler and absorber**
    - Components horizontal test with tuner and LLRF in low magnetic field
  - **Common cutting-edge research with ILC and SCLF (Shanghai XFEL) and possible breakthroughs in Fe-pnictides superconducting cavity**

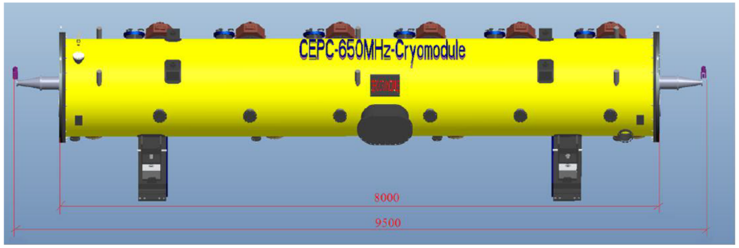


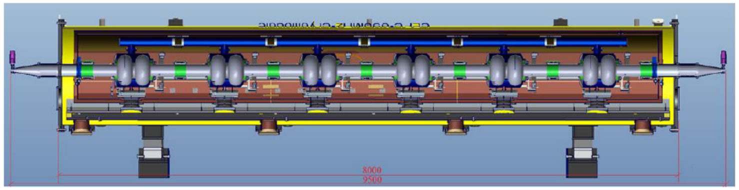


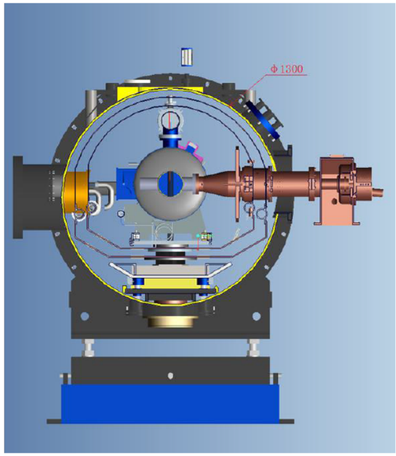


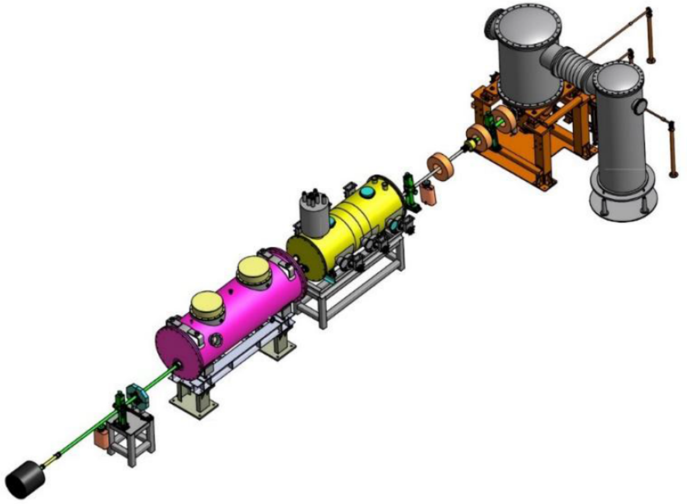
Cryomodule R&D and Test at the PAPS Facility

- **Develop High Performance Cryomodule Prototypes for CEPC**
  - **Main Ring: 650 MHz 2 x 2-cell (4 m) and 6 x 2-cell (10 m) & Booster: 1.3 GHz 2 x 9-cell (4 m) and 8 x 9-cell (12 m)**
    - Cavity string clean assembly and cryomodule assembly
    - **High power test** with strong flux expulsion by fast cool down
    - **Beam test** with DC-photocathode gun and high efficiency klystron
- **Demonstrate Mass-Production Capability for CEPC etc. Projects**









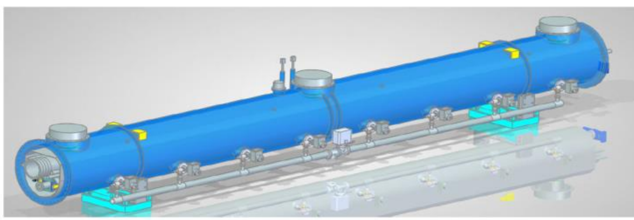
CEPC SRF R&D Plan (2017-2022)

- **Two small Test Cryomodules** (650 MHz 2 x 2-cell, 1.3 GHz 2 x 9-cell)
- **Two full scale Prototype Cryomodules** (650 MHz 6 x 2-cell, 1.3 GHz 8 x 9-cell)
- **Schedule**
  - 2017-2018 (key components, IHEP Campus)
    - high Q 650 MHz and 1.3 GHz cavities, N-doping + EP
    - 650 MHz variable couplers (300 kW) , 1.3 GHz variable couplers (10 kW)
    - high power HOM coupler and damper, fast-cool-down and low magnetic module, reliable tuner
  - 2019-2020 (test modules integration, Huairou PAPS)
    - Horizontal test 16 MV/m, Q_0 > 2E10
    - beam test 1~10 mA
  - 2021-2022 (prototype modules assembly and test, Huairou PAPS)

Cryomodule Development and Production for SCLF

SCLF Cryomodule Performance

- 1.3GHz 8x9cell cavity-string
- 8 tunners
- 8 power couplers
- 16个HOM couplers
- 1 Magnetic shielding
- 1 sc magnet
- 1 BPM
- 1 cryotat
- …



Cavity Performance

RF frequency	1.3 GHz
Temperature	2.0 K
Cavity length	1.038 m
Vertical test	>25 MV/m
Operation	>16 MV/m
Q0	> 2.7×10^{10}

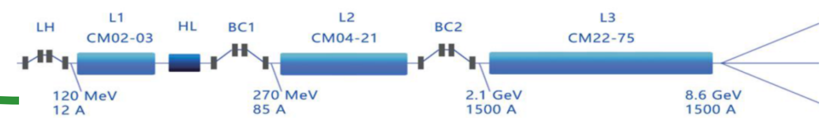
Cryomodule Performance

CW RF Voltage	≥ 128 MV
Dark current	< 1 nA
Heat load 2 K 5 K 45 K	< 93 W < 25 W < 215 W

Shanghai Coherent Light Facility (SCLF)

- SCLF is a newly proposed MHz high rep-rate XFEL, based on an 8 GeV CW SRF linac;
- This facility will be built in a 3.2 km long tunnel (38m underground) at Zhang-Jiang High Tech Park, across the SSRF campus in Shanghai;
- This XFEL facility includes 3 undulator lines and ~10 experimental stations in phase one, it can provide the XFEL radiation in the photon energy range of 0.2 -25 keV.
- The project proposal was recently approved by the central government in April 2017, and now it is in the feasibility study phase, aiming at commencing the tunnel construction in 2018.

Nominal performance of the SCLF linac



	No. of CM's	Avail. Cavities	Powered. Cavities	Gradient (MV/m)	E_{out} (MeV)	σ_z-out (mm)	σ_δ-out (%)	ϕ_{rf}	R_{56} (mm)
L0	1	8	7	16.3	120	1	0.04	0	
L1	2	16	15	13.6	326	1	0.383	-12.7	
HL	2	16	15	12.5	270	1	1.468	-150	
BC1	-	-			270	0.144	1.468		-55
L2	18	144	135	15.5	2148	0.144	0.368	-29	
BC2	-	-			2148	0.0072	0.368		-37
L3	54	432	406	15.5	8653	0.0072	0.086	0	

IHEP will provide one test cryomodule (8-cavities), and 100 9-cell cavities for SCLF

excellent exercise for CEPC

SppC Design Scope (201701 version)

Top priority: reducing cost!
Instead of increasing field

- **Baseline design**
  - Tunnel circumference: 100 km
  - Dipole magnet field: 12 T, iron-based HTS technology (IBS)
  - Center of Mass energy: >70 TeV
  - Injector chain: 2.1 TeV
- **Upgrading phase**
  - Dipole magnet field: 20 -24T, IBS technology
  - Center of Mass energy: >125 TeV
  - Injector chain: 4.2 TeV (adding a high-energy booster ring in the main tunnel in the place of the electron ring and booster)
- **Development of high-field superconducting magnet technology**
  - Starting to develop required HTS magnet technology before applicable iron-based wire is available
  - ReBCO & Bi-2212 and LTS wires be used for model magnet studies and as an option for SPPC: stress management, quench protection, field quality control and fabrication methods

Collaboration on HTS

"Applied High Temperature Superconductor Collaboration (AHTSC)" was formed in Oct. 2016. with >13 related institutes & companies and 50 scientists & engineers to advance HTS R&D and Industrialization.

- **Goal：**
  1) To increase the J_c of IBS by 10 times, reduce the cost to 20 Rmb/kAm @ 12T & 4.2K in 10 years, and realize the industrialization of the conductor;
  2) To reduce the cost of ReBCO and Bi-2212 conductors to 20 Rmb/kAm @ 12T & 4.2K in 10 years;
  3) Realization and Industrialization of iron-based SRF technology.
- **Working groups：** 1) Fundamental science investigation; 2) IBS conductor R&D; 3) ReBCO conductor R&D; 4) Bi2212 conductor R&D; 5) performance evaluation; 6) Magnet and SRF technology.
- **Collaboration meetings**: every 2~3 months.

Funded by CAS, more expected from MOST

执行委员会 (姓氏拼音排序)	
陈仙辉	中国科技大学
蔡传兵	上海大学/上创超导
李贻杰	上海交通大学/上海超导
马衍伟	中科院电工研究所
王贻芳	中科院高能物理所
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赵忠贤	中科院物理研究所
周廉	西北有色院

CEPC Funding

HEP seed money

11 M RMB/3 years (2015-2017)

国家重点研发计划
项目预申报书

FY 2016

Ministry of Science and Technology
Requested 45M RMB; **36M RMB approved**

项目名称：	高能环形正负电子对撞机相关的物理和关键技术预研究
所属专项：	大科学装置前沿研究
指南方向：	新一代粒子加速器和探测器关键技术和方法的预先研究
推荐单位：	教育部
申报单位：（公章）	清华大学

R&D Funding - NSFC

Increasing support for CEPC D+RDby NSFC
5 projects (2015); 7 projects(2016)

CEPC相关基金名称（2015-2016）	基金类型	负责人	承担单位
高精度气体径迹探测器及激光校正的研究 (2015)	重点基金	李玉兰/陈元柏	清华大学/高能物理研究所 Tsinghua IHEP
成像型电磁量能器关键技术研究(2016)	重点基金	刘树彬	中国科技大学 USTC
CEPC局部双环对撞区挡板系统设计及螺线管场补偿 (2016)	面上基金	白莎	高能物理研究所
用于顶点探测器的高分辨、低功耗SOI像素芯片的若干关键问题的研究(2015)	面上基金	卢云鹏	高能物理研究所
基于粒子流算法的电磁量能器性能研究 (2016)	面上基金	王志刚	高能物理研究所
基于THGEM探测器的数字量能器的研究(2015)	面上基金	俞伯祥	高能物理研究所
高粒度量能器上的通用粒子流算法开发(2016)	面上基金	阮曼奇	高能物理研究所
正离子反馈连续抑制型气体探测器的实验研究 (2016)	面上基金	祁辉荣	高能物理研究所
CEPC对撞区最终聚焦系统的设计研究(2015)	青年基金	王逗	高能物理研究所
利用耗尽型CPS提高顶点探测器空间分辨精度的研究 (2016)	青年基金	周扬	高能物理研究所
关于CEPC动力学孔径研究(2016)	青年基金	王毅伟	高能物理研究所

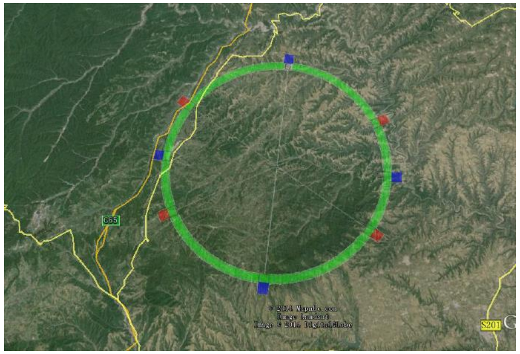
~60M RMB CAS-Beijing fund, talent program

~500M RMB Beijing fund (light source)

year 2017 funding request (45M) to MOST and other agencies under preparation

funding needs for carrying out CEPC design and R&D should be fully met by end of 2018

CEPC Site Exploration



1) QingHuangDao, Hebei（completed preCDR）

2) Huangling, Shaanxi（2017.1 signed contract to exp.）

3) ShenShan, Guangdong, （completed in August, 2016)

CEPC International Advisory Committee

Report:

The Second Meeting of the CEPC (SppC) International Advisory Committee

November 20, 2016

The IAC has been impressed with an amount of work done by the CEPC-SppC team since the first IAC meeting. There was significant progress on many fronts including accelerator R&D, detector R&D, simulation and theory. Much CEPC accelerator-related work has been done to address future possibilities including the optimum circumference, advantages of single ring, partial double ring, advanced partial double ring, or double rings, and crucial beam dynamics. Engineering work has concentrated on getting critical accelerator R&D started, on site evaluations, and on getting Chinese industry involved in new CEPC components. Three tunnel options are currently being considered: 54 km, 88

CEPC International Collaboration

Report:

The Second Meeting of
the CEPC (SppC) International Advisory Committee

November 20, 2016

- CEPC still looks like a Chinese project owned by China. It is important to find a mechanism that allows the international community to take some sense of ownership. In order to get international support and participation, the scope of the CEPC project must be clear, and its science case and future opportunities must be powerful and attractive to the international community.
- It is critical to get CEPC onto the regional strategic plans such as the European Strategy (ES) and the P5 in the U.S. through grassroots community support. LP 2017, LHCP 2017 and TIPP 2017, which will take place in China in 2017, will bring significant parts of the international community to China and will provide opportunities to build relationships with potential international partners.
- To enhance international participation, the IAC believes that CEPC working groups should be co-led by a Chinese and a foreign member, and advises to set up an International Steering Committee for the R&D phase.

✓ **MOU， joint research， established collab. with ILC-TPC, HL-LHC， …**

CEPC Outreach, PR and Communication

- Colloqiuia and outreach in Chinese universities

  北京大学，中国科大，浙江大学，中山大学，山东大学，武汉大学

  国科大，华中师大，清华，交大，南大， 复旦，…

- Fragrant Hill Meeting on CEPC
- social media& news
- CEPC Web revamp
- ……

A forum to discuss and plan for major projects of national significance

Fragrant Hill Meeting on CEPC

香山科学会议

高能环形正负电子对撞机-中国发起的大型国际科学实验

October 18-19, 2016

会议主题：Meeting Theme: CEPC

高能环形正负电子对撞机-中国发起的大型国际科学实验

中心议题：Focused Discussions

CEPC科学意义、物理目标、发展潜力 Science

CEPC预研究，和加速器、探测器、实验室建设 CDR, R&D

对社会发展的牵引作用和国际合作 Impact and Intl. Collab.

CEPC方案，时间表和论证 Plan, Timetable, Approval Process

consensus on R&D program, …

大型环形正负电子对撞机

中国物理协会高能物理分会达成共识

The HEP division of the Chinese Physical Society reached a consensus in August, 2016 that placed CEPC as the top priority accelerator based program for the future and endorsed CEPC design and R&D

中国物理学会高能物理分会第九届常务委员会

第四次（扩大）会议

中国物理学会高能物理分会

关于基于加速器的中国高能物理未来发展的意见

2016 年 8 月 20 日至 21 日，中国物理学会高能物理分会第六次战略研讨会在中国科学技术大学召开。2016 年 8 月 24 日经过高能物理分会常务委员会议讨论，形成了关于基于加速器的中国高能物理未来发展的意见。

中国高能物理未来发展的可能选项有大型环型正负电子对撞机（CEPC：Circular Electron Positron Collider，它包括 Higgs 工厂和 Z 工厂）、高亮度正负电子加速器(HIEPA：High Intensity Electron Positron Accelerator)。 委员会 对它们的前沿科学问题、技术先进性及在国际上的地位进行了深入分析和讨论。认为 CEPC 是我国未来高能加速器物理发展的首选项目。我国高能物理学界应该以 CEPC 作为发展战略目标，积极争取成为中国发起的国际大科学工程之一。在实现这一战略目标的过程中，要充分发挥和利用现有的 BEPC 的作用（包括升级改造及在该能区进一步发展），布置力量在高能量和高亮度前沿开展相关的预研究，培养和储备科研力量，掌握关键核心技术。在兼顾 Higgs 和 Z 工厂物理目标的前提下优化 CEPC 加速器和探测器的设计。高能物理分会将尽快组织制定基于加速器的中国高能物理发展路线图。

高能物理学界将同心协力，分工合作，全力以赴，推动我国高能物理的持续发展。

中国物理学会高能物理分会

2016 年 9 月 12 日

Objectives

1. Conceptual Design Report a major push
2. Organization and global collaboration
3. R&D
4. Preparation for the realization of CEPC

Focuses

- **CDR** **chapters available (parallel sessions), good time to contribute to the CDR**
  informal CEPC, SppC accelerator mini reviews (Nov. 4-5) at IHEP
  informal detector-simu mini review (Nov. 10) at IHEP

- **Organization**
  members & conveners of working groups
  domestic advisory committee (on China related issues)

- **R&D**
  design and performance study
  Prototyping
  infrastructure

- **Preparation for the realization of CEPC**
  project management (IAC meeting)
  industrial support and preparation (industrial consortium)
  international collaboration and support
  site exploration and design
  funding agency, government support
  ……

Focuses

- **Institutional Board**

  "Institutional Board meeting (to discuss future organizations around the CEPC) today, and that one representative from each institution will be invited to attend the meeting, either as a member or an observer. We advise the participants to consult with colleagues at their home institutions to determine if they will participate in this meeting"

Monday, November 6, 2017

08:30 - 10:30	CEPC-SppC Overview: Plenary Session I Convener: Prof. Yuanning Gao (THU) (Tsinghua University)
	08:30 **Openning Adress** *10'* Speaker: Prof. Yifang WANG (IHEP)
	08:40 **CEPC-SppC Overview & Objectives** *25'* Speaker: Prof. Xinchou LOU (高能所)
	09:05 **CEPC Physics CDR - status** *20'* Speaker: Liantao Wang (University of Chicago)
	09:25 **CEPC accelerator CDR - status** *25'* Speaker: Prof. Jie 高杰 (高能所)
	09:50 **CEPC Detector CDR - status** *20'* Speaker: Joao Guimaraes Costa
	10:10 **SppC CDR - status** *20'* Speaker: Prof. Jingyu Tang (IHEP, CAS)
10:30 - 10:40	Conference photo *10'*
10:40 - 11:00	Coffee-Tea Break
11:00 - 12:15	CEPC-SppC Development and R&D: Plenary Session II Convener: Prof. Anton Bogormygkov (BINP)
	11:00 **CEPC-SppC infrastructure – status & plan** *25'* Speaker: Mr. Guoping Lin (通用运行部)
	11:25 **CEPC R&D highlights – status and plan** *25'* Speaker: Prof. Yunlong Chi (Institute of High Energy Physics,Chinese Acade
	11:50 **SppC super conducting magnet – status and plan** *25'* Speaker: Dr. Qingjin XU (高能所)
12:15 - 14:00	Lunch at IHEP Guest House Restaurant
12:15 - 14:00	IB Meeting *1h45'* (B410) Speaker: Prof. Yuanning Gao (Tsinghua University)

- **Poster Session**

16:00 - 16:30	Coffee-Tea Break
16:00 - 16:30	Poster Convener: Joao Guimaraes Costa Location: Particle Cafe, 2nd floor
16:30 - 18:30	Detector & Physics I (detector concepts and system aspects): Parallel Session I Conveners: Joao Guimaraes Costa, Dr. Massimo Caccia
	16:30 **Status of the CEPC magnet R&D** *20'*

Focuses

➢ **Industrial Consortium (A214)**

Nov. 7

Speaker: Dr. Jia Liu (Chicago)

12:30 - 14:00	Lunch at IHEP Guest House Restaurant
14:00 - 16:00	CEPC-Industrial Consortium (Presentation on CEPC, Procedure and Organization): Parallel Session IV
16:00 - 16:30	Coffee-Tea Break & CEPC-Industrial Consortium meets with Press *CEPC-Industrial Consortium meets with Press*
16:30 - 18:15	SppC IV: Discussion on the cold bore temperature Convener: Prof. Jingyu Tang (IHEP, CAS) 16:30 **Discussion on the cold bore temperature** *1h45'* Speaker: Prof. Jingyu Tang (IHEP, CAS)
16:30 - 18:15	CEPC-Industrial Consortium II (Business): Parallel Session V

➢ **Next workshop on CEPC**

April 5-7, 2018 at Sun Yat-Sen University University, Guangzhou, China

http://indico.ihep.ac.cn/event/7388/

Summary

- **CEPC CDR is progressing**
- **Design + R&D funding needs are largely met with various sources; people are hard working on DRD**
- **Build a stronger CEPC team w. intl. collab. & participation**
- **For the very long future, economic HTS magnet program is being explored in China with a carefully constructed consortium**
- **Infrastructure, experience and engineering proficiency gained through current projects (light source, CSNS, etc.) helpful for the CEPC**
- **Upon successfully completing the DRD program, we expect to make the case to the national government for building CEPC (~5 years from now)**