IHEP-KEK SCRF Collaboration for Future High Energy Colliders (CEPC-ILC)

J. Gao

The 7th IHEP-KEK SCRF Collaboration Meeting
IHEP, Beijing, September 22, 2018

Purposes of this meeting

- Exchange information on the progress status of ILC and CEPC
- Discussion on future collaboration issues
- Meeting of next time

Main points

- The purpose and the history of the IHEP-KEK SCRF collaboration
- The collaboration results review since last meeting
- The future pespectives

Program and Indigo page

7th IHEP-KEK SCRF Collaboration Meeting

Beijing, 22-23 September 2018

September 22, Room A415 of Main Building, IHEP

Morning Session, Chair: Jie GAO

08:30-08:40	Welcome and Introduction	Yifang Wang
08:40-09:00	Introduction to CEPC Status	Jie Gao
09:00-09:15	Introduction to ILC Status	Shin Michizono
09:15-09:35	Study on Nitrogen Infusion for 1.3 GHz SRF Cavities Using J-PARC Furnace and Construction of New KEK Vacuum Furnace	Kensei Umemori
09:35-09:55	First trial of the In-situ Nitrogen Infusion at KEK	Taro Konomi
09:55-10:25	*Group Photo and Coffee Break*	
10:25-10:45	Investigation of SRF elliptical cavities made by new Nb materials in KEK	Takeshi Dohmae
10:45-11:05	Long-term operation with beam and cavity performance degradation in Compact-ERL main linac at KEK	Hiroshi Sakai
11:05-11:25	Recent results for study of ceramic and copper plating for power couplers	Yasuchika Yamamoto
11:25-11:40	Precise Evaluation of Characteristic of the Multi-Layer Thin-Film Superconductor Consisting of NbN and Insulator on Pure Nb Substrate	Ryo Katayama
11:40-11:55	The study of the RF reference phase stabilization system	Na Liu
11:55-12:10	L-band Resonant Ring for testing RF window for ILC	Baiting Du
12:10-14:00	*Lunch (lunch box) and IHEP Tour*	

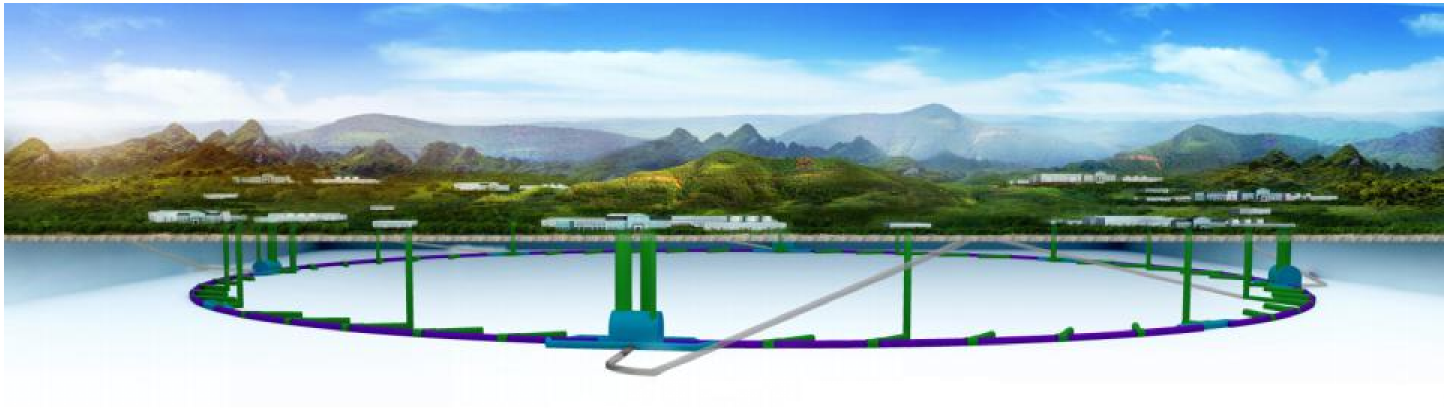
Afternoon Session, Chair: Shin MICHIZONO

14:00-14:20	PAPS SRF Facility	Feisi He
14:20-14:40	IHEP EP System	Song Jin
14:40-15:00	HEPS SRF System	Pei Zhang
15:00-15:20	CEPC SRF System	Jiyuan Zhai
15:20-15:40	*Coffee Break*	
15:40-16:00	CEPC Cavity and High Q & New Material Research	Peng Sha
16:00-16:15	CEPC Cavity Helium Vessel and Tuner	Zhenghui Mi
16:15-16:30	CEPC Test Cryomodule	Ruixiong Han
16:30-16:45	CEPC Input Coupler	Qiang Ma
16:45-17:00	CEPC HOM Coupler	Hongjuan Zheng
17:00-17:15	CEPC HOM Absorber	Fanbo Meng
17:15-18:00	*IHEP-KEK SRF collaboration discussion*	
18:30-20:30	*Dinner at the IHEP Guest House Restaurant*	

September 23, Huairou Science City, Beijing

08:00-12:00 PAPS site tour (Guide: Jin DAI, Chao DONG)

http://indico.ihep.ac.cn/event/8804



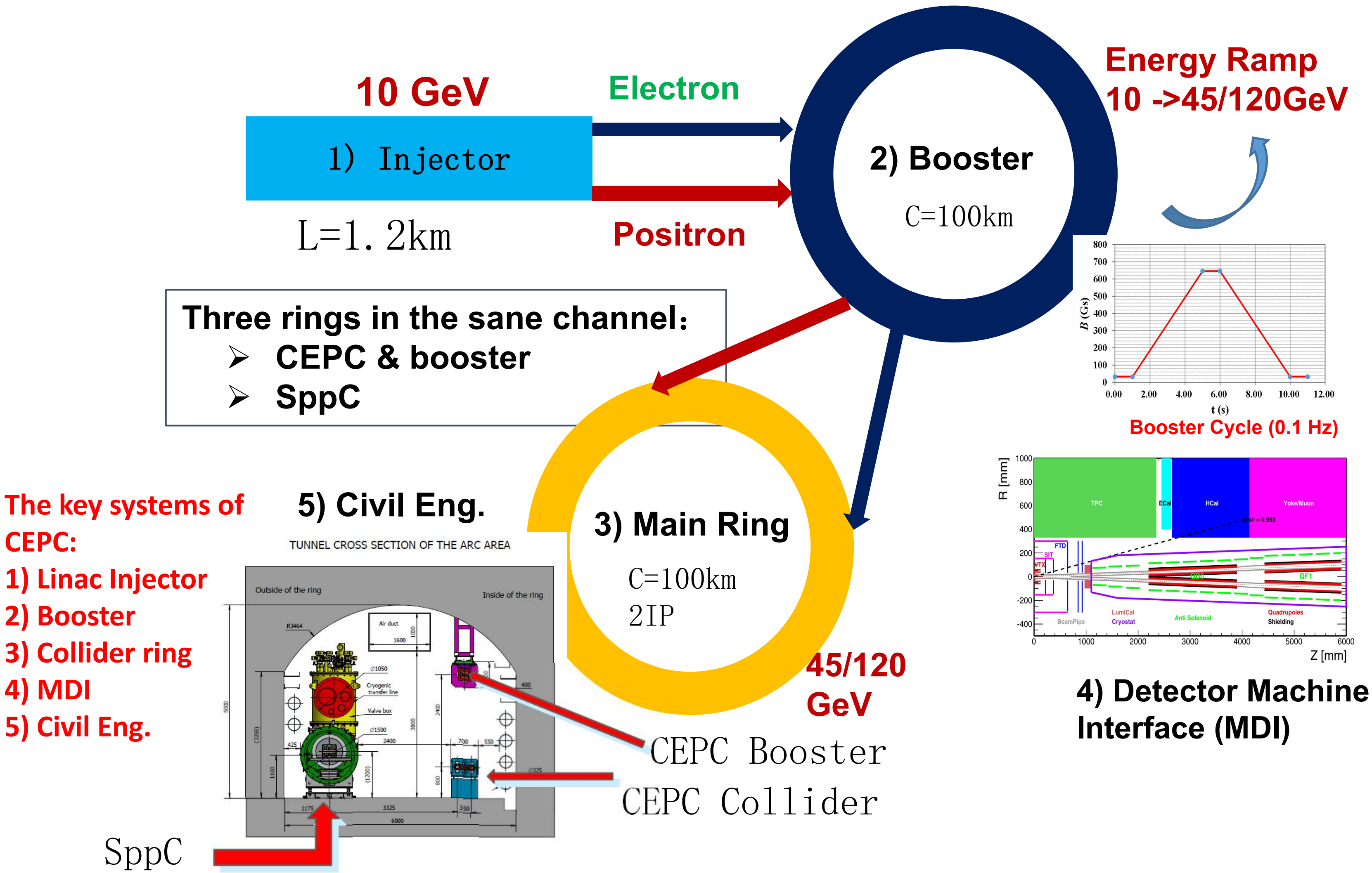
CEPC Status Overview

J. Gao
On behalf of CEPC Study Group

Institute of High Energy Physics

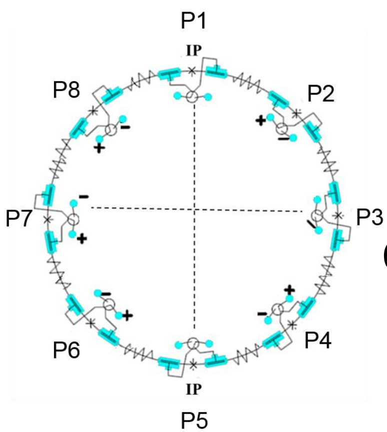
The 7th IHEP-KEK SCRF Collaboration Meeting
IHEP, Beijing, September 22, 2018

CEPC CDR Accelerator Chain and Systems



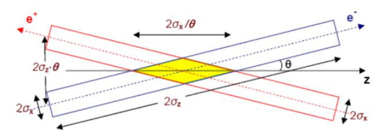
CEPC Four Options Evoluting towards CDR

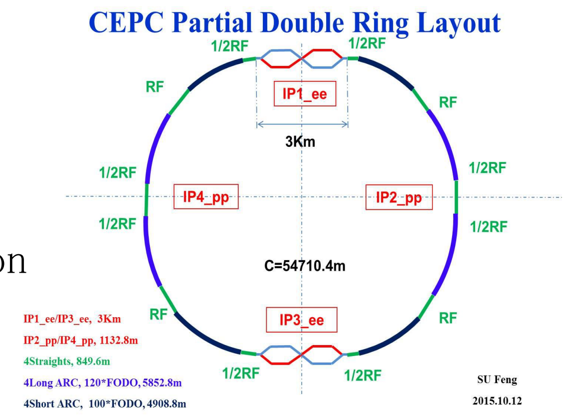
CEPC Pre-CDR Scheme (head -on collision)



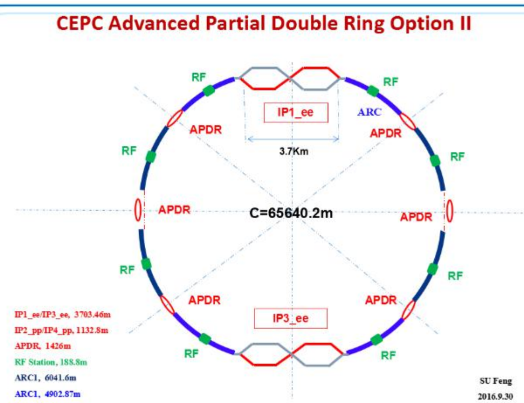
Since Oct 2012

Crab-waist collision in CEPC CDR





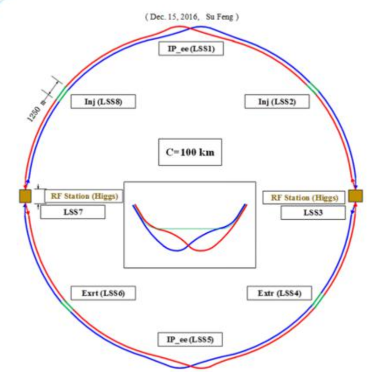
Since May 2015



Since May 2016

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



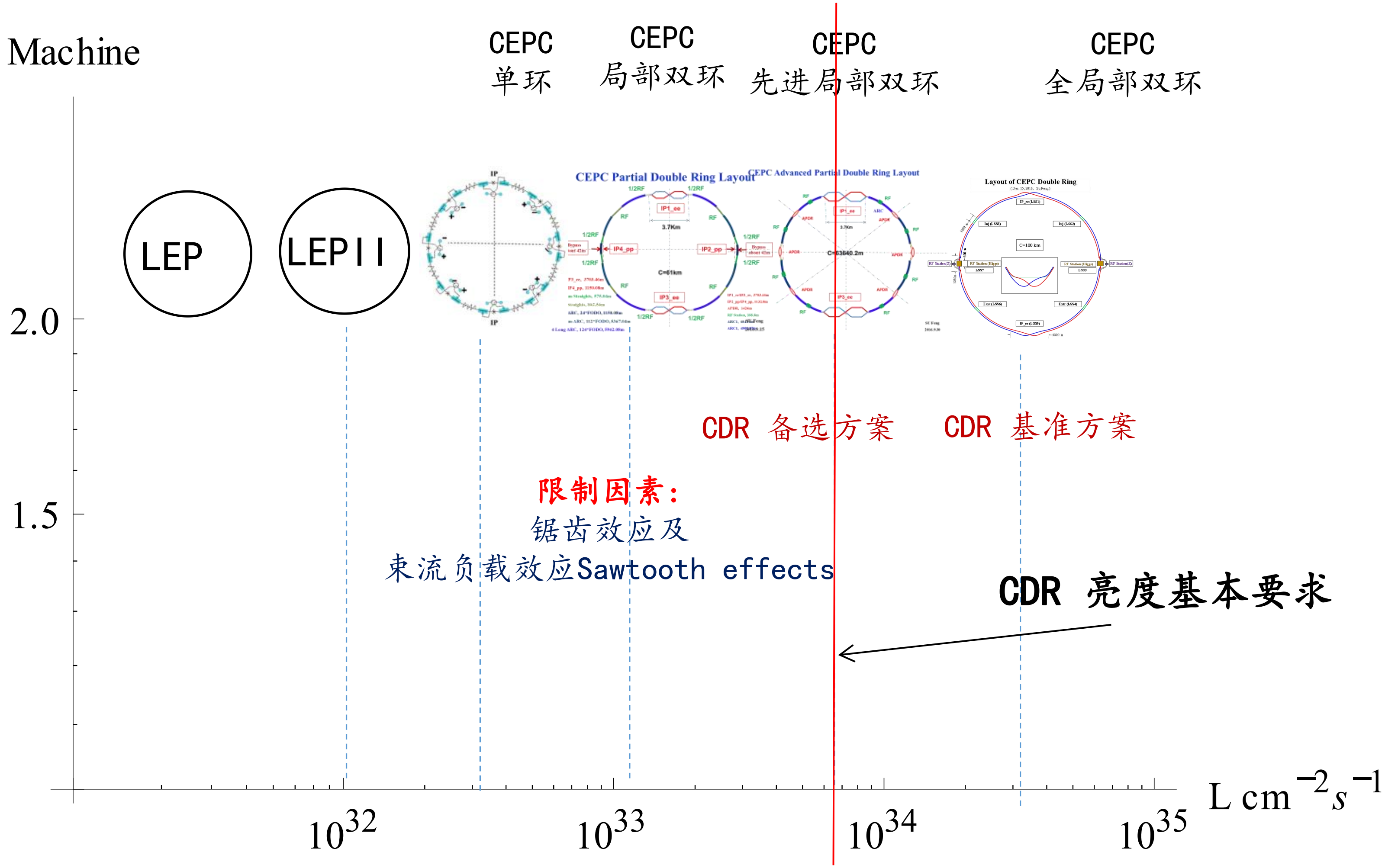
Since Nov 2016

CEPC Baseline Design

Better performance for Higgs and Z compared with alternative scheme, without bottle neck problems, but with higher cost 30MW synchrotron radiation power/beam

- CEPC 100km circumference was decided by CEPC SC based on the recommendation from IAC in Nov. 2016
- CEPC baseline and alternative options have been decided on Jan. 14, 2017

对撞机选型与亮度对应关系



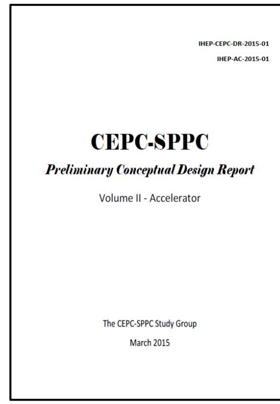
亮度 H: 10^32 (102GeV) <~2*10^34 >2~5*10^34 (cm^-2s^-1)

亮度 Z: 10^32 <~1*10^34 >10*10^34

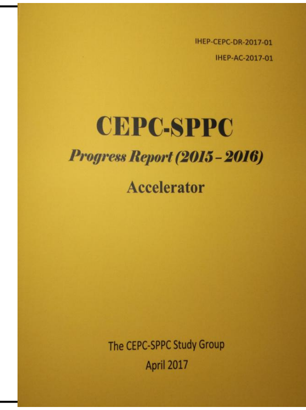
CEPC Accelerator from Pre-CDR to CDR

CEPC accelerator CDR completed in June 2018 (to be printed in
uly 2018)

- Executive Summary
1. Introduction
2. Machine Layout and Performance
3. Operation Scenarios
4. CEPC Collider
5. CEPC Booster
6. CEPC Linac
7. Systems Common to the CEPC Linac, Booster and Collider
8. Super Proton Proton Collider
9. Conventional Facilities
10. Environment, Health and Safety
11. R&D Program
12. Project Plan, Cost and Schedule
- Appendix 1: CEPC Parameter List
- Appendix 2: CEPC Technical Component List
- Appendix 3: CEPC Electric Power Requirement
- Appendix 4: Advanced Partial Double Ring
- Appendix 5: CEPC Injector Based on Plasma Wakefield Accelerator
- Appendix 6: Operation as a High Intensity γ-ray Source
- Appendix 7: Operation for e-p, e-A and Heavy Ion Collision
- Appendix 8: Opportunities for Polarization in the CEPC
- Appendix 9: International Review Report



March 2015



April 2017

Draft CDR for Mini International Review in Nov. 2017

CDR Version for International Review June 2018
Formally relased on Sept. 2, 2018:arXiv: 1809.00285
http://cepc.ihep.ac.cn/CDR_v6_201808.pdf

International Review of CEPC CDR
(June 28-30, 2018, IHEP)

International Review of CEPC CDR

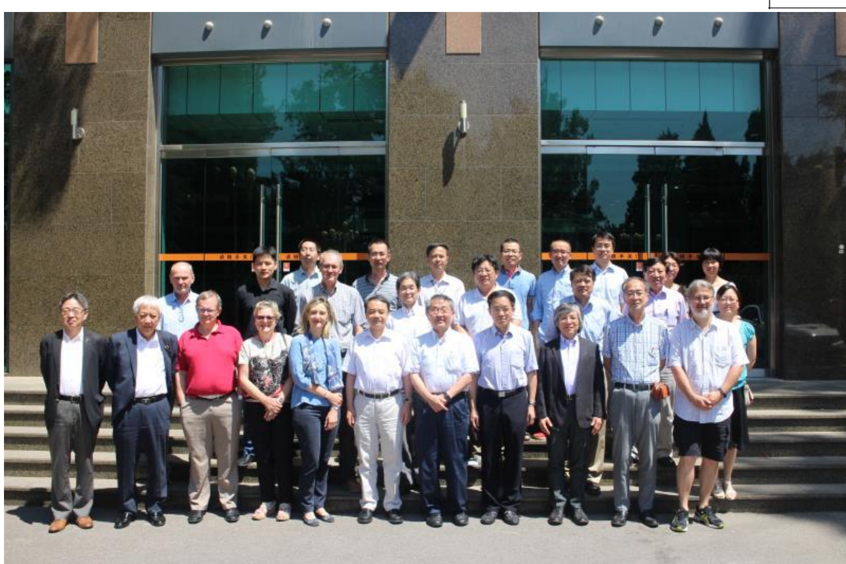
June 28 – 30, 2018, IHEP, Main Building, Room A415

Agenda

Thursday, June 28		
8:30-9:00	Chair: K. Oide Committee Executive Session	
9:00-9:05 9:05-9:20 9:20-9:35 9:35-10:05 10:05-10:35	Chair: Qing Qin Welcome Overview of CEPC Overview of beam dynamics CEPC collider lattice design CEPC beam-beam and DA	Yifang Wang Jie Gao Chenghui Yu Yiwei Wang Yuan Zhang
11:05-11:35 11:35-12:05	Coffee break(30') Chair: K. Oide Instabilities Machine-detector interface	Na Wang Sha Bai
12:05 – 14:00	Lunch break	
14:00-14:30 14:30-15:00 15:30-16:00	Chair: K. Oide Booster Injection and extraction Linac injector	Dou Wang Xiaohao Cui Cai Meng
16:30-18:30	Coffee break(30') Committee Executive Session	
19:00	Dinner of Committee	

8:30-9:00 9:00-9:30 9:30-10:00 10:00-10:20 10:20-10:40	Chair: K. Oide SRF system RF power source Cryogenic system CEPC collider ring Magnet CEPC booster ring magnet
11:10-11:30 11:30-12:00 12:00-12:30	Coffee break(30') SC magnet for CEPC IR Power supplies Vacuum
12:30 – 14:00	
14:00-14:30 14:30-15:00 15:00-15:30 15:30-16:00	Chair: K. Oide Instrumentation Control Synchrotron radiation Radiation shielding
16:30-18:30	Coffee break(30') Committee Executive Sessic
	Dinr

Saturday, June 30		
8:30-9:00 9:00-9:30 9:30-10:00 10:00-10:30	Chair: K. Oide Survey and alignment Mechanics Conventional facilities Site investigation	Xiaolong Wang Haijing Wang Guoping Lin Yu Xiao
11:00-12:00	Coffee break (30') Discussion with CEPC team	
12:00 – 14:00	Lunch break	
14:00-16:00	Committee Executive Session	
16:30-17:30	Coffee break (30') Close out	
	Banquet	



Review Committee Members:

Brian Foster	Oxford U./DESY
Eugene Levichev	BINP
Katsunobu Oide (chair)	CERN/KEK
Kazuro Furukawa	KEK
Manuela Boscolo	INFN
Marica Biagini	INFN
Masakazu Yoshioka	KEK/Tohoko University
Norihito Ohuchi	KEK
Paolo Pierini	ESS
Steinar Stapnes	CERN
Yoshihiro Funakoshi	KEK
Zhengtang Zhao (absent)	SINAP

International Review Report (draft) of CEPC CDR (June 28-30, 2018, IHEP)

International Review of the CEPC Conceptual Design Report
- Accelerator Design –

June 28 – 30, 2018
IHEP, Beijing

This is the review report of the accelerator part of the CEPC CDR. The review is done for the presentations based on the draft version of the CDR. Extensive discussions have been held between the review committee members and the CEPC team during the review meeting.

General remarks

The Circular Electron-Positron Collider (CEPC) is a very ambitious and important project aimed at various physics at ZH (E_{beam} = 120 GeV), W± (80 GeV), and Z (46 GeV) production which would produce the highest luminosity ever achieved by a collider in the world. The Superconducting Proton-Proton Collider (SppC) is planned as the second stage of the project using the same collider tunnel to explore the energy frontier of elementary particle physics.

The Review Committee unanimously congratulates the CEPC team on the completion of the CDR, with remarkable successes in various aspects of the design. The progress since the pre-CDR has been a major step in the project, especially the full double-ring scheme, lattice design, and various beam dynamics with beam-beam effects and collective phenomena. The design work on each system has verified the basic feasibility of the project, including the superconducting RF, normal and superconducting magnets, cryogenic system, vacuum system, injectors with a booster synchrotron and a linac, instrumentation, control, safety, civil engineering, etc.

The Committee believes that the CDR has already reached a sufficient level of maturity to allow approval to proceed to a Technical Design Report. On the other hand, we think that this machine has more potential for further extensions, including:

(1) Experiments for ttbar production (E_{beam} ≈ 180 GeV);
(2) Even higher luminosity (~x10) at Z and W±;
(3) Higher beam current, up to 50 MW/beam synchrotron radiation loss;
(4) More interaction points;
(5) Polarized beams.

These extensions will be achievable if the machine preserves the possibility to implement these possibilities by relatively small investments, such as longer quadrupole magnets, a less compressed layout around the interaction point (IP) with shallower bends, and sufficient length for the RF section. Actually, such improvements may even reduce the operation costs. The committee encourages the CEPC team to explore and preserve these possibilities, since once CEPC is built, no second machine with the same scale is likely to be built in the world.

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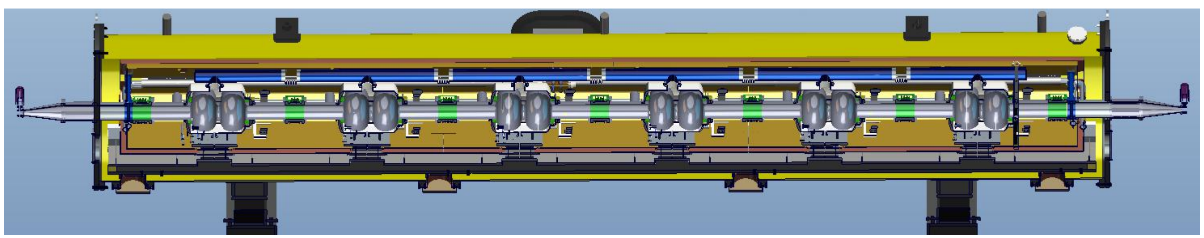
The Committee believes that the CDR has already reached a sufficient level of maturity to allow approval to proceed to a Technical Design Report.

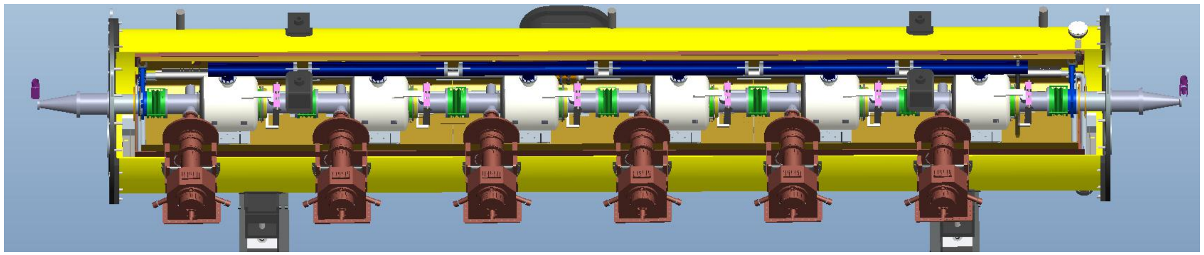
CEPC Collider Ring SRF Parameters

Collider parameters: 20180222	H	W	Z
SR power / beam [MW]	30	30	16.5
RF voltage [GV]	2.17	0.47	0.1
Beam current / beam [mA]	17.4	87.9	461
Bunch charge [nC]	24	24	12.8
Bunch number / beam	242	1220	12000
Bunch length [mm]	3.26	6.53	8.5
Cavity number (650 MHz 2-cell)	240	2 x 108	2 x 60
Cavity gradient [MV/m]	19.7	9.5	3.6
Input power / cavity [kW]	250	278	276
Klystron power [kW] (2 cavities / klystron)	800	800	800
HOM power / cavity [kW]	0.54	0.86	1.94
Optimal Q_L	1.5E6	3.2E5	4.7E4
Optimal detuning [kHz]	0.17	1.0	18.3
Total cavity wall loss @ 2 K [kW]	6.6	1.9	0.2

CEPC 650 MHz Cavity Cryomodule

- Structure based on ADS cryomodule. High Q requirement drives new design features (fast cool down and magnetic hygiene).
- Fast cool down rate is supposed to be 10 K/min during 45 K to 4.5 K.
- Ambient magnetic field at cavity surface should be less than 5 mG. Magnetic shielding and demagnetization of parts and the whole module should be implemented for the magnetic hygiene control.





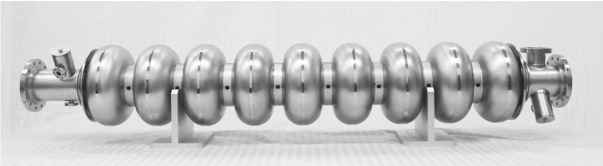
Overall length (flange to flange, m)	8.0
Diameter of vacuum vessel (m)	1.3
Beamline height from floor (m)	1.2
Cryo-system working temperature (K)	2
Number of cavities and tuners	6
Number of couplers	6
Number of RT HOM absorbers	2
Number of 200-POSTs	6
Static heat loads at 2 K (W)	5
Alignment x/y (cavities) (mm)	0.5
Alignment z (mm)	2

CEPC Booster SRF Parameters

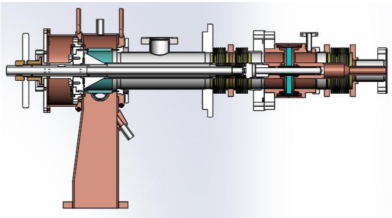
10 GeV injection	H	W	Z
Extraction beam energy [GeV]	120	80	45.5
Bunch number	242	1524	6000
Bunch charge [nC]	0.72	0.576	0.384
Beam current [mA]	0.52	**2.63**	**6.91**
Extraction RF voltage [GV]	1.97	0.585	0.287
Extraction bunch length [mm]	2.7	2.4	1.3
Cavity number in use (1.3 GHz TESLA 9-cell)	96	64	32
Gradient [MV/m]	19.8	8.8	8.6
Q_L	1E7	6.5E6	1E7
Cavity bandwidth [Hz]	130	200	130
Beam peak power / cavity [kW]	8.3	12.3	6.9
Input peak power per cavity [kW] (with detuning)	18.2	12.4	7.1
Input average power per cavity [kW] (with detuning)	0.7	0.3	0.5
SSA peak power [kW] (one cavity per SSA)	25	**25**	**25**
HOM average power per cavity [W]	0.2	0.7	**4.1**
Q_0 @ 2 K at operating gradient (long term)	1E10	1E10	1E10
Total average cavity wall loss @ 2 K eq. [kW]	0.2	0.01	0.02

1.3 GHz SRF Technology for CEPC Booster

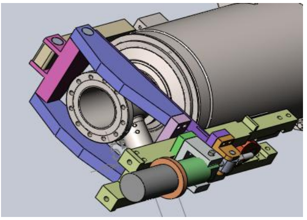
XFEL and LCLS-II type cryomodule, without SCQ. Technology R&D in synergy with Shanghai XFEL (SCLF). No big challenge.



TESLA cavity. Nitrogen-doped bulk niobium and operates at 2 K. $Q_0 > 3 \times 10^{10}$ at 24 MV/m for the vertical acceptance test. $Q_0 > 1 \times 10^{10}$ up to 20 MV/m for long term operation.

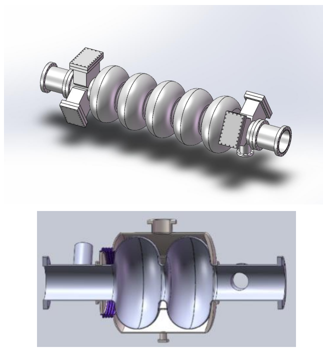


XFEL/ILC/LCLS-II or other type **variable power coupler**. Peak power 30 kW, average 4 kW, Q_{ext} 1E7-5E7, two windows.

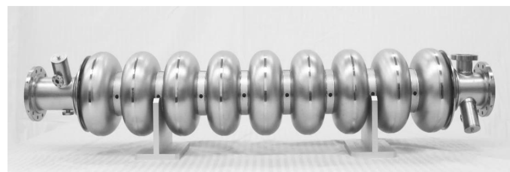


XFEL/LCLS-II type **end lever tuner**. Reliability. Large stiffness. Piezos abundance, radiation, overheating. Access ports for easy maintenance.

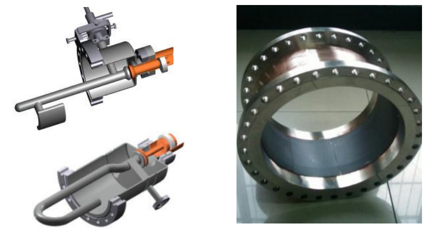
CEPC SCRF technology R&Ds



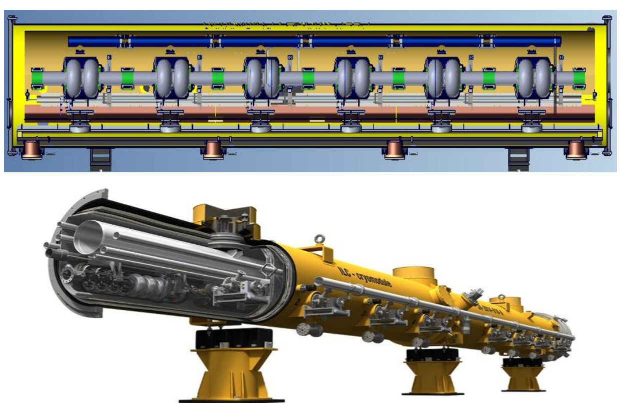
650 MHz cavity in fabrication



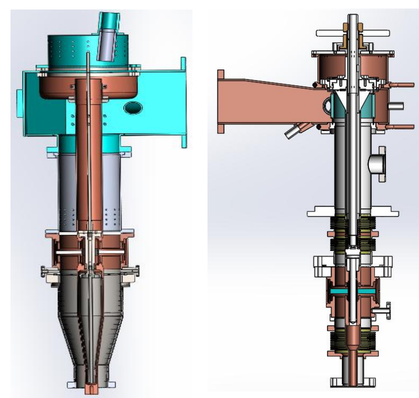
IHEP made 1.3 GHz cavity



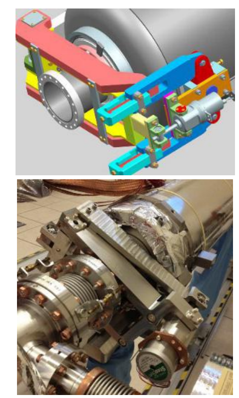
HOM Coupler and Absorber



Cryomodule



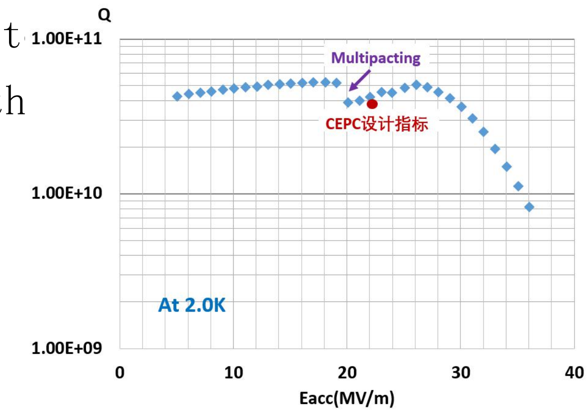
Input Coupler



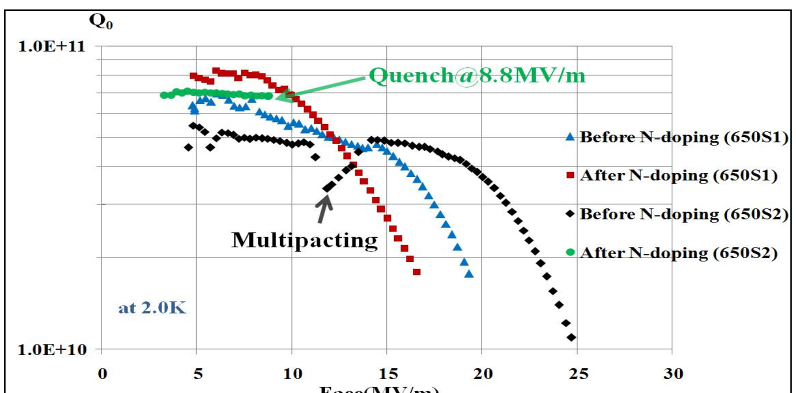
Tuner

CEPC 650 MHz Cavity Development

- Vertical test result: Q_0=5.1E10@26MV/m, which has reached the CEPC target (Q_0=4.0E10@22.0MV/m).
- Next, the CEPC target will be again improved by N-doping and EP, to increas Q_0 and t furth



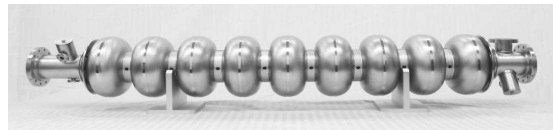
After N-doping, Q_0 increased obviously at low field for both 650MHz 1-cell cavities.



The civil construction of the EP facility is on going, and the commissioning will be at the end of 2018.

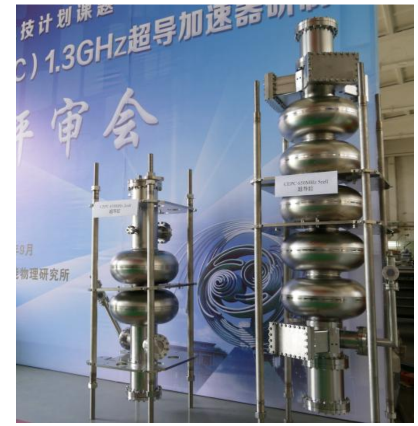
IHEP New SCRF Technology Progress towards Project

http://www.ihep.ac.cn/xwdt/gnxw/2018/201809/t20180918_5084684.html



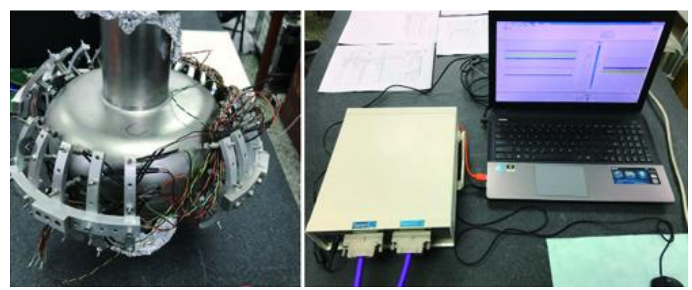
IHEP 1.3GHz 9cell industrialization cavity

IHEP innner surface repariment equipment:
1.3GHz 9cell;650MHz 5cell; 500MHz single cell



CEPC 650MHz 5cell
and 2 cell cavities

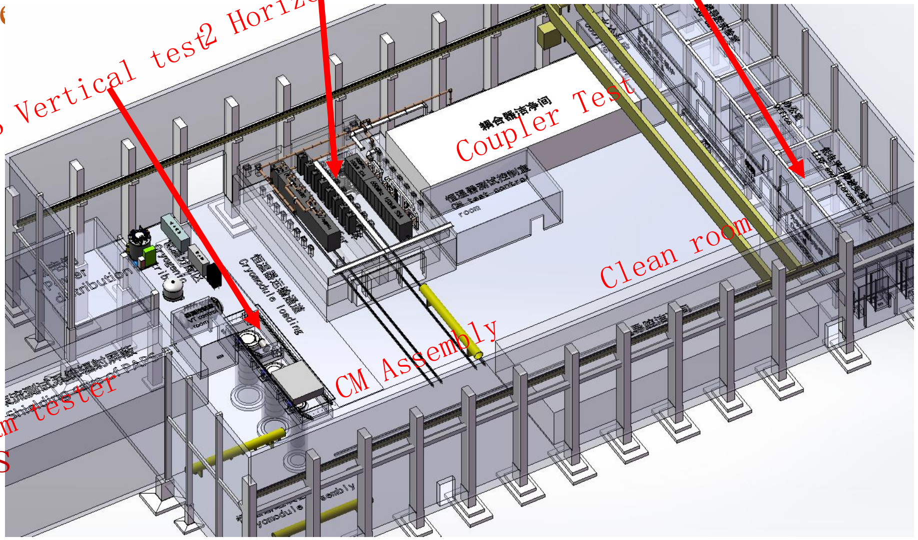
IHEP EP: 1.3GHz 9cell;650MHz 5cell;
500MHz single cell



IHEP1.3GHz cavity T-mapping system

IHEP New SRF Infrastructure

- **4500 m² SRF lab** in the Platform of Advanced Photon Source Technology R&D (PAPS), Huairou Science Park, Beijing.
- **Mission** to be World-leading SRF Lab for Superconducting Accelerator Projects and SRF Frontier R&D.
- **Mass Production**:
  - 200 ~ 400 cavities & couplers test per year
  - 20 cryomodules assembly and horizontal test pe
- **Construction : 2017 - 2020**
  - 3 VT dewars, 2 HT caves,
  - 500m2 Clean Room



Shanghai city government decided to built Shanghai Coherent Light Facility(SCLF).

- 432 1.3 GHz cavities
- 54 Cryomodules
- IHEP plans to provide > 1/3 of cavities and cryomodules, an excellent exercise for CEPC

Tour to PAPS in Huairou Science City

A mini-bus will depart in front of the IHEP Guest House at 8:00 am and go back to IHEP before 12:00 am after the tour. Dr. DAI Jin and Dr. DONG Chao of IHEP will be the guide.

IHEP ILC Collaboration Since 2005

IHEP ILC R&D domain:

Since 2005 IHEP accelerator center has setup ILC collaboration group and since 2010 ILC group with administration nature has been established also, which guaranteed the smooth progress of China's participation of ILC international collaboration. The main R&D domais which IHEP participated are as following as shown in Fig. 3.

1) ILC250 GeV and ILC500 GeV parameter optimization design
3）ILC SC accelerator technologies
2) ILC ATF2 beam dynamics and hardwares
4）ILC damping ring design and technologies
5）ILC final focus optimization design and beam-beam effect study
6）ILC positron source target thermodynamics study and polarization source
7）ILC power source: Marx modulator

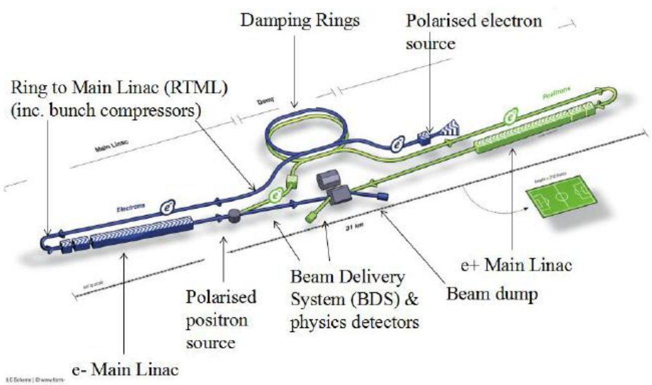


Fig. 3: IHEP ILC collaboration domains

Achievement of IHEP on ILC collaboration:

Since 2005 IHEP participated ILC ATF2 collaboration and fabricated all ATF2 beam line magnets, such as dipole and quadupoles, as shown in Fig. 4. In 2008, IHEP ILC group first demonstrated that on ATF2 the beam size has the potential to reach 20nm instead of 37nm, and due to this important result, ATF2 became a final focus facility not only for ILC but also for CLIC.

Fig. 4: ILC ATF2 beam line magnets

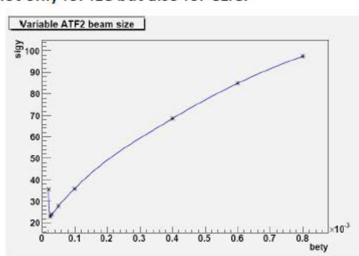


Fig. 5 AFT2 design and beam dynamics studies

Since 2005, IHEP ILC group started to make R&D on 1.3GHz superconducting cavities, from single cell to 9 cell, from fine grain to large grain niobium, from low loss shape, to TELSLA-like, and to TESLA cavities shapes, IHEP becomes the Institute which covers the whole range of the cavity types and materials, as shown in Fig. 5. In addition to cavity R&D, IHEP conducted ILC cryomodule study with both a 1.3GHz single 9cell cavity ILC Test Cryomoulde, including cacity, tunner, high power coupler, LLRF and cryostate, and 12m cryomodule cold mass industrialization for European X-XFEL project, as shown in Fig. 6 and 7. In the domain of 1.3GHz ILC rf power source R&D, IHEP ILC group made industrialization of high power L band Marx modulator and in collaborate with Institute of Electronics, CAS (IECAS), an ILC type 1.3GHz klystron of 10MW has been also constructed and tested by IECAS, as shown in Fig. 8. In the domain of ILC damping ring study, IHEP ILC group made a ILC damping design and made damping fast kicker, as shown in Fig. 9. As for ILC250GeV proposed in 2017, IHEP group made the optimization design for the accelerator parameters.

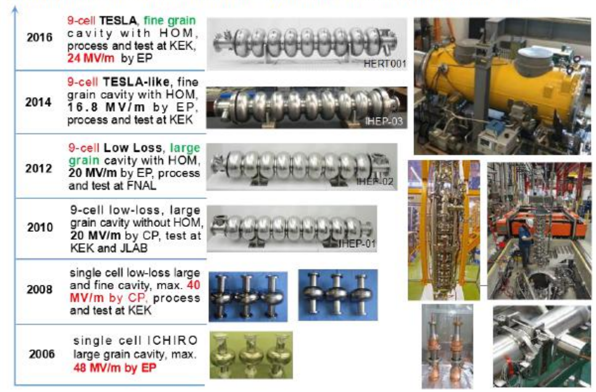


Fig. 5: ILC 1.3GHz 9-cell superconducting cavities

Fig: 6: IHEP ILC test cryomodule

Fig. 7: Euro-XFEL thermostat cryostate industrialization

Fig. 8: L band MarX Modulator and ILC 10MW klystron

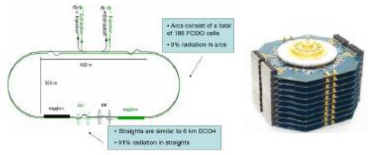
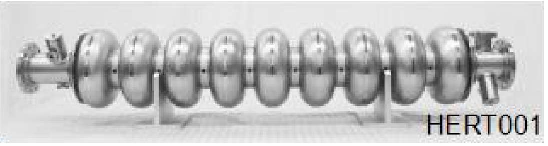


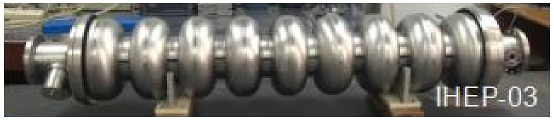
Fig. 9: ILC damping design and fast kiker

ILC Related SCRF Activities and Industrialization in IHEP

2016 — 9-cell **TESLA**, fine grain cavity with HOM, process and test at KEK, 24 MV/m by EP



2014 — 9-cell **TESLA-like**, fine grain cavity with HOM, **16.8 MV/m** by EP, process and test at KEK

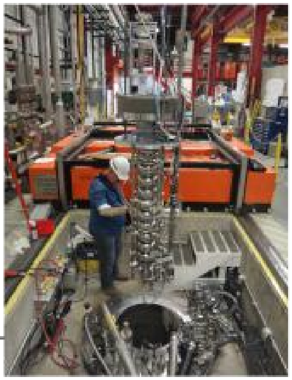


2012 — 9-cell **Low Loss**, large grain cavity with HOM, **20 MV/m** by EP, process and test at FNAL

2010 — 9-cell low-loss, large grain cavity without HOM, **20 MV/m** by CP, test at KEK and JLAB

2008 — single cell low-loss large and fine cavity, max. 40 MV/m by CP, process and test at KEK

2006 — single cell ICHIRO large grain cavity, max. 48 MV/m by EP



Potential technical contribution to ILC 250GeV construction from China
(Just possibilities and hope, personal point of view)

Parameters	Value
C.M. Energy	250 GeV
Peak luminosity	1.35 x10^{34} $cm^{-2}s^{-1}$
Beam Rep. rate	5 Hz
Pulse duration	0.73 ms
Average current	5.8 mA (in pulse)
Av. field gradient	31.5 MV/m +/- 20% Q_0 = 1E10
# 9-cell cavity	8012 (x 1.1)
# cryomodule	928
# Klystron	~200

Higgs factory (250GeV)

300 cryomodules (cold mass) or more? realistic

Three cavity production centers: 800-1000 cavities in total (ideal maximum case, needs great efforts…)

Magnets for international collaborations

For NSLS-II (BNL, USA)

For ILC-ATF2(KEK, Japan)

For PEFP (KAERI, Korea)

For PEP-II (SLAC, USA)

For SPEAR3 (SLAC, USA)

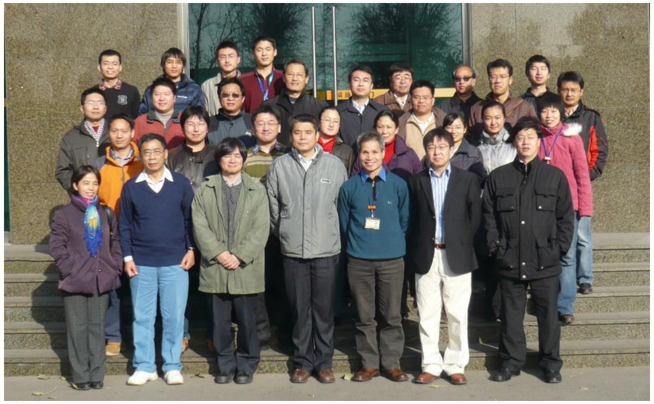
Undulator for Europe XFEL

Damping ring magnets
Components like vacuum Chamber, etc
~1/3 or more?

ILC 250GeV parameter comparison

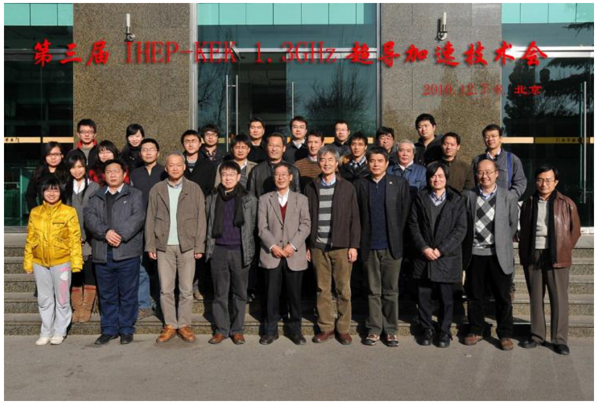
ILC@250GeV	Yokoya	IHEP	IHEP-2
E_{cm} (GeV)	250	250	250
Ne	2.0×10^{10}	2.0×10^{10}	2.0×10^{10}
F_{rep} (Hz)	5	5	5
N_b	1312	1312	1312
Bunch separation (ns)	554	554	554
I_b (mA)	5.8	5.8	5.8
P_b (MW)/beam	2.65	2.62	2.62
β_x (mm)	13.0	11.0	9.0
β_y (μm)	410	464	469
$\gamma\varepsilon_x$ (μm)	5.0	5.05	5.0
$\gamma\varepsilon_y$ (nm)	35	37.5	37.5
σ_x / σ_y (nm)	515.5/7.66	476.5/8.4	428.9/8.5
σ_z (μm)	300	317.8	328
δ_B	0.024	0.0264	0.0315
n_γ	1.62	1.7	1.88
Dy	34.5	35.8	40.8
H_D	2.43	2.84	3.39
Disruption angle θ (rad)	0.00088	0.00095	0.00105
N_{had}	2.1	2.72	4.4
θx/θy (urad)	39.7/18.7	43.3/18.2	47.6/18.1
L_0 ($cm^{-2}s^{-1}$)	1.285×10^{34}	1.475×10^{34}	1.946×10^{34}

IHEP-KEK SCRF Collaboration Meetings



1st Meeting (no group photo)
June, 2009

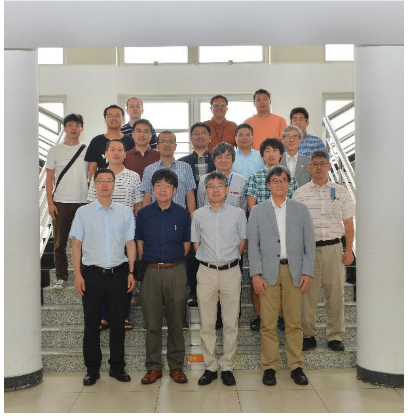
2nd Meeting
December, 2009



3rd Meeting
December, 2010

4th Meeting (during TTC meeting), December, 2011

5th Meeting, January, 2013



6th Meeting, July, 2018

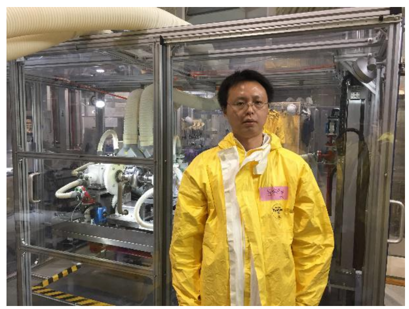
Minutes of the 6th IHEP-KEK SCRF Collaboration Meeting

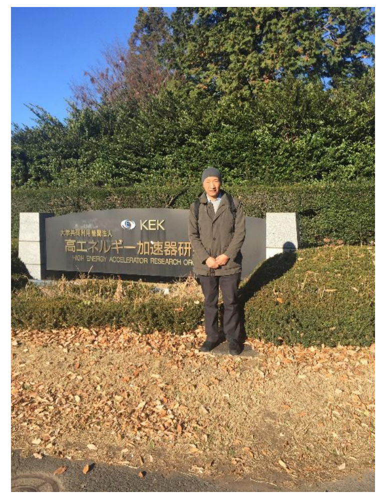
We agree to continue the successful IHEP-KEK SCRF collaboration since 2005. We propose and agree on the following collaboration items for the next year (August 2017 to August 2018):

1. N-doping and N-infusion R&D for high Q and high gradient. IHEP's 1.3 GHz single-cell and 9-cell cavities processing and testing at KEK. IHEP people visit KEK to participate in these research. Detailed plans to be proposed by IHEP.
2. EP and other SRF infrastructure design and commissioning. IHEP consulting with KEK, people and information exchange. Two IHEP staffs will visit KEK EP facility in Aug 2017 as the first step.
3. SRF theory and new material (Nb3Sn and others). Consultation and people exchange, sample testing.
4. High power variable input coupler design (1.3 GHz and 650 MHz). Consultation and people exchange.
5. HOM coupler and absorber design. Consultation and people exchange.
6. LLRF control and tuner design. Consultation and people exchange.
7. Cryomodule assembly, testing, heat load measurement, distribution box, transfer lines. Consultation and people exchange.
8. High power rf system development. Consultation and people exchange.

Collaboration Highlights of Last Year (2017.8-2018.8)

- **KEK EP facility visit** (Dr. Song JIN and Jin DAI of IHEP in August 2017, two people from a Chinese company in December 2017). Very important for the design of IHEP EP facility.





Collaboration Highlights of Last Year (2017.8-2018.8)

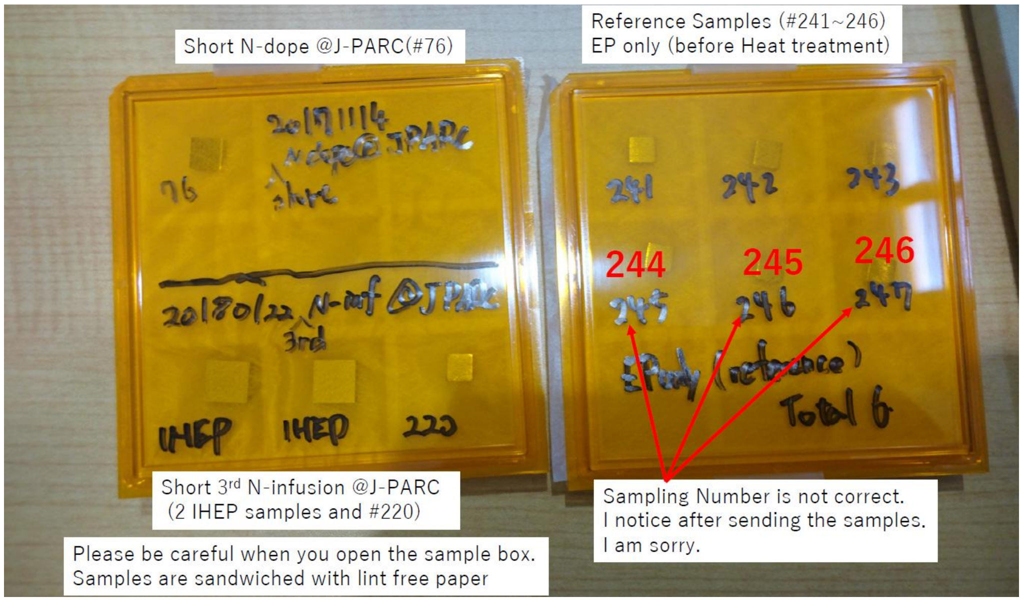
N-doping/N-infusion

- Dr. Peng Sha and Baiqi Liu visited KEK in Nov, 2017.
- Two 1.3 GHz 1-cell cavities have just been shipped from IHEP to KEK, which will have EP, N-doping and vertical test in near future.
- Samples has been exchanged for experiments between KEK and IHEP.

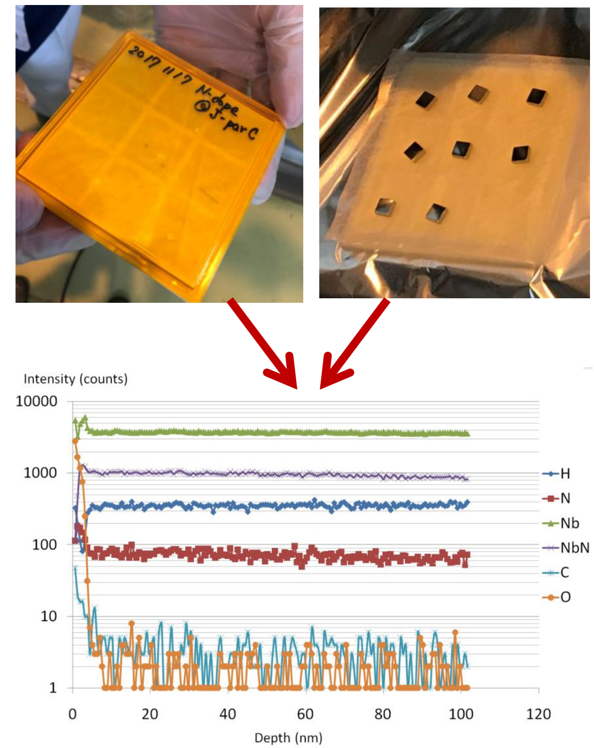
N-doping at KEK/J-PARC (17th Nov, 2017)

IHEP two single cell 1.3 GHz cavities arrived at KEK (4th Sept, 2018)

Collaboration Highlights of Last Year (2017.8-2018.8)



N-doping samples posted from KEK to IHEP



N-doping at KEK, SIMS test at IHEP.

Collaboration Highlights of Last Year (2017.8-2018.8)

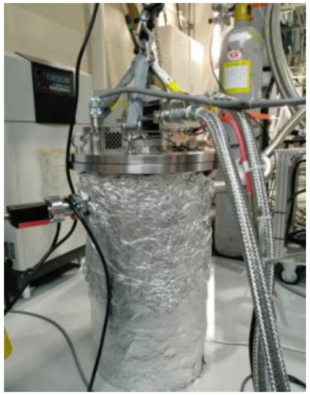
IHEP postdoc Chao Dong visit KEK for 3 months: Jun.4 ~ Aug.31, 2018.

Main activities: Surface treatment (EP, HPR, Assembly in cleanroom, etc.);
N-doping/Infusion; VT of different types of cavities;
Sample analysis (RRR measurement, PF-XRD, SIMS, SEM, EDS, etc.) .
Other activities: TTC meeting, The SRF technology workshop for ILC, Cavity group meeting, etc.

EP

Vertical Test

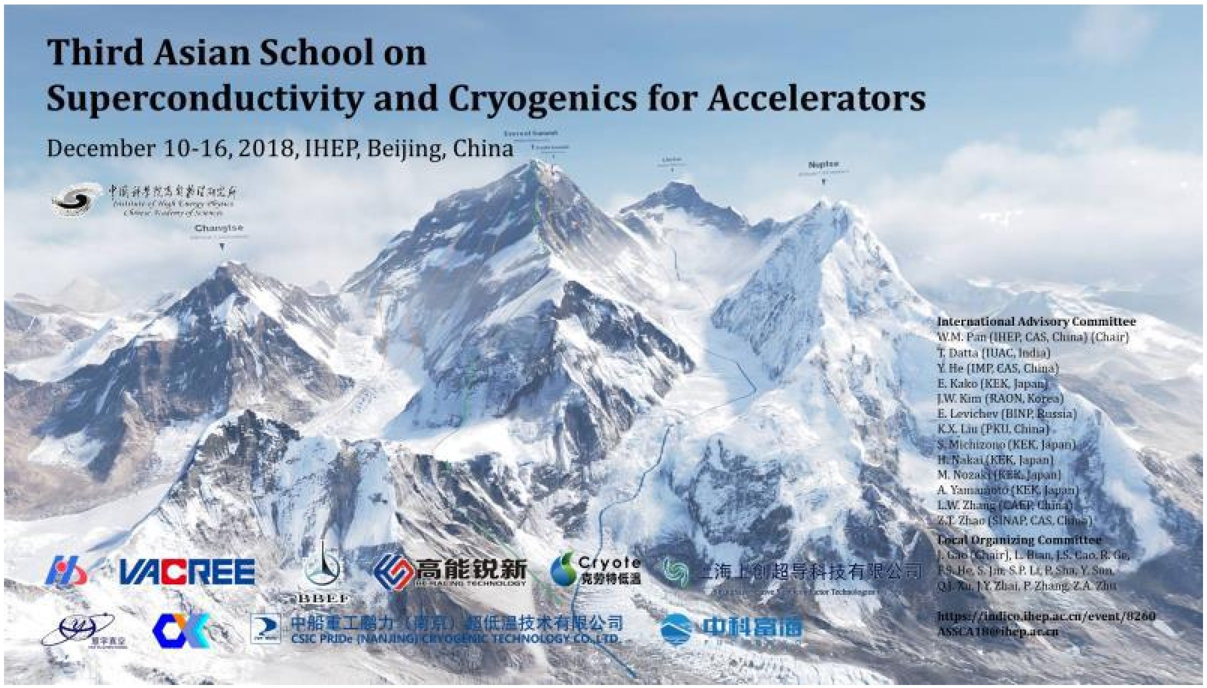
N-Doping/Infusion



RRR Measurement

Future Collaboration Proposals

1. **1.3 GHz high Q cavity** (EP&VT at KEK, two one-cell cavities, Chao Dong visit KEK 2018.10-12, Peng Sha etc. visit KEK in early 2019)
2. **Sample analysis for N-doping & infusion study**
3. **EP and other SRF infrastructure** (KEK experts come to help IHEP EP facility commissioning)
4. **RRR measurement of coupler copper plating on stainless steel**
5. **1.3 GHz high power variable input coupler** (CW 75 kW conditioning at KEK)
6. **SRF theory and new material** (Nb3Sn and others, sample test, Chao Dong)



https://indico.ihep.ac.cn/event/8260

Thanks and have a good discussions