# The CEPC-SppC Project

# Status Report

Qing QIN (IHEP), Nu XU (CCNU), XinChou Lou (IHEP)

For the CEPC-SppC Study Group

April 8, 2016

# Outline

Progress & development since the CEPC meeting in Sept. 2015

- **Organization and updates**
- **On the detector front**
- **On the accelerator front – CEPC and SppC**
- **Global effort**
- **R&D funding**

**high quality, real overall progress**

At this meeting

- **CEPC design towards CDR**
- **R&D progress and future activities**
- **Organization, plan and actions**

# CEPC Organization a reminder

The CEPC management was reorganized in May 2015, after the preCDR, moved forward with the CEPC CDR process; deadline ~ "**year end of 2016**"

**Institutional Board**
Chair: Y. N. GAO (Tsinghua U)
Deputy: J. GAO (IHEP)

**Steering Committee**
Chair: Yifang WANG (IHEP)
J. Gao, Y.N. GAO(Tsinghua U), Nu XU (CCNU), J. SHAN (IHEP), H.J. YANG (SJTU), Q. QIN(IHEP), H.J. HE(Tsinghua), Y.J. MAO(PKU), J. B. LIU(USTC), W.R.CHOU(FNAL/IHEP),X.C.LOU(IHEP),…

**Project Directors**
X.C. LOU(IHEP)
N. XU(CCNU), Q. QIN(IHEP)

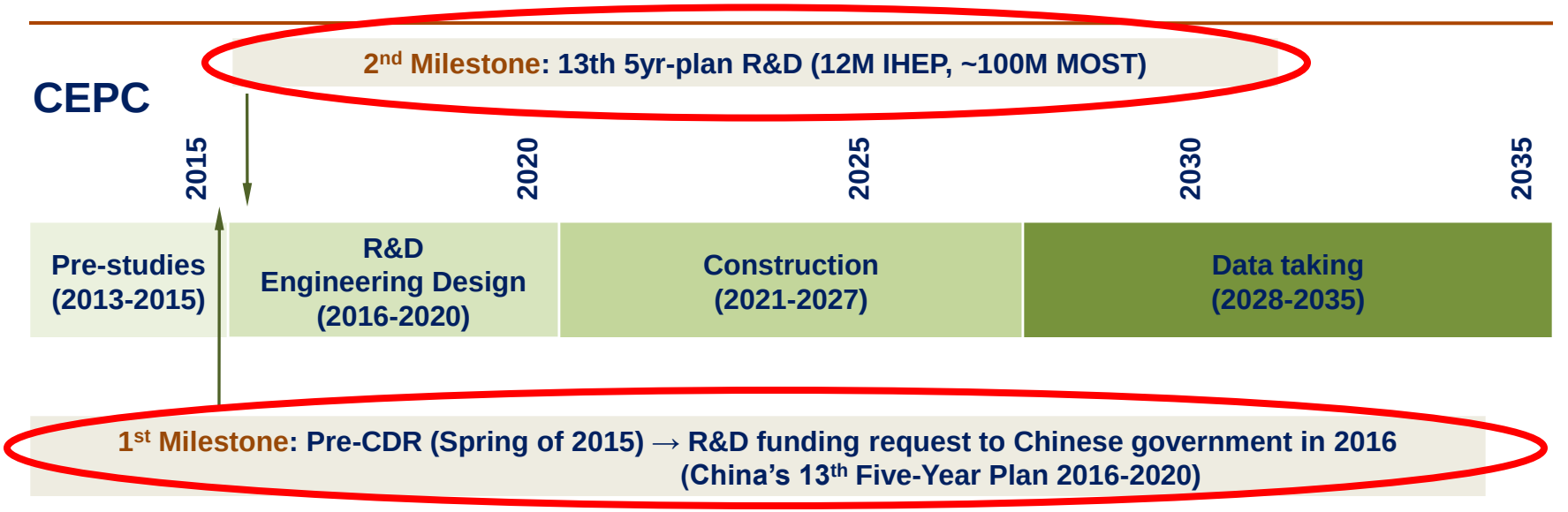
**Theory**
H.J. HE(Tsinghua )
**J.P.MA(ITP)**
**X.G.HE(SJTU)**

**Accelerator**
Q. QIN( IHEP)
J. GAO (IHEP)
J.Y. TANG(IHEP)

**Detector**
Y.N.GAO(Tsinghua)
S. SHAN(IHEP)
N. XU(CCNU)

borrowed from Weiren Chou

# CEPC-SPPC Timeline (preliminary/ideal)





**This is a good schedule to follow**

- **CEPC Detector** supported by IHEP + other funds

Filter iCal export More | Asia/Shanghai | X. LOU

## Regular Meeting on March 31,2016

**Thursday, 31 March 2016 from 09:00 to 11:00 (Asia/Shanghai) at IHEP ( A415 )**

### Thursday, 31 March 2016

| | | |
|---|---|---|
| 09:00 - 09:20 | CEPC理论子课题研究进展 *20'* | Speaker: Prof. Cai-Dian Lu (IHEP) |
| 09:20 - 09:40 | CEPC探测器模拟子课题研究进展 *20'* | Speakers: Mr. Manqi Ruan (IHEP), Gang LI (IHEP) |
| 09:40 - 10:00 | CEPC顶点探测器子课题研究进展 *20'* | Speakers: Dr. Hongbo ZHU (IHEP), ZHANG ZHANG Ying (IHEP) |
| 10:00 - 10:20 | CEPC-TPC探测器子课题研究进展 *20'* | Speaker: Dr. Huirong Qi (Institute of High Energy Physics, CAS) |
| 10:20 - 10:40 | CEPC量能器子课题研究进展 *20'* | Speaker: Prof. Hu Tao (IHEP) |
| 10:40 - 11:00 | CEPC探测器磁铁子课题研究进展 *20'* | Speakers: Mr. Zian ZHU Zian (高能所), Ling Zhao (高能所) |

→ official meeting minutes and publications

### CEPC Pre-research Project

March 2016
- 31 Mar Regular Meeting on March 31,2016
- 16 Mar Regular Meeting on March 17,2016 (protected)

February 2016
- 25 Feb Regular Meeting on Feb 25,2016 (protected)

January 2016
- 28 Jan Regular Meeting on Jan 28,2016 (protected)
- 07 Jan Regular Meeting on Jan 7,2016 (protected)

December 2015
- 02 Dec Regular Meeting on Dec 3,2015 (protected)

November 2015
- 12 Nov Regular Meeting onNov 12,2015 (protected)

October 2015
- 29 Oct Regular Meeting on Oct 29,2015 (protected)
- 15 Oct Regular Meeting on Oct 15,2015 (protected)

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- **CEPC Accelerator supported by IHEP + other funds**

## CEPC accelerator design activities towards CDR

Weekly CEPC Accelerator design beam dynamics meeting
after Pre-CDR towards CDR:

http://indico.ihep.ac.cn/category/350/

Website contents:
1) Talks ppt
2) Minutes

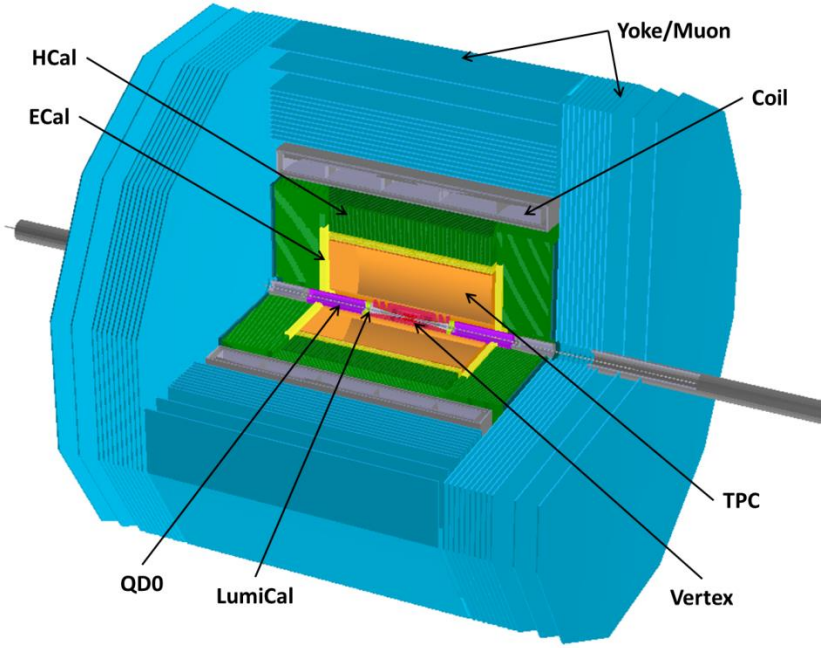
The main working fields:
1) Double ring schemes
2) Crab-waist collider parameters
3) Beam-beam effect simulations
4) Pretzel scheme
5) Dynamic aperture optimization (with FFS)
6) Boosters (conventional and wiggling dipole field schemes)
7) Magnet error effects on DA
8) MDI
9) SppC lattice design
10) CEPC bunch lengthening effects (other collective effects)

# Progress & development

## The detector front

**Just a few examples; please attend detector sessions for details**

# CEPC Detector (preCDR) a reminder




**ILD-like detector with additional considerations (*incomplete list*):**

- Shorter L* (**1.5**/2.5m) → constraints on space for the Si/TPC tracker
- No power-pulsing → lower granularity of vertex detector and calorimeter
- Limited CM (up to 250 GeV) → calorimeters of reduced size
- Lower radiation background → vertex detector closer to IP
- …

- **Similar performance requirements to ILC detectors**
  - Momentum: $\sigma_{1/p} < 5\times10^{-5}\ \mathrm{GeV}^{-1}$ ← recoiled Higgs mass
  - Impact parameter: $\sigma_{r\phi} = 5 \oplus 10/(p\cdot\sin^{\frac{3}{2}}\theta)\ \mu\mathrm{m}$ ← flavor tagging, BR
  - Jet energy: $\frac{\sigma_E}{E} \approx 3-4\%$ ← W/Z di-jet mass separation

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# CEPC Detector – Pixel Vertex Detector

*high precision, low power consumption, fast readout pixel sensors*

- CMOS technology: in collaboration with IPHC Strasburg, France (**Key Lab, IHEP**)
- SOI technology: in collaboration with KEK, Japan (**NSFC**)

| | Target 1: fine pitch, low power | Target 2: ~1 μs time resolution |
|---|---|---|
| Strategies | – Fine pitch to achieve **<3 μm** single point resolution for the inner most layer<br>– Low power compatible with air cooling<br>– Relaxed requirement on readout speed ( flexible ) | – Relaxed requirement on single point resolution<br>– Low power compatible with air cooling<br>– Enhanced readout speed by a factor of 10 |
| Specifications | – 16 μm pitch<br>– 50 mW/cm$^2$<br>– 10-100 μs readout speed | – ~1 μs readout intervals<br>– 20-30 μm pitch to achieve σ~5 μm<br>– 50 mW/cm$^2$ |

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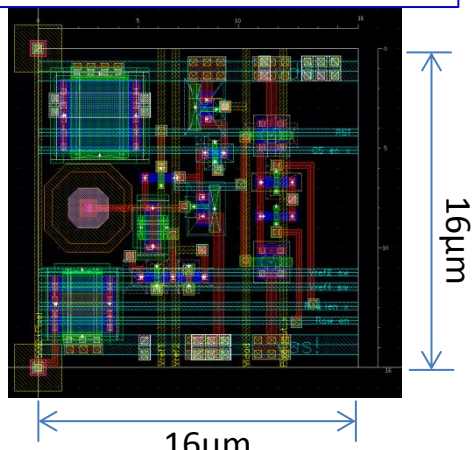
# CEPC Detector – Pixel Vertex Detector

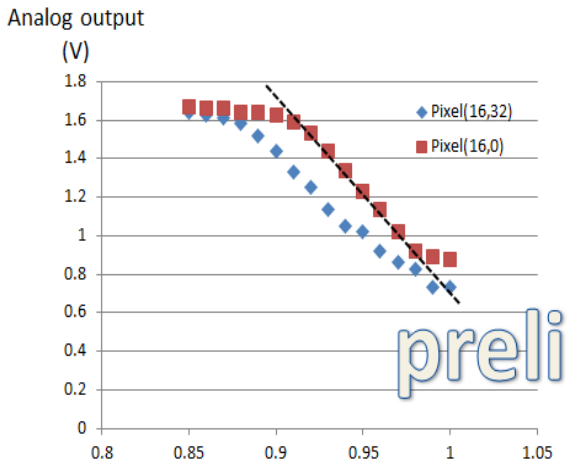
- Compact Pixel for Vertex (CPV1) – **SOI sensors**
  - 16*16 μm with in-pixel-discrimination
  - Based on the measurement of full depletion
  - Double-SOI process for shielding and radiation enhancement
  - Submitted in June, 2015
- Preliminary test results
  - **Gain of amplifier measured compatible with the design value**
  - **A decent ENC noise ~ 17e$^-$**
  - Radiative source test in preparation

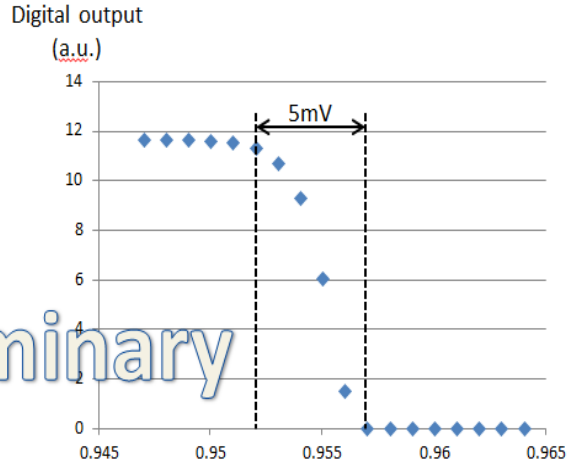
Funding from NSFC

Chinese Physics C, Vol.40, No. 1 (2016)

CPV1 digital pixel layout




preliminary

April 8, 2016

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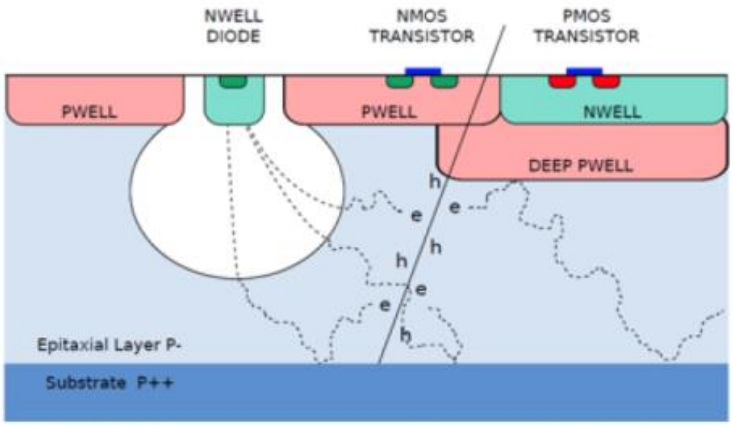
# CEPC Detector – Pixel Vertex Detector

## CMOS Sensor design and production

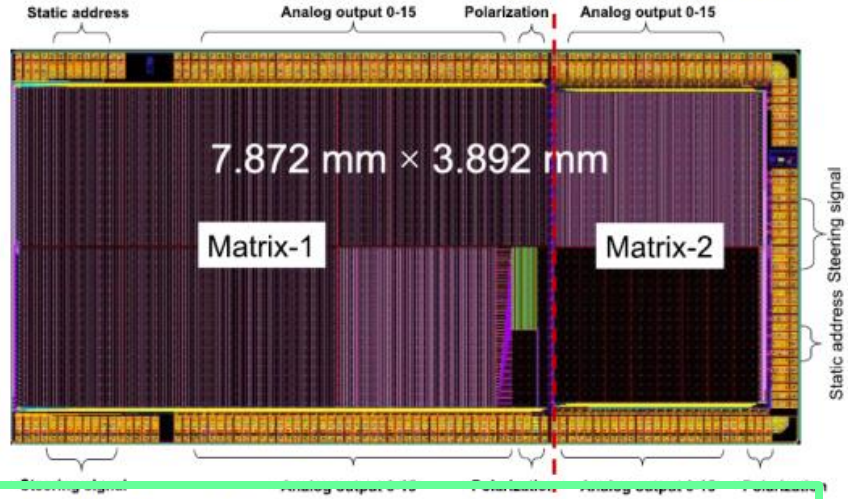
Funding from Key Lab, IHEP

- Initialized CEPC pixel sensor design based **CMOS** technology
- **1st joint MPW submission** with IPHC last November to understand **charge collection** with different diode geometries, epitaxial-layer properties and possible radiation hardness




CMOS sensor working principle

Sensor floorplan

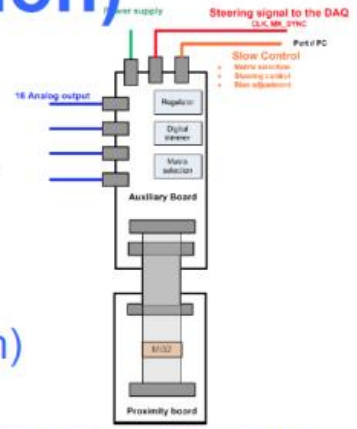


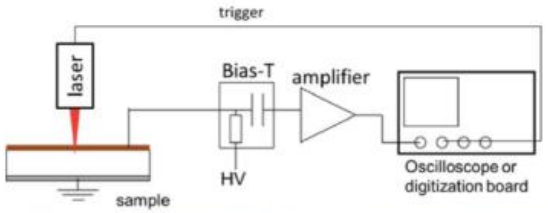

- On-going design effort on in-pixel electronics and readout architecture; second MPW submission later this year

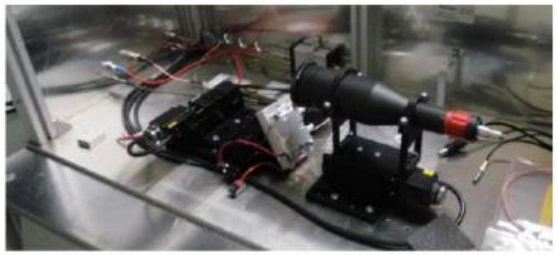
# CEPC Detector – Pixel Vertex Detector

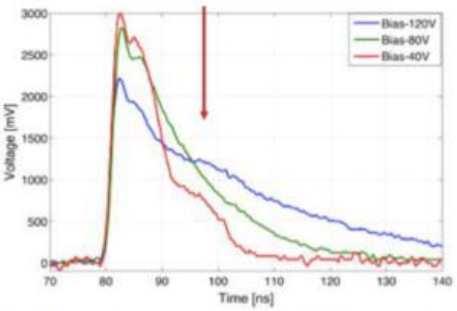
## Sensor Characterization (Preparation)

- Prepare test system to characterize charge collection
  - NI crate based or customized DAQ system
- Signal response with the TCT scan system
  - Commissioned to achieve resolution ~ 30μm (target: 10μm)

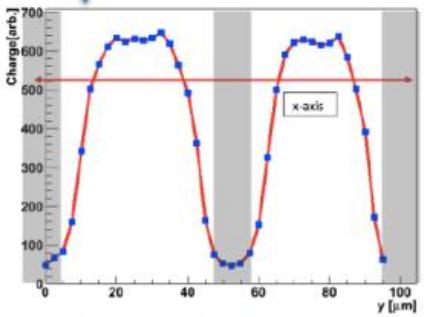





Signal response of the default strip sensor




- **Irradiation facilities** @ NINT allowing TID up to 5 MRad (Co-60) and NIEL up to $10^{14}$ 1MeV $n_{eq}/cm^2$ (pulsed neutron reactor)

# CEPC Detector – Pixel Vertex Detector

## TCAD Simulation

- Important to understand/predict device performance and assist sensor design
- 3D device simulation with improved boundary treatment and reliable physics models to estimate charge collection

Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment

Available online 15 March 2016

In Press, Corrected Proof — Note to users

Charge collection and non-ionizing radiation tolerance of CMOS pixel sensors using a 0.18 μm CMOS process

Ying Zhang[a, b], Hongbo Zhu[a, b], Liang Zhang[c], Min Fu[d]

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doi:10.1016/j.nima.2016.03.031

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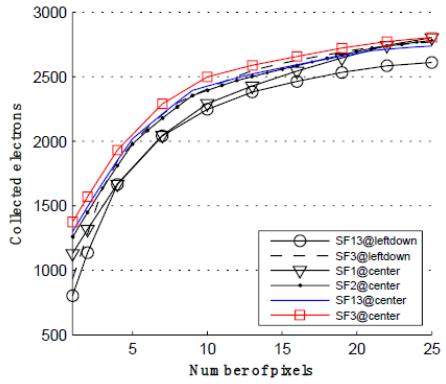
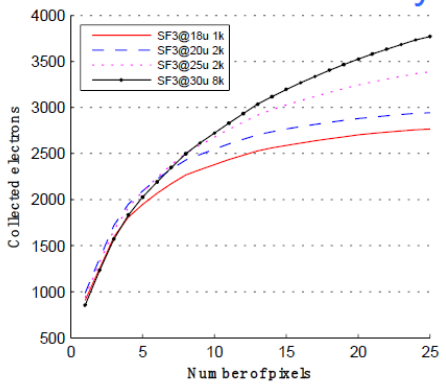
Abstract

The proposed Circular Electron Positron Collider (CEPC) will be primarily aimed for precision measurements of the discovered Higgs boson. Its innermost vertex detector, which will play a critical role in heavy-flavor tagging, must be constructed with fine-pitched silicon pixel sensors with low power consumption and fast readout. CMOS pixel sensor (CPS), as one of the most promising candidate technologies, has already

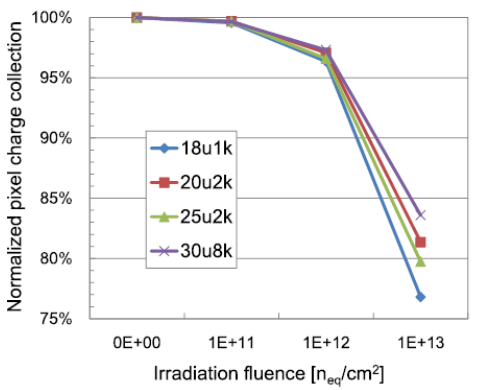
### Diode geometries




### Epitaxial layer thickness/resistivity




### Radiation damage




- *Simulation results to be verified with real measurements*

# CEPC Detector – TPC

YL Li, Huirong QI *et. al.*

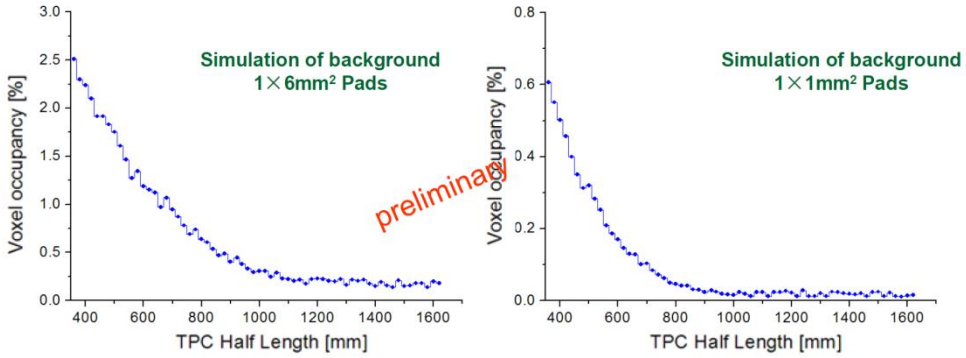
Funding： IHEP IF; NSFC重点

## Simulation of occupancy

Supported by 高能所创新基金

- Occupancy@250GeV
  - Very important parameter for TPC
  - Detector structure of the ILD-TPC like
  - ADC sampling 40MHz readout
  - Time structure of beam:·4us/Branch
  - Beam Induced Backgrounds at CEPC@250GeV(Beam halo muon/e+e- pairs)+γγ→hadrons with safe factors(×15)

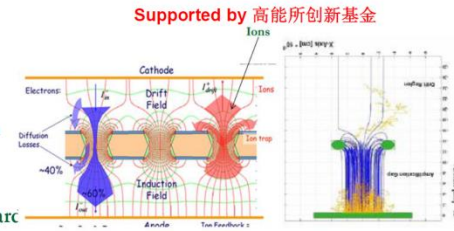
CLIC_ILD ~30%@3TeV
1×6mm² Pads
CLIC_ILD ~12%@3TeV
1×1mm² Pads
NO TPC Options!



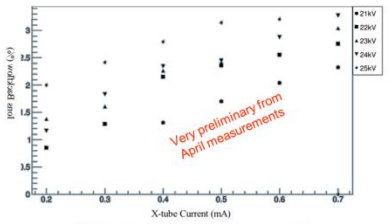

## New ideas for the ions

Supported by 高能所创新基金

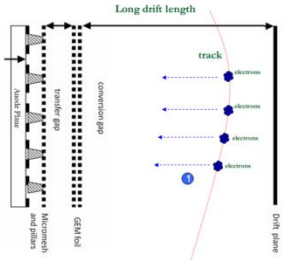
- GEM+Micromegas hybrid module
  - GEM as the preamplifier device
  - GEM as the device to reduce the ion back flow continuously
  - Stable operation in long time
  - Reach to the higher gain than standard Micromegas with the pre-amplification GEM detector
  - Increase the operating voltage of GEM detector to enlarge the whole gain




IBF of GEM and Mciromegas




IBF of the hybrid module




Particles track in the hybrid module

# CEPC Detector – TPC

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## Common efforts R&D

**Collaboration for the IBF R&D:**

CEA Scalay (France)

IHEP, Tsinghua Univ. (China)

ALEKSAN Roy (Saclay)
GAO Yuanning (THU)
QI Huirong (IHEP)

**Collaboration for the Laser calibration R&D:**

Tsinghua Unviversity, Beijing

IHEP, Beijing

LI Yulan (THU)
DENG Zhi (THU)
QI Huirong (IHEP)

**Targets:**

- R&D of IBF used UV light
  - Goal: ~0.1% IBF, Resistive Micromegas modules, Hybrid modules
- Laser optical design
- TPC Prototype design with Laser calibration
  - Readout active area: ~200mm$^2$, Drift length: ~500mm
- ASIC electronic readout
  - Goal: ~32Chs/CHIP, Channels: ~1K
- Toward CEPC CDR

# CEPC Detector – Calorimeters

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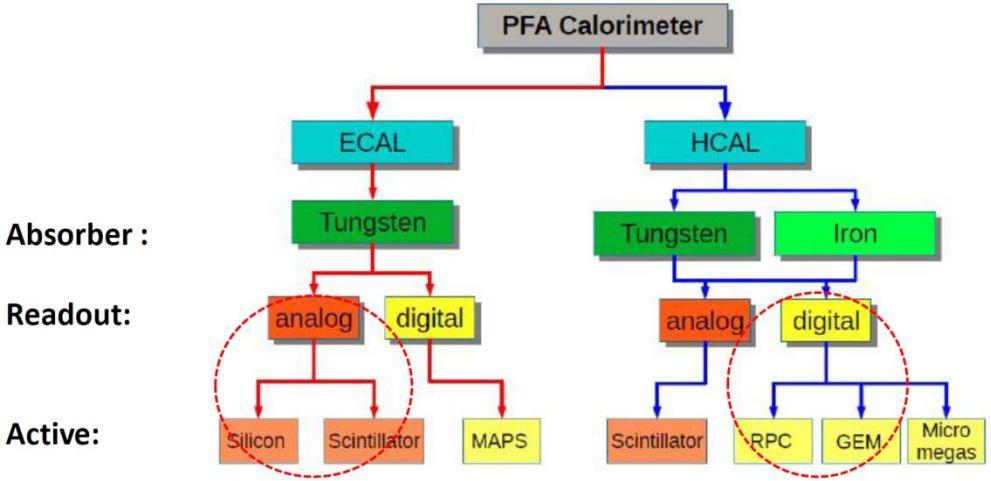
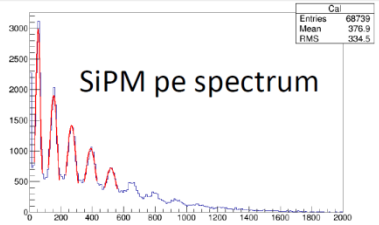
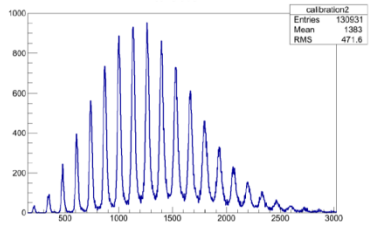
Funding： IHEP IF



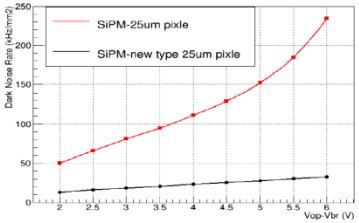

## Tests of SiPM at IHEP



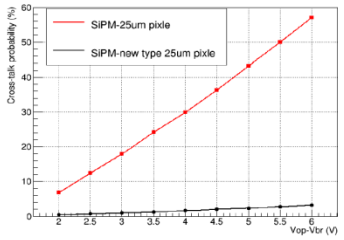



pulse height spectrum.

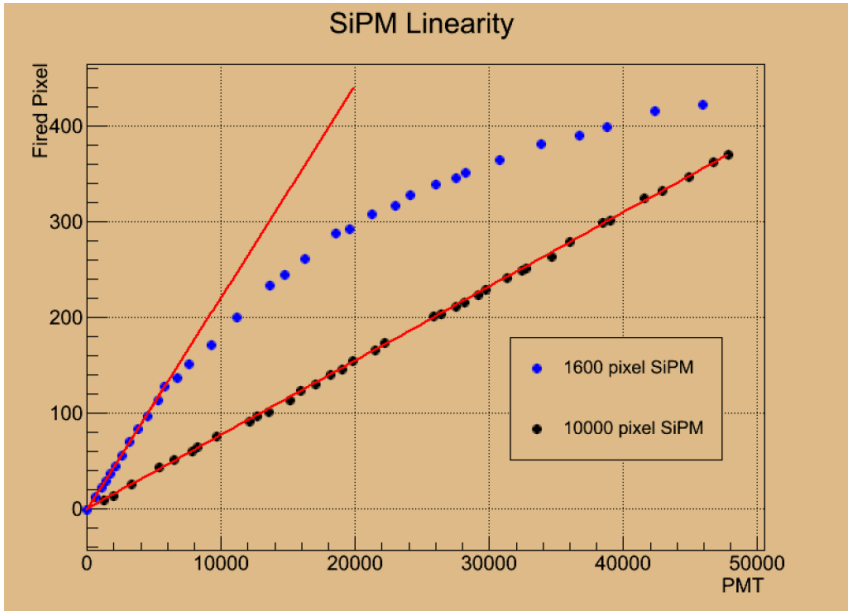
Excellent photon counting




The dark noise of the new SiPMs is 1/3 to the old



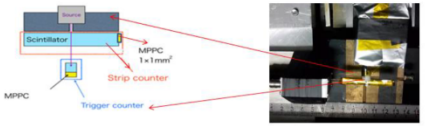

The cross-talk of the new SiPMs is 10% to the old



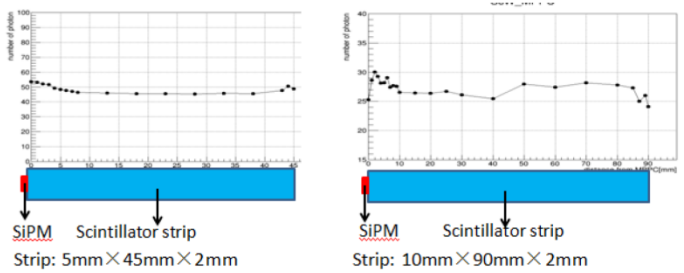
# CEPC Detector – Calorimeters

T. Hu *et. al.*

## Tests of Scintillator strip at IHEP

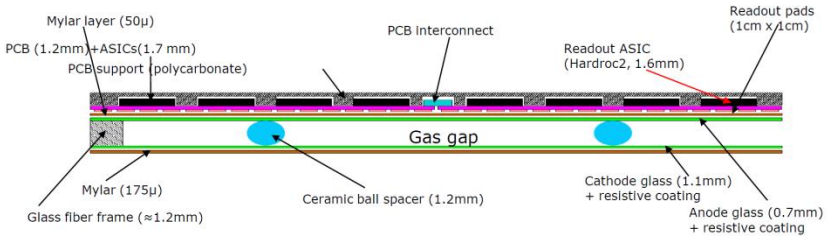



Scintillator strip irradiated with β collimated (1mm) from Sr-90



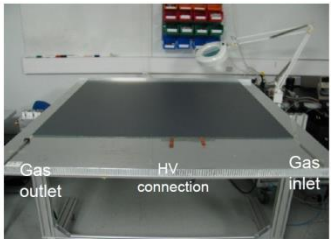

- Peaky Npe near MPPC
- Larger Npe than ILD probably due to different scintillator material and reflector.
- Significant reduction of Npe with long strip.

## HCAL: GRPC Study



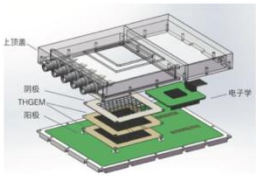

Large GRPC R&D

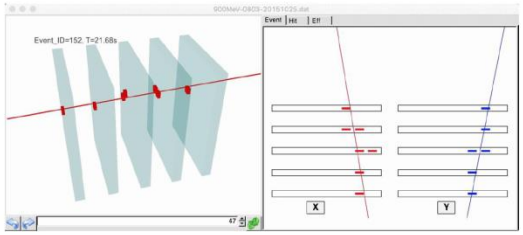
- ✓ Negligible dead zone (tiny ceramic spacers)
- ✓ Large size: 1 × 1 m²
- ✓ Cost effective
- ✓ Efficient gas distribution system
- ✓ Homogenous resistive coating

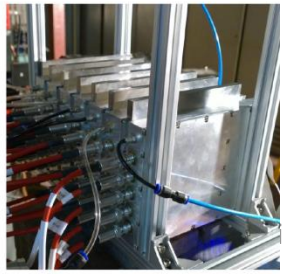



## WELL-THGEM Beam Test at IHEP in Oct., 2015

- 7 THGEMs ware installed, and 5 of them were used, and flushed with Ar/iso-butane = 97:3.
- 1 threshold, binary readout
- 900 MeV proton beam was used
- 5cm x 5cm sensitive region

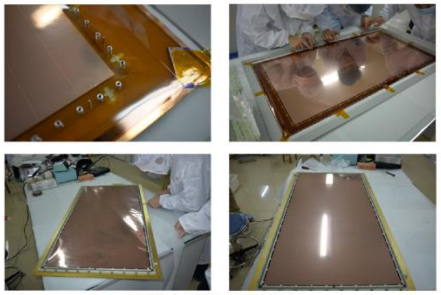






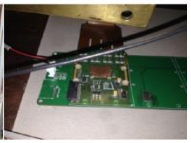
## Large-area GEM @ USTC

GEM assembly using a novel self-stretching technique

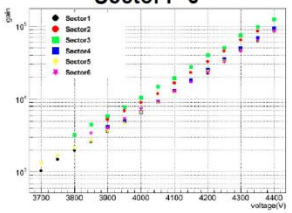


APV25 GEM readout

INFN APV25 chip



Sector1~6



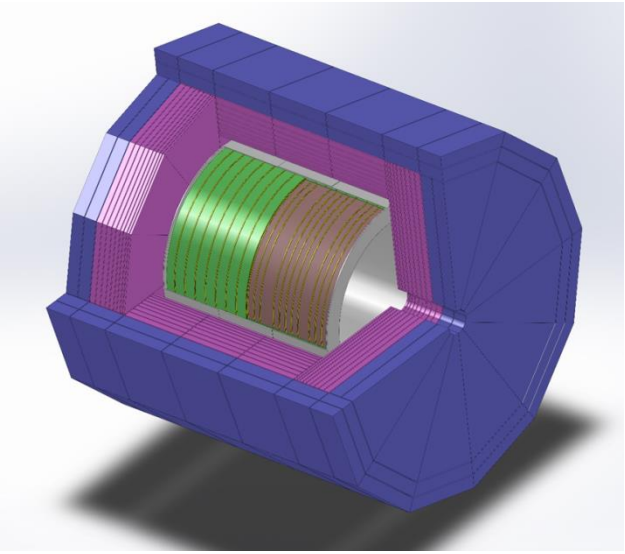

- Large-area GEM (0.5x1m²) is one of main detector R&D focuses at USTC recently.
- Technology has been developed and matured to produce high-quality GEM detectors as large as ~1m² that are also applicable to CEPC DHCAL.

➔ Resolution uniformity ~11%
➔ Gain uniformity ~16%
➔ Can reach gain of $10^4$ at 4000V

# CEPC Detector – Detctor Magnet

L. Zhao *et. al.*

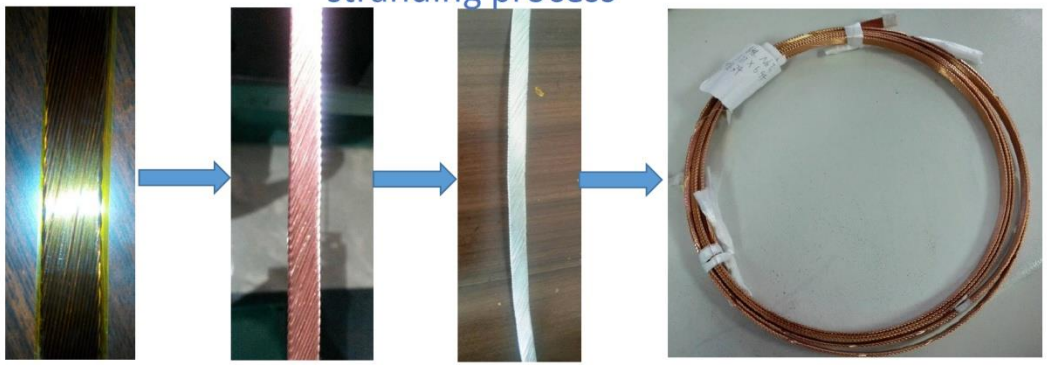
Funding： IHEP IF



Key technology:

- Optimization of Magnetic filed
- Superconductor
- Inner winding and impregnating
- Coil cryogenic system
- Power lines with HTS
- Manufacturing and assembling of huge scale yoke

stranding process



Number of strands：20
Strand diameter：1.0mm
Materiel: Copper
Complete time:2015.5

Number of strands：17
Strand diameter：0.727mm
Materiel :Nb/Ti
Complete time:2015.7

Number of strands：24
Strand diameter：0.727mm
Materiel :Nb/Ti
Complete time:2015.8

Number of strands：18
Strand diameter：1.2mm
Materiel :Nb/Ti
Complete time:2016.2

insert process

Test results:

1.RRR value declined by about 1/3 after the stranding process.

2.The decrease of the critical current is less than 5%.

Copper cable +Aluminum alloy

G. Li, MQ Ruan, YQ Fang *et. al.*

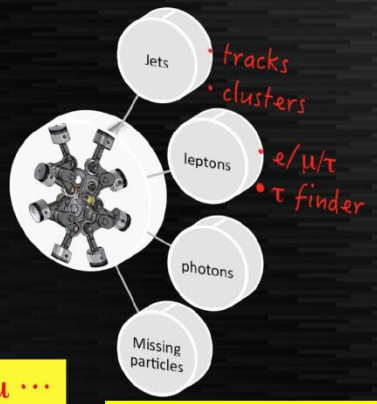
# CEPC Detector – Software & Tools

Funding： IHEP IF

## A dedicated analysis framework

Novices can start from root …

Feed all types of particle object to the combination engine for further processing

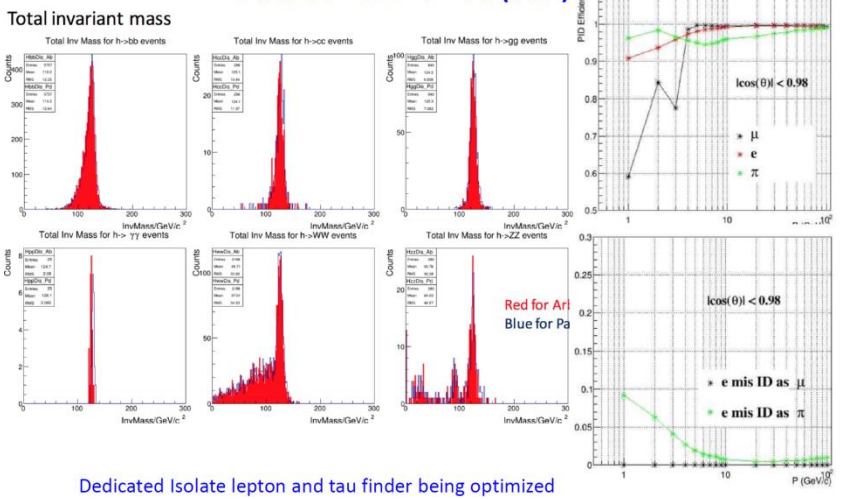



ee+X, μμ+X, jj+ee, jj+μμ …

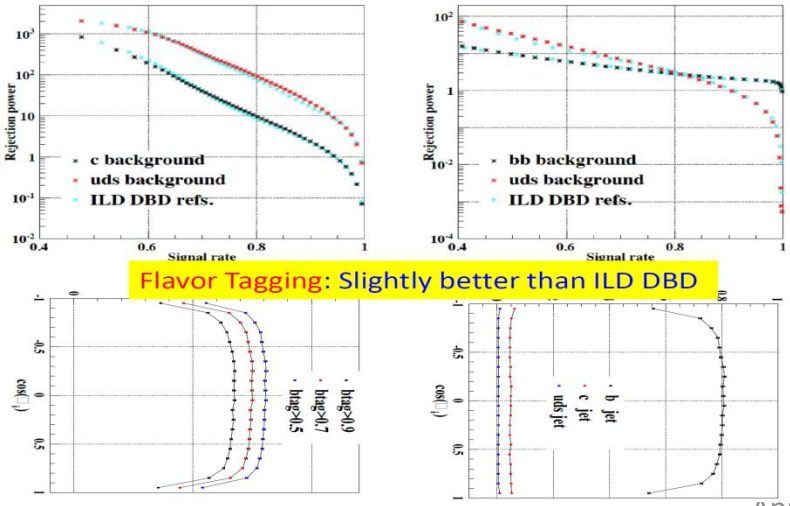
Data → ntupes → plots

## PFA/PID/JER

Arbor v1 → v3(KD)




Dedicated Isolate lepton and tau finder being optimized




- 统计工具:
  - 变量的shape information 可用在fit中.
  - 可以同时测量分值比和散射截面.
  - 可以将各个道的migration和相关性引入统计工具之中.
- 多变量分析:
  - 多个道引入多变量分析的方法: h->bb,cc,gg,ll
- 数据驱动(data-driven)的方法:
  - 产生较完整数据(背景),用来进行data-driven method's 练习.
  - 三月份workshop给学生们一次tutorial,介绍ATLAS中各种用到的data-driven methods.

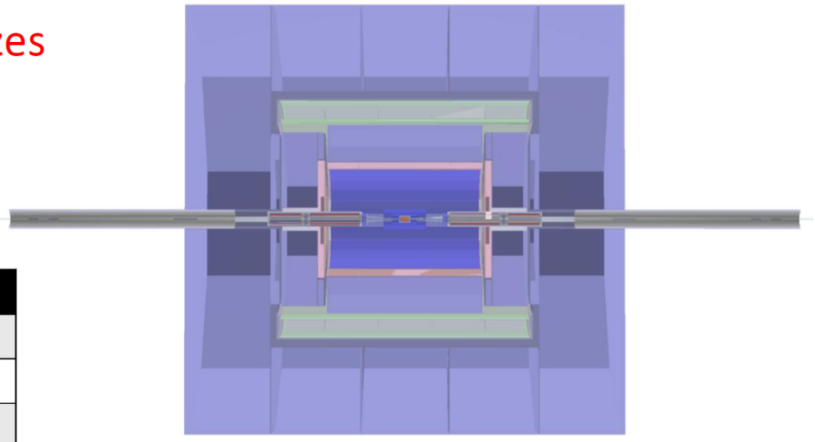
G. Li, MQ Ruan, YQ Fang *et. al.*

# CEPC Detector – Software & Tools

## New geometry: CEPC_o_V2

**shrink the ILD detector**

- New calo, TPC, and MDI
- Smaller TPC& Calo sizes
- More details in MDI
- Detailed B field map



**an important step towards sizing, design & optimization of the CEPC detector**

| Parameter | CEPC_o_v2 | CEPC_v1 |
|---|---|---|
| LStar_zbegin | 1150 | 1146.9 |
| VXD_inner_radius | 12 | 15 |
| VXD_radius_r1 | 12 | 15 |
| VXD_radius_r3 | 35 | 37 |
| TPC_outer_radius | 1500 | 1808 |
| Hcal_nlayers | 40 | 48 |
| Ecal_cells_size | 10 | 4.9 |
| Field_nominal_value | 3 | 3.5 |
| Yoke Layers | 2 | 3 |

- Need more validation
- To be released soon …

**Plus:**

- **full simulation of all analyses**
- **two papers: one published and other answering the referee's questions**

# Progress & development

## CEPC and SppC accelerators

**Jie Gao's talk will provide a full picture**

# CEPC Accelerator

J Gao *et. al.*

Funding： IHEP IF

same layout and hardware at the Z(91) and ZH(240)

## CEPC Design Goal –Higgs Parameters

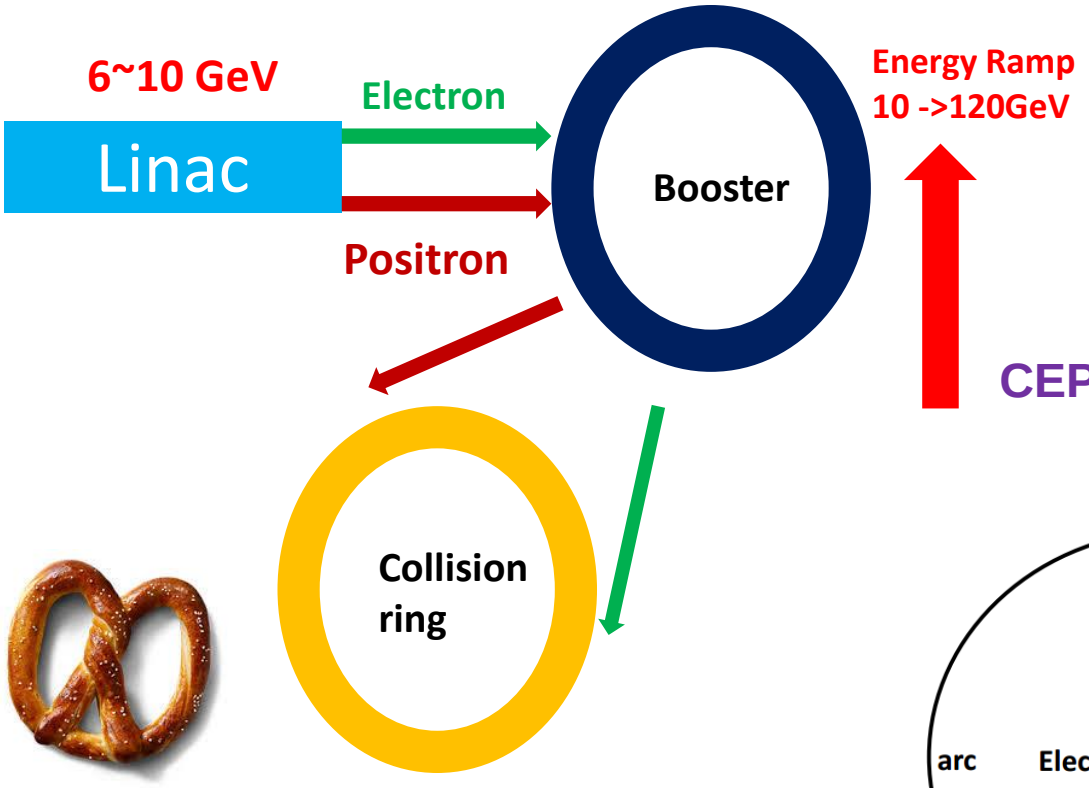
| Parameter | Design Goal |
|---|---|
| Particles | e+, e- |
| Center of mass energy | 240 GeV |
| Luminosity (peak) | 2*10^34/cm^2s |
| No. of IPs | 2 |

## CEPC Design Goal – Z-pole Parameters

| Parameter | Design Goal |
|---|---|
| Particles | e+, e- |
| Center of mass energy | 45.5 GeV |
| Integrated luminosity (peak) | >1*10^34/cm^2s |
| No. of IPs | 2 |
| Polarization | Consider in the second round |

# CEPC Accelerator

## CEPC Accelerator Baseline Design





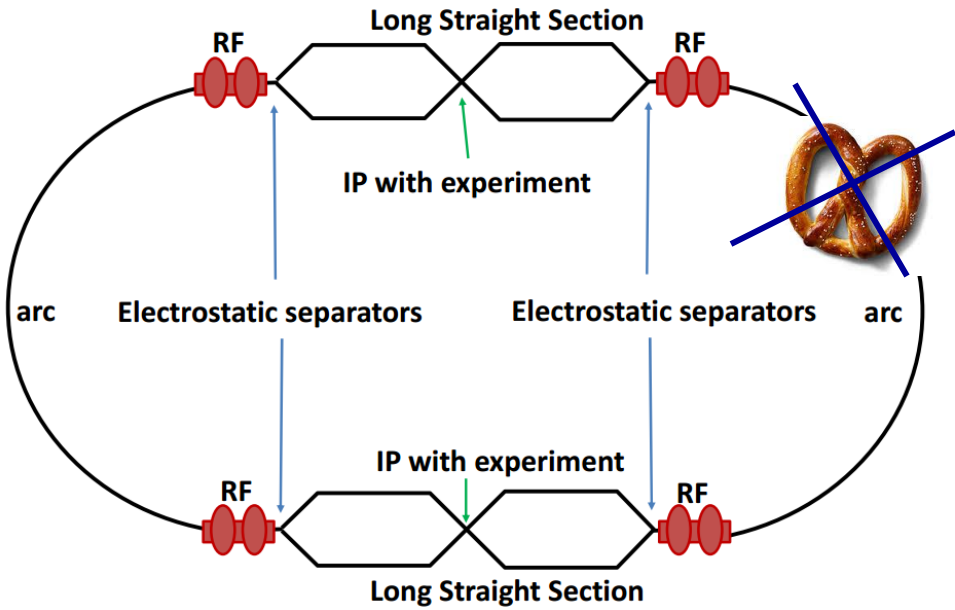

Pretzel scheme to separate opposing beams at crossings

**Single ring**: cheap, low lumi.

**Double ring:** expensive, high lumi

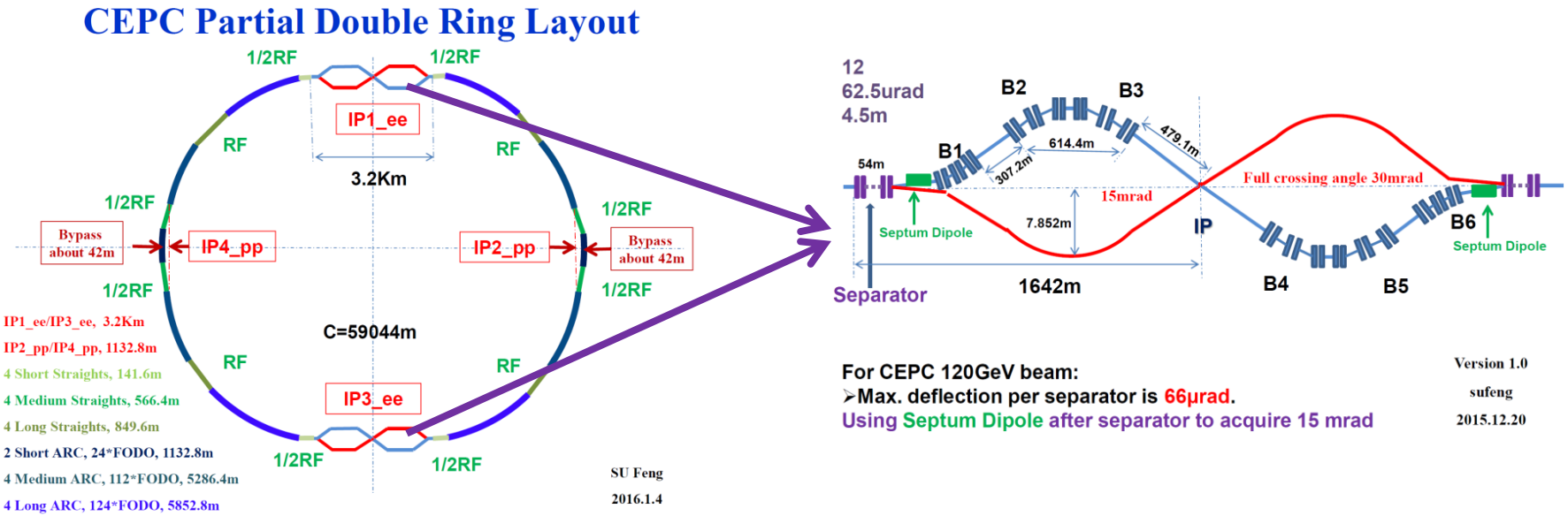
**Local Double ring:** a balance?

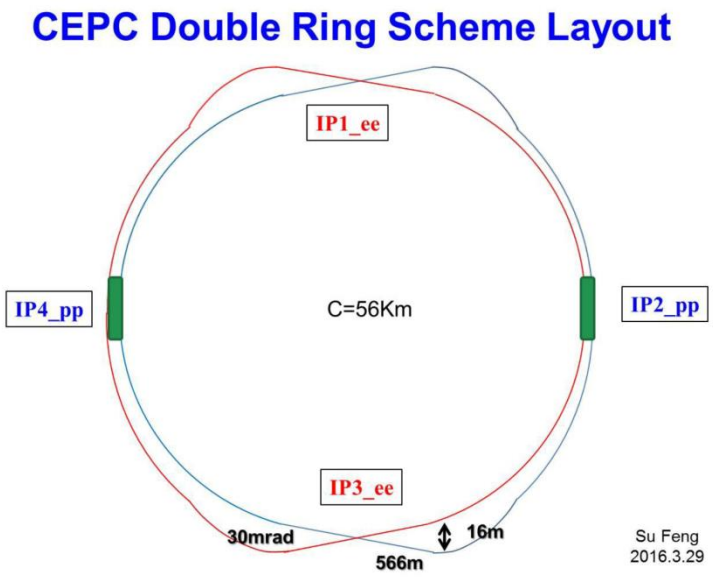
## CEPC Accelerator local double rings



# CEPC accelerator layout

J Gao *et. al.*



# CEPC Accelerator

J Gao *et. al.*

## Preliminary

## Parameters for CEPC partial double ring

（wangdou20160325）

| | *Pre-CDR* | *H-high lumi.* | *H-low power* | *W* | *Z* |
|---|---|---|---|---|---|
| Number of IPs | 2 | | | | |
| Energy (GeV) | 120 | | | | |
| Circumference (km) | 54 | | | | |
| SR loss/turn (GeV) | 3.1 | | | | |
| Half crossing angle (mrad) | 0 | | | | |
| Piwinski angle | 0 | | | | |
| $N_e$/bunch ($10^{11}$) | 3.79 | | | | |
| Bunch number | 50 | | | | |
| Beam current (mA) | 16.6 | | | | |
| SR power /beam (MW) | 51.7 | | | | |
| Bending radius (km) | 6.1 | | | | |
| Momentum compaction ($10^{-5}$) | 3.4 | | | | |
| $\beta_{IP}$ x/y (m) | 0.8/0.0012 | | | | |
| Emittance x/y (nm) | 6.12/0.018 | | | | |
| Transverse $\sigma_{IP}$ (um) | 69.97/0.15 | | | | |
| $\xi_x$/IP | 0.118 | | | | |
| $\xi_y$/IP | 0.083 | | | | |
| $V_{RF}$ (GV) | 6.87 | | | | |
| $f_{RF}$ (MHz) | 650 | | | | |
| *Nature* $\sigma_z$ (mm) | 2.14 | | | | |
| Total $\sigma_z$ (mm) | 2.65 | | | | |
| HOM power/cavity (kw) | 3.6 | | | | |
| Energy spread (%) | 0.13 | | | | |
| Energy acceptance (%) | 2 | | | | |
| Energy acceptance by RF (%) | 6 | | | | |
| $n_\gamma$ | 0.23 | | | | |
| Life time due to beamstrahlung cal (minute) | 47 | | | | |
| $F$ (hour glass) | 0.68 | | | | |
| $L_{max}$/IP ($10^{34}$cm$^{-2}$s$^{-1}$) | 2.04 | | | | |

See J Gao's talk

# CEPC Accelerator

J Gao *et. al.*

**Preliminary**

## Parameters for CEPC PDR-100km

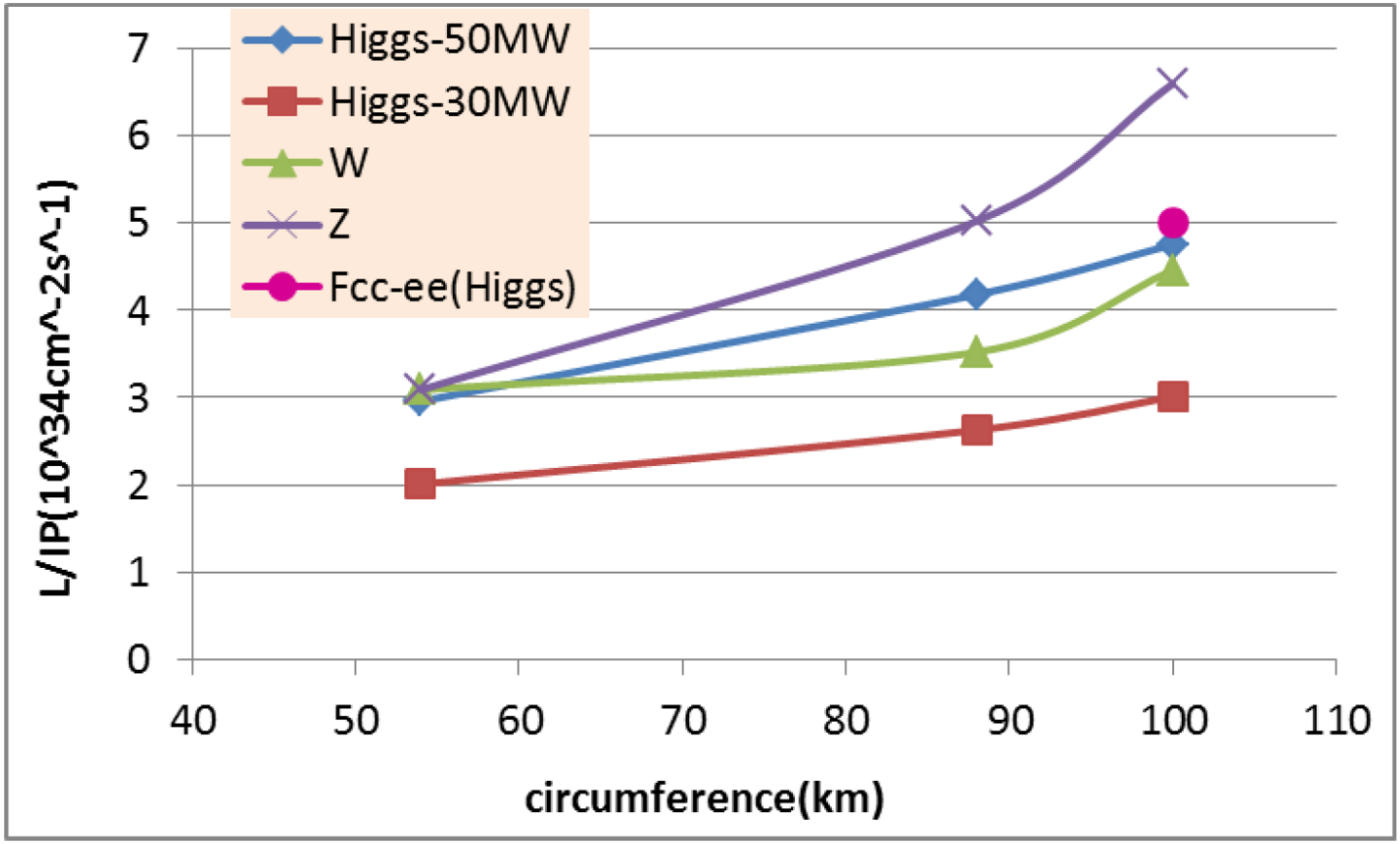
（wangdou20160329）

| | *H-high lumi.* | *H-low power* | *W* | *Z* |
|---|---|---|---|---|
| Number of IPs | | | | |
| Energy (GeV) | | | | |
| Circumference (km) | | | | |
| SR loss/turn (GeV) | | | | |
| Half crossing angle (mrad) | | | | |
| Piwinski angle | | | | |
| $N_e$/bunch ($10^{11}$) | | | | |
| Bunch number | | | | |
| Beam current (mA) | | | | |
| SR power /beam (MW) | | | | |
| Bending radius (km) | | | | |
| Momentum compaction ($10^{-5}$) | | | | |
| $\beta_{IP}$ x/y (m) | | | | |
| Emittance x/y (nm) | | | | |
| Transverse $\sigma_{IP}$ (um) | | | | |
| $\xi_x$/IP | | | | |
| $\xi_y$/IP | | | | |
| $V_{RF}$ (GV) | | | | |
| $f_{RF}$ (MHz) | | | | |
| *Nature* $\sigma_z$ (mm) | | | | |
| Total $\sigma_z$ (mm) | | | | |
| HOM power/cavity (kw) | | | | |
| Energy spread (%) | | | | |
| Energy acceptance (%) | | | | |
| Energy acceptance by RF (%) | | | | |
| $n_\gamma$ | | | | |
| Life time due to beamstrahlung_cal (minute) | | | | |
| $F$ (hour glass) | | | | |
| $L_{max}$/IP ($10^{34}$cm$^{-2}$s$^{-1}$) | | | | |

**See J Gao's talk**

J Gao *et. al.*

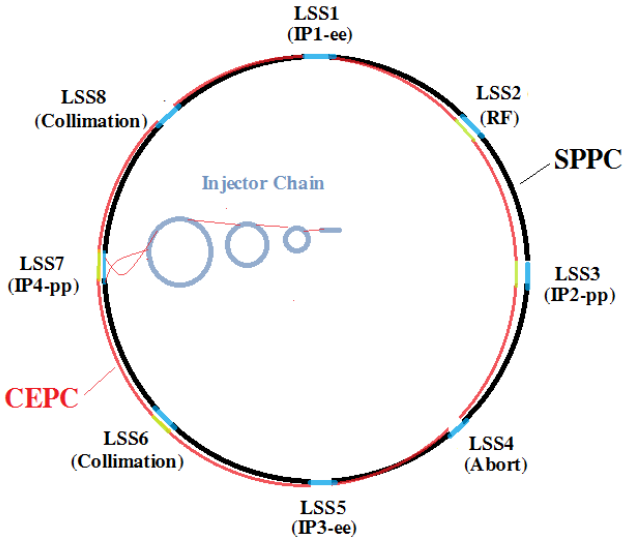
# CEPC PDR Luminosity vs circumference

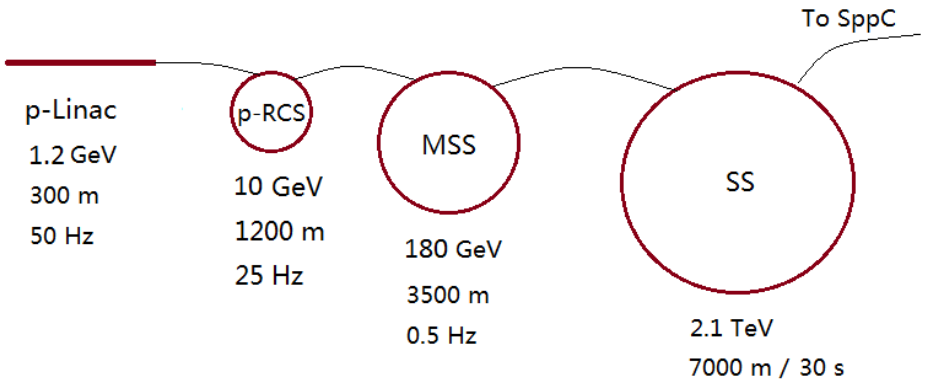


# SppC Accelerator

JY Tang *et. al.*

- Study team is still growing, regular meetings
- We are making progress on SPPC study steadily, on both the collider and injector accelerators.
  - Pre-conceptual designs (main parameters, accelerator frame, stage schemes, lattice and layout, etc)
  - Key accelerator problems (collimation, beam screen, etc.)
  - Key technology R&D (high-field superconducting magnets, cryogenic vacuum, etc.)

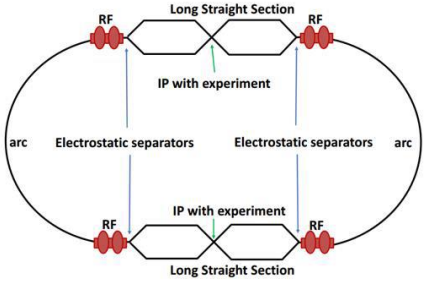


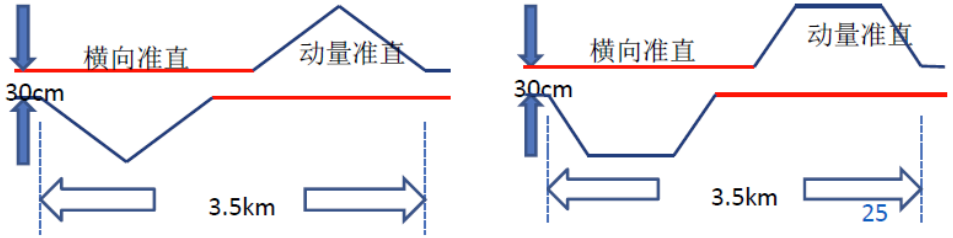
# SppC Accelerator

JY Tang *et. al.*

- Lattice design: three persons (1 postdoc, 2 students) working on the SPPC lattice
  - Race-track lattice to be compatible with CEPC
  - We do not need to by-pass the CEPC detectors
  - Different schemes (@70, 100 TeV)




- Collimation Study: two persons (1 postdoc, 1 student) working on collimation method and schemes
  - Transverse and longitudinal collimation in the same long straight section (overcoming beam loss at arc encountered by LHC)




- High-field SC magnets: seeking collaboration with industry, HT conductor research units, international partners

# Global effort

# Global Effort

## The First IHEP-BINP CEPC Accelerator Collaboration Workshop
## Jan. 12-13, 2016, IHEP

http://indico.ihep.ac.cn/event/5410/other-view?view=standard


The first IHEP-BINP CEPC Accelerator Collaboration Workshop

chaired by Prof. Jie GAO

from Tuesday, 12 January 2016 at **09:00** to Wednesday, 13 January 2016 at **18:00** (Asia/Shanghai)
at **IHEP ( A415/C407 )**

Manage

**Vidyo Info** Room Name IHEP-BINP
Link http://vidyo.ihep.ac.cn/flex.html?roomdirect.html&key=IGvrwkPyEFRikPtaLQPUWVRmHw
Extension 002016010700

Go to day

**Tuesday, 12 January 2016**

09:00 - 12:00 Session I
Convener: Prof. Jie GAO
Location: A415
- 09:00 **Welcome and Introduction** *10'* — Speaker: Prof. Xinchou LOU
- 09:10 **CEPC(SppC) accelerator design status and challenge (including the field of interested collaboration)** *30'* — Speaker: Prof. Jie Gao (IHEP, CAS, Beijing)
- 09:40 **CEPC double ring scheme and CEPC crab-waist parameters** *20'* — Speakers: Dr. Dou WANG (IHEP), Mr. Feng SU (高能所)
- 10:00 **CEPC Final focus design and DA studies** *20'* — Speaker: Mr. Yi Wei Yiwei Wang (高能所)
- 10:20 **Coffee break** *20'*
- 10:40 **DA aperture optimization method study** *20'* — Speaker: Mr. Yuan Zhang (IHEP, Beijing)
- 11:00 **Preztel scheme of CEPC** *20'* — Speaker: Ms. Huiping GENG Huiping (高能所)
- 11:20 **CEPC booster design** *20'* — Speaker: Mr. Xiaohao Cui (Accelerator Center)
- 11:40 **CEPC Alternating field booster design** *20'* — Speaker: BIAN Tianjian

12:00 - 13:30 Lunch ( Expert restaurant )

13:30 - 17:20 Session II
Convener: Prof. EUGENE LEVICHEV
Location: A415
- 13:30 **MDI study for CEPC** *20'* — Speaker: Dr. Sha Bai (高能所)
- 13:50 **CEPC DA due to magnets' error** *20'* — Speaker: Dr. Sha Bai (高能所)
- 14:10 **SppC lattice design** *20'* — Speaker: Mr. Feng SU (高能所)
- 14:30 **Beam-Beam Effects and Luminosity Optimization for e+e- Colliders at High Energies** *20'* — Speaker: Dmitry Shatilov
- 14:50 **Optics and IR study for electron-positron Higgs factories** *20'* — Speaker: Anton Bogomyagkov
- 15:10 **Coffee break** *20'*
- 15:30 **MDI and head-on collision option for electron-positron Higgs factories** *20'* — Speaker: Sergei Sinyatkin
- 15:50 **On denamic aperture study for high performance e+e- colliders** *20'* — Speaker: Eugene Levichev
- 16:10 **Energy calibration issues in electron-positron Higgs factories** *20'* — Speaker: Ivan Koo
- 16:30 **Beam energy calibration without polarization** *20'* — Speaker: Nikolay Muchnoi
- 16:50 **Discussion** *30'*

18:30 - 20:30 Dinner ( Expert Restaurant )

**Wednesday, 13 January 2016**

09:00 - 18:00 Session on 13 Jan.
Location: C407

**MoU between IHEP and BINP on Electron Positron Circular Colliders has been agreed by both Lab Directors, waiting for final signature**

# Global Effort

## IAS Conference Accelerator Program (Jan. 18-21, 2016, Hongkang)

More than 30 accelerator physicists from CERN, SLAC, KEK, BINP, INFN, Cornell, BNL, LBNL, IHEP etc.


Very successfully international Conference (could be regarded as a Pre-meeting for the first CEPC International Collaboration Meeting, in Sept. 2016 (TBD)

Jan, 18, 2016
Plenary
10:15 John Seeman, "A Brief History of Circular e+e- Colliders Emphasizing Future Applications"
10:45

11:15 Jie Gao, "CEPC Status and International Collaboration"
11:45

Parallel Session chair: J. Gao
14:00 (1) Oide, "Design of Beam Optics for Future Circular Colliders"
14:30 (2) Dou Wang, "CEPC Parameter and Lattice Design with Crab Waist Scheme"
14:50 (3) Anton Bogomyagkov, "Chromaticity Correction of the Interaction Region"
15:10 (4) Catia Milardi, "DAFNE Experience with the Crab - Waist Collision Scheme"
15:30 (Coffee)
15:45 (Coffee)
Parallel Session Chair: Eugene Levichev:
16:00 (5) Yunhai Cai, "An Accelerator Design of Circular Higgs Factory"
16:20(6) Michael Koratzinos, "Challenges of Modem e+e - Colliders"
16:40 (7) Dmitry Shatilov, "Beam - beam Effects and Luminosity Optimization for e+e - Colliders at High Energies"
17:00 (8) Kazuhito Ohmi, "Beam Dynamics Issues of Future Curcular e+e - Colliders and Hadron Colliders"
17:20 (9) Eugene Levichev, "Nonlinear Perturbations for High Luminosity e+e - Collider Interaction"
17:40 (10) Valery Telnov (TBD)
18:00

Jan, 19, 2016
Plenary
10:15 A. Yamamoto, "ILC Accelerator Status"
10:45
11:15 W. Chou, "Future High Energy pp Colliders and Challenges"
11:45
Parallel Session Chair: Marica Biagini
14:00 (11) Jongjun Li, "Multi - objective Optimization of Dynamic Aperture in Storage Rings"
14:30 (12) Yuan Zhang, "Comparison Between Crab - waist and Head - on Scheme in CEPC"
14:50 (13) Huiping Geng., "Pretzel scheme for CEPC"
15:10 (14) Ivan Koop, "Energy Calibration Issues"
15:30 (Coffee)
15:45 (Coffee)
Paralle Session Chair:: W. Chou
16:00 (15) Kaoru Yokoya, TBD
16:20(16) Nikolay Muchnoi," Polarization Free Methods for Beam Energy Calibration"
16:40 (17) Jingyu Tang, "SPPC Status and R&D Planning"
17:00 (18) Feng Su, "CEPC Partial Double Ring Lattice Design & SPPC Lattice Design"
17:20 (19) Stephen Gourlay," The US High Field Magnet Program"
17:40 (20) Qing Jin Xu, "SPPC High Field SC Magnet R&D Issues"
18:00

Jan, 21, 2016
Plenary
10:15 Accelerator Summary, Qing Qin
10:45
14:00 Forum Discussion ((De Roech, K. Yokova, J. Gao, Wang, Kotwal)
15:30

# Global Effort

## CEPC Accelerator International Collaboration Status

- **CEPC accelerator design group members sent out to the collaborating labs**

- KEK: Yiwei Wang, Yun Zhang (on Lattice collaboration) (done)
- SLAC: Tianjian Bian (On booster design) (now)
- BNL: Feng Su (On dynamic aperture optimizations) (now)
- LAL: Sha Bai (On MDI) (now)
- CERN: Na Wang (done) and Xiaohao Cui (now) (On collective effects and lattice)

# R&D Funding

科技部

April 8, 2016

# 科技部国家重点研发计划 ~90M RMB

## “大科学装置前沿研究”重点专项2016年度项目申报指南

新一代粒子加速器和探测器关键技术和方法的预先研究

- 高能环形正负电子对撞机预先研究 ~45M RMB

国家重点研发计划
项目预申报书
已于3月递交

| | |
|---|---|
| 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 |
| 项目负责人： | 高原宁 |

期待2017年

- 高能环形正负电子对撞机关键技术验 ~45M RMB

# Future

- CDR
- R&D funding
- Make progress in critical design and R&D
- International collaboration
- Follow closely the schedule

**"Highest Quality is required in the presence of Fcc, ILC, …."**

# This Meeting

- CEPC design towards CDR
  **Physics goals; detector-accelerator design; …**
- R&D progress and future activities
- Organization, plan and actions

“要创新，把目标定高些，要往上跳才能够得着的目标”–王贻芳