

Introductory remarks

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中國科學院高能物理研究所

*Institute of High Energy Physics
Chinese Academy of Sciences*

Wuhan: CEPC Workshop, Apr 19-21

<http://indico.ihep.ac.cn/event/6433/>



Serious homework to do...



Wuhan Workshop

Wednesday parallel sessions: CDR discussions

11:00	Light-quark Yukawa couplings and hadronic event shapes in Higgs ... Jun GAO	Status report from Vertex Detector group Ms. Ping YANG	CEPC accelerator physics	SPPC General Progress
	Dark matter searches at the CEPC Science Hall – Lecture Hall, Central China Normal University	The test setup development and sens... Mr. Jian LIU	CEPC parameter optimization and lattice design	LATTICE Design Progress
		Study of SOI pixel for the vertex detector	CEPC lattice design and DA optimization	Bunch Filling Schemes (remote)
12:00	Progress on quarkonium physics Dr. Yaqing MA	Discussion on Vertex Detector CDR planning	CEPC beam-beam study and dynamic aperture study	Progress in Collimation Studies
13:00	IWCEPC Organizing Committee Vertex room 301, Central China Normal University		Lunch Break Central China Normal University 12:30 - 14:00	
14:00	Estimate the interference effects on Higgs mass measurement at CEPC	Status report from Tracker Detector group Central China Normal University	CEPC/SPPC lattice design Mr. Feng SU	LHC Beam Collimation (remote) Mr. Ye ZOU
	Triple gauge couplings at future hadron and lepton collider	Status and plans of TPC ASIC FEE readout Dr. Zhi DENG	CEPC sawtooth effect Dr. Sha BAI	Beam-beam effect
		Drift chamber alternative	CEPC injector Linac beam dynamics Dr. Cai MENG	Collective Instabilities
15:00	Recent progress of precision calculations at CEPC Zhao LI	Discussion on the Tracker CDR planning Dr. 曹	CEPC booster injection/extraction and timing	Injection and Extraction (remote) Dr. Ye YANG
			CEPC injector based on plasma based accelerator Wei LU	

Tracker

Coffee Break Central China Normal University				Muon 15:30 - 16:00	
16:00	How Does Leptonic Collider Indirectly Probe Neutralino Dark Matter? Science Hall – Lecture Hall, Central China Normal University	Status report from Muon group Prof. Liang LI	CEPC SRF system study	Proton and Ion linacs	
	Higgs Exotic Decays Science Hall – Lecture Hall, Central China Normal University	Status of the R&D on the CEPC detector ma... Mr. Zhen ZHU	CEPC SC quadrupole and sextupole designs	SS Conceptual Design	
		General status of simulation study Dr. Gang LI	CEPC 650MHz high efficiency klystron study	All HTS Magnets Dr. Qingjin XU	
			CEPC cavity R&D Dr. Peng SHA	Science Hall – room 203, Central China Normal University	
17:00	Implications of CP-violating Top-Higgs Couplings at LHC and Higgs Factories Dr. Lei WU	Progress and Plan for the CEPC Software Tools Chengdong FU	CEPC cavity with WG HOM coupler and EP Dr. Sang JIN	Beam Screen	
			CEPC HOM coupler and bunch lengthening effects		



Wuhan Workshop

Thursday parallel sessions: CDR discussions

09:00	CEPC Precision of Electroweak Oblique Parameters and Weakly Interacting Dark Mat...	Status of HCAL based on GEM	CEPC injector R&D	Discussions on future SPPC energy upgrade
	Testing the electroweak phase transition and electroweak baryogenesis at the LHC and a circular electron...	Status of THGEM and Scintillator	CEPC booster low field magnet R&D Dr. Wen KANG	Discussions on cryogenic temperature
		Status of SDHCAL based on RPC Dr. Bing LIU	CEPC electrostatic separator and power sources	
10:00	Testing CP-Violation in the Scalar Sector at Future e^+e^- Colliders	Dual readout calorimeter	CEPC vacuum chamber R&D	Science Hall – room 203, Central China Normal University
	Singlet charged scalar and CEPC		CEPC instrumentation R&D	
	Coffee Break Central China Normal University 10:40 - 11:00			
11:00	Multi-Higgs final state and new physics Dr. Qi-shu YAN	Status of ECAL R&D from IHEP Dr. Zhigang WANG	e-p collision at CEPC-SPPC Dr. Yuhong ZHANG	
	Charged Lepton Flavor Violations at CEPC Mr. Qin QIN	Status of ECAL R&D from USTC	Compatible arc regions between CEPC and SPPC Mr. Feng SU	
	WW Threshold	Discussion on Calorimeter CDR planning Prof. Tao HU	Compatible straight sections between CEPC and SPPC Dr. Yukai CHEN	
12:00	The CP-violation phenomena and implications to future coll...	Science Hall – room 201, Central China Normal University		

Calorimeter

14:00	Validation of Delphes Card for the CEPC Fast Simulation Mr. Zhenwei CUI	
	Central China Normal University 14:00 - 14:15	
	Energy Calibration Dr. Guangyi TANG	
14:15	Central China Normal University 14:15 - 14:30	
	dE/dx measurement in TPC Ms. Fenfen AN	
	Central China Normal University 14:30 - 14:45	
15:00	Status and Plans of the CEPC Physics Analysis towards the CDR plus discussion Yu BAI	
	Central China Normal University 14:45 - 15:30	
	Coffee Break Central China Normal University 15:30 - 16:00	
16:00	Introduction to CEPC MDI Dr. Sha BAI	EB Meeting
	Central China Normal University 15:00 - 16:15	
	Introduction to CEPC Beam Background Mr. Qinglei XIU	
17:00	Discussion on MDI Dr. Hongbo ZHU	
	Central China Normal University 16:30 - 17:30	Room 201, Central China Normal University

MDI

Friday plenary session: CDR discussions

Joao: CDR plans

Manqi: Concepts and optimization

Detector and Physics: Conceptual Design Report

- **May ~~1~~³, 2017: Monday, P&D meeting**
 - * Decide on editors and timescale *today!*
 - ✓ * Establish SVN/git repository area
- **September 30: Text for all subsections finalized**
 - * Includes R&D results available until this date
 - * All text committed to repository
- **October 31: Version for internal review finalized**
 - * Harmonization of text across chapters
 - * Finalize introduction and other common aspects (references, authors, etc)
- **December 20: Version for external review ready**
- **March 1, 2018: Release to public**

still about one year
of work

Preliminary

To be discussed at this meeting



CDR Organization

- **Possibility 1: One detector concept**

- This detector needs to “work” at high-luminosity for Z physics
- TPC or full Silicon?
- Consider options:
 - TPC, full silicon and drift chamber
 - Particle Flow and Dual readout calorimeter

- **Possibility 2: Detector concepts in equal footing**

- TPC-based, full silicon-based and drift-chamber detectors
- Requires manpower for full simulation in equal footing of the two concepts
- Very difficult to achieve within the timescale of 2017

- **Possibility 1.5:**

- Describe the two/three concepts early in the CDR (low-field/high-field)
- Detector options described in parallel in the text
- Physics performance discussed together at the end



Possible CDR outline

Preliminary

1. CEPC Physics Potential
 1. Higgs physics
 2. Electroweak precision physics
 3. Searches for physics beyond the Standard Model
 4. Flavor physics
2. Experimental conditions and detector requirements
 1. The CEPC experimental environment
 1. Beam backgrounds, polarization, etc
 2. Detector requirements for e^+e^- physics
 1. Track momentum and jet energy resolution, flavor tagging, particle identification
 3. Basic description of Detector Concepts
3. Vertex detectors
4. Tracking system
 1. Tracker concepts
 1. The TPC tracking system
 2. The All-Silicon tracking system
 3. The Drift Chamber tracking system
 2. Beam induced backgrounds in tracking system
 3. Performance



Possible CDR outline

Preliminary

5. Calorimetry
 1. Particle flow calorimeter
 1. Hadronic calorimeter
 2. Electromagnetic calorimeter
 2. Dual readout calorimeter
 3. Calorimeter performance
6. Detector magnet system
7. Muon system
 1. Conceptual design of muon system
 2. Muon reconstruction algorithm and system performance
8. Readout electronics and data acquisition (?)
9. CEPC interaction region and detector integration
10. Physics performance
 1. Simulation and reconstruction
 2. Luminosity measurement
 3. Energy measurement
 4. Performance of low-level physics observables
 5. Detector benchmark processes
11. Future plans and R&D prospects



CEPC Optimized Detector Parameters

Presented at Wuhan:

	CEPC_v1 (~ ILD)	Optimized (Preliminary)	Comments
Track Radius	1.8 m	≥ 1.8 m	Requested by Br(H $\rightarrow\mu\mu$) 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 $\rightarrow\gamma\gamma$) at 250 GeV; 90mm for bhabha event at 350 GeV
ECAL/HCAL Cell Size	5/10 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; Margin might be reserved for 350 GeV.

- To be covered at CDR
 - Include the MDI/FWD design to Full Simulation
 - Full Sim Analysis on Physics Benchmarks at **this** Conceptual geometry

Need similar parameter set for Low-field Detector Concept



Work towards CDR

- Need to integrate work done in **Detector subgroups** with work done by **Simulation subgroup**
- Decide and review final options for detector to be simulated:
 - This will be our baseline detector!
 - Deviations from “Full Simulation” should be clearly explained in the CDR
 - Need to agree upon details now, before moving with large scale CDR work
- **Suggestions:**
 - Discuss within detector groups to decide what designs should be put forward as baseline
 - Common meetings between each detector subgroup and simulation subgroup to clarify details
 - Decisions need to be documented in **short notes** made available for review by CEPC colleagues (these can then turn into parts of the CDR)
 - Detector subgroups should provide manpower to aid on any needed improvements on digitization and geometry
 - Integrate international partners in discussions. We are planning **one** CDR with an integrated structure



Work towards CDR

- Need outline proposals from each subgroup
- Need name proposals for contact editors of each section
 - So far, only got information from Calorimeter subgroup
 - CEPC Gitlab server:
 - <http://cepcgit.ihep.ac.cn/groups/cepcdoc>
- If you are not providing this today, please let me know when you will do it by
 - When will your subgroup meet to discuss this?
- **We will likely move to weekly meetings in the near future**



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Agenda

Wednesday, 3 May 2017

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| 15:00 - 15:20 | Introduction 20'
Speaker: Joao Guimaraes Costa | ▼ |
| 15:20 - 15:40 | MDI 20'
Speaker: Dr. Hongbo ZHU (IHEP) | ▼ |
| 15:40 - 16:00 | Vertex 20'
Speakers: Prof. Qun OUYANG (IHEP), Mr. Xiangming Sun (CCNU), Prof. Meng Wang (Shandong University) | ▼ |
| 16:00 - 16:20 | Tracker 20'
Speaker: Dr. Huirong Qi (Institute of High Energy Physics, CAS) | ▼ |
| 16:20 - 16:40 | Calo 20'
Speakers: Haijun Yang (Shanghai Jiao Tong University), Prof. Tao HU (IHEP), Dr. Jianbei Liu (University of Science and Technology of China) | ▼ |
| 16:40 - 17:00 | Muon 20'
Speaker: Prof. Liang Li (Shanghai Jiao Tong University) | ▼ |
| 17:00 - 17:20 | Magnet 20'
Speakers: Mr. Zian ZHU (高能所), Dr. Feipeng NING (高能所) | ▼ |
| 17:20 - 17:40 | Simulation 20'
Speakers: Mr. Manqi Ruan (IHEP), Dr. Gang LI (Experimental Physics Division, Institute of High Energy Physics) | ▼ |



Extra Slides



Detector Pre-CDR Outline

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Detector Pre-CDR Outline

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CLIC Detector CDR - an example

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CLIC Detector CDR - an example

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CLIC Detector CDR - an example

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International Collaboration

- **INFN, Italy**

- Possible new detector components
 - Full tracker concept, drift chamber tracker, dual readout calorimeter, muon detector
- Electroweak physics studies

- **Taiwan Collaboration**

- Interested in software and physics studies (<https://indico.cern.ch/event/579684/overview>)
 - Luminosity, EW measurements (Sinica), Jet energy scale studies (NCU) and ECAL Studies (Taiwan U)

- **Vinca Institute, Belgrade, Serbia**

- MOU signed with IHEP

- **University of Chicago, USA**

- Young Kee-Kim
 - Chicago/Beijing Workshop, June 5-17 (tentative)

- **Monash University, Australia**

- Tong Li (李佟)

- **University of Liverpool, UK**

- Yanyan Gao, Lecturer

- **Others,**

- Barcelona, Iowa State, Univ. of Geneva, SLAC, Weizmann Institute, Mainz U



Chicago/Beijing Workshop

- **Date: June 5-17 (tentative)**
 - Visiting graduate students (~ 6) from Chicago University
 - Fulvio Piccinini (INFN theorist) — expert in electroweak physics
 - Will invite Lian Tao (Chicago)
 - Explore physics issues that can be tackled in 2 weeks!
 - Needs careful preparation
 - Fast simulation using Delphes card
 - Finish with 1-day workshop at Chicago/Beijing Center with students presenting their results