Plans for the CEPC CDR

-TPC tracker

Huirong Qi, Yulan Li

On behalf of the tracker detector subgroup

2017/05/03

Plan for the CDR

- Based on the pre-CDR contents and ILD like version
- List of resources in tracker R&D
  - IBF for distortion
  - Alignment and calibration of tracker
- Man power

- ~100 μm position resolution in rφ
- Systematics precision (<20 μm internal)

6 The CEPC Detector

6.1 Detector Overview

6.4 Main Tracking Detector – TPC

6.4.1 Design ~~and Challenges~~

6.4.2 ~~Alignment and Calibration~~

6.4.3 ~~Critical R&D~~

Simulation and Estimation
- Requirements of Higgs and Z pole run
- Occupancy in high rate
- Distortion of IBF

Mechanics

detector module R&D

Alignment and calibration
- Alignment by laser system
- Gas/HV/Readout
- Software/correction methods

Wire chamber option

Further R&D

Cost estimation

Discussion in Wuhan conference.

pre-CDR → **CDR**

Draft of contents

Draft of the TPC tracker for CEPC CDR

H.R Qi, ...

May 3, 2017

Contents

Manpower and activities

高能所、清华大学、山东大学
兰州大学，中国科学院大学
原子能科学院

- Manpower
  - Detector module R&D@IHEP
    - Huirong Qi, Yulian Zhang (PhD), Haiyun Wang(PhD), Zhiwen Wen(PhD), Prof. Jin Li
  - Electronics @Tsinghua University
    - Zhi Deng, Yiming Cai(PhD), Zhao Mingrui (Master, THU) and three PhDs in electronics lab, Prof. Yuanning Gao, Prof. Yulan Li
  - Gas/HV simu.@ Lanzhou University
    - Zhang Yi and two PhDs, Prof. Bitao Hu
  - IBF distortion @ ShangDong University
    - Prof. Chengguang Zhu, one PhD
  - Baseline design@ UCAS
    - Qian Liu, Zhao Xiao (PhD)
  - Mechanics @ CIAE
    - Prof. Xiaomei Li, one staff and one PhD
- Regular meeting per month

Confirmed!

International cooperation

- CEA-Saclay IRFU group (FCPPL)
  - Three vidyo meetings with Prof. Aleksan Roy/ Prof. Yuanning/ Manqi and some related persons (2016~2017)
  - Personnel exchange: Two students will participate Saclay's R&D six months in 2017~2018
  - Doctoral students: Haiyun Wang and Yiming Cai
  - Bulk-Micromegas detector assembled and IBF test
  - IBF test using the new Micromegas module with more 500 LPI
- LCTPC collaboration group (LCTPC)
  - Singed MOA and joined in LC-TPC collaboration @Dec. 14,2016
  - As coordinator in ions test and the new module design work package
  - Plan to beam test in DESY with our hybrid detector module in 2018

Current R&D

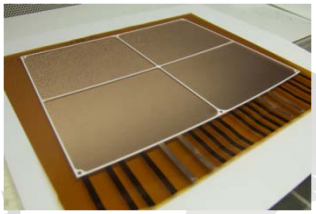
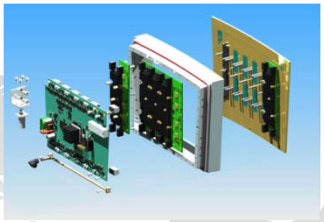
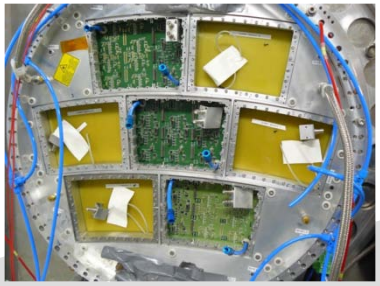
- Simulation and estimation
  - Z-pole run for CEPC R&D (prepared one NOTE)
  - Tracker alignment and calibration (~100um resolution)
  - Hybrid detector module concept

- Experiment and module R&D
  - Continuous Ion Back Flow detector module (GEM+MM)
    - IBF could reach to ~0.1%
    - Stable long time operation
    - Maintaining the electron transmittance
    - Plan to design and study in 1.0T magnetic (In LCTPC collaboration) /1~2years

    MOST funding/IHEP+THU
  - Prototype with laser system
    - Laser system with 266nm
    - Drift velocity
    - Electric field in fieldcage
    - Waveform sampling electronics
    - Plan to assemble and test/~1 year

    Key NSFC funding/IHEP+THU

Timelines

Concept study | **Smaller prototype** | **Large prototype** | **Common module**

2006~2010 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019

TUTPC prototype
GEM-TPC prototype
Micromega-TPC

MPGDs suffer less from ExB effects than MWPCs
They require less heavy mechanics

GEM prototype
Micromemgas protype
Ingrid prototype
Hybrid prototype

Common module
Laser calibration
Cooling
Electronics

Tsinghua starting for prototype
PCB readout design
Dr. Li bo
Prof. Yulan Li

IHEP starting for prototype
Hybrid concept for IBF
Dr. Huirong Qi
Prof. Yuanning Gao

We are in here
Hybrid prototype starting
Calibration using laser