CEPC Physics and Detector Conceptual Design Report: Mini-review

Introduction

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Mini-review of the CEPC Physics and Detector CDR
10 November 2017
Conceptual Design Report (CDR) – Status

Pre-CDR completed in 2015

- No show-stoppers
- Technical challenges identified → R&D issues

Detector and Physics - Conceptual Design Report (CDR)

- Goal: A working concept on paper, including alternatives

This week: Draft-0 preliminary chapters available for discussion

- Chapter 3: Detector concepts (partial)
- Chapter 4: Vertex detector
- Chapter 5: Tracking system (TPC, silicon tracker, silicon-only concept, drift chamber)
- Chapter 6: Calorimeter (PFA and DR calorimeter options)
- Chapter 7: Magnet system
- Chapter 8: Muon system
- Chapter 10: MDI, beam background and luminosity measurement
- Chapter 11: Physics performance (partial)

(See: http://cepc.ihep.ac.cn/preCDR/volume.html)
### Conceptual Design Report (CDR) – Status

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- Technical challenges identified → R&D issues

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**Detector and Physics - Conceptual Design Report (CDR)**

- Goal: A working concept on paper, including alternatives

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- **Spring 2018: Planned release date**
  - Soon after CEPC accelerator CDR is released

- **From this week’s workshop till publication:**
  - Plenty of opportunities for everyone to contribute
  - Lots of room to make a serious impact

- **Nov 10–11: Informal CDR Mini-review**
  - [http://indico.ihep.ac.cn/event/7384/](http://indico.ihep.ac.cn/event/7384/)

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More definite schedule available towards end of November

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[Pre-CDR completed in 2015](http://cepc.ihep.ac.cn/preCDR/volume.html)
Baseline detector for CDR
ILD-like
(similar to pre-CDR)

Low magnetic field concept

Full silicon tracker concept

Final two detectors likely to be a mix and match of different options
Current CDR Status

CEPC

Conceptual Design Report

Volume I - Physics & Detector

The CEPC Study Group

Spring 2018
Outline

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  - 5.1.4 Conclusion

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12 Future plans and R&D prospects

12.1 New Colliders for a New Frontier
Outcome

- **Charge:**
  - Informal discussion on different topics. Feel free to be controversial and provide input in the content, format and text
  - Some chapters clearly more polished than others
    - No need to provide English corrections on text that is clearly incomplete

- **Outcome:**
  - Short summary with comments from individual people
  - No need for a common report
CEPC baseline detector: ILD–like

- Impact parameter resolution: less than 5 μm
- Tracking resolution: $\delta(1/Pt) \sim 2 \times 10^{-5}$ (GeV$^{-1}$)
- Jet energy resolution: $\sigma_E/E \sim 0.3/\sqrt{E}$

Magnetic Field: 3 Tesla — changed from preCDR

- Flavor tagging
- BR(Higgs $\rightarrow \mu\mu$)
- W/Z dijet mass separation
Major concerns being addressed

MDI region highly constrained
- L* increased to 2.2 m
- Compensating magnets

TPC as tracker in high-luminosity Z-pole scenario

ECAL/HCAL granularity needs
- Passive versus active cooling

Magnetic Field: 3 Tesla — changed from preCDR

- Impact parameter resolution: less than 5 μm
- Tracking resolution: δ(1/Pt) ~ 2 × 10⁻⁵ (GeV⁻¹)
- Jet energy resolution: σ_E/E ~ 0.3/√E

Flavor tagging
BR(Higgs → μμ)
W/Z dijet mass separation
Low magnetic field detector concept

Proposed by INFN, Italy colleagues

**Magnet:** 2 Tesla, 2.1 m radius

Thin (~30 cm), low-mass (~0.8 \(X_0\))

**Beam pipe:** radius 1.5 cm

**Vertex:** Similar to CEPC default

**Drift chamber:** 4 m long; Radius ~30-200 cm

**Preshower:** ~1 \(X_0\)

**Dual-readout calorimeter:** 2 m/8 \(\lambda_{\text{int}}\)

(yoke) muon chambers

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**Integrated into Conceptual Design Report**

- Dual readout calorimeter: Chapter 6
- Talk: Session IV - Roberto Ferrari
- Drift chamber: Chapter 5
- Talk: Session II - Franco Gancagnolo
- Muon detector (\(\mu\)Rwell): Chapter 8
- Talk: Session IV - Paolo Giacomelli
Full silicon tracker concept

Replace TPC with additional silicon layers

**CEPC-SID:**
- 6 barrel double strip layers
- 5 endcap double strip layers

**SIDB: SiD optimized**
- 5 barrel single strip layers
- 5 endcap double strip layers

**Drawbacks:** higher material density, less redundancy and limited particle identification (dE/dx)