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

(http://cepc.ihep.ac.cn/preCDR/volume.html)

Detector and Physics - Conceptual Design Report (CDR)

- Goal: A working concept on paper, including alternatives

Preliminary

- **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)

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Detector and Physics - Conceptual Design Report (CDR)

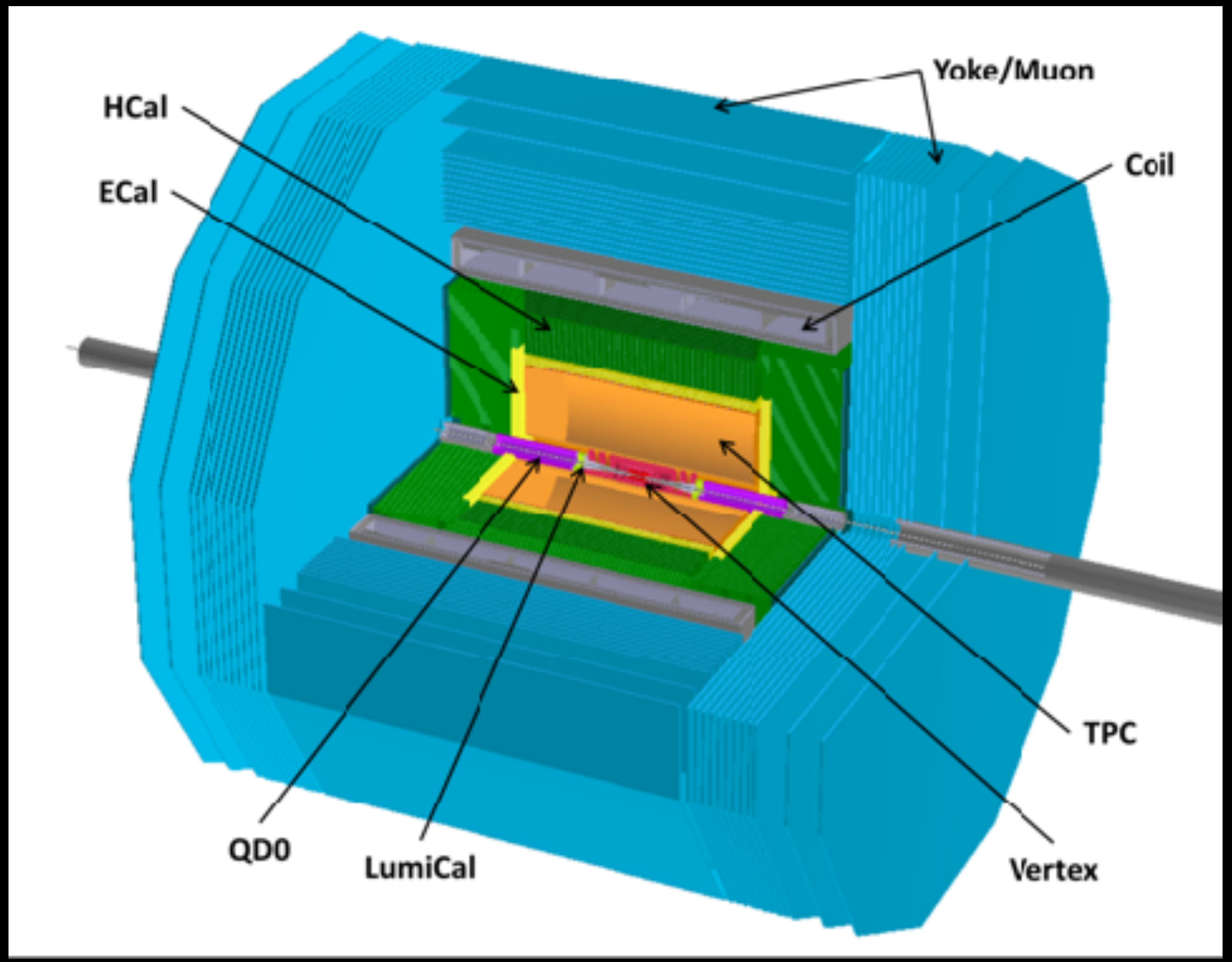
- Goal: A working concept on paper, including alternatives

- **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/

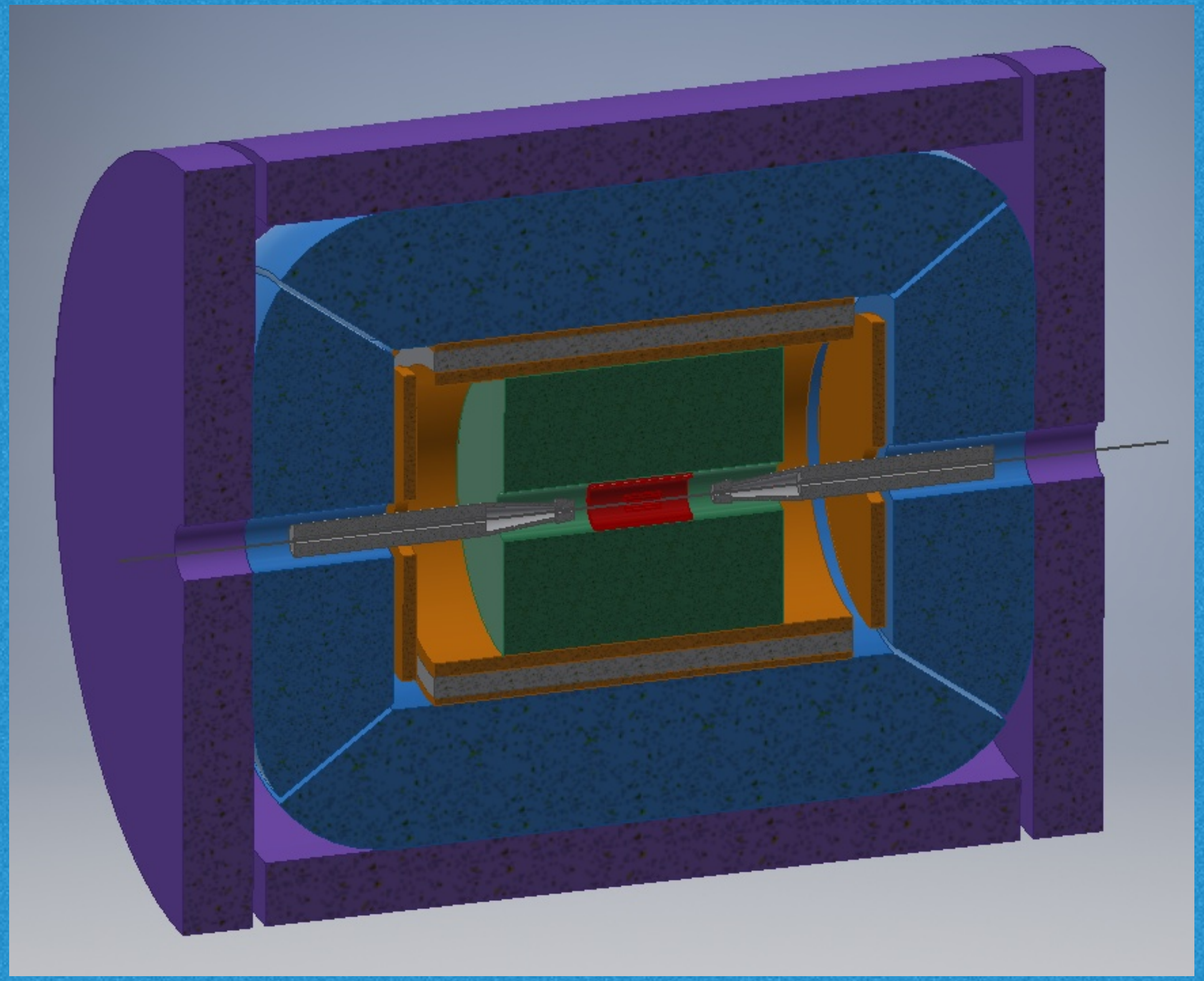
More definite schedule available towards end of November

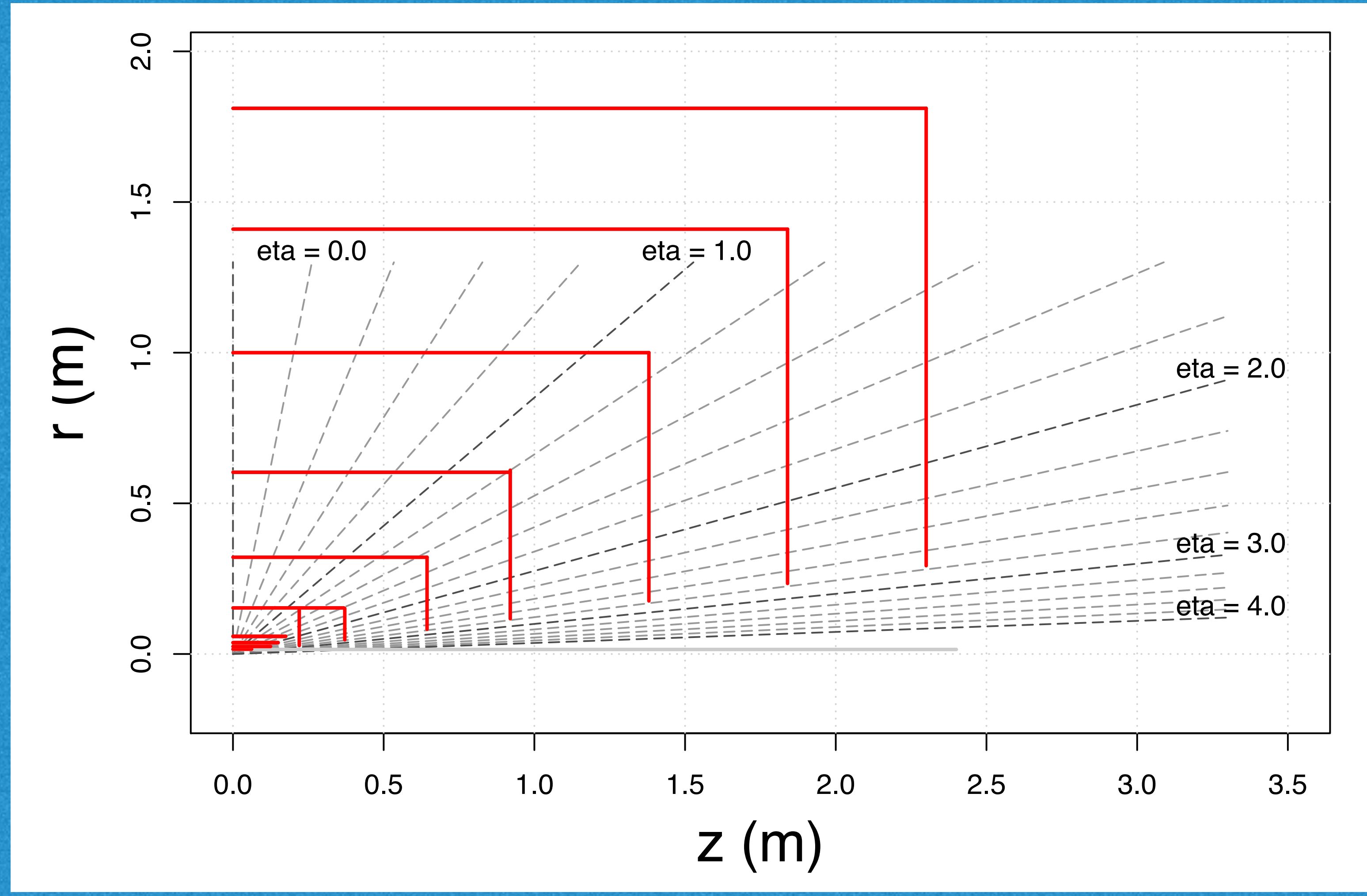
CDR Conceptual Designs

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

IHEP-CEPC-DR-2018-XX

IHEP-EP-2018-XX

IHEP-TH-2018-XX

CEPC

Conceptual Design Report

Volume I - Physics & Detector

The CEPC Study Group

Spring 2018

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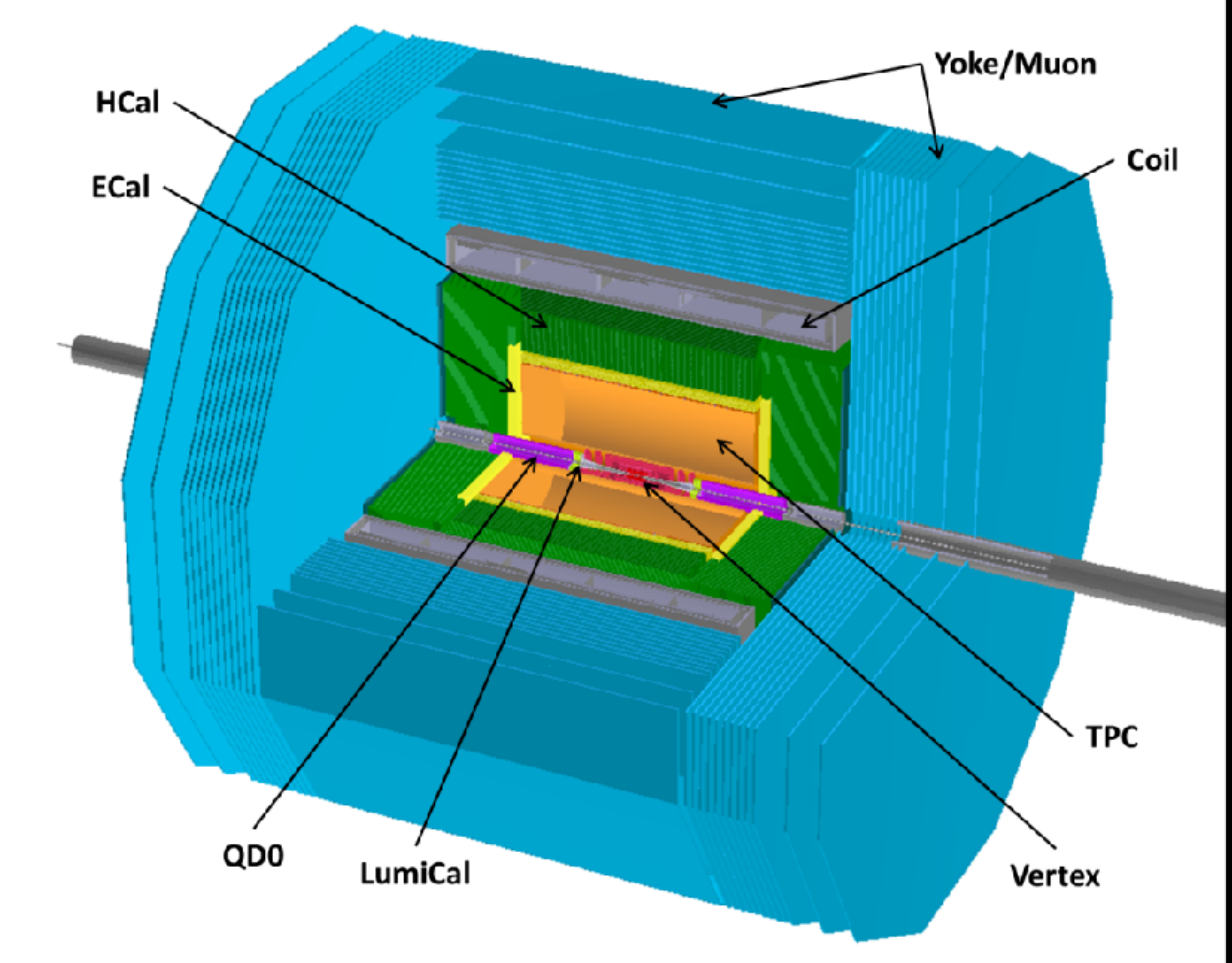
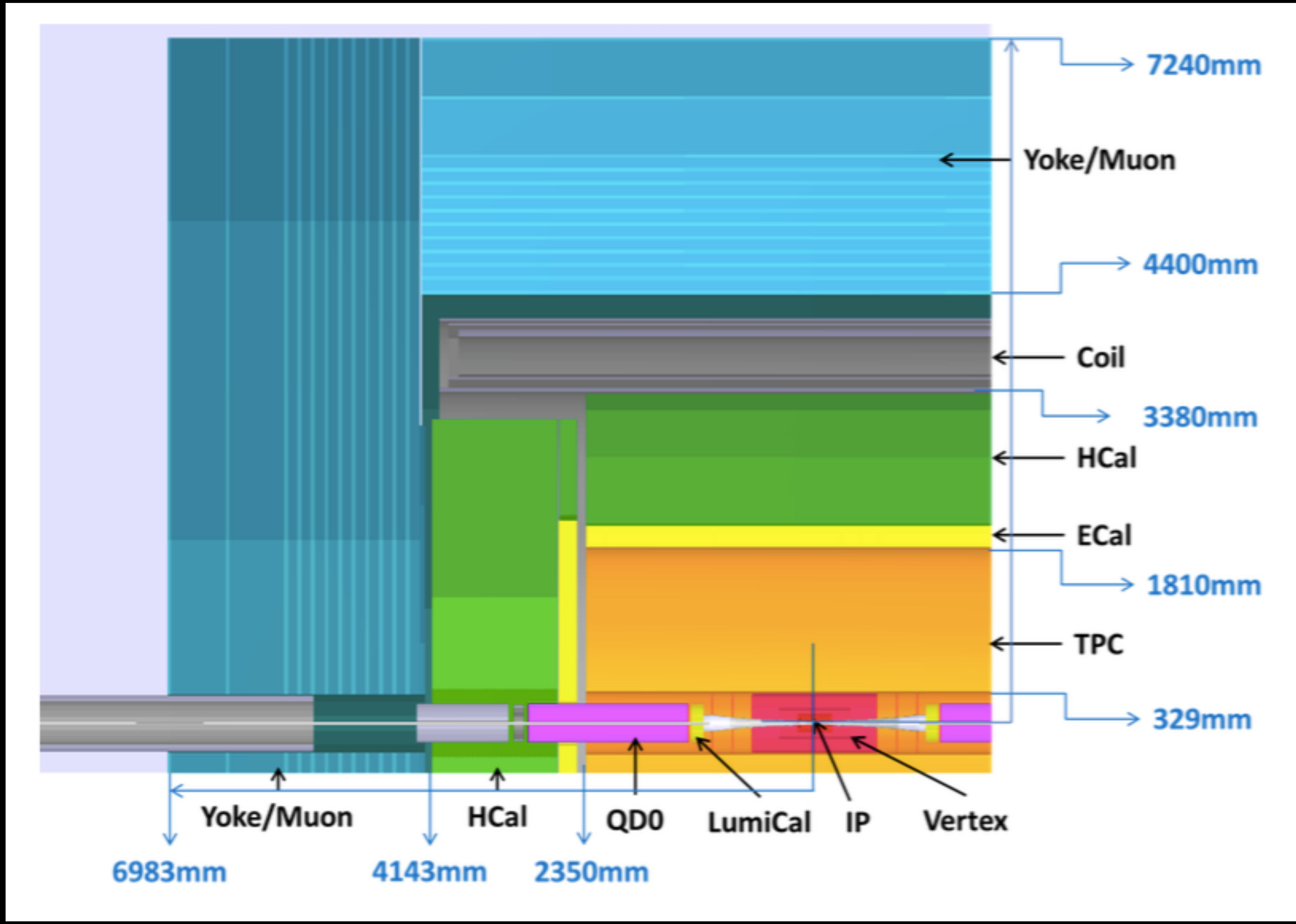
Outcome

- 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





Magnetic Field: 3 Tesla — changed from preCDR

- **Impact parameter resolution**: less than 5 μm ⟵ **Flavor tagging**
- **Tracking resolution**: $\delta(1/Pt) \sim 2\times10^{-5}\ (GeV^{-1})$ ⟵ **BR(Higgs → μμ)**
- **Jet energy resolution**: $\sigma_E/E \sim 0.3/\sqrt{E}$ ⟵ **W/Z dijet mass separation**

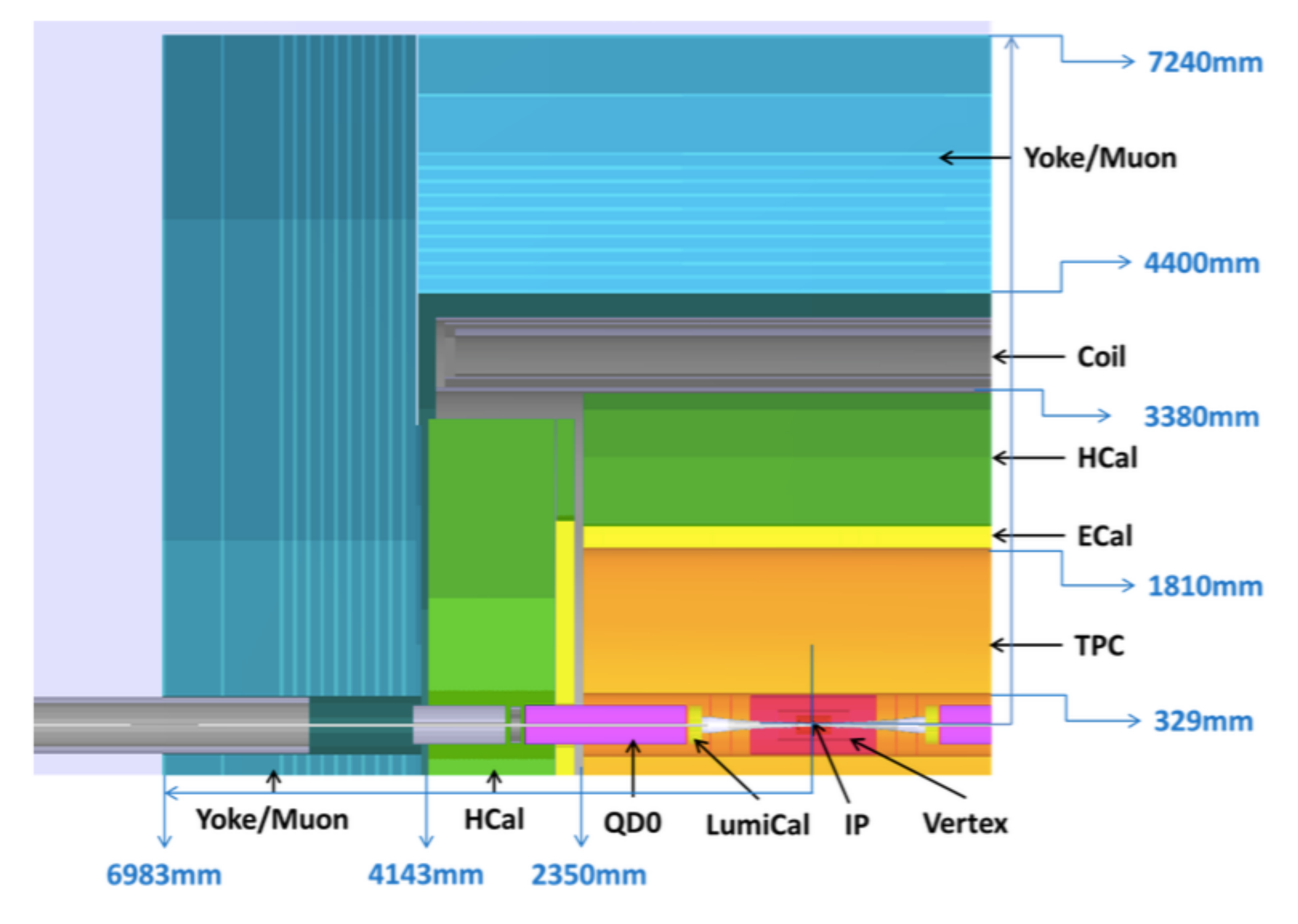
CEPC baseline detector: ILD-like: Design Considerations

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



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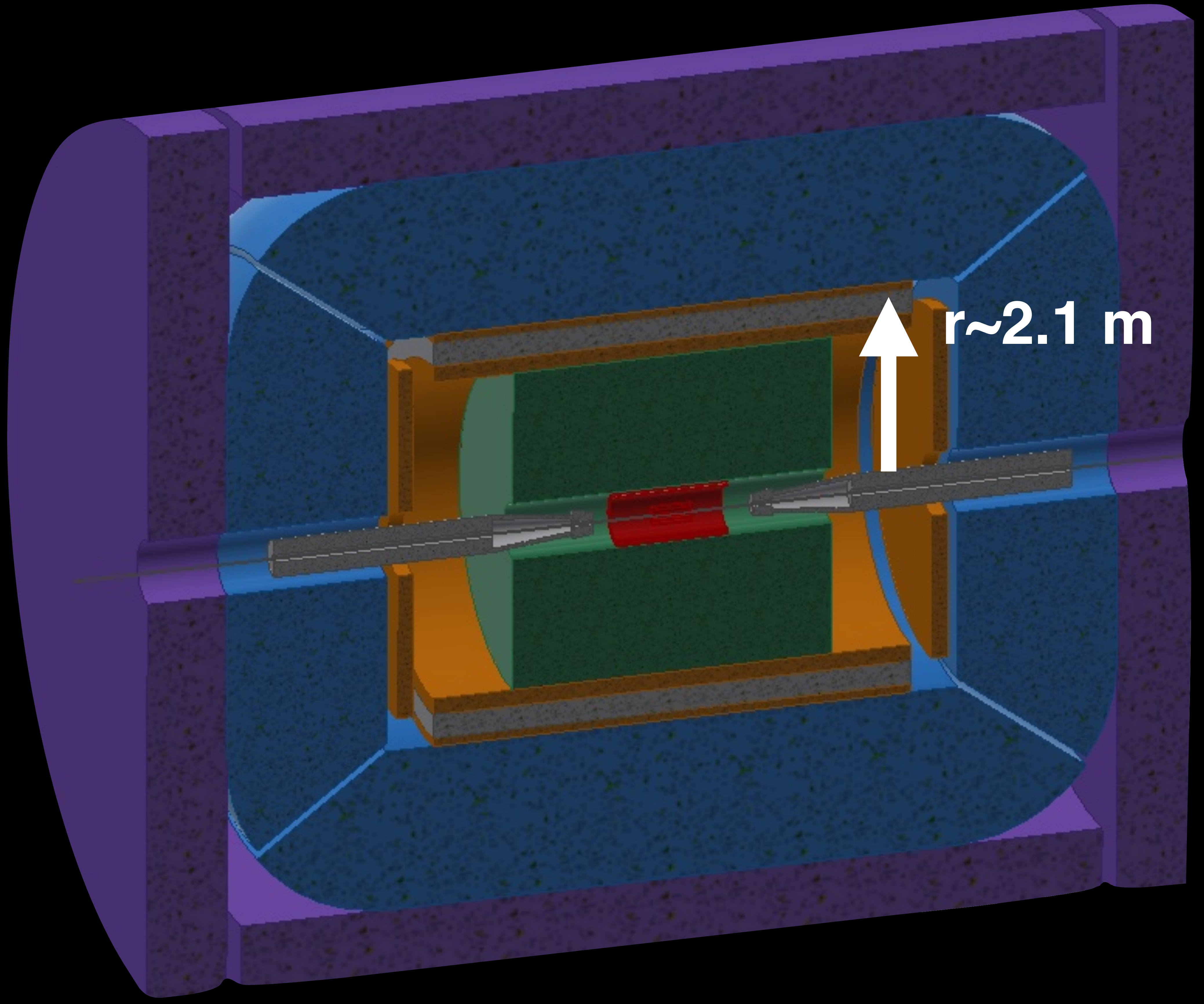
Low magnetic field detector concept

Session I: Franco Bedeschi
CDR: Section 3.3

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 λ_{int}

(yoke) muon chambers

Integrated into Conceptual Design Report
Dual readout calorimeter: Chapter 6
Talk: Session IV - Roberto Ferrari

Drift chamber: Chapter 5
Talk: Session II - Franco Gancagnolo

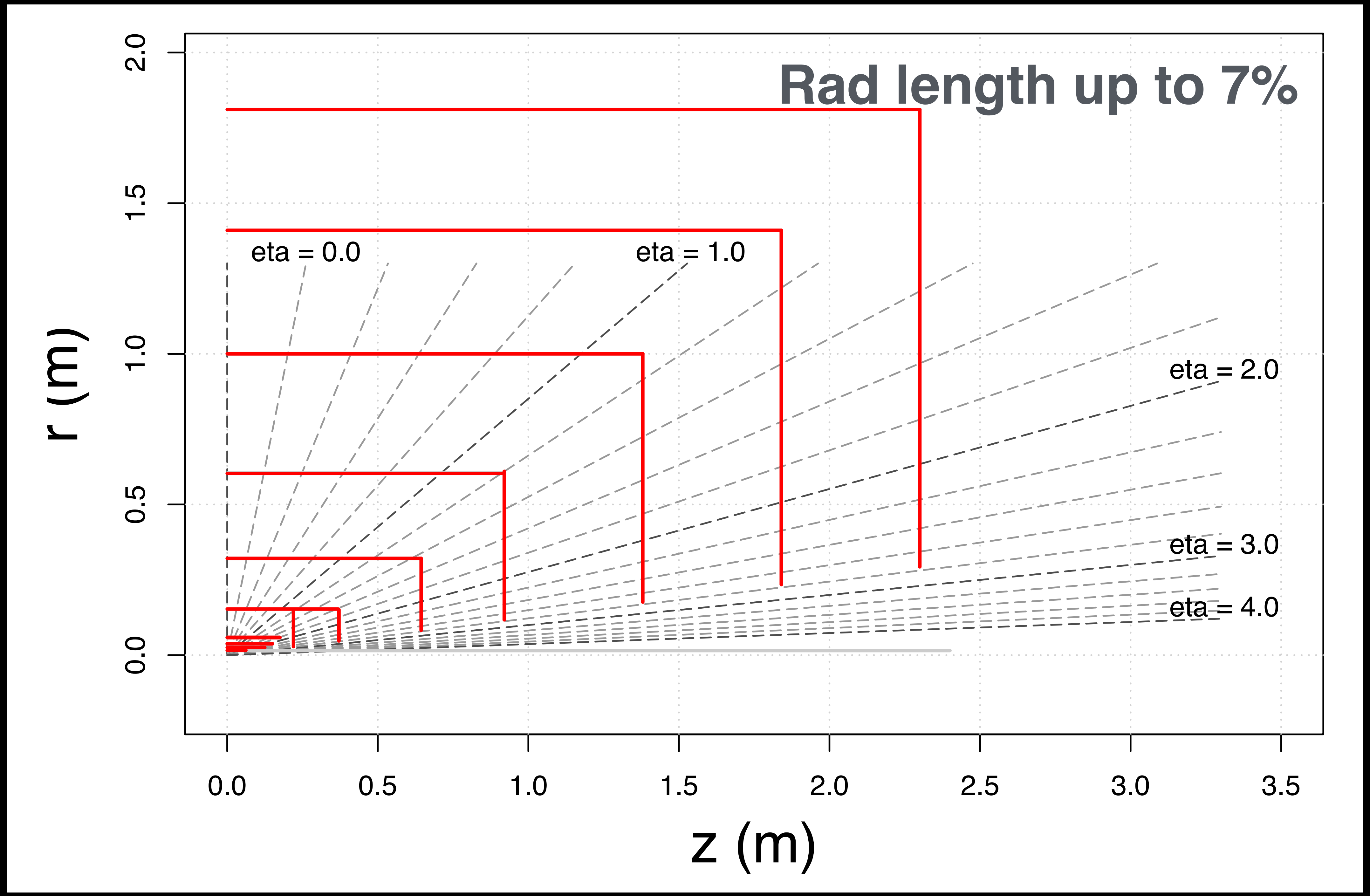
Muon detector (μRwell): Chapter 8
Talk: Session IV - Paolo Giacomelli

Full silicon tracker concept

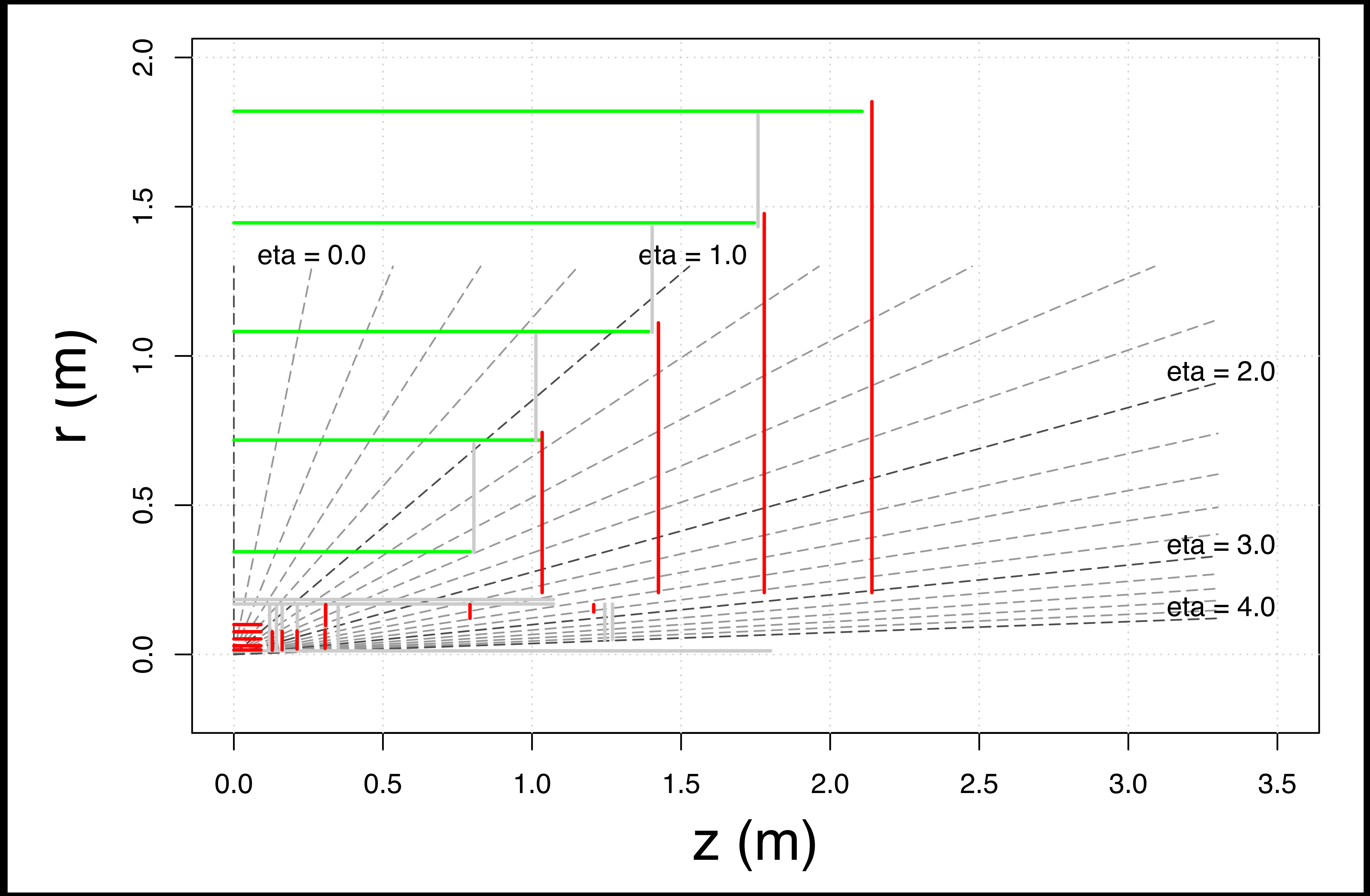
Session I: Weiming Yao
CDR: Section 5.3

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)