CEPC Detector Overall Facilities and Hall Issues

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2020.1.16

MDI mini-workshop， Hong Kong University of Science and Technology

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- Two IP/detector of CEPC
- Stray magnetic field distribution
- Cavern & Shaft
- Procedure of large piece down to cavern
- Ground building
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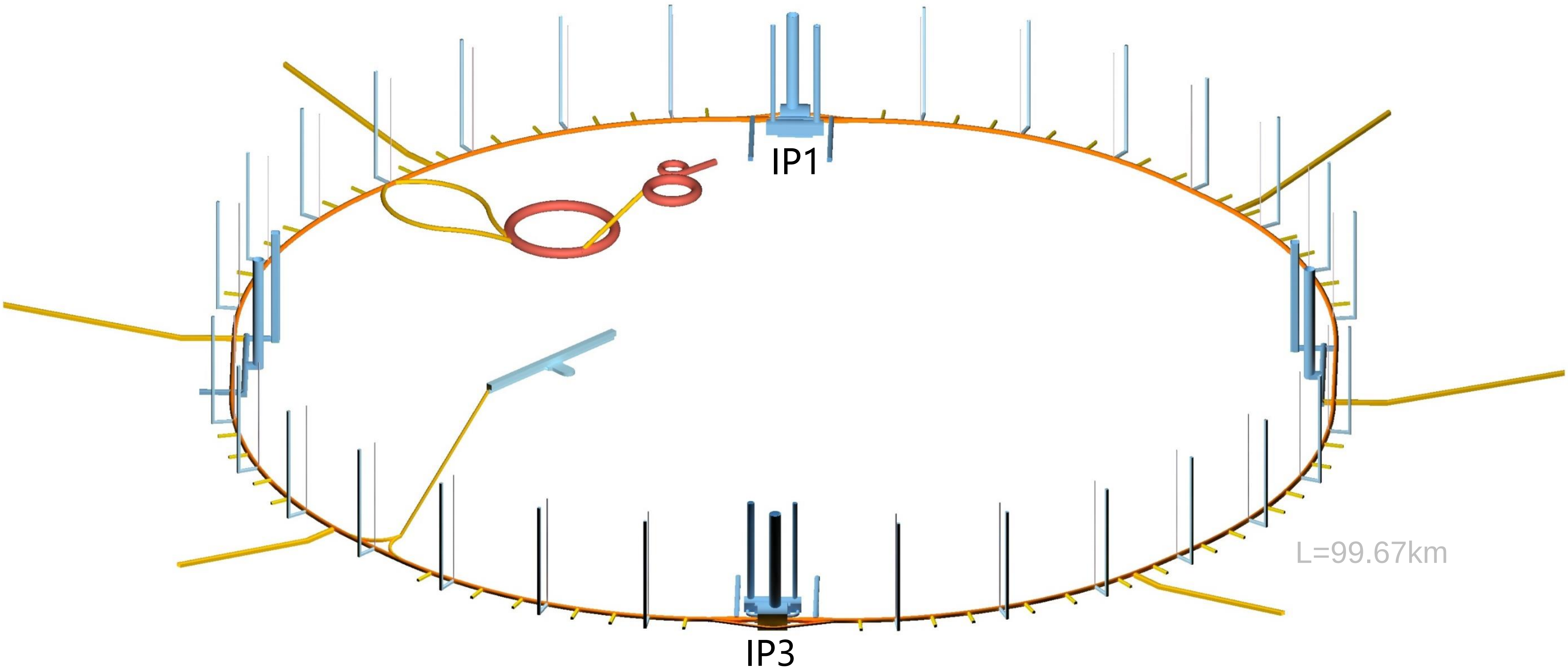
Design points

Meet the requirements from the following aspects

- **Overall requirements of the detector physics**
- **MDI complexity**
- **Largest downhole components**
- **Arrangement of detector assembly procedure (ground and cavern process planning)**
- **Project schedule (priority,parallel/serial)**
- **Electricity, cooling, air, gas, magnetic leakage and coupling**
- **Working space management**
- **Minimize costs**

CEPC layout



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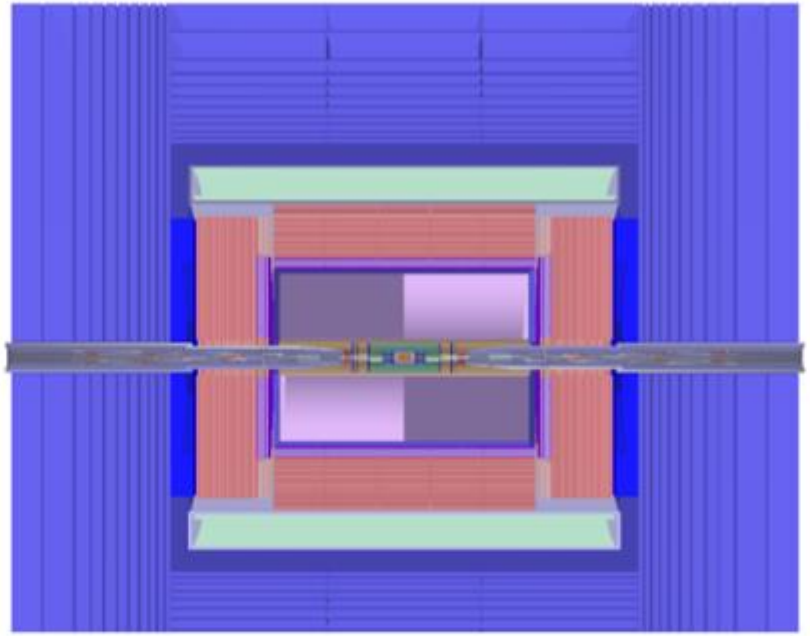
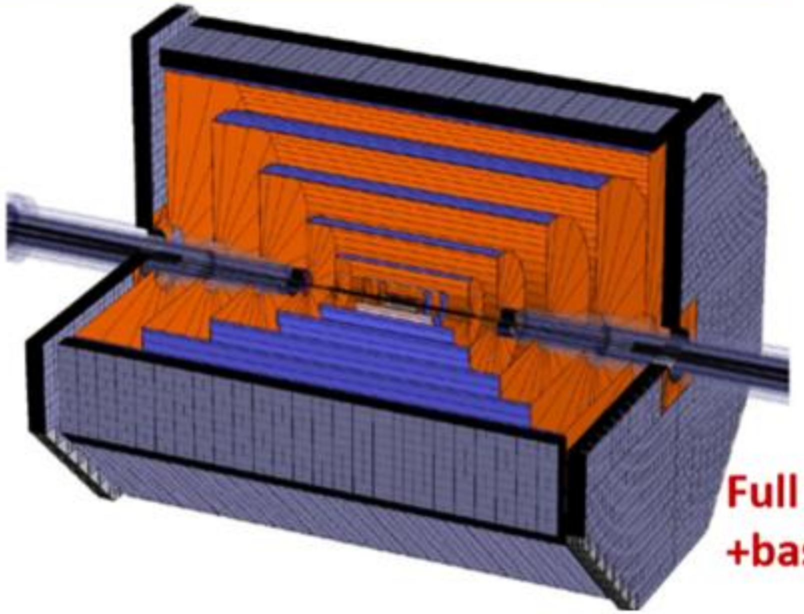
Two detectors in IP1/IP3

Two Detectors for CEPC

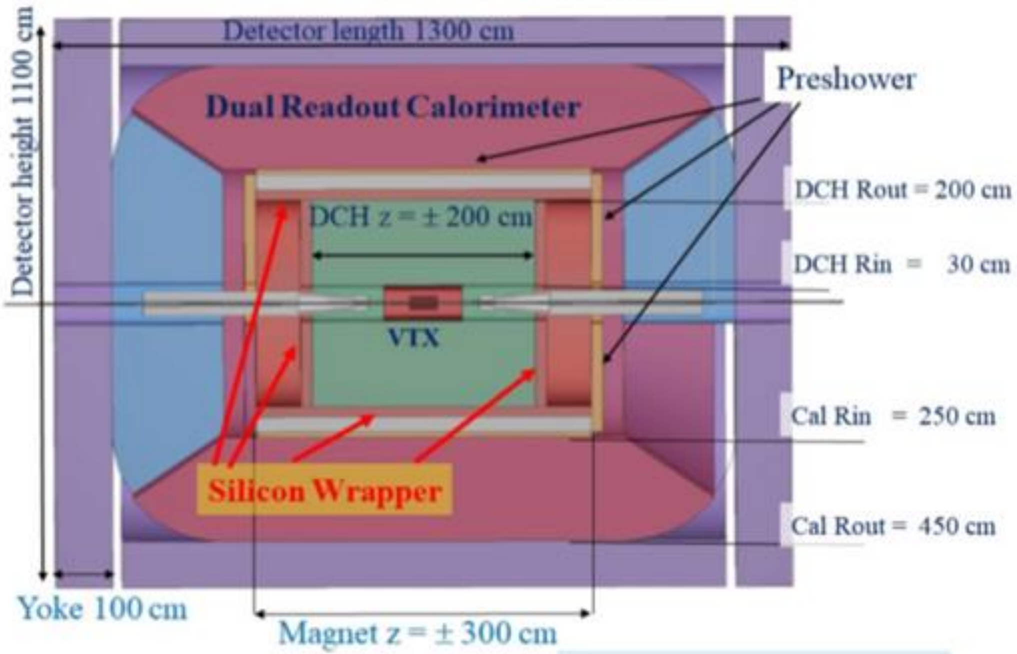


Baseline detector: pixel vertex detector, silicon inner tracker, a TPC, Si external tracker, ECAL, HCAL, 3 T B-field, embedded muon detector



Full silicon tracker
+baseline detector

Alternative detector



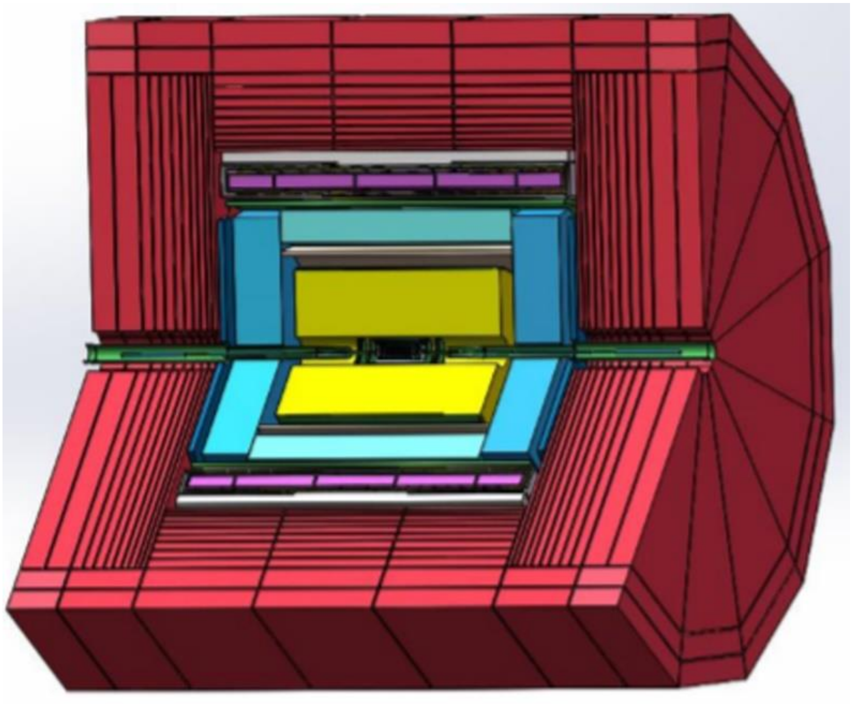
details from Joao

CEPC plans for 2 interaction points
IDEA detector also proposed for FCC-ee

Two Detectors for CEPC

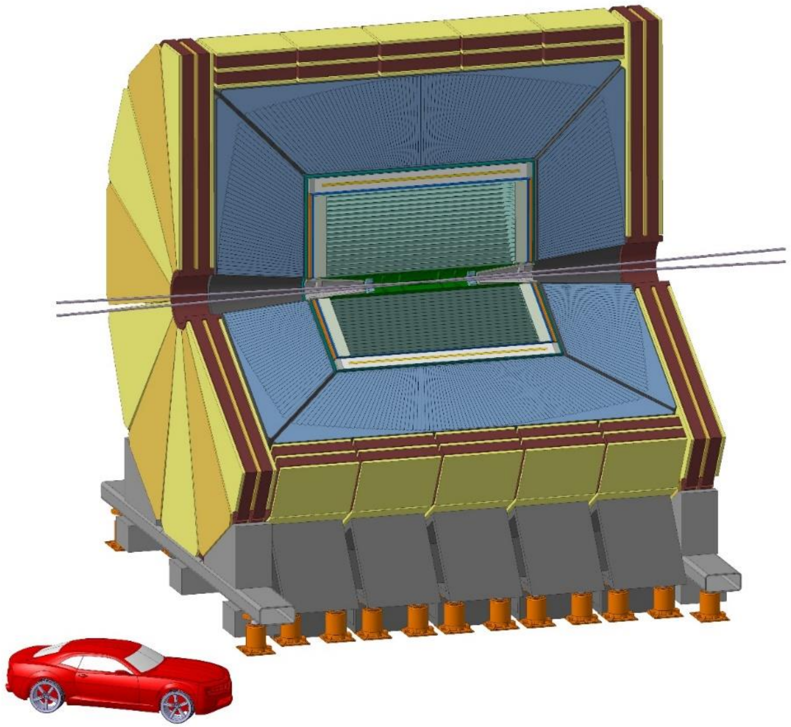
LTS Solenoid：
•Solenoid located outside calorimeter
•Inner diameter 7.2 m, length 7.4 m
•Central field： 3 T
•Superconductor： NbTi
•Operation temperature： 4.2 K

HTS Solenoid：
•Solenoid located outside calorimeter/less material
•Inner diameter 4 m, length 6 m
•Central field： 2 T
•Superconductor： YBCO
•Operation temperature： 20 K

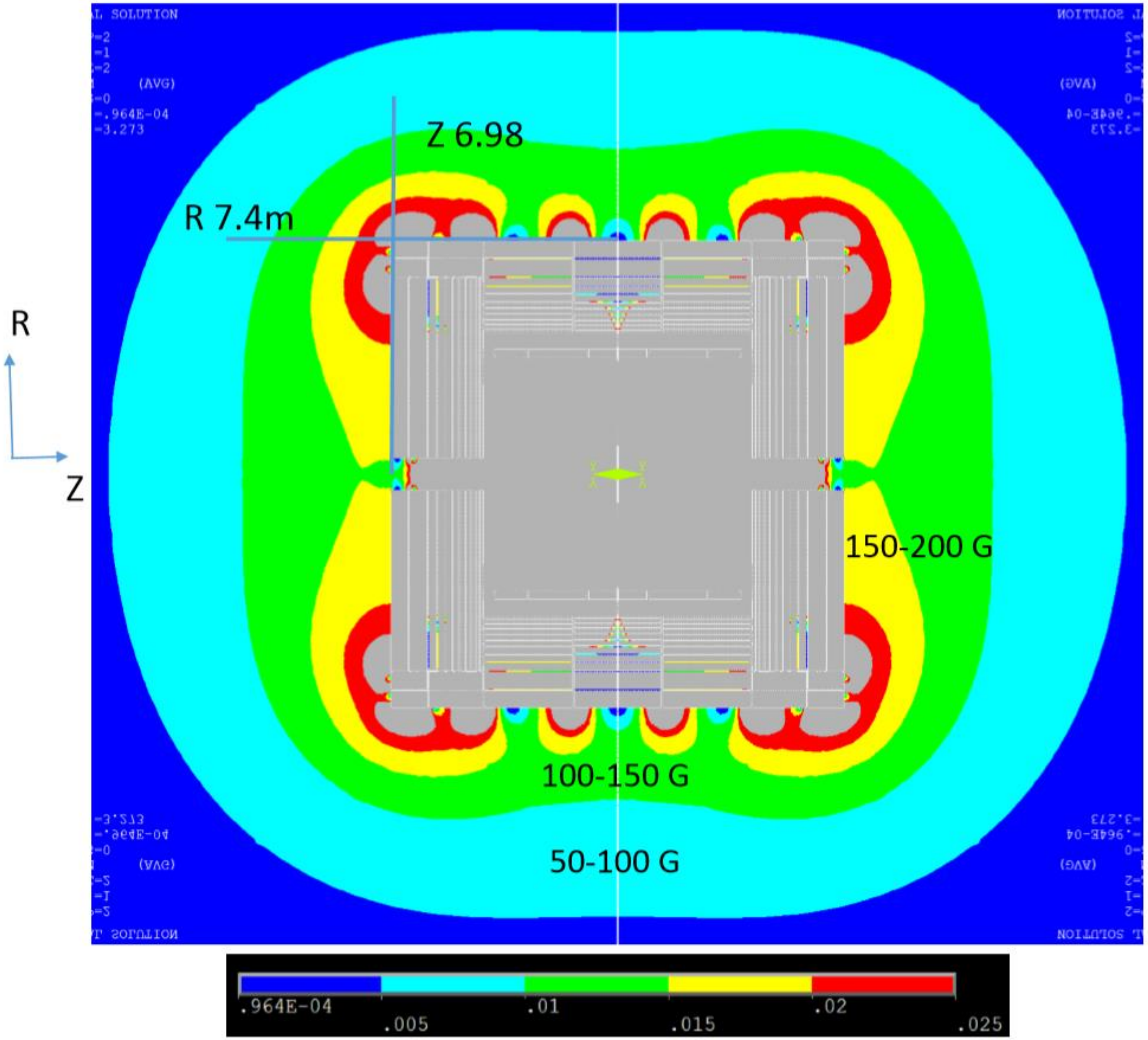


Baseline detector

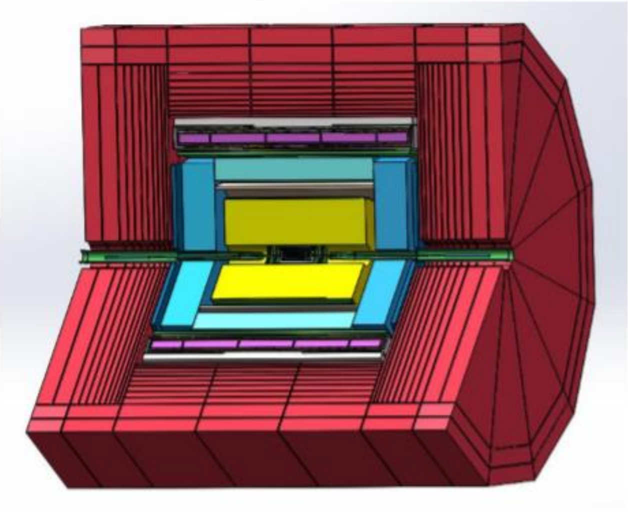
IDEA detector



Stray field of detector magnet



Baseline design of CEPC detector



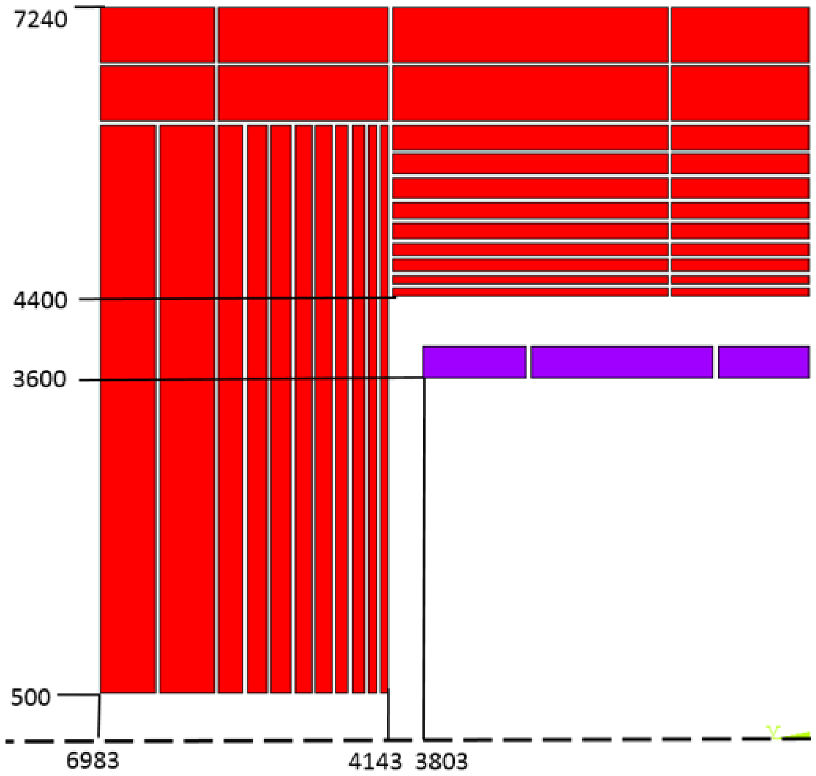
Stray field outside iron yoke

Stray field	R (m)	Z(m)
50 Guass	13.6	15.7
100 Guass	10.2	11.6
150 Guass	9.4	7.9

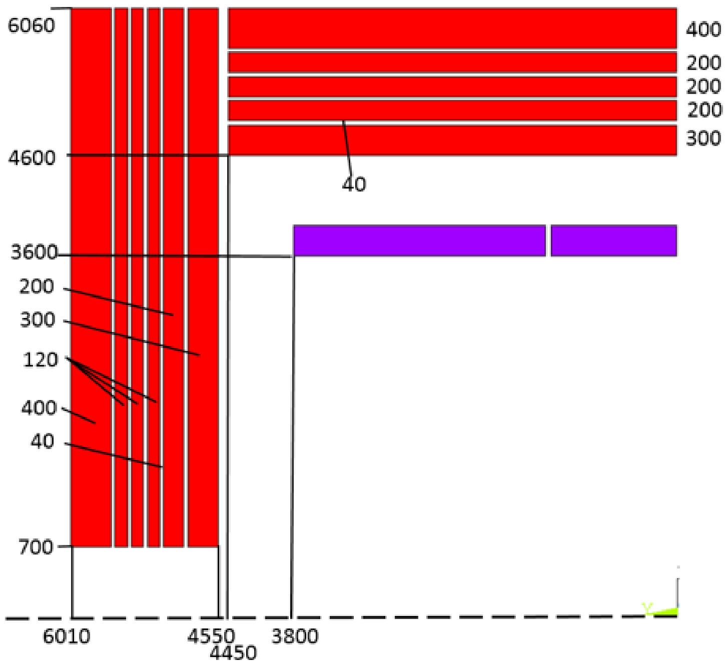
Stray field distribution around detector

Solenoid iron yoke reduction

- Optimization from detector overall design
  - → too much iron, no so many muon layers
- Significant reduction of baseline detector yoke



left: pre-CDR



right: new version

	pre-CDR	new version
Operating current (kA)	15.7	16.8
Yoke weight (t)	12573	5425

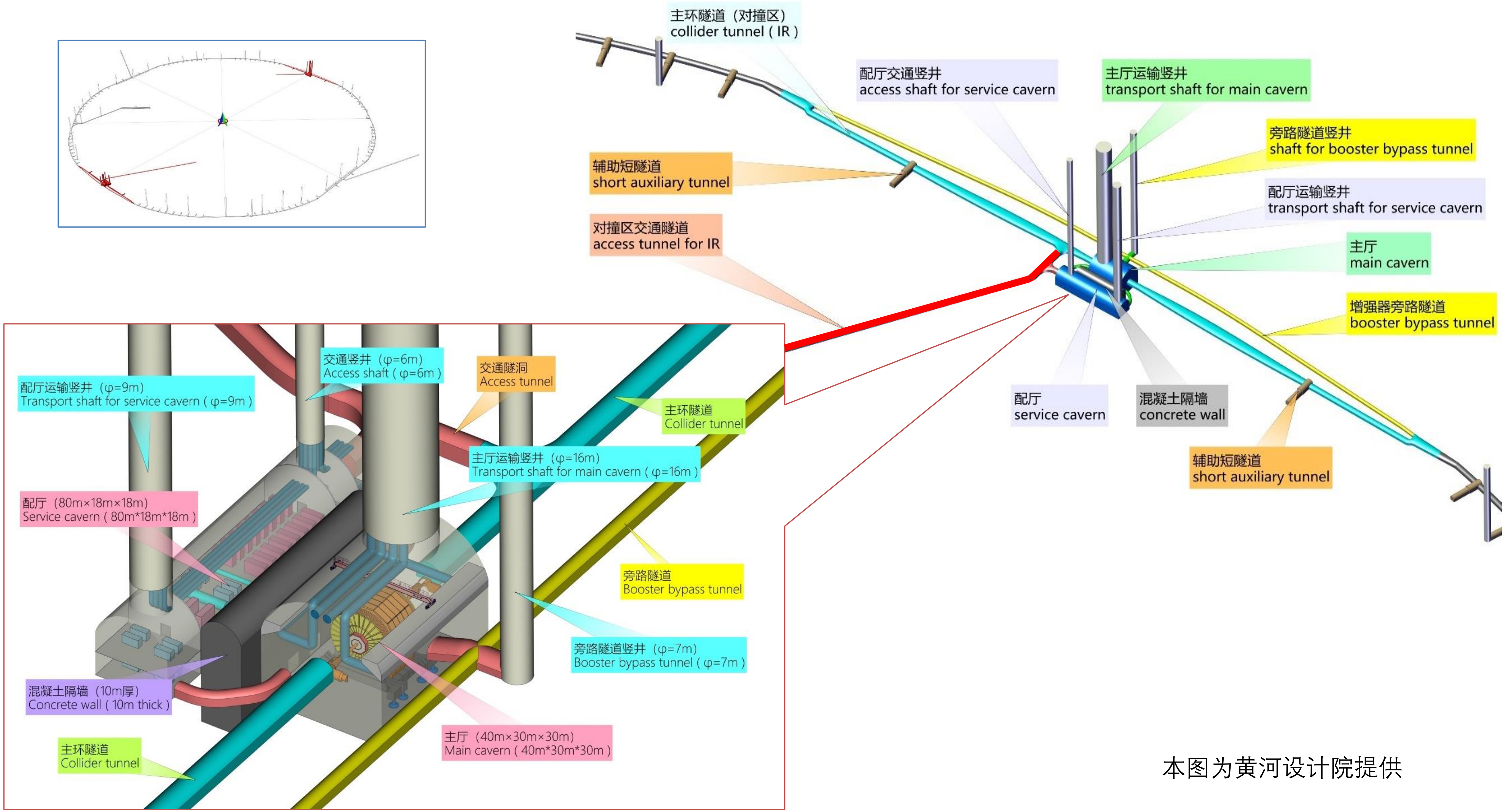
Solenoid stray field comparison

Stray field line		pre-CDR	new version
50 Gs	R direction	13.6 m	20.6 m
	Z direction	15.7 m	25.5 m
100 Gs	R direction	10.2 m	16.4 m
	Z direction	11.6 m	20.1 m

Field at booster location(R=25m)

Pre-CDR	8.4 Gs
New version	28 Gs

Cavern and Shafts



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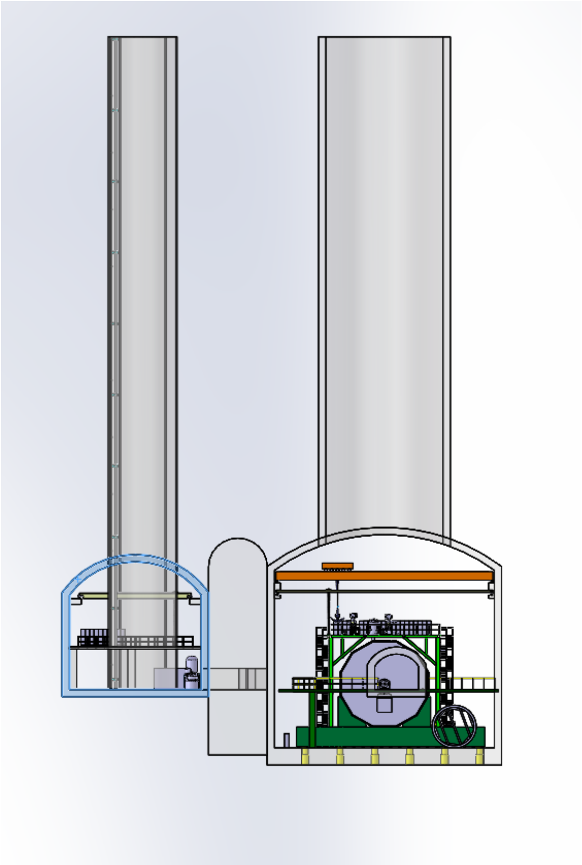
Cavern and Shafts

Main cavern

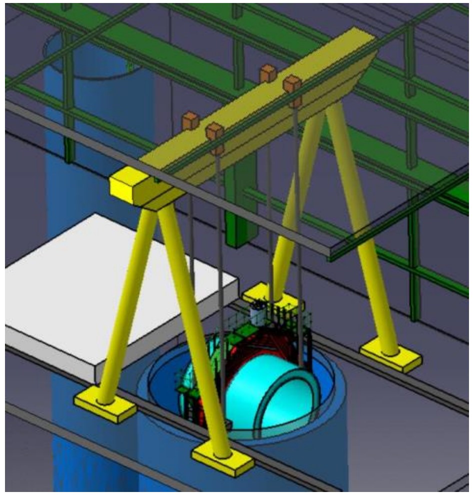
- 30*30*40 m(H*W*L)
- Host the detector and front-end electronics
- Host machine devices near colliding point
- Allow detector opening and maintenance
- equipped with two crane, 20 and 300 tons
- One main access shaft, Ø16 m, equipped with a 1000 tons gantry crane, permitting successive installation of the large detector pieces from ground

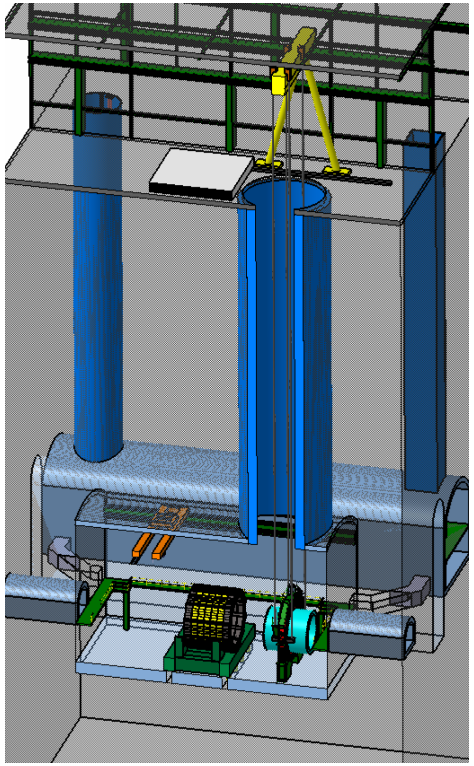


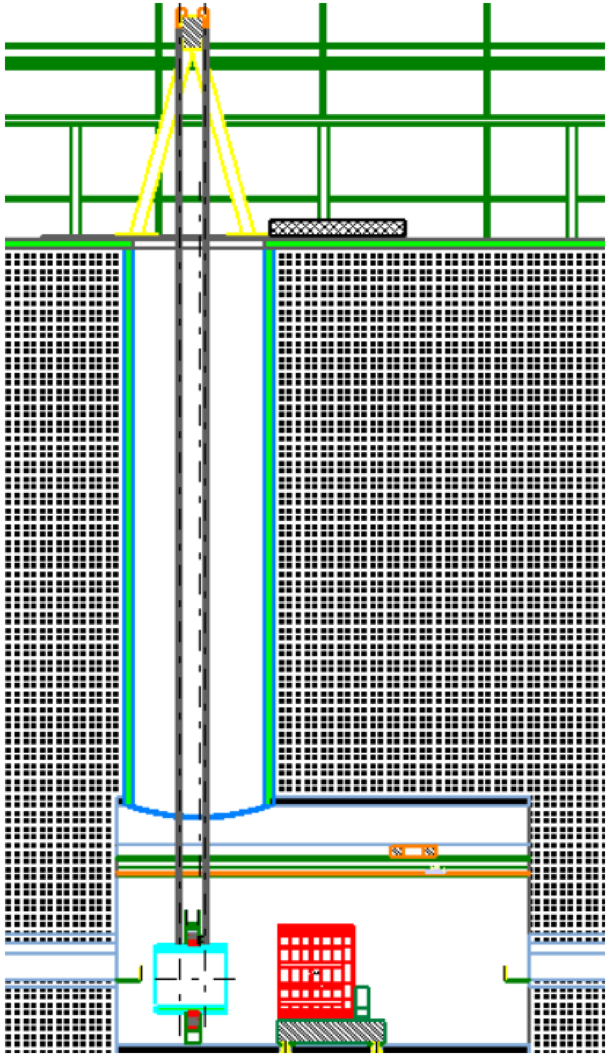
Auxiliary cavern

- 18*18*80 m(H*W*L)
- Parallel to the main cavern, accessible for maintenance during data taking
- One service shaft Ø9 m provides equipment access
- One personnel access shaft Ø6 m
- Electronics and power supply sub-detectors
- Detector working gas buffer and distribution
- Detector magnet power supply and quench protection device
- Cryogenic refrigerator and distribution for superconducting magnet
- Power supply and control cabinet of the machine colliding devices

Large part down to underground cavern

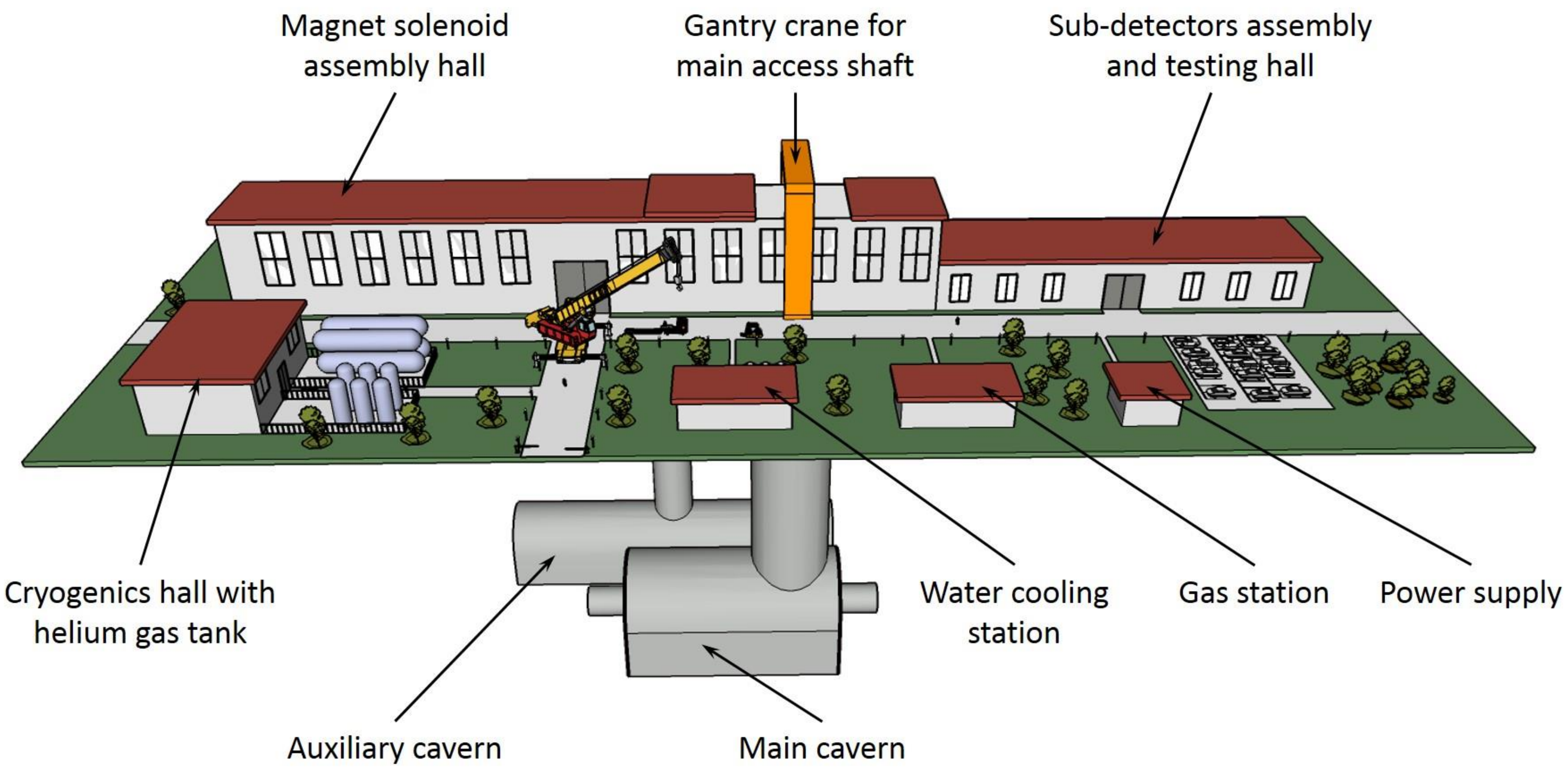






- Biggest and most heavy part to be lowered： detector solenoid magnet
- Solenoid are fully assembled and tested on the surface and descent into the cavern
- After landing, only moving longitudinally, no necessary heavy crane lifting, to integrate with the yoke and sub-detectors
- A temporarily/middle yoke ring pre-assembled together with the solenoid, weight about 800 tons
- To be optimized and improved with yoke assembly procedure

Ground building



Design from pre-CDR

Ground building

Layout of ground building around colliding area

Detector assembly and testing Hall:

- Most of sub-detector assemble and test here in series
- To avoid too many personal crowded in underground cavern
- Provides additional advantage of rehearsing the risky operations
- More convenience for hardware working groups

Latest design

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Summary

- This is a preliminary design for the detector overall facilities and layout
  - includes the underground experimental hall, auxiliary hall and shaft, surface building in the collision area
- Work to be done in the next
  - Connection between underground facilities and ground facilities
  - Pipelines, cable tray connecting with the detector
  - Peripheral equipment and devices will be updated gradually according to the progress of detector design
- Thanks to ATLAS/CMS of the LHC experiment, for their rich experiences from the large collider activities

Happy Chinese New Year!

预祝各位春节快乐！