2T Field of Detector Magnet

Zian Zhu/Feipeng Ning

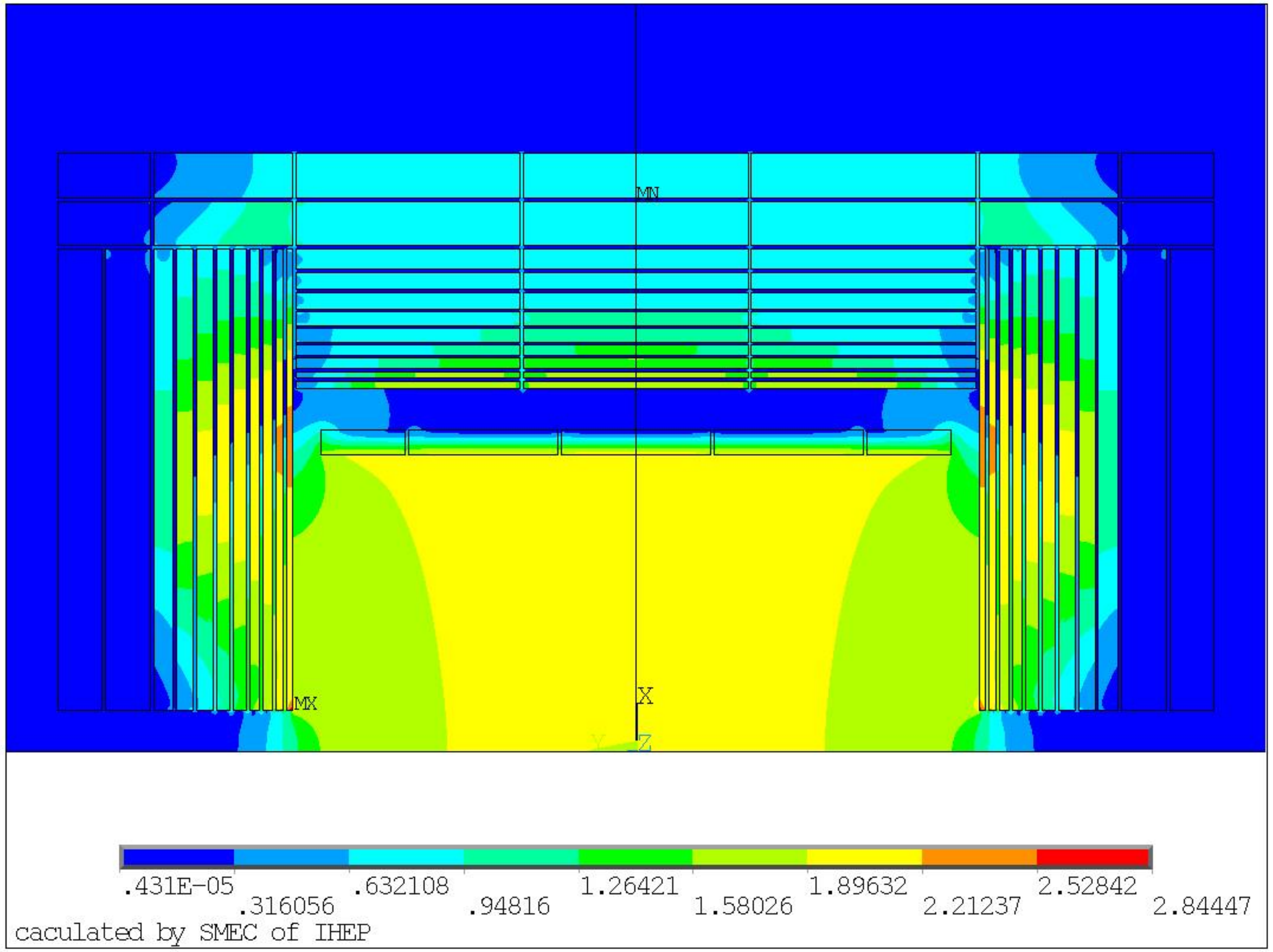
Institute of High Energy Physics

Feipeng Ning

Magnetic field design

- magnetic field design of 2 T.
  - The dimension is the same with 3.5 T;
  - Just the current decreases from 18,575 A to 10,347 A

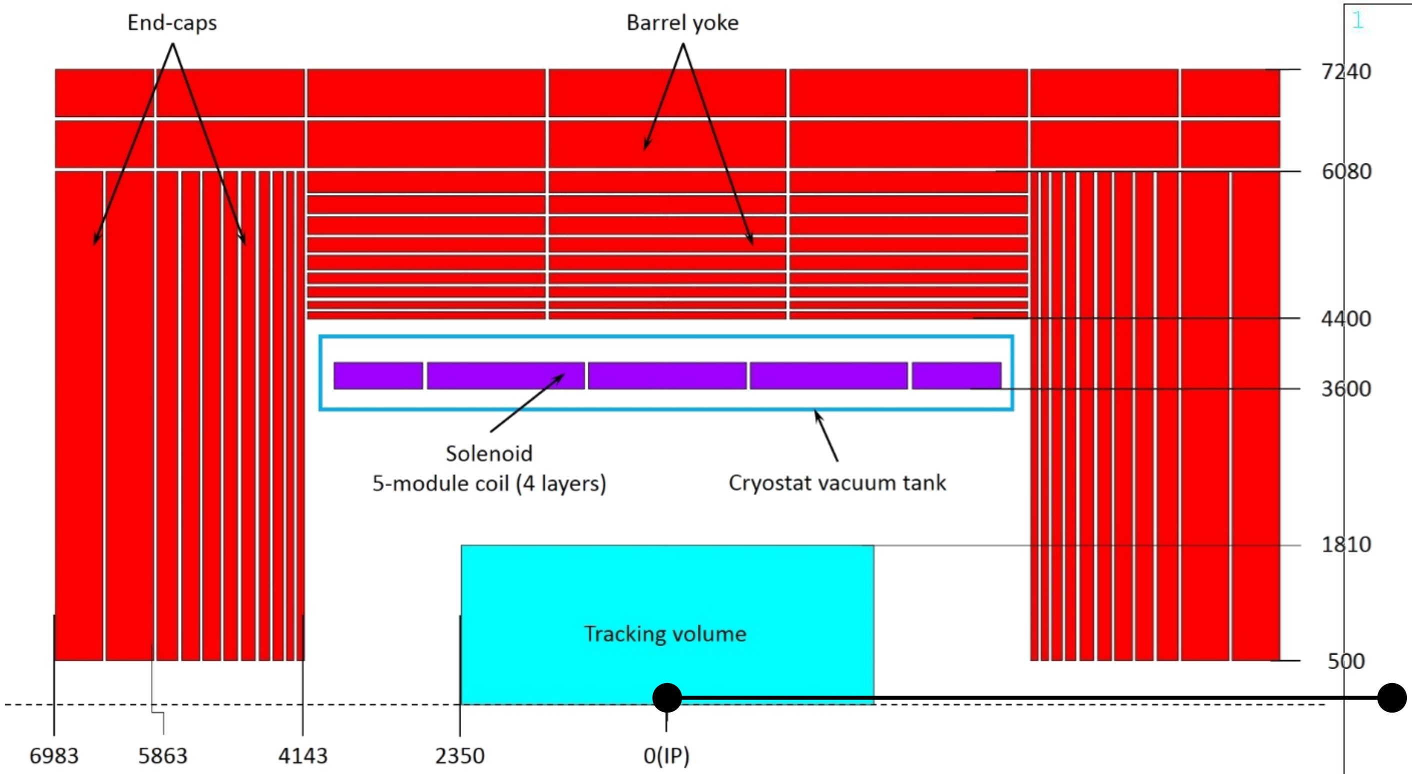
Central magnetic field	2 T
Operating current	10347 A
Stored energy	0.566 GJ
Inductance	10.57 H

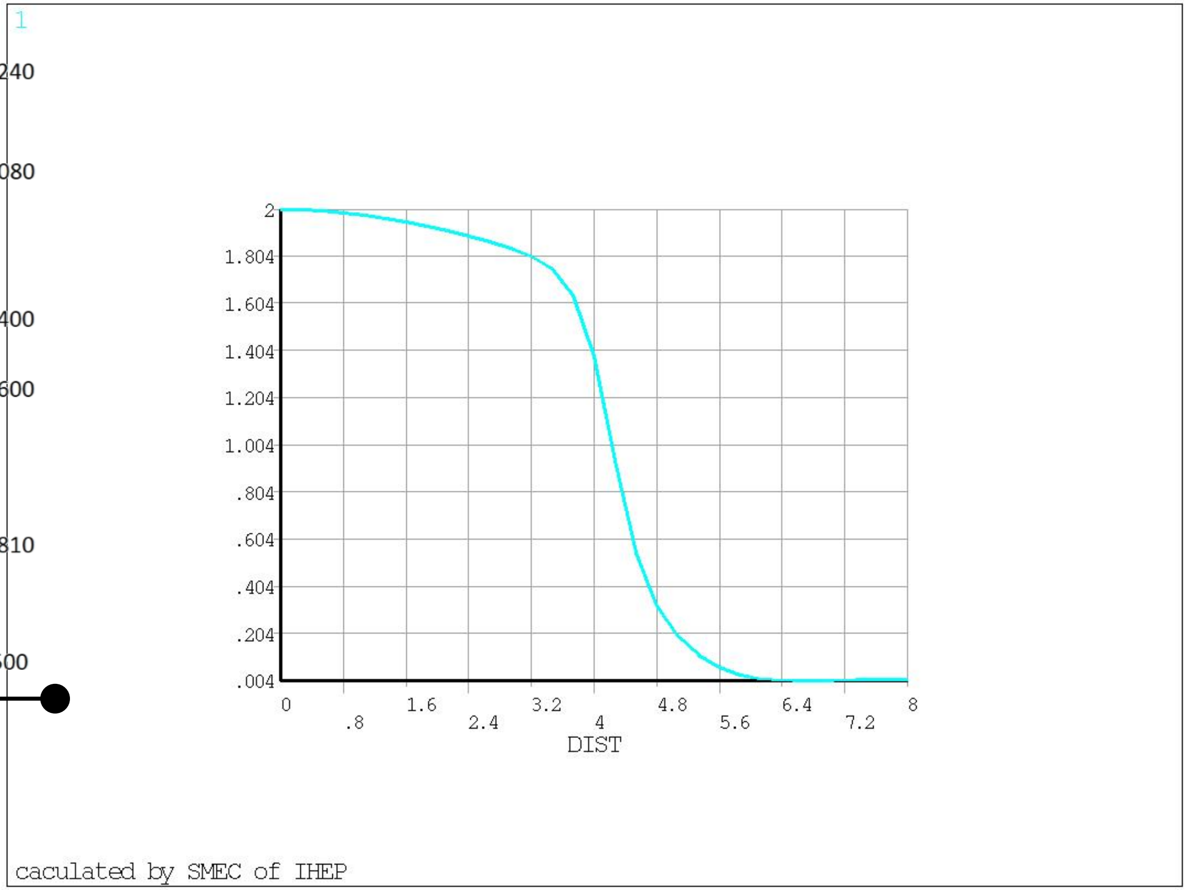


2D Magnetic field distribution(unit： T)

Feipeng Ning

Magnetic field design





Magnetic field distribution of axis from 0 to 8 meters

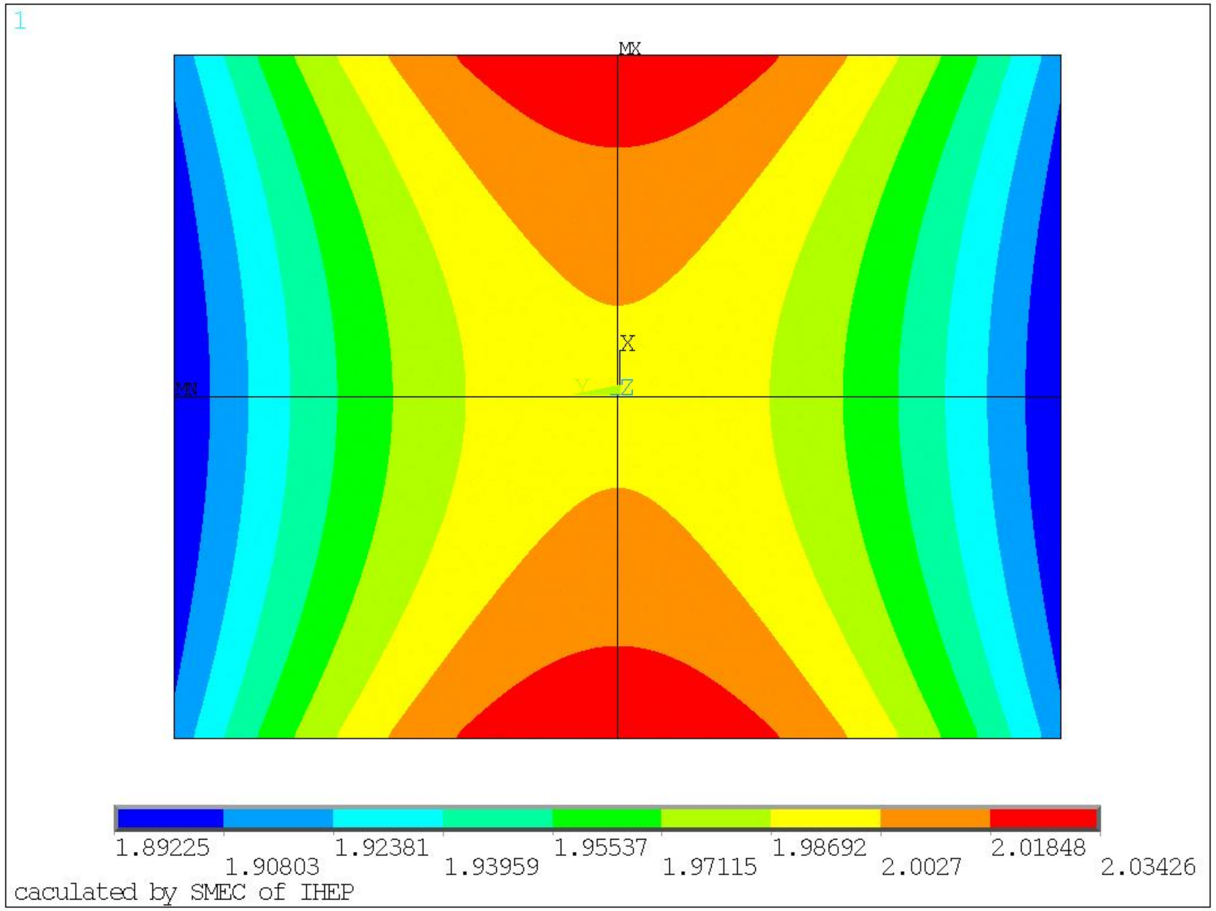
Magnetic field design

- The non uniformity of Tracking Volume (diameter 3.62m,length 4.7m) is 7.1%

$$B_p = \frac{B_{max} - B_{min}}{B_{center}} = 7.1\%$$

Central field	non uniformity
3.5 T	10.1%
3 T	9.2%
2 T	7.1%

The magnetic field distribution of TV.



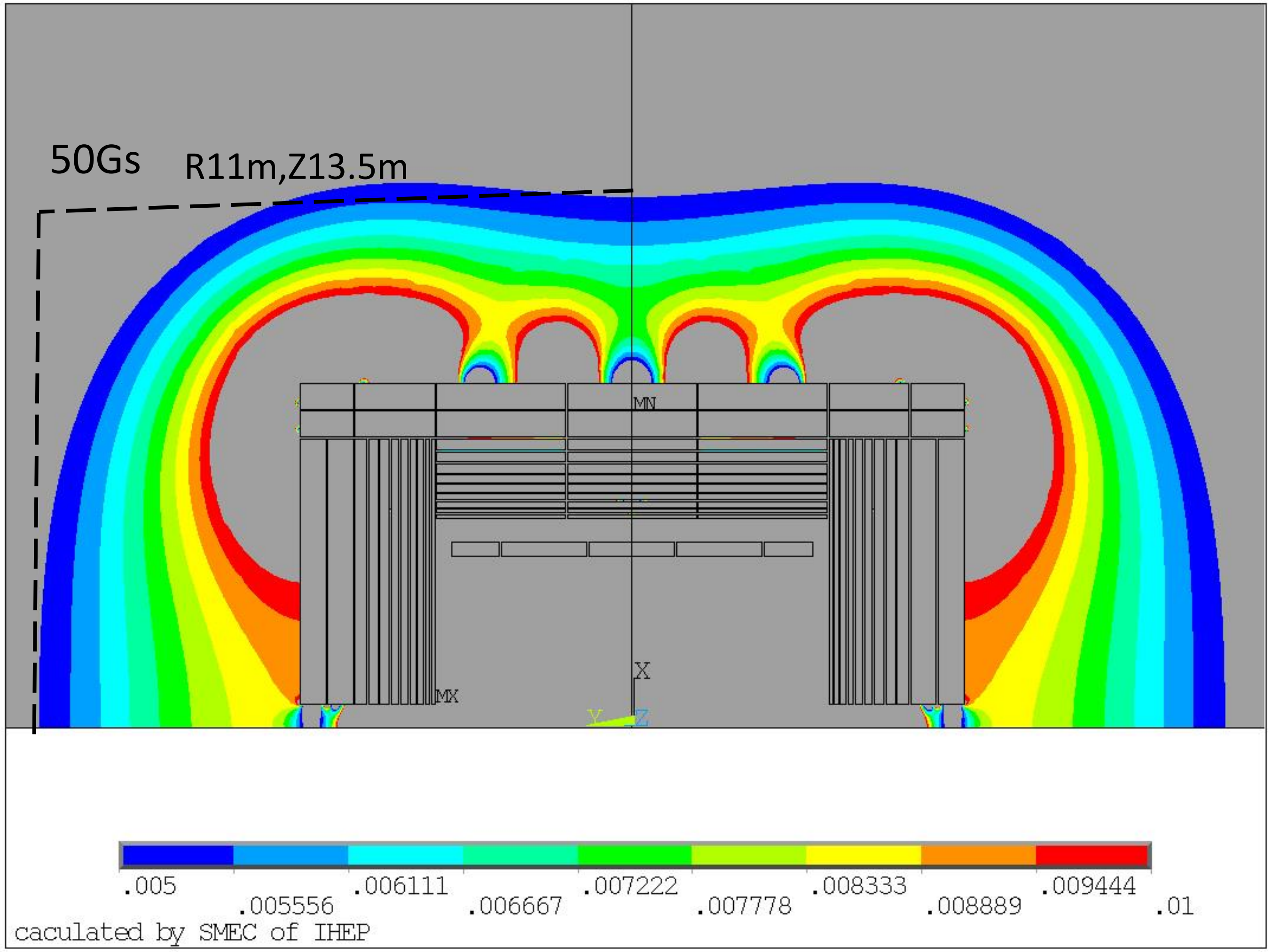
Feipeng Ning

Magnetic field design

Stray field distribution:

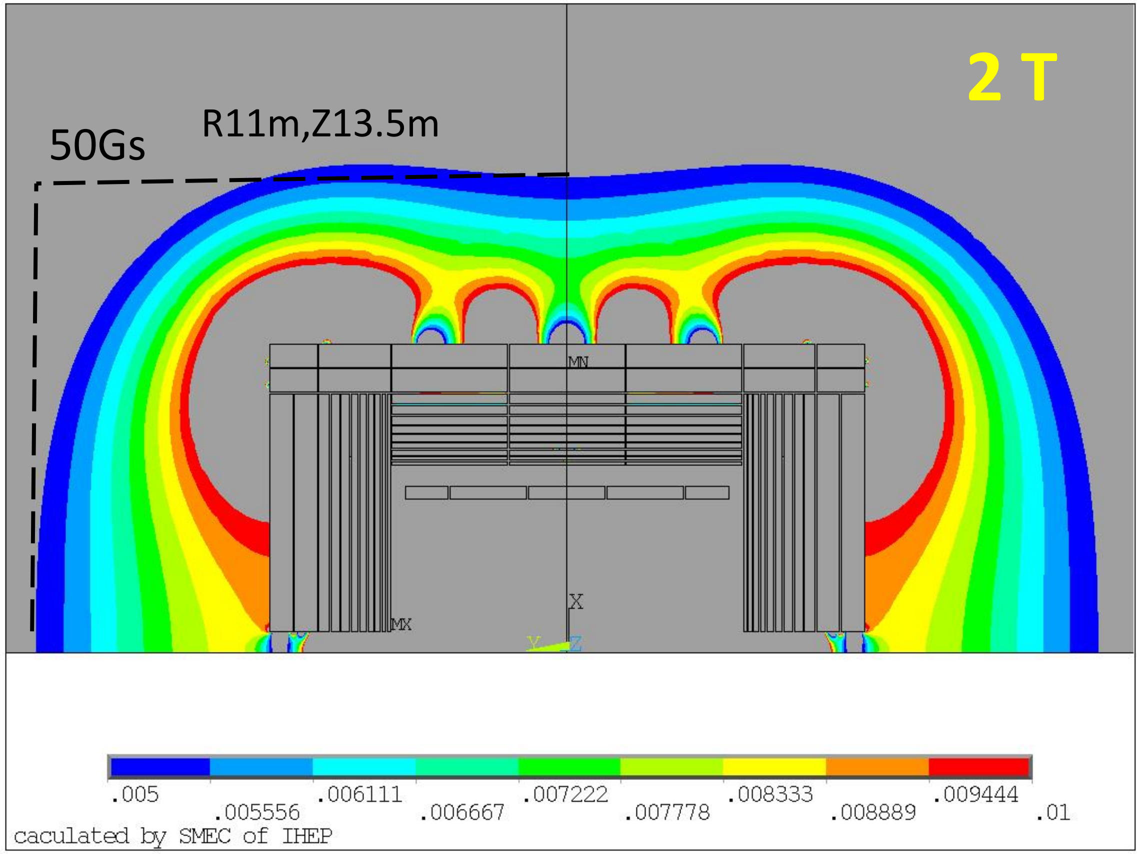
Compared to 3.5 T, base on the **same yoke.**

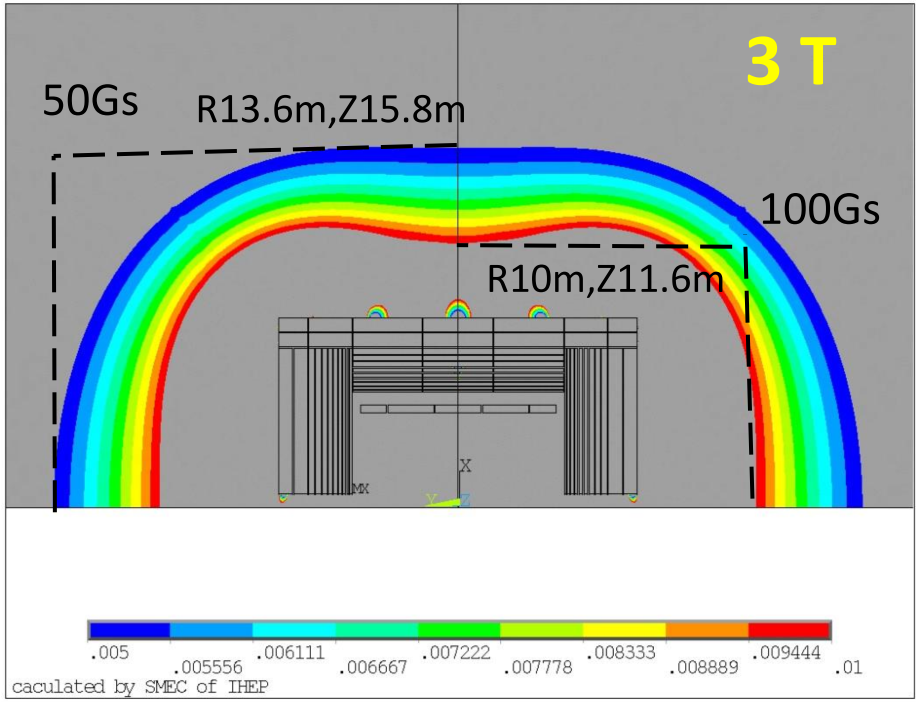
Stray field		3.5 T	3 T	2 T
50 Gs	R direction	14.8 m	13.6 m	11 m
	Z direction	17.2 m	15.8 m	13.5 m
100 Gs	R direction	11 m	10 m	
	Z direction	13 m	11.6 m	

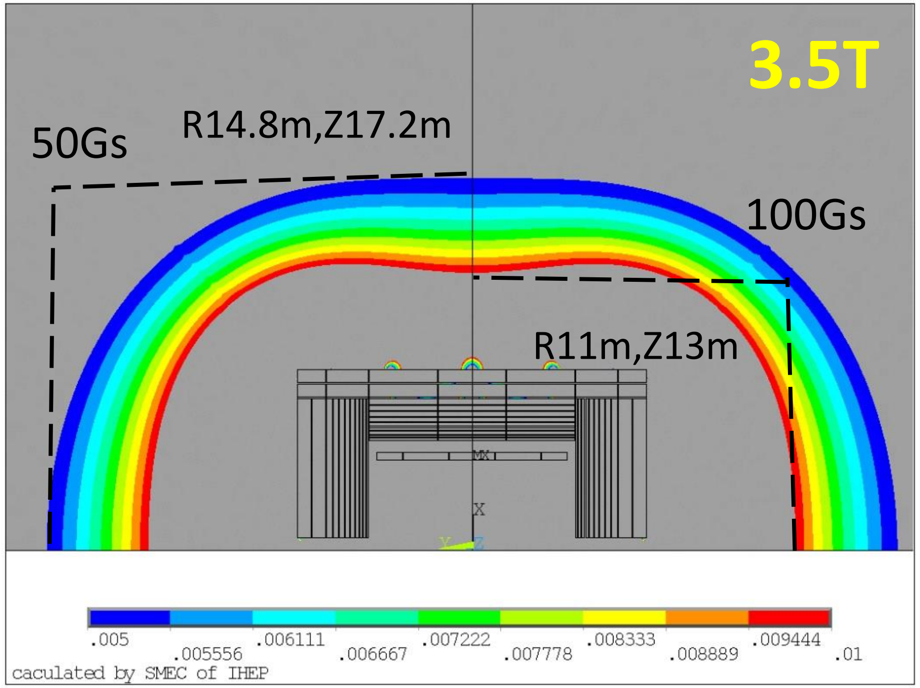


Stray field distribution outside the magnet (the field is given in T)

Stray field distribution



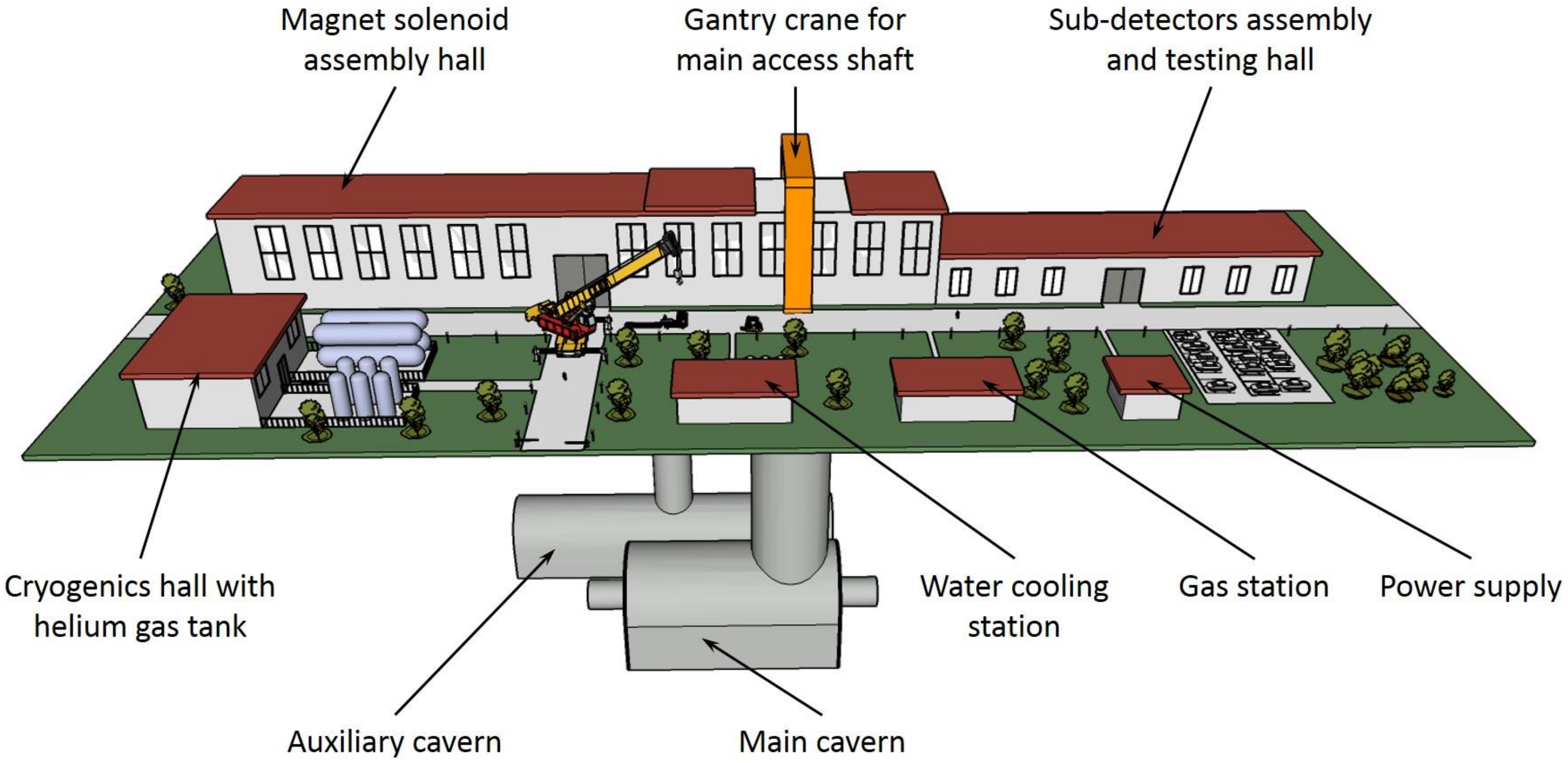




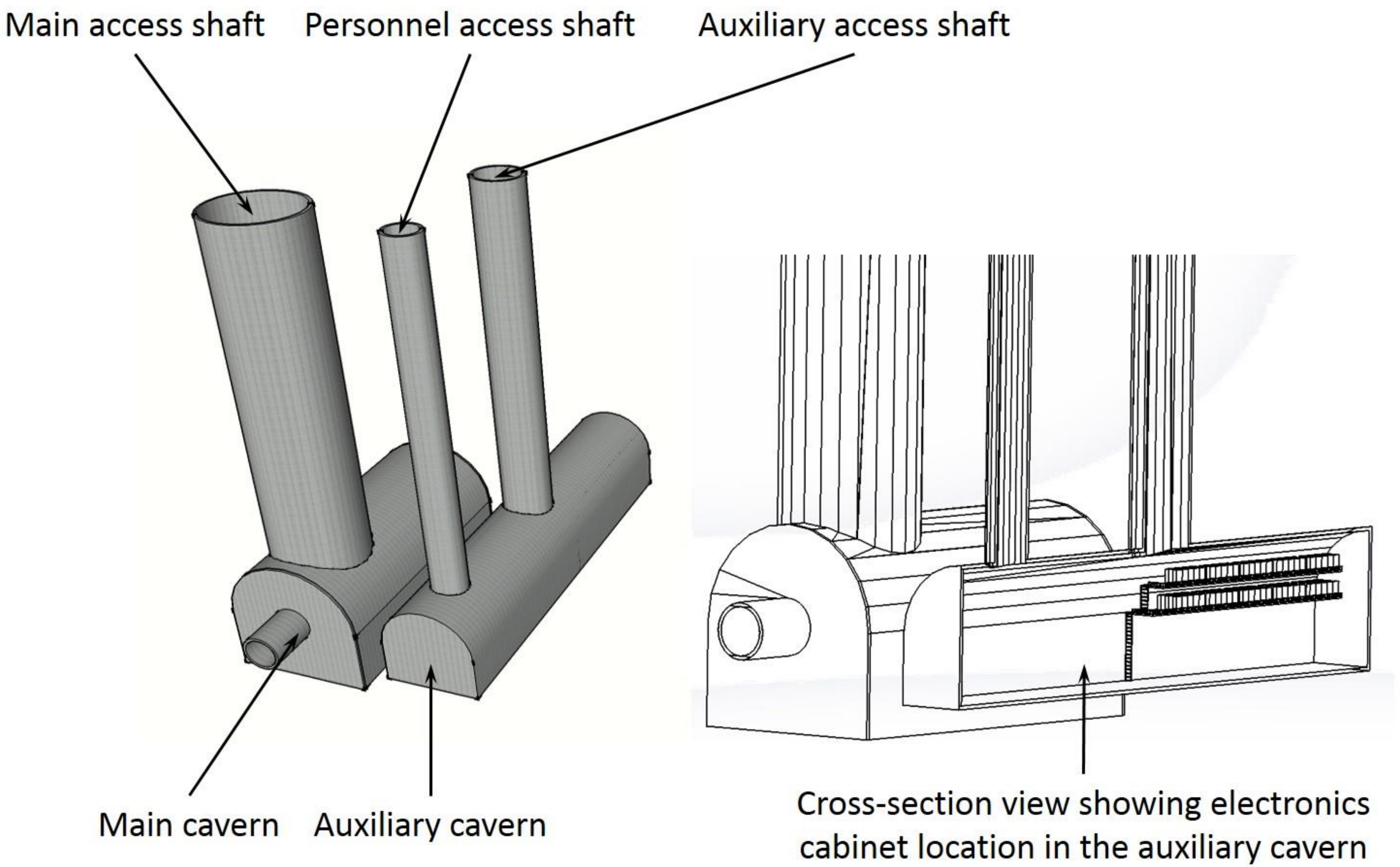
CEPC detector facility at the experimental area

Zian Zhu/Huan Yang

Institute of High Energy Physics


Magnet solenoid assembly hall
Gantry crane for main access shaft
Sub-detectors assembly and testing hall
Cryogenics hall with helium gas tank
Water cooling station
Gas station
Power supply
Auxiliary cavern
Main cavern

•A main cavern providing space for the withdrawal of the detector sections
30 m in width and height, 50 m long. The cavern is equipped with two crane, 60 and 300 tons, with an effective hook-span of 20 m.
•One main access shaft, permitting successive installation of the large detector pieces from ground,
The main access shaft , 15 m in diameter, equipped with a 300 tons gantry crane, provides an opening for the installation of the magnet and the detector units.
•An auxiliary cavern with its access shaft, placed parallel to the main cavern, housing the counting room and the technical services, should be accessible for maintenance work during data taking,
Overall diameter of 18 m and a total length of 80 m, which will divide into several sections: one for the counting room, one for the gas distribution system and one for the general detector services.
A second access shaft, 9 m in diameter, provides auxiliary cavern equipment installation.
•The auxiliary cavern may integrate with the machine by-pass tunnel
It also house the power supply and the cryogenic refrigerator for the magnet, the quench protection system, the cooling and ventilation distribution systems.
•One personnel access shaft serving both caverns
•Surface assembly and testing Hall: Several sub-detectors, such as the barrel and end-cap muon chambers, will be installed in the yoke in the underground cavern. Other sub-detector construction work can proceed in series on the surface as much, while others assembling in the underground cavern. Moreover, assembling and testing some of the detector on the surface provides the additional advantage of rehearsing the risky operations and convenience.


Main access shaft
Personnel access shaft
Auxiliary access shaft
Main cavern
Auxiliary cavern
Cross-section view showing electronics cabinet location in the auxiliary cavern

The requirements of the detector facility at the experimental area strongly depend on the assembly procedure of the detector, which is mainly constrained by the construction and the installation of the magnet.

CMS case: The middle ring assembled together with the solenoid, the biggest part to be lowered into the IR hall, weight about 3000 tons. A temporary gantry crane will be equipped.
CEPC case: Solenoid are fully assembled and tested on the surface and brought down into the experimental cavern with a minimum of further assembly work, and then integrated with the yoke ring. This scheme would reduce the size and weight of biggest and most heavy part to be lowered into the underground experimental hall, but longer assembly time at underground cavern.