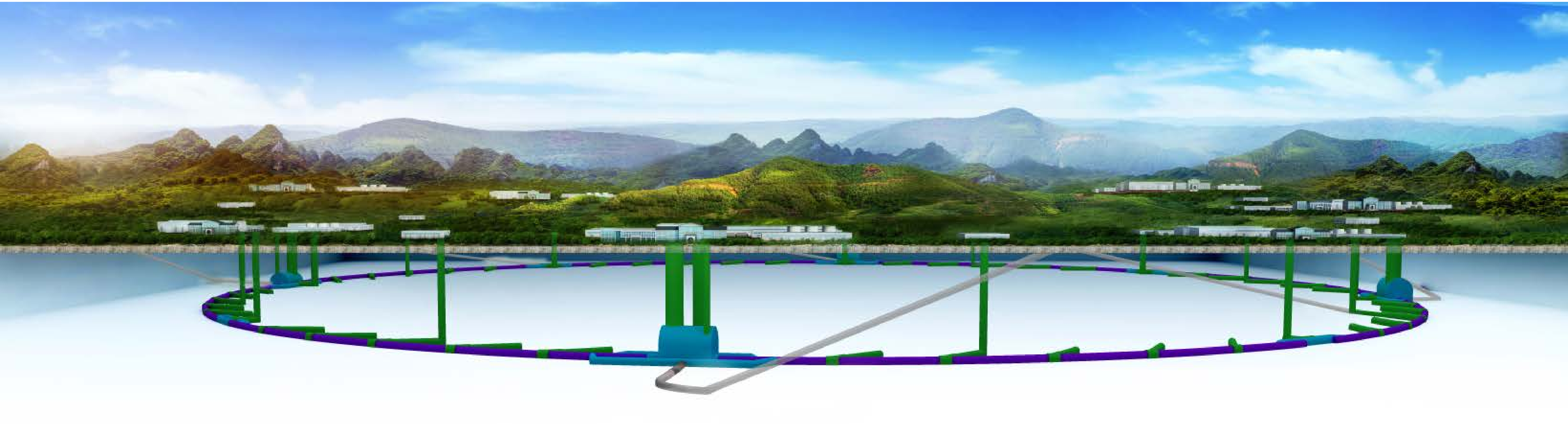
黄河勘测规划设计有限公司
Yellow River Engineering Consulting Co.,Ltd

CEPC Civil Engineering design and Infrastructure

Yu Xiao



26 Sep 2018

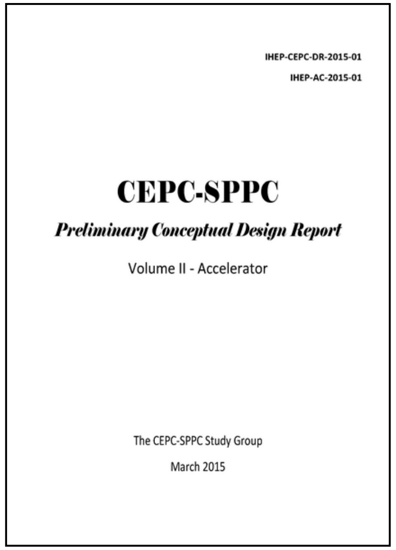
Contents

01 Working Process

黄河勘测规划设计有限公司
Yellow River Engineering Consulting Co.,Ltd

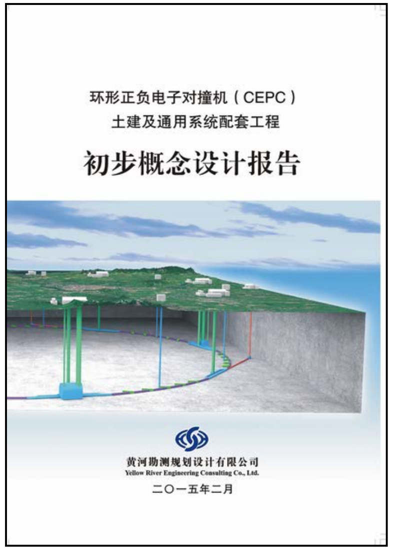
Pre-CDR

CDR

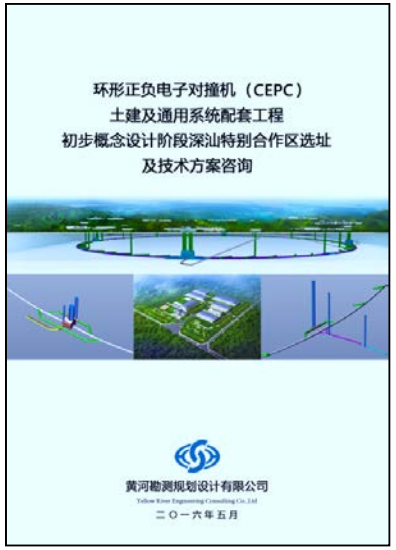

IHEP-CEPC-DR-2015-01
IHEP-AC-2015-01

CEPC-SPPC
Preliminary Conceptual Design Report
Volume II - Accelerator

The CEPC-SPPC Study Group
March 2015


环形正负电子对撞机（CEPC）
土建及通用系统配套工程
初步概念设计报告

黄河勘测规划设计有限公司
Yellow River Engineering Consulting Co., Ltd.
二〇一五年二月

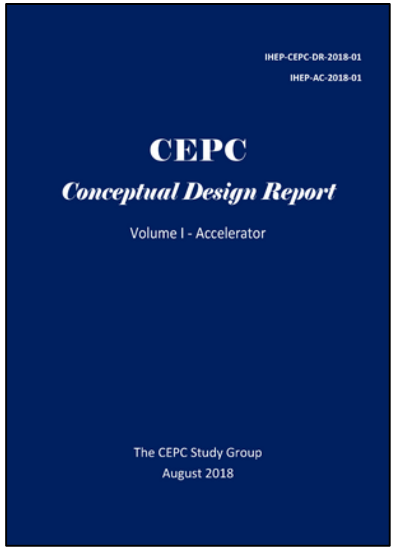

环形正负电子对撞机（CEPC）
土建及通用系统配套工程
初步概念设计阶段深汕特别合作区选址
及技术方案咨询

黄河勘测规划设计有限公司
二〇一六年五月


环形正负电子对撞机（CEPC）
土建及通用系统配套工程
初步概念设计阶段黄陵区域
初步选址及技术方案咨询报告
（中间成果）

郑重声明

黄河勘测规划设计有限公司
Yellow River Engineering Consulting Co., Ltd.
二〇一七年六月


IHEP-CEPC-DR-2018-01
IHEP-AC-2018-01

CEPC
Conceptual Design Report
Volume I - Accelerator

The CEPC Study Group
August 2018

2013.4 ~ 2015.3	2014.5 ~ 2016.8	2014.6 ~ 2017.7	2016.9	2017.7 ~ 2017.8	2017.9	2017.9 ~ now
• Site selection in Hebei	• Site selection in Guangdong	• Site selection in Shaanxi	• Site selection in Jiangsu	• Site selection in Baoding, Hebei	• Site selection in Zhejiang	• 100km design of Qinhuangdao

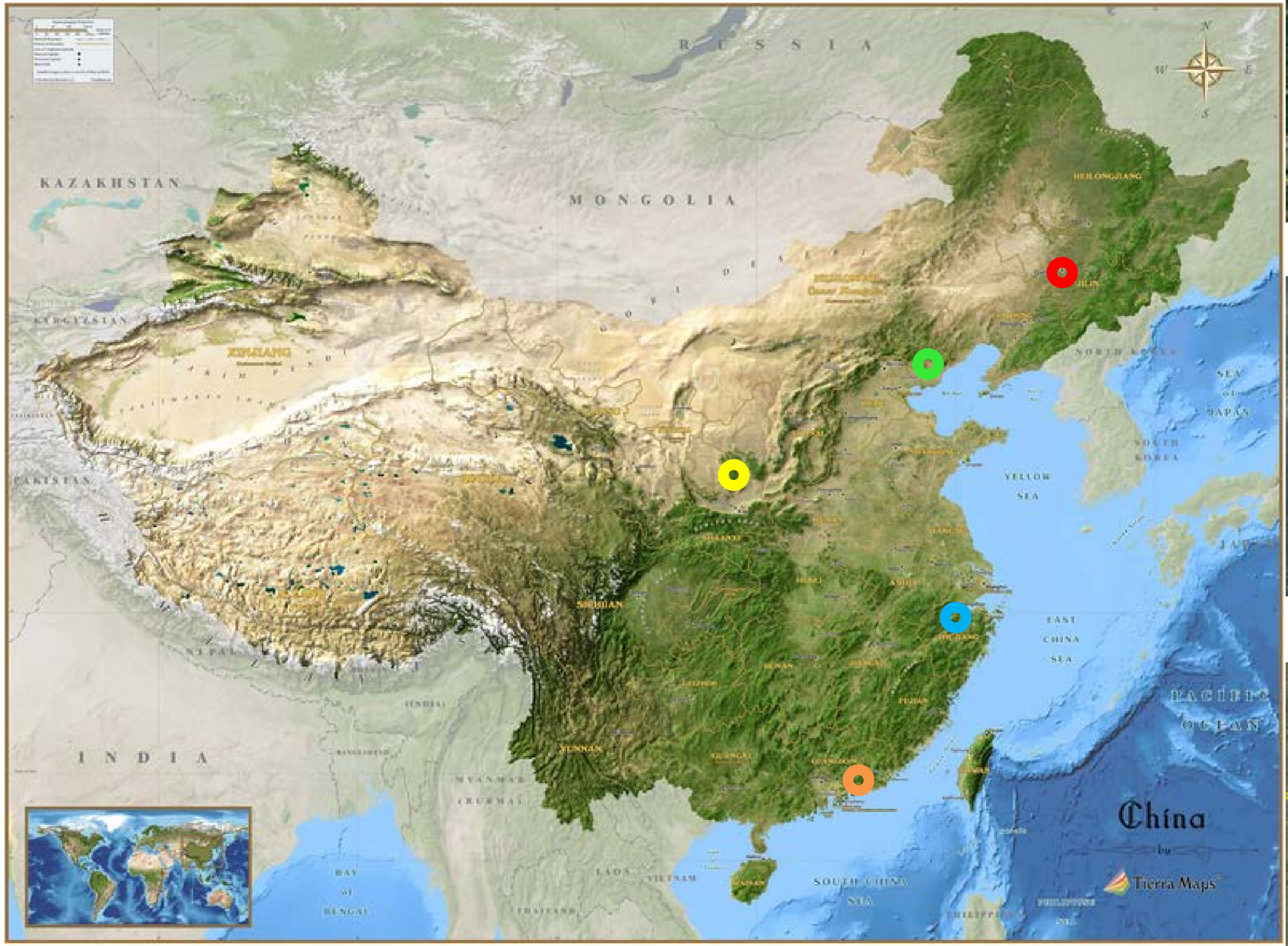
02 Site Investigation

黄河勘测规划设计有限公司
Yellow River Engineering Consulting Co.,Ltd

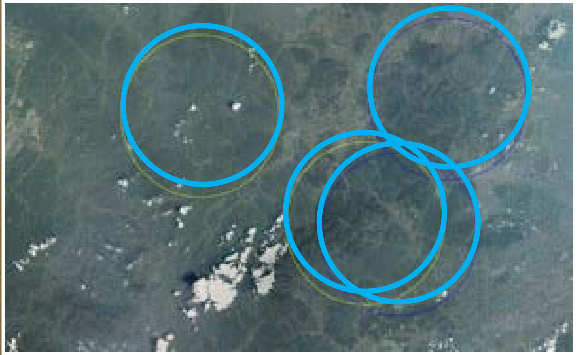
Site Investigation

Changchun, Jilin

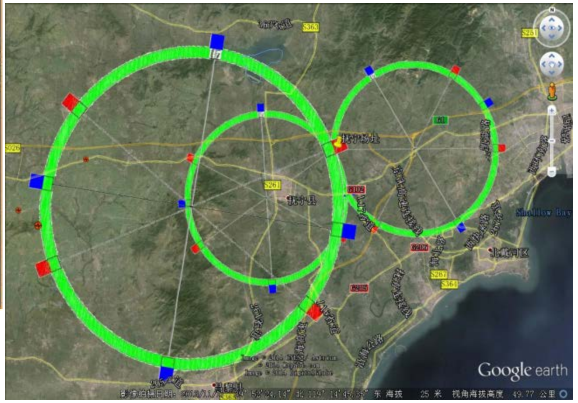
Shenshan, Guangdong



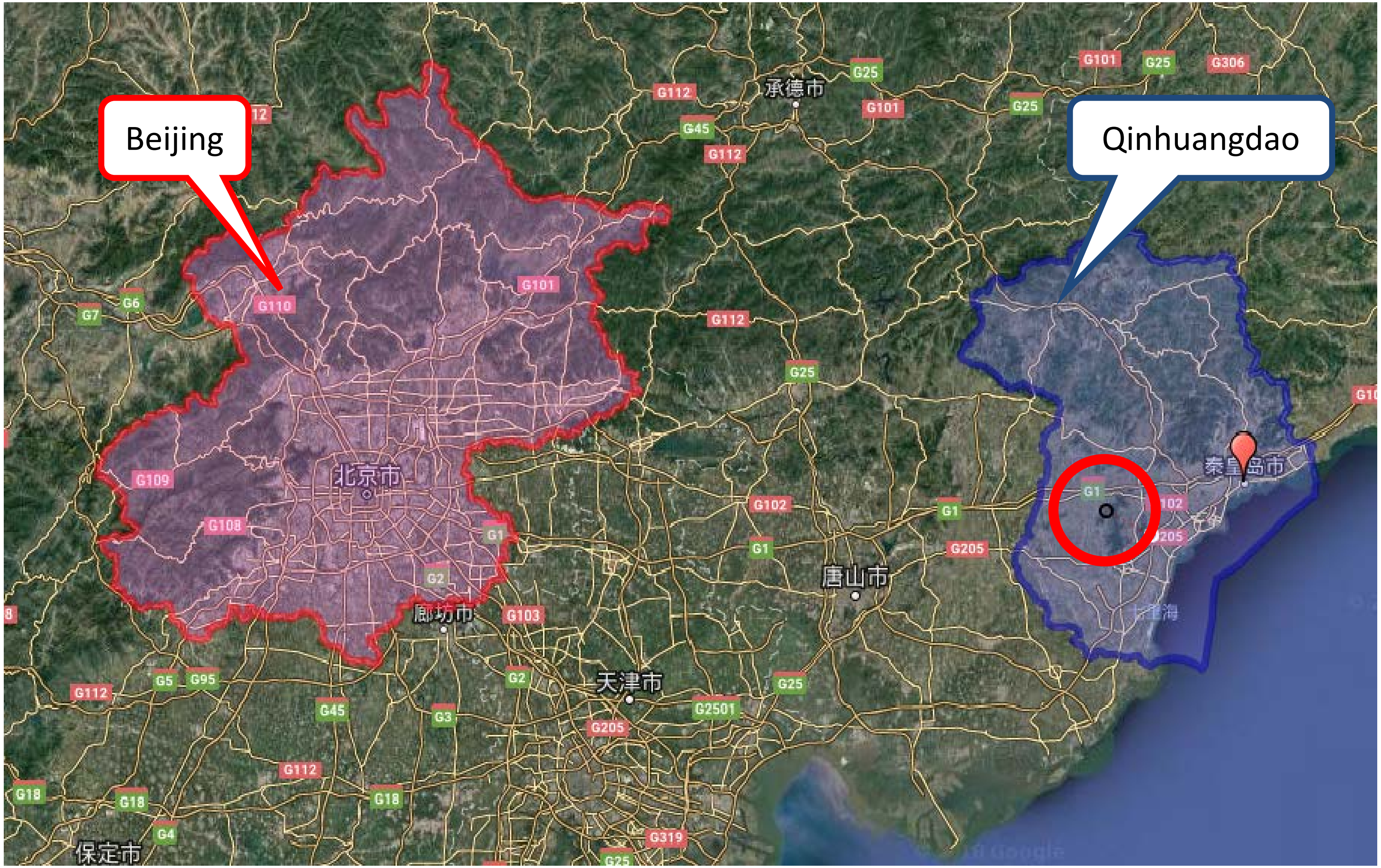
Huangling, Shaanxi

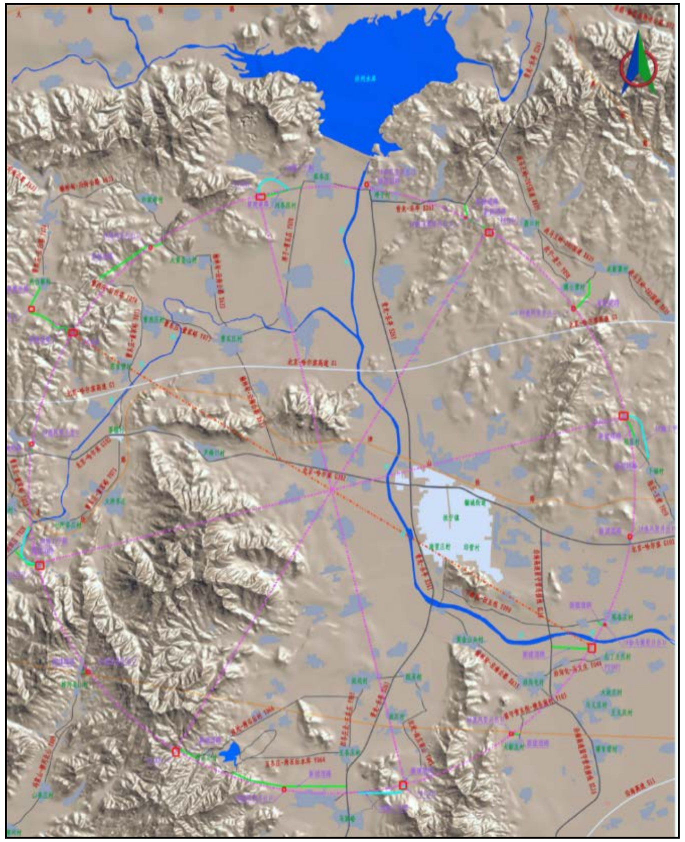


Zhejiang



Qinhuangdao, Hebei


Beijing
Qinhuangdao
北京市
承德市
唐山市
天津市
廊坊市
保定市
秦皇岛市



Qinhuangdao, Hebei Province



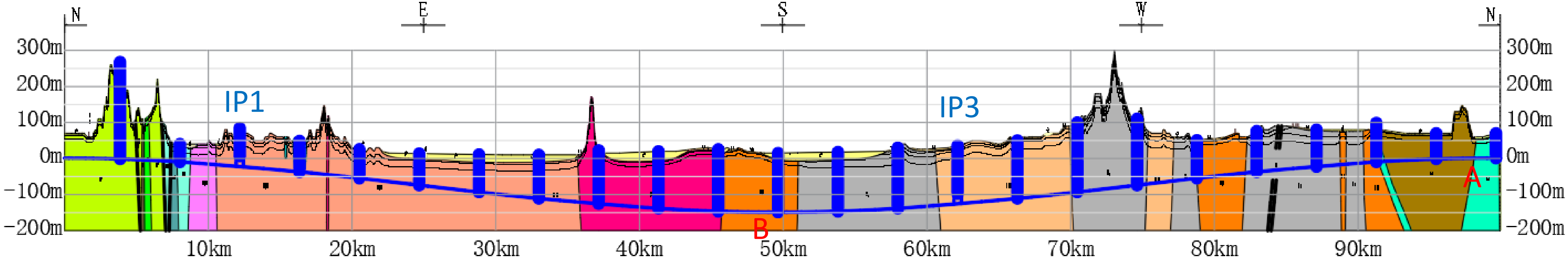

Topography and landforms

Stratum Lithology



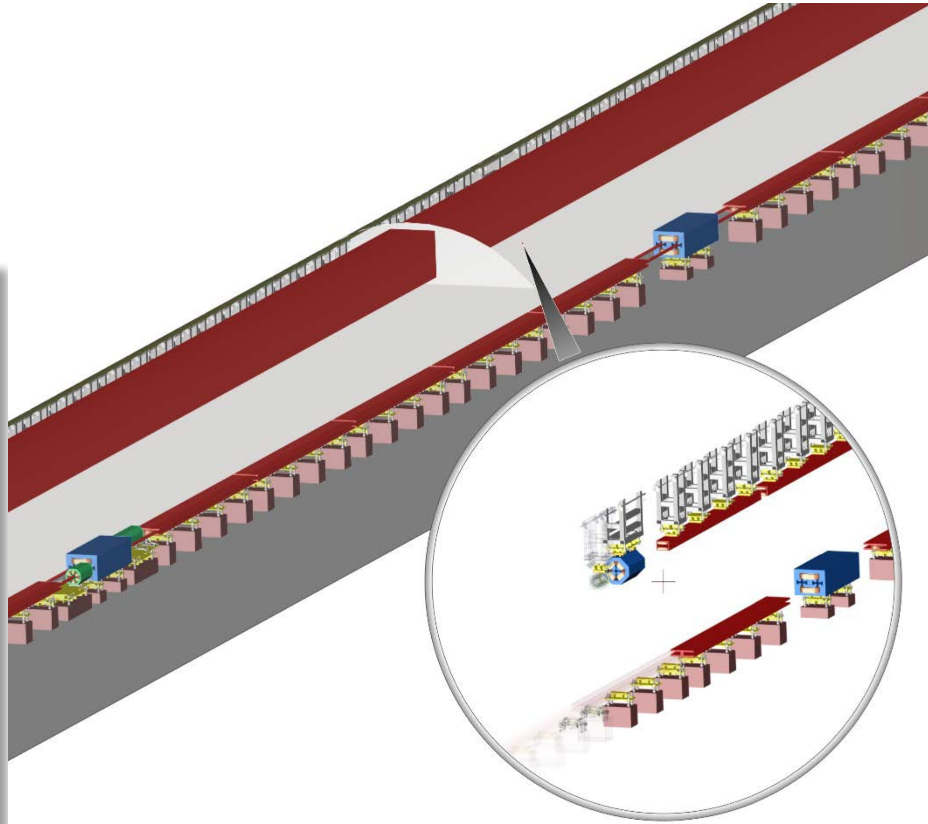


Drill Holes

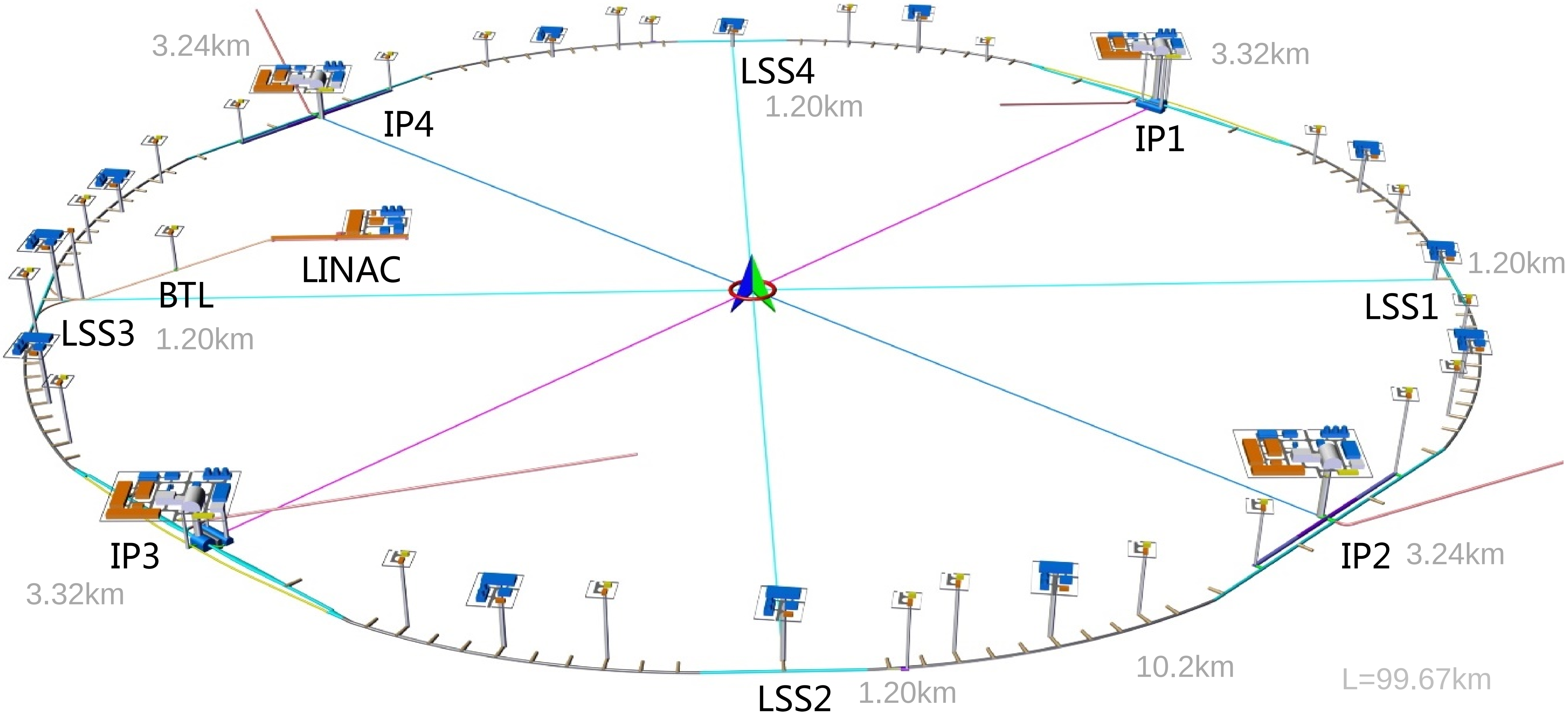


03

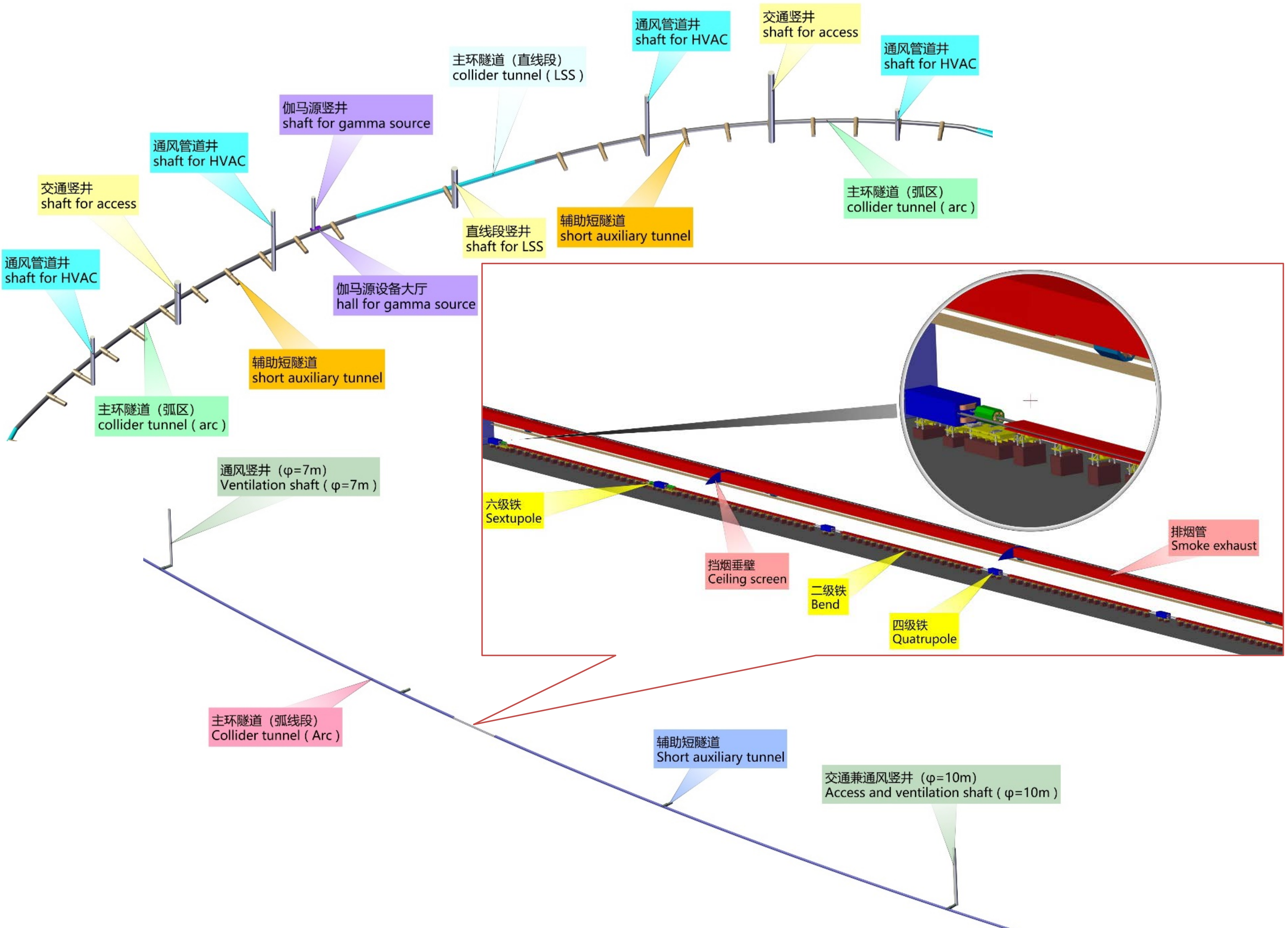
Project Layout and Scheme Design

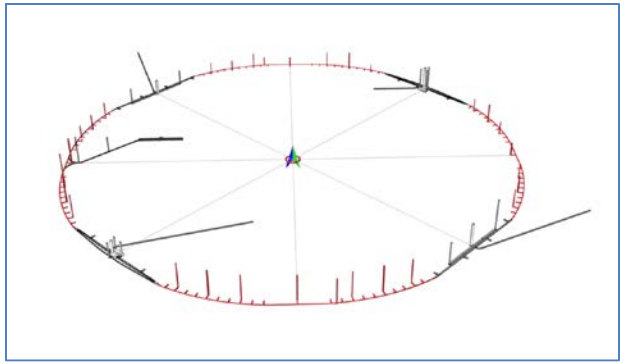


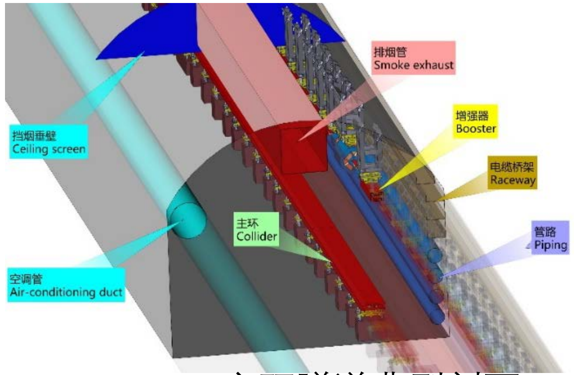
01. General Layout



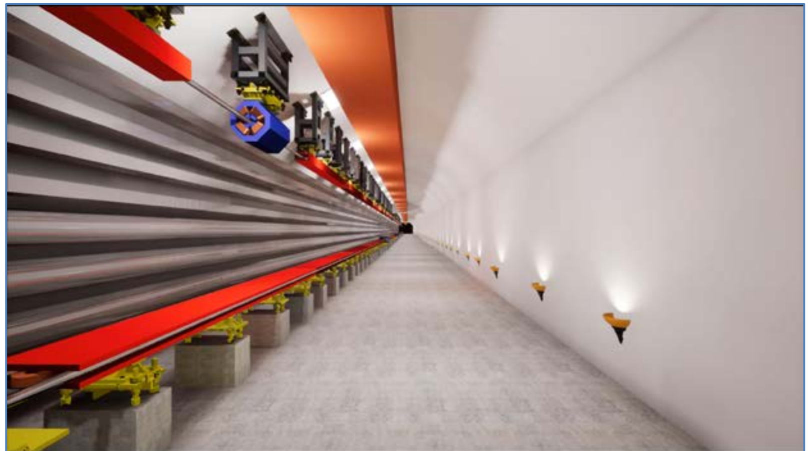
Collider ring tunnel and short auxiliary tunnel



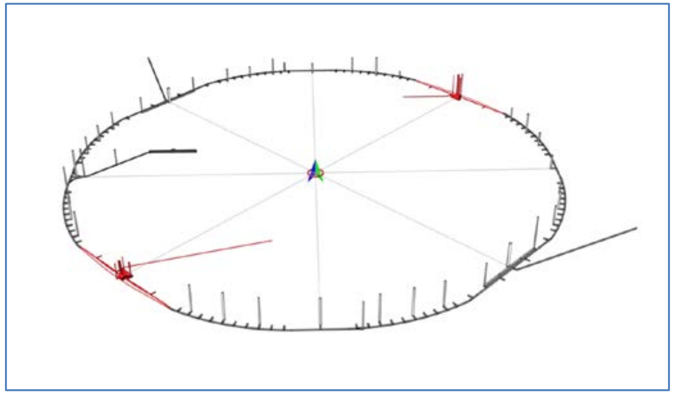


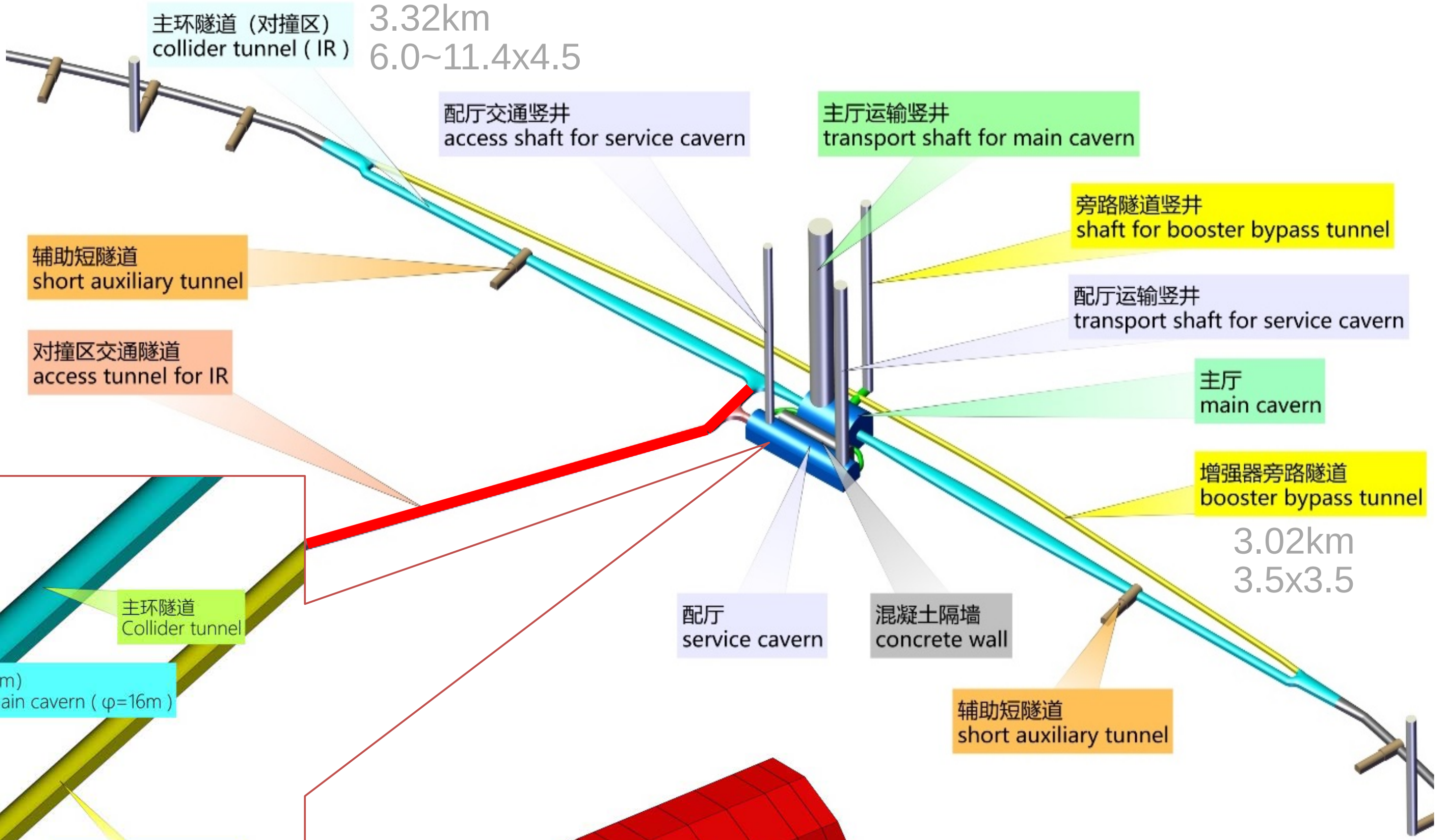


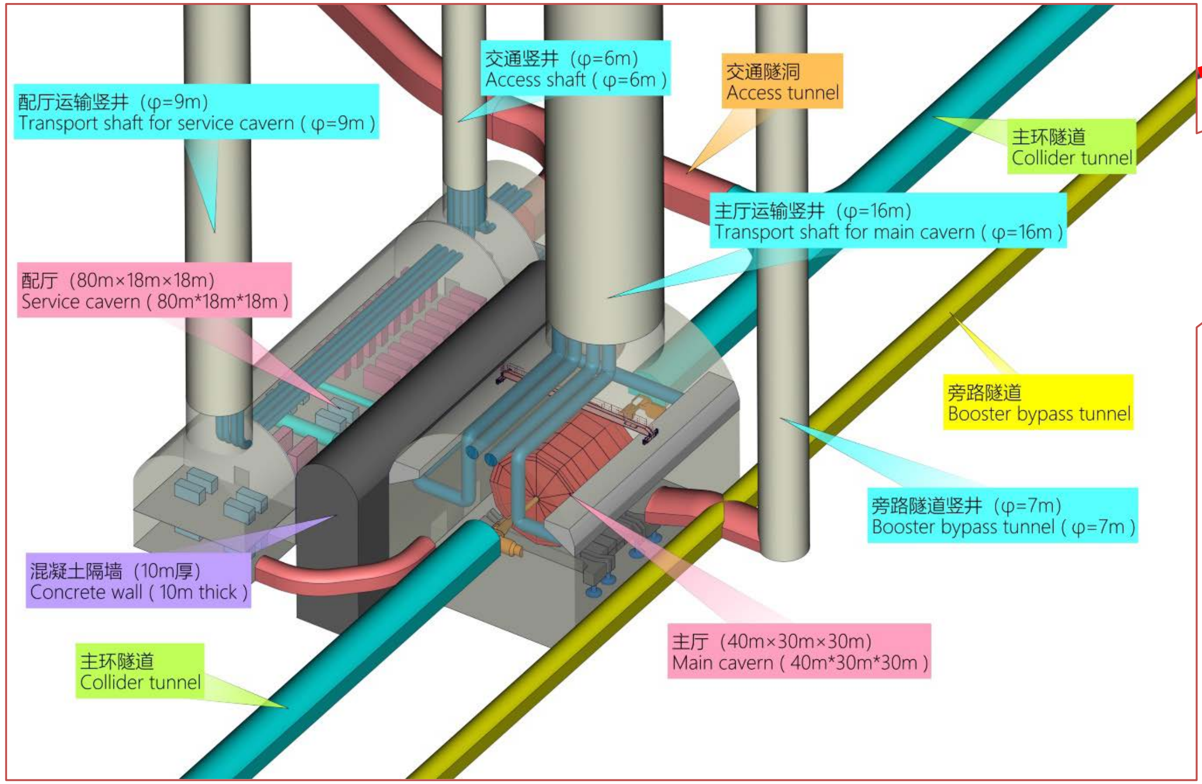
主环隧道典型剖面
Typical cross section of collider tunnel

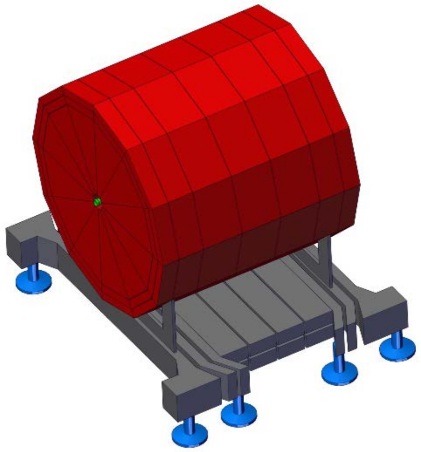


IP1 / IP3



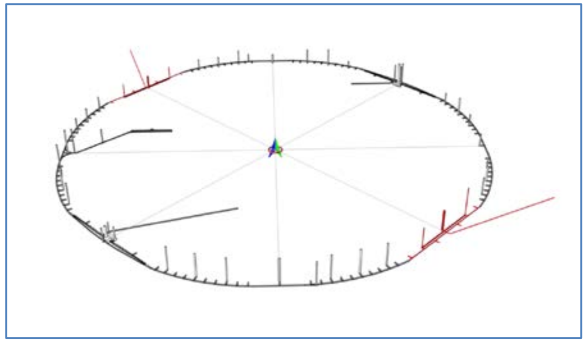


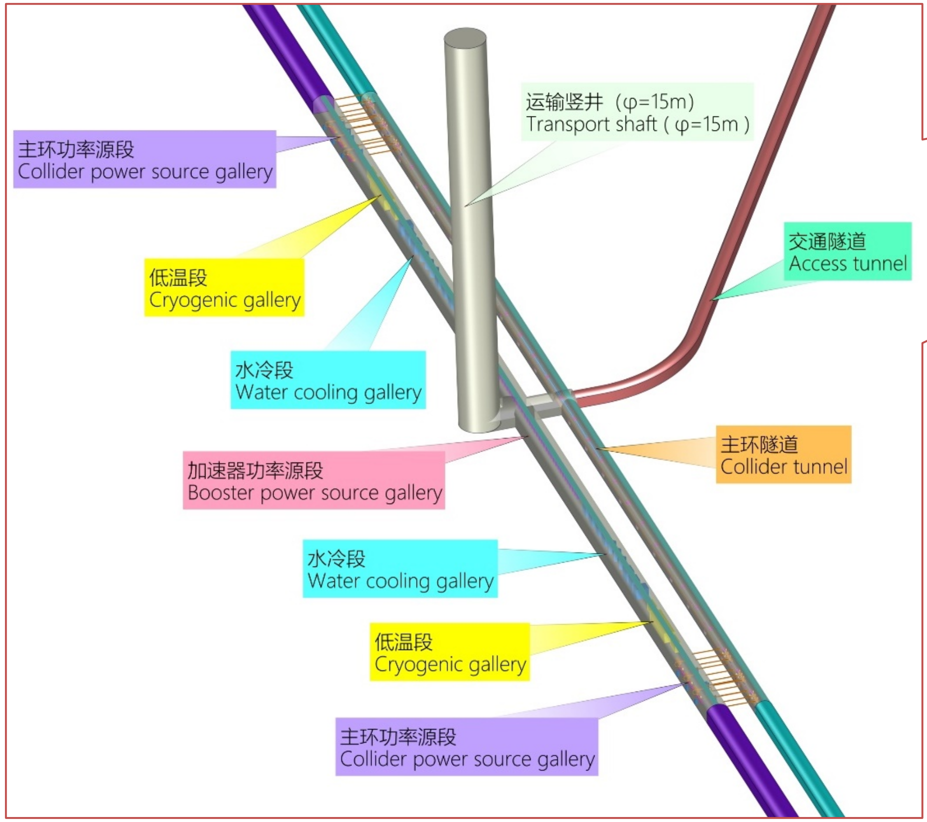


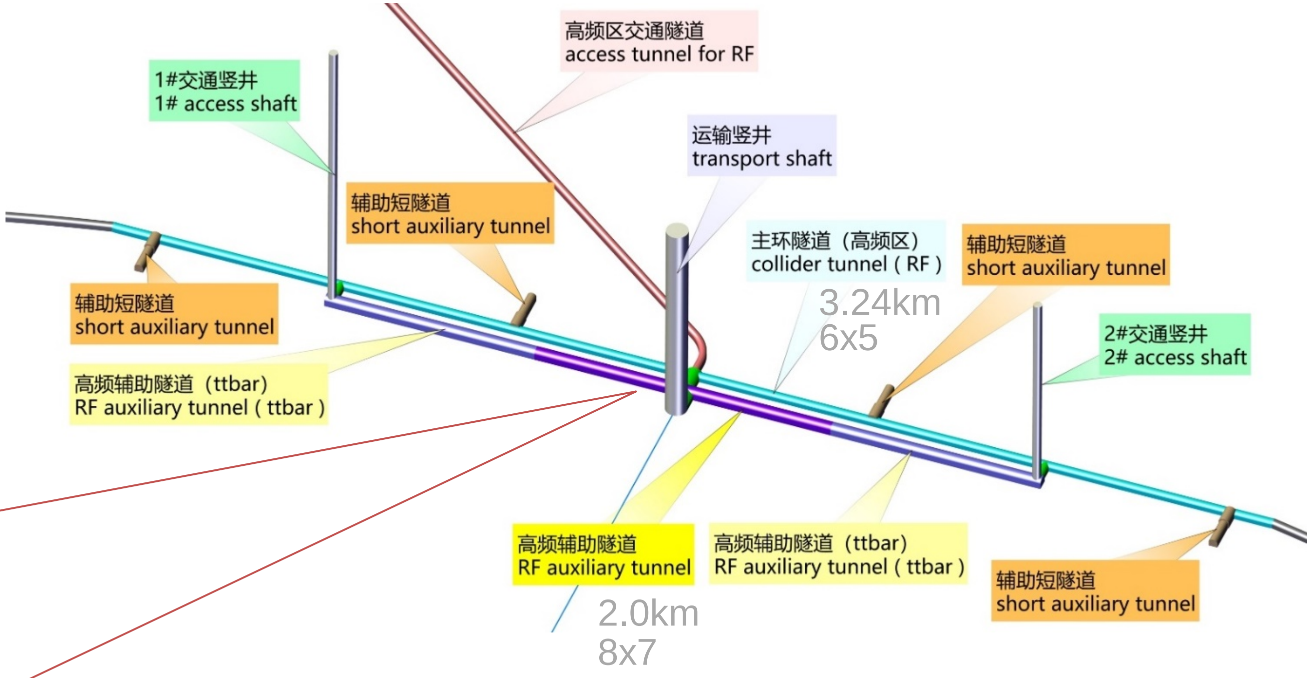


Main detector (apodis)
主探测器（apodis）

IP2 / IP4



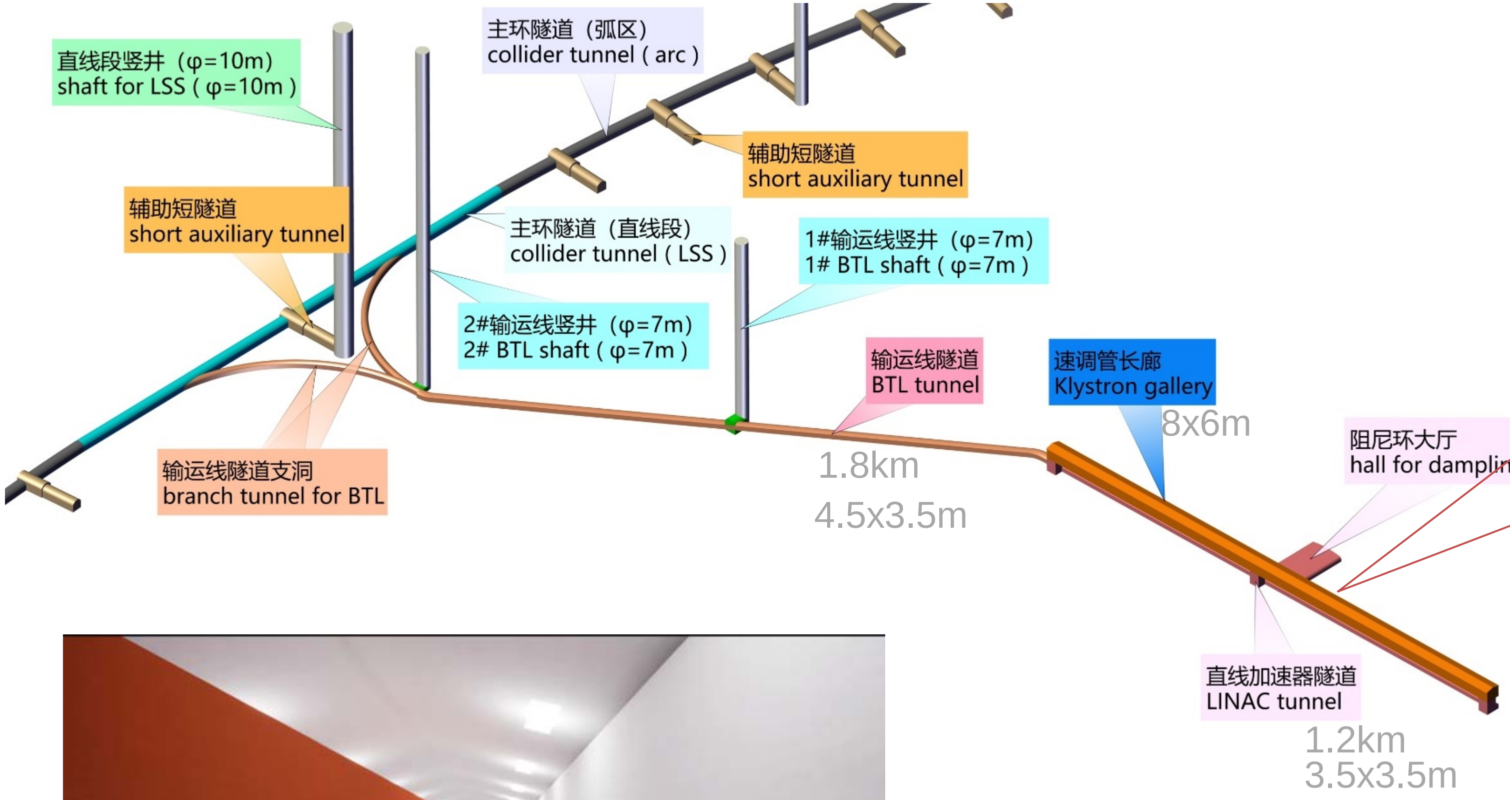


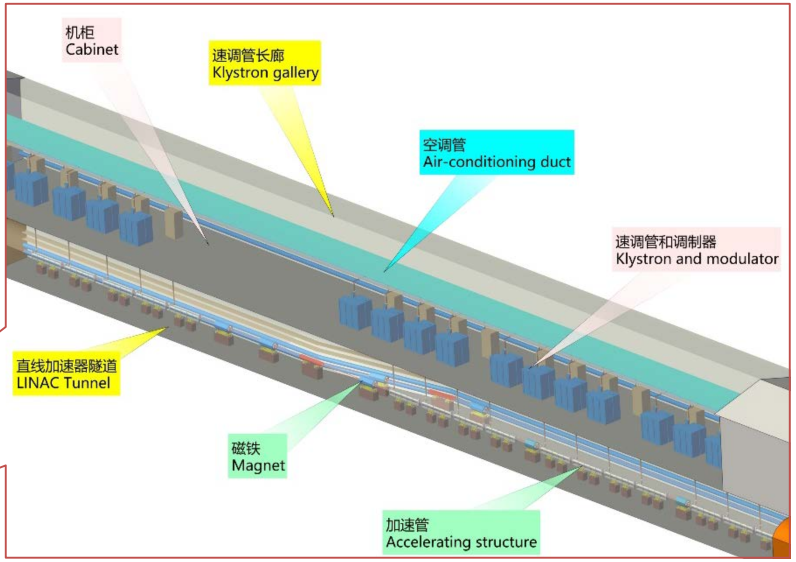


RF Auxiliary Tunnel
高频辅助隧道

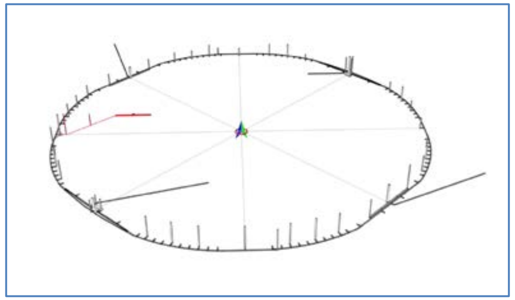
Collider Tunnel（RF）
高频段主环隧道

Linac Tunnel & BTL Tunnel





Klystron gallery
速调管长廊

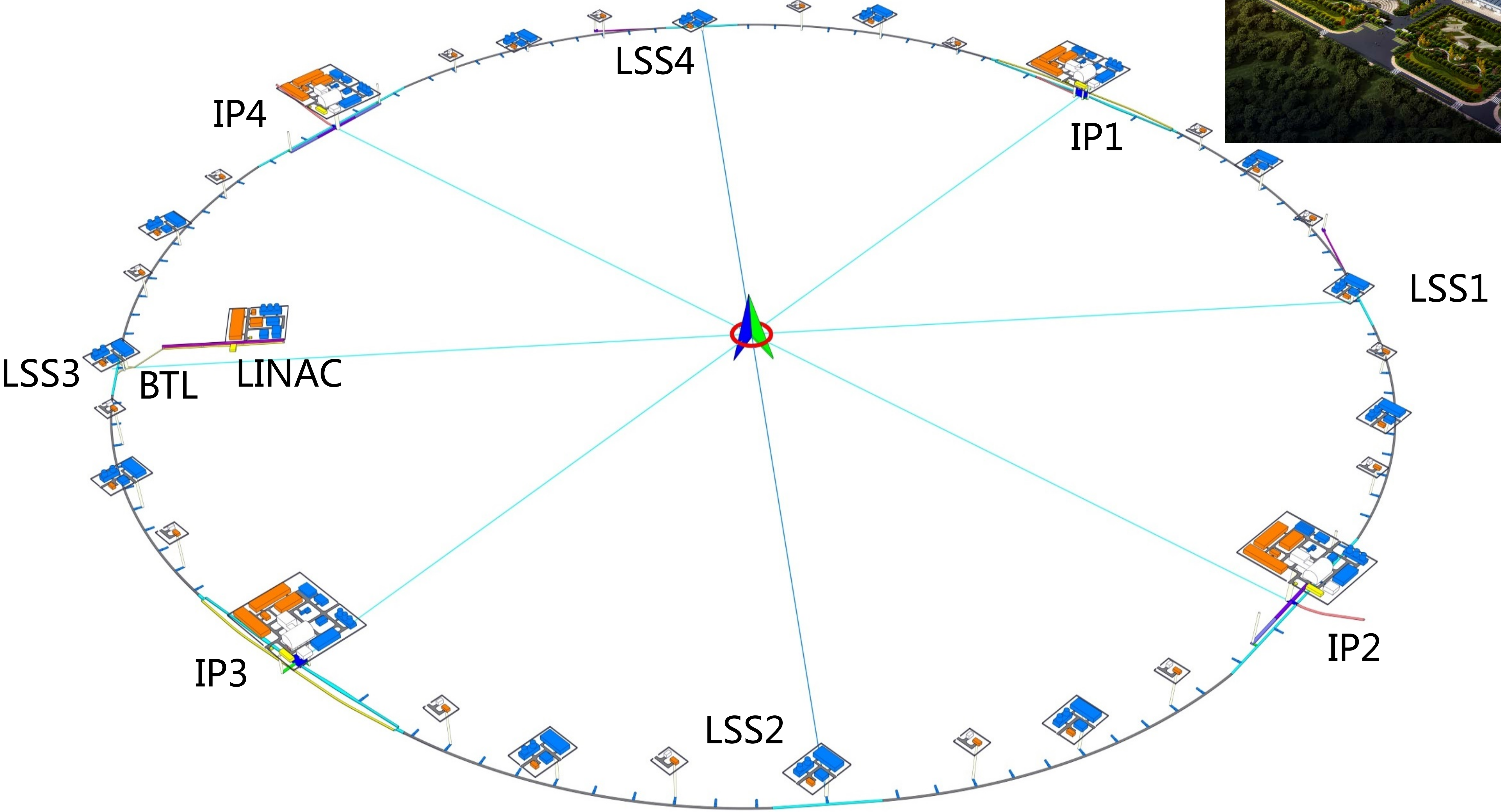


Straight line accelerator tunnel
直线加速器隧洞

Shafts

Region	Item	Qty	Diameter (m)
IR	Transport shaft	2	16.00
	Bypass tunnel access shaft	2	7.00
	Auxiliary shaft	2	9.00
	Auxiliary access shaft	2	6.00
RF	Transport shaft	2	15.00
	Transport shaft	4	6.00
LSS	Access & pipe shaft	4	10.00
Arc sections	Access & pipe shaft	8	10.00
	Ventilation shaft	16	7.00
BTL	Access & pipe shaft	2	7.00

Surface Buildings



140,450m^2

02. Electrical Engineering

（1）Power loads

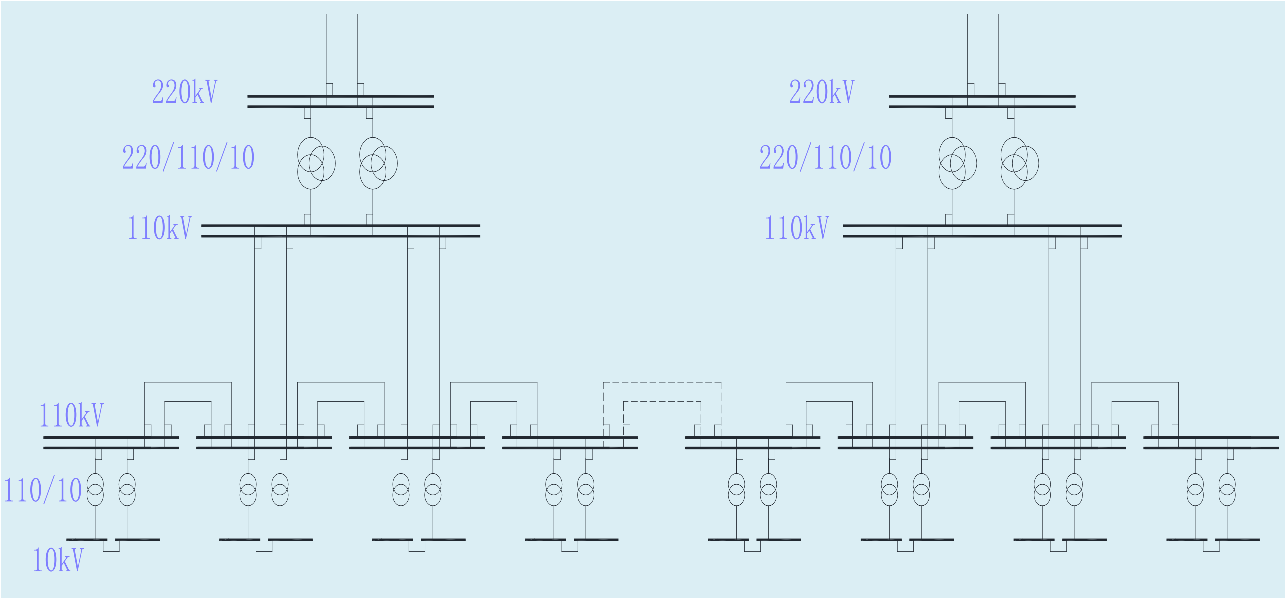
The total electrical load for physical experiments and general facilities is about 270MW.

	System for Higgs（30MW）	Location and electrical demand(MW)						Total (MW)
		Ring	Booster	LINAC	BTL	IR	Surface building	
1	RF Power Source	103.8	0.15	5.8				109.75
2	Cryogenic System	15.67	0.89			1.8		18.36
3	Vacuum System	9.784	3.792	0.646				14.22
4	Magnet Power Supplies	47.21	11.62	1.75	1.06	0.26		61.9
5	Instrumentation	0.9	0.6	0.2				1.7
6	Radiation Protection	0.25		0.1				0.35
7	Control System	1	0.6	0.2	0.005	0.005		1.81
8	Experimental devices					4		4
9	Utilities	31.79	3.53	1.38	0.63	1.2		38.53
10	General services	7.2		0.2	0.15	0.2	12	19.75
	Total	217.604	21.182	10.276	1.845	7.465	12	270.37

（2）Power supplies and schemes

It is proposed to adopt 220kV power supply for the project, and to set two 220kV central substations in the project area.

110kV substation will be set respectively near the shaft ground exits of IR and RF (IP1-IP4) and linear sections (LSS1-LSS4), with 8 step-down substations in total.



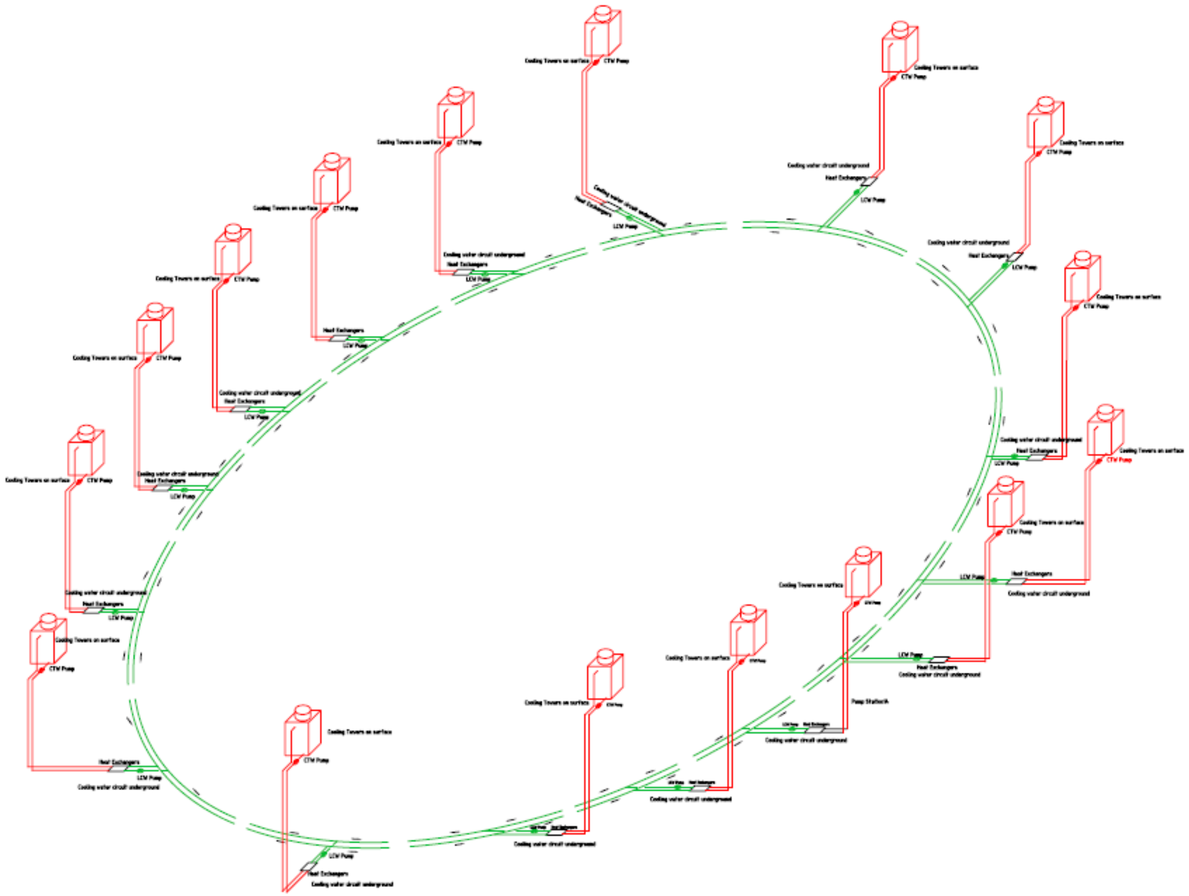
For critical loads where a power failure could cause damage, diesel generators, EPS power supplies, or UPS will be installed.

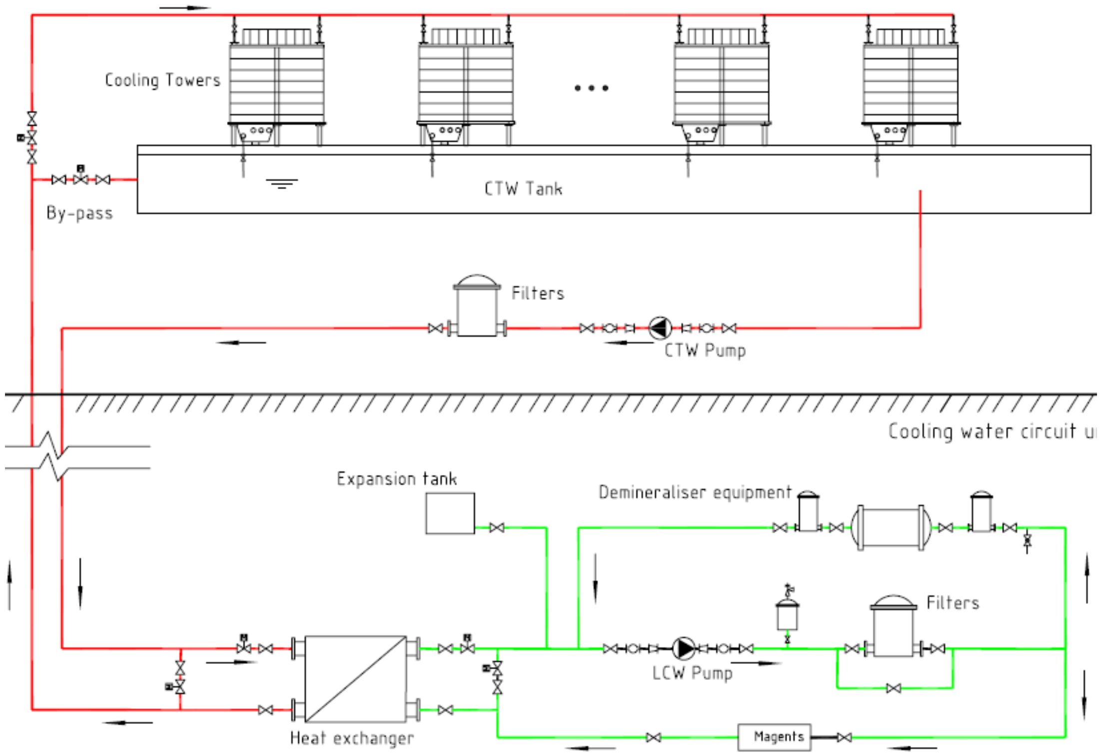
03. Cooling Water System

- **The heat load dissipated by CEPC machine**

System	Location and heat loads(MW)					
	Ring	Booster	Linac	BTL	IR	Total
Accelerating tube / Waveguide			2.32			2.32
Power source	43.8	0.15	3.48			47.43
Cryogenics	11.62	0.68			1.8	14.1
Experimental devices					2.5	2.5
Magnets	33.763	7.604	1.367	0.838		43.572
Vacuum chamber of ring	60					60
Power convert for magnets	4.721	1.162	0.175	0.093	0.026	6.177
Condenser in stub tunnel	18.169					18.169
Pump	16.787		0.745	0.121	0.466	18.119
Total	188.86	9.596	8.087	1.052	4.792	212.387

Schematic layout of cooling circuits in the tunnel





- There are 16 circuits around ring tunnel.
- Primary loops on surface
- Secondary loops are underground.

Flow diagram of typical cooling water circuits

04. Ventilation and air-conditioning system

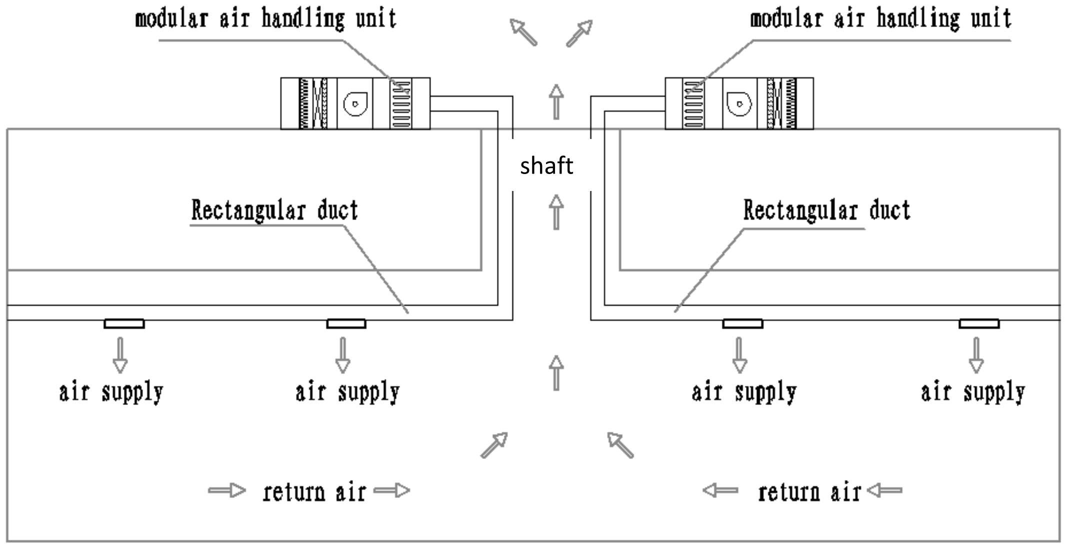
（1）Air-conditioning system in tunnel

The air conditioning cold load of collider ring tunnel is about 6MW according to the existing design scheme.

The collider ring tunnel is generally divided into 32 sections, with about 3km interval, by shafts in experiment halls, vent shafts, access shafts and shafts in RF. Each section is considered as an independent section for the ventilation and air-conditioning system and shall be processed respectively. Each shaft is used for air supply and air exhaust.

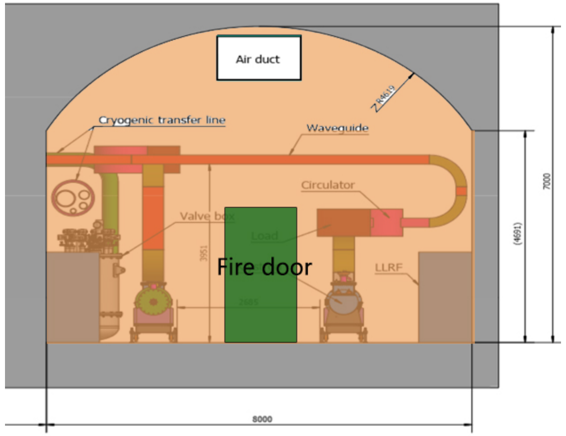
（2）Ventilation and smoke exhaustion system

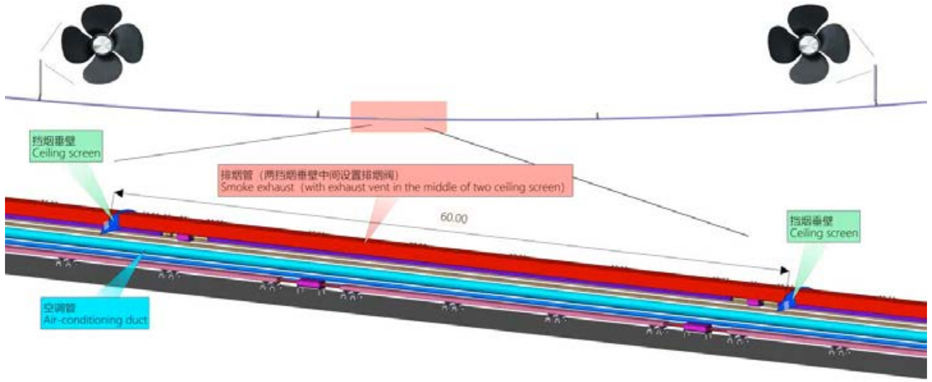
It is proposed to combine the smoke exhaust system with the mechanical air exhaust system based on the layout features of underground caverns. Emergency smoke exhaust is applied to both the collider ring tunnel and the experiment halls.



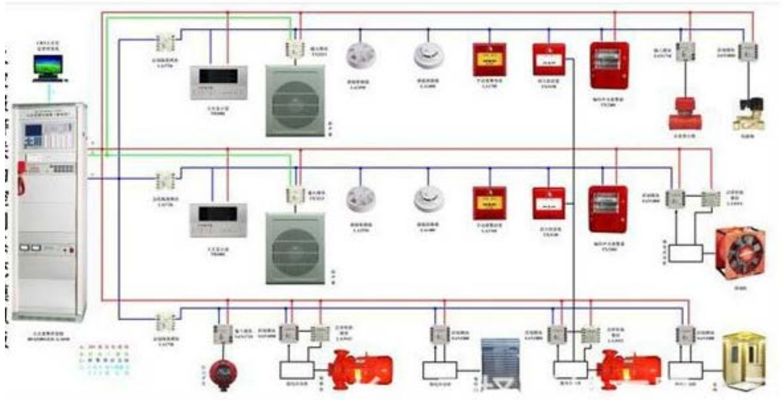
05. Fire Protection Design

Fire prevention and exhaust systems, hydrant and fire extinguisher systems, and fire detection and fire alarm systems are combined with building fire prevention and evacuation, to minimize fire hazards.





Normal



06. Permanent Transportation and Lifting Equipment

Position	Equipment and specs	QTY
Access shafts	Elevator	24sets
IP2/IP4	30t Crane	2 sets
IP1/IP3 ground assembly halls	1500t Gantry Crane	1 set
	1000t Gantry Crane	1 set
	80t Gantry Crane	2 sets
IP1/IP3 underground main cavern, service cavern	20t Overhead Crane (L=28m)	1 set
	10t Overhead Crane (L=18.5m)	1 set
Underground vehicle	Trucks for passengers & goods	20 sets

07. General Construction Schedule

The total construction period is 54 months, including preparatory work of 8 months, main works of 43 months and completion work of 3 months.

The critical activities are:

- Preparation 8 months
- Construction shafts 5 months
- Main tunnel excavation 24 months
- Tunnel lining & water prevention 10 months
- Ventilation installation in shafts 4 months
- Completion work 3 months

The surface buildings and electrical installation are carried out in parallel and not on the main path.

04 Summary & Key Activities in the Next Stage

Summary

Based on the terrain and geological conditions, Qinhuangdao site is the best among current sites. But in general, all the sites are suitable for the underground construction of such a large extent. The main geological problems encountered can be solved by engineering measures.

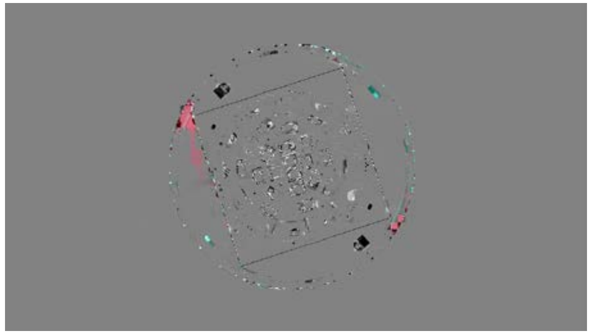
There are no limitation factors for engineering construction and project operation from all the sites considering the conditions of external access, water and electricity supply, social service, hydrology and meteorology, etc.

The engineering design and construction of CEPC will adopt the mature technology widely used in hydraulic engineering, road, railway or mining sectors. The site conditions are good enough to meet the requirements for construction arrangement.

With comprehensive comparison from construction technology, construction period and project cost, the drill and blast method is recommended at present.

CEPC-SppC is the national major scientific infrastructure facilities, and the site selection shall be compared and determined comprehensively considering the factors of social environment, ecological environment, engineering design and project cost, etc.

Key Activities in the Next Stage



Green Design

BIM Design

Waterproof Study

Construction Options

Thanks！