



CEPC Site Selections and Civil Engineering Designs

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Ke HUANG POWERCHINA HUADONG Engineering Corporation Limited (HDEC)

Jiangyang PAN POWERCHINA ZHONGNAN Engineering Corporation Limited (ZNEC)

Content

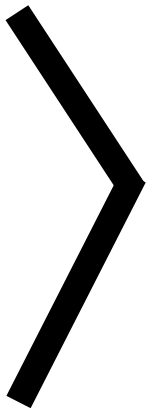
- **1 Design Progress of Sites**
- **2 Civil Engineering**
- **3 Construction Planning**
- **4 Summary**

Introduction

- This talk is about CEPC Site Selections and Civil Engineering Designs
- This talk relates to the TDR chapter 10.1~10.6
- The content relates to the “charge letter” item 7 and 9

01

Design Progress of Sites



1 Design Progress of Sites



YREC



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HDEC



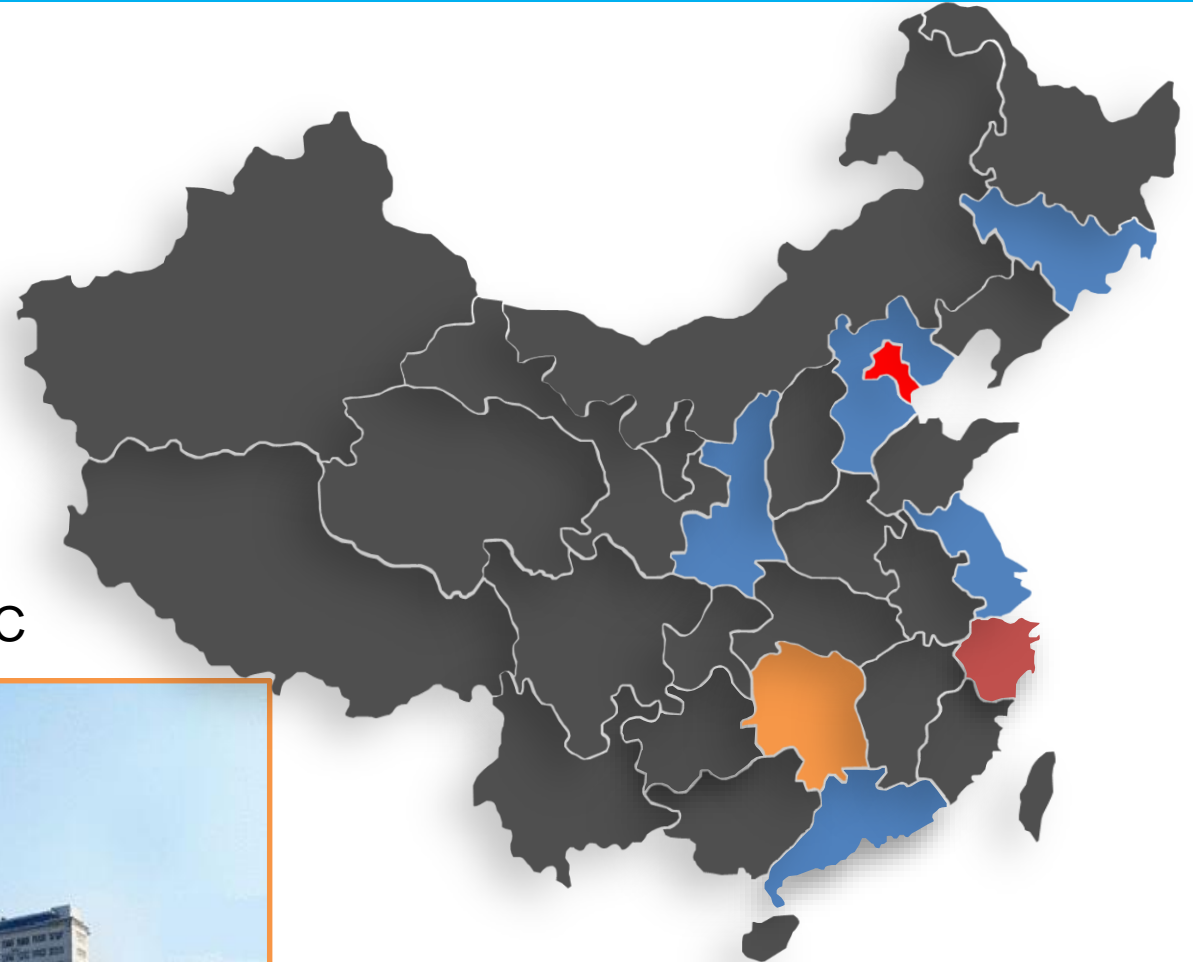
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HUADONG ENGINEERING CORPORATION LIMITED



ZNEC



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1 Design Progress of Sites



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Pre-CDR

CDR

TDR



2013.4 ~
2015.3

2014.5 ~
2016.8

2014.6 ~
2017.7

2016.9

2017.7 ~
2017.9

2017.9 ~
2018.8

2018.9 ~
2023.6

- Site selection in Hebei
- Site selection in Guangdong
- Site selection in Shaanxi
- Site selection in Jiangsu
- Site selection in Baoding, Hebei & Zhejiang
- 100km design of Qinhuangdao
- TDR design (Qinhuangdao, Changchun)

1 Design Progress of Sites



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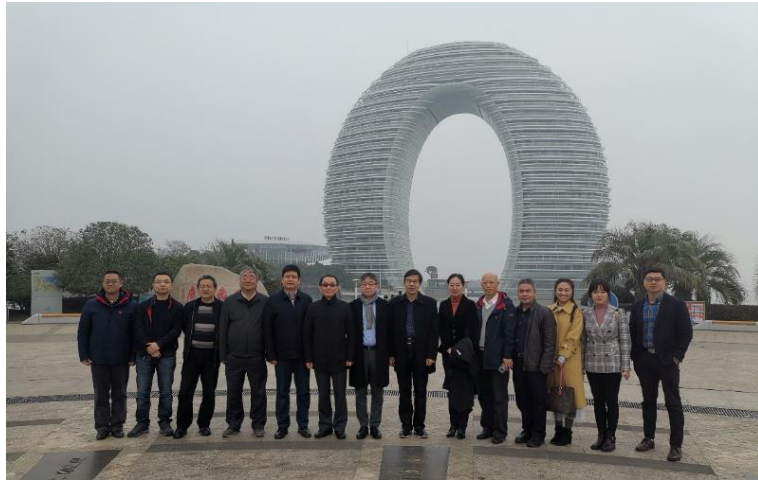
From March 25 to 29, 2018

The starting point of Huzhou site



By June 2023

the work that has been done is as follows



The General Office of the Zhejiang Provincial People's Government invited CEPC-SPPC project experts from The High Energy Institute to visit the four sites preselected in Zhejiang province, and organized a CEPC-SPPC site evaluation meeting in Zhejiang. Huzhou site was preliminarily recommended as candidate site of Zhejiang Province after analysis and study.

- **CEPC report on site selection (Zhejiang Huzhou)**

Answer the questions-Why did CEPC choose huzhou

- **CEPC report on socio-economic assessment**

Answer the questions-Why did huzhou choose CEPC

- **CEPC Technology Design Report on Civil engineering of the first stage**

- **CEPC report on science city concept plan**

Find a comfortable home for scientists

1 Design Progress of Sites



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From December, 2018

The starting point of Changsha site

ZNEC continually carries out necessity demonstration and study on construction technology on CEPC Changsha Site.

- In July 2021, the government of Changsha City entrusted Hunan University to take the lead in the demonstration of the settlement of the CEPC Project in Changsha.
- In September 2021, Hunan University organized the site review meeting of the *Demonstration Report of China (Changsha) CEPC and New International Science City Project*.



02

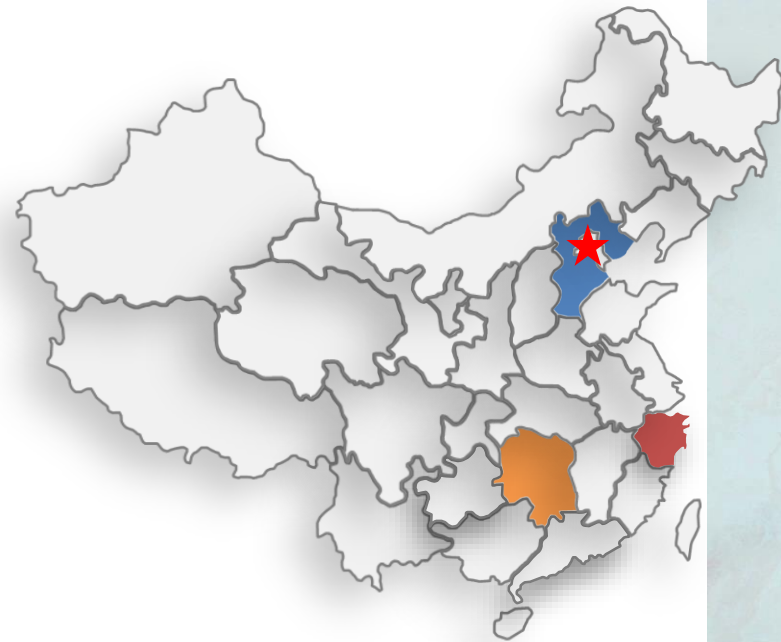
Civil Engineering

——
Qinhuangdao
Huzhou
Changsha



2 Civil Engineering

2.1 Location



Qinhuangdao is located in the northeast of Hebei Province. It is an important node city in the Beijing-Tianjin-Hebei metropolitan area.



The Qinhuangdao site is situated in the northeast of Hebei province and the northwest of Qinhuangdao city. It is located 478 km north of Shijiazhuang, the provincial capital, 240 km east of Beijing, and 23 km west of Qinhuangdao.

2 Civil Engineering

2.1 Location



Huzhou is located in the Yangtze River Delta Region.

The Huzhou site is situated in the north of Zhejiang province and central south of Huzhou city. It is adjacent to Hangzhou and about 100km away from Shanghai.



Huzhou

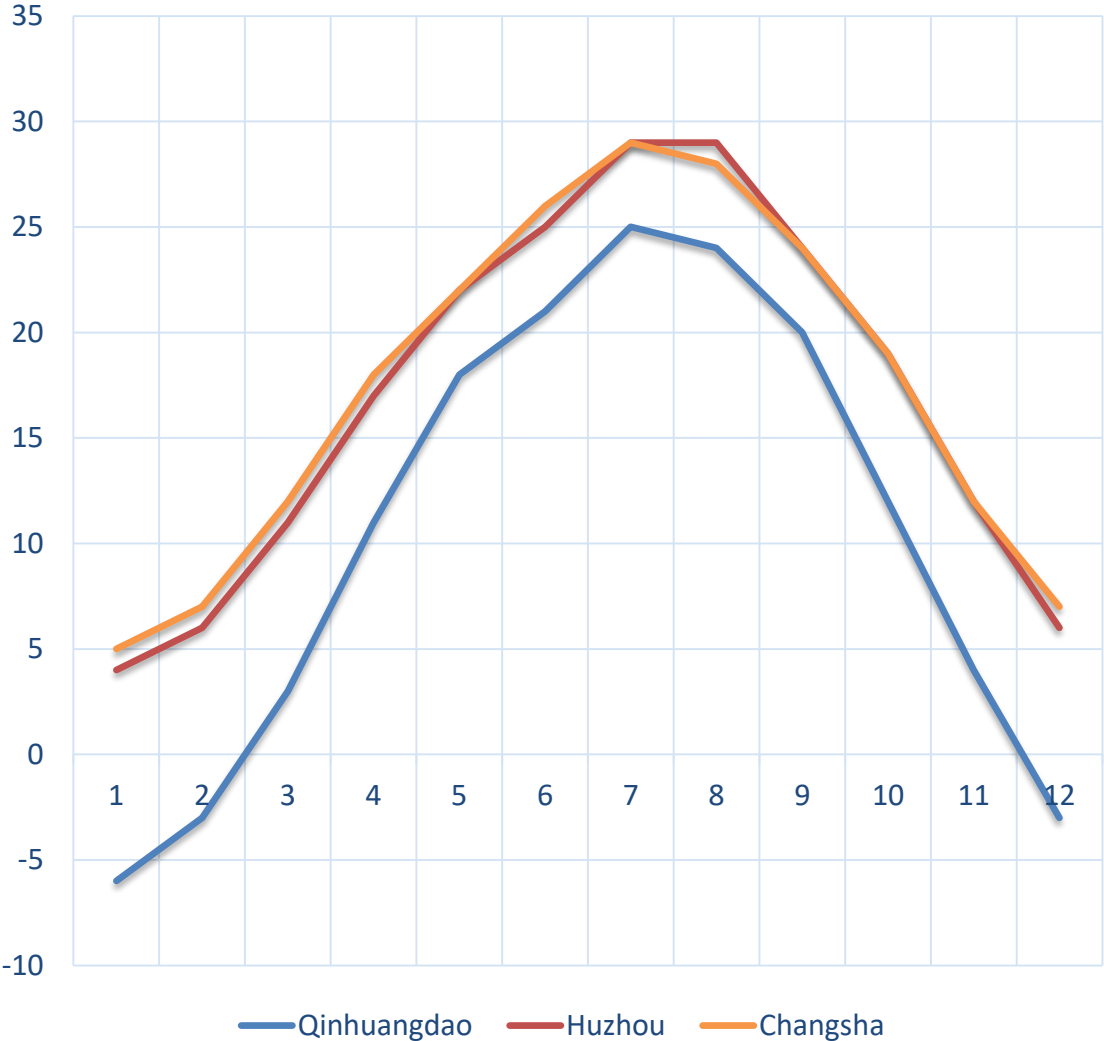
2 Civil Engineering

2.1 Location

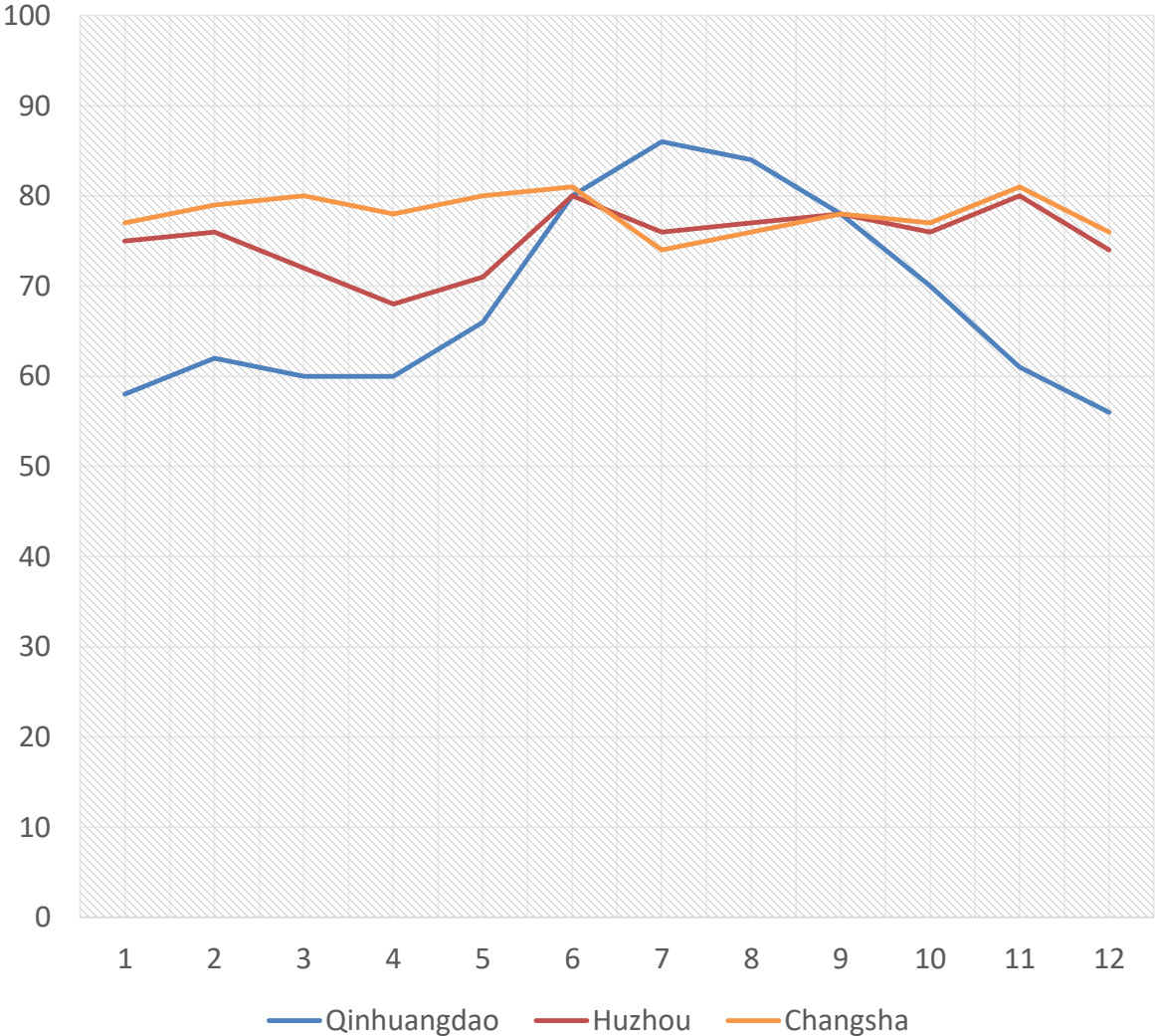


Hunan province lies on the transition zone between the eastern coastal regions and the central and western regions, serving as the junction of the Yangtze River open economic belt and the coastal open economic belt. Changsha city is the provincial capital of Hunan. Changsha site is located in the north of the city. It is about 13km to Changsha airport.

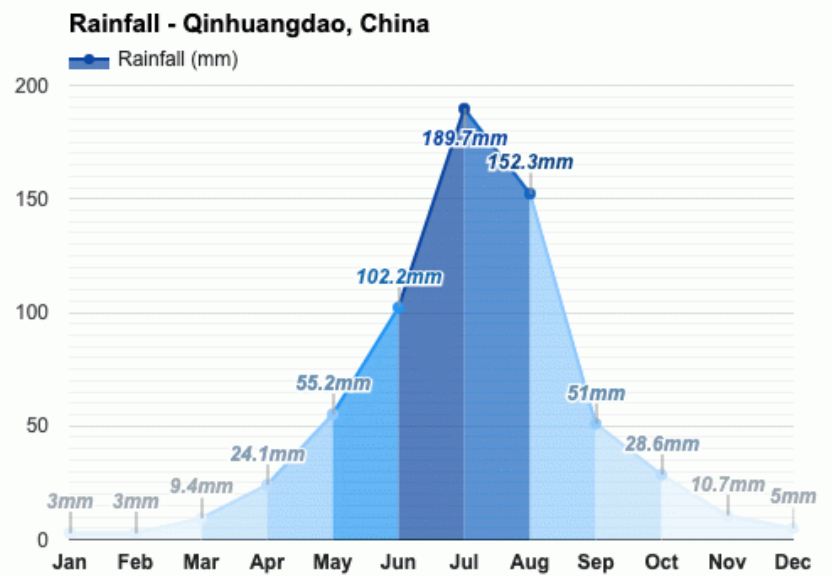
Annual Monthly Mean Temperature (°C)



Annual Monthly Mean Humidity (%)

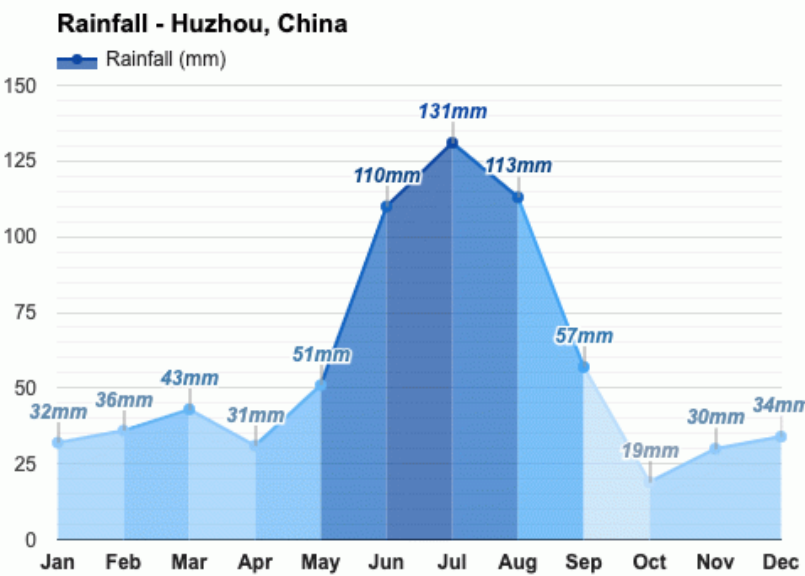


Qinhuangdao



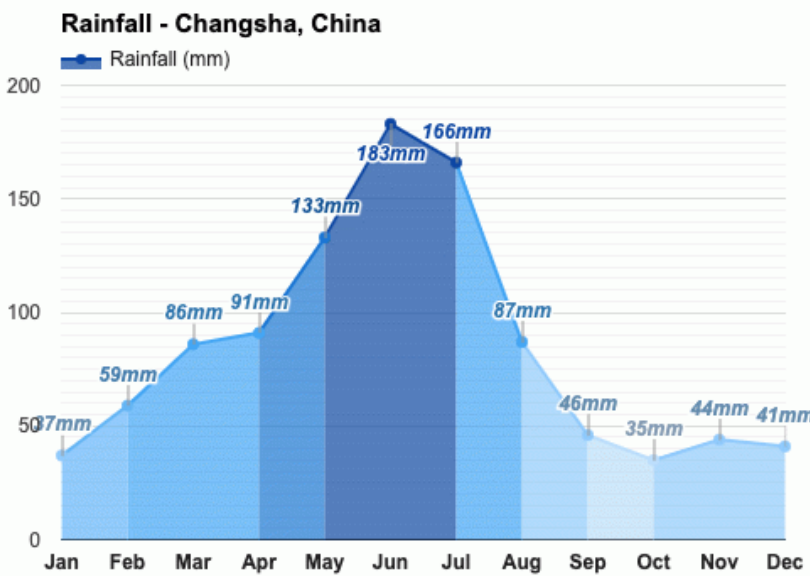
630mm

Huzhou



1023mm

Changsha



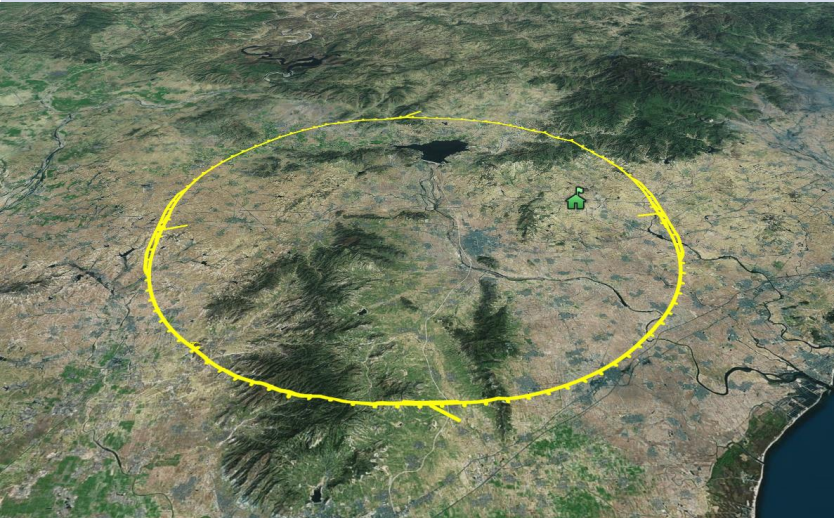
1362mm

Annual mean precipitation

2 Civil Engineering

2.3 Engineering Geology

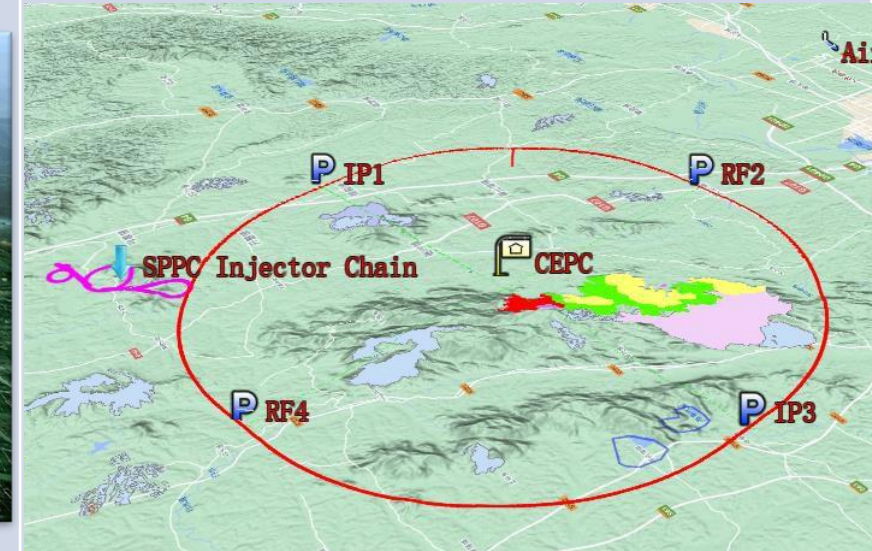
Qinhuangdao



Huzhou



Changsha



Topography and landforms



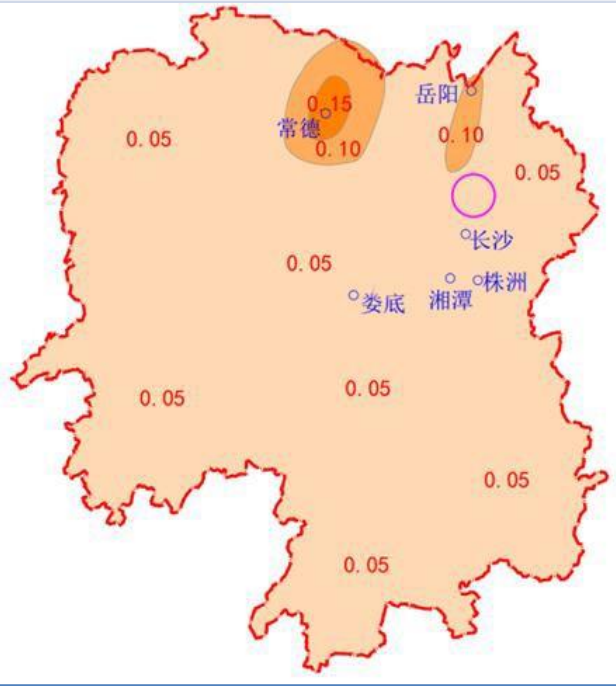
The site is in hilly area. The elevation of most places is 20~200m. The highest elevation is 695m.

The site is in low mountain and hilly area. The elevation of most places is 5~400m. The highest elevation is 710m.

The site is in hilly area. The elevation of most places is 40~200m. The highest elevation is 725m.

2 Civil Engineering

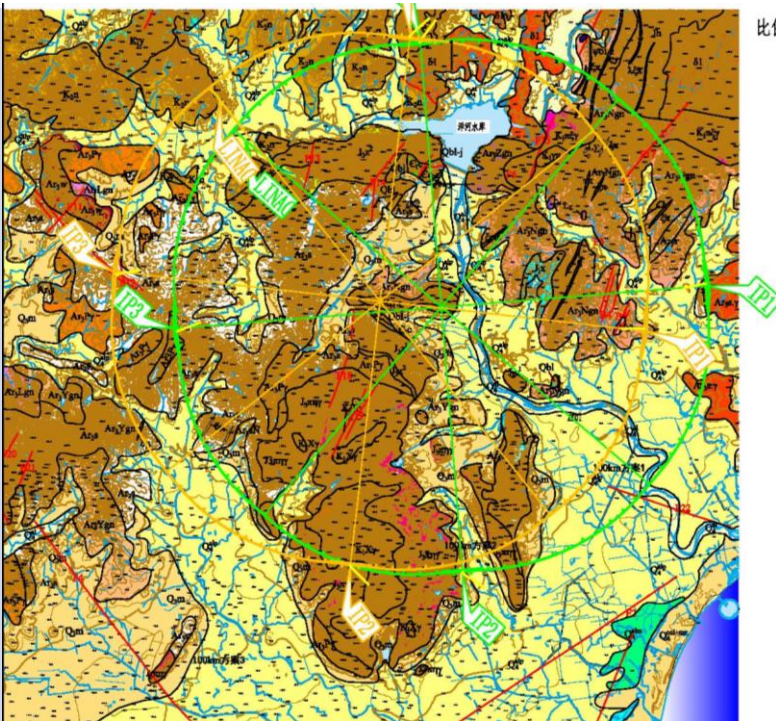
2.3 Engineering Geology

Qinhuangdao	Huzhou	Changsha
		
	Seismic peak acceleration	
0.10g~0.15g	0.05g	0.05g
	Basic seismic intensity	
VII	VI	VI

2 Civil Engineering

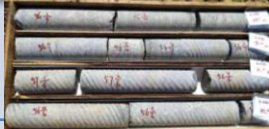
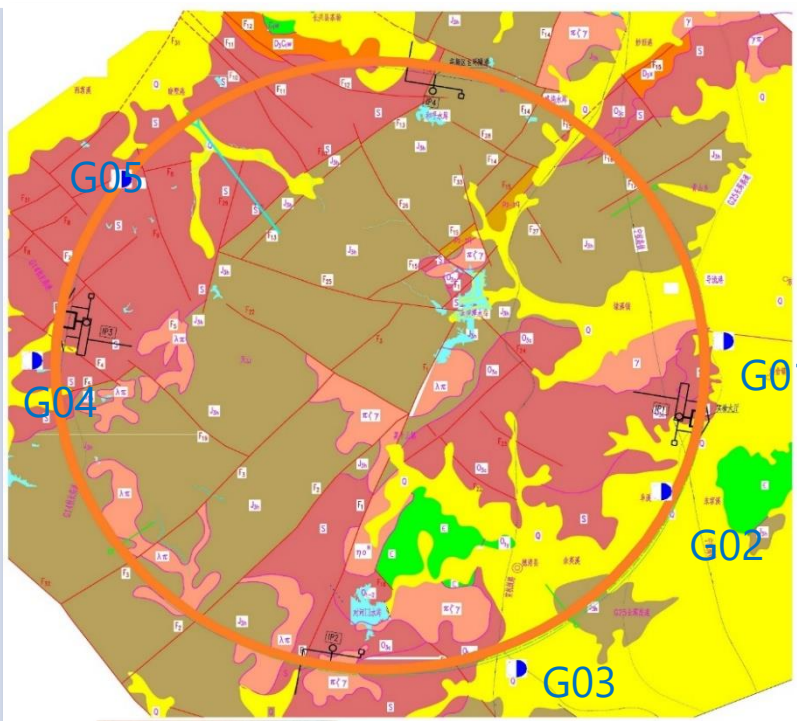
2.3 Engineering Geology

Qinhuangdao



Gneiss
Granite

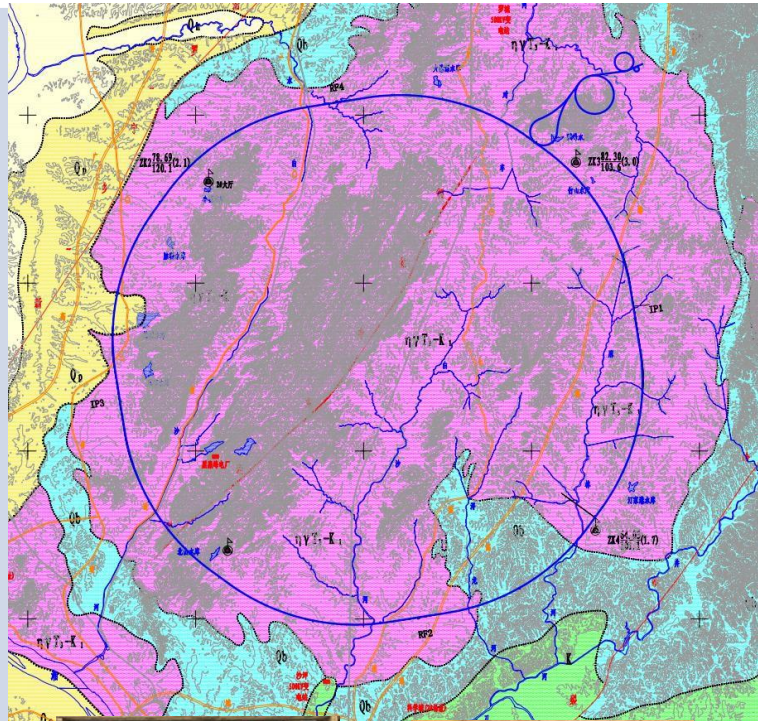
Huzhou



Stratum Lithology

Sandstone
Tuff

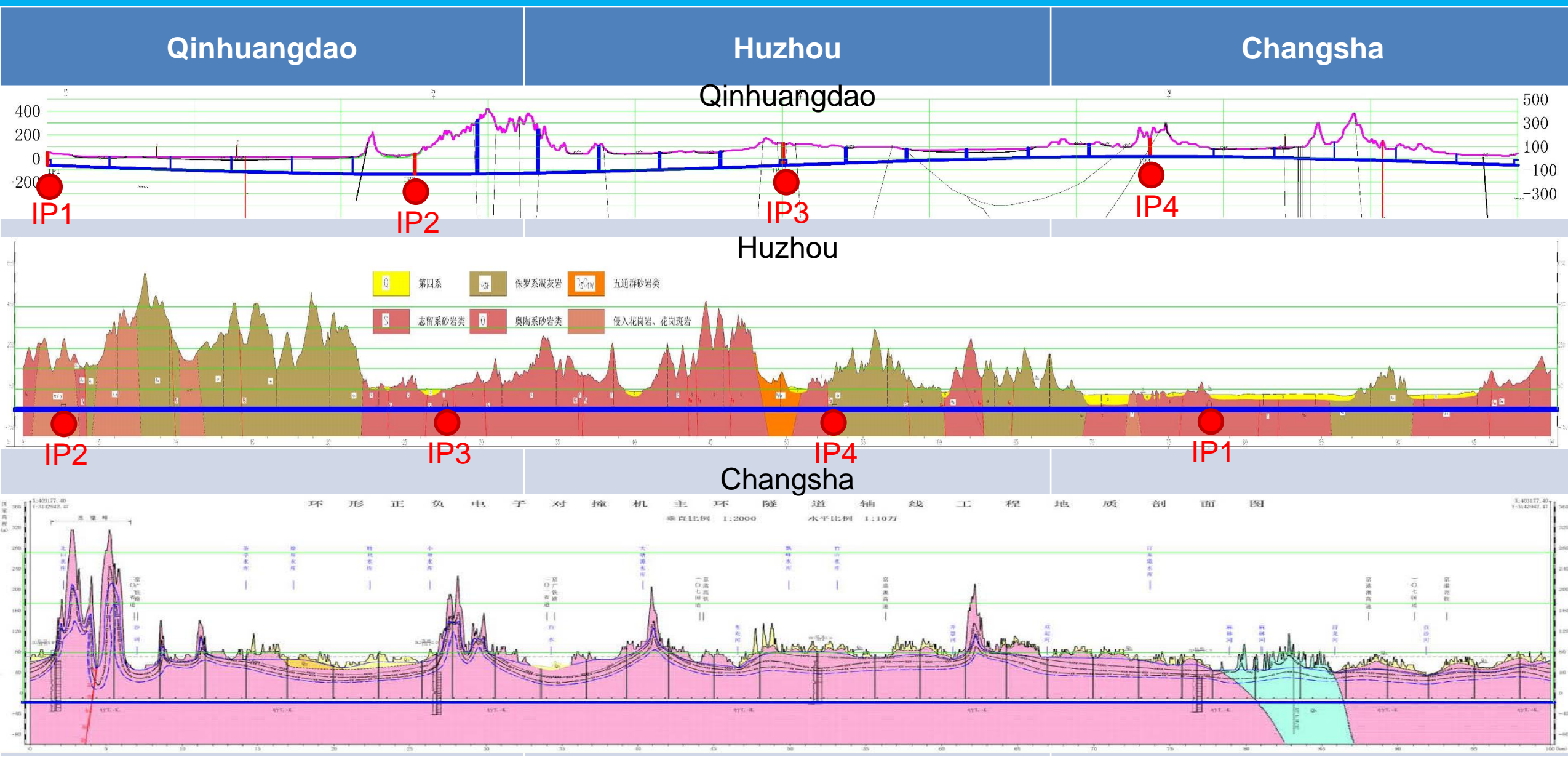
Changsha



Granite
Sandstone, Slate

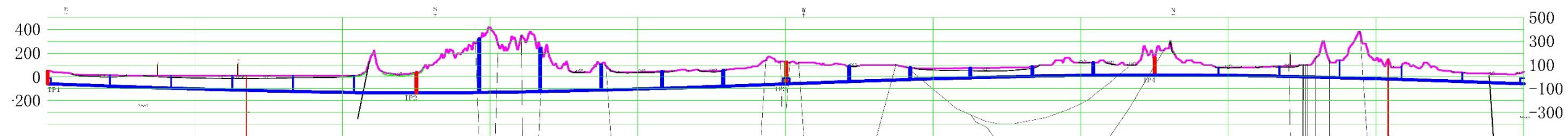
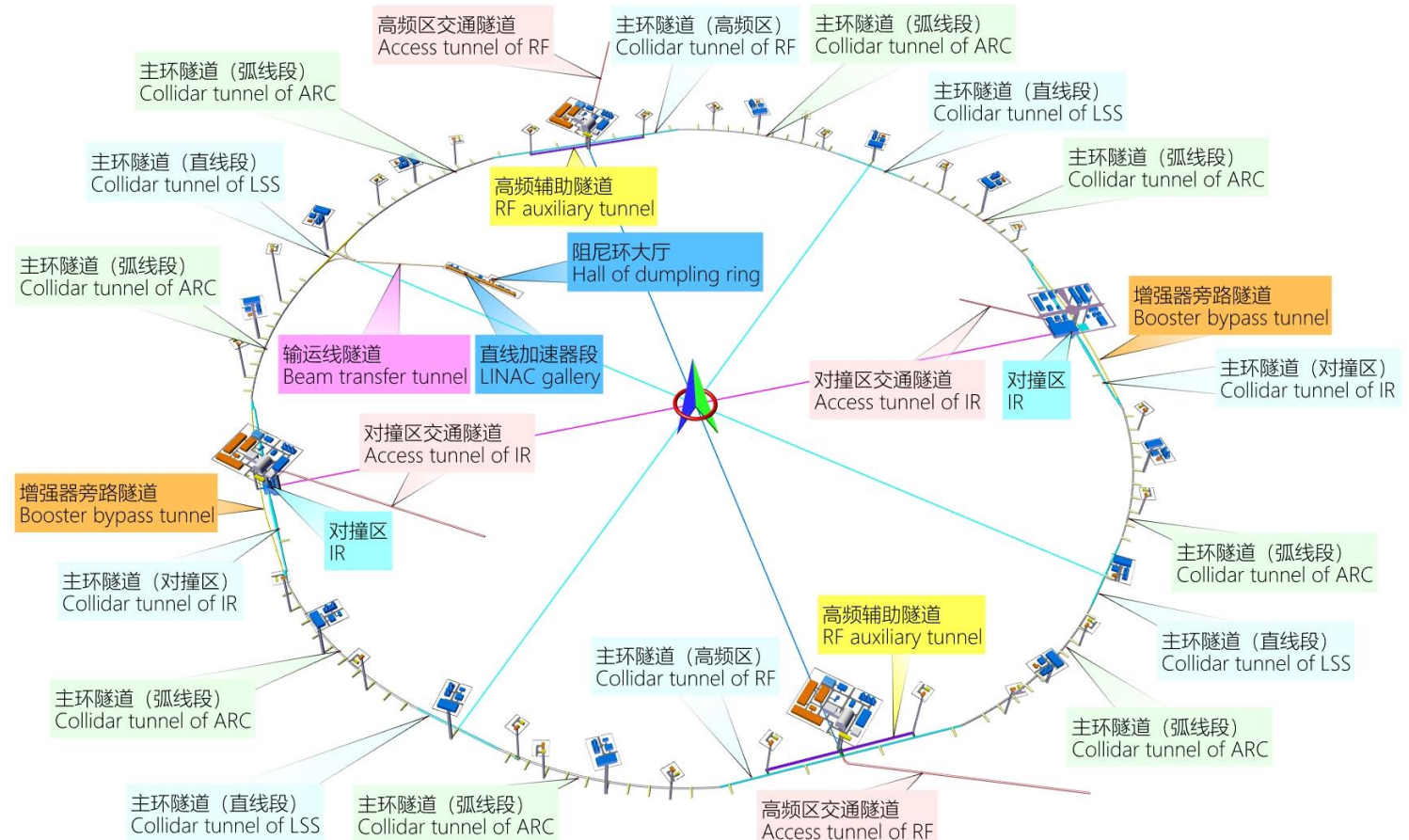
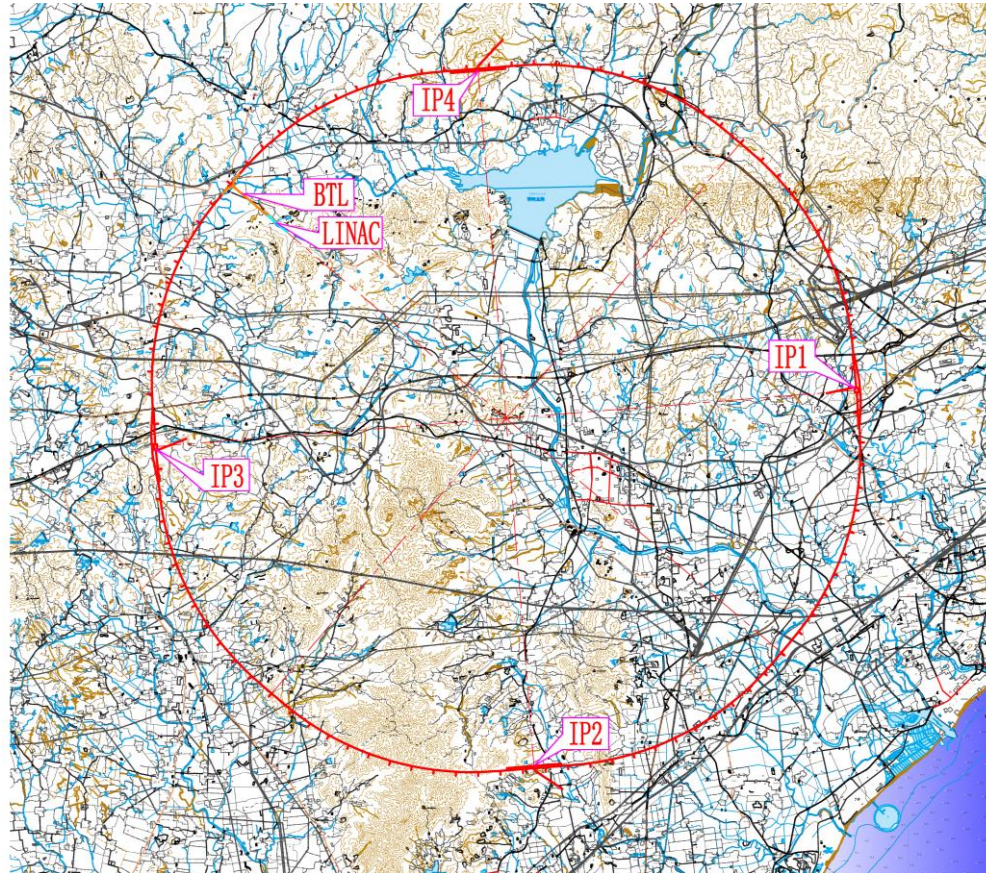
2 Civil Engineering

2.3 Engineering Geology



2 Civil Engineering

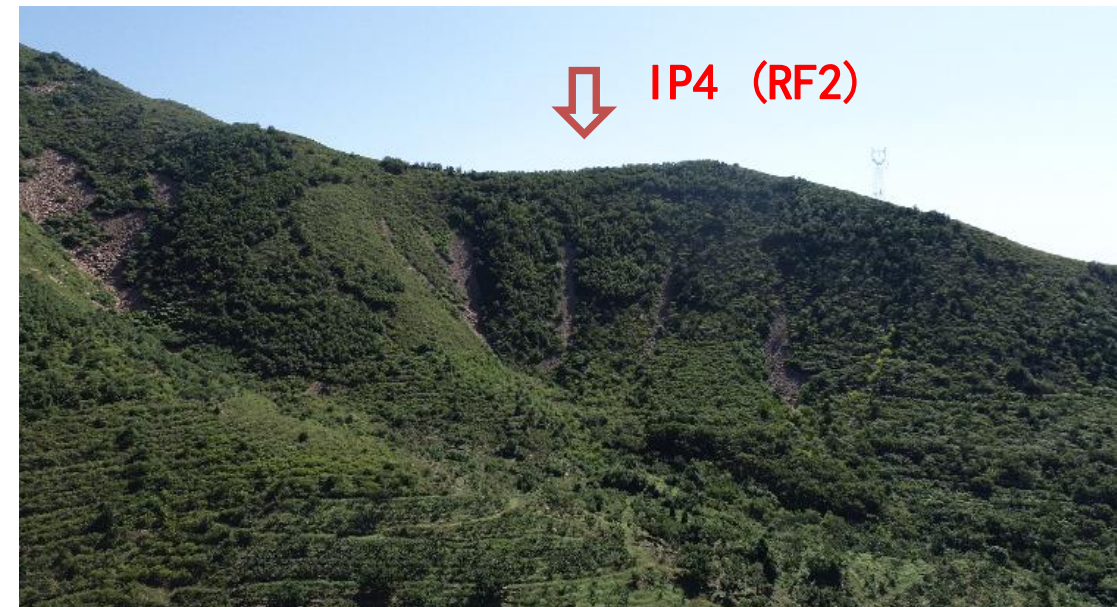
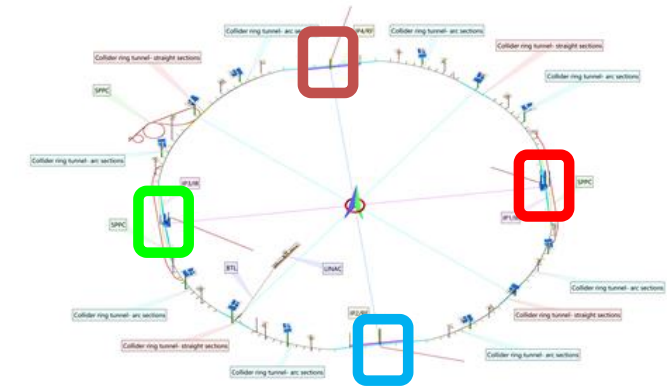
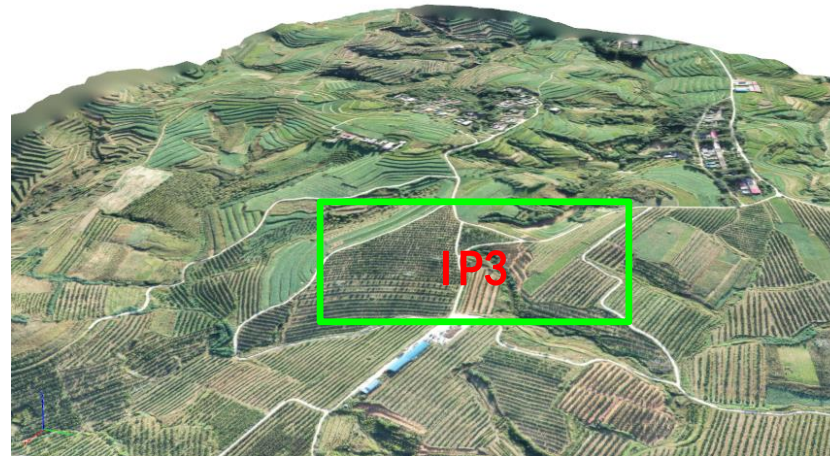
2.4 Project Layout



2 Civil Engineering

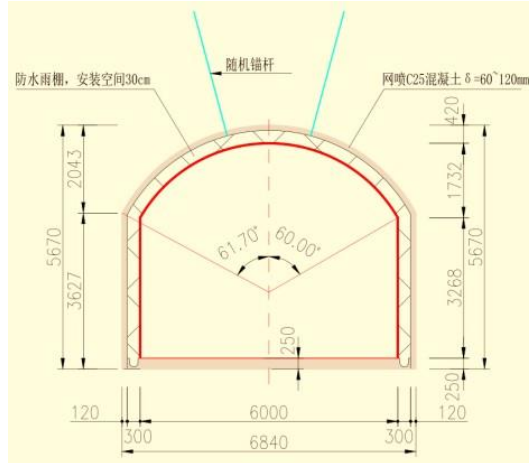
2.4 Project Layout

Preferred Option

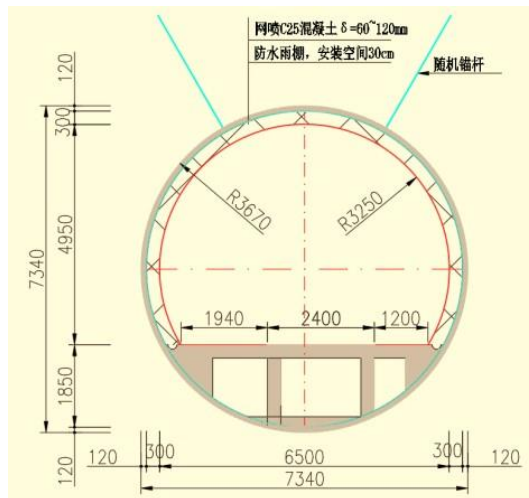


2 Civil Engineering

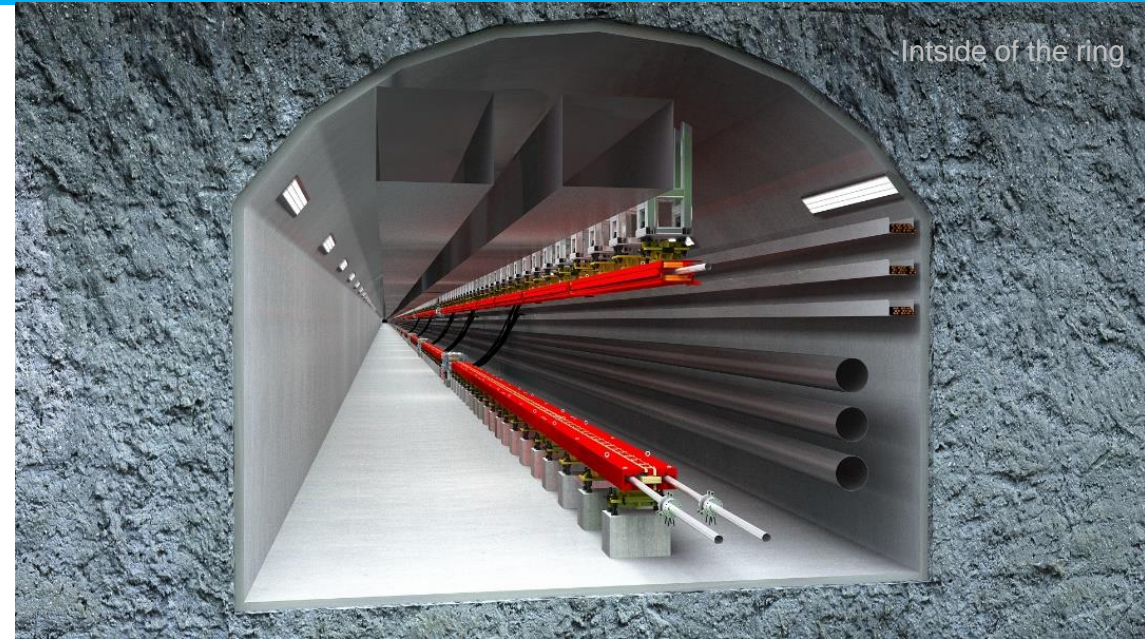
2.4 Project Layout



Drill-blast tunnel (6.0m×5.0m)



TBM tunnel (D6.5m)



Typical cross section of collider tunnel

Both drilling & blasting and TBM are feasible. Construction periods of the two methods are similar, and overall cost of drilling & blasting is lower. With the continuous advancement of TBM technology, the cost of TBM equipment and operation are gradually reduced, while the labor cost of drilling & blasting method increases year by year. The advantages of TBM will be increasingly prominent for implementation of the project.

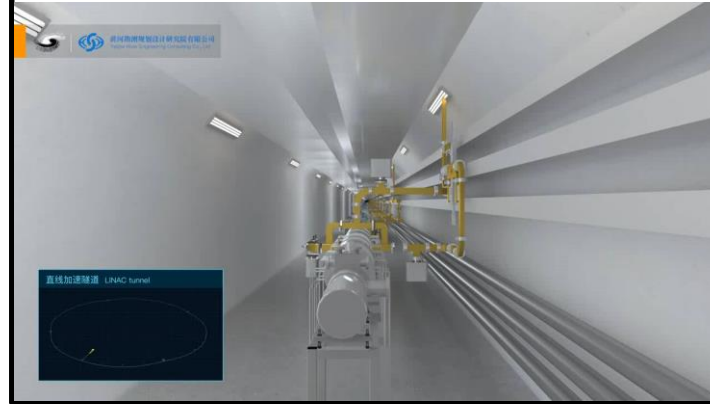
2 Civil Engineering

2.5 Equipment Layout

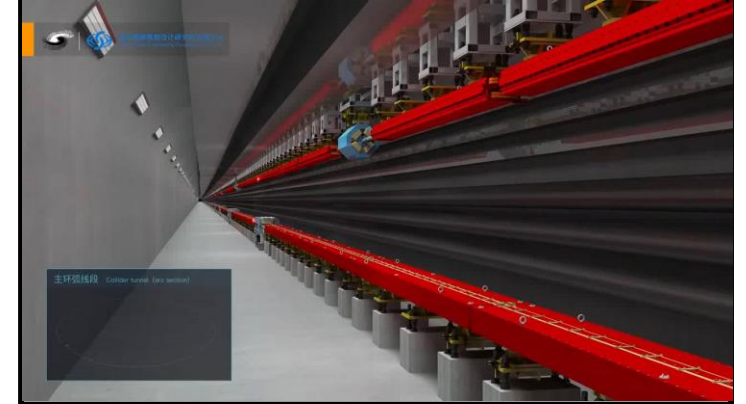
Klystron Gallery



Linac & BTL Tunnel



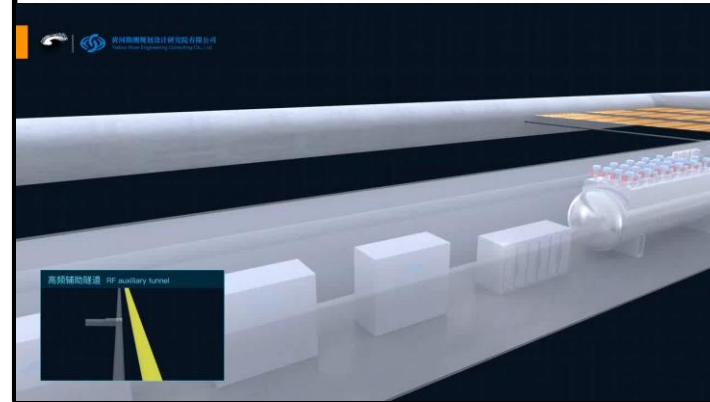
Collider ring tunnel



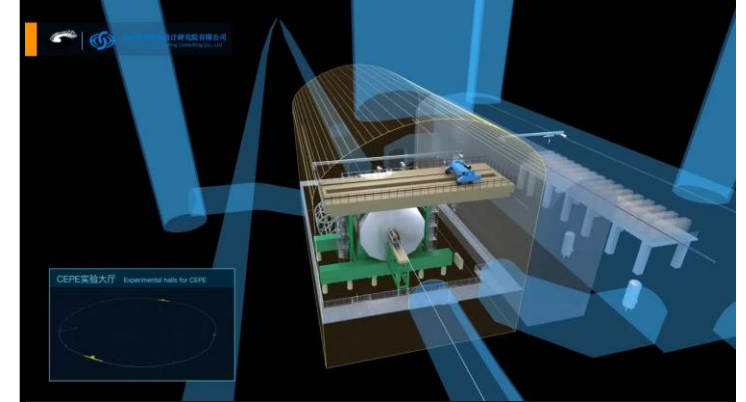
Collider ring tunnel (RF)



RF Auxiliary Tunnel



IP1 / IP3



2 Civil Engineering

2.5 Equipment Layout

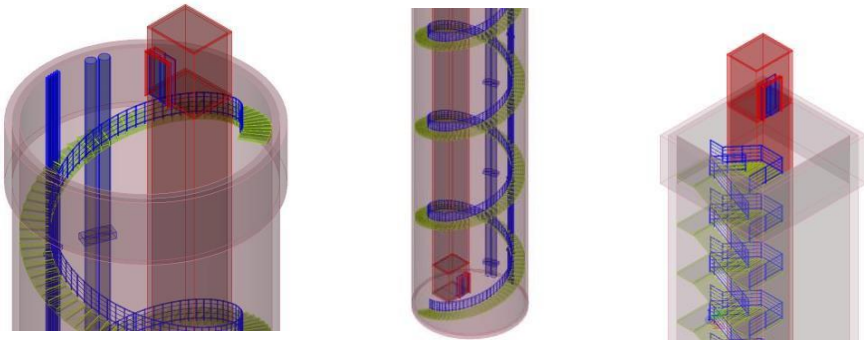
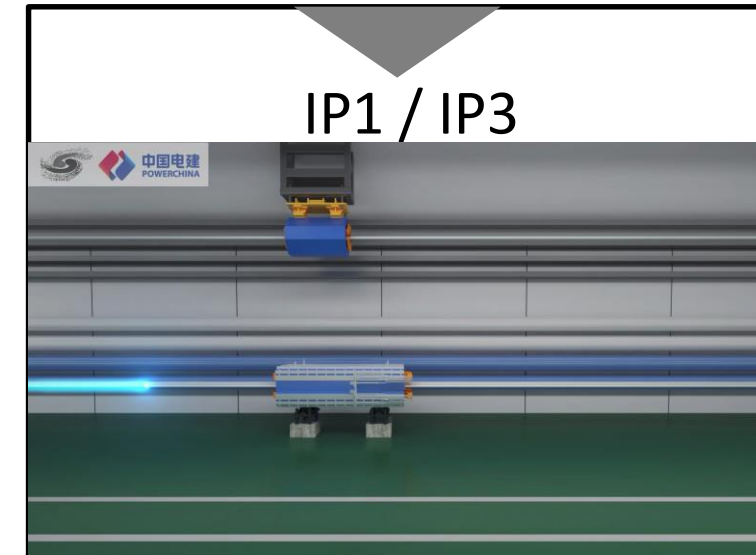
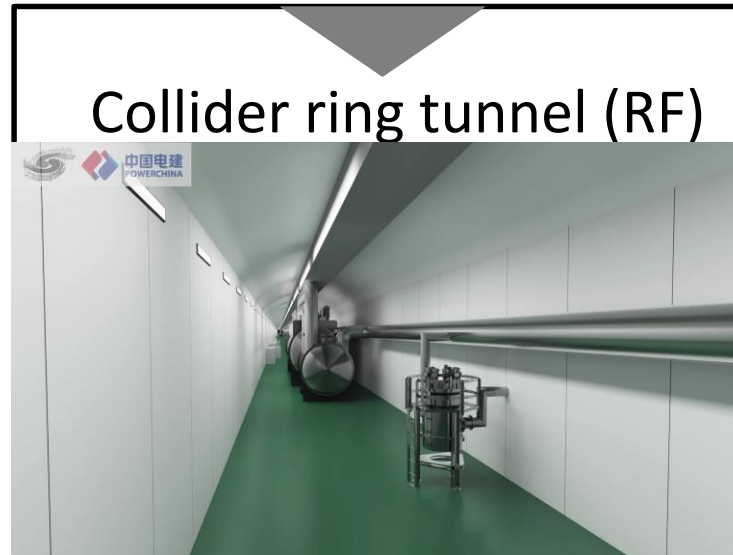
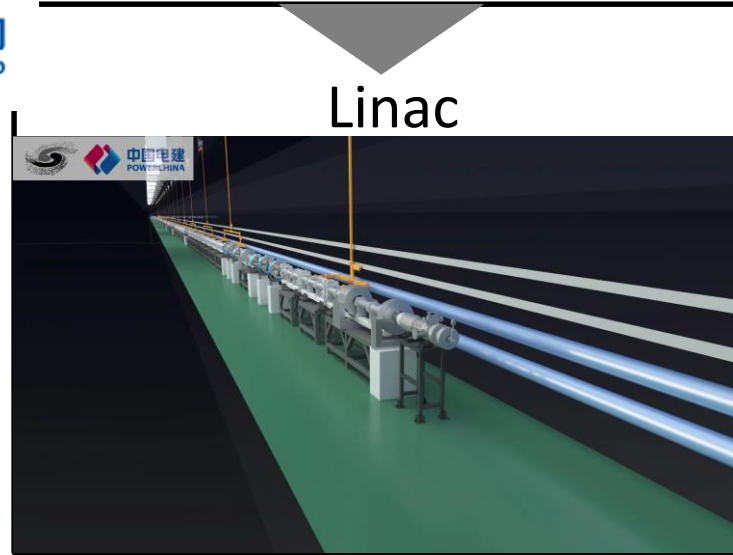
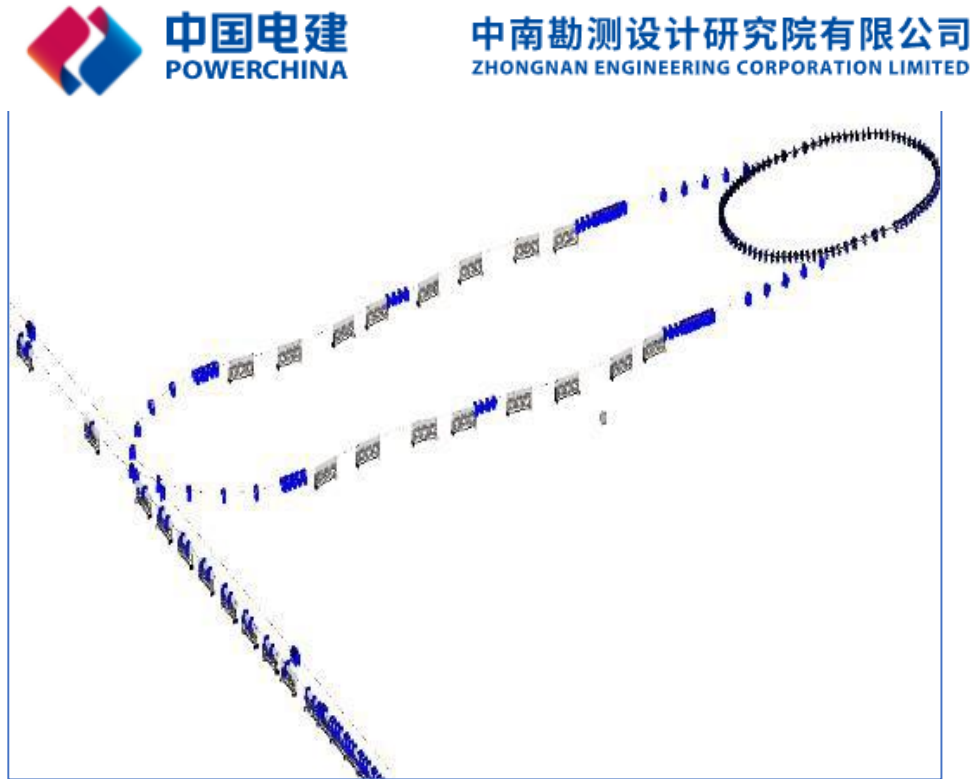


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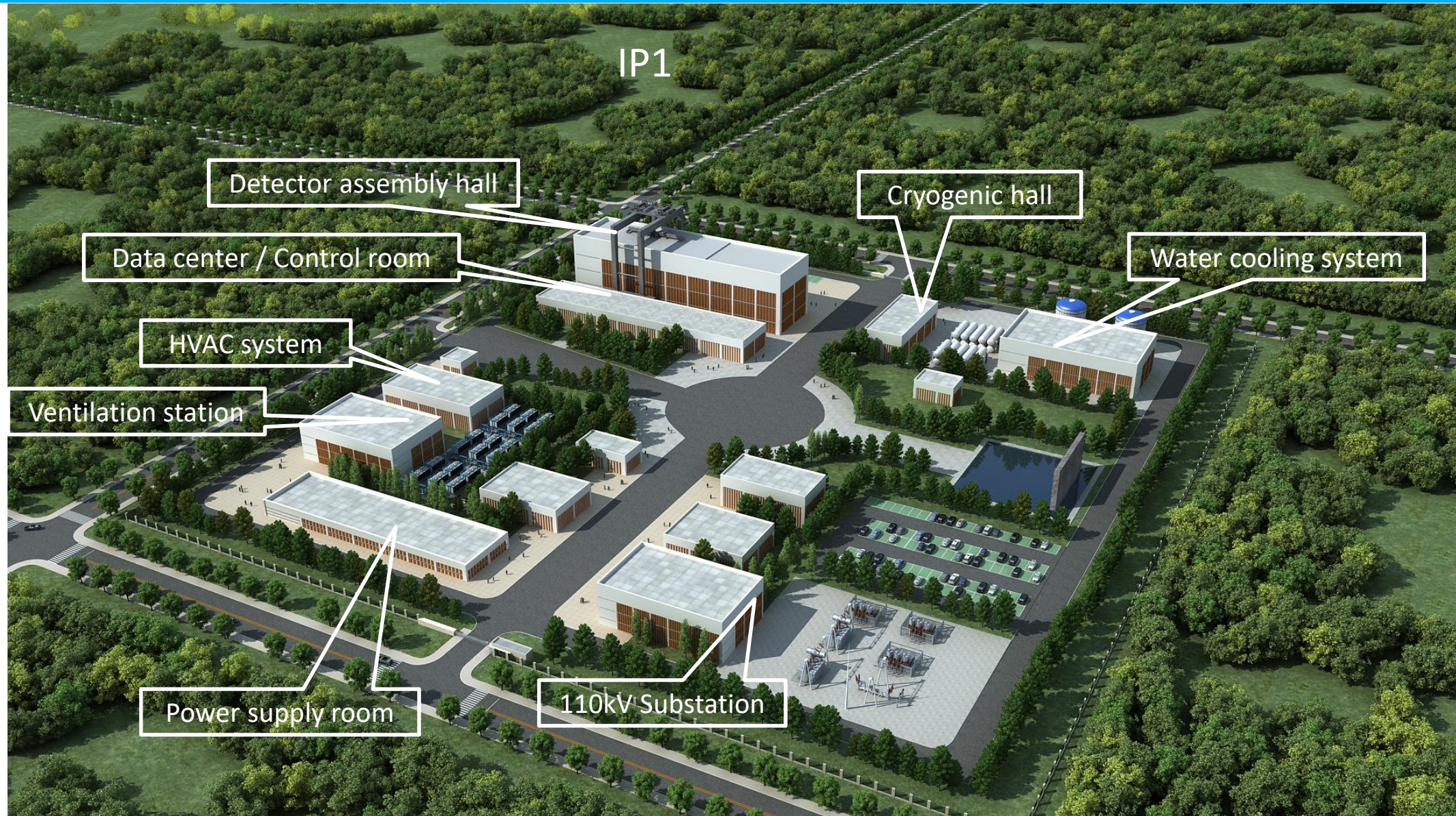
2 Civil Engineering

2.5 Equipment Layout



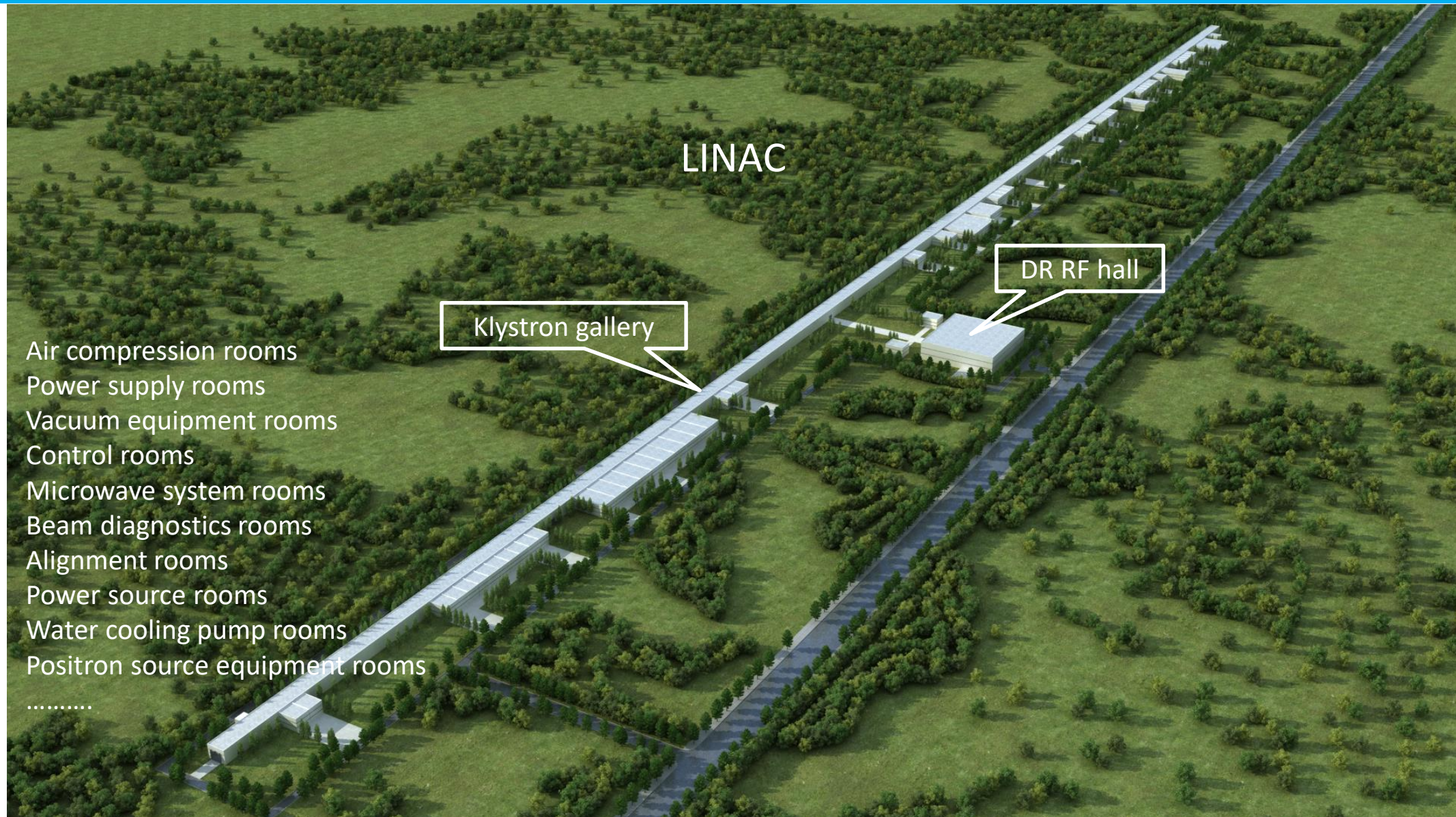
2 Civil Engineering

2.6 Surface Buildings



2 Civil Engineering

2.6 Surface Buildings

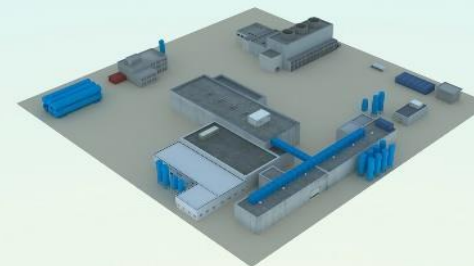
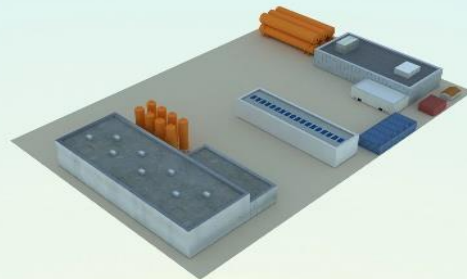
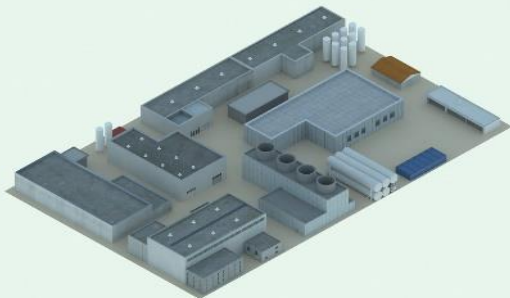


2 Civil Engineering

2.6 Surface Buildings



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2 Civil Engineering

2.7 International Science City



Huzhou



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Changsha



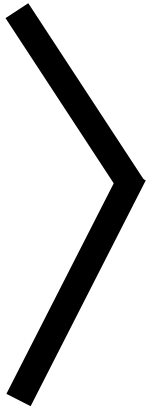
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03

Construction Planning



3 Construction Planning

3.1 Construction Scheme of the Main Structures

Preview of Whole Construction Process

全工程进度预览



3 Construction Planning

3.2 General Construction Schedule

General Construction Schedule (DBM)

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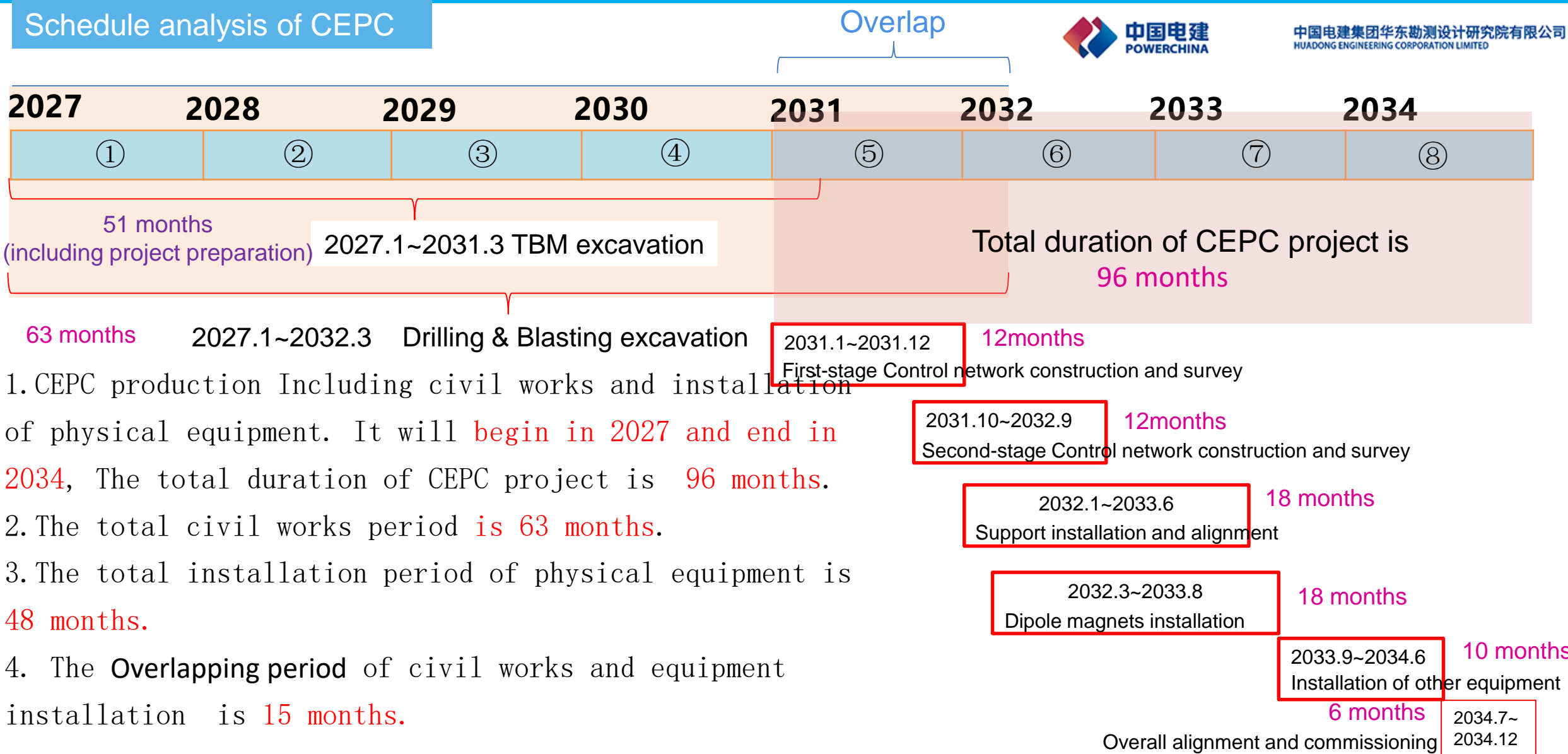
Total construction period - 54 months



Main works - 43 months

3 Construction Planning

3.2 General Construction Schedule



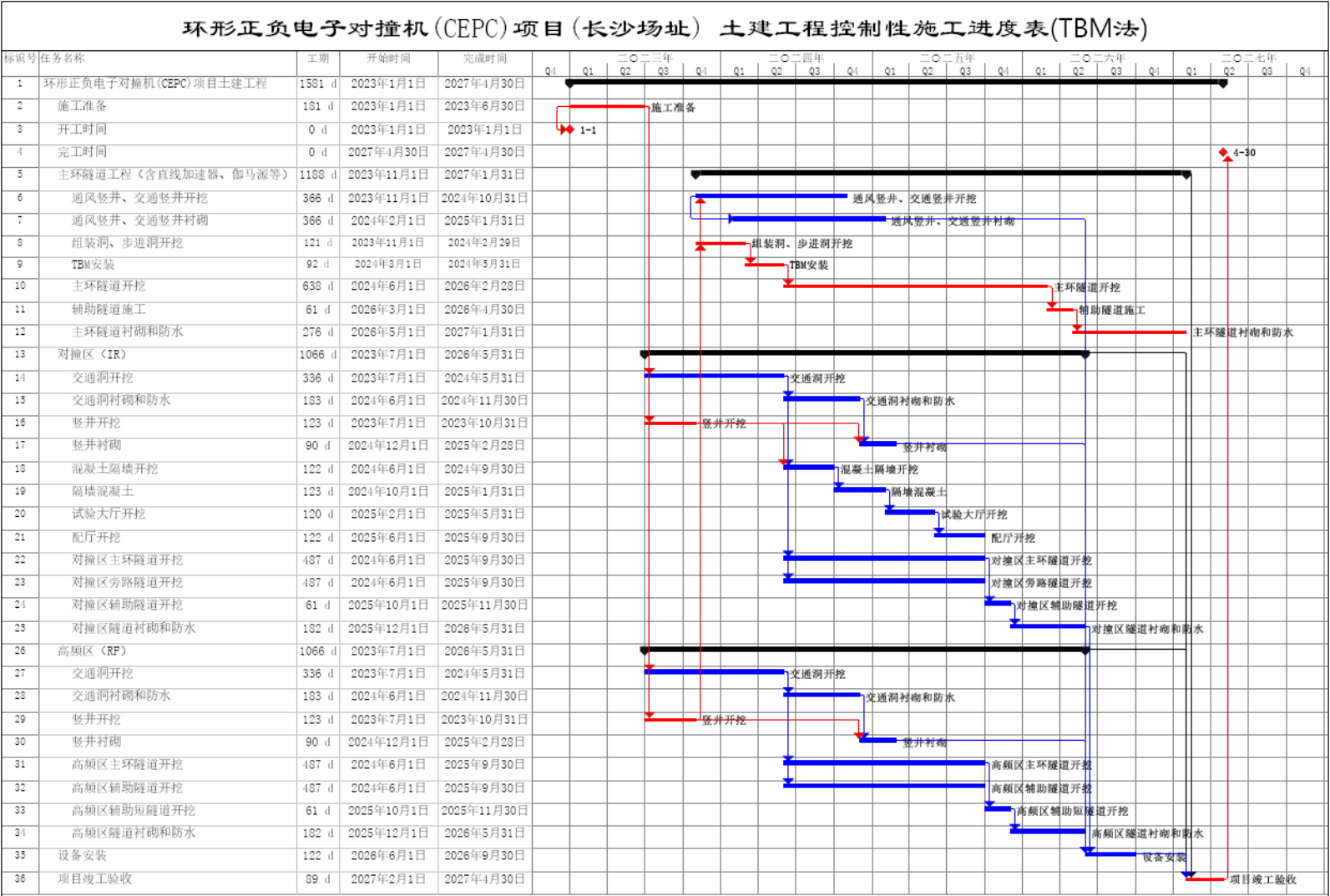
3 Construction Planning

3.2 General Construction Schedule



■ Construction Organization Design

- Eight open-type TBMs will be adopted for construction, and the shafts of permanent structures can be used as launch shaft and receiving shaft of the TBMs.
- The total TBM construction period is 52 months, including 6 months for construction preparation, 43 months for construction of main works, and 3 months for completion.



3 Construction Planning

3.3 Similar Projects

● Dianzhong Water Diversion Project



The total length of the project is 664km, including 612km of the headrace tunnel. The project started construction in October 2018, with a total construction period of 8 years. It is planned to be put into trial operation by the end of 2026.

The 104.56km long **Kunyu Tunnel** is the longest tunnel in this project and also the longest tunnel under construction in China's water conservancy projects. It has 26 construction adits and 4 construction shafts arranged. (Max cross section 7.6m x 8.2m)

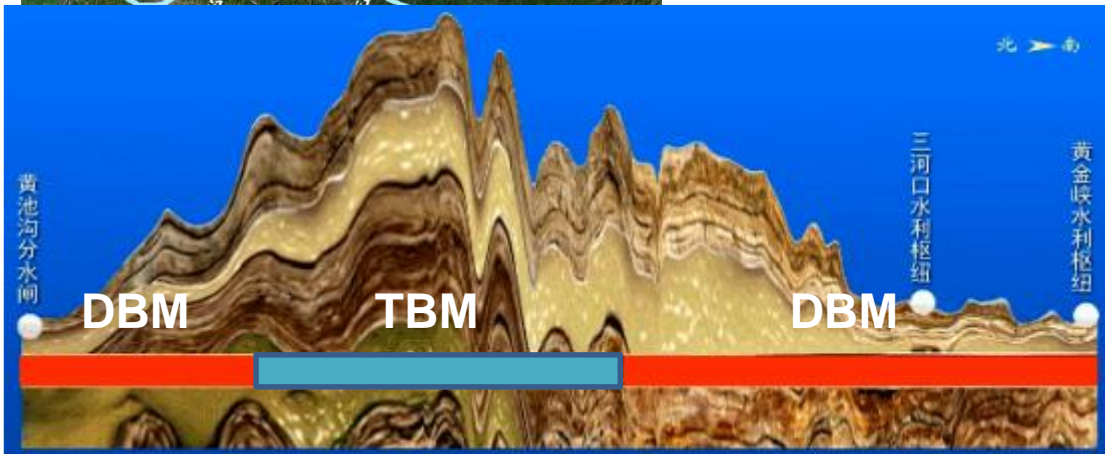
The 62.59km long **Xianglushan Tunnel** is the second longest tunnel in the project, with a maximum burial depth of 1450m. It is constructed using a combination of DBM and two TBMs, with 9 construction adits arranged. The diameter of TBM is 9.83m, which is the largest TBM in the world for water diversion projects.

3 Construction Planning

3.3 Similar Projects

Water Diversion from Han to Wei River Project

The **Qinling Headrace Tunnel** is the key control project of this project, with a total length of 98.3km. The 35km section crossing the main ridge of the Qinling Mountains is constructed using TBM, while the other shallow buried sections (63.3km) are constructed using drilling and blasting methods. A total of 14 construction adits are arranged along the tunnel, with a total length of nearly 30km. The maximum burial depth of the tunnel is 2012m, with a longitudinal slope of 1/2500. Two TBMs with a diameter of 8.02m were used for construction. The entire section of the tunnel is lined with reinforced concrete, with a lining thickness of 30cm to 100cm.

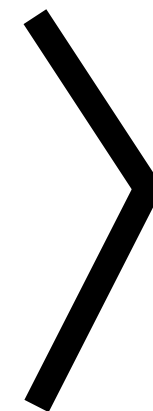


The construction began in June 2007, the entire tunnel was completed on February 22, 2022, and the main project was completed on April 29, 2023.

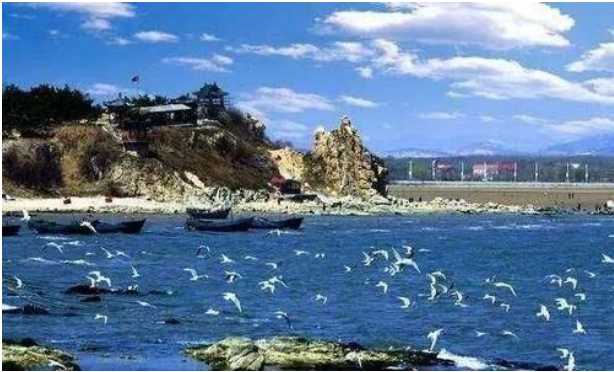
The construction section of the tunnel using the drilling and blasting method has a horseshoe shaped cross-section of $6.67\text{m} \times 6.76\text{m}$; The diameter of the tunnel in the TBM construction section is 6.92m.

04

Summary



4 Summary



Qinhuangdao

- Qinhuangdao is the “Summer Capital” in China famous for its coastal tourism, leisure and resort.
- Qinhuangdao site is in hilly area. The region is basically stable. There are no major geological problems.
- The site is suitable for the underground structures of such a large extent.

4 Summary

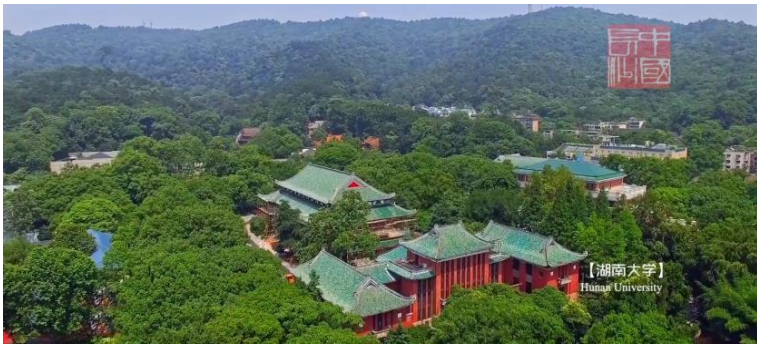


Huzhou

- Based on the preliminary comprehensive analysis of multiple influencing factors, the CEPC site selection in Huzhou has no constraints and the conditions in Huzhou are superior.
- Relying on CEPC, research on digital solutions for collaborative management of multi-source and massive data has produced rich results with obvious spillover benefits.



4 Summary



Changsha

Changsha site has completed the conceptual design of civil engineering and carried out the assembly and layout of some professional equipment. The main conclusions are as follows:

- Hunan Province has superior geographical location, rich tourism resources and high degree of internationalization, which meets the requirements of CEPC civil engineering site selection.
- The main ring and hall are basically located in granite, with favorable terrain and geological conditions.
- The next step focuses on the tunnel support and waterproof forms which affect the civil engineering investment, and optimize the investment.

4 Summary



All sites can satisfy requirements for CEPC construction. The main geological problems encountered can be solved by engineering measures.



Advance the civil engineering design as soon as possible.

Decide the site

Complete the project proposal, feasibility study, preliminary design, and tender design before construction



Qinhuangdao

THANK YOU FOR YOUR ATTENTION



Huzhou



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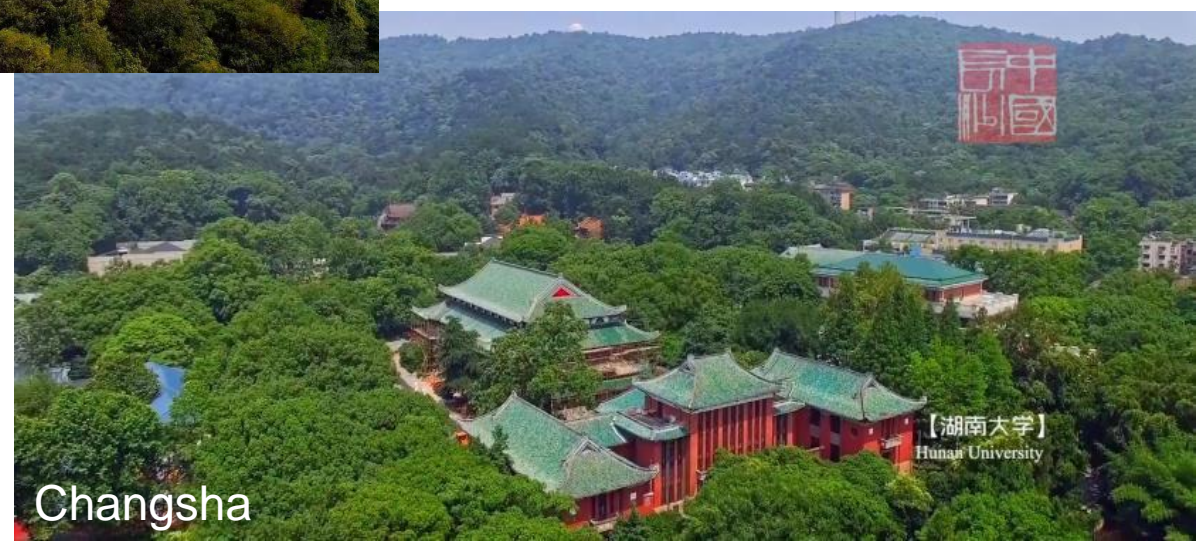
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Changsha

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Hunan University