Low Radioactivity Techniques 2019, Jaca, Spain

A New Low-Background Facility in China Jinping underground Lab

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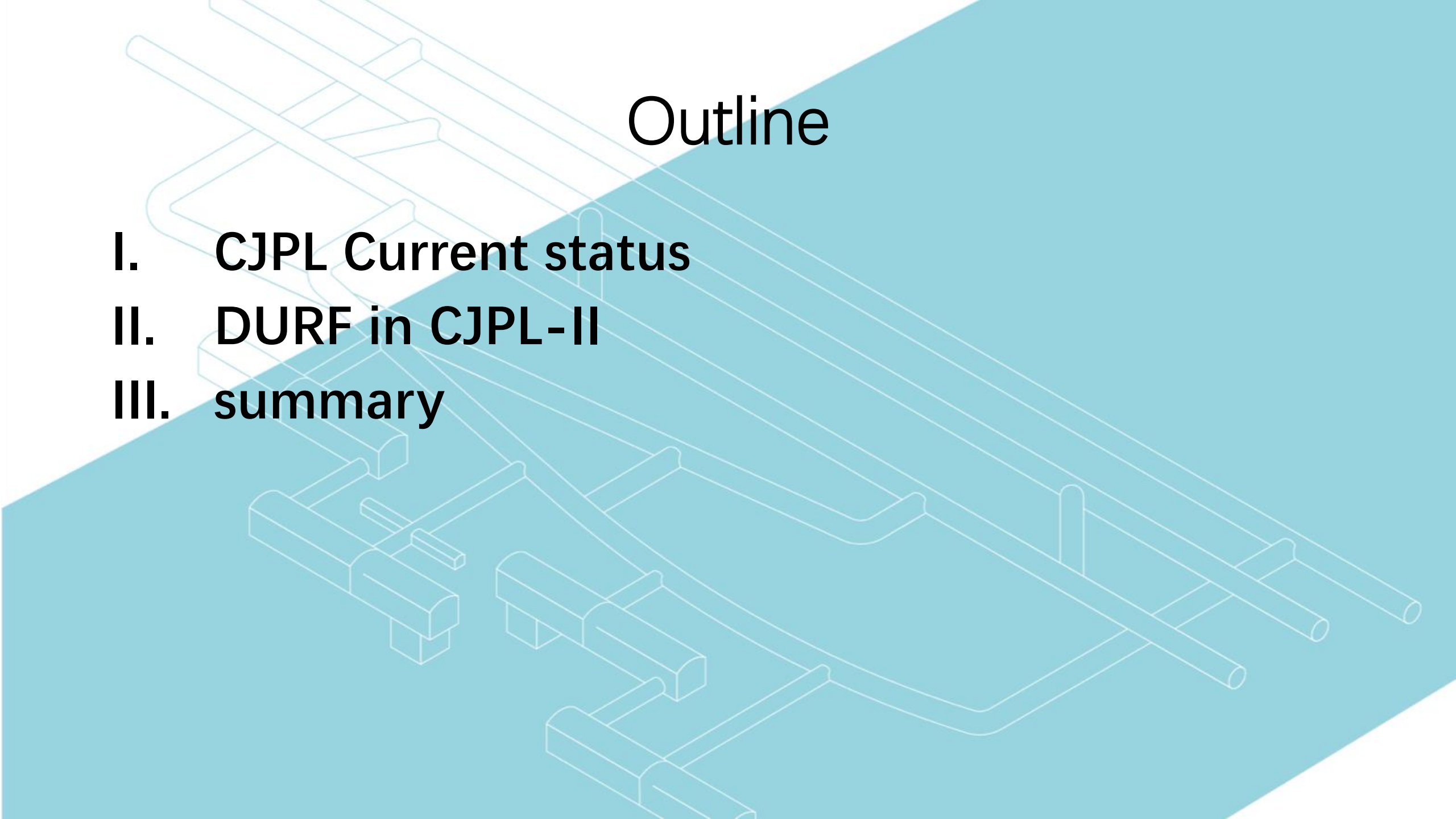
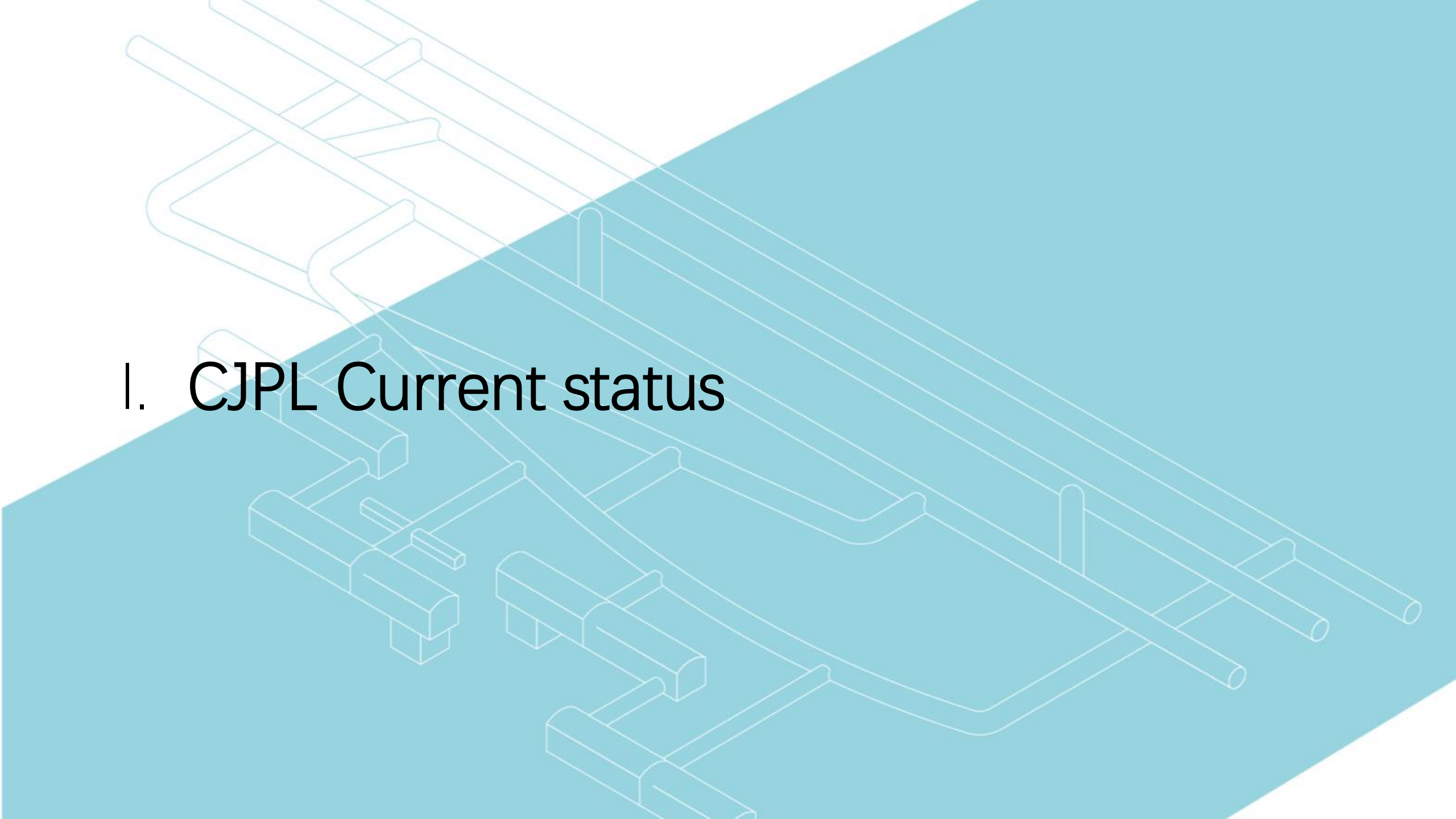
2019-05-20

Outline

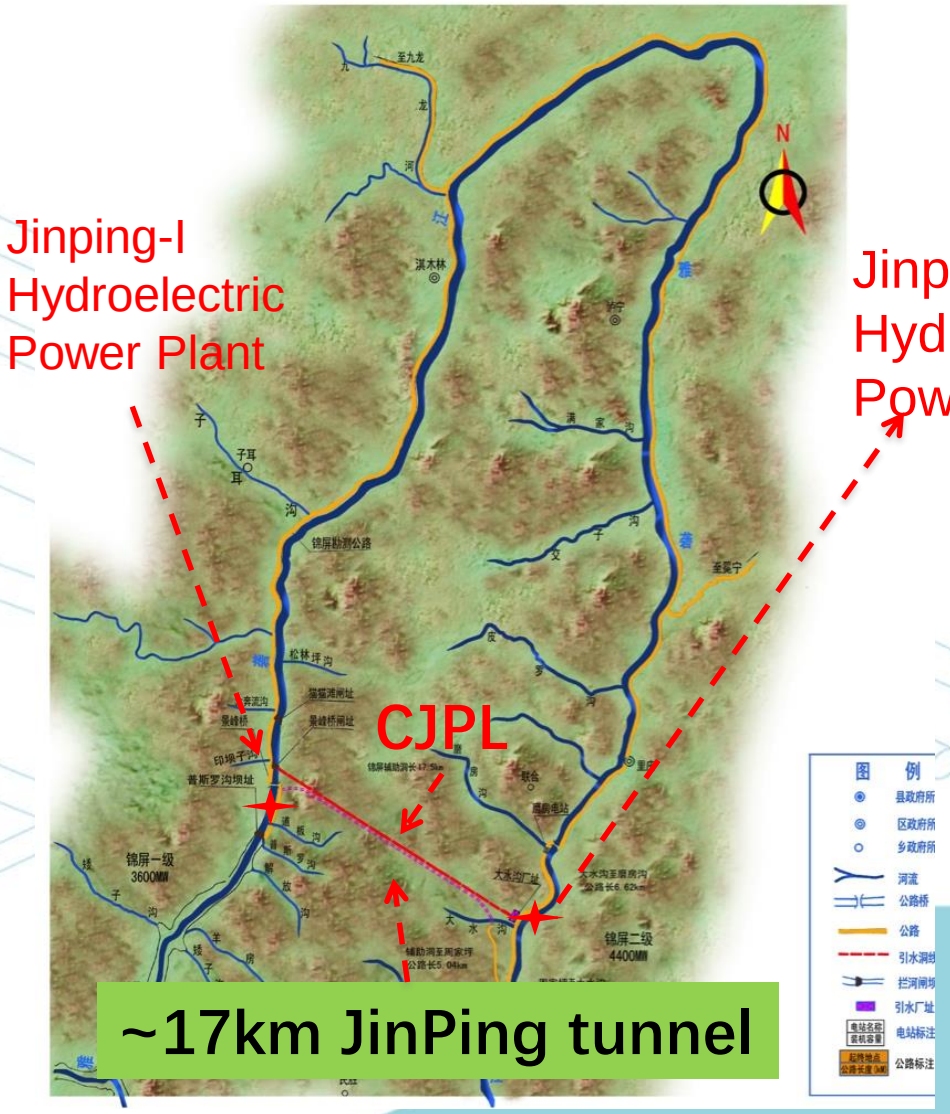
I. CJPL Current status
II. DURF in CJPL-II
III. summary



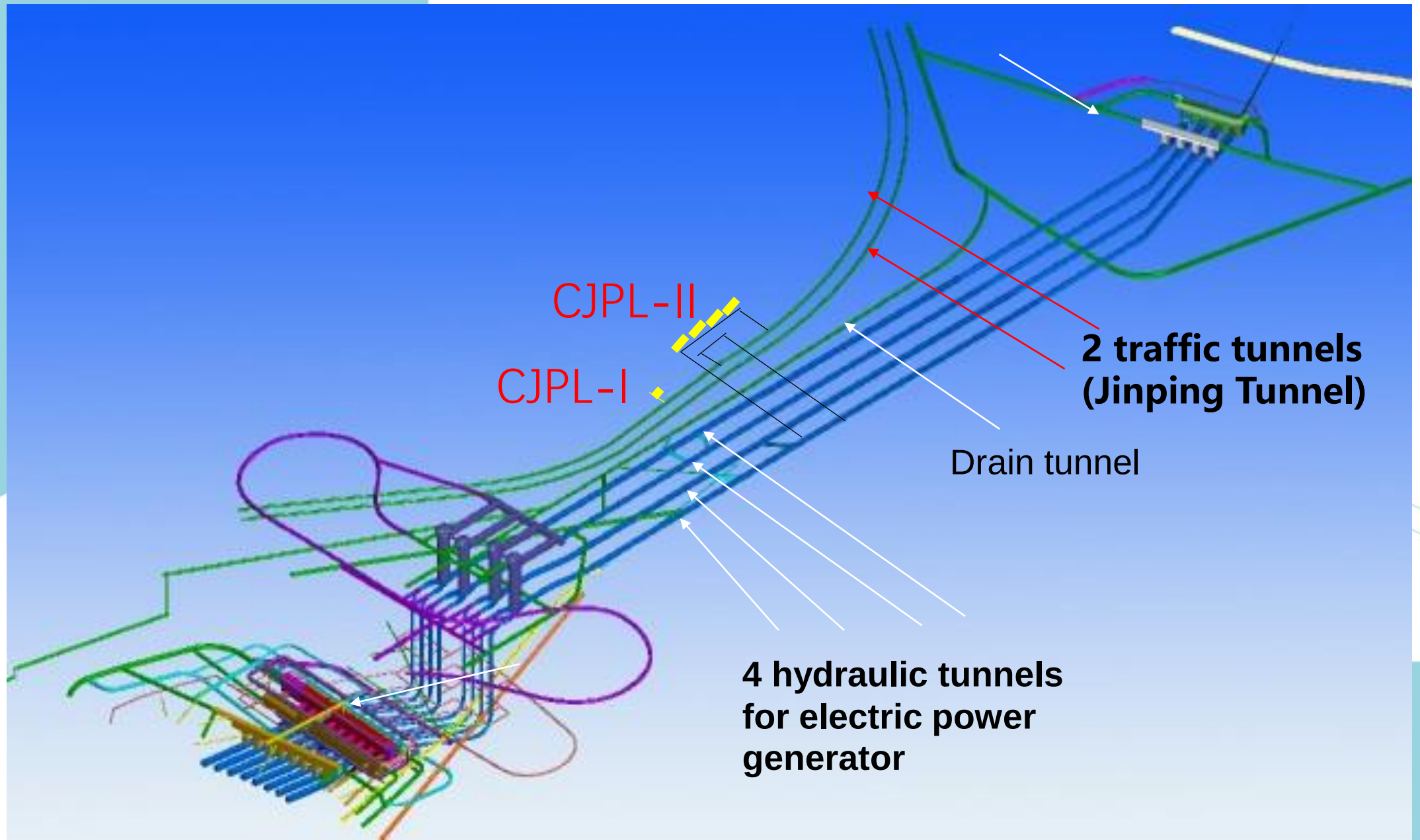


I. CJPL Current status

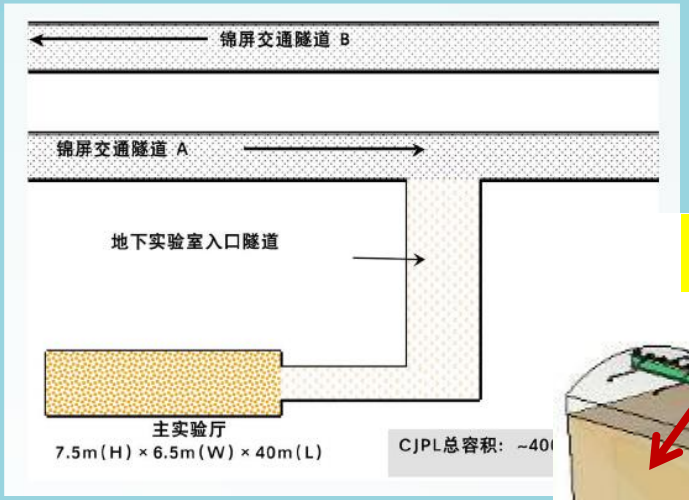
CJPL Location

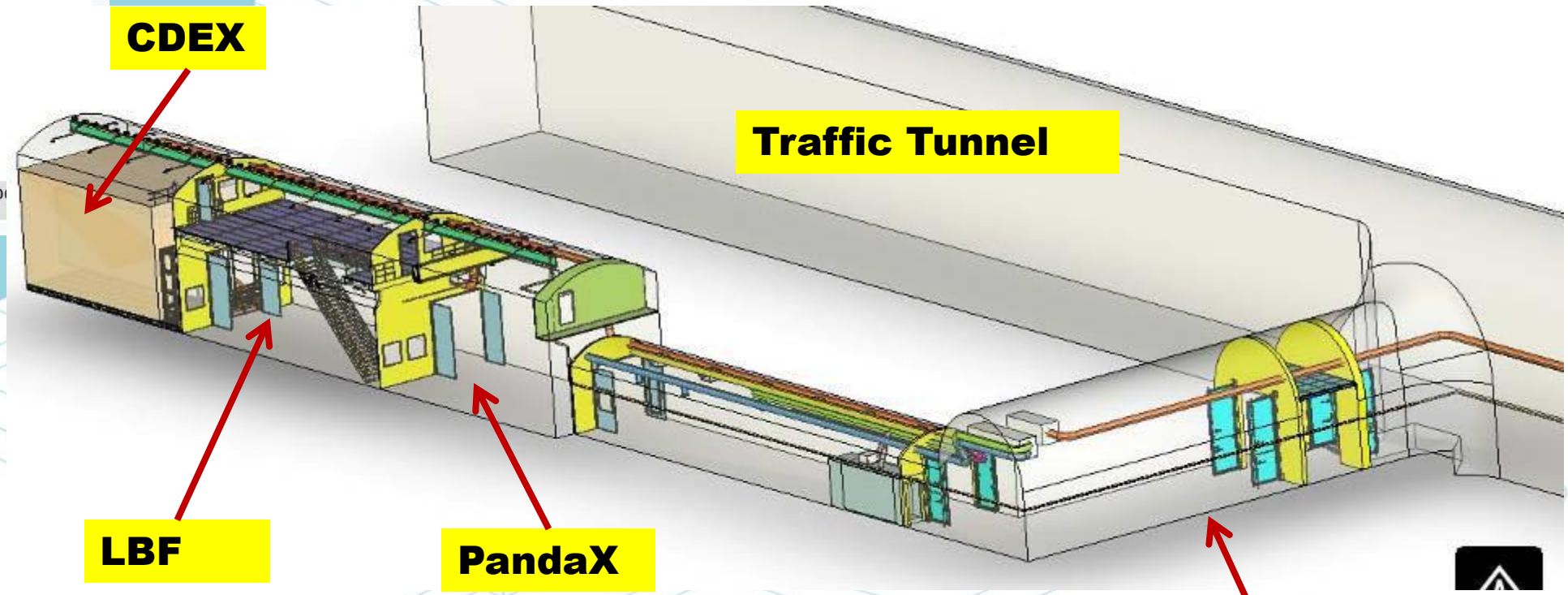


Tunnel Layout



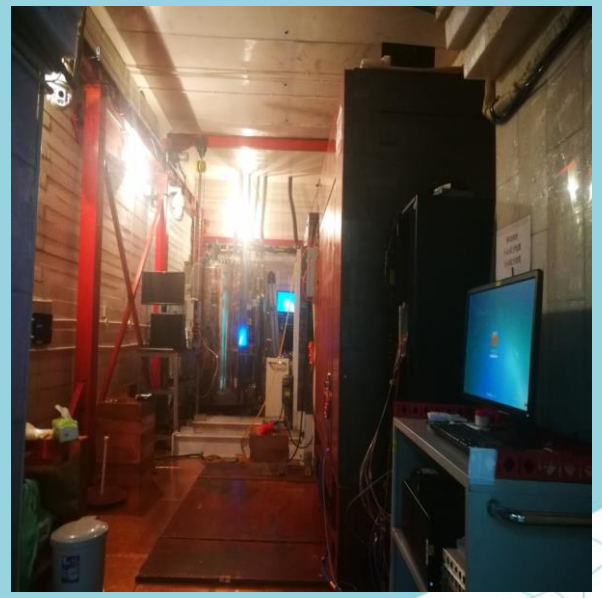
Layout of CJPL-I





- Total space: 4000 m^3
- Main Lab Space: 6.5(W) x 6.5(H) x 42(L)

Current Status of CJPL-I



CDEX experiment

PandaX

Jinping neutrino

Low-background gamma spectrometer

- Physics experiments:
  - 2 dark matter experiments: CDEX, PandaX
  - 1 neutrino experiment: Jinping Neutrino experiment
- Low background counting facilities:
  - 3 low-background gamma spectrometers

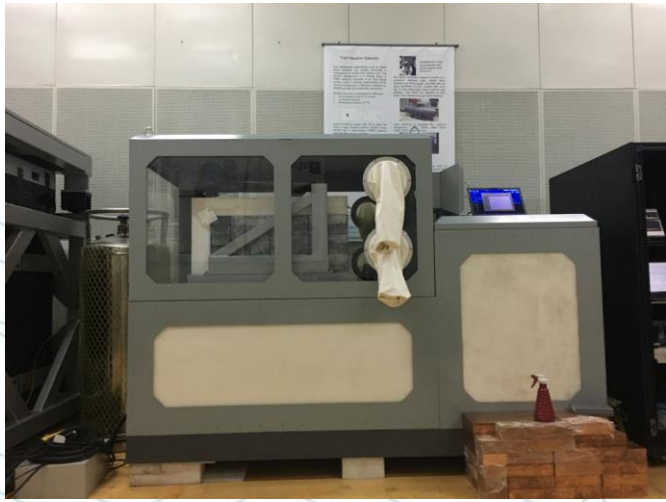
Low-background gamma spectrometer

GeTHU, low background gamma spectrometers in CJPL-I, designed for material screening for dark mater experiment..

CJPL-I low background facility

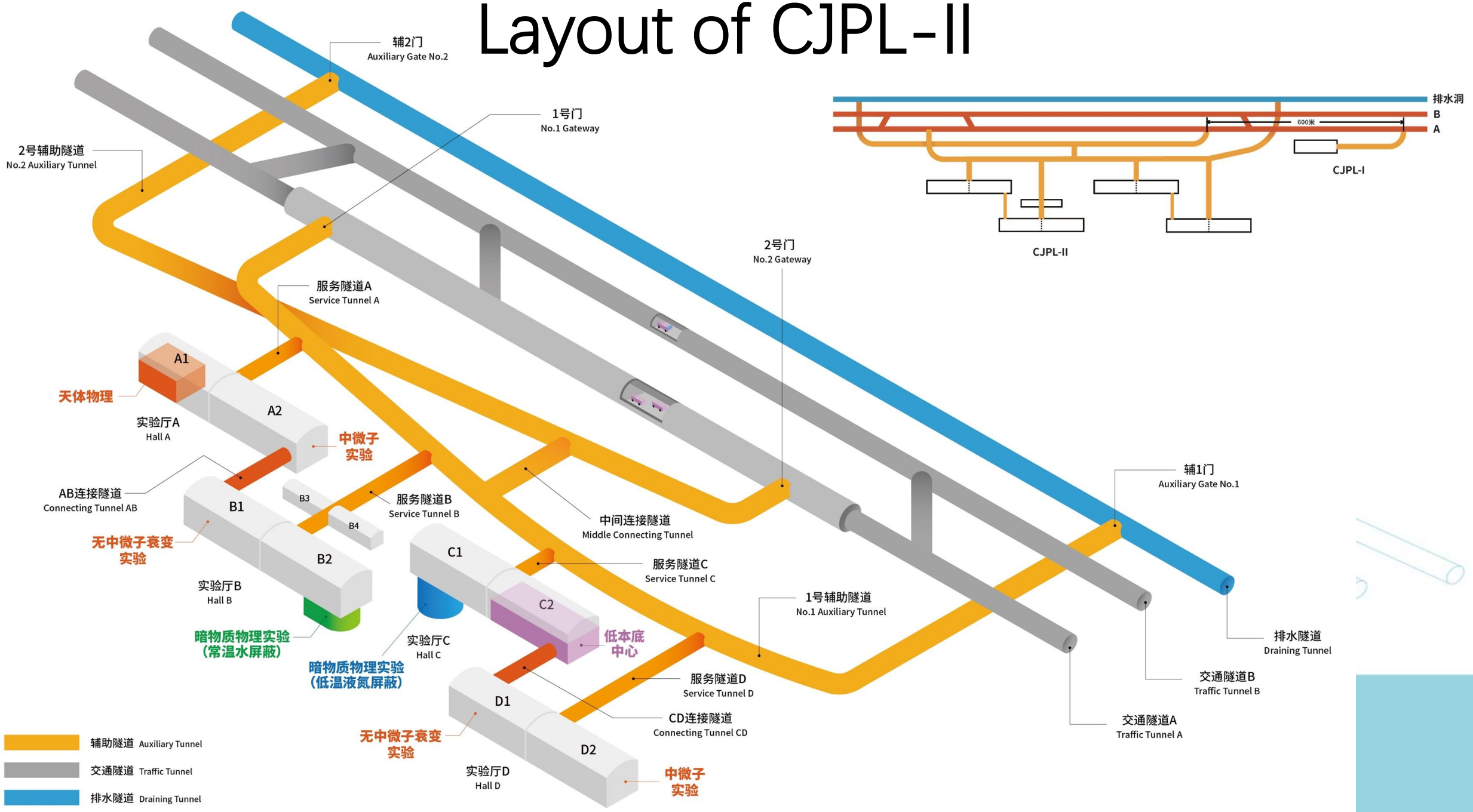
GeTHU-I

GeTHU-II



GeTHU-III

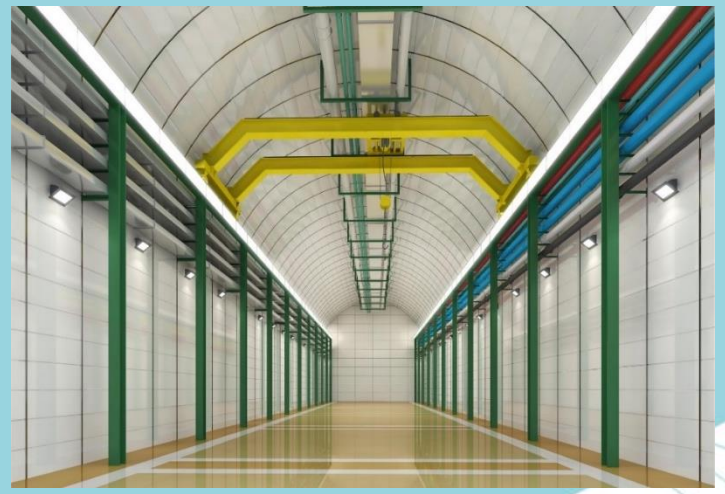
Layout of CJPL-II



CJPL-II construction and current status

II. DURF in CJPL-II

DURF introduction

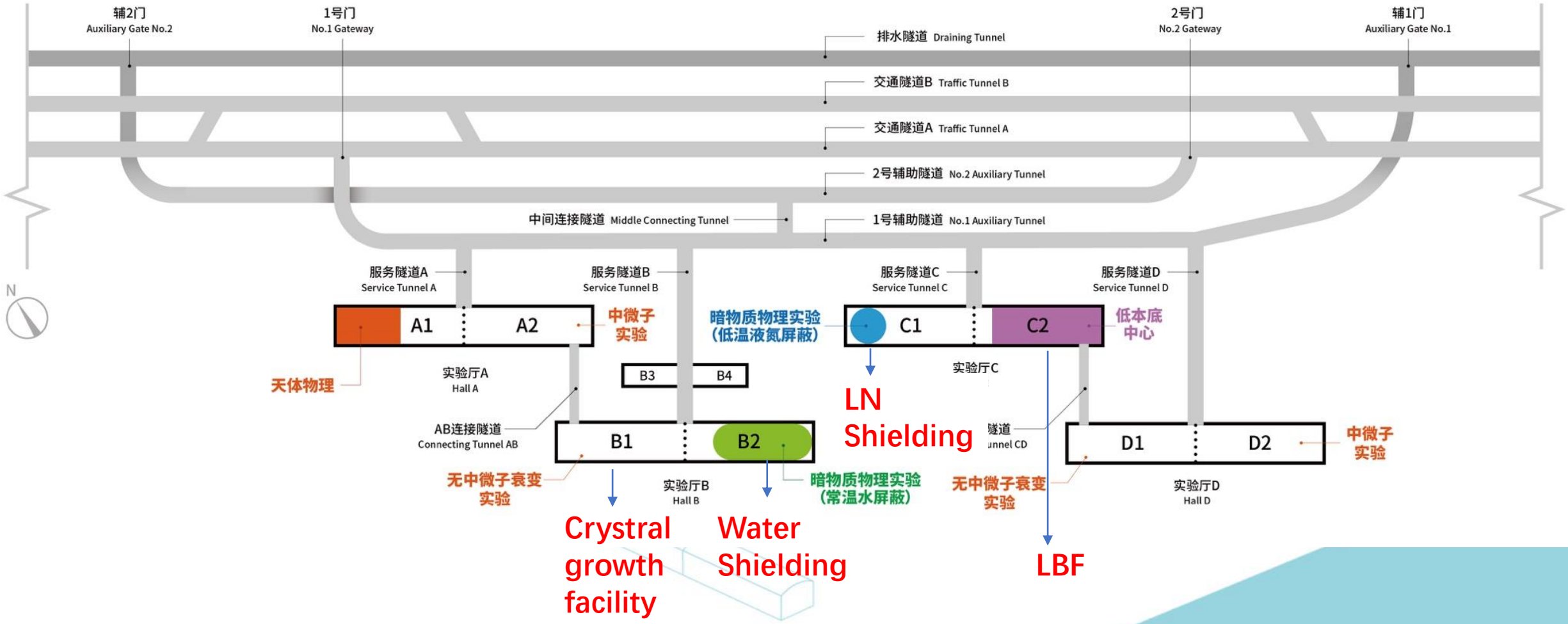


Hall

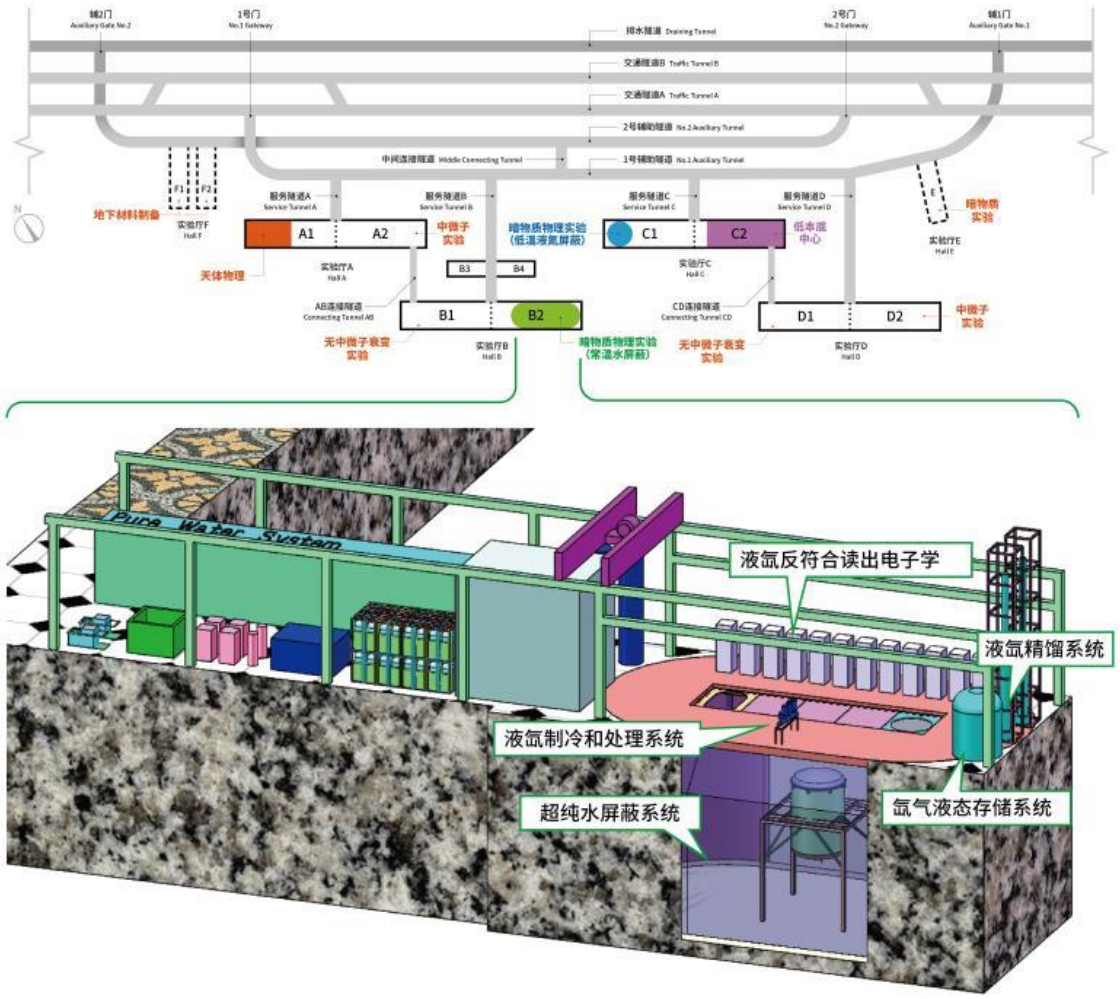
Service tunnel

- **Deep Underground and ultra-low Radiation background Facility for frontier physics experiments(DURF)** is one of the 10 prior projects of ***National Major Science &Technology infrastructure***.
- CJPL-II was selected to build DURF, and the proposal approved in the Dec.13 , 2018, ~177 million euros.
- DURF would involve:
  - Three Shielding devices for different experiment
  - Low background counting facilities
  - Ultra pure copper production devices
  - Crystal growth and process

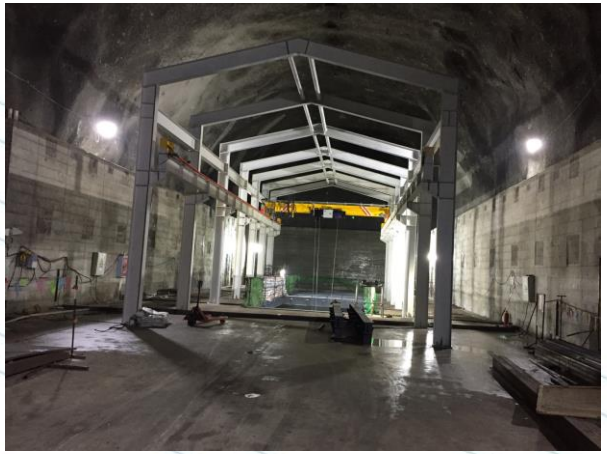
DURF in CJPL-II

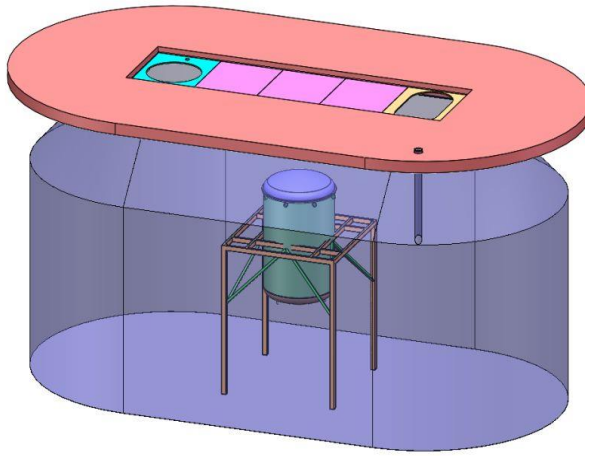


A large water shielding vessel



Large Water shielding vessel in B2 Hall

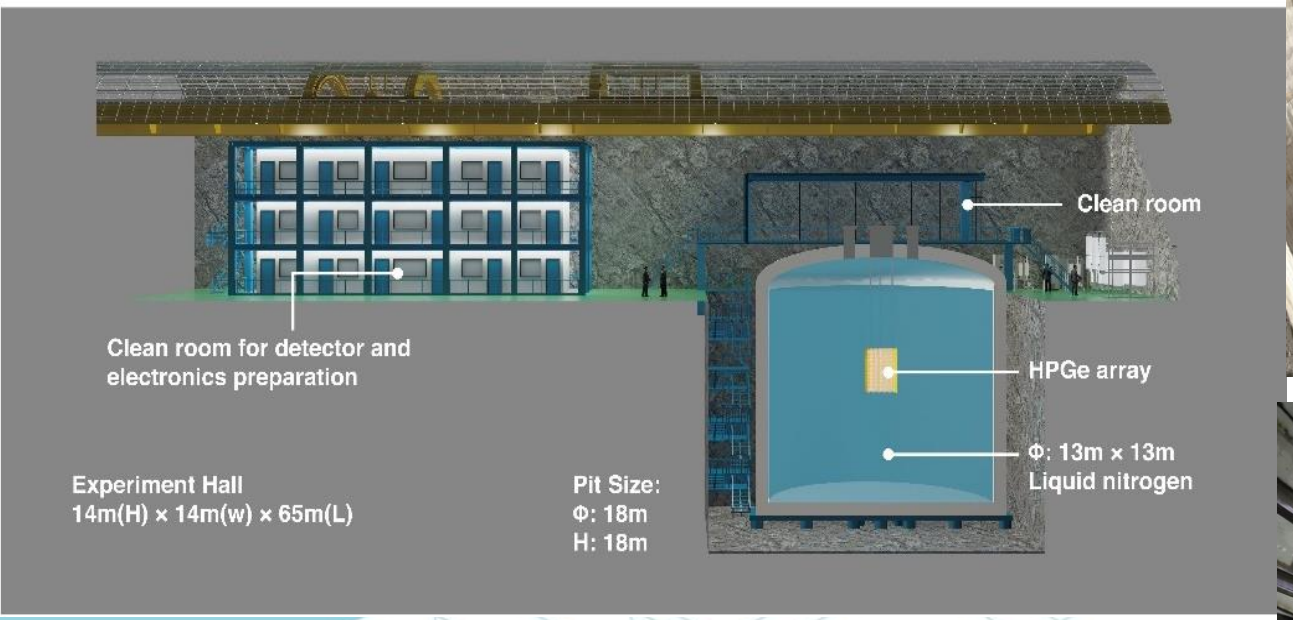


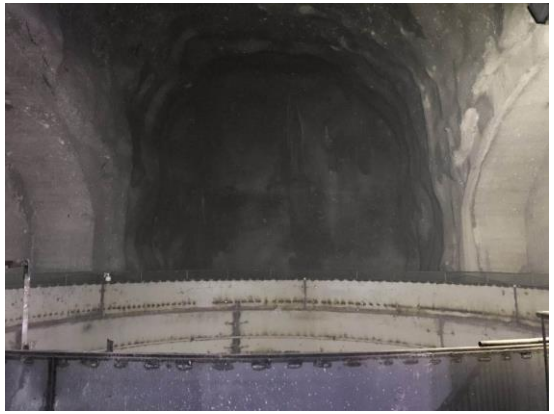


Prepare for LXe/LAr experiments shielding:

- Size: L27m*W15m*D13m
- Volume: 4500m^3 pure water
- Gamma background: 10^{-5} cpkkd@2MeV

A large liquid nitrogen shielding vessel

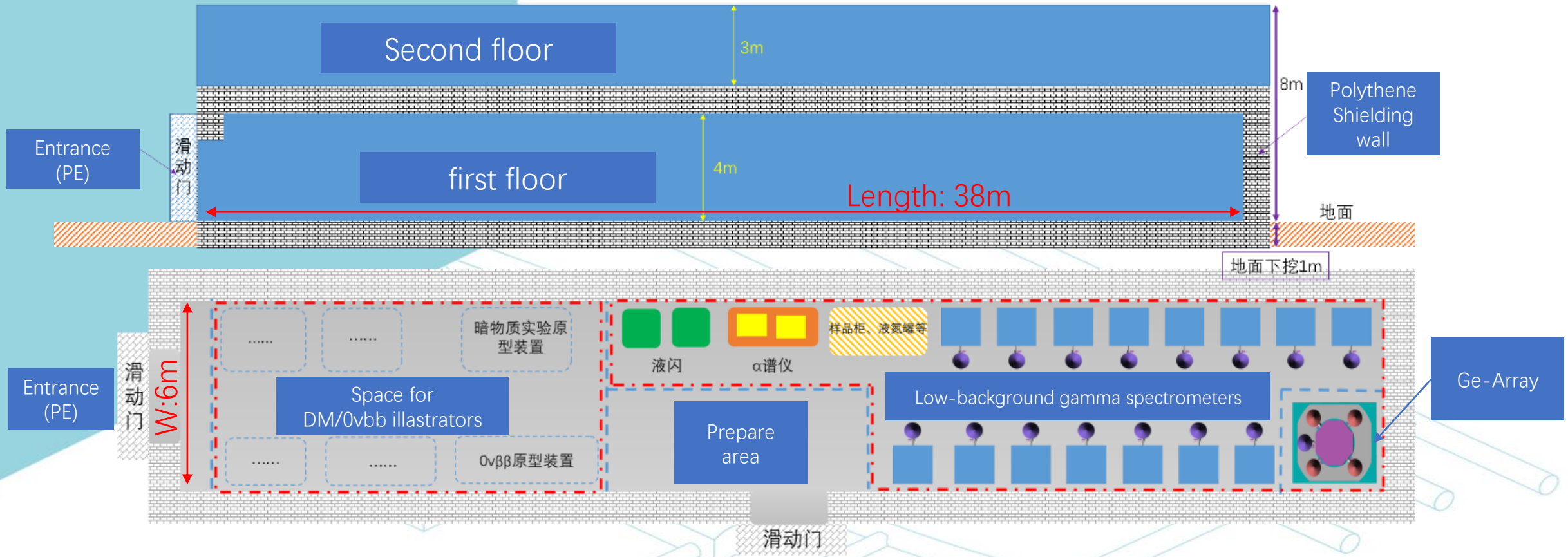




Prepare for HPGe experiments in C1 hall:

- Vessel Size:ϕ16.4m*H20m(outer), ϕ13m*H13m(inner)
- Volume: 1725m^3 liquid nitrogen
- Gamma background: 10^{-8} cpkkd@1-3keV.
- The Liquid Nitrogen tank is now constructing.

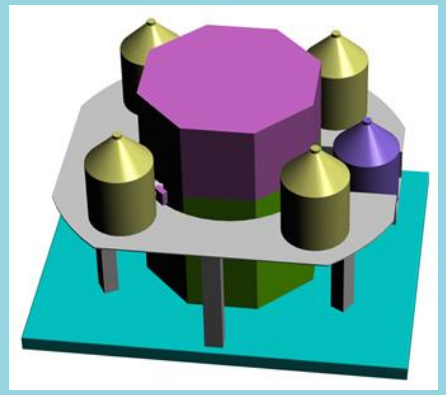
A Polythene Shielding Room

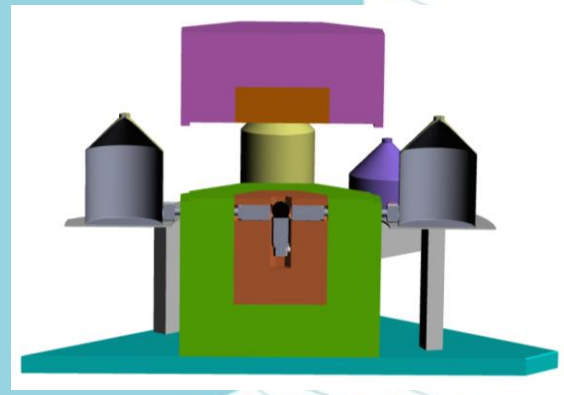


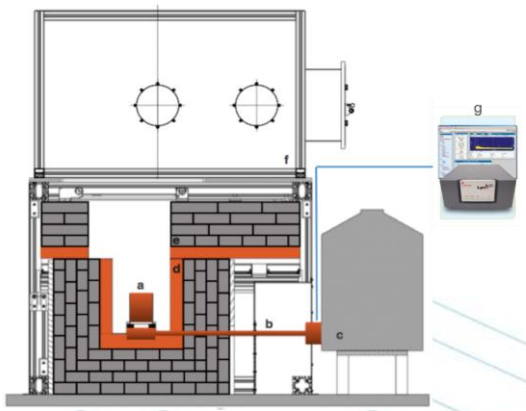
Prepare for demo/prototype experiment and Low background facility in C2 hall:

- Room size: L38m*W6m*H4m(inside),
- Radon reduction Air input
- Additional lead, OFHC copper could be used inside the PE room.

Low Background Facility







One HPGe Array:

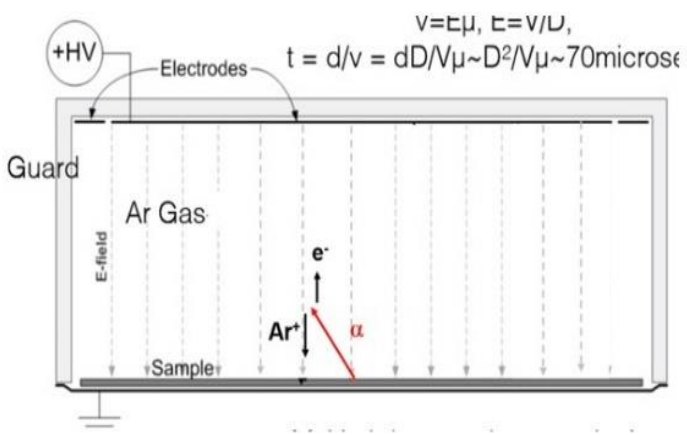
- 5 ULB-HPGe detectors
- OFHC copper, lead shielding;
- MDA: ~10μBq/kg

15 HPGe Spectrometer:

- 10 coaxial p-type
- 2 coaxial n-type
- 2 well-type
- 1 ultra-low energy

- OFHC copper, lead shielding;
- MDA: ~1.0 mBq/kg

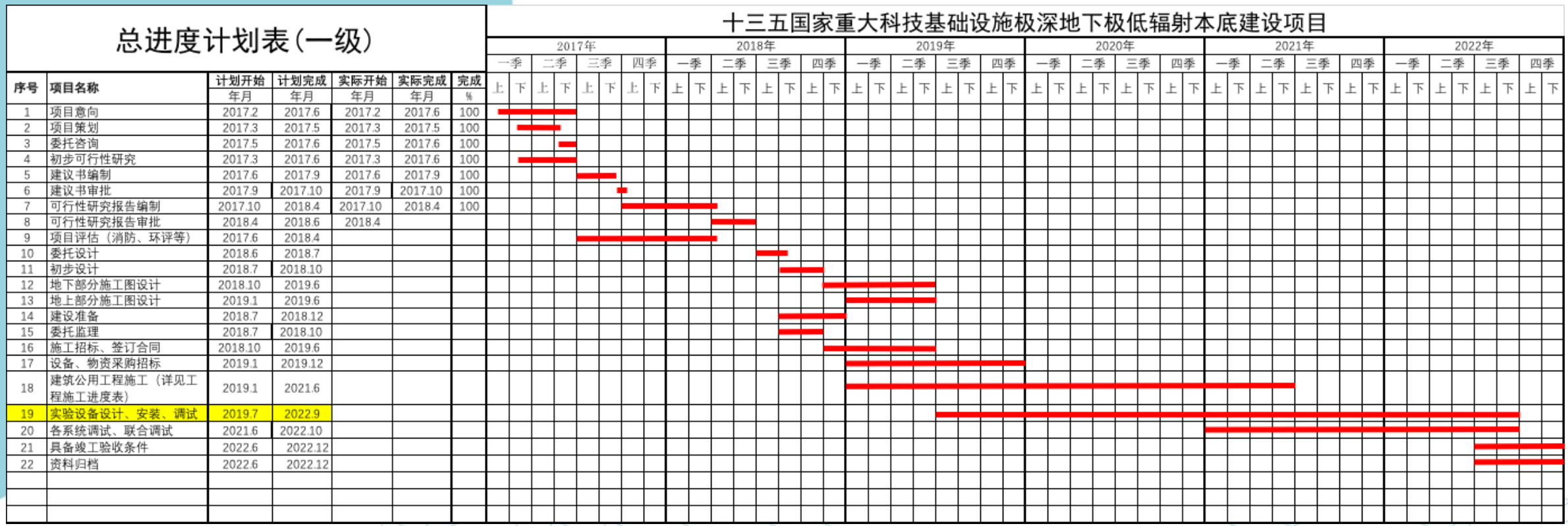
Low Background Facility



Include some additional instruments:

- 2 alpha ultra-low background counting devices
  - Detection efficiency:>90%
  - Background counts rate:< 0.0001 alphas/cm^2/h
- 2 liquid scintillator spectrometer
- 2 high resolution ICP-MS

Timetable



总进度计划表(一级)

十三五国家重大科技基础设施极深地下极低辐射本底建设项目

序号	项目名称	计划开始	计划完成	实际开始	实际完成	完成
		年月	年月	年月	年月	%
1	项目意向	2017.2	2017.6	2017.2	2017.6	100
2	项目策划	2017.3	2017.5	2017.3	2017.5	100
3	委托咨询	2017.5	2017.6	2017.5	2017.6	100
4	初步可行性研究	2017.3	2017.6	2017.3	2017.6	100
5	建议书编制	2017.6	2017.9	2017.6	2017.9	100
6	建议书审批	2017.9	2017.10	2017.9	2017.10	100
7	可行性研究报告编制	2017.10	2018.4	2017.10	2018.4	100
8	可行性研究报告审批	2018.4	2018.6	2018.4		
9	项目评估（消防、环评等）	2017.6	2018.4			
10	委托设计	2018.6	2018.7			
11	初步设计	2018.7	2018.10			
12	地下部分施工图设计	2018.10	2019.6			
13	地上部分施工图设计	2019.1	2019.6			
14	建设准备	2018.7	2018.12			
15	委托监理	2018.7	2018.10			
16	施工招标、签订合同	2018.10	2019.6			
17	设备、物资采购招标	2019.1	2019.12			
18	建筑公用工程施工（详见工程施工进度表）	2019.1	2021.6			
19	实验设备设计、安装、调试	2019.7	2022.9			
20	各系统调试、联合调试	2021.6	2022.10			
21	具备竣工验收条件	2022.6	2022.12			
22	资料归档	2022.6	2022.12			

Aug. 2019, preliminary design completed;
Dec. 2019, engineering project bidding;
Jun. 2021, civil engineering completed;
Sep. 2022. Shielding projects completed;
Dec. 2022, Project completed.

III. Summary

- A new low-background facility, DURF, would be constructed in CJPL-II since 2019.
- DURF can provide three different shielding conditions for DM/0vbb experiments.
- Some ultra-low background counting devices would be equipped in DURF project and could be used for material screening, sample measurements.

Welcome to Jinping!