



国家高能物理科学数据中心
National HEP Science Data Center



高能所计算中心
IHEP Computing Center

IHEP Site(s) Report

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On behalf of IHEP CC

2025-09-25

the 9th Asian Tier Center Forum, University of Tsukuba



1 Introduction of IHEP & IHEPCC

2 Grid Sites in China

3 Updates of BEIJING-T1 and Tier2 sites

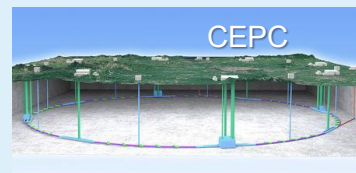
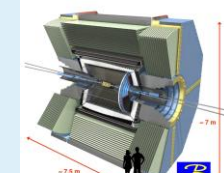
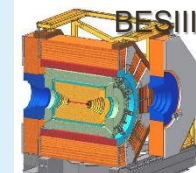
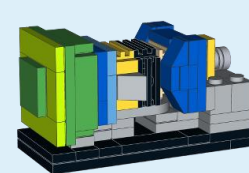
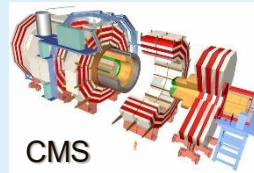
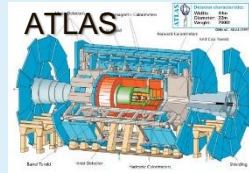
4 Summary

Related Projects for IHEP

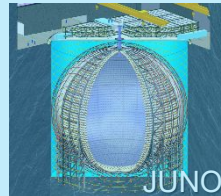
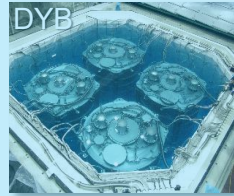


- The largest fundamental research center in China with research fields:

- Experimental Particle Physics
- Theoretical Particle Physics
- Astrophysics and cosmic-rays
- Accelerator Technology and applications
- Synchrotron radiation and applications
- Nuclear analysis technique
- Computing and Network Application



Accelerator based particle physics



Neutrino and gravitational wave experiments

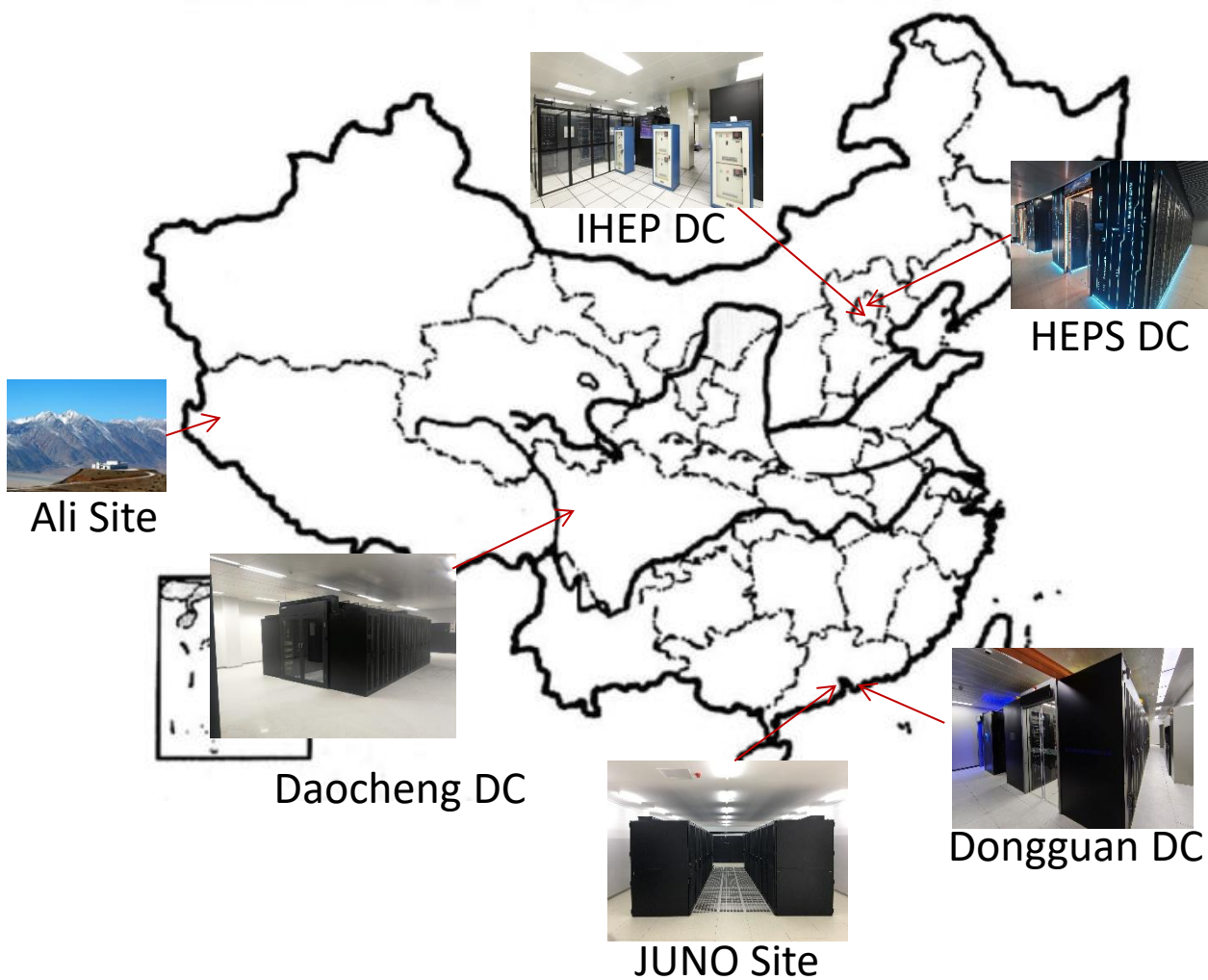


Cosmic ray and astrophysics experiments



Neutron source and synchrotron radiation facilities

Data Centers of IHEP



	CPU Cores	Disk Storage	Tape Storage	Network
IHEP-CC	>60000	Lustre, ~55 PB EOS, ~70 PB	~130 PB	100G
IHEP-Dongguan Guangdong Province	~6000	Lustre 3 PB	1 PB	10G-100G to IHEP
IATAMS Shandong Province	~27400	Lustre 2.5 PB		1G-10G to IHEP
IHEP-Daocheng Sichuan Province	~3400	EOS ~6 PB		2G to IHEP
USTC, Anhui Province	~3200	Lustre 4 PB		Internet
LZU Gansu Province	>8000	Lustre >6PB		2G to IHEP
Shandong Uni. Shandong Province	~1500			Internet
Dongguan DC Guangdong Province	~28000	6 PB		20G to Dongguan DC
IHEP Huairou Branch (ready by end of 2025)	~10000	Lustre 30 PB		100G to IHEP

WLCG Sites in China

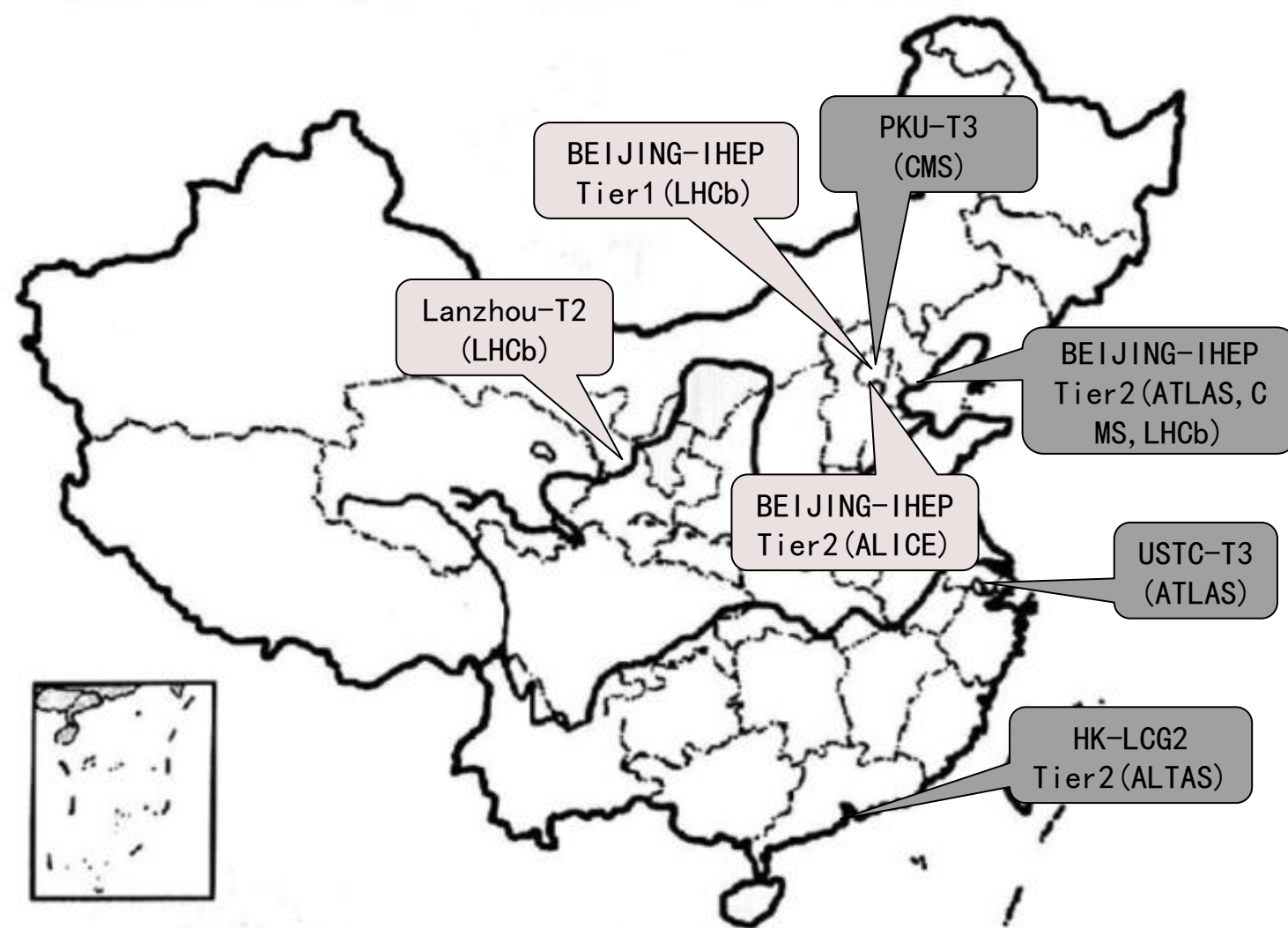


• Tier-2 sites

- BEIJING-IHEP (ATLAS, CMS, LHCb)
- HK-CUHK(ATLAS)

• New Sites

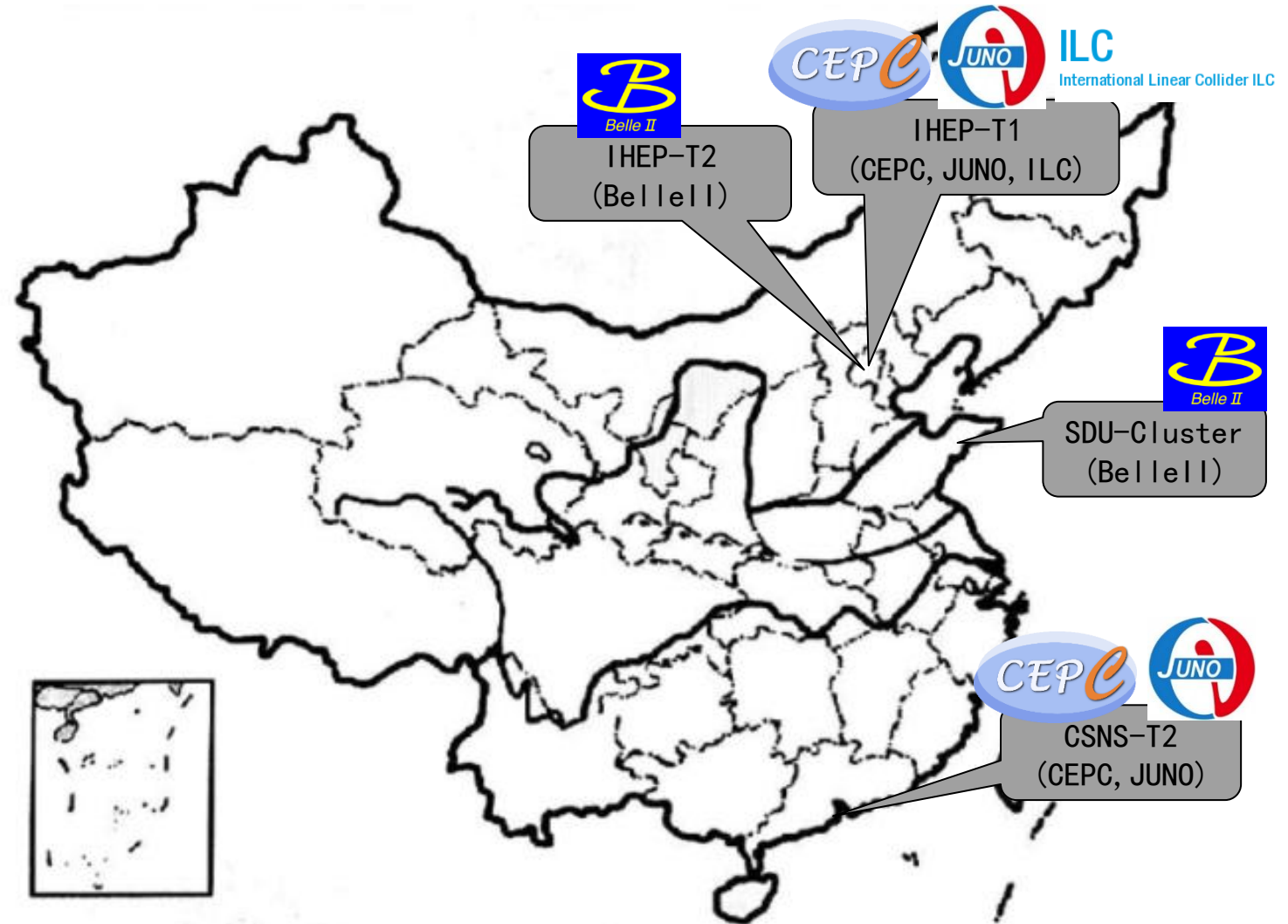
- Tier-1: BEIJING-IHEP (LHCb)
- Tier-2: Lanzhou-T2 (LHCb)
- Tier-2: BEIJING-IHEP (ALICE)



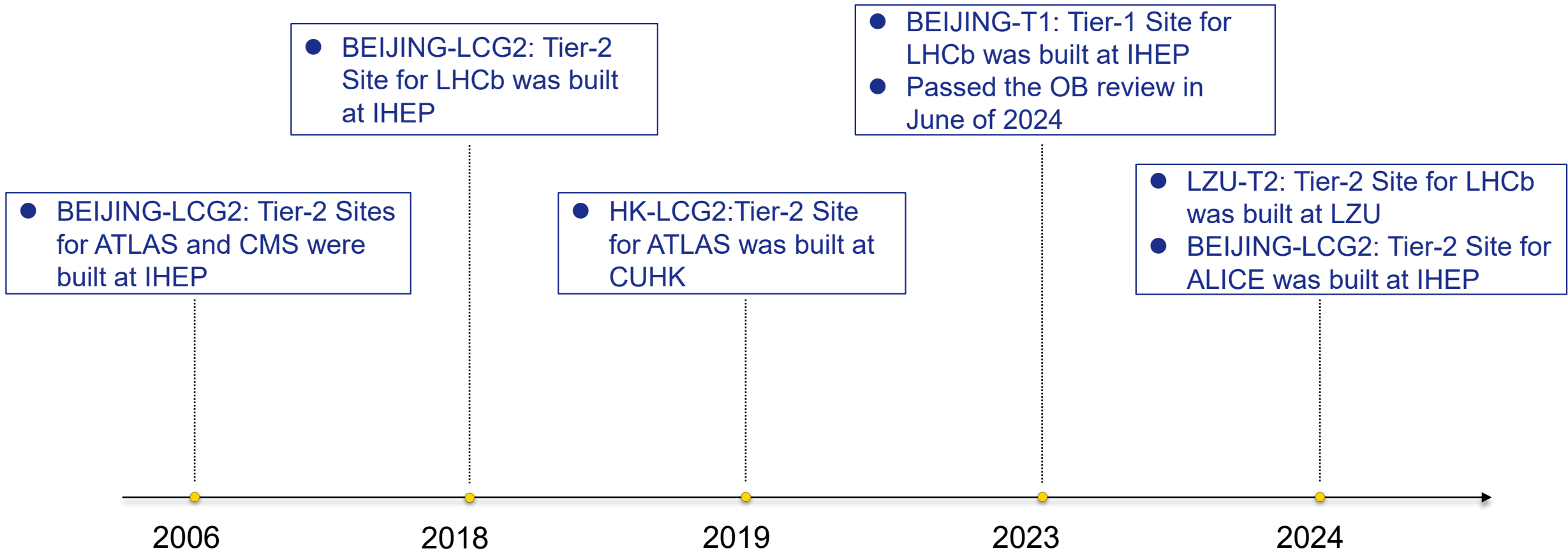
Grid Sites for Other Experiments



- CEPC & JUNO
 - T0&T1 is located at IHEP
 - CSNS Tier2 site in Dongguan
- BELLEII
 - Tier-2: BEIJING-IHEP
 - Cluster: SDU
- ILC
 - Cluster: IHEP



WLCG History in China



BEIJING-T1 Site - Milestone



- Oct. 2022: LHCb Chinese group and CC-IHEP decided to construct Tier-1 site for LHCb
- May. 2023: All hardware ready
- Jun. 2023: middleware deployed
- Jun. 2023: 100Gbps network link established between CSTNET and EU
- Dec. 2023: Connected to LHCOPN
- Feb. 2024: Construction completed
- Jun. 2024: Data challenge completed
- Jun. 2024: Site Review Passed
- Sep. 2024: Fully support all tasks for LHCb



- LHCb [reports \(raw view\)](#) -
 - Beijing: Is now in production as a full Tier 1

Resources of BEIJING-T1



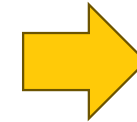
- LHCb asks that the computing contribution should be proportional to the number of authors

- Computing: ~5500 CPU cores
- Disk Storage: ~10 PB
- Tape Storage: ~20 PB

LHCb demands

- Computing: 3280 CPU cores
- Disk Storage: 3.2 PB
- Tape Storage: 3 PB

Beginning of BEIJING-T1



- Computing: 5500 CPU cores
- Disk Storage: 12.5 PB
- Tape Storage: 20 PB

Pledge for 2026
(red numbers are ready now)

- HTU (new LHCb member) has funding to add more CPU and disk storage, so finally:

- CPU: >5500 CPU cores
- Disk storage: > 12.5 PB
- Tape storage: 20 PB

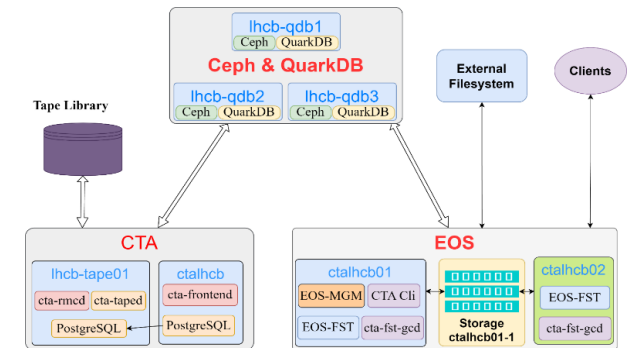
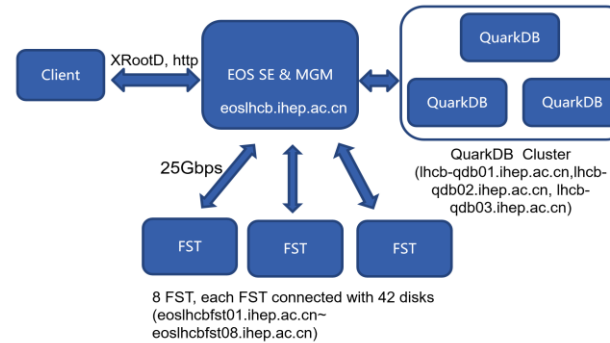
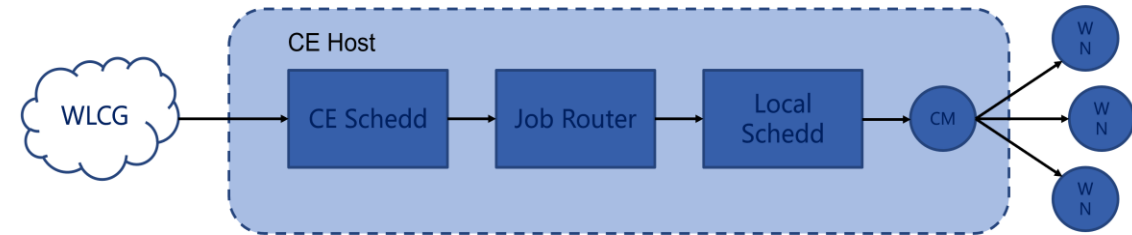
LHCb Chinese Collaboration and IHEP CC would have more funding to contribute more, it should follow LHCb's requirements.

Middleware Deployment for BEIJING-T1



- All the middleware are following a typical WLCG site

- Computing System: HTCondorCE and HTCondor
- Disk Storage System: EOS
- Tape Storage System: EOS-CTA
- Other services
 - ◆ Certification service: Argus
 - ◆ Grid information service: BDII
 - ◆ Accounting service: APEL



- OS has been upgraded to Alma Linux 9 in Aug. 2024

- All Tier-2 sites are also using the same middleware technologies

Network for BEIJING-T1

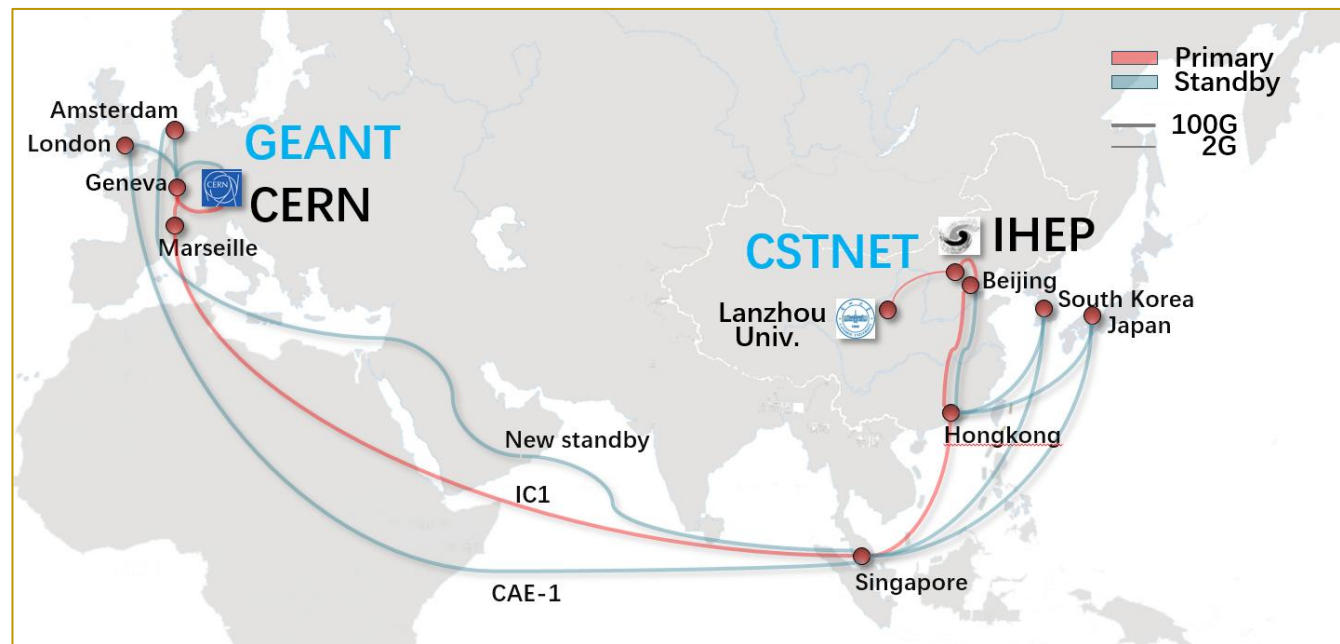


● LHCOPN@IHEP

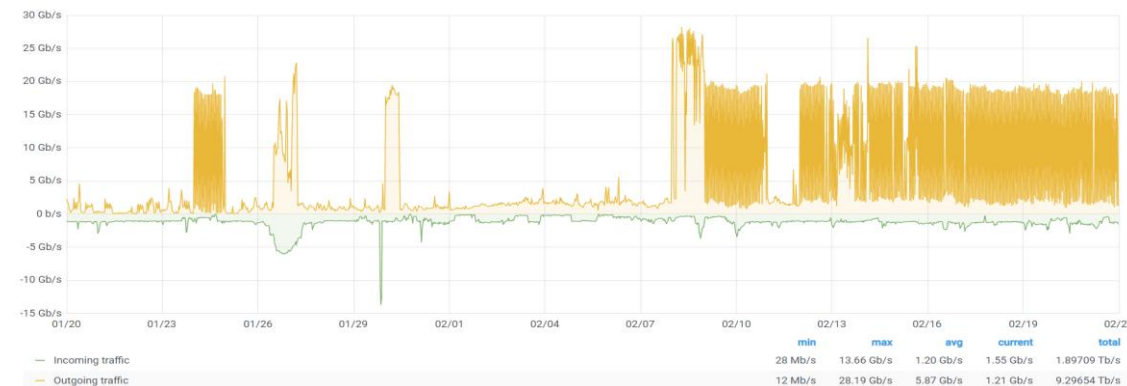
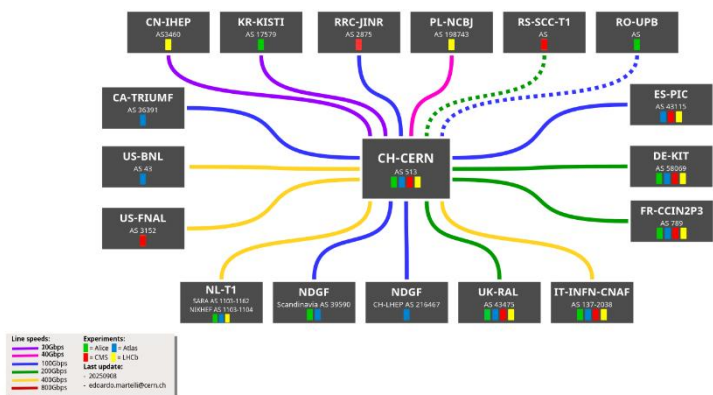
- 20Gbps bandwidth ensured
 - ◆ Exceeding the original number of 10Gbps
- 3 links redundancy

● LHCONE@IHEP

- 100Gbps bandwidth Shared
- WLCG is the largest user of the links



LHCOPN



Disk Storage for BEIJING-T1

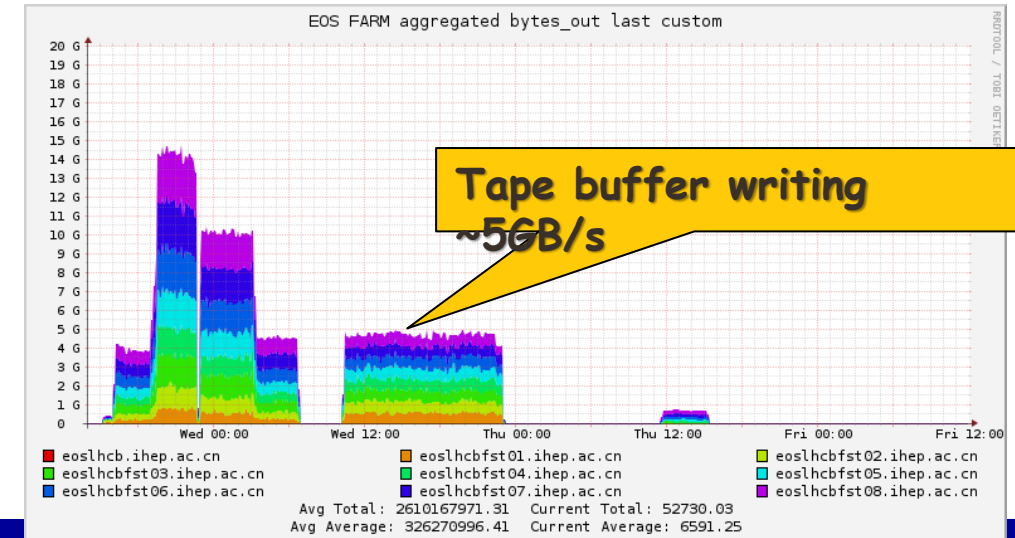
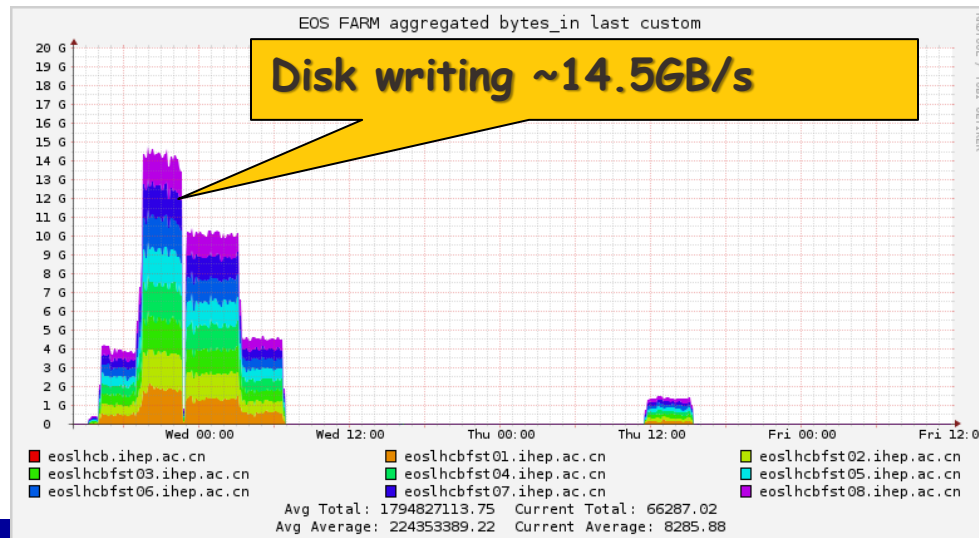
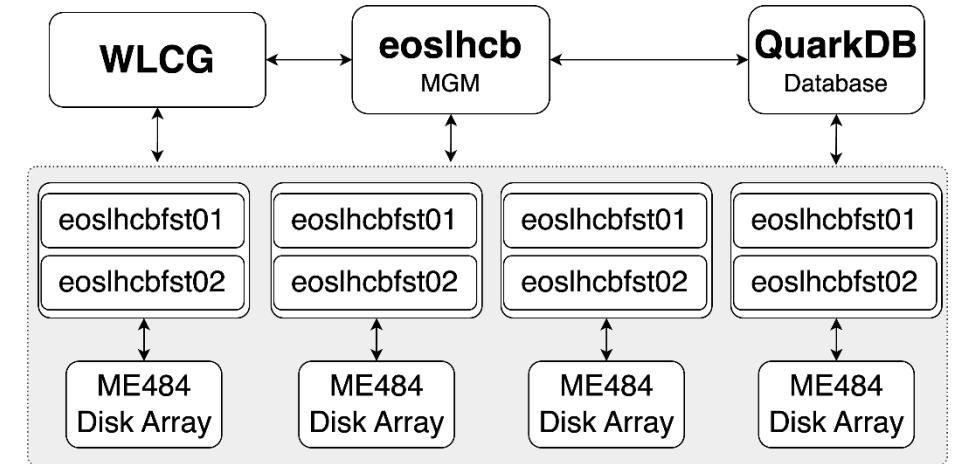


• Disk storage structure

- 4 management servers: MGM and DB
- 24 storage nodes with 21 disk arrays

• Performance Test with a 200TB dataset

- Write into SE: speed by $\sim 14.5\text{GB/s}$
- Read from SE and write into tape buffer: speed by $\sim 5\text{GB/s}$



Tape Storage for BEIJING-T1



- CTA provides tape service for LHCb as well as others

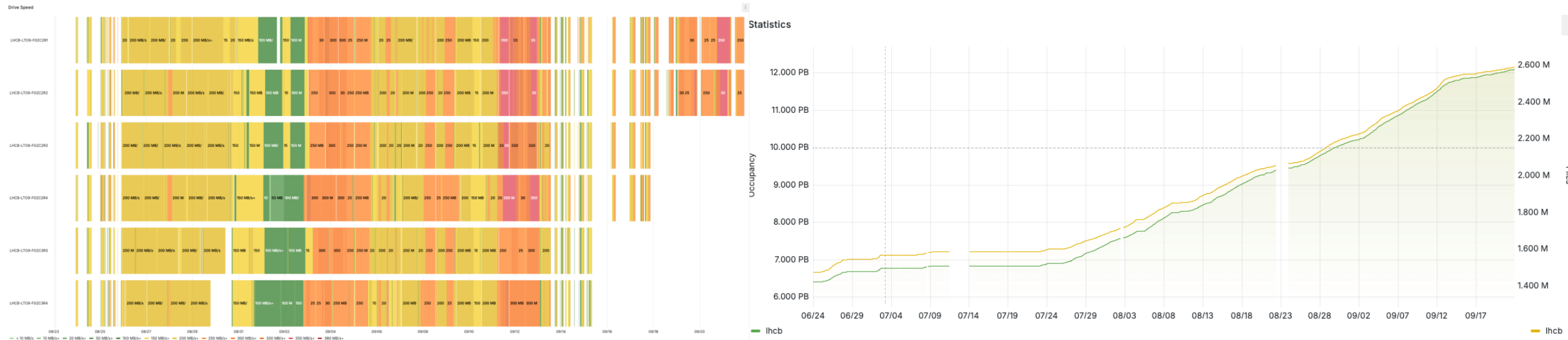
- Current Status

- 20 PB with 1.24K LTO9 tapes
- 6 LTO9 drives
 - ◆ Will add two more drives

```
[root@ctalhcb ~]# eos ls -lh /eos/ihep/ctalhcb
drwxrwxr--+ 1 slhcb001 lhcb          5.30 P Sep 16 2024 archive
drwxrwxr--+ 1 slhcb001 lhcb          5.56 P Sep 22 2024 raw
[root@ctalhcb ~]#
```

- Usage

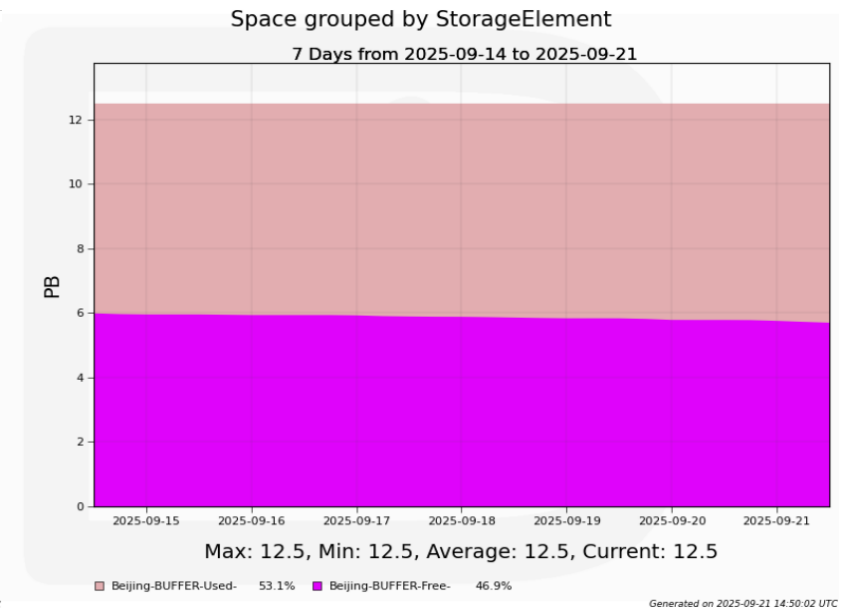
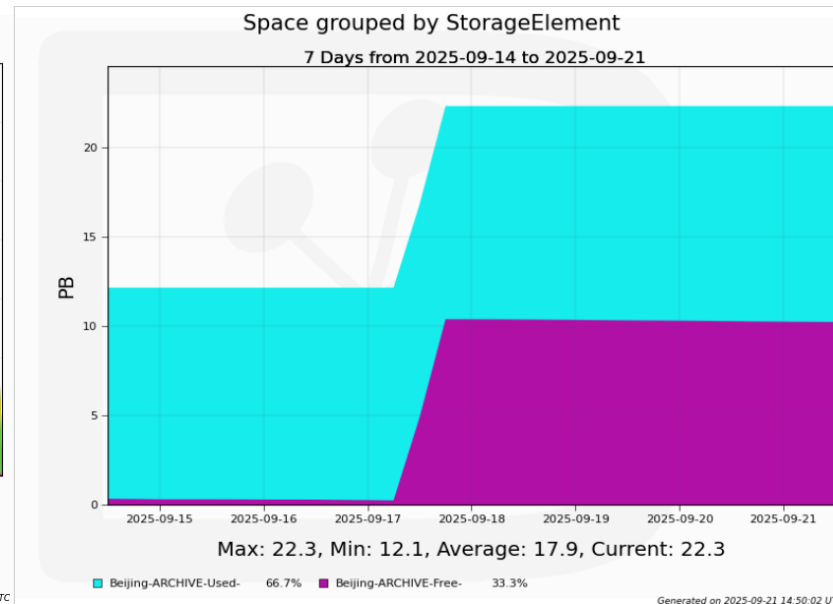
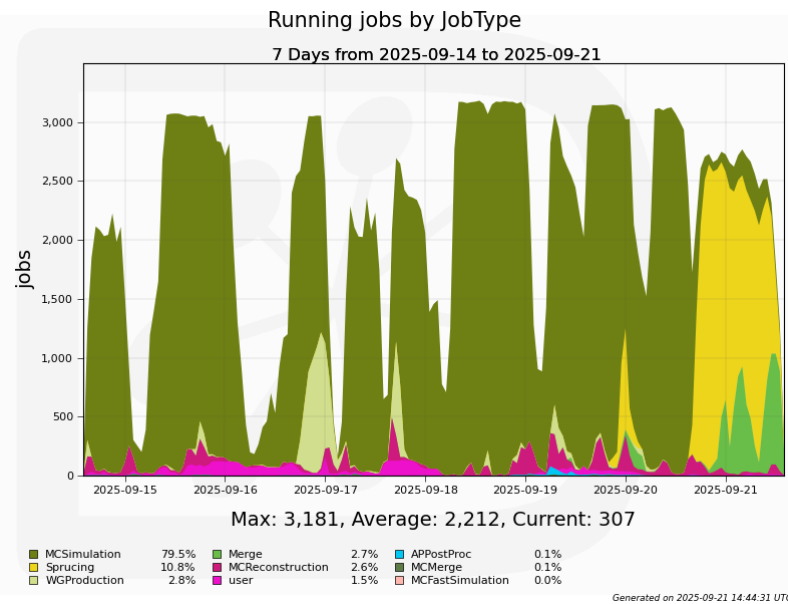
- 12.1 PB in use and 2.59 M files stored



Running Status of BEIJING-T1



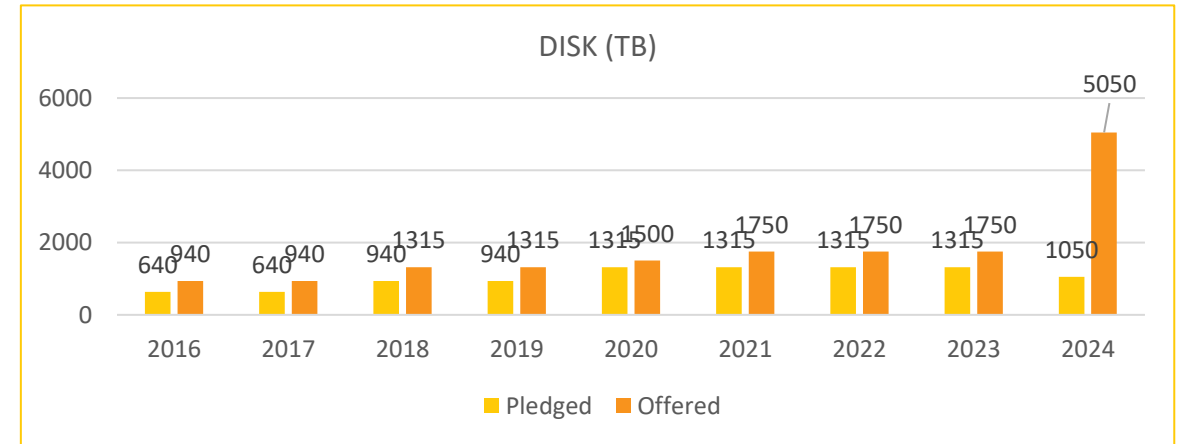
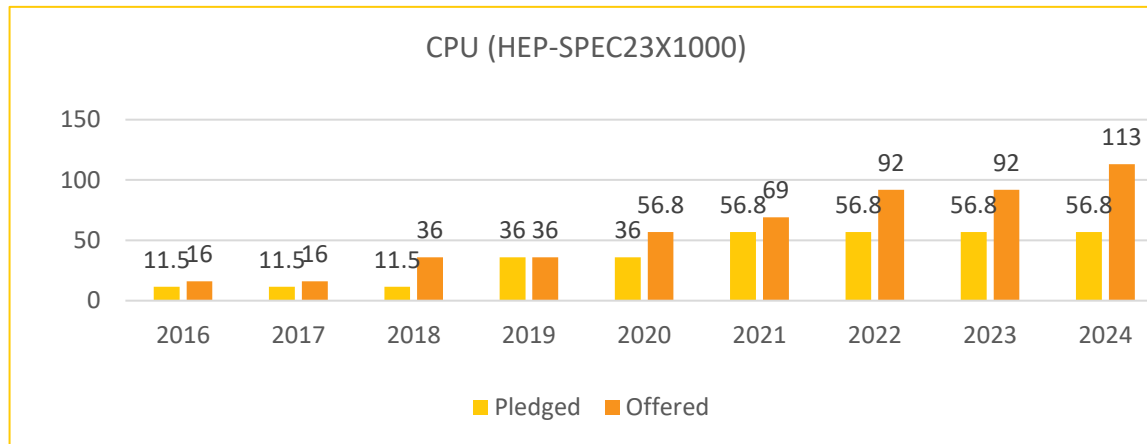
- CPU resources is fully used in most time
- Disk storage is used > 6 PB (total 12.5 PB)
- Tape storage is used > 11 PB (total 20 PB)



Tier-2 Sites at IHEP



- VO: ALICE, ATLAS, CMS, LHCb, BELLEII, ...
 - CPU: ~5500 cores with 113,000 HS23
 - Disk Storage: ~5PB



Computing and Storage Pledge of BEIJING LCG Tier-2

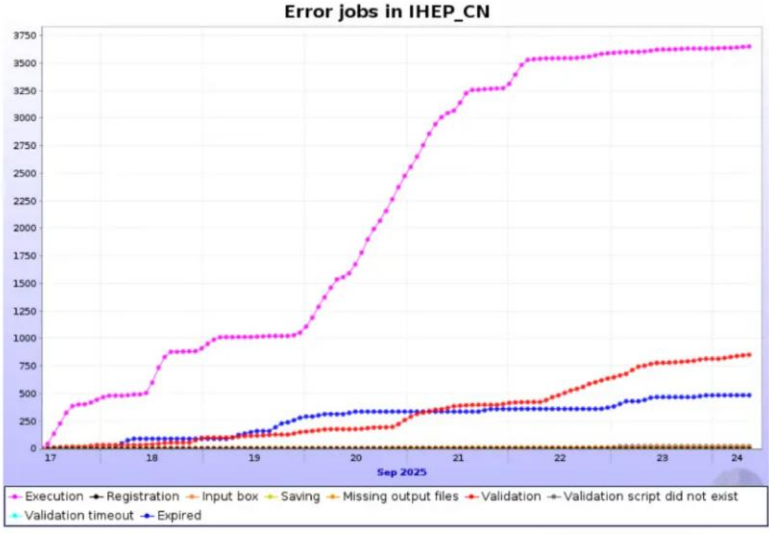
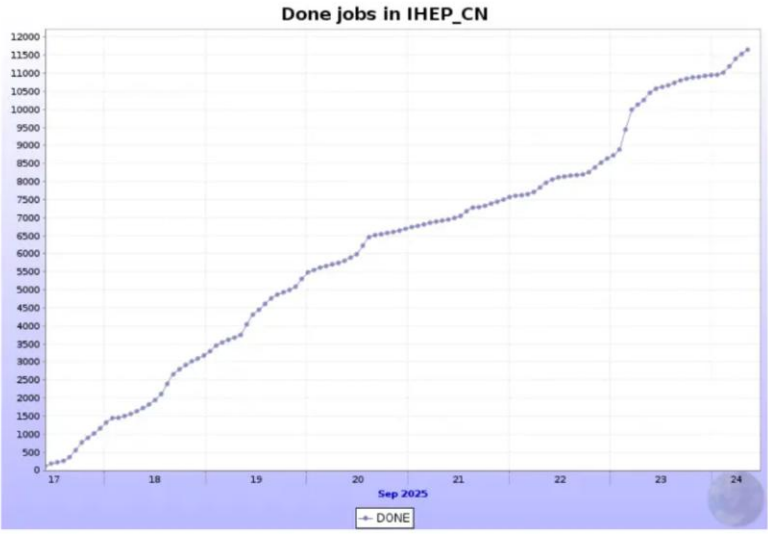
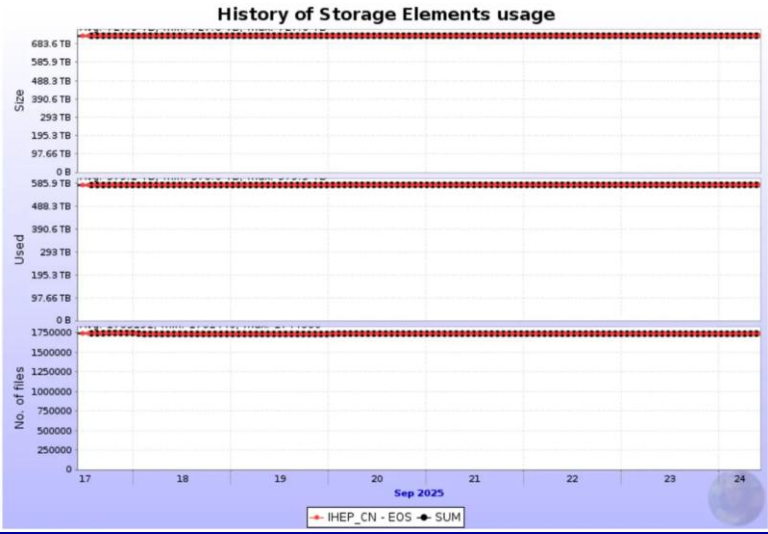
New ALICE Tier-2 Site at IHEP



- A new ALICE Tier-2 is built and located at IHEP
 - Cooperated with Chinese ALICE group, lead by FDU
 - All servers are deployed at the new machine room in Huairou DC
- Construction started since Dec. 2023
 - 1152 CPU cores, 30,600 HS23
 - 840TB disk storage (Phase 1)
- Already run in production since Sep. 2024

• ALICE

- Thanks very much to IHEP Beijing as T2 also for ALICE now!
 - Good job success rates since Aug 20
 - SE fully functional since last week
 - Maarten: Worth to mention this is the first time ALICE has significant resources allocated in China



New LHCb Tier-2 Site at LZU



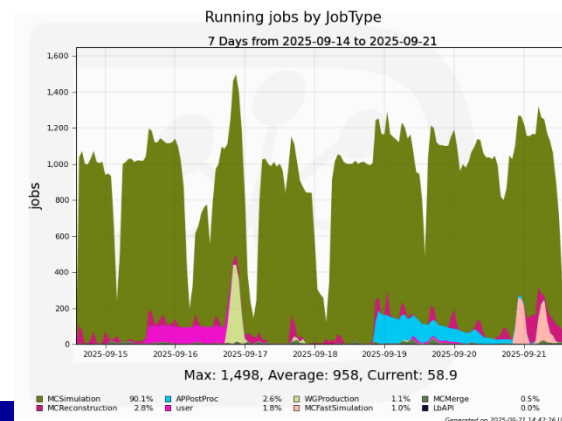
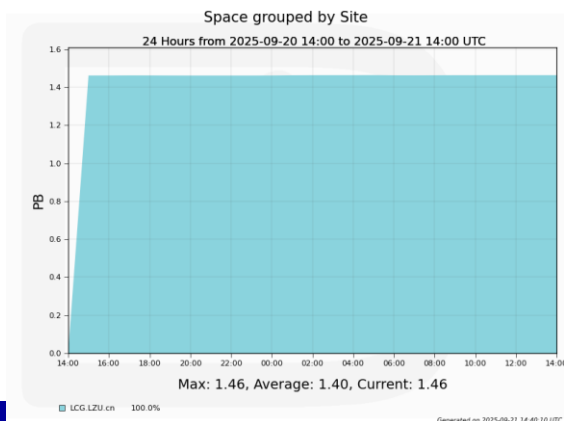
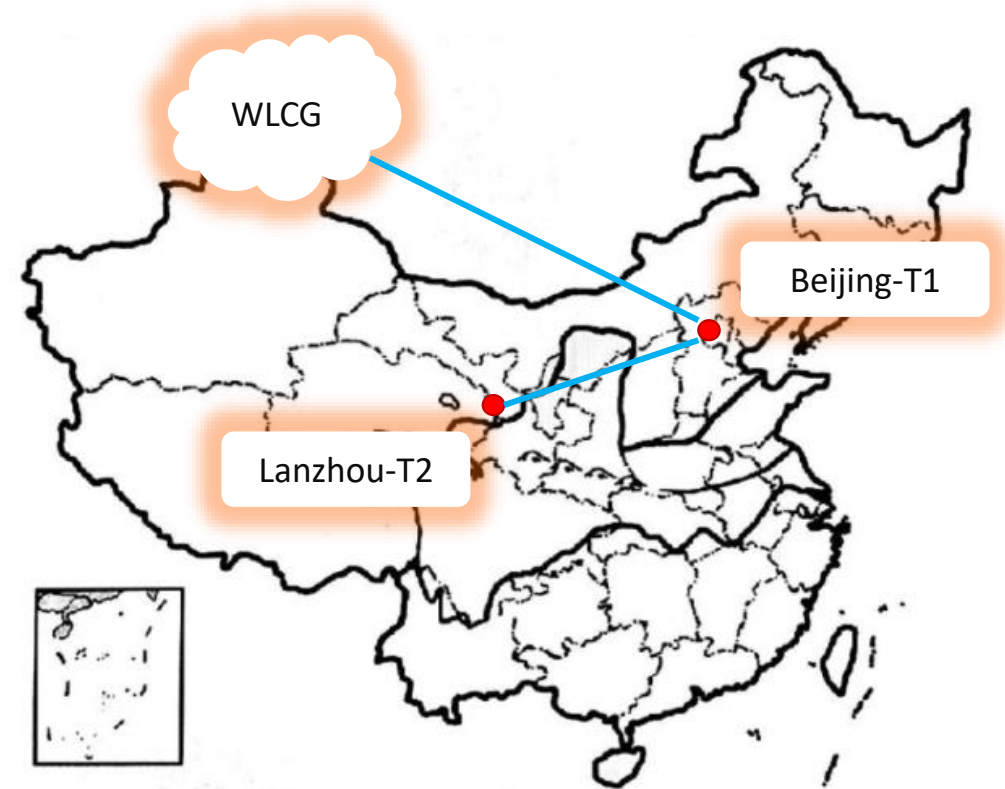
• Resources at LZU-T2

- 3520 CPU cores, ~77,000 HS23
- 3.4PB Disk Storage
- Dedicated 2Gbps link between IHEP and LZU

• Jointly maintained by CC-IHEP and LZU

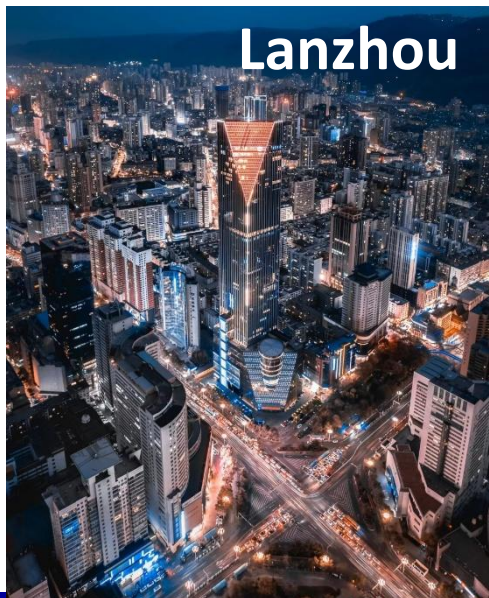
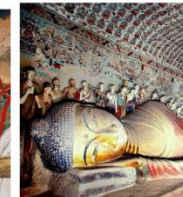
- Hardware maintenance: Lanzhou Univ
- Software deployment and maintenance: CC-IHEP

• The site is mainly running MC jobs



HEPiX Fall 2025 Workshop in Lanzhou of China

- indico link: <https://indico.cern.ch/event/1536836/overview>





- BEIJING-T1

- Supported by LHCb Chinese Collaboration and IHEP CC, also with CSTNET (network)
- New requirements: LHCb hope to increase the computing contribution by 15%-20%
- Working hard to contribute more resources (now have some possibilities)

- Chinese Tier-2 Federation

- New sites: IHEP T2 for ALICE and LZU T2 for LHCb
- Jointly maintained by CC-IHEP and the local team

- Distributed computing system for other VOs

- JUNO: started running this year
- HERD: looking for joining LHCONE
- CEPC: will be a large-scale for distributed computing system

Thanks!