IHEP Site Report

On Behalf of IHEP-CC

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Outline
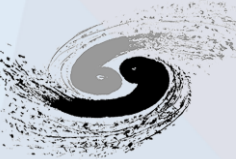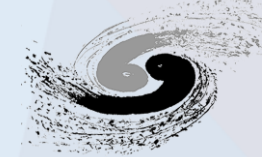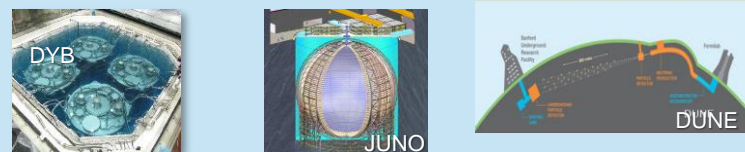
Brief Introduction to IHEP

- **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**

HEP Related Projects

ATLAS
CMS
LHCb
BESIII
BELLE II
CEPC
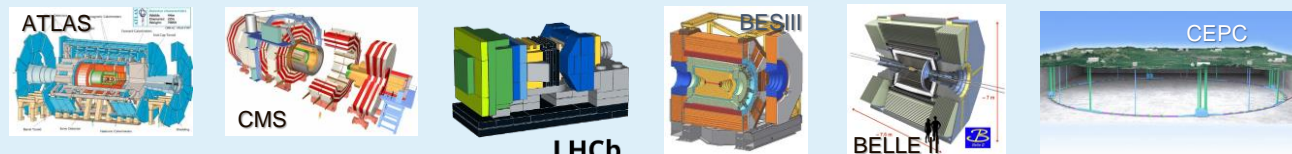
Accelerator based particle physics

DYB
JUNO
DUNE

Neutrino physics

AliCPT
LHAASO
HERD
HXMT
GECAM
AMS02
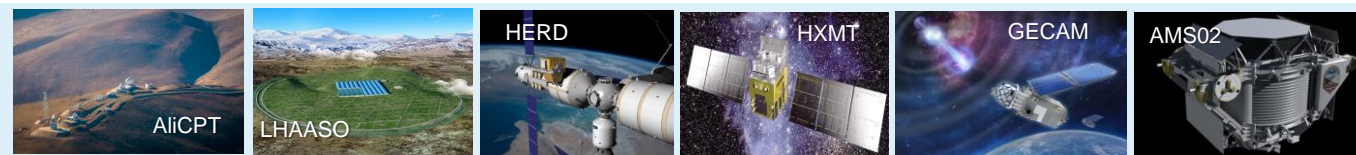
Cosmic ray and astrophysics experiments

CSNS
BSRF
HEPS

Neutron Source and Synchrotron Radiation Facilities

Facilities of IHEP

Overview of WLCG Sites in China
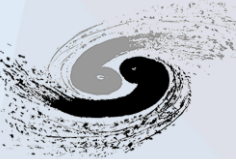
International Network of IHEP

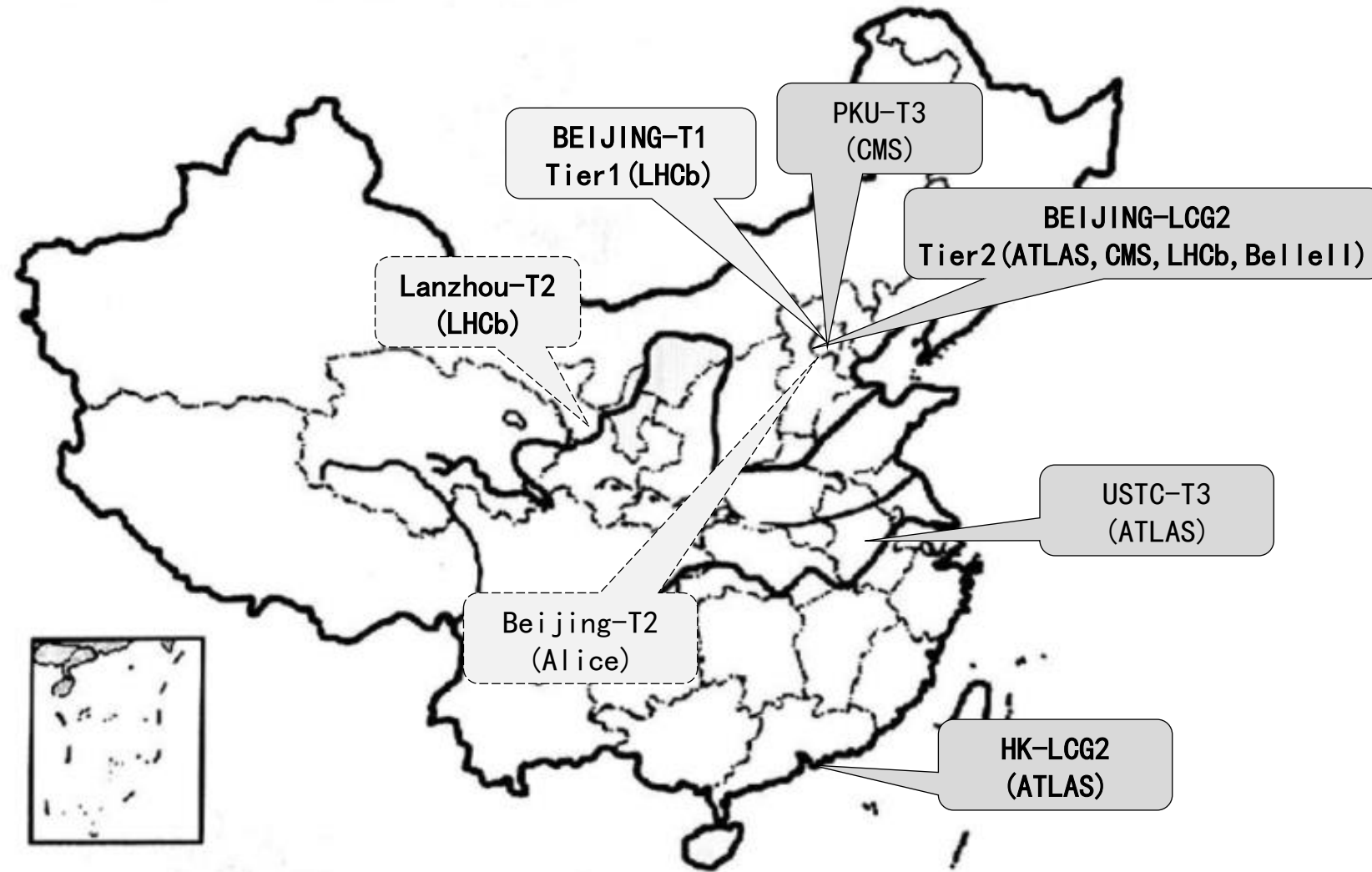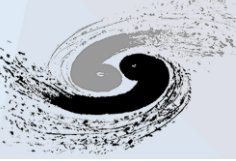- **International network link upgraded to 100Gbps in 2023**
  - **With the help from CSTNET, GEANT and CERN**
  - **The data transfer test showed the peak performance between IHEP and Europe reach to 50Gbps**

- **Dedicated links between IHEP and domestic remote sites**
  - **HEPS-IHEP: 100 Gbps**
  - **CSNS-IHEP: 20 Gbps**
  - **LHAASO-IHEP: 2 Gbps(3 Gbps since Mar. 2024)**
  - **JUNO**
  - **Lanzhou Univ-IHEP: 2 Gbps**
  - **.....**
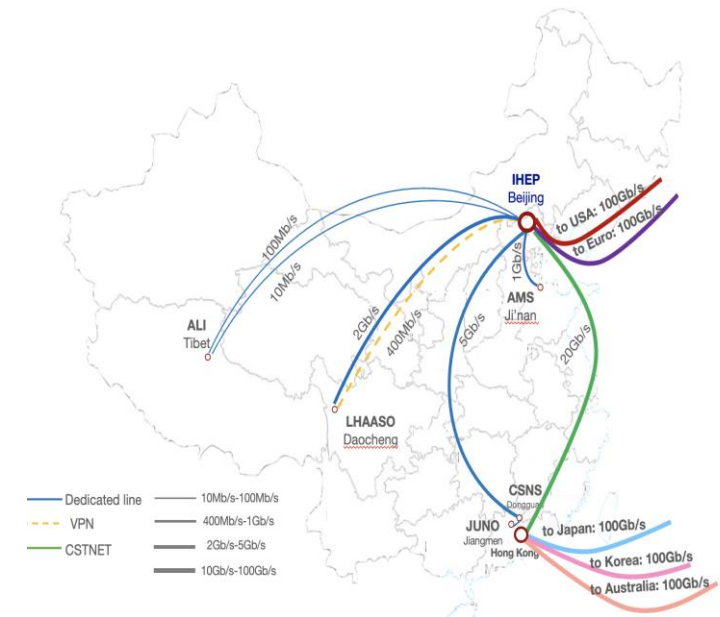
Construction and Resource of LHCb Beijing Tier-1 Site

- **Construction**
  - Oct. 2023: Chinese LHCb collaboration and CC-IHEP decided to construct Tier-1 Site for LHCb
  - Dec. 2023: Discussed and received the approval from WLCG
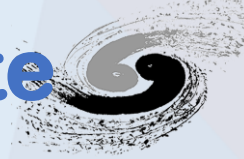 - Feb. 2024: Construction completed

- **Resource provided for LHCb Beijing Tier-1**
  - Computing:
    - 40 worker nodes (Intel & AMD) with 3216 CPU cores: 67,000 HepScore
  - Disk storage
    - 4 sets of storage arrays provide 3.2 PB
  - Tape storage:
    - 4 drivers (IBM) and 170 tapes with 3PB
  - Network equipment and management server:
    - 6 switches, 1 router, 2 band cards and 10 servers

- **First data challenge has been done in Mar. 2024**
  - 189TB data was transferred into IHEP Site in ~2 days
  - Average transfer speed is about 1.55GB/s (Max is 1.98)
  - Transfer efficiency is close to 100%

- **Has been in production in Jun. 2024**

Discussion on China Tier1 and Tier2
Monday 12 Dec 2022, 09:30 → 11:00 Europe/Zurich
2/R-030 (CERN)

Videoconference 2-r-030

| 09:30 → 09:40 | Setup / context | 10m |
| 09:40 → 10:00 | Tier 1 IHEP and Tier2 Lanzhou: status and evolution | 20m |

Currently available resources at IHEP Beijing (CPU, disk, tape, network) and their evolution; underlying technical infrastructure, e.g. batch system, storage system, processor type, memory, internal network, etc.

Speakers: Fazhi QI, Fazhi Qi (Chinese Academy of Sciences (CN)), Jingyan Shi (Chinese Academy of Sciences (CN)), Jingyan Shi, Tao Cui (Chinese Academy of Sciences (CN)), Xiaofei Yan (Chinese Academy of Sciences (CN)), Xiaofei Yan (Institute of High Energy Physics)

Discussion on Chin...   Discussion on Chin...

| 10:00 → 10:20 | LHCb requirements | 20m |

Speakers: Christophe Haen (CERN), Federico Stagni (CERN), Vladimir Romanovskiy (Institute for High Energy Physics of NRC Kurchatov Institute (RU))

LHCb VO card
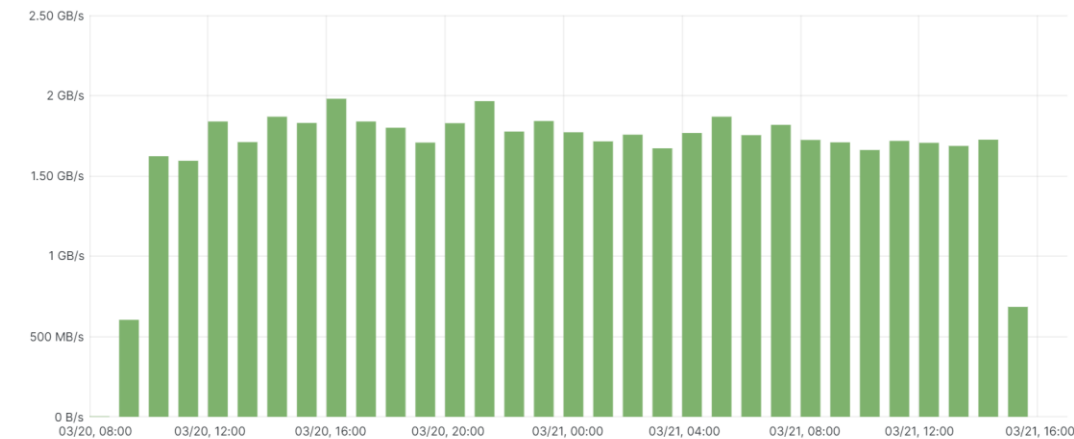
Network traffic of the first data challenge

Chinese Tier-2 Site Federation
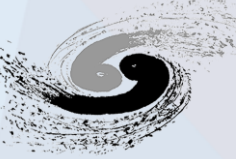
- **CPU: 4472 cores with 95,000 HepScore**

  - AMD 9654:   1152 Cores

  - Intel Golden 6338:   1280 Cores

  - Intel Golden 6140:   1152 Cores

  - Intel E5-2680V3:   696 Cores

  - Intel X5650:   192 Cores

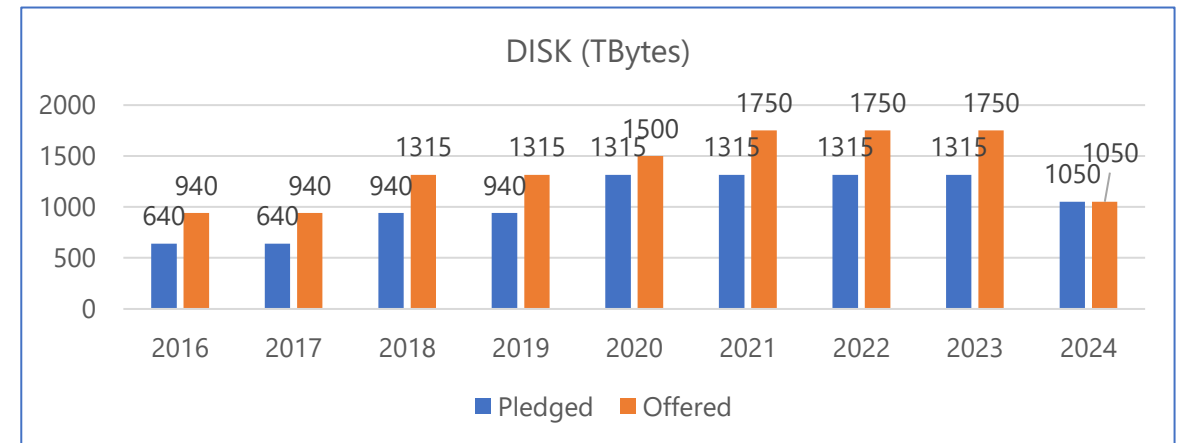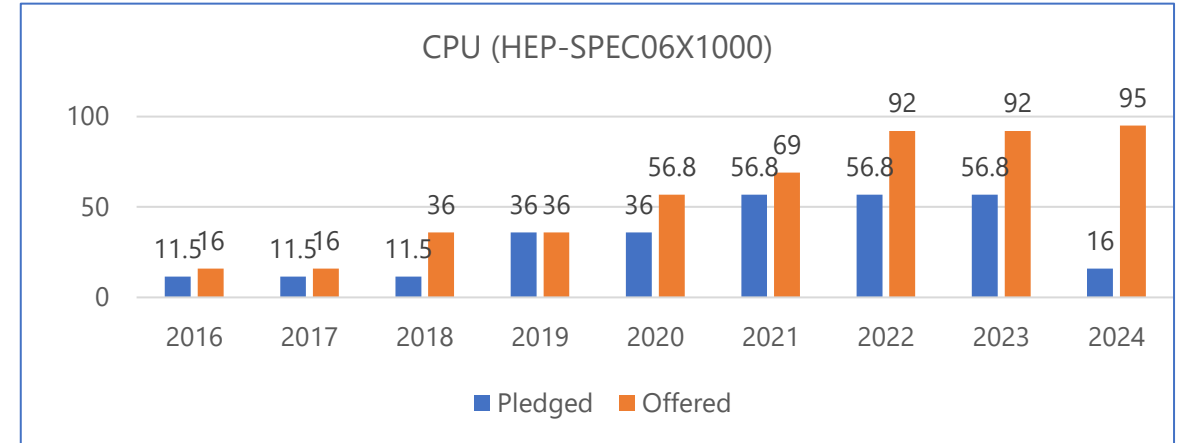- **CE & Batch: HTCondorCE & HTCondor**

- **VO: ATLAS, CMS, LHCb, BELLEII, JUNO, CEPC**

- **Storage: 1050TB**

  - 4TB * 24 slots with Raid 6, 5 Array boxes

  - DELL MD3860 8TB * 60 slots

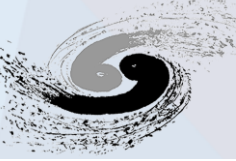 - DELL ME4084 10TB * 42 slots

  - DELL ME4084 12TB * 84 slots

- **Got new budget for upgrading ATLAS and CMS Tier-2 in 2024**

  - CPU：60,000 HepScore

  - Disk storage：2.5PB

CPU (HEP-SPEC06X1000)

Year	Pledged	Offered
2016	11.5	16
2017	11.5	16
2018	11.5	36
2019	36	36
2020	36	56.8
2021	56.8	69
2022	56.8	92
2023	56.8	92
2024	16	95

- Pledged - Offered

DISK (TBytes)

Year	Pledged	Offered
2016	640	940
2017	640	940
2018	940	1315
2019	940	1315
2020	1315	1500
2021	1315	1750
2022	1315	1750
2023	1315	1750
2024	1050	1050

- Pledged - Offered

Computing and Storage Pledge of BEIJING LCG Tier- 2

Construct New WLCG Tier-2 Site

- **LHCb Tier-2 site in Lanzhou**
  - **Construction started in Oct. 2023**
    - ~3500 CPU cores with 77,000 HepScore
    - ~3PB Disk Storage
    - Dedicated 2 Gbps link between IHEP and Lanzhou Univ.
  - **Software deployment started in Apr. 2024**
  - **Jointly maintained by CC-IHEP and Lanzhou Univ.**
    - Hardware maintenance: Lanzhou Univ.
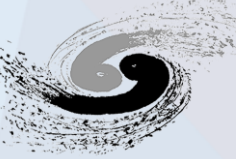   - Software deployment and maintenance: CC-IHEP

- **Alice Tier-2 at IHEP**
  - **Chinse Alice collaboration would like to build Tier-2**
    - 1152 CPU cores with 30,600 HepScore
    - 840TB disk storage
   - CC-IHEP to be responsible for the overall maintenance

WLCG

Beijing-T1
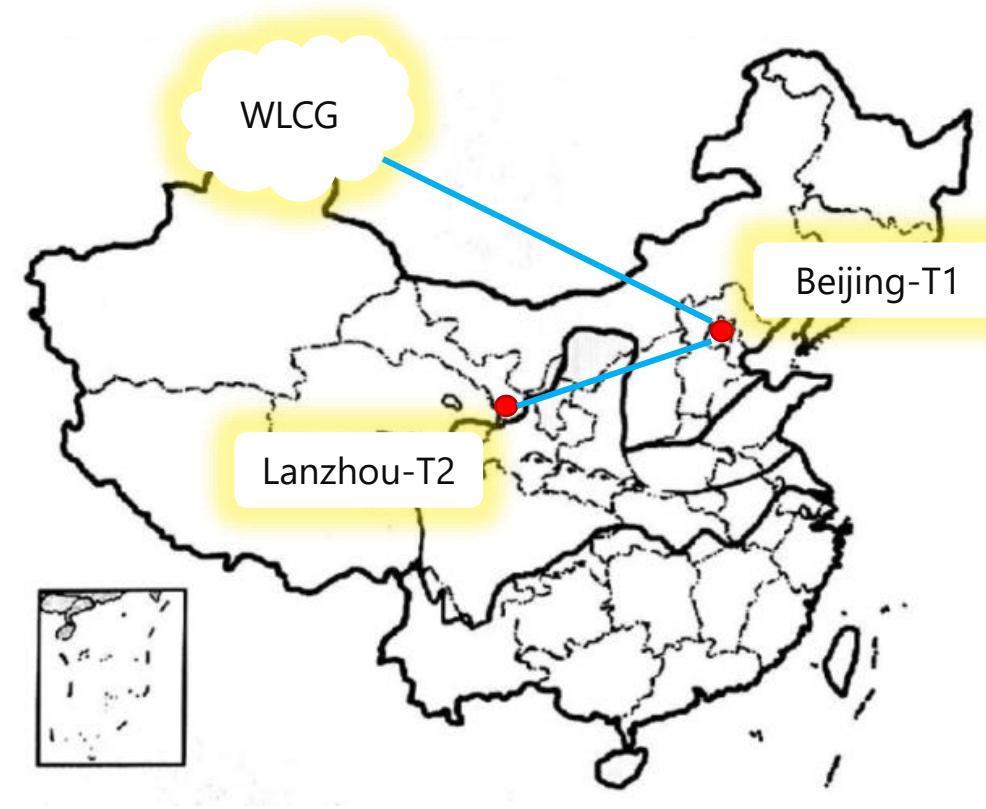
Lanzhou-T2

Lanzhou Univ. LHCb Tier-2 Site

ALICE Tier 2 Site at IHEP

- **Hardware were ready in Mar. of 2024**
  - 6 worker nodes: Fusion 1258H V7
  - 2 Servers: Dell PowerEdge R650
  - 1 Storage Array: Dell EMC Me484

- **Status : expected to provide services in Sep. 2024**
  - Vobox ready
  - CE : ~20,000 test jobs done
  - Network : LHCOPN routes ready
  - SE : File access permission under test & debug

Grid Computing of JUNO & HERD at IHEP
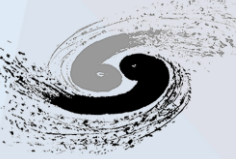
- **JUNO: Jiangmen Underground Neutrino Observatory, will start production in 2024**
  - **IHEP site runs as Tier-0 and Tier-1**
    - Storage: 8 PB by EOS, Lustre on disk, 4 PB by EOS-CTA on tape.
    - Computing: 180 KHS06 by HTCondor on x86, Slurm on ARM and GPU.
  - **Network: 10Gbps(From JUNO-onsite to IHEP), 100Gbs(From IHEP to GEANT).**
 - **Grid computing platform: DIRAC system with IHEP-extensions.**
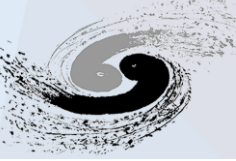
- **JUNO Data Challenge 1:**
  - **12th ~ 26th Feb 2024, corresponding to WLCG DC24.**
  - **Pressure transfer (500-1000 Mbps) with 4-8 times throughput than JUNO design.**
    - IHEP -> CNAF/IN2P3 transfer worked well, almost no failure.
      IHEP->JINR is bad and always get stuck.
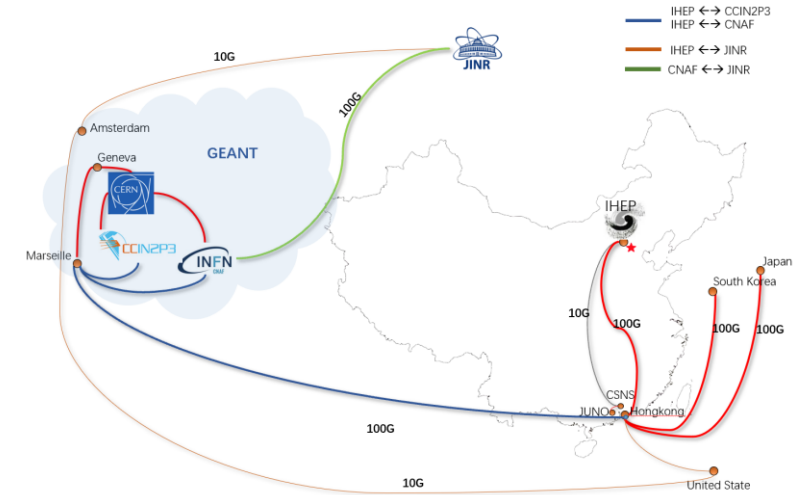
- **HERD: High Energy Radiation Detection Facility, will start production in 2027**
  - **Storage requirements: 70 PB in 10 year.**
  - **Computing requirement: 16000 CPUs in 10 years.**
  - **Two Tier-1 sites will run at China and Europe**
  - **Grid computing platform**
    - DIRAC + dHTC (HTC&HPC) for computing, Rucio for data management

Summary
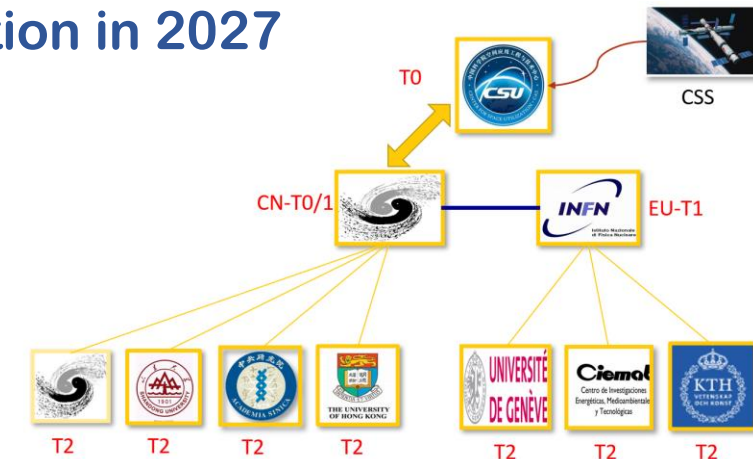
- **CC-IHEP has good experiences to operate WLCG sites.**

- **IHEP grid site has great expansion in two years**
  - Supports all the experiments of LHC
  - BelleII and several HEP experiments leading by IHEP

- **Looking forward to more contributions**