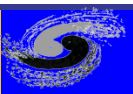
# HPC in IHEP

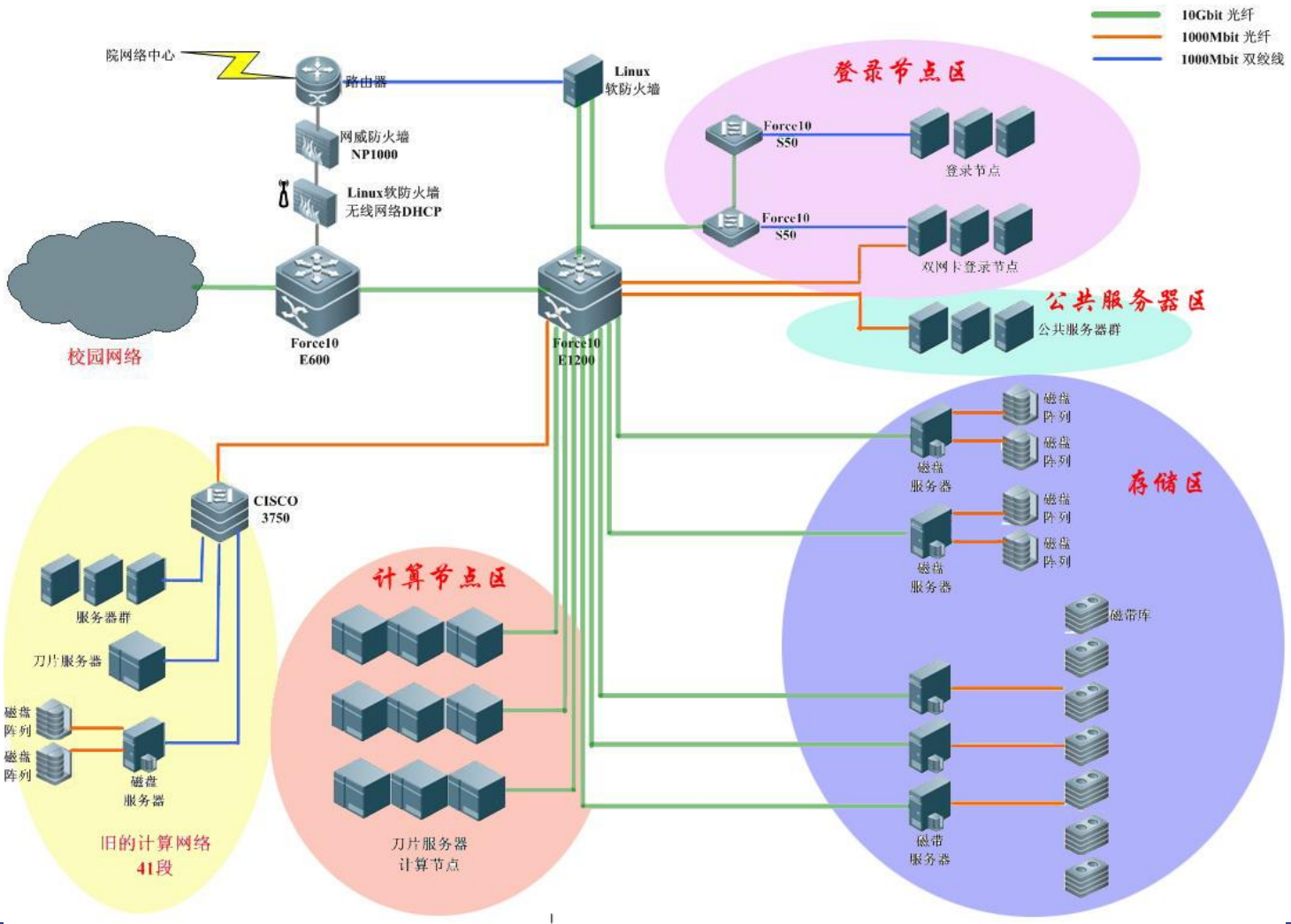
Xiaomei Zhang
Computing Center,IHEP



# Introduction to IHEP

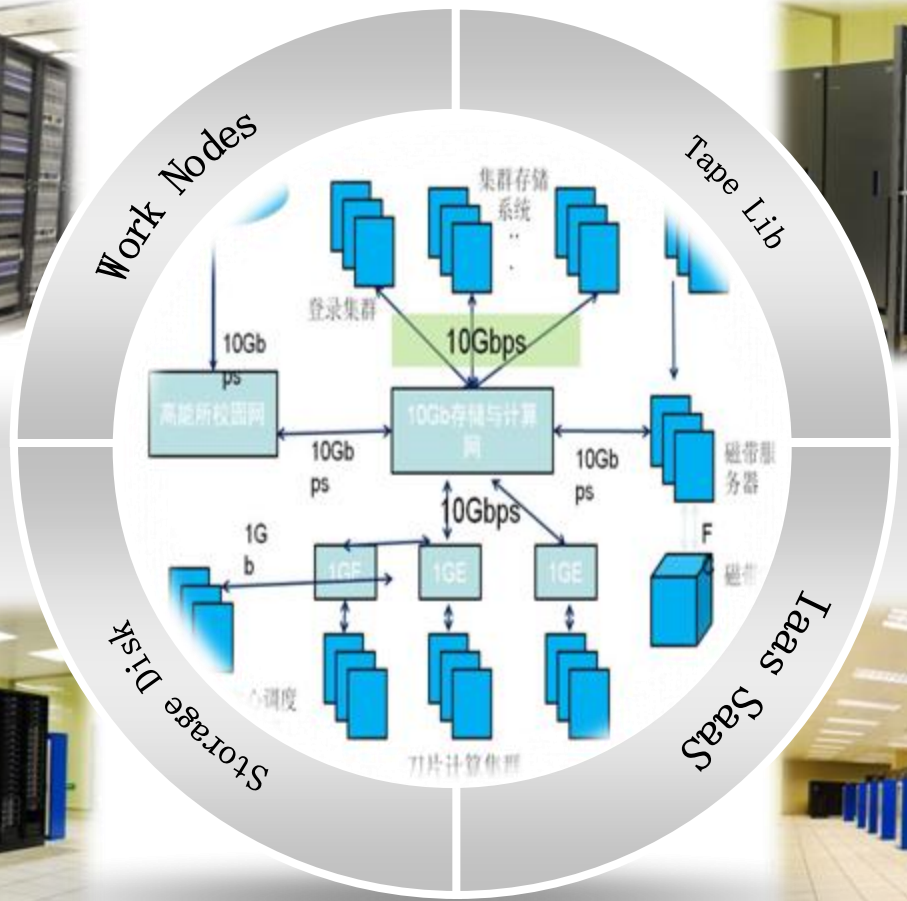
- Institute of High Energy physics, Beijing
- The largest fundamental research center in China with research fields:
  - Experimental particle physics
  - Theoretical particle physics
  - Astrophysics and cosmic rays
  - Accelerator technology and applications
  - Synchrotron radiation and applications
  - Nuclear analysis technique

# Computing Environment in IHEP



# Resources and facility

6600 CPU/Cores

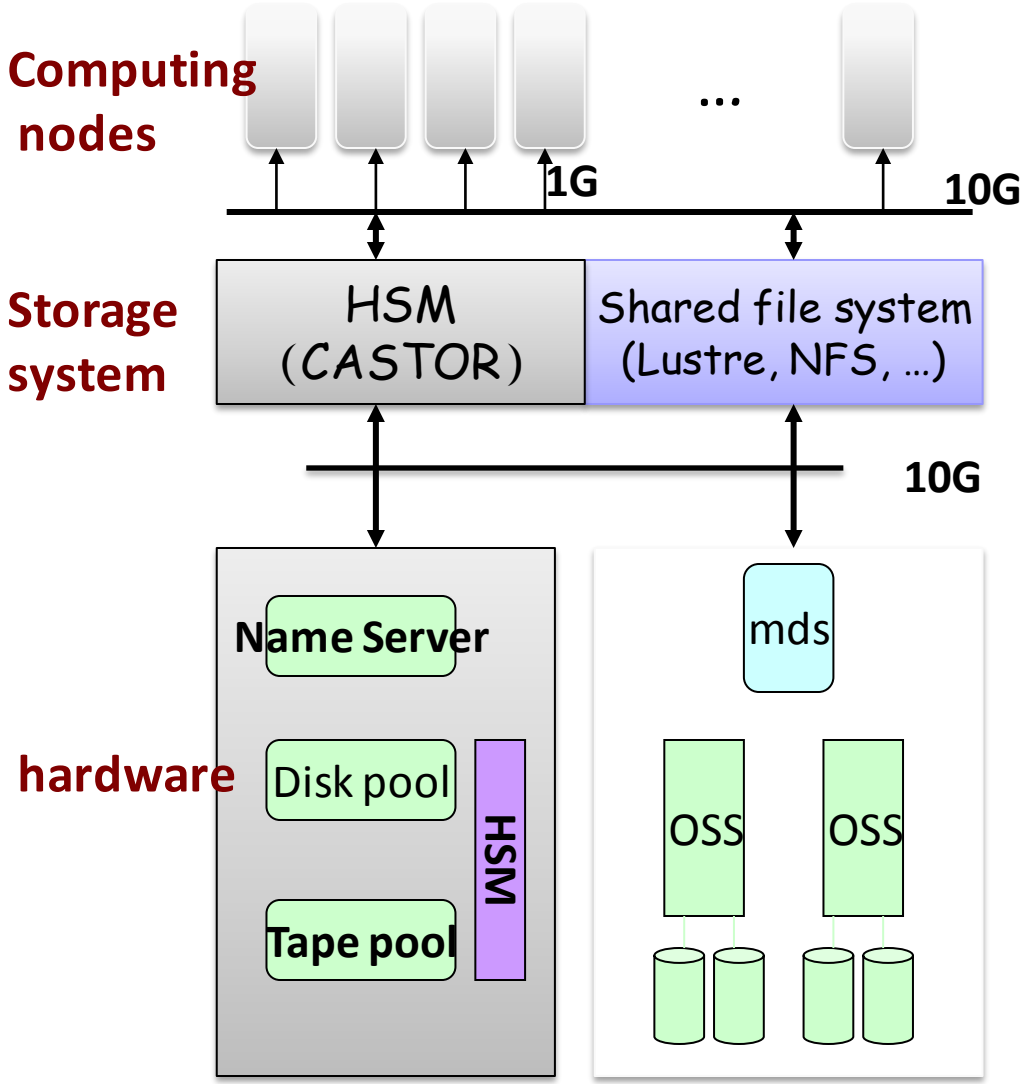



5PB Tape Lib

2PB+ Storage

IaaS/PaaS/SaaS

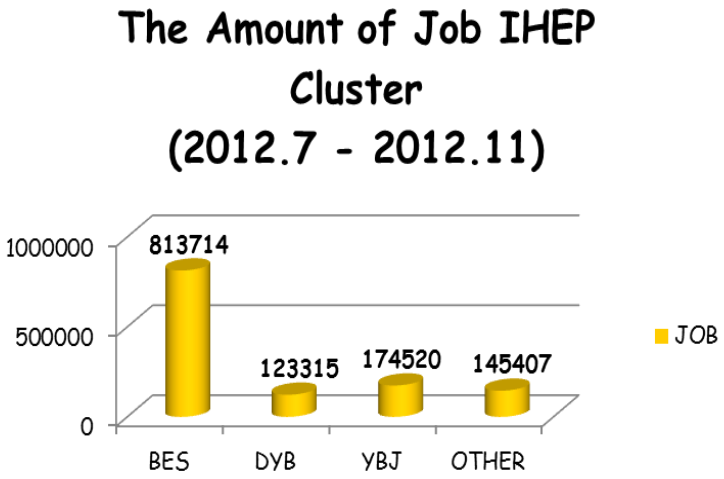
# Storage Architecture

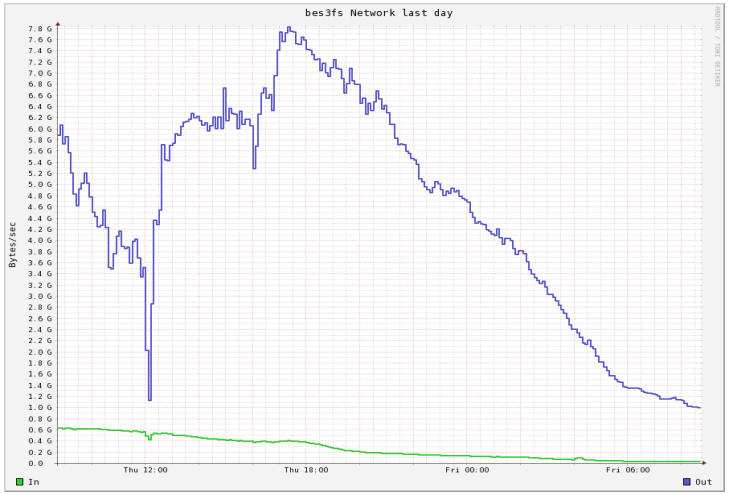



- **HSM**
  - Two IBM 3584 tape libraries
  - ~5800 slots, with 26 LTO-4 tape drivers
  - Managed by castor
  - 10Gbps link between disk servers and tape servers
- **Shared file system**
  - Lustre is the main system for physics data access and processing
  - 32 I/O servers, each attached with 4 SATA Disk Arrays

# Usage

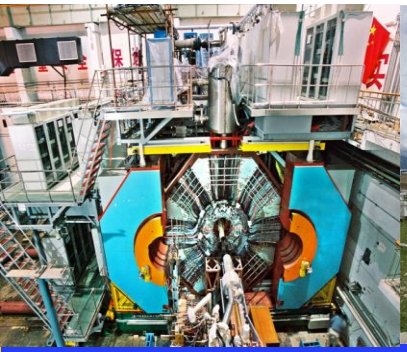
- More than 2 million jobs are running every year in local farms
- 3.22PB disk used
- 1.7PB tape used
- Peak throughput of data access from lustre
  - 800MB/s per I/O server
  - 3 mount points
  - Total throughput ~25GB/s

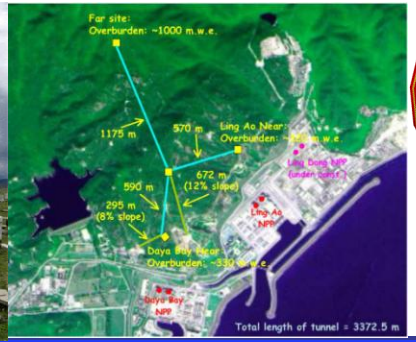


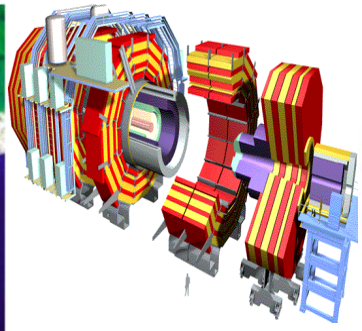
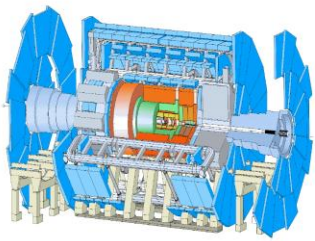



# Experiments mainly supported

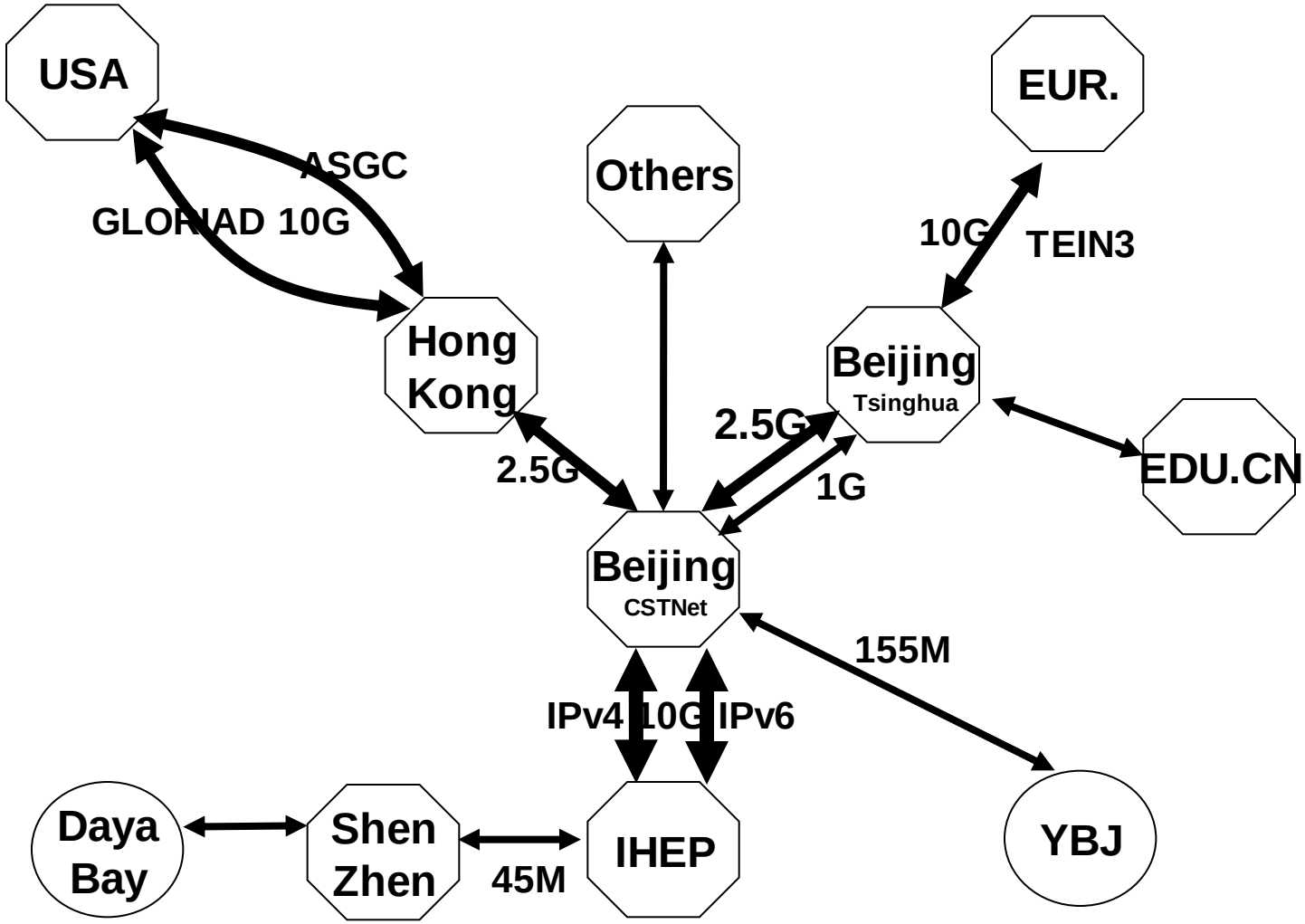
- BEPC/BES: Beijing Electron-Positron Collider/Beijing Spectrometer
  - Current biggest users, use more than half of resources
- Cosmic-ray observatory at Yang-Ba-Jing in Tibet
- Daya Bay Reactor Neutrino Experiment in dongguang
- LHC experiments: CMS/Atlas





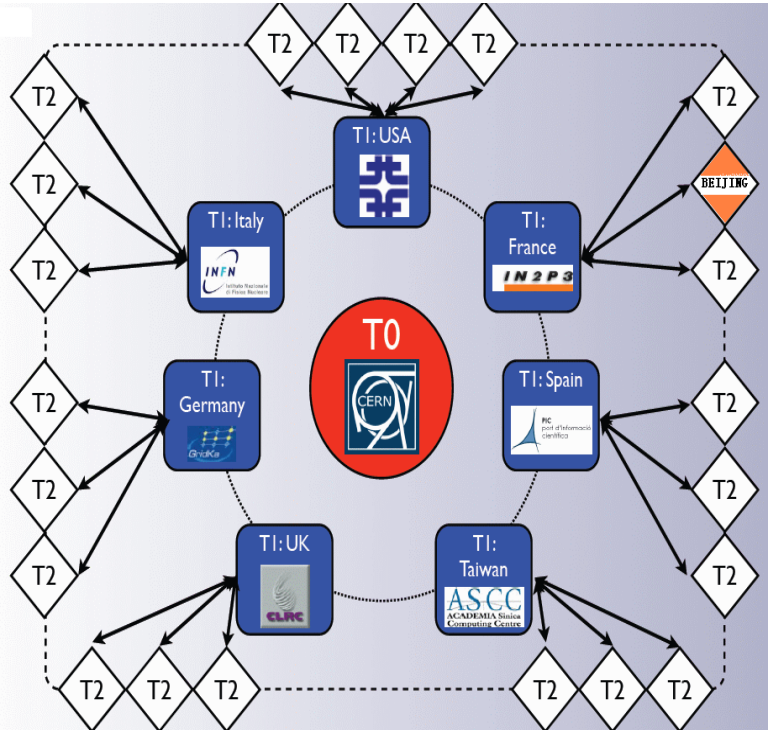



# Network connection



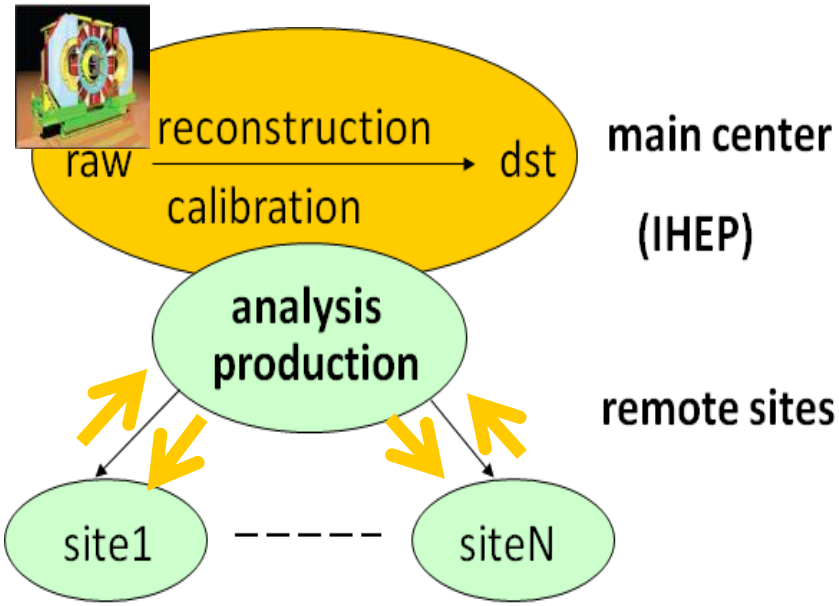
# LCG T2 grid site

- **T2_CN_Beijing grid site has been built in 2006 to support ATLAS and CMS experiment in China**
  - The only LCGT2 site in China
- **Resources**
  - With 1000 cores, 640 TB disk space
- **Usage**
  - Data transfer to/from IHEP 4TB/day
  - about 6000jobs running/day



# BESIII distributed computing

- It is the first experiment in IHEP to start their own distributed computing project
  - Aggregate about 1PB data and continue to grow
- Started in 2010, and the system put into production in 2013
- Basic computing model
  - Data taking at IHEP
  - IHEP as central site
    - Raw data processing, bulk reconstruction, analysis ….
    - Central storage for all the data
  - Remote sites
    - MC production, analysis
- 7 sites joined the system
  - About 2000 cores involved




| Name | Tier | GridType | Country | MaskStatus | Efficiency (%) | Status |
|---|---|---|---|---|---|---|
| China: 5 Sites | | | | | | |
| BES.GUCAS.cn | Tier-2 | BES | China | Active | 100.0 | Good |
| BES.IHEP-LCG.cn | Tier-2 | BES | China | Active | 0.0 | Idle |
| BES.PKU.cn | Tier-2 | BES | China | Active | 100.0 | Good |
| BES.IHEP-PBS.cn | Tier-2 | BES | China | Active | 100.0 | Good |
| BES.USTC.cn | Tier-2 | BES | China | Active | 100.0 | Good |
| Russia: 1 Site | | | | | | |
| BES.JINR.ru | Tier-2 | BES | Russia | Active | 99.1 | Good |
| United States: 1 Site | | | | | | |
| BES.UMN.us | Tier-2 | BES | United States | Active | 100.0 | Good |

# Future Plan

- 1000 CPU resources and 400TB or so each year have been purchasing for extension and retirement
- Distributed computing becomes supplement of local resources
- GPU, Volunteer Computing, cloud are new trends and new type of resources we start to use and study