# Jiangmen Underground Neutrino Observatory

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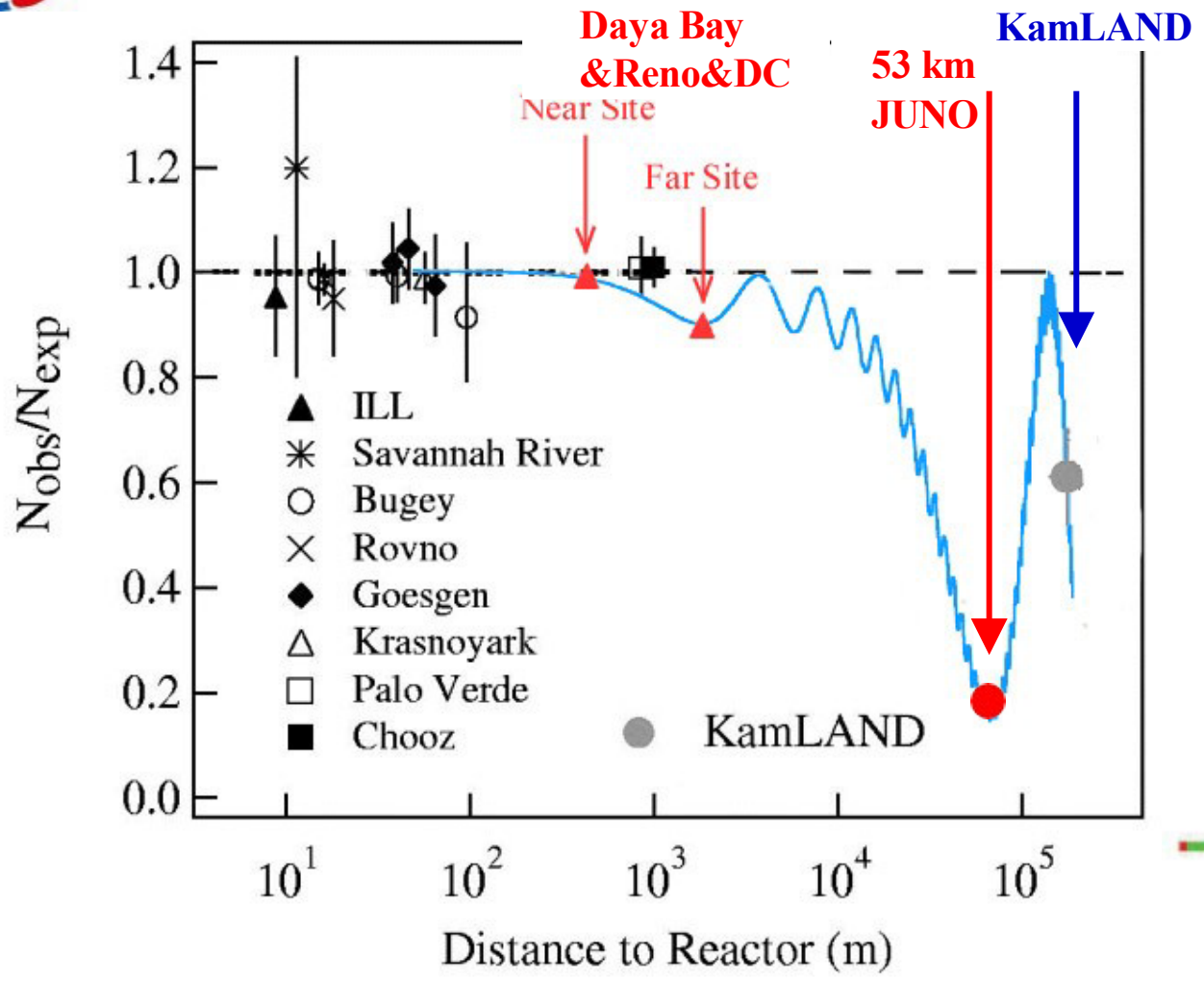
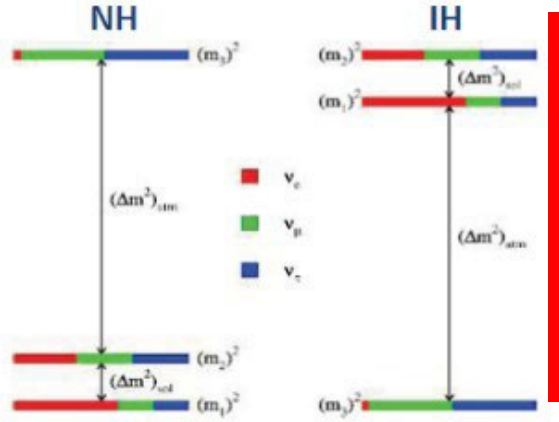
On behalf of JUNO collaboration

# JUNO physics summary




- **20 kton LS detector**
- **~3 % energy resolution-the greatest challenge for MH**
- Rich physics possibilities-neutrino oscillation and other particle program
  - ⇨ **Mass hierarchy**
  - ⇨ **Precision measurement of 3 mixing parameters $\Delta m^2_{atm}$ $\Delta m^2_{sol}$ $\theta_{12}$**
  - ⇨ **Supernova neutrinos**
  - ⇨ **Diffuse supernova background**
  - ⇨ **Geo-neutrinos**
  - ⇨ **Solar neutrinos**
  - ⇨ **Atmospheric neutrinos**
  - ⇨ **Nucleon Decay**
  - ⇨ **Exotic searches**




Background challenge target range for g/g of U and Th
$10^{-15}$ (minimum requirement)
$10^{-17}$ (ideal)

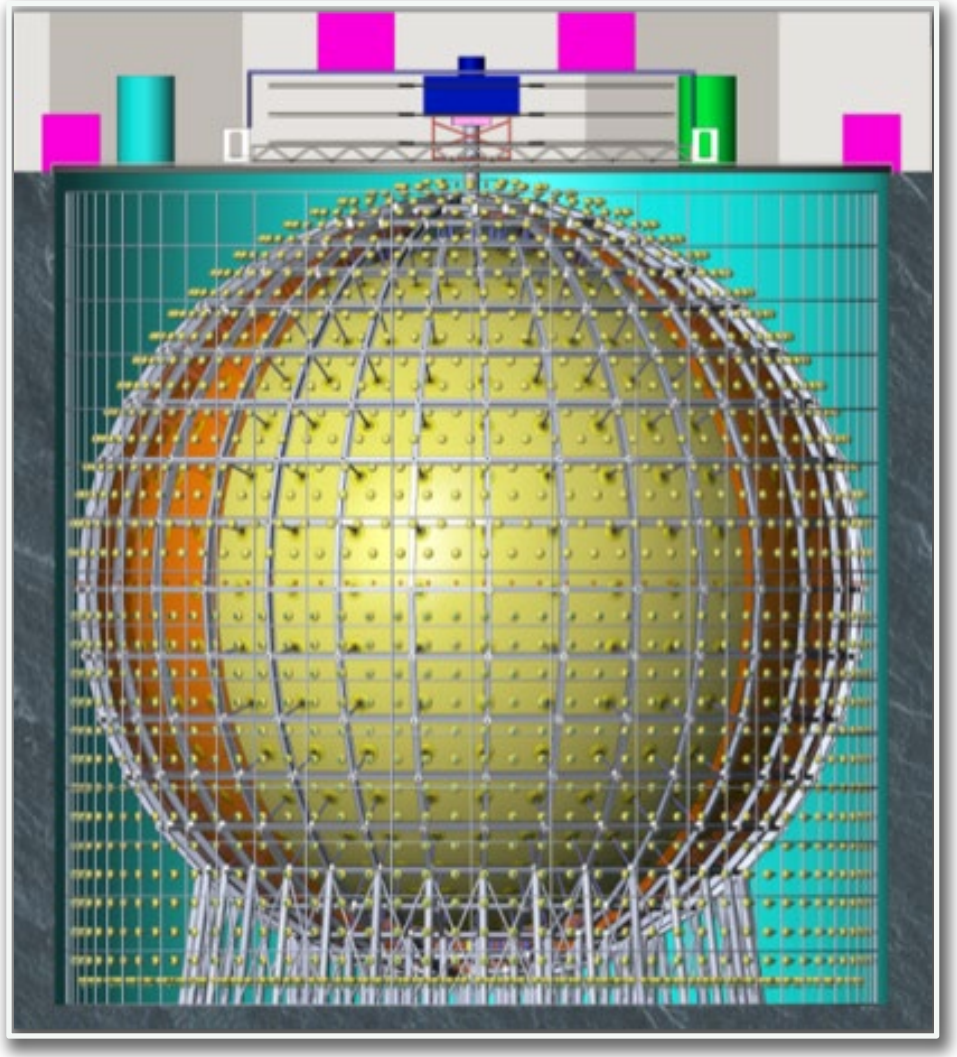
*Neutrino Physics with JUNO*, J. Phys. G 43, 030401 (2016)
*JUNO physics and detector*, Progress in Particle and Nuclear Physics 123, 103927 (2022)

# A large LS spherical detector

- **LS large volume: ➔ for statistics**
- **High Light yield and transparency➔ for energy resolution**

**Steel Truss**
Holding PMTS
17612 x 20”
25600 x 3”

**Acrylic Sphere**
filled with 20 kton
of liquid scintillator



**JUNO collaborations is made from 74 institutes in 17 countries and more than 700 collaborators**

| | |
|---|---|
| Armenia | Italy |
| Belgium | Pakistan |
| Brazil | Russia |
| Chile | Slovakia |
| China | Taiwan-China |
| Czech | Thailand |
| Finland | U.K. |
| France | U.S.A. |
| Germany | |

# CD status

⇐

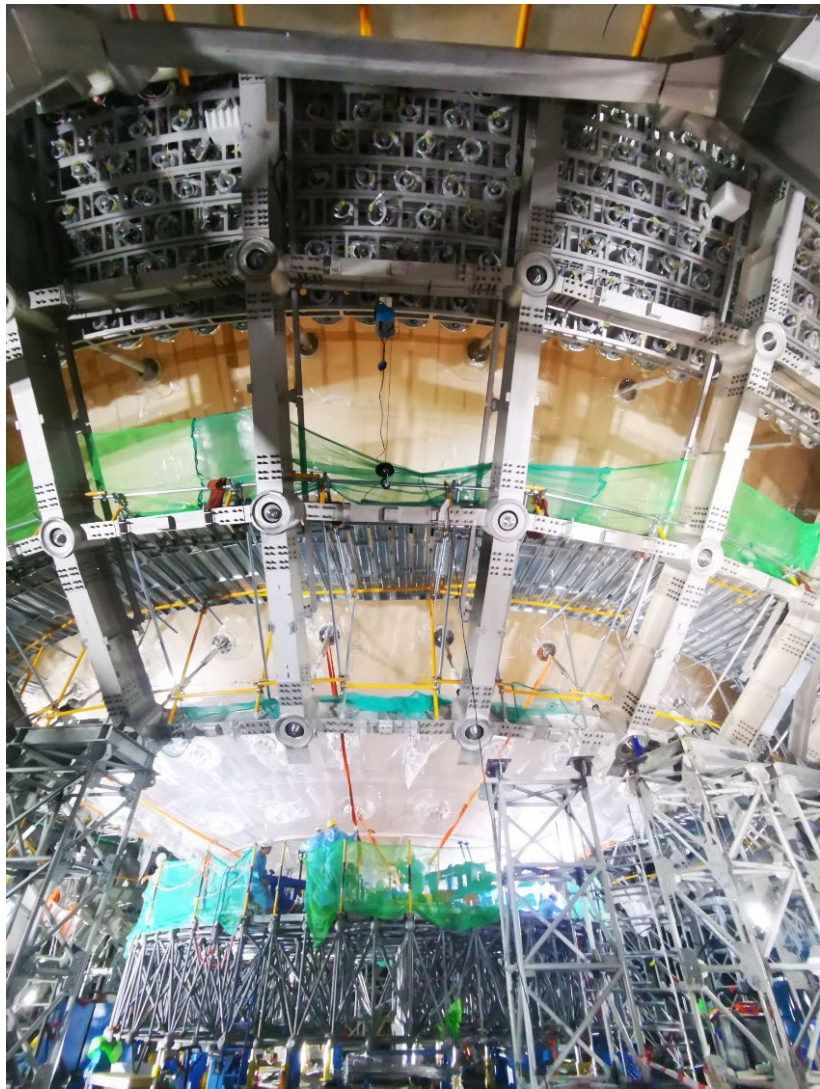
Acrylic

⇒

LPMT

Modules

**Data taking expected on 12/2024**



# Data volumes, computational requirements

| | |
|---|---|
| Estimated Raw data production | 60 MB/s ↔ 2PB/year |
| Estimated other data (reconstructed, calibration, analysed) | 1.0 PB/year |
| Bandwidth required to copy 3 PB in 1 year | 0.8 Gbps |

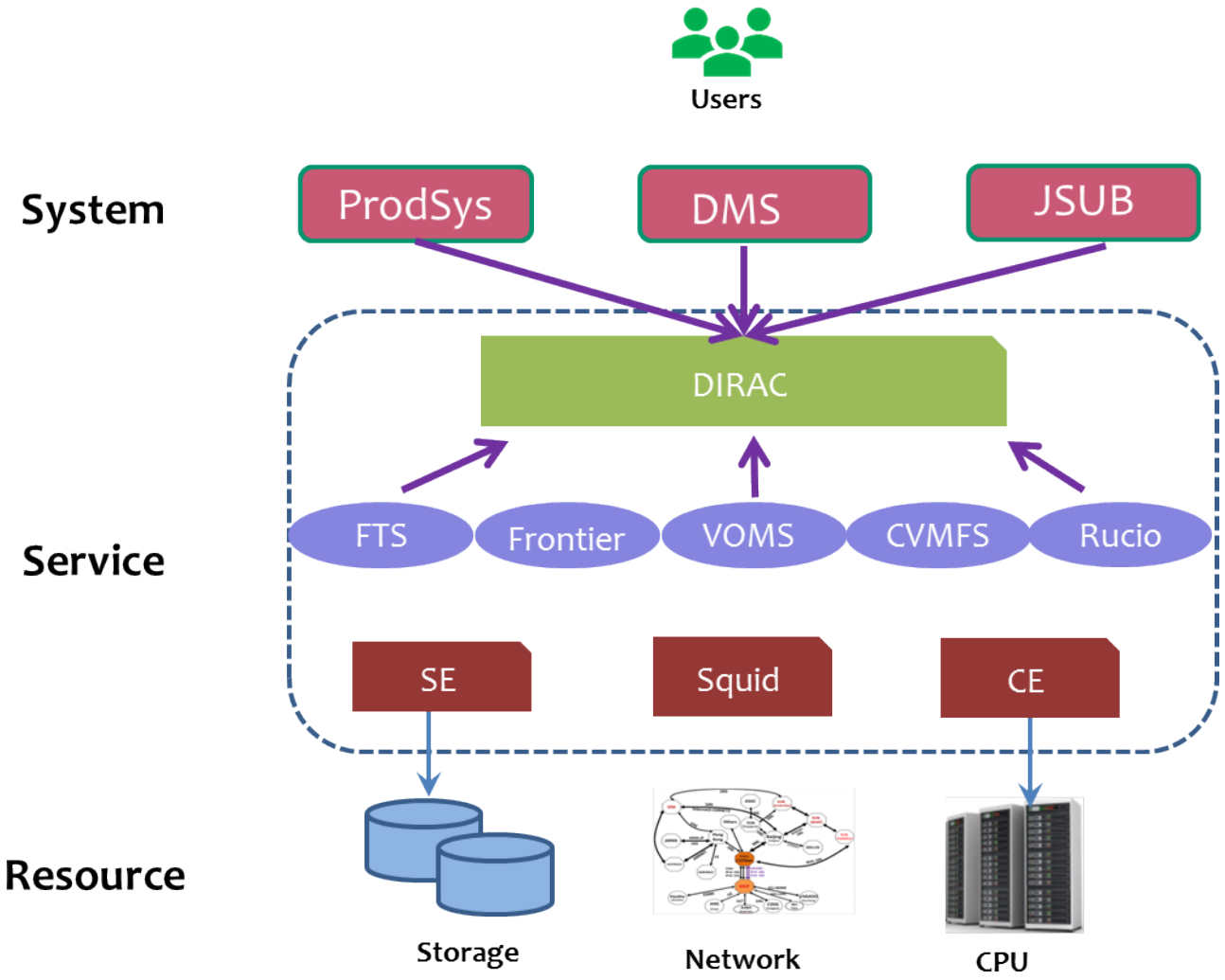
- 1 event reconstruction goal: 5s with a 18 HS06 core
- Rate: 1kHz
- Reconstruct 1 year data in 1 year then requires about 155 kHS23.

# JUNO Data Centres

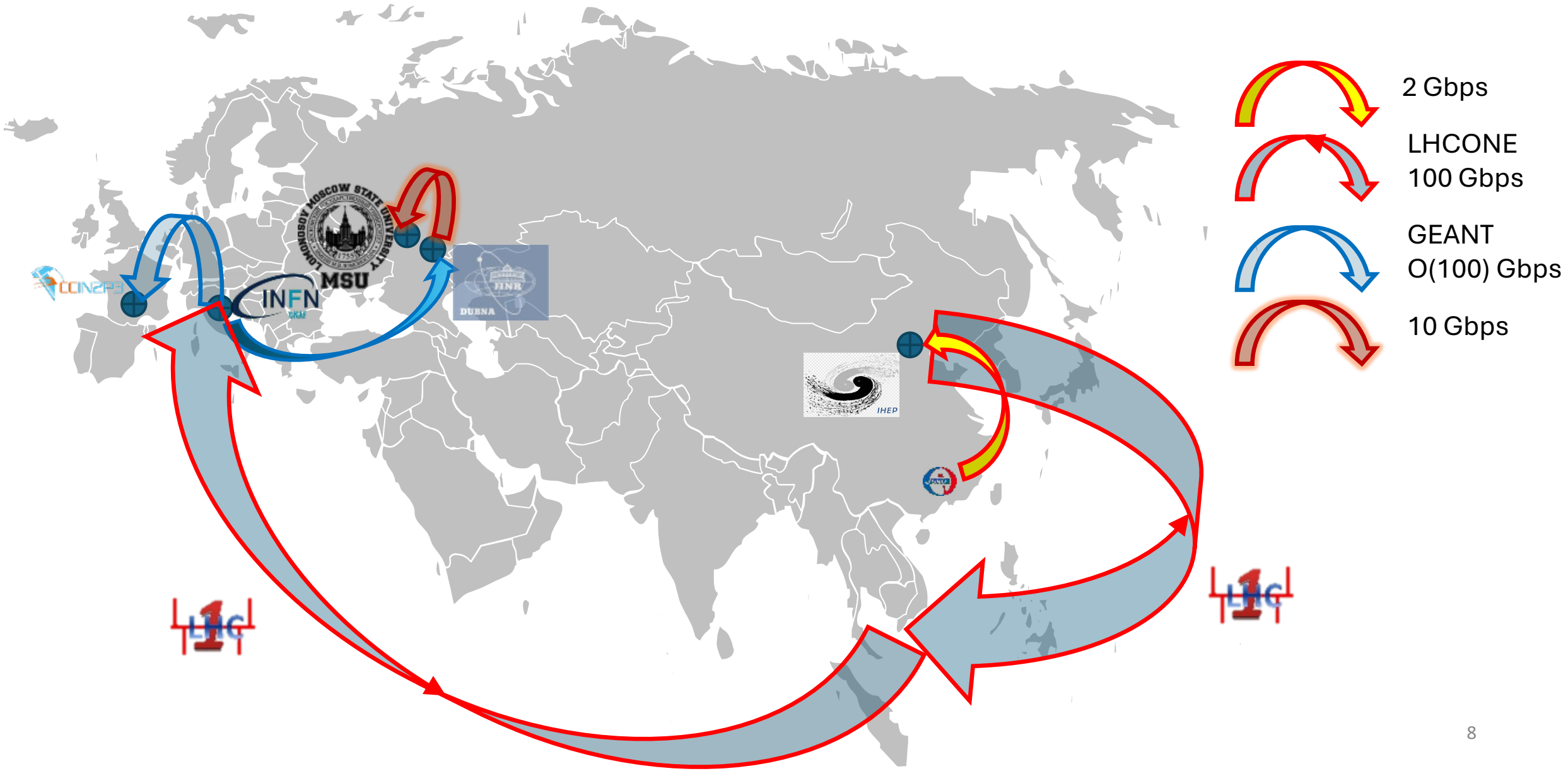
| | Role | Available in 2024 | | |
|---|---|---|---|---|
| | | CPU (kHS06) | Disk (PB) | Tape (PB) |
| IHEP | T0: next to JUNO site, collect all data, DQM, first reconstruction | 180 | 8.0 | 4.0 |
| CCIN2P3 | T1: 1/3 of data, computing power | 15 | 0.2 | 2.0 |
| INFN CNAF | T1: full data, computing power | 20 | 3.0 | 1.0 |
| JINR DUBNA | T1: full data, computing power | 120 | 10.0 | 10.0 |
| MSU | T2: no data, computing power; not yet on line | | | |
| **Totals** | | 335 | 21.2 | 17.0 |

# DCI Architecture





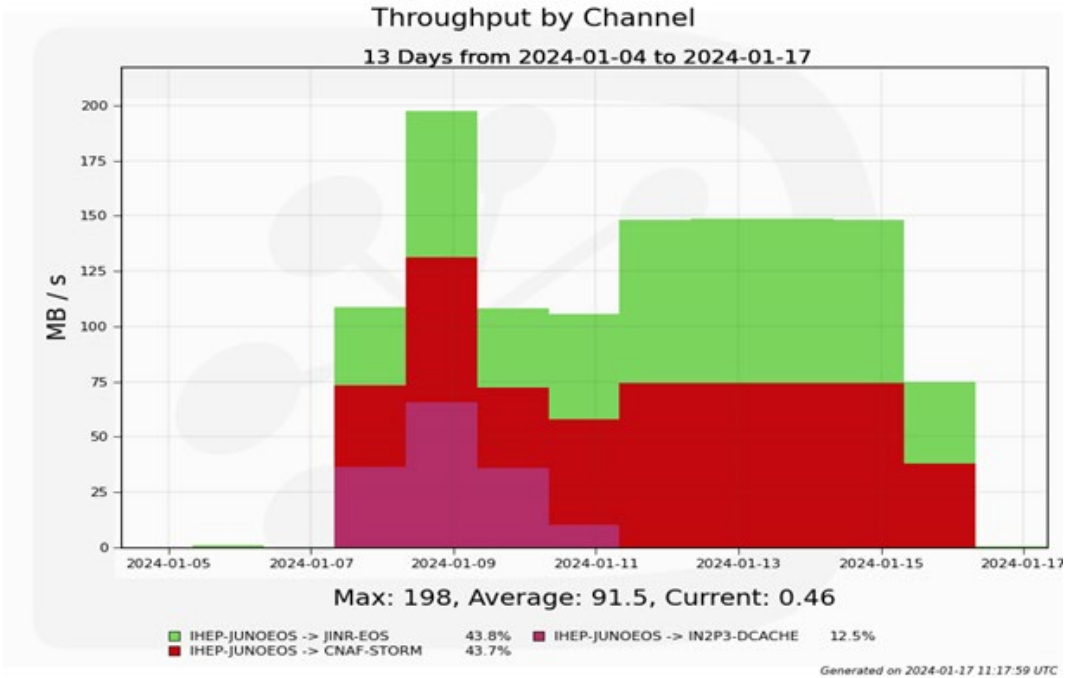
# International networks

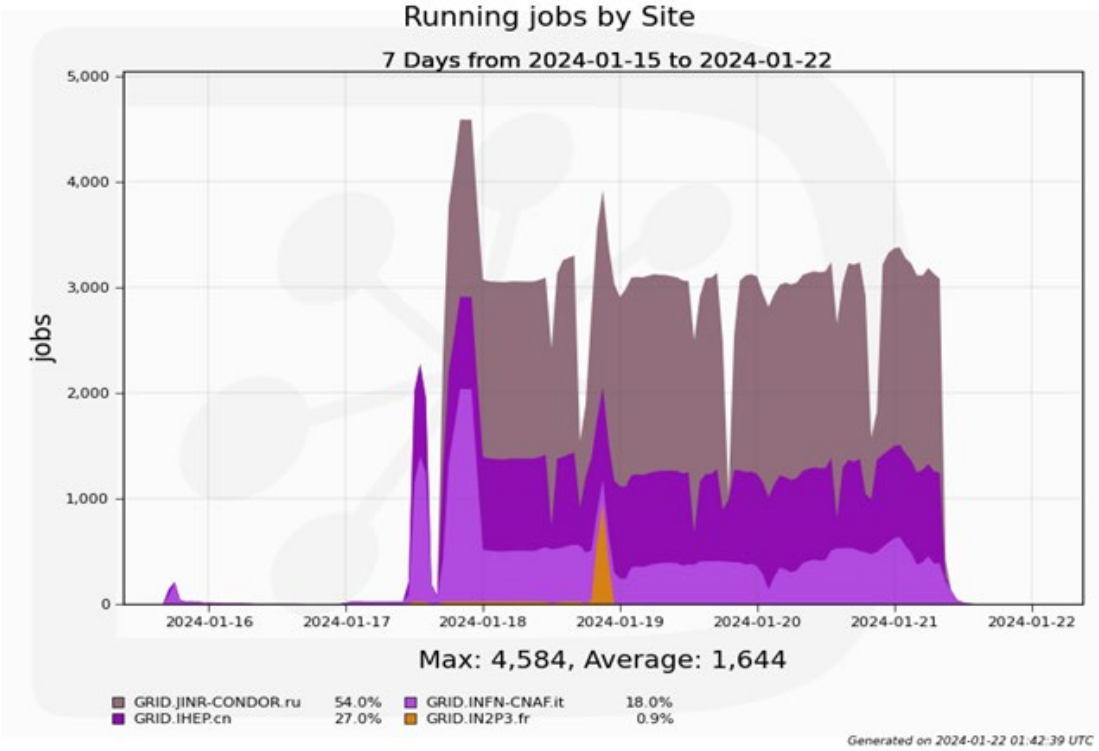


# Data challenges

DC-1: functions of physics production

- RTRaw distributed to three data centers (IN2P3 only a small part)
- Split and scheduled jobs to proper data centers depending on data location and resource availability
- Production monitoring

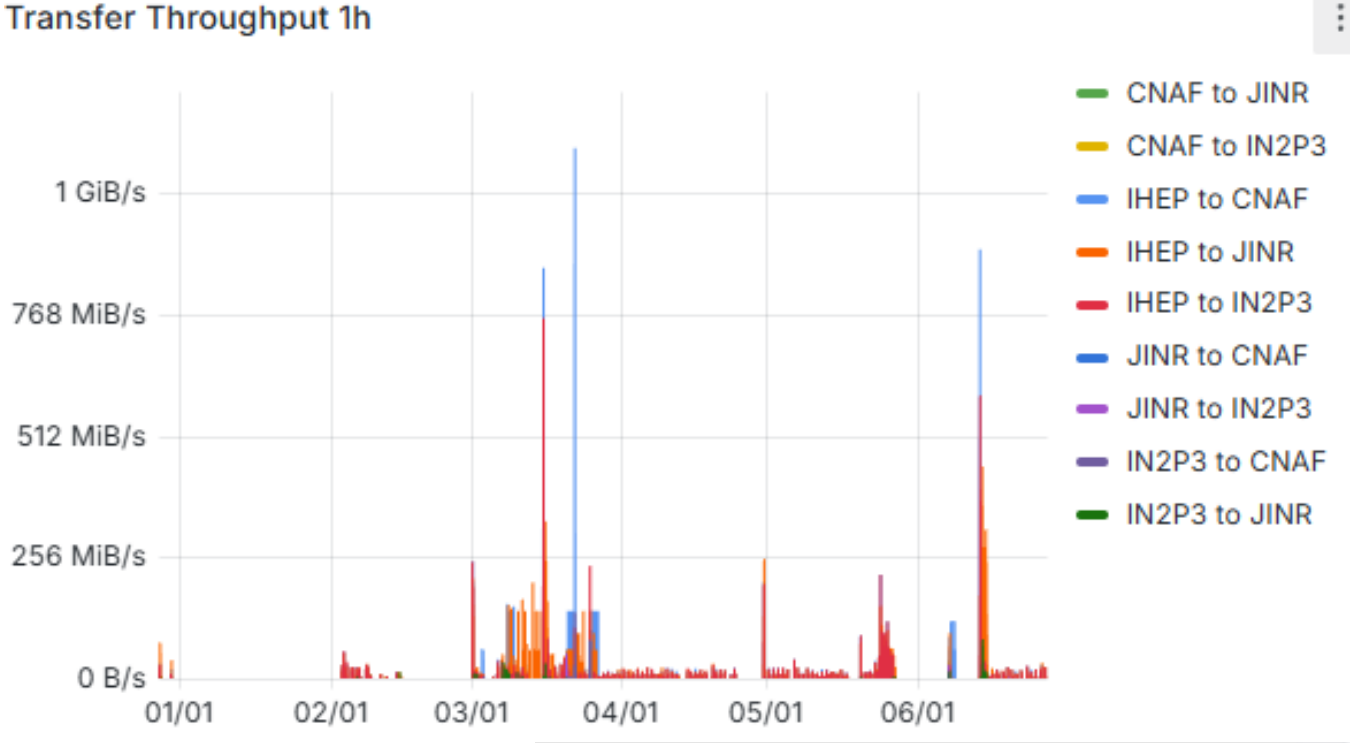


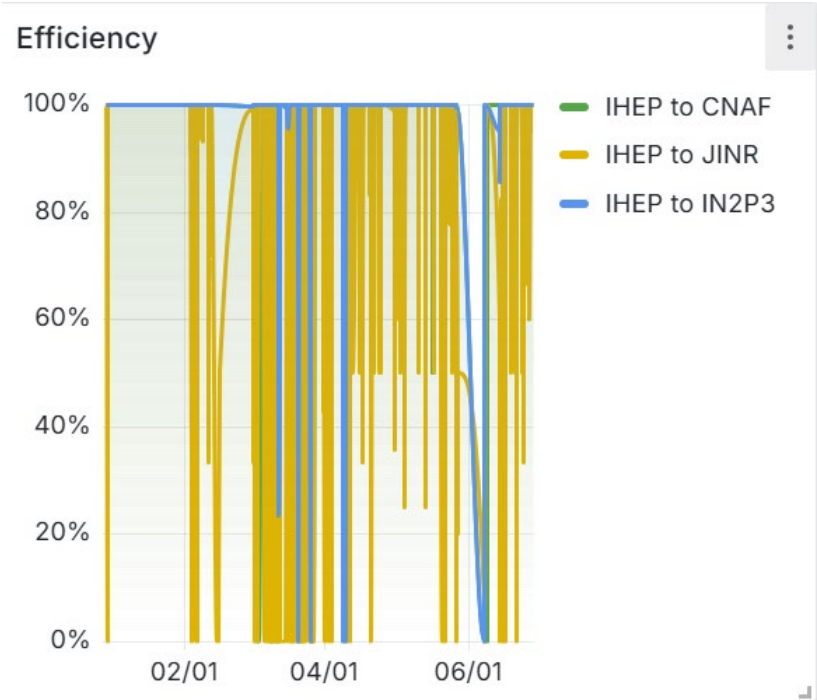



# Data transfers

Data transfer

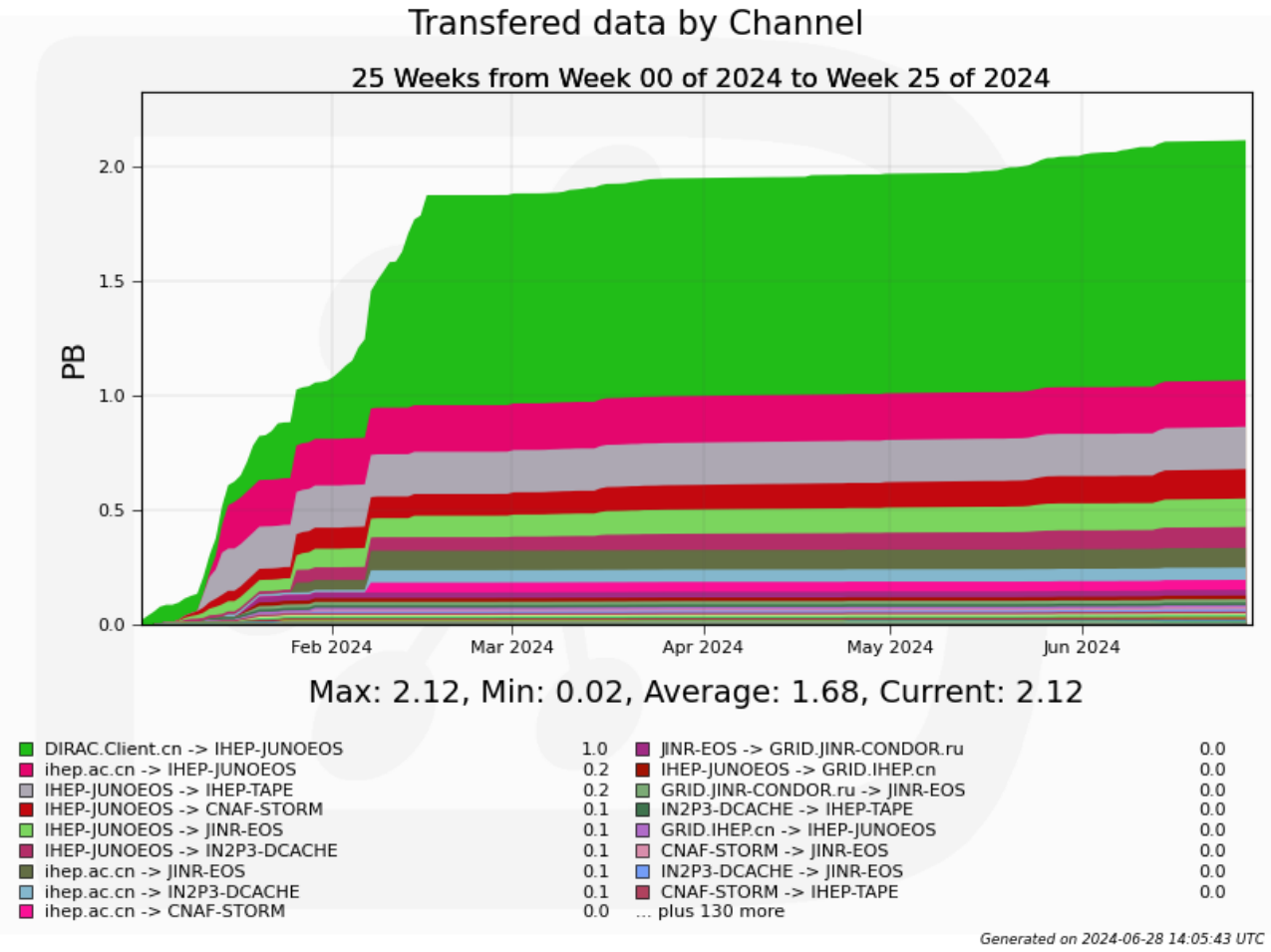
- RAW files
- OSIRIS

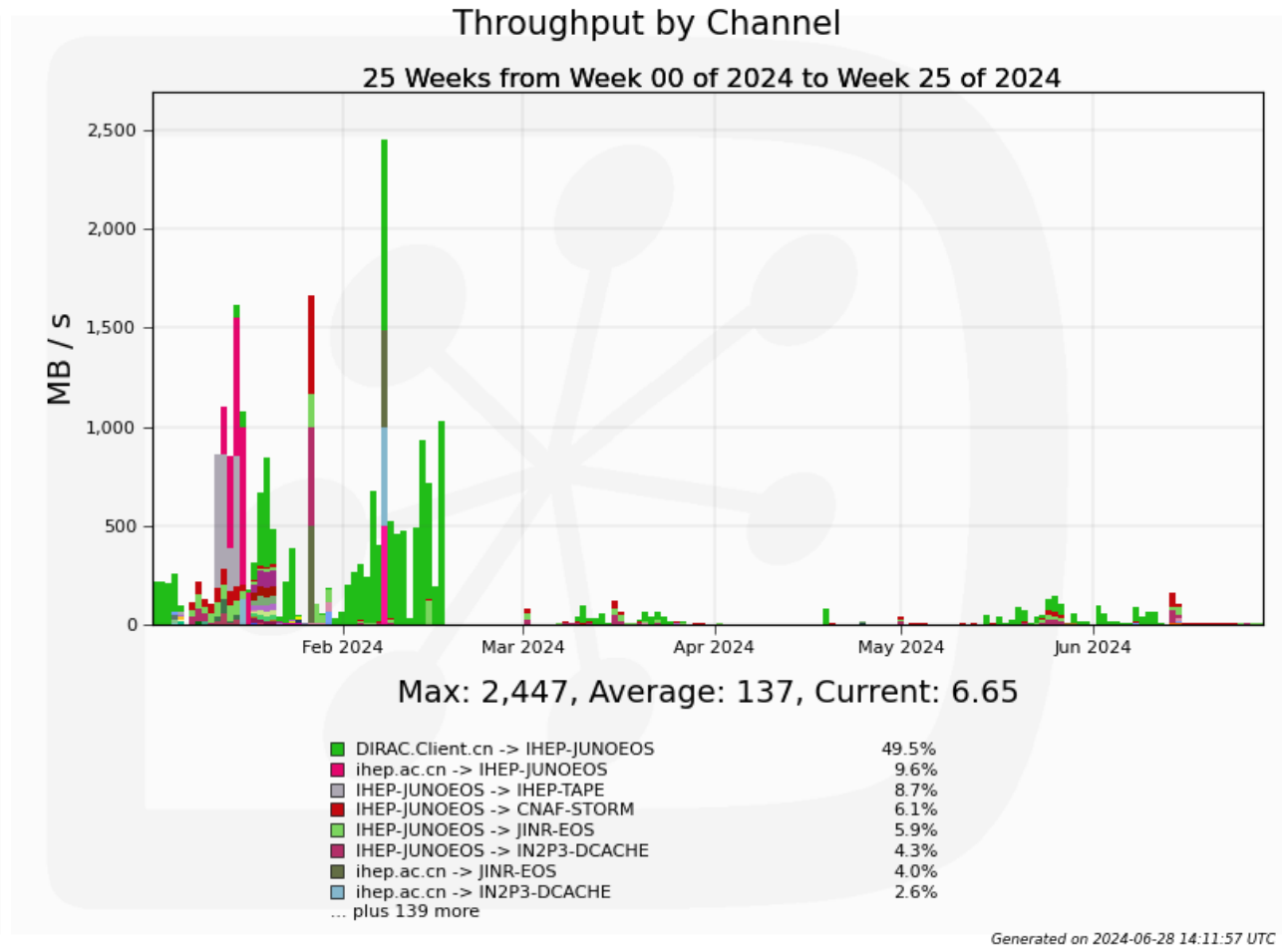


# Data transfers

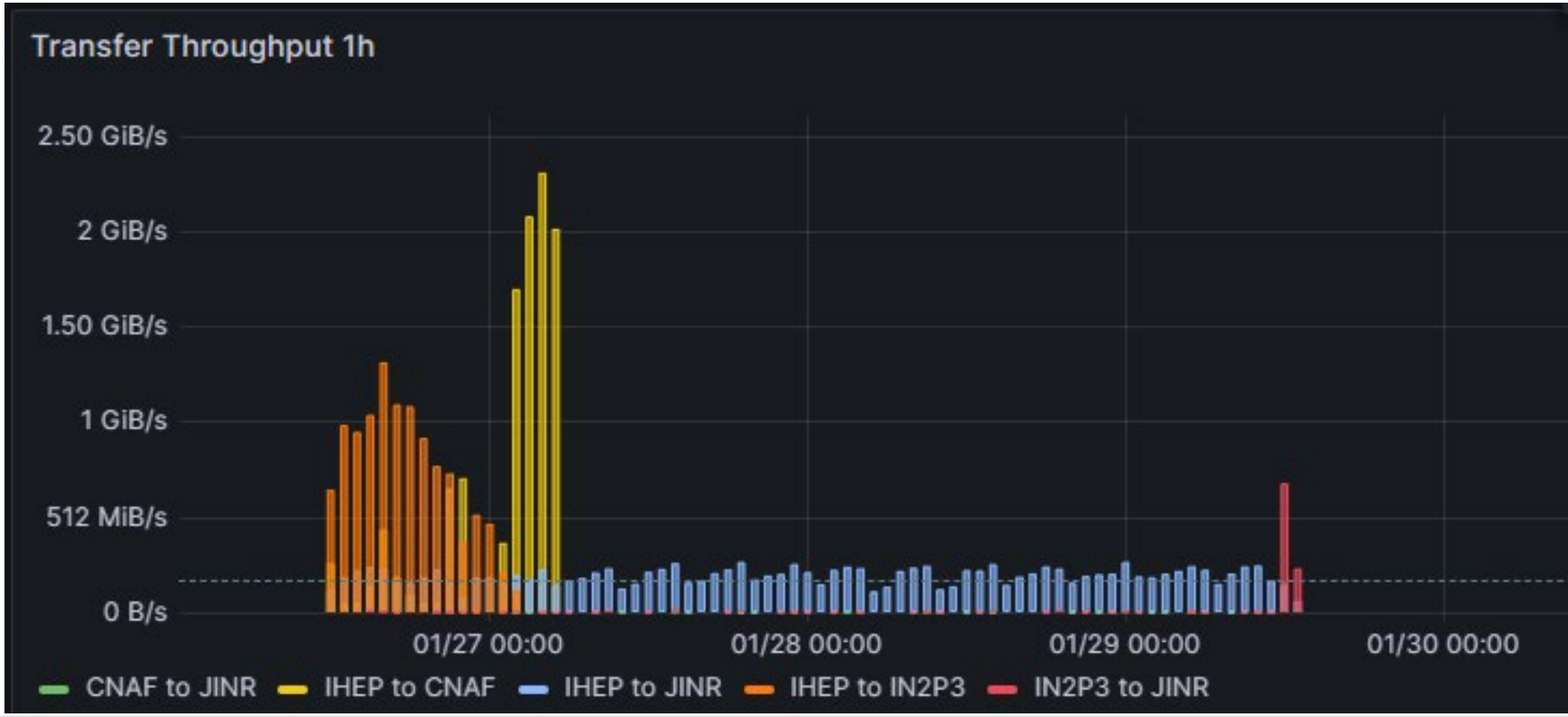
During the first half of 2014, total transferred data is about 2PB



# Network data challenge

- IHEP-> CNAF, JINR, IN2P3
  - 8000files, each file 5GB
- IHEP->CNAF and IHEP->IN2P3 very good performance
  - CNAF can reach 20Gb/s and IN2P3 can reach 10Gb/s
  - Success rate 100%




| | | | | | | |
|---|---|---|---|---|---|---|
| ☐ | 4544 | Active | Automatic | Transfer-J… | 5G_IHEP2JINR | 8000 |
| ☐ | 4543 | Active | Automatic | Transfer-J… | 5G_IHEP2DCACHE | 8000 |
| ☐ | 4542 | Active | Automatic | Transfer-J… | 5G_IHEP2CNAF | 8000 |

# Summary

- JUNO is about to start data taking in December
  - Data taking will increase smoothly till full data flow in a coule of months
- JUNO DCI in test is performing well
- JUNO DCI is able to take advantage from existing network