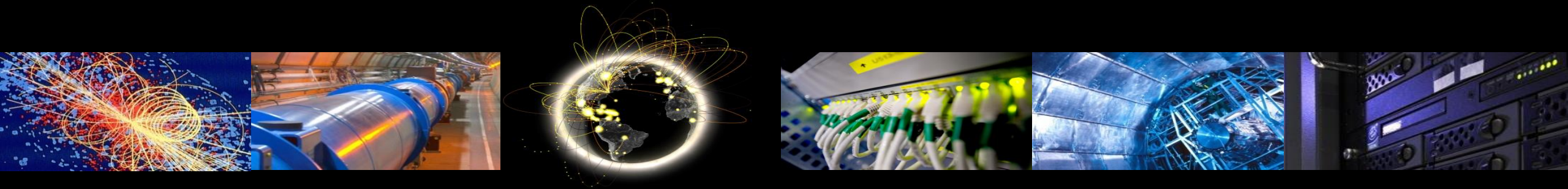


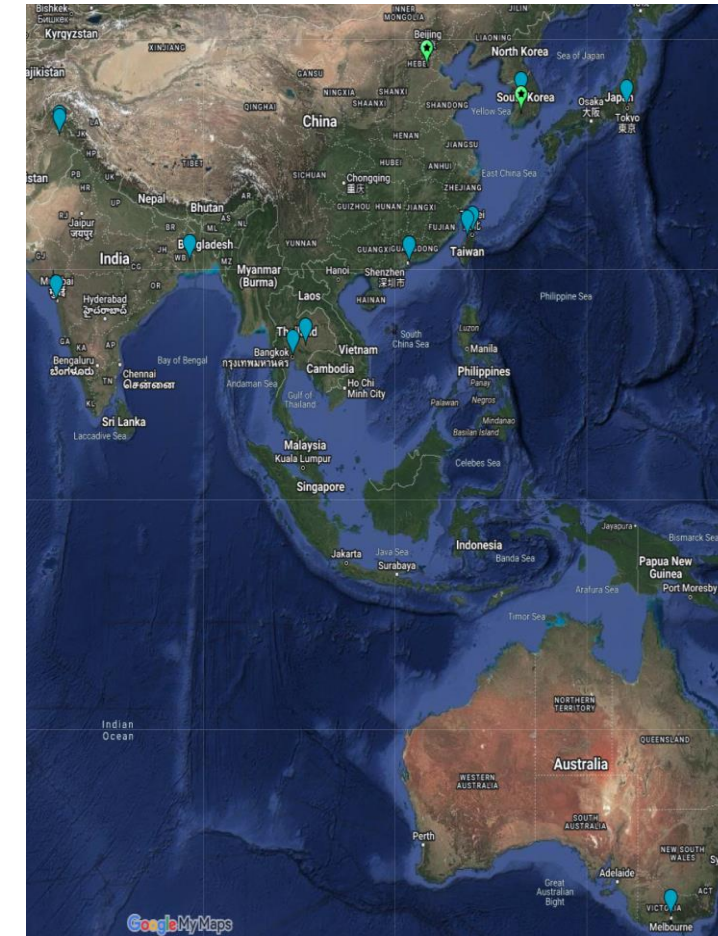
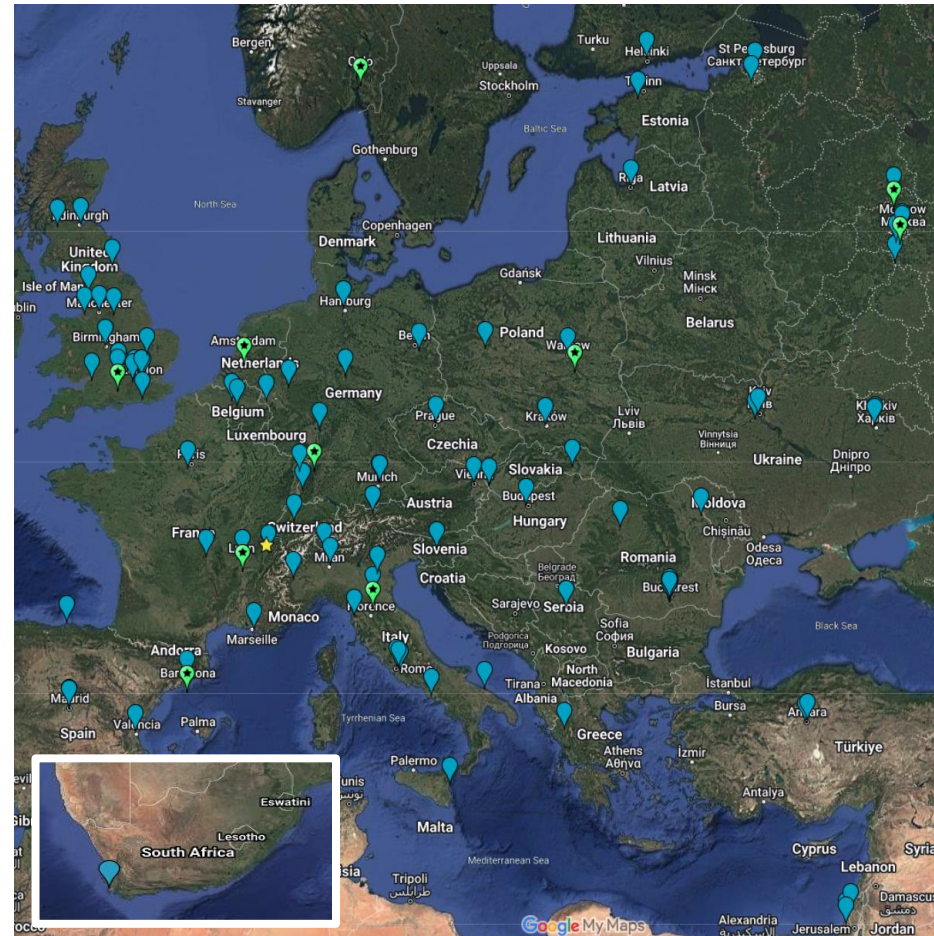
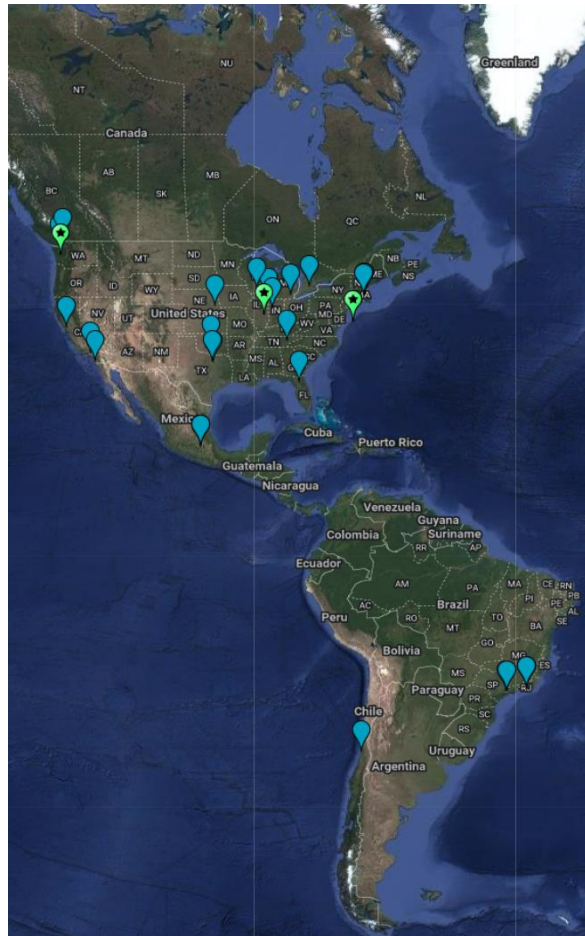
# WLCG status and news

Simone Campana (CERN)



# The WLCG Collaboration

65 MoU's (164 sites) in October 2024



# New commitments to WLCG

## Belgrade (Serbia)

- Signed the WLCG MoU in Dec 2023
- Plan to become a T1 for CMS



## Latvia

- Signed the WLCG MoU in April 2024
- Commissioning a T2 for CMS



# New T1s in WLCG

**IHEP – Beijing (CN)** was endorsed  
as a new Tier-1 for LHCb (Jun 2024)



**NCBJ – Swierk (PL)** was endorsed  
as a new Tier-1 for LHCb (Dec 2023)



**Network capabilities are one of the main enabling factors for a Tier-1,  
together with archive storage and availability/reliability/support**

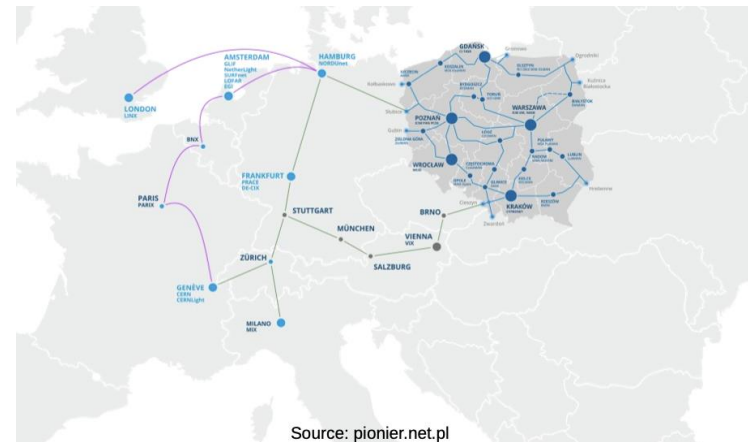
# Commissioning of Swierk (PL)

## Network Resources

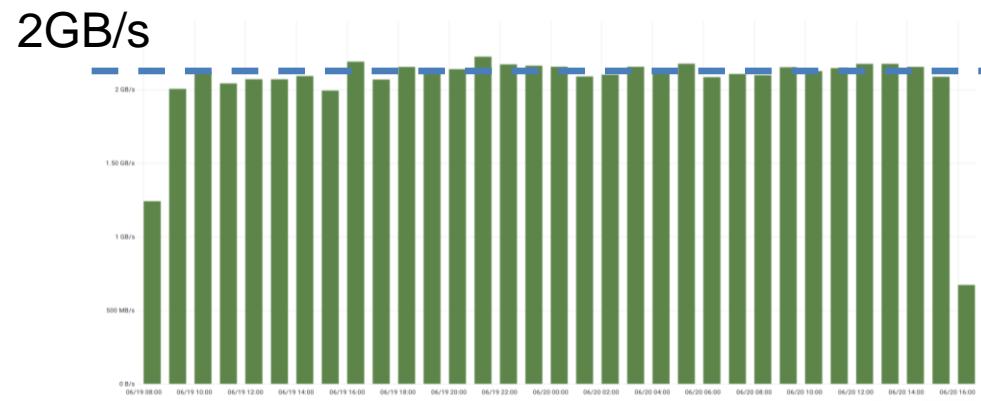
- **100 Gbps** link to PIONIER (academic internet, Geant)
  - **20 Gbps** dedicated channel to **LHCONE**
    - Full speed achieved (2022 Data Challenge)
  - **20 Gbps** dedicated channel to **LHCOPN**
    - Primary and backup links established
    - Full speed achieved (2023 LHCb Data Challenge)
- Two independent **8 Gbps** links to internet (Exatel)
  - Provides around **5.6 Gbps** to CERN (2022 Data Challenge)
  - **Backup** links for WLCG activities
- **2 x 40Gbps** internal backbone
- **2 x 10Gbps** external firewall links (upgrade in mid 2024)

### Achievements

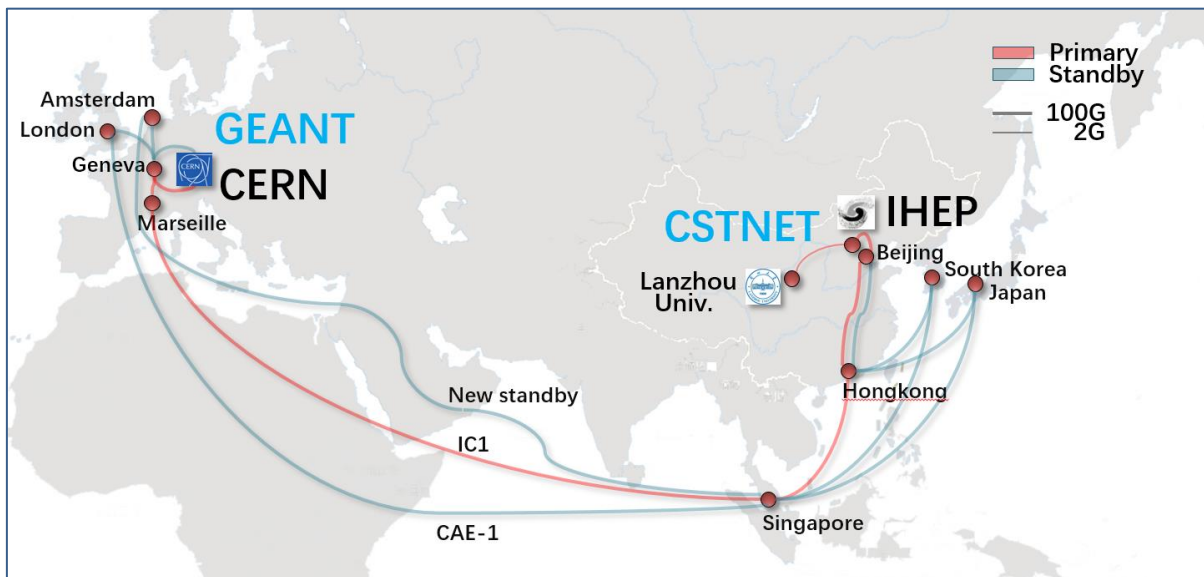
- 1) Dedicated **LHCOPN** channel
- 2) Support of **IPv6**



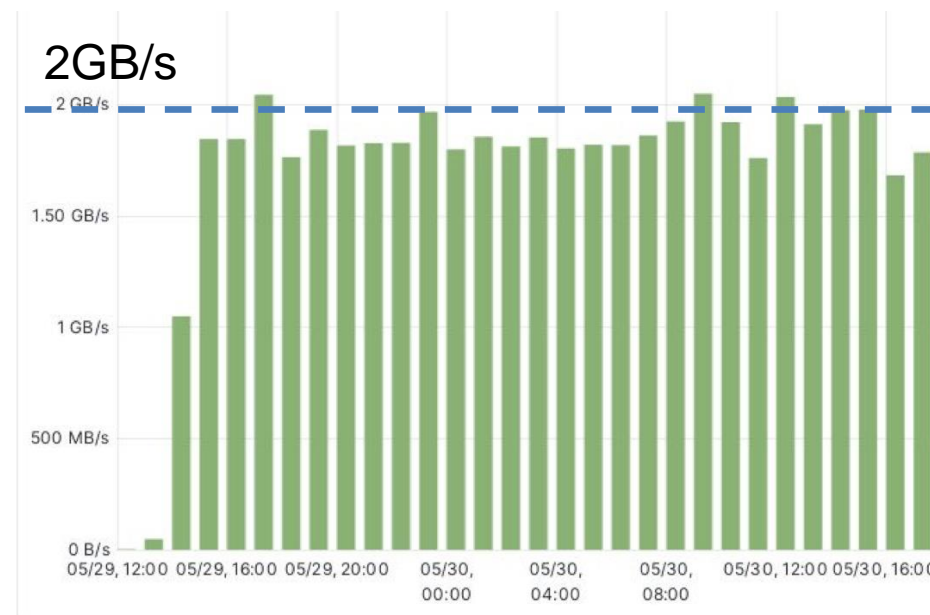
## CERN-Swierk data challenge 2023



# Commissioning of IHEP (CN)



CERN-IHEP data challenge 2024



OPN: 3 redundant links to CERN, 20Gbps, 200ms

Connectivity from Asian sites to Europe is challenging (and expensive for dedicated links).

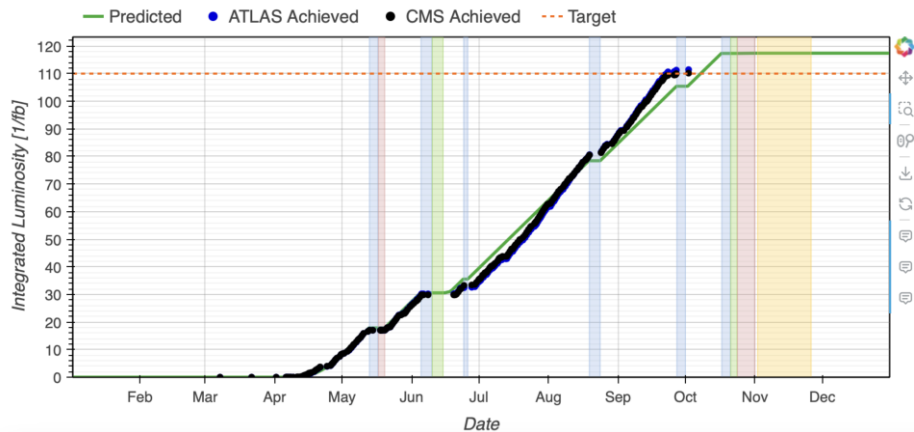
**We need to strike the right balance between managing network-related risks and encouraging new commitments for Tier-1 and Tier-2 services**

# 2024 LHC Data Taking

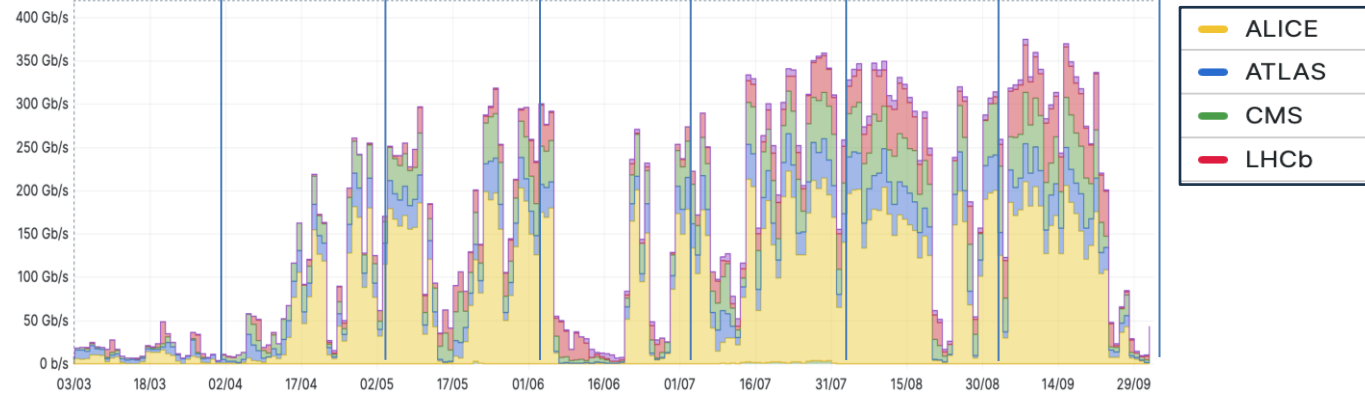
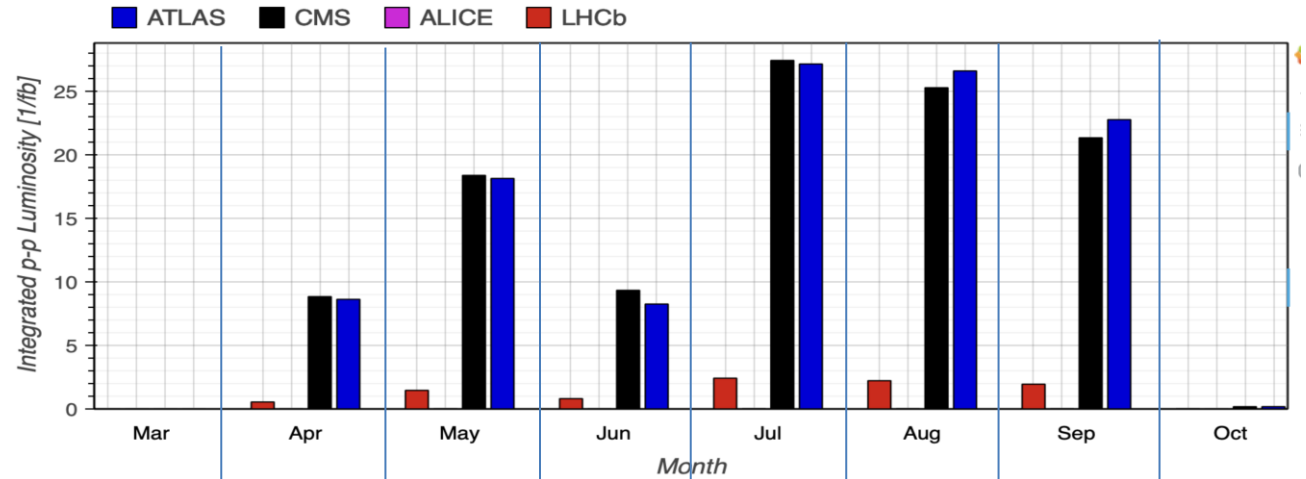
The LHC has been extremely “productive” in 2024

Yearly pp target already reached, and we still have weeks to go

This is great for physics. It presents unprecedented challenges for computing



### LHC pp integrated luminosity / Month (1/fb)

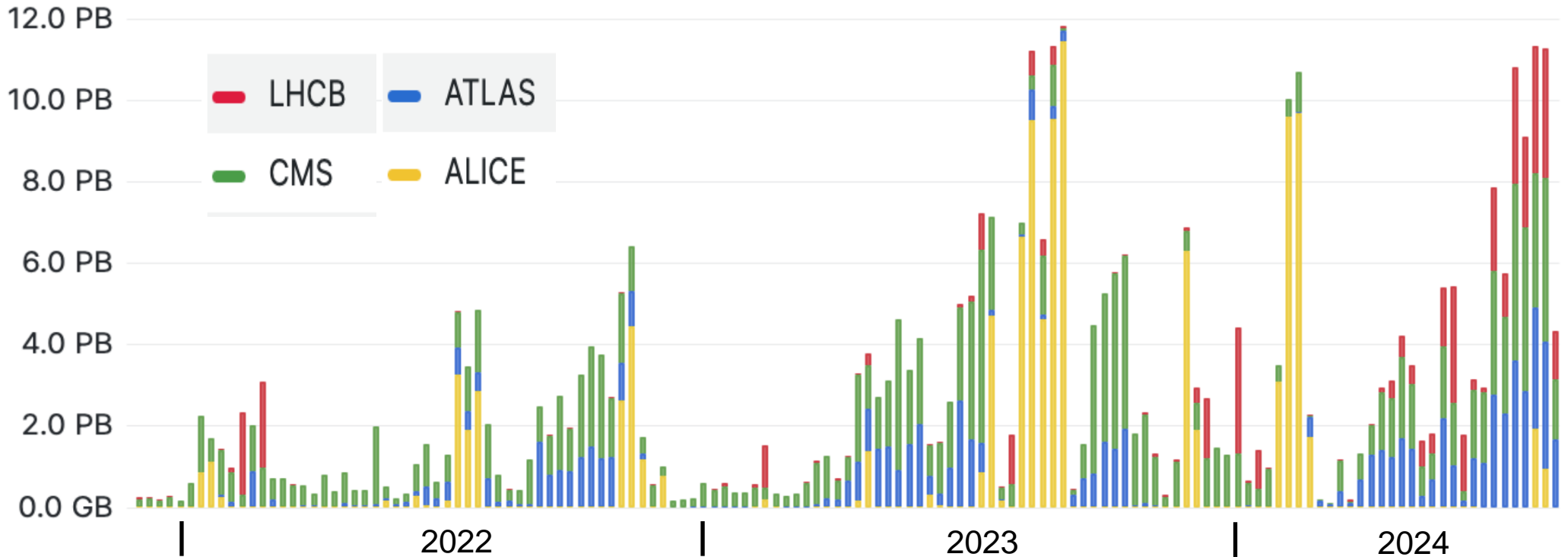


### Daily data rate from experiments to T0 (Gb/s)

# LHC RAW data archiving

Data being promptly archived at CERN and at the T1s (11.5 PB/week in July 2024)  
Archiving data promptly is vital to avoid data loss. The OPN performance/reliability is essential

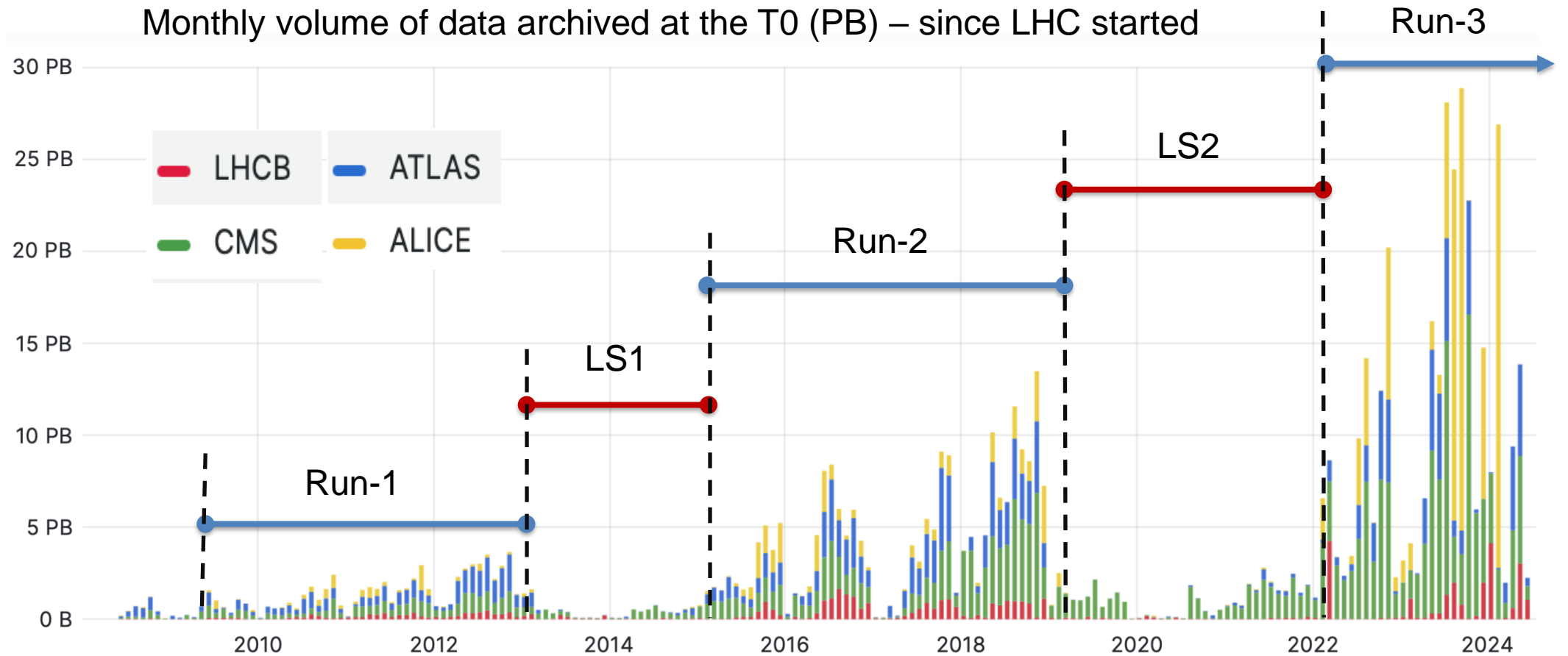
Weekly volume of data archived at the T0 (PB) during Run-3





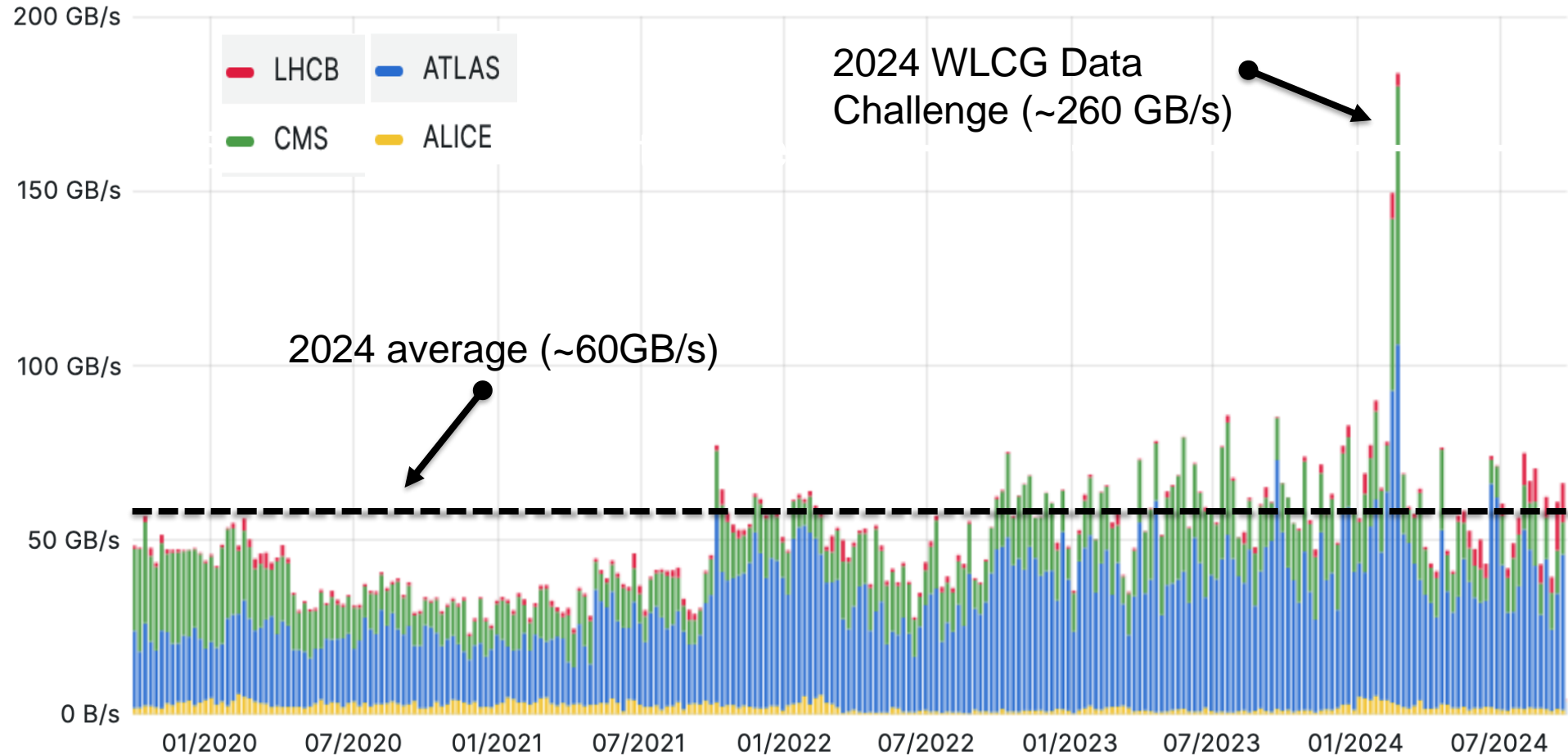
# The LHC RAW data volume

Run-3 is not just "the same as Run-2, just few years later". Particularly for ALICE and LHCb



# WLCG traffic (GB/s) in the last 12 months

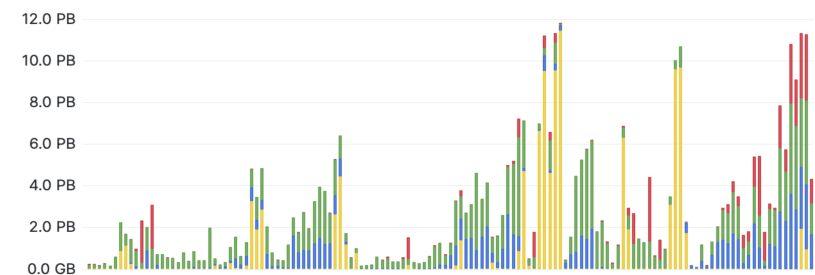
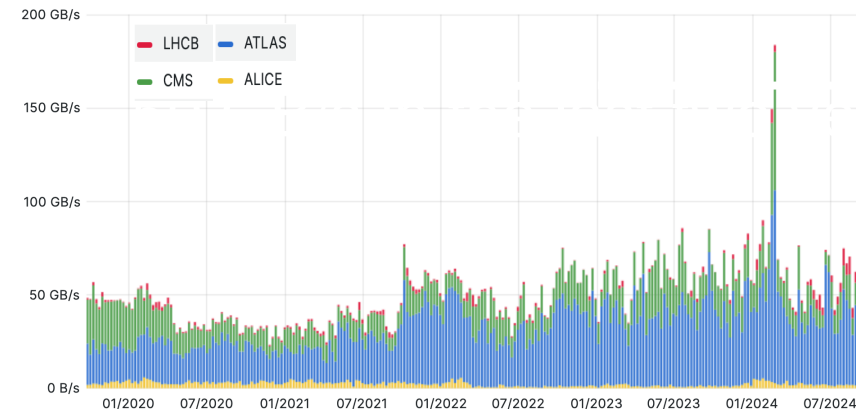
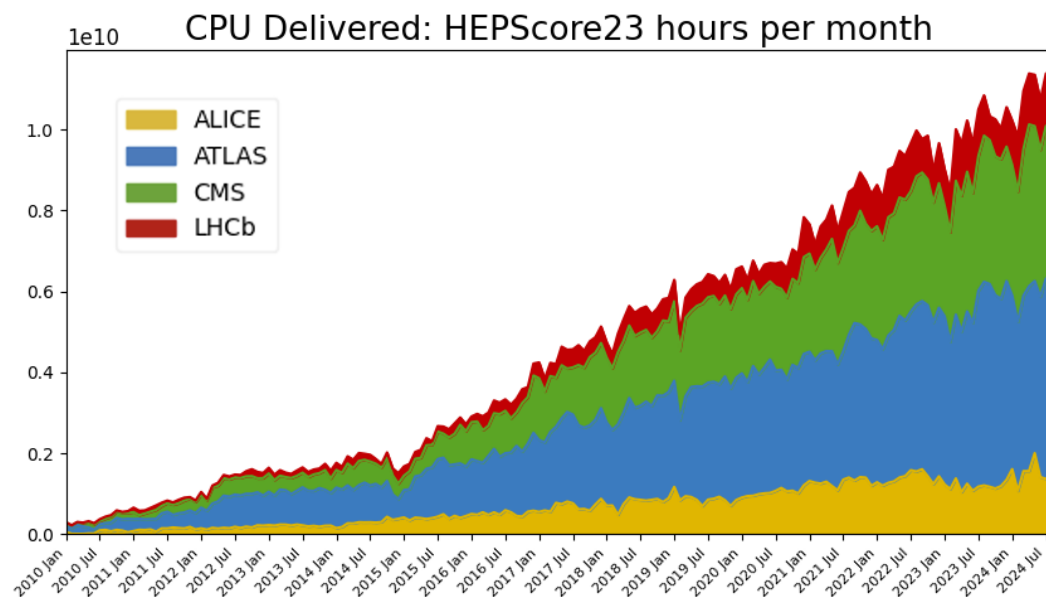
WLCG data transfer capability supports well the experiments needs, with contingency.  
Excellent performance and reliability of LHCONE and LHCOPN



# WLCG traffic: some observations

The two plots on the right show ~ the same time-period, but they look completely different.

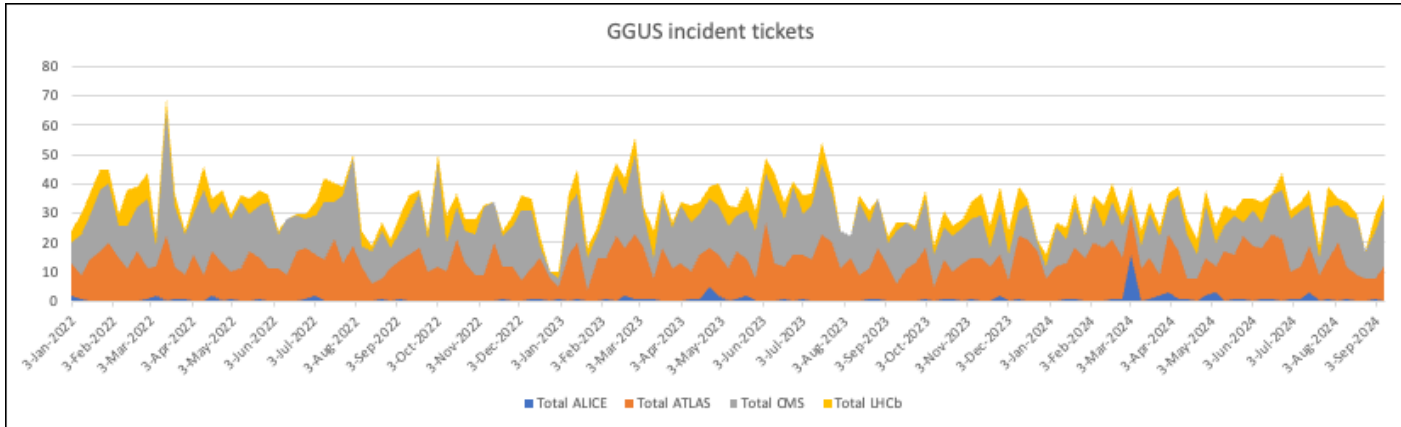
No structure visible in the global WLCG transfers



Data taking is the most critical activity. But the WLCG transfer volume is driven by Monte Carlo production and that never stops. => **You cannot relax nor sleep, even during LHC shutdown !**

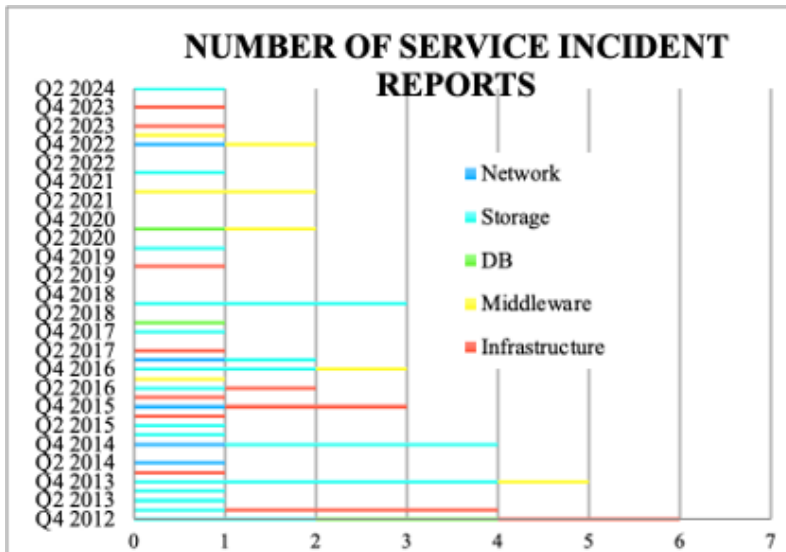


# WLCG Service Operations



Stable operations, despite many ongoing upgrades

- e.g. upgrade of Linux OS from CentOS7 to RHEL9/Alma9/.. at all WLCG sites



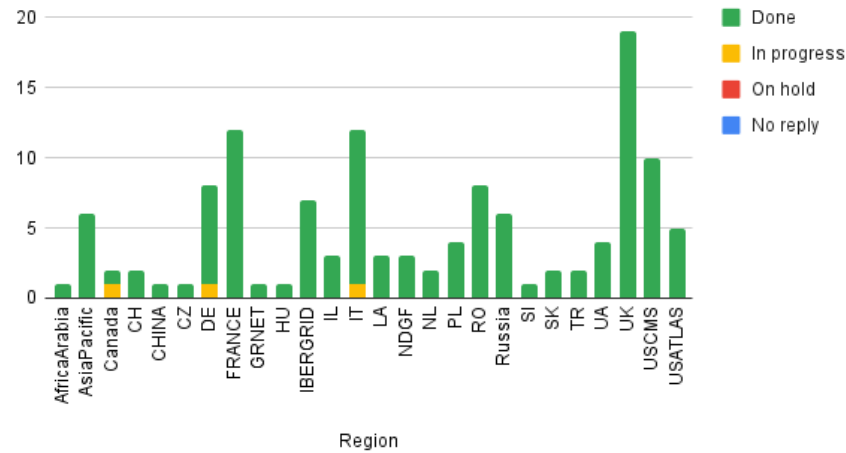
The number of major incidents has remained very low for several years. That includes network issues. Monitoring remains essential (e.g. perfSONAR)

I hardly hear about network issues. In the past I remember many more and it was taking a lot times to fix them

Happy to hear your feedback. Maybe I simply do much less real work nowadays ..

# WLCG operations: IPv6 deployment

Tier-2 IPv6 deployment status [06-06-2024]



It is fundamental to have all storage dual stack (IPv4/IPv6).

all T1s and 98% of T2s are DONE



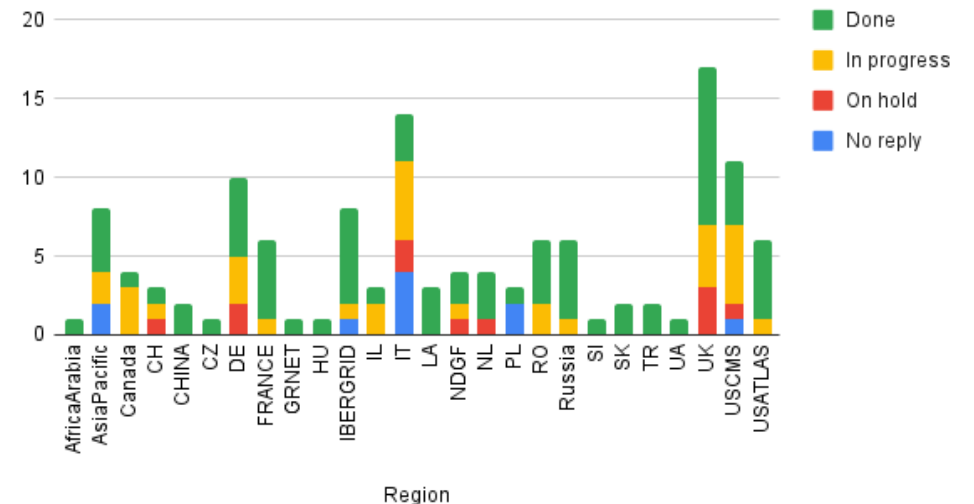
IPv6 in Worker Nodes is progressing slowly

- agreed in Oct 2023, deadline June 2024

While the migration might take time, we invite all sites to at least reply and provide an estimate

Details in the [WLCG Task Force Twiki](#)

Tier-1/2 IPv6 CE/WN deployment status [16-07-2024]



# WLCG strategic vision: Innovation and Collaboration

WLCG presented:

- its vision about a common scientific computing infrastructure at the European Strategy for Particle Physics in 2019
- a joint paper with DUNE and Belle-2 to the Snowmass 2021 process, which detailed the strategic directions to address the computing challenges of the experiments over the next decade
- We are now preparing for the European Strategy for Particle Physics in 2025

The [WLCG strategy for 2024-2027](#) has a strong focus on innovation and collaboration

- Innovation: modernise software and services to leverage the most modern technologies and architectures
- Collaboration: leverage synergies between HEP experiments and other sciences



# DC24 Network R&D – one example

R&D proposed as follow up of DC21. Deployed in time for DC24

**In production today for Run-3 data taking**

Reduces cost while providing more bandwidth (x2) and expansion capabilities

Reduces latency (30%)

Being tested now for longer network paths

### Transmission Testing

**CNAF-CERN DCI**

- spectrum sharing over GEANT and GARR dark fibres
- 4x100Gbps links between CERN and CNAF used for DC24 and now in production

**Cost effective technique to get >1Tbps LHCOPN links already today**

Geneva CERN DC

Bologna CNAF DC

1.6 Tbps

Milan PoP

WLCG Worldwide LHC Computing Grid

LCG

WLCG/HSF Workshop 2024 8

**Network R&D is essential in view of HL-LHC. Remember that solutions need to be deployable in a large-scale distributed infrastructure of loosely coupled facilities such as WLCG**

# Collaboration

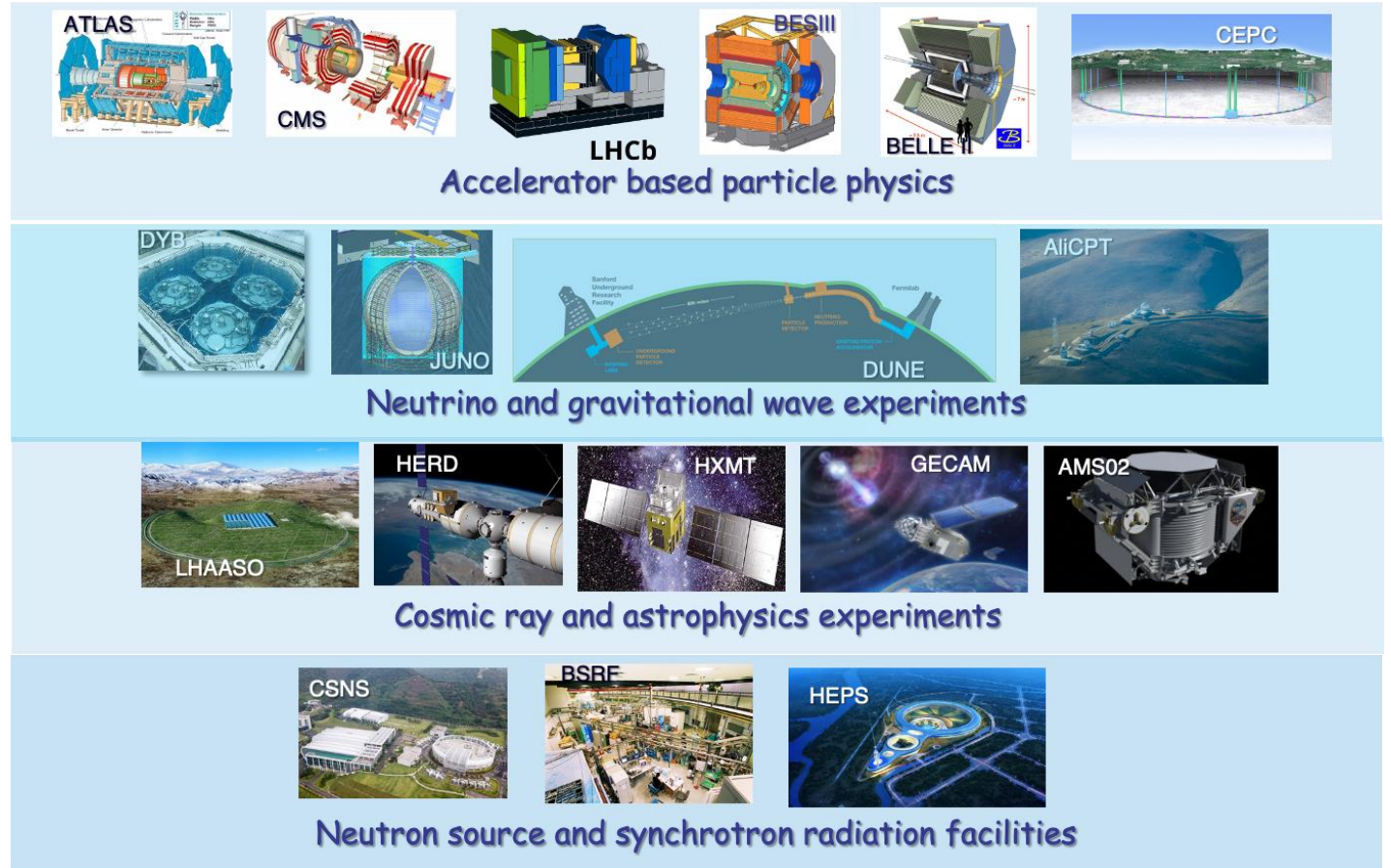
I took this from the IHEP presentation at the WLCG Overview Board

The institute supports many HEP experiments but also several other projects

All these sciences share similar challenges in terms of data processing and data handling

Most of (if not all) our WLCG institutes are in the same situation

They do not want to deploy a "WLCG" for each science, but rather support all sciences with a common set of services





# WLCG partners and collaborators

DUNE, Belle-2, JUNO and VIRGO are now WLCG **partners** - a formal status in WLCG MoU

**Collaboration** with Astronomy in the context of the [ESCAPE Open Collaboration](#) in Europe. OSG in the US also supports all these sciences

In the area of networks, the work on Traffic Identification (SciTag) and MultiONE BGP tagging is very important

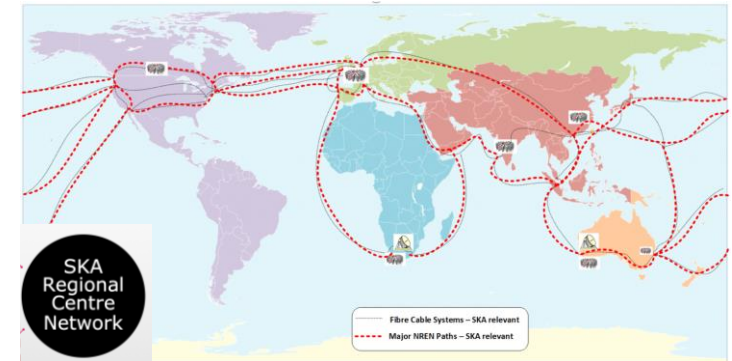
## Summary and future timeline

- DUNE successfully utilizing resources at WLCG sites
- Looking forward to addressing challenges
  - fuller Rucio integration (see talks on Thu)
  - developing new workflows and workflow management - including access to HPC
  - integrate GPU software and hardware for processing - data prep especially
- improved understanding that will come from ProtoDUNE II operations
- exploring ideas for analysis centers
- improved projections for resource needs



27

Michael Kirby, WLCG Workshop - Nov 2022

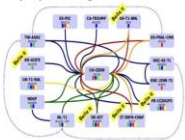


## Belle II Network

100G Global Ring  
runned by SINET



LHCOPN Optical  
infrastructure that can  
be used without  
jeopardizing resources



LHCONE L3 VPN  
Connecting all the major  
Data Centres



**Fostering this collaboration is essential for the sustainability of the WLCG infrastructure: optimise investments and effort**

# Technical Coordination Board

WLCG is setting up a Technical Coordination Board to drive the technical evolution of the services. The full description is below as part of the WLCG Strategy 2024-2027

The TCB replaces some of the functions of the Grid Deployment Board and extends them. Data Organisation Management an Access (DOMA) is one of the key areas of interest of the TCB

The functions of the GDB more related to deployment and operations will be absorbed by [WLCG Operations Coordination](#)

The GDB stopped in September 2024

The **WLCG Technical Coordination Board** (TCB) is responsible for the technical evolution of WLCG services in line with the needs of the experiments and the capabilities of the infrastructure providers. The TCB defines a multi-year roadmap for such evolution and is responsible for its implementation. The TCB achieves these goals with a bottom-up approach through an **Open Technical Forum** (OTF) which welcomes the participation of all contributors to the technical evolution in the WLCG community. The TCB may establish ad hoc technical working groups and projects as deemed necessary to accomplish its responsibilities. The MB appoints the chair(s) of the TCB, for a period of four years and endorses its composition. The members of the TCB should include representatives from the WLCG experiments, infrastructure and technology providers.

# WLCG Data Challenges program

The [WLCG Data Challenges](#) program was initiated to

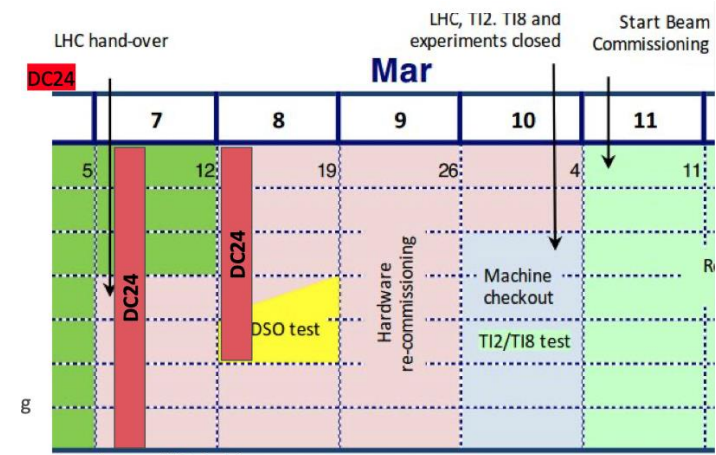
- Increasingly commission the WLCG data management infrastructure to the HL-LHC scale
- Progressively evolve the service technology and introduce innovative solutions

Started in 2021, run every 2 to 3 years. DC21 (10% of HL-LHC) lessons documented [here](#).

DC24 had 3 goals:

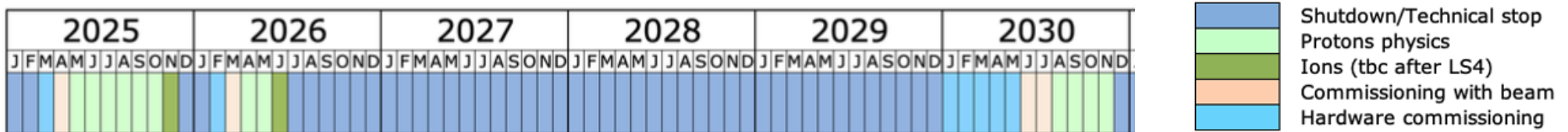
- Measure the end-to-end data transfer capabilities at WLCG sites (target is 25% of HL-LHC needs)
- Assess the progress integrating new technologies (e.g. tokens and monitoring)
- Assess the status of different R&D initiatives

DC24: from Feb 12 to Feb 23 in 2024



# Conclusions

DC26 is tentatively in less than 2 years (need to re-think based on new LHC schedule)



That will be a “50% exercise”. There is also a long list of [lessons learned](#) from DC24 to address

Need to start planning now:

- How to address the lessons and by when
- What are the achievable targets
- Which technologies do we want to test or enable

Network performance was not the limiting factor so far (but rather storage and other services)

Can we try to further challenge the network next time?