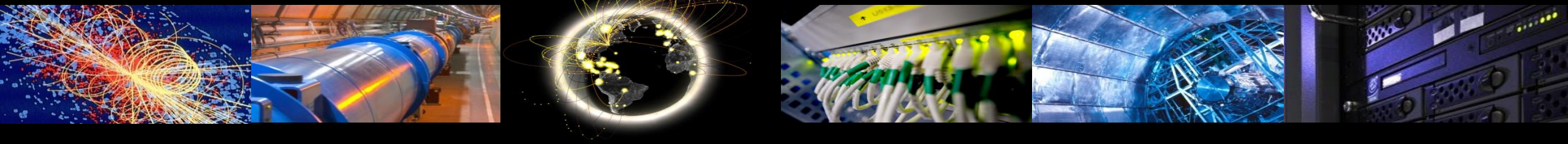
WLCG status and news

Simone Campana (CERN)



ATCF sites in WLCG

13 Asian federations in WLCG + many T3s

New commitments 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)

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

Suspended, Terminated and Valid MoUs

WLCG started tackling cases where a Federation signed an MoU but has been inactive for many years. The process was discussed at the WLCG Overview Board

- Two federations (KAVALA – GR and University of Malaysia) were contacted and asked about the future intentions.
- KAVALA and University of Malaysia participation in WLCG has been **SUSPENDED** and the MoU should be considered not effective any longer

Russia - Sites in the Russian federation will not be part of WLCG from the end of November 2024, following the decision of the CERN Council to **TERMINATE** the cooperation with Russia

JINR - The CERN Council agreed **NOT** to terminate the Cooperation Agreeemnt with the Joint Institute for Nuclear Research

- The MoUs between CERN and JINR remain **VALID**, including the WLCG MoU
- JINR continues being part of the WLCG Collaboration and providing resources to the LHC experiments – T1 for CMS and T2 for the others

WLCG MoU

WLCG has recently reviewed the MoU Annexes to better reflect our way of operating

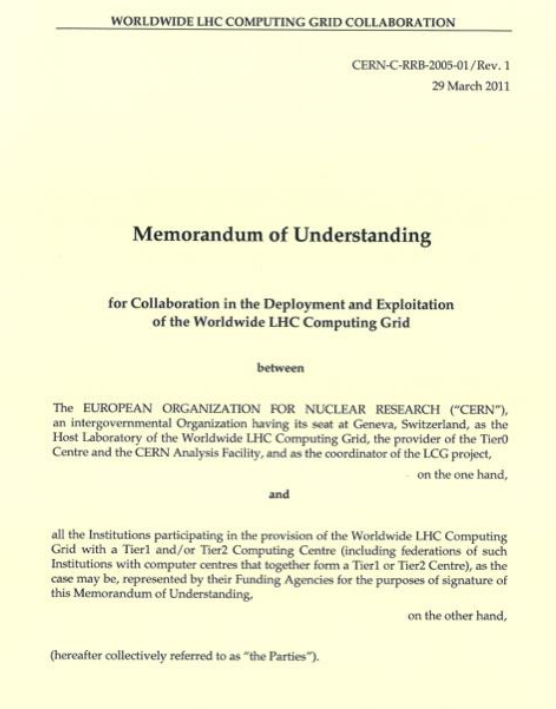
- We commit to review the annexes once/year from now on, as specified in the MoU

The current list of agreed annexes can be found here.

Annex-5 and Annex-9 are still to be endorsed by the WLCG Collaboration Board. Proposals in here (A5) and here (A9)

Note: changes in the annexes do not require re-signing the WLCG MoU

Important: changes in the Tier-1 and Tier-2 representatives or in the Funding Agencies should be communicated to lcg.office@cern.ch as soon as they happen. They are part of Annex-1, 2 and 4.



WORLDWIDE LHC COMPUTING GRID COLLABORATION

CERN-C-RRB-2005-01/Rev. 1
29 March 2011

Memorandum of Understanding

for Collaboration in the Deployment and Exploitation of the Worldwide LHC Computing Grid

between

The EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH ("CERN"), an intergovernmental Organization having its seat at Geneva, Switzerland, as the Host Laboratory of the Worldwide LHC Computing Grid, the provider of the Tier0 Centre and the CERN Analysis Facility, and as the coordinator of the LCG project,

on the one hand,

and

all the Institutions participating in the provision of the Worldwide LHC Computing Grid with a Tier1 and/or Tier2 Computing Centre (including federations of such Institutions with computer centres that together form a Tier1 or Tier2 Centre), as the case may be, represented by their Funding Agencies for the purposes of signature of this Memorandum of Understanding,

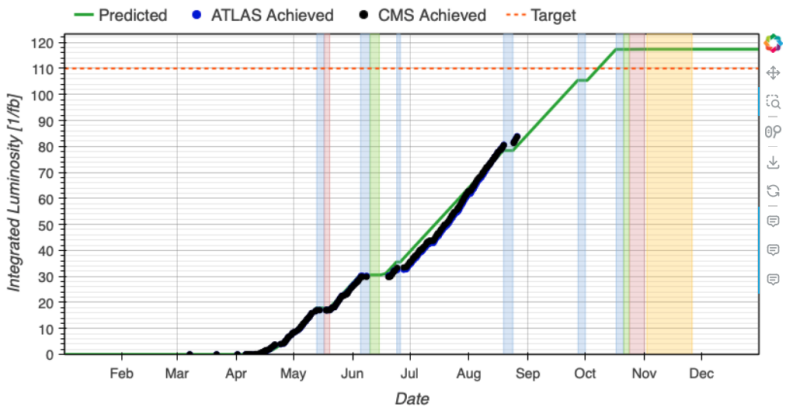
on the other hand,

(hereafter collectively referred to as "the Parties").

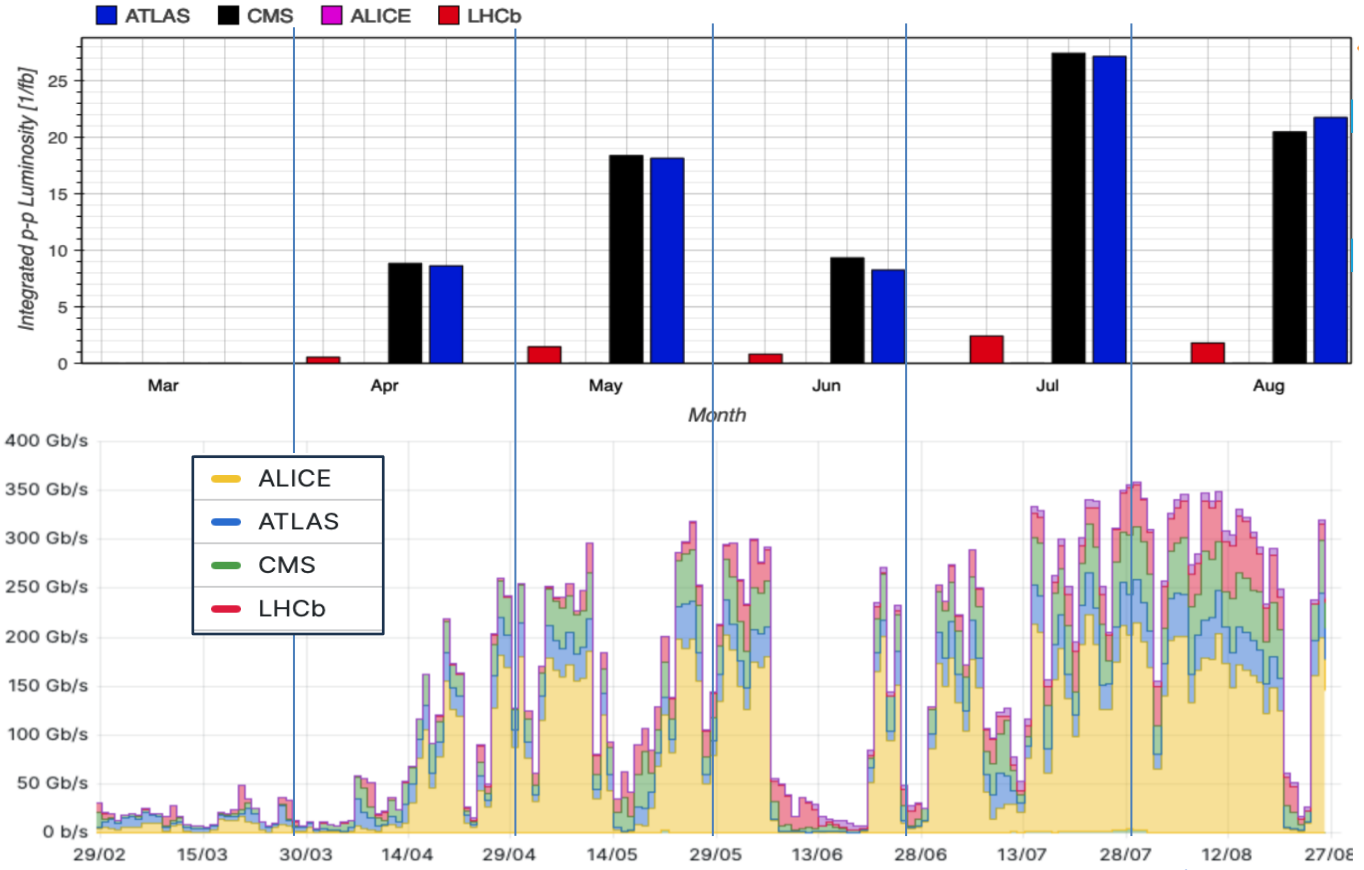
2024 LHC Data Taking

LHC performing according to schedule

Data promptly delivered from the experiments to the T0 with no delay nor sign of network saturation



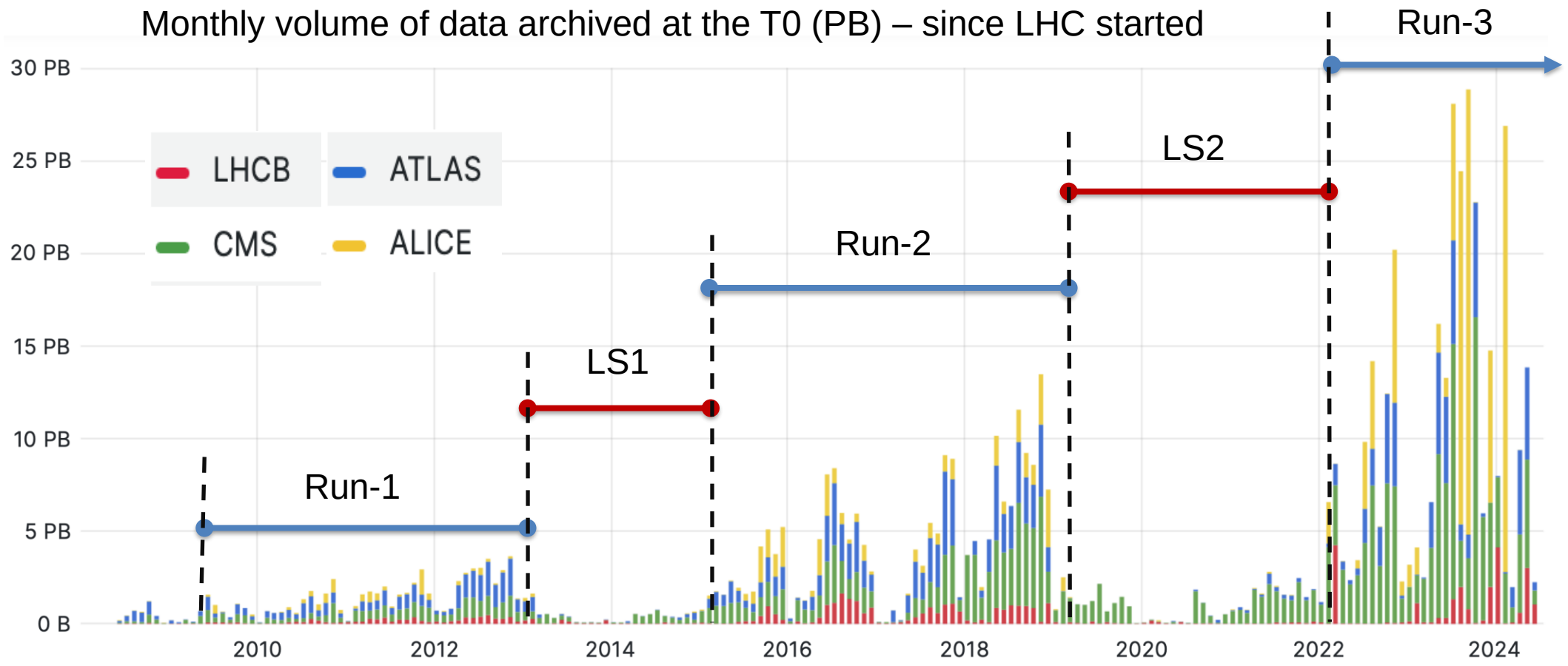
LHC pp integrated luminosity / Month (1/fb)



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

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 RRB process

Federations are requested to provide their **2025 resource pledges** into CRIC by **Friday 13 September 2024.** See here for details

As a reminder, the WLCG pledges should be deployed by April 1st (e.g. 2025 pledges should be installed by April 1st 2025)

It is important to respect the deadlines and to inform lcg.office@cern.ch in case of any delay

		Pledge Year				
RRB Year	**RRB**	**2023**	**2024**	**2025**	**2026**	**2027**
2023	**Spring**	**Pledges Used**	Requirements Finalised			
	Autumn		Pledges Confirmed	Requirements Estimates		
2024	**Spring**	Usage Reported	**Pledges Used**	Requirements Finalised		
	Autumn			Pledges Confirmed	Requirements Estimates	
2025	**Spring**		Usage Reported	**Pledges Used**	Requirements Finalised	
	Autumn				Pledges Confirmed	Requirements Estimates
2026	**Spring**			Usage Reported	**Pledges Used**	Requirements Finalised
	Autumn					Pledges Confirmed

Hardware Cost Trends

WLCG is tracking the evolution of hardware and its cost. It is very important to understand the future trends

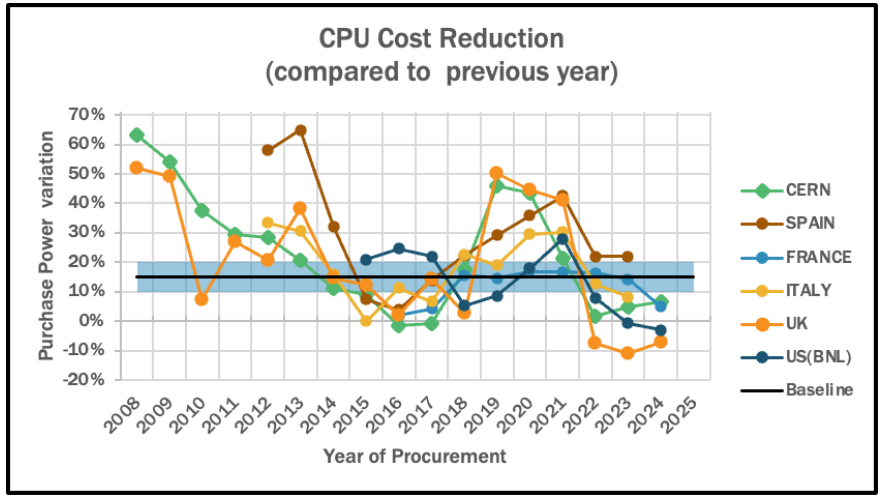
We **do not** collect and expose the cost of hardware (e.g. US$/TB)

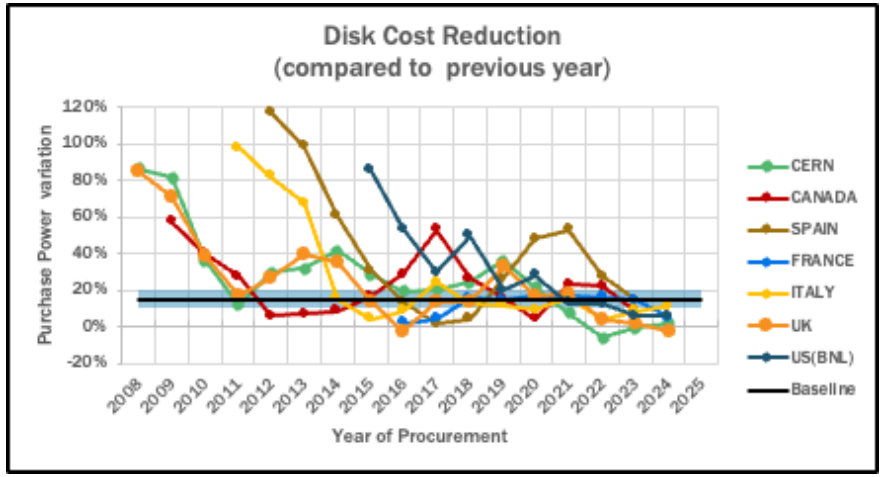
We **do** collect the cost variation with respect to the previous year

- E.g. “at my site in this year’s procurement 1TB of disk was 10% cheaper than last year”

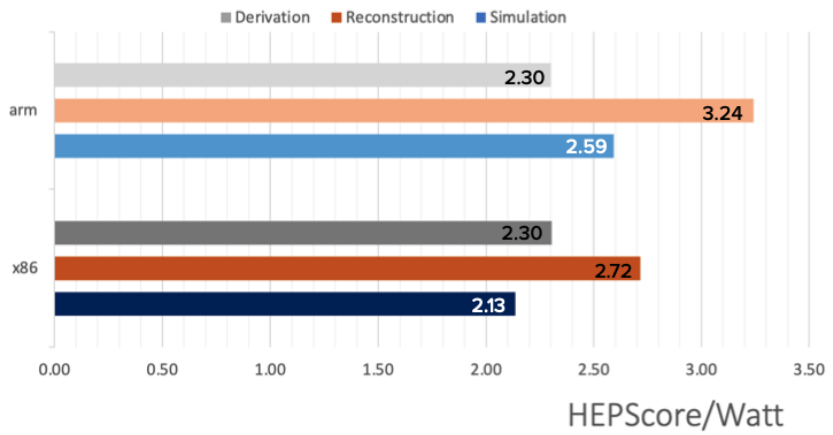
We have no information about the Asia sites, and it would be important to have it

- Please contact lcg.office@cern.ch





Non-X86 CPUs



ARM CPUs process more events/Watt wrt X86

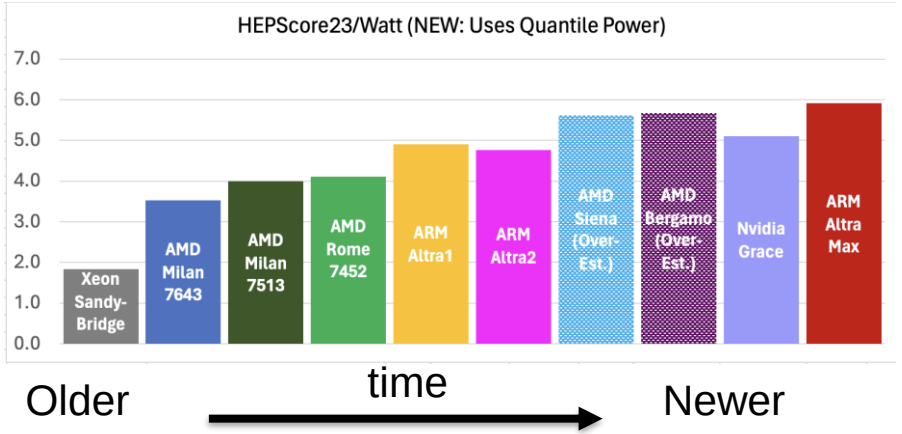
- This is the case for the HW in Glasgow Tier-2
- Differences between workflows
- Modern AMDs perform similarly to ARM - again based on the HW in Glasgow Tier-2

See this presentation for details

ARM resources available at various WLCG sites

ATLAS agreed to accept some ARM resources as part of the 2025 pledge. See details here

Premature for other experiments



LHC running conditions

The LS3 schedule will be discussed in September 2024. For the 2026 preliminary requests at the October 2024 RRB, this is too late

We agreed with the LPC to prepare for two scenarios:

1) No run in 2026

2) Full run in 2026

For the 2026 full run scenario we will use the 2025 conditions

For the 2026 final requests at the April 2025 RRB we will review all running conditions (2024, 2025 and 2026)

2025 Running Conditions for Computing estimates including contingency

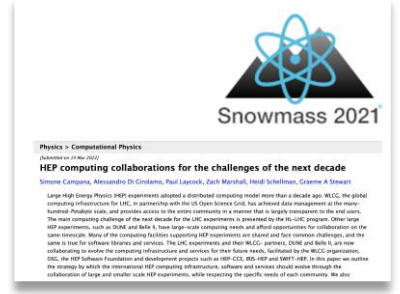
- ATLAS/CMS luminosity: <120/fb
- ATLAS/CMS average pile-up: 62 (peak PU=65)
- LHCb luminosity: <15/fb
- ALICE luminosity (pp): <100/pb
- Running time pp: $<6.3 \times 10^6$ seconds
- Running time ions (PbPb,OO,pO): $<1.4 \times 10^6$ seconds

Source

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

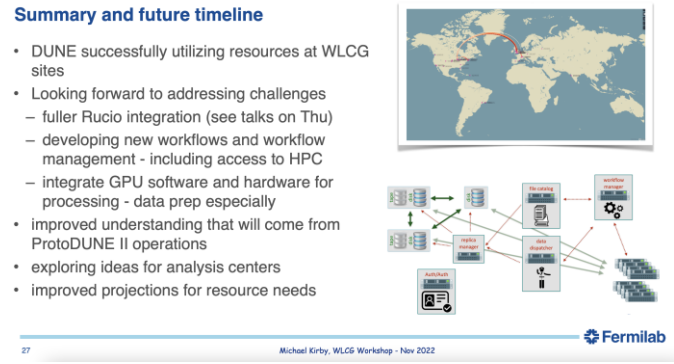
- Innovation: modernise software and services to leverage the most modern technologies and architectures
- Collaboration: leverage synergies between HEP experiments and other sciences

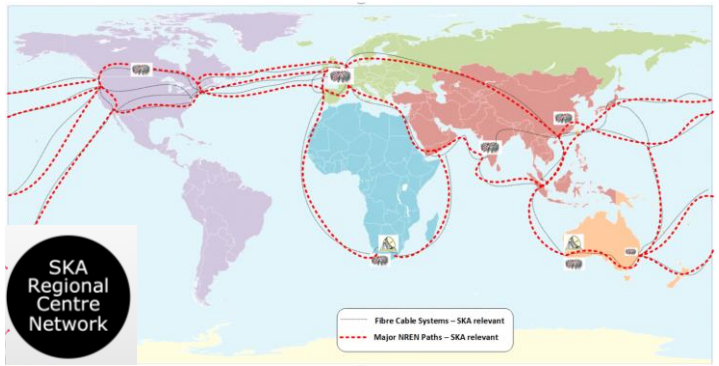
WLCG partners and collaborators

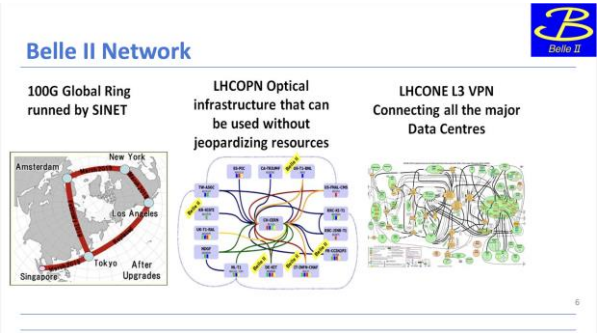
Many communities collaborate with WLCG, share some of the same technologies, services and resources

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]







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 (extract from Annex-5) as part of the WLCG Strategy 2024-2027

The TCB replaces some of the functions of the Grid Deployment Board and extends them

The functions of the GDB more related to deployment and operations will be absorbed by WLCG Operations Coordination

The GDB will stop in Fall 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

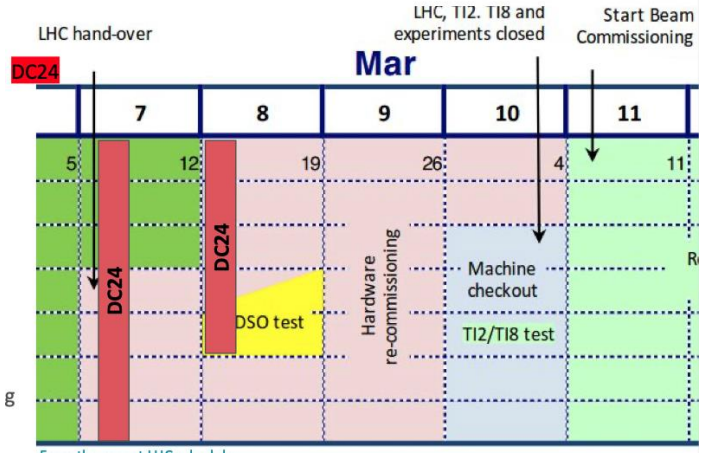
- Increasingly commission the WLCG data management infrastructure to the HL-LHC scale
- Progressively evolve the service technology and introduce innovative solutions

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

DC24 had 3 goals:

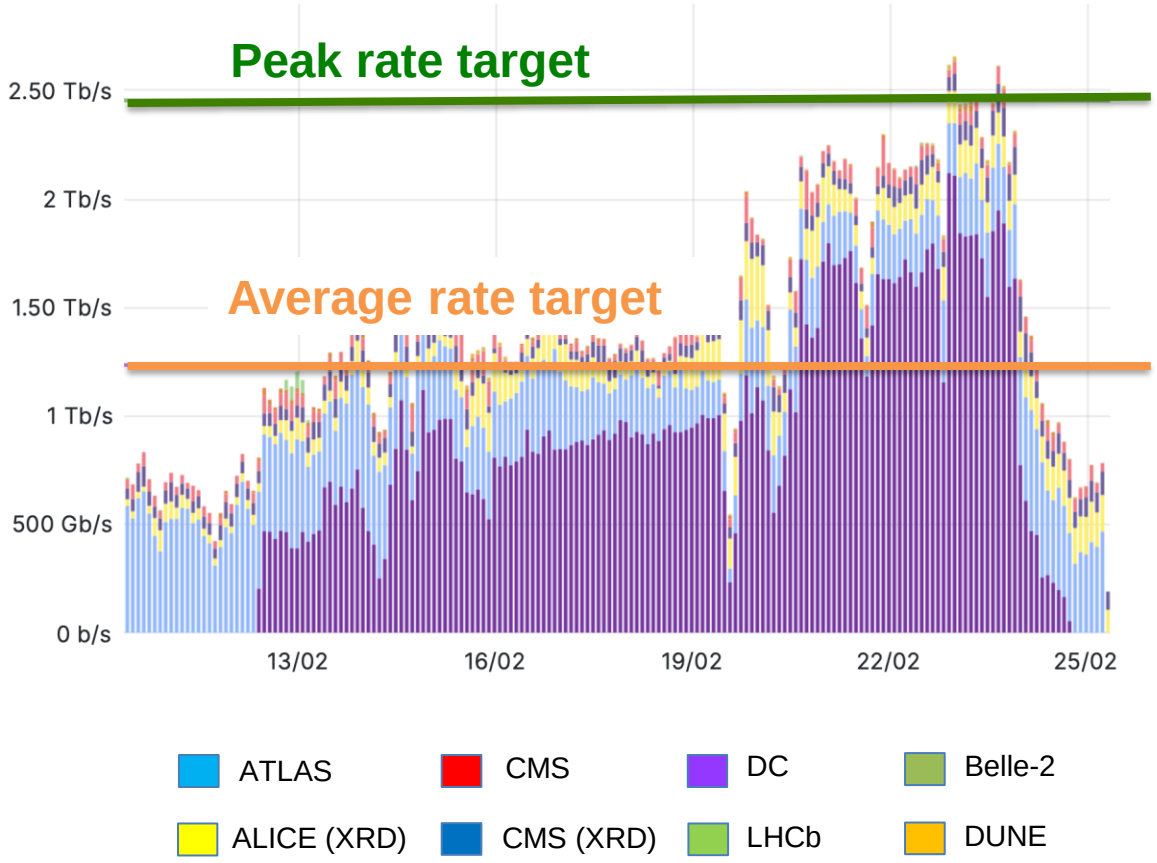
- Measure the end-to-end data transfer capabilities at WLCG sites (target is 25% of HL-LHC needs)
- Assess the progress integrating new technologies (e.g. tokens and monitoring)
- Assess the status of different R&D initiatives

DC24: from Feb 12 to Feb 23 in 2024

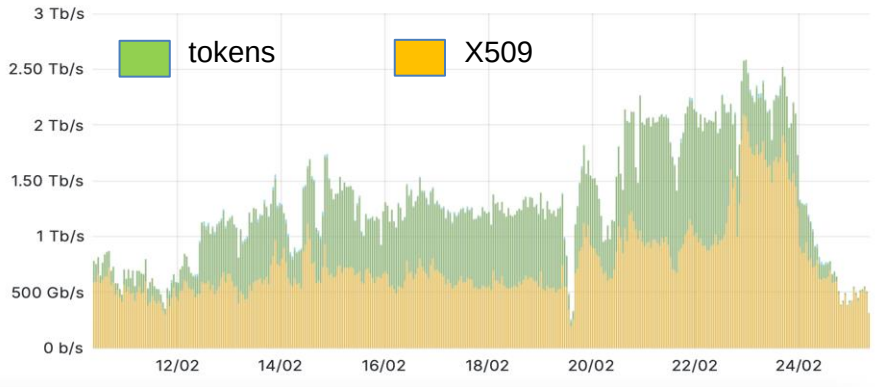


Data Challenge 2024 - Highlights

DC24 WLCG data transfers (Gbps) – 15 days: **all targets achieved**



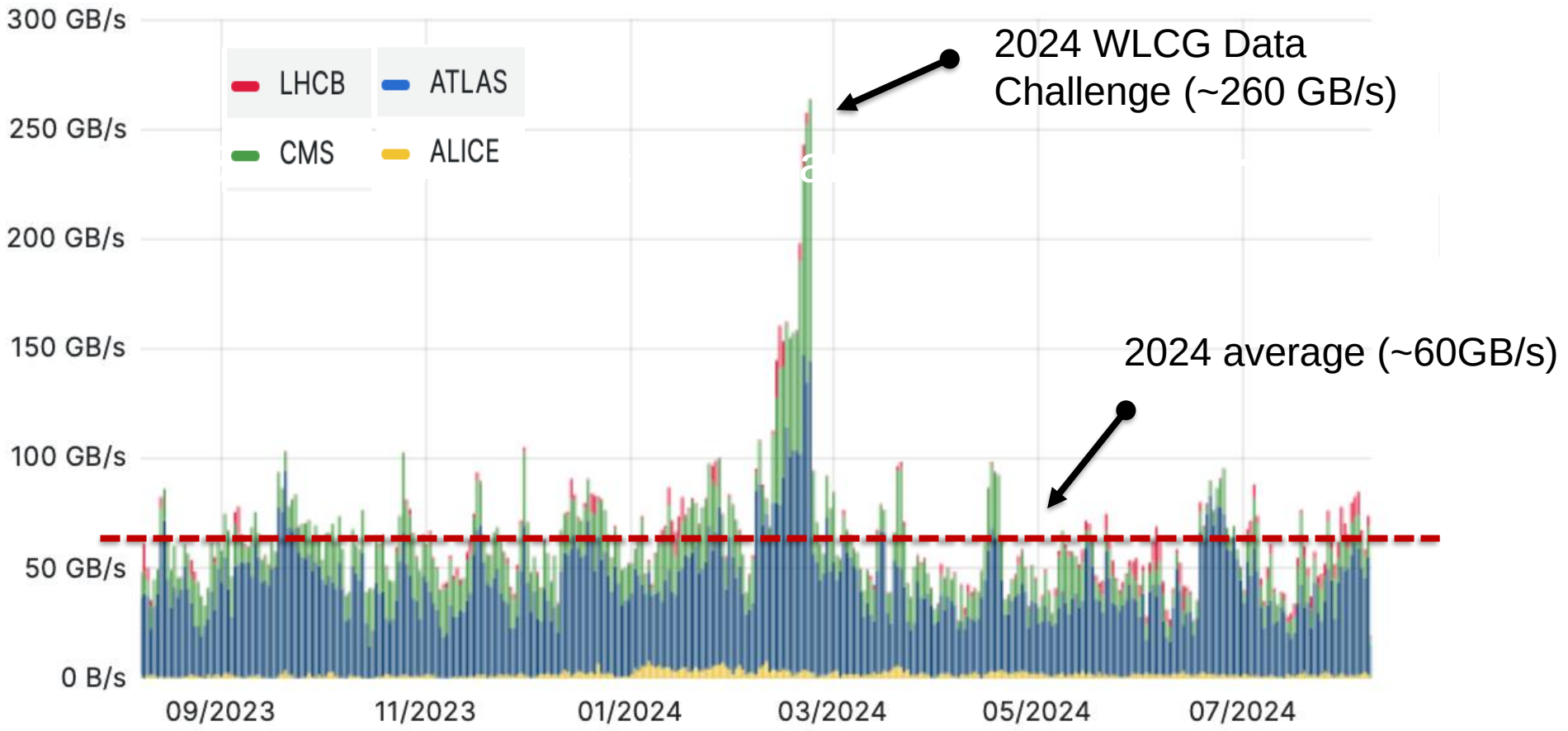
New technologies (e.g. authentication tokens) introduced and validated



WLCG services successfully support DUNE and Belle-2 computing models

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

WLCG data transfer capability supports well the experiments needs, with contingency



DC24 Network R&D – one example

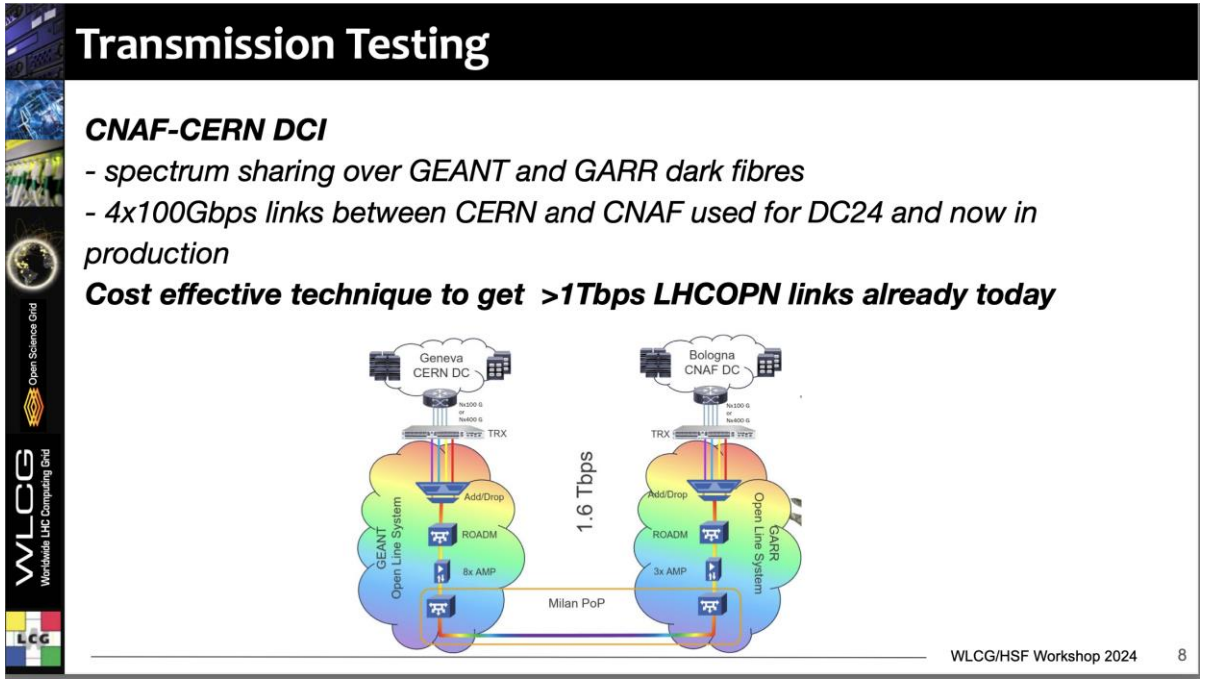
R&D proposed as follow up of DC21. Deployed in time for DC24

In production today for Run-3 data taking

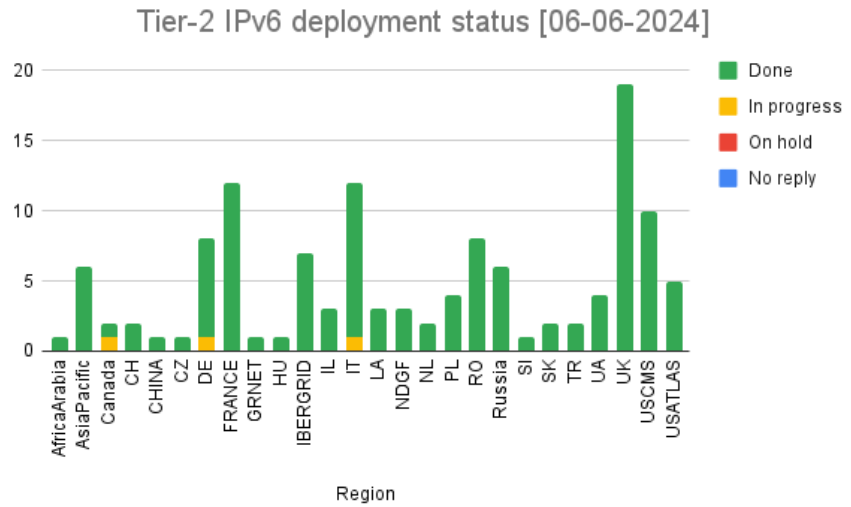
Reduces cost while providing more bandwidth (x2) and expansion capabilities

Reduces latency (30%)

Being tested now for longer network paths



IPv6 deployment



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

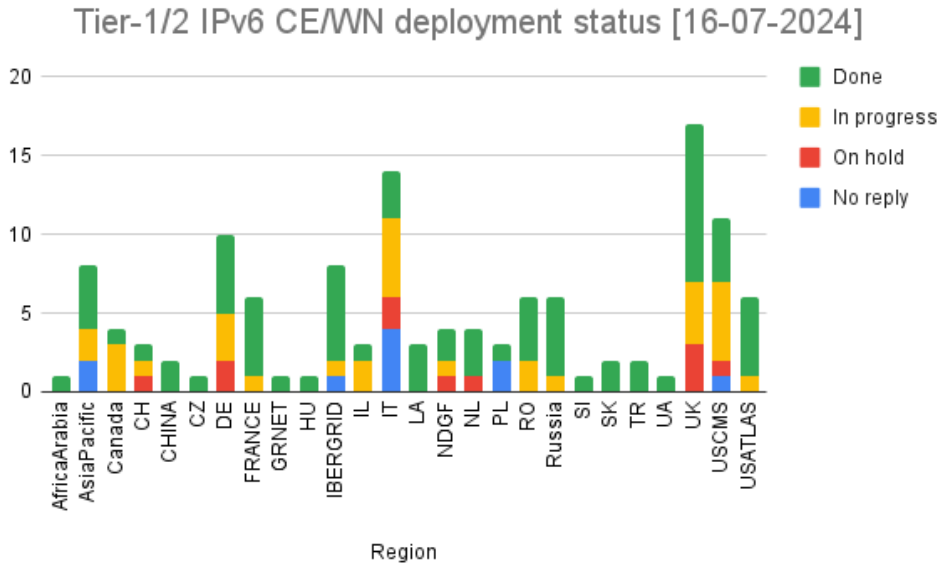
all T1s and 98% of T2s are DONE

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]



Energy efficiency

The electricity costs have been an unexpected development in the last couple of years. Environmental impact needs proper addressing!

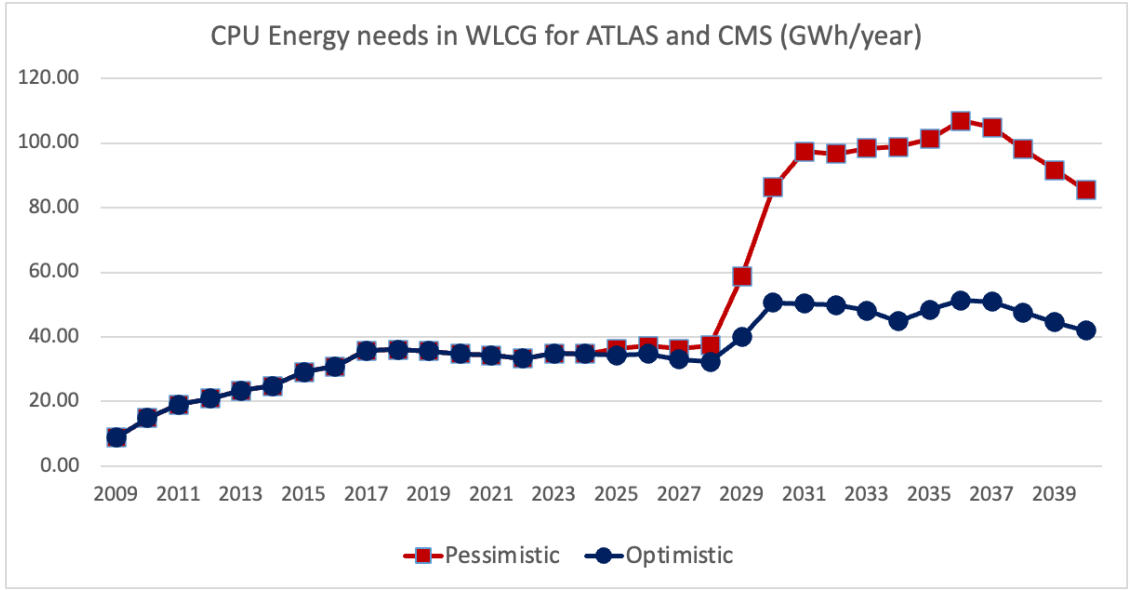
What to do:

- Improve software performance
- Leverage modern architectures
- Invest in the facilities

There is no magic wand, however.

In a pessimistic scenario – little progress on all the above – the energy need is x2 than in an optimistic one

WLCG: the peak of energy need at the start of Run-5)

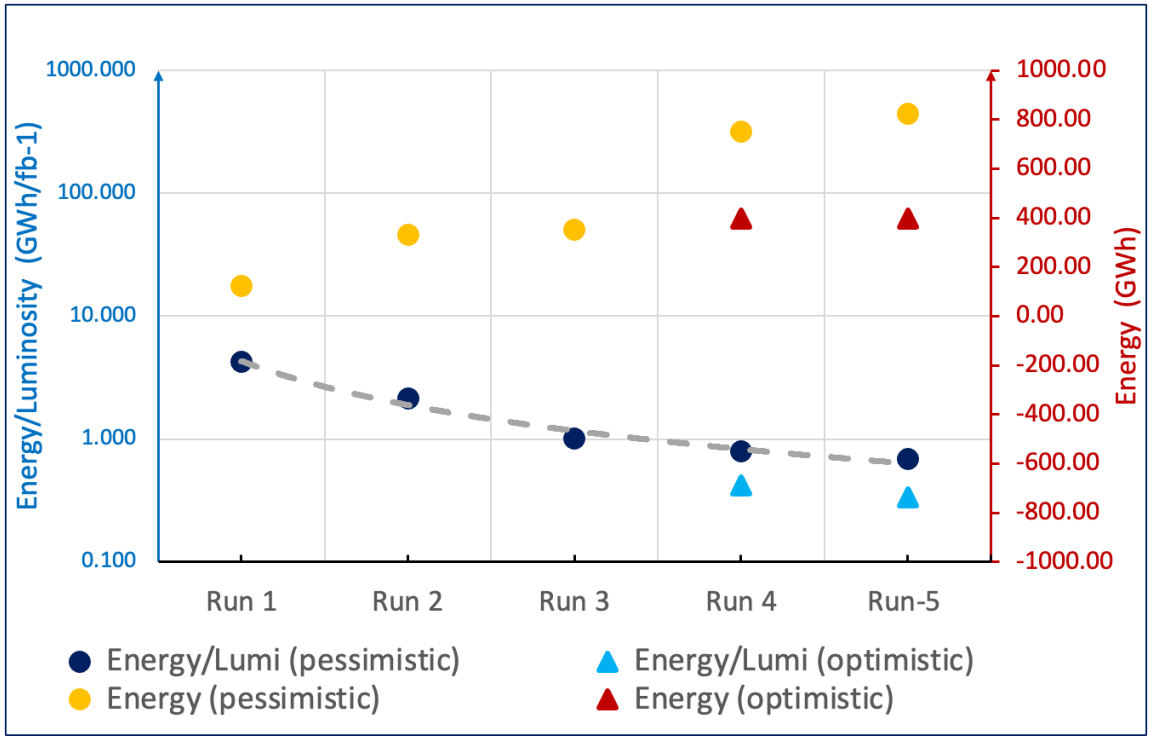


Energy Needs per unit of “science”

In WLCG GWh/fb^{-1} represent the energy needed to **analyse** the data - energy per unit of science

The scale on the right **(RED)** shows the energy and the scale on the left **(BLUE)** shows GWh/fb^{-1} (log!)

Energy needs in Run-4 and Run-5: +100% compared to Run-2 in the **pessimistic** scenario, only +10% in the **optimistic** scenario



GWh/fb^{-1} decreases a factor 10 between Run-1 and Run-5 (exponential trend fits well)
In Run-5, GWh/fb^{-1} in the **optimistic** scenario is half compared to the **pessimistic** scenario

Invest in R&D

Conclusions

The Asian sites provide a very important contribution to WLCG (2 T1s, 11 T2 federations) and are trusted partners since decades

Time zones and geographical distribution make it NOT simple for Asian sites.

It is important to have in place a structure such as the ACTF to organize and support activities is such a large region

DC26 is tentatively in less than 2 years. That will be a “50% exercise” and there is also a long list of lessons learned from DC24 to address

Next WLCG events:

- Environmental sustainability workshop: 11-13 December 2024 @ CERN (TBC)
- WLCG/HSF workshop: 5-9 May 2025 @ Orsay (Paris) (TBC)