

# Spotkanie WLCG-PL i eksperymenty przy LHC

Michał Bluj



21 maja 2024



# Plan wystąpienia

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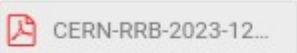
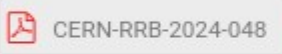

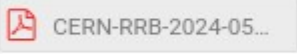
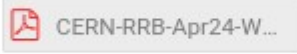
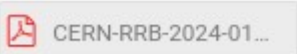
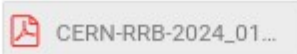
- ⊙ Podsumowanie ostatniego okresu działalności WLCG
  - Informacja z ostatniego spotkania C-RRB (kwiecień 2024)
- ⊙ Pledges na 2024 i zapotrzebowanie na 2025
- ⊙ Dyskusja i AOB



# Informacje ze spotkania C-RRB

NCBJ

⦿ Zebranie odbyło się 23. IV. 2024

09:00	→ 09:02	<b>Introduction</b> Speaker: Joachim Mnich	🕒 2m
09:02	→ 09:05	<b>Approval of the minutes of the last meeting</b> 	🕒 3m
09:05	→ 09:35	<b><u>Status of the WLCG project</u></b> Speaker: Simone Campana  	🕒 30m
09:35	→ 09:40	<b>LHCC Deliberations</b> Speaker: Lorenzo Moneta (Scientific Secretary, LHCC)  	🕒 5m
09:40	→ 10:00	<b><u>Computing Resources Scrutiny Group Report</u></b> Speaker: Pekka Sinervo (Chairperson, CRSG)  	🕒 20m
10:00	→ 10:05	<b>Summary</b> Speaker: Joachim Mnich	🕒 5m



NCBJ

# WLCG news

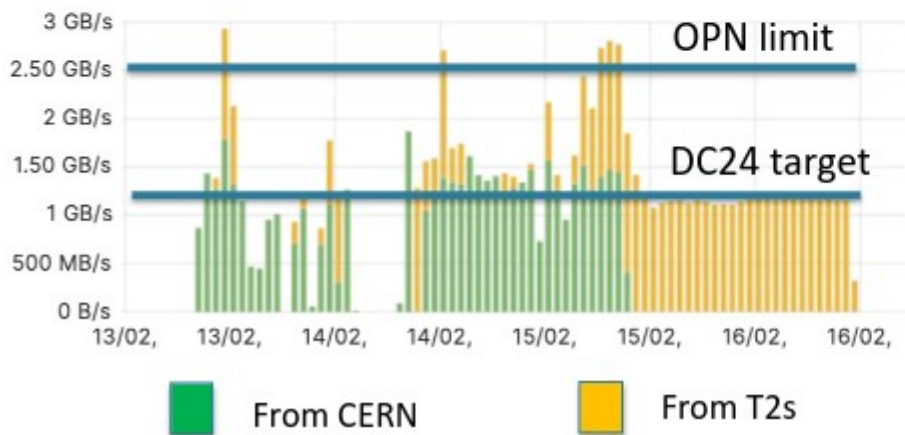
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## NCBJ – Swierk (PL)

Endorsed as WLCG Tier-1 for LHCb by the WLCG Overview Board



Throughput WLCG->NCBJ



Successfully tested during the Data Challenge in Feb 2024

- 10Gb/s target rate achieved and sustained
- 70% of OPN capacity used



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# WLCG news

## © Za raportem projektu WLCG z C-RRB (S. Campana)

### IHEP – Beijing (CN)

- 100Gbps (best effort rather than reserved) network connection in place. Reserved OPN capacity being discussed
- Not tested in DC24. Will be tested in the next months



### Belgrade (Serbia)

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



## © Za raportem projektu WLCG z C-RRB (S. Campana)

### Russia

The CERN Council agreed to terminate the Cooperation Agreement with Russia.

- All MoUs will be automatically terminated end Nov 2024, including the WLCG one
- Russian sites will not be part of WLCG after that
- The Russian Certification Authority will continue to be trusted by EUGridPMA
- Russian resources continue being used opportunistically and efficiently for the time being

JINR (Dubna) will be discussed by CERN Council in 2024

### Other membership news

- The MoU with University of Malaya (MY) has been suspended indefinitely by the WLCG Overview Board, due to inactivity and unresponsiveness

## © Proporcjonalnie największy udział w zasobach dostarczanych dla CMS (T1 w Dubnej ~7-8%)

- Obecnie używane taktycznie
- Poszukiwanie T1 dla CMS (Belgrad, i/lub T1 w CIS/Pekinie?)





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# WLCG i Run3 LHC (1)

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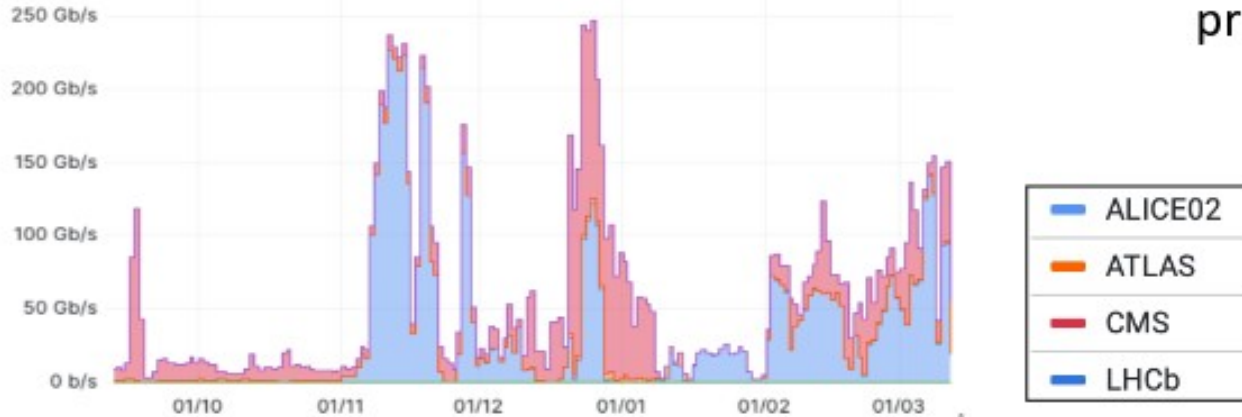
Experiments -> T0 network use (6 months)



The experiments collected ~97 PB of data (+ 45PB of ALICE pp CTF). ~39 PB in 2022

- Efficiently transferred at the T0

T0 -> Experiments network use (6 months)



Online farms used for offline processing when possible

- Input data imported from the T0

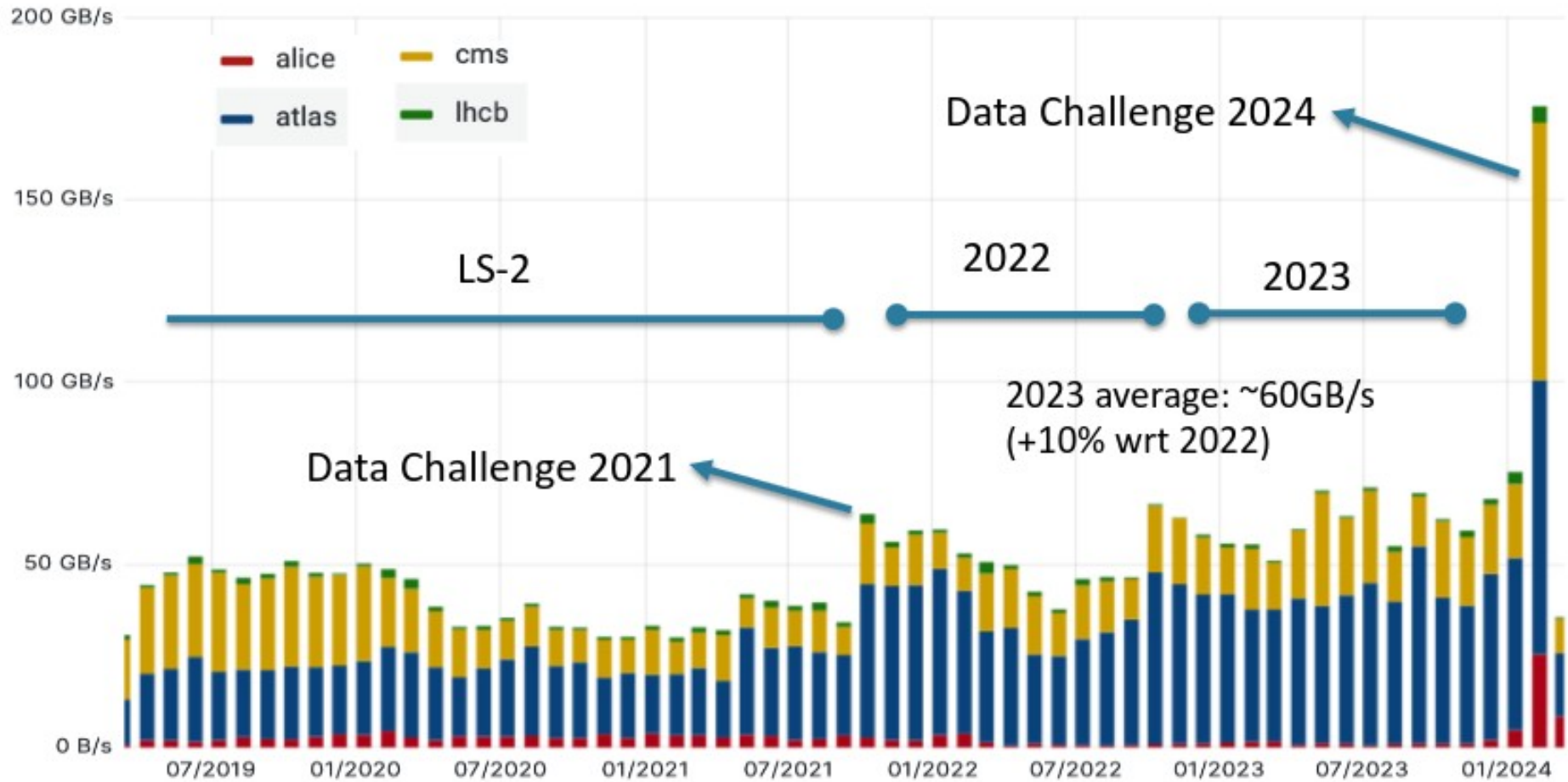


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# WLCG i Run3 LHC (2)

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Monthly data transfer throughput between WLCG sites (GB/s) – 5 years







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# Data challenge 2024 (DC24)

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DC24 is the next phase of the computing infrastructure commissioning for HL-LHC

DC21 lessons learned are documented here. Planning workshop in Nov 2023

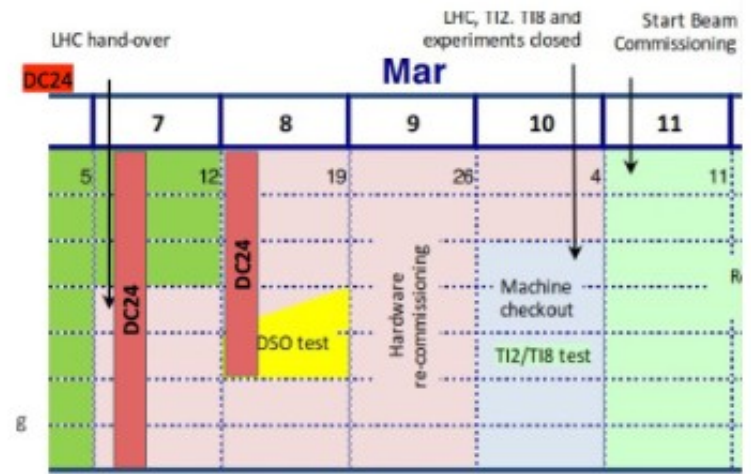
DC24 had 3 goals:

- Measure the end-to-end data transfer capabilities at WLCG sites (target is 25% of HL-LHC needs) W DC21 było to 10%
- Assess the progress integrating new technologies (e.g. tokens and monitoring)
- Assess the status of different R&D initiatives

DC24 targets:

- 1200 Gbps **minimal** scenario
- 2400 Gbps **flexible** scenario

DC24: from Feb 12 to Feb 23 in 2024



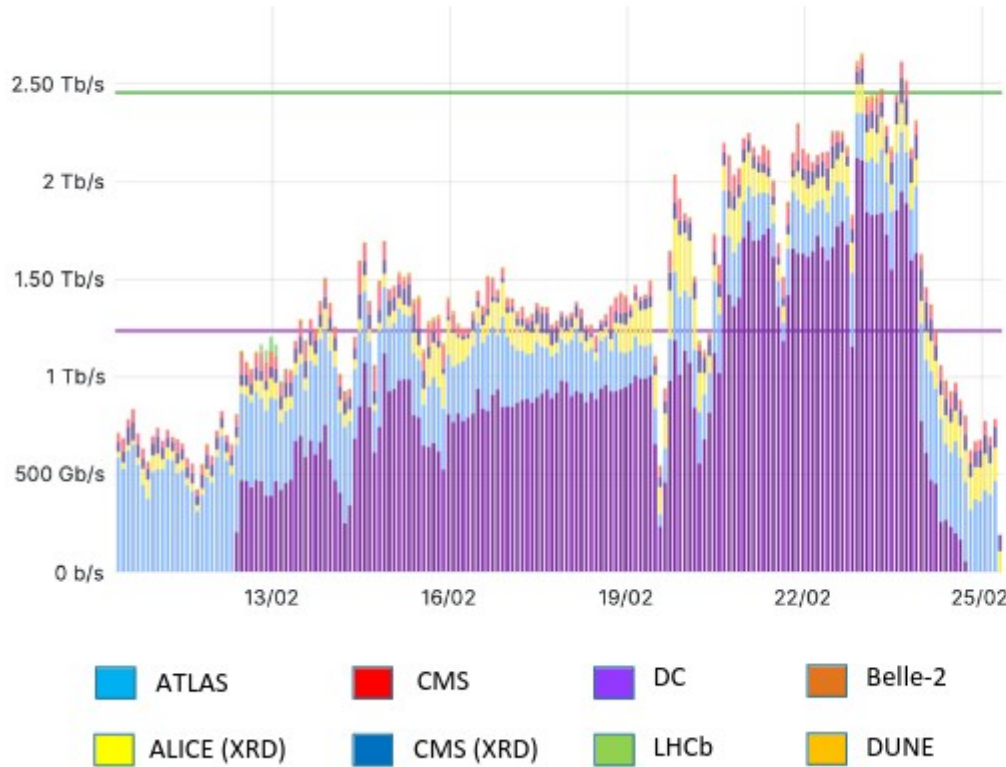


# Data challenge 2024 (DC24)

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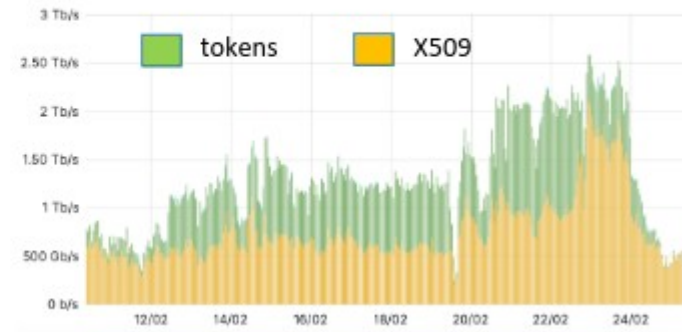
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DC24 WLCG data transfers (Gbps) – 15 days



Since DC21

- New monitoring following the DC21 post mortem. Includes xrootd streaming from CERN/FNAL
- Use of tokens



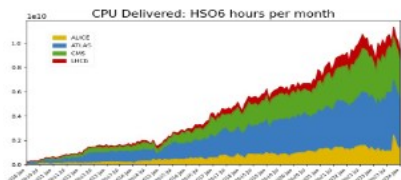


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# Accounting

## ⊙ Za raportem projektu WLCG z C-RRB (S. Campana)

### WLCG accounting (EGI)



This plot shows the used CPU capacity at Grid sites: WLCG T0/T1/T2 + T3s. Resources can be pledged or opportunistic

Cloud/HPC/HLT/Volunteer Computing resources are not accounted for in this view, unless they are part of / integrated with a WLCG site

Information collected by the **sites** and uploaded in the OSG/EGI accounting system

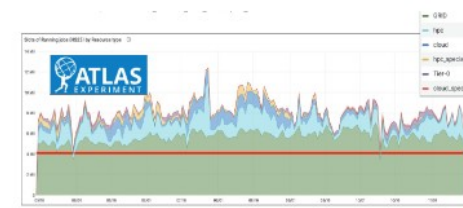
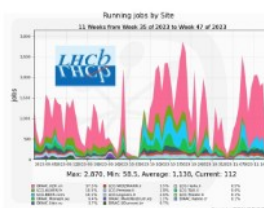
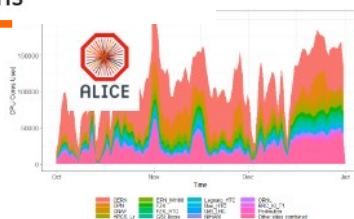
- The collection and upload process is still error prone. WLCG operations performs an extra validation
- Some information is uploaded with a noticeable delay, up to 2 months

## Experiments accounting

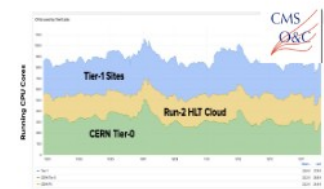
### ⊙ Wyniki WLCG i eksperymentów periodycznie porównywane

- Zgodność na poziomie ~5%-- różnice na bieżąco wyjaśniane
- Prace nad konsolidacją prezentacji pomiarów 4 eksperymentów (CERN MonIT)

### ⊙ Wciąż używane ok. 40% więcej zasobów niż pledges (głównie CPU)



The **experiments** have the accounting of all consumed resources, from the Workload Management Systems (PanDA, WMAgent, Dirac, Alien)



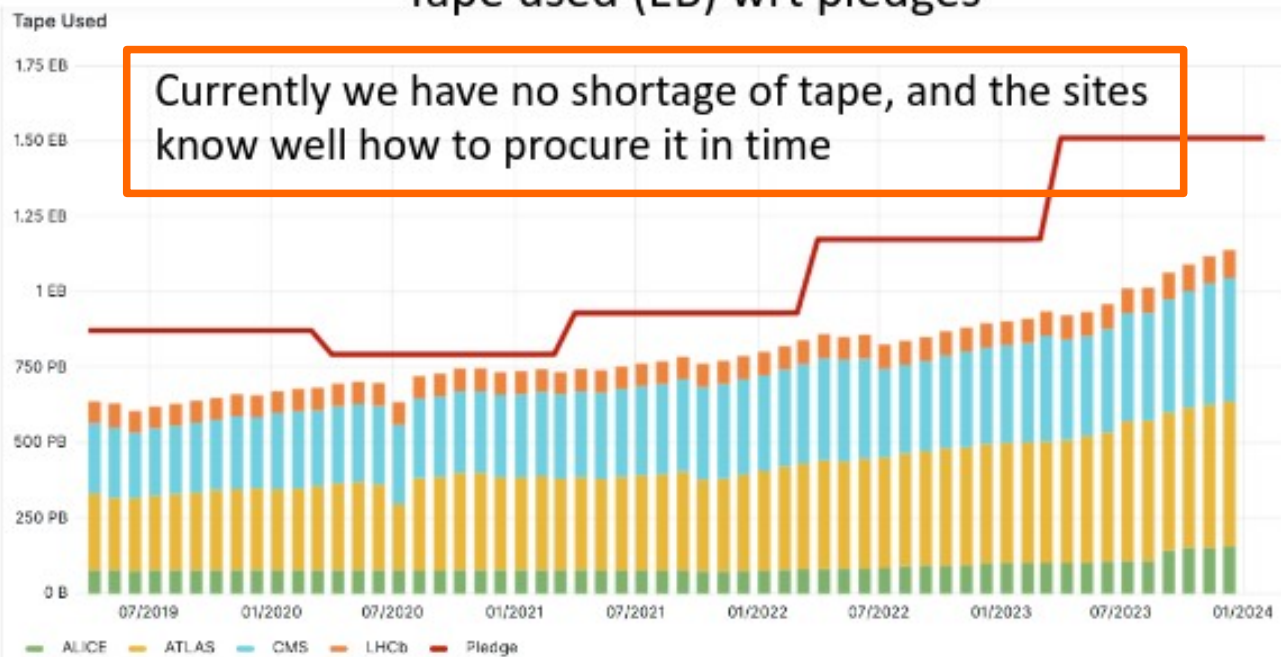


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# Pledges na 2024

- ⊙ Zbieranie danych w 2023 poszło inaczej (gorzej) niż spodziewane => uwzględnione w planowaniu zasobów na 2025
- ⊙ Planowanie (pledges) na 2024 nie uwzględnia przeniesienia 4 tyg. zderzeń proton-proton z 2025 na 2024
  - dodatkowe ~30PB taśm (+ kilka PB dysków) na T0 i T1 potrzebnych już w 2024 => prośba do agencji o wsparcie
  - Nie wygląda żeby na razie był problem z brakiem pamięci masowych
- ⊙ Zadeklarowane zasoby (pledges) zainstalowane i gotowe do użycia

Tape used (EB) wrt pledges



**2024 pledges: installed and ready to be used (minimal delays)**

Delivery times now slightly shortened than in the past and the sites have a lot of experience with procurement





# Pledges na 2024

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		ALICE		ATLAS		CMS		LHCb	
		2024		2024		2024		2024	
		C-RSG recomm.	Pledged	C-RSG recomm.	Pledged	C-RSG recomm.	Pledged	C-RSG recomm.	Pledged
<b>CPU</b>	Tier-0	600	600	936	936	980	980	174	174
	Tier-1	630	540	1516	1514	930	1020	572	542
	Tier-2	650	641	1852	2074	1600	1484	319	394
	HLT	n/a	n/a	n/a	n/a	n/a	n/a	50	0
	<b>Total</b>	<b>1880</b>	<b>1781</b>	<b>4304</b>	<b>4524</b>	<b>3510</b>	<b>3484</b>	<b>1115</b>	<b>1110</b>
<b>Disk</b>	Tier-0	67.5	67.5	49.0	49.0	54.0	54.0	30.6	30.6
	Tier-1	71.5	61.9	163.0	163.1	122.0	115.7	61.2	53.0
	Tier-2	66.5	69.8	200.0	194.0	149.0	134.1	11.8	9.4
	<b>Total</b>	<b>205.5</b>	<b>199.2</b>	<b>412.0</b>	<b>406.1</b>	<b>325.0</b>	<b>303.8</b>	<b>103.6</b>	<b>93.0</b>
<b>Tape</b>	Tier-0	181.0	181.0	207.0	207.0	320.0	320.0	117.1	117.0
	Tier-1	107.0	102.4	452.0	460.0	380.0	353.9	133.3	125.0
	<b>Total</b>	<b>288.0</b>	<b>283.4</b>	<b>659.0</b>	<b>667.0</b>	<b>700.0</b>	<b>673.9</b>	<b>250.4</b>	<b>242.0</b>

- © Zadeklarowane zasoby (pledges) zainstalowane i gotowe do użycia
  - W wielu przypadkach trochę mniejsze niż rekomendowane przez CRSG



# Planowanie na 2025

- ⊙ Obecnie estymacja zapotrzebowania eksperymentów w oparciu o warunki pracy LHC jak w 2023
  - Uściślone w grudniu'23 przed decyzją o zmianach w kalendarzu LHC
- => Niewielkie różnice w porównaniu z pokazanymi na poprzednim spotkaniu
  - Redukcje w związku z mniejszą ilością danych zebranych w 2023

**"Big picture"**: wzrosty (vs 2024) związane z wzrostem ilości danych

- ⊙ ALICE: +15-20%
  - CPU: +12%, dyski: +14%, taśmy: +19%
- ⊙ ATLAS: +10-20%
  - CPU: +10%, dyski: +14%, taśmy: +24%
  - ograniczony wzrost CPU dzięki szerszemu użyciu szybkiej symulacji
- ⊙ CMS: +20%
  - CPU: +19%, dyski: +19%, taśmy: +27%
- ⊙ LHCb: +60%
  - CPU: +60%, dyski: +57%, taśmy: +46%
  - związany z upgrade detektora i systemu wyzwalania (trygera)



# Wstępne oczekiwania na 2025

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## ALICE

## ATLAS

## CMS

## LHCb

		2025			2025			2025			2025		
		Request	2025 req. / 2024 C-RSG	C-RSG recomm.	Request	2025 req. / 2024 C-RSG	C-RSG recomm.	Request	2025 req. / 2024 C-RSG	C-RSG recomm.	Request	2025 req. / 2024 C-RSG	C-RSG recomm.
CPU	Tier-0	680	113%	680	1100	118%	1100	1180	120%	1180	283	163%	283
	Tier-1	690	110%	690	1635	108%	1635	1100	118%	1100	928	162%	928
	Tier-2	730	112%	730	1998	108%	1998	1900	119%	1900	518	162%	518
	HLT	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	50	n/a	50
	<b>Total</b>	<b>2100</b>	<b>112%</b>	<b>2100</b>	<b>4733</b>	<b>110%</b>	<b>4733</b>	<b>4180</b>	<b>119%</b>	<b>4180</b>	<b>1779</b>	<b>160%</b>	<b>1779</b>
Others													
Disk	Tier-0	78.0	116%	78.0	56.0	114%	56.0	70.0	130%	70.0	54.9	179%	54.9
	Tier-1	79.0	110%	79.0	186.0	114%	186.0	142.0	116%	142.0	89.9	147%	89.9
	Tier-2	77.0	116%	77.0	227.0	114%	227.0	175.0	117%	175.0	17.4	147%	17.4
	<b>Total</b>	<b>234.0</b>	<b>114%</b>	<b>234.0</b>	<b>469.0</b>	<b>114%</b>	<b>469.0</b>	<b>387.0</b>	<b>119%</b>	<b>387.0</b>	<b>162.2</b>	<b>157%</b>	<b>162.2</b>
Tape	Tier-0	220.0	122%	220.0	258.0	125%	258.0	442.0	138%	442.0	170.4	146%	170.4
	Tier-1	123.0	115%	123.0	561.0	124%	561.0	445.0	117%	445.0	194.8	146%	194.8
	<b>Total</b>	<b>343.0</b>	<b>119%</b>	<b>343.0</b>	<b>819.0</b>	<b>124%</b>	<b>819.0</b>	<b>887.0</b>	<b>127%</b>	<b>887.0</b>	<b>365.2</b>	<b>146%</b>	<b>365.2</b>

- 2025 plan is 15 days of Pb-Pb run
  - Reduction of about 20%
- Continuing work to calibrate TPC and implement higher compression
- Working on understanding decrease in efficiency

- 2025 expected to be full year of running to collect 120 fb<sup>-1</sup> of data
  - CPU & storage increases reflect improved simulation, smaller raw event size and lighter physics formats
- Porting to other architectures & platforms will continue
  - Opportunistic CPU expected to continue to play key role

- 2025 requests is needed for Run 3 data analysis
  - T0 changes arise from raw data repacking & buffers
  - T1 and T2 resources used for simulation and periodic reprocessing of entire Run 3 dataset

- 2025 request reflects full year of data-taking in new model
  - Will need 125 PB of tape for data storage alone
  - 75% of CPU used for simulation
- Bringing new T1 sites online



# Posumowanie



- ⊙ **Dobre działanie WLCG (i WLCG-PL) w 2023**
  - Pomyślna certyfikacja T1 dla LHCb w CIŚ/NCBJ
  - Testy podczas Data Challenge 2024 pomyślne (transfery ~25% zapotrzebowania HL-LHC)
- ⊙ **Pledges na 2024 zainstalowane i gotowe do użycia**
  - (prawie) zgodne z rekomendacjami CRSG
  - Nie uwzględniają ostatnich zmian w kalendarzu LHC => potrzeba szybszej instalacji ~30PB taśm (T0/T1) przewidzianych na 2025
- ⊙ **Oczekiwania eksperymentów na 2025 (ostatni w Run-3)**
  - "Adiabatyczne" zwiększenie zasobów ALICE, ATLAS, CMS (+15-20%)
  - Isototny wzrost zapotrzebowania LHCb (+60%) w związku z upgrade detektora i trygera (opóźnione o 1 rok)
- ⊙ **Prace nad integracją wyników monitoringu zasobów eksperymentów**
  - m.in. dla łatwiejszego porównia z monitoringiem WLCG/EGI
  - platforma CERN MonIT