

# Preventivi CMS 2025

Daniele Spiga INFN-PG  
On behalf of CMS-Calcolo Italia

**Bologna 04.09.2024**

# Agenda



## Uso risorse Calcolo 2023

- CMS e focus su Italia

## Nuove richieste 2025

- Crescita e rimpiazzo dismissioni

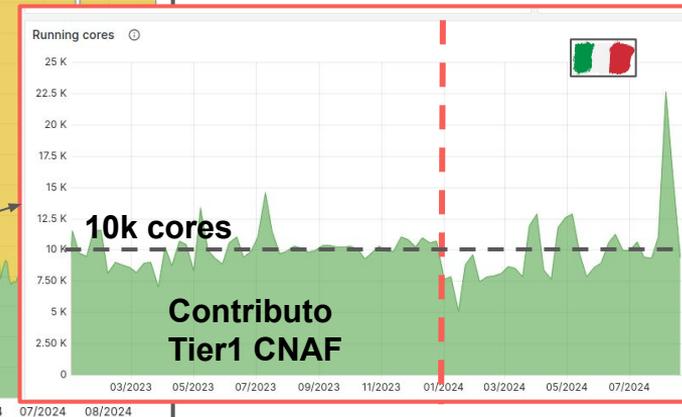
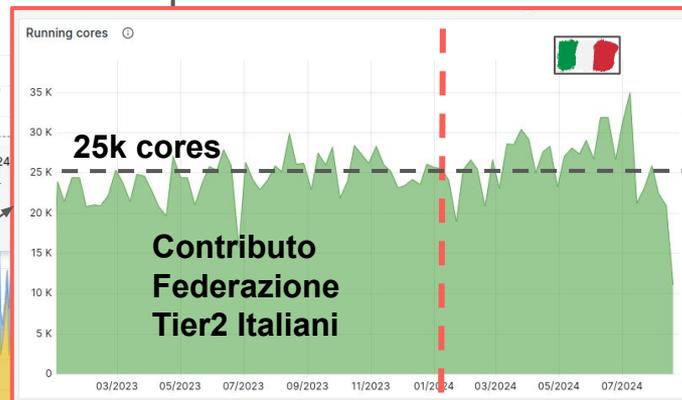
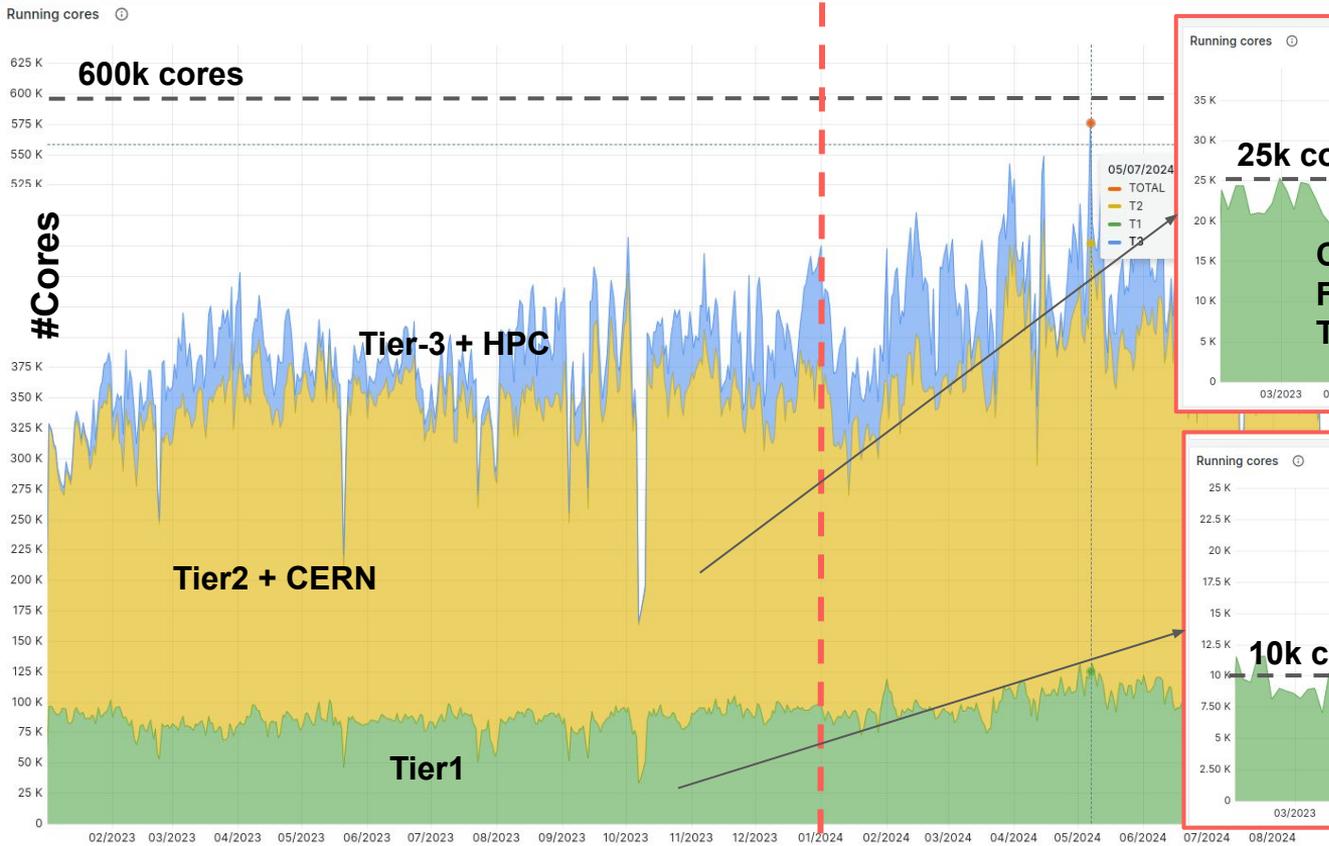
## Aggiornamenti flash su:

- nuovo/i Tier1 a CMS
- contributi R&D @CMS-ITA

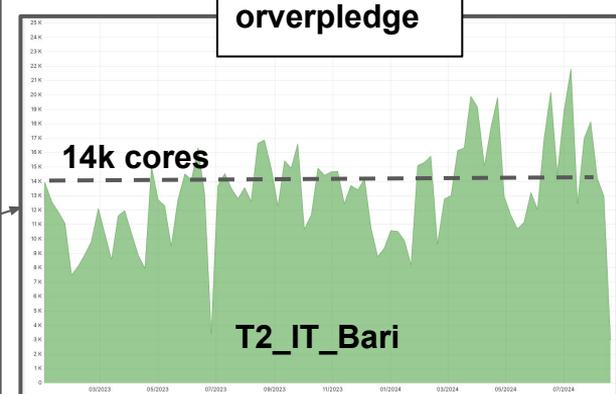
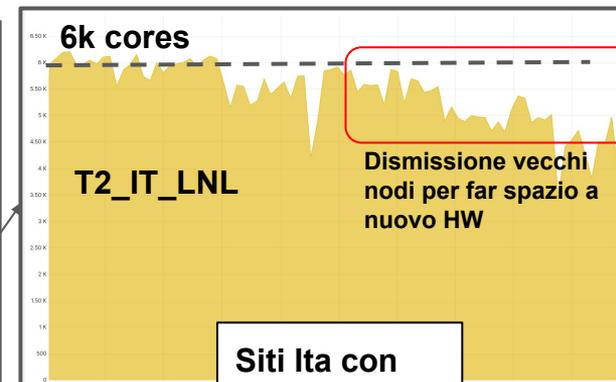
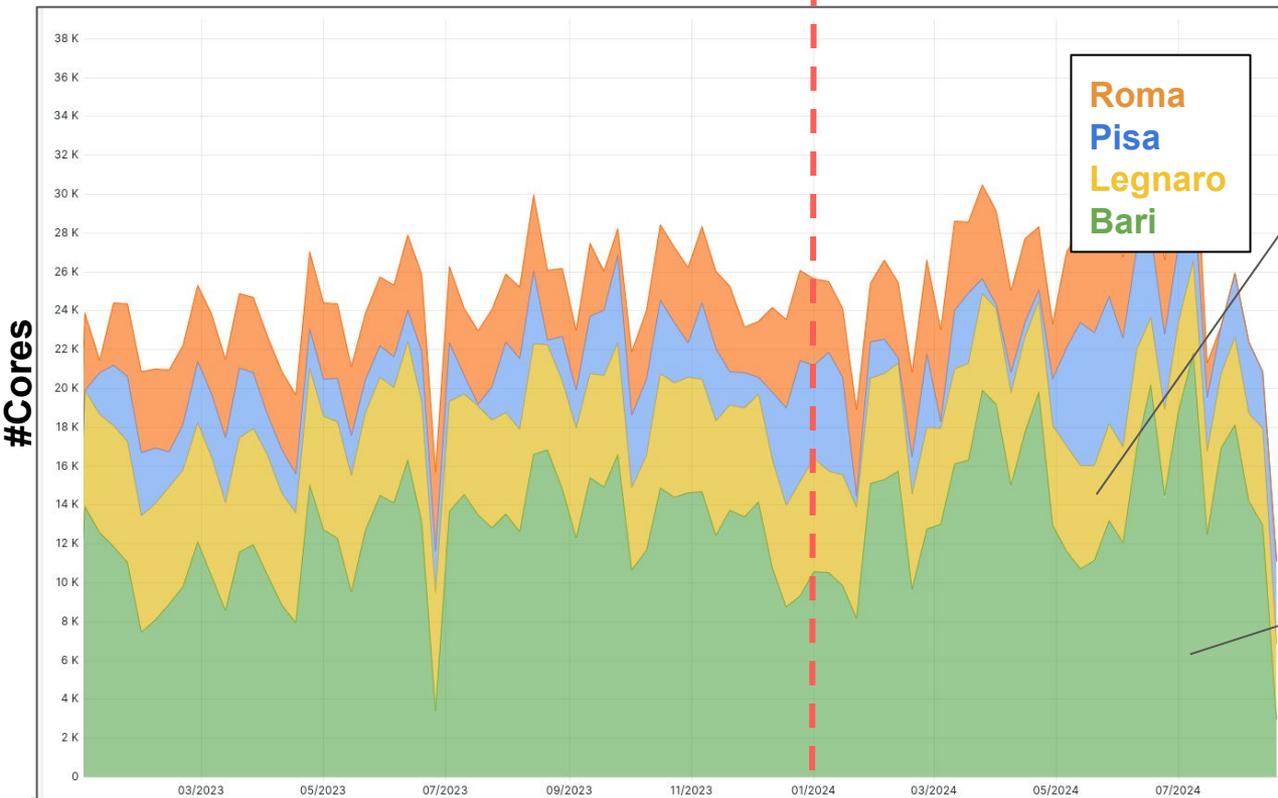
## Responsabilità e Missioni

-

# Overview risorse CPU 2023

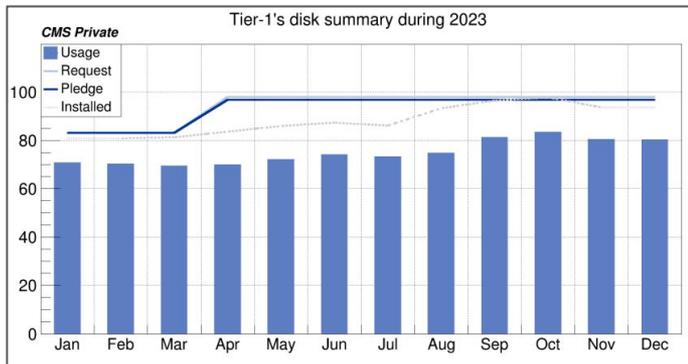


# Focus sui Tier2 Italiani (CPU)



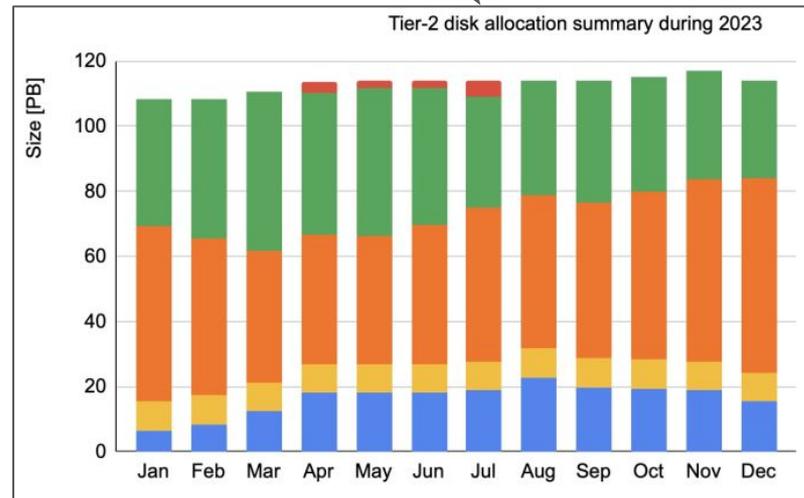
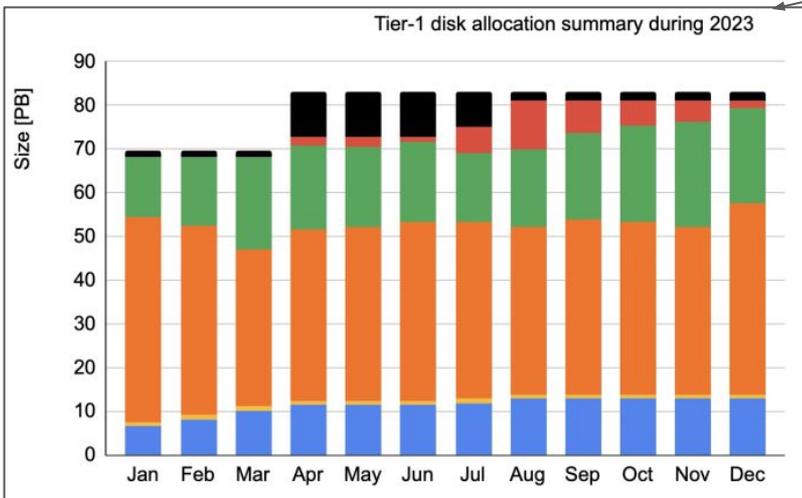
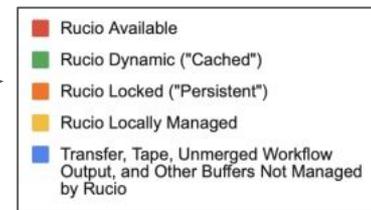
Siti Ita con contributo overpledge

# Overview risorse Disco 2023



Utilizzo disco/mese e quote (WLCG Accounting).  
Gestione centrale 85% del pledge

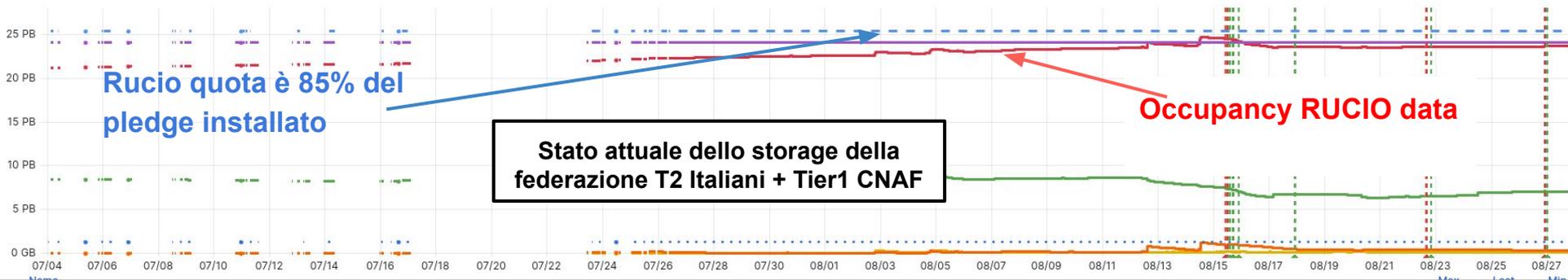
Breakdown per **categoria** dell'  
allocazione spazio disco ai T1 e T2



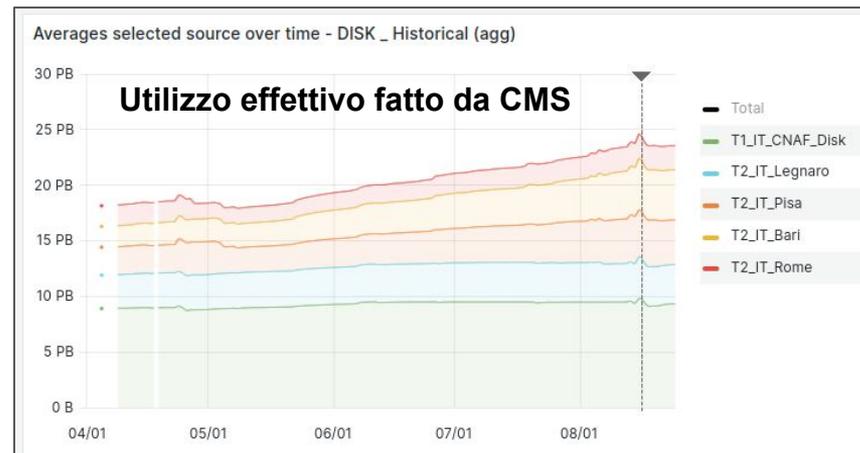
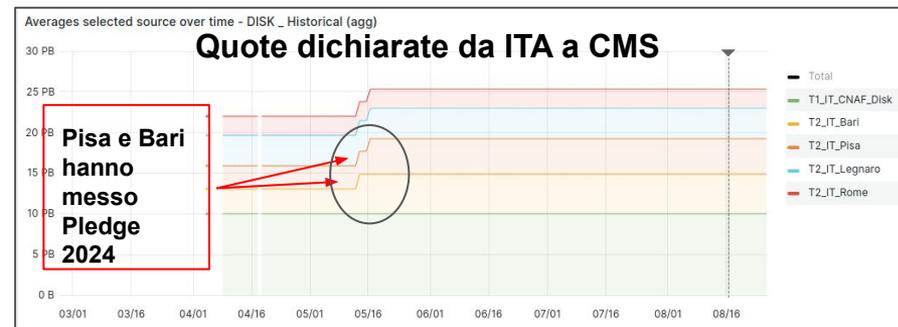
# Focus su storage @ Tier2/1 Ita



RSE Overview



## Nuovo Monitoring CMS!!!

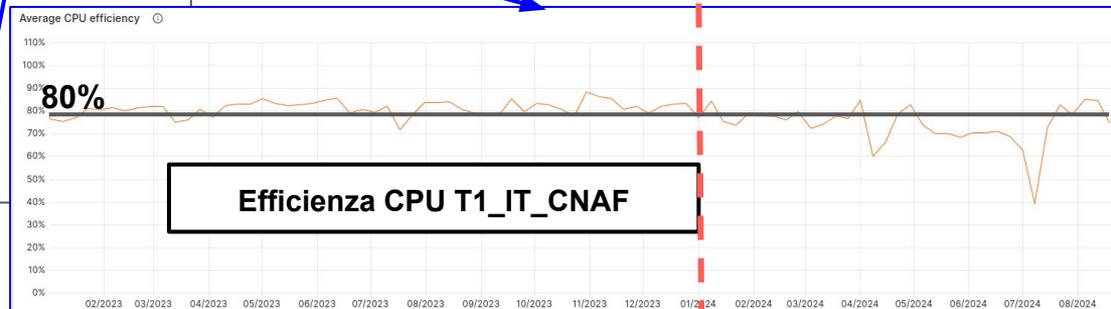


# Summary utilizzo risorse e CPU Eff.



**Summary Utilizzo Pledge 2023: in numeri**

CMS		Pledged	Used	Used/Pledged	Avg. CPU Eff
CPU [kHS23]	Tier-0	720 (540)	969 (628)	135% (116%)	66% (68%)
	Tier-1	916 (852)	1,173 (1,118)	128% (131%)	82% (80%)
	Tier-2	1,313 (1,232)	2,544 (2,386)	194% (194%)	71% (68%)
	<b>Total</b>	<b>2,949 (2,624)</b>	<b>4,686 (4,132)</b>	<b>159% (157%)</b>	<b>73% (71%)</b>
Disk [PB]	Tier-0	45.0 (35.0)	39.2 (30.8)	87% (88%)	
	Tier-1	96.8 (83.2)	76.7 (70.3)	79% (84%)	
	Tier-2	109.7 (96.0)	96.1 (89.3)	88% (93%)	
	<b>Total</b>	<b>251.5 (214.0)</b>	<b>212.0 (190.4)</b>	<b>84% (89%)</b>	
Tape [PB]	Tier-0	228.0 (155.0)	202.8 (144.4)	89% (93%)	
	Tier-1	303.7 (254.9)	226.4 (205.1)	75% (80%)	
	Tier-2				
	<b>Total</b>	<b>531.7 (409.9)</b>	<b>429.2 (349.5)</b>	<b>81% (85%)</b>	





# Recap installazione Pledge 2024

(“Teoricamente dovuta per Aprile”)

- **Bari**
  - Storage in fase di messa in produzione; CPU in consegna
- **Pisa**
  - Storage e CPU non ancora consegnate
- **Legnaro situazione più complicata (ma sotto controllo)**
  - Grossa dismissione Storage 2024 primo semestre rimasta scoperta
  - Storage 2024 (prima gara) non sufficiente per coprire il pledge. Arrivato e installato ma non in produzione)
  - CPU 2024 (legnaro è nel secondo giro. Ordine fatto a fine luglio)
- **Roma**
  - Storage arrivato e installato ma non ancora messo in produzione
  - CPU 2024 sono arrivate e in produzione
- **Tier1**
  - CPU e Tape OK. Disco ?

Entrambi hanno fornito il pledge 2024 sfruttando anticipi di HW locali. GRAZIE

Bari sta coprendo temporaneamente il deficit di LNL. Abbiamo spostato quote (abbastanza facile grazie ai sistemi DM)

Ma purtroppo Roma attualmente è spento

# Richieste CMS 2025 (RRB)<sup>☆</sup>



CMS		'24 Approved Request - Spring '23	'25 Preliminary Request - Fall '23	'25 Final Request - Spring '24	Increase wrt '24	
					Abs.	Perc.
CPU [kHS23]	Tier-0	980	1,180	1,180	200	20%
	Tier-1	930	1,100	☆ 1,100	170	18%
	Tier-2	1,600	1,900	☆ 1,900	300	19%
	<b>Total</b>	<b>3,510</b>	<b>4,180</b>	<b>4,180</b>	<b>670</b>	<b>19%</b>
Disk [PB]	Tier-0	54	64	70	16	30%
	Tier-1	122	142	☆ 142	20	16%
	Tier-2	149	175	☆ 175	26	17%
	<b>Total</b>	<b>325</b>	<b>381</b>	<b>387</b>	<b>62</b>	<b>19%</b>
Tape [PB]	Tier-0	320	420	442	122	38%
	Tier-1	380	452	☆ 445	65	17%
	<b>Total</b>	<b>700</b>	<b>872</b>	<b>887</b>	<b>187</b>	<b>27%</b>

WLCG RRB Aprile 2024 ha approvato le richieste riportate in questa tabella

Consideriamo sempre il contributo italiano pari al **13% anche se siamo cresciuti al 14%**

Parameter	Approved 2024	Updated 2024	Preliminary 2025	Final 2025
<i>LHC</i>				
LHC Energy pp [TeV]	13.6			
Average (Peak) pileup	62 (65)			
Integrated luminosity / year [ $\text{fb}^{-1}$ ]	110		120	
Lifetime pp / year [ $\text{s}/10^6$ ]	5.2		6.3	
Lifetime HI / year [ $\text{s}/10^6$ ]	1.7		1.7	1.4
Heavy Ion run type	Pb-Pb		Pb-Pb	Pb-Pb, O-O, Pb-O
<i>CMS-Specific</i>				
Prompt HLT Rate [kHz]	2.6			
Parked HLT Rate [kHz]	3.0	4.9	3.5	4.9
HLT Scouting Rate [kHz]	30		35	30
L1 Scouting Rate [kHz]	-	1.1		1.1
Run 3 MC events / year in billions	53		57	
Phase-2 MC events / year in billions	0.5			

Parametri utilizzati per la definizione delle richieste sopra.

- Parametri della Macchina
- Parametri specifici di CMS

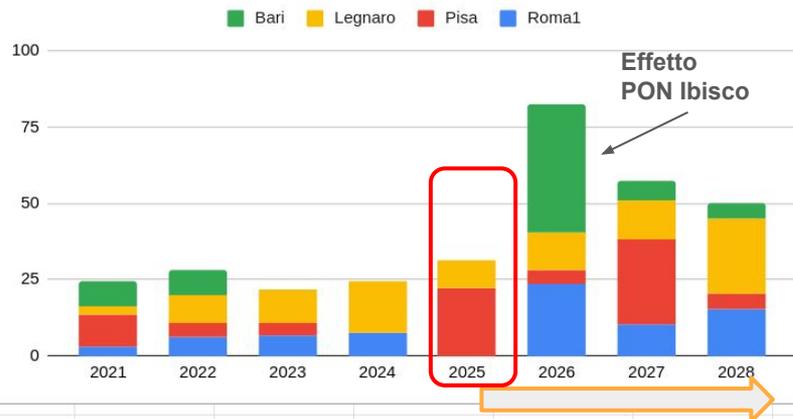
# Dismissioni Hardware: Stato & Proiezioni



## DISMISSIONI CPU

	Roma1	Pisa	Legnaro	Bari	TOT
2021	3	10.4	3	8	24.4
2022	6	4.75	9.2	8	27.95
2023	6.7	4.14	11	0	21.84
2024	7.6	0	16.7	0	24.3
<b>2025</b>	<b>0</b>	<b>22.2</b>	<b>8.9</b>	<b>0</b>	<b>31.1</b>
2026	23.36	4.5	12.4	42.32	82.58
2027	10.24	28	12.9	6	57.14
2028	15.36	5	24.8	4.9	50.06

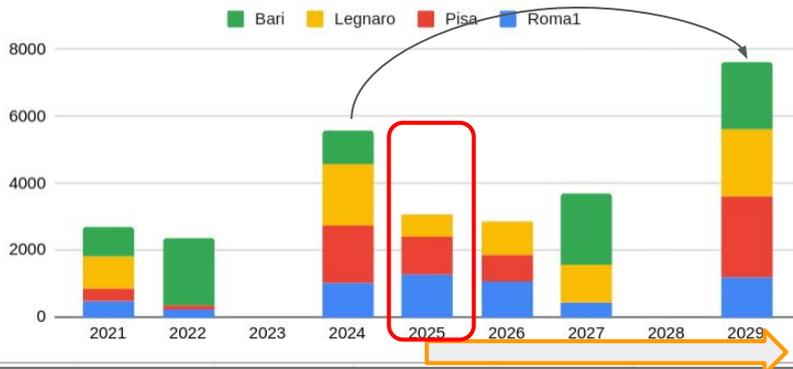
CPU - kHS06



## DISMISSIONI DISCO

	Roma1	Pisa	Legnaro	Bari	TOT
2021	500	350	970	880	2700
2022	240	120	0	2000	2360
2023	0	0	0	0	0
2024	1008	1708	1840	1035	5591
<b>2025</b>	<b>1291</b>	<b>1095</b>	<b>677</b>	<b>0</b>	<b>3063</b>
2026	1056	805	986	0	2847
2027	448	0	1130	2122	3700
2028	0	0	0	0	0
2029	1200	2430	2000	2000	7630

DISCO - TBN



# Richieste 2025

Per la monetizzazione si è fatto riferimento a questo preziario:



## Distribuzione flat di crescita CPU e Storage sui 4 siti della Federazione

Tape 10 euro / TB  
Disco 100 euro / TBN  
CPU 10 euro / HS06

Crescita prevista per il 2025



	Disco (TBN)	CPU (kHS06)	\$Disco	\$CPU
Bari	845.0	9.745	84500	97450
Pisa	845.0	9.745	84500	97450
Legnaro	845.0	9.745	84500	97450
Roma1	845.0	9.745	84500	97450
<b>TOT</b>	<b>3380.0</b>	<b>38.98</b>	<b>338001</b>	<b>389800</b>

Rimpiazzo  
dismissioni HW  
Tier2



	Disco (TBN)	CPU (kHS06)	\$Disco	\$CPU
Bari	0	0	0	0
Pisa	1095	22.2	109500	222000
Legnaro	677	8.9	67700	89000
Roma1	1291.4	0	129140	0
<b>TOT</b>	<b>3063.4</b>	<b>31.1</b>	<b>306340</b>	<b>311000</b>

# Totali CMS per 2025

## Incluso OH rete e server



TOT (euro)	disco TBN	disco Eur	CPU kHS06	CPU Eur	Rete Eur	Server Eur
<b>204758.78</b>	845.0	84500	9.7	97450	10072.0125	12736.5175
<b>578258.78</b>	1940.0	194000	31.9	319450	28867.0125	35941.5175
<b>381152.78</b>	1522.0	152200	18.6	186450	18797.0125	23705.5175
<b>349395.58</b>	2136.4	213640	9.7	97450	16529.0125	21776.3175
<b>1513565.92</b>	<b>6443.41</b>	<b>644341.00</b>	<b>70.1</b>	<b>700800.00</b>	<b>74265.05</b>	<b>94159.87</b>

# Nuove Richieste per il Tier1



RICHIESTE 2025				
T1	pledge 2024	pledge 2025	Incremento	Eur Delta
CPU (kHS06)	120.9	143	22.1	221000
DISK (TBN)	15680	18460	2780	278000
TAPE (TB)	49400	57850	8450	84500
				583500

È Stato considerato il 13% e NON è stato incluso nessun “effetto JINR”

# Situazione Tier1 a CMS (JINR)



JINR Tier-1 lo stiamo utilizzando solo come risorsa opportunistica

- No copie uniche su Tape/Disk; No custodial tape copies data/MC
- In generale non è usato per campagne più importanti (no/poco classical mixing)

Stato nuovi centri con pledge sperabilmente nel 2025:

## Serbian

## NCBJ-CIS (Poland)

### PROJECT ROAD MAP – CONSTRUCTION AND COMMISSIONING

Construction and Commissioning of SSC-T1 (Phase-1)

Table 3. Baseline schedule for the Project SSC-T1 center, Construction and Commissioning phase (Phase-1), for year 2024

	January	February	March	April	May	June	July	August	Septem	Octob	Novem.	Decem.
Coordination Team	PL	TC, DTC										
Define Technology		Study	Converge									
Core Team		Expert Search			Expert Hire		Student Hire					
Disc Storage			Procurement		Set-up		MW & Test					
Network			Procurement		Set-up		MW & Test					
CPU Servers			Procurement				Set-up		MW & Test			
Archive Storage			Procurement					Set-up		MW & Test		
Integration								Link HW, install MW, Test				

## Upgrade to CMS Tier-1

### Schedule

- Preparation of the computing resources (May)
- Request for CMS Proto Tier-1 status (June, WLCG OB meeting)
- Deployment of all required services (since July)
- Integration of Tier-1 services with CMS central services, site tests (since September)
- Final Tier-1 pledge for 2025 (October)

# Analisi ad alto throughput

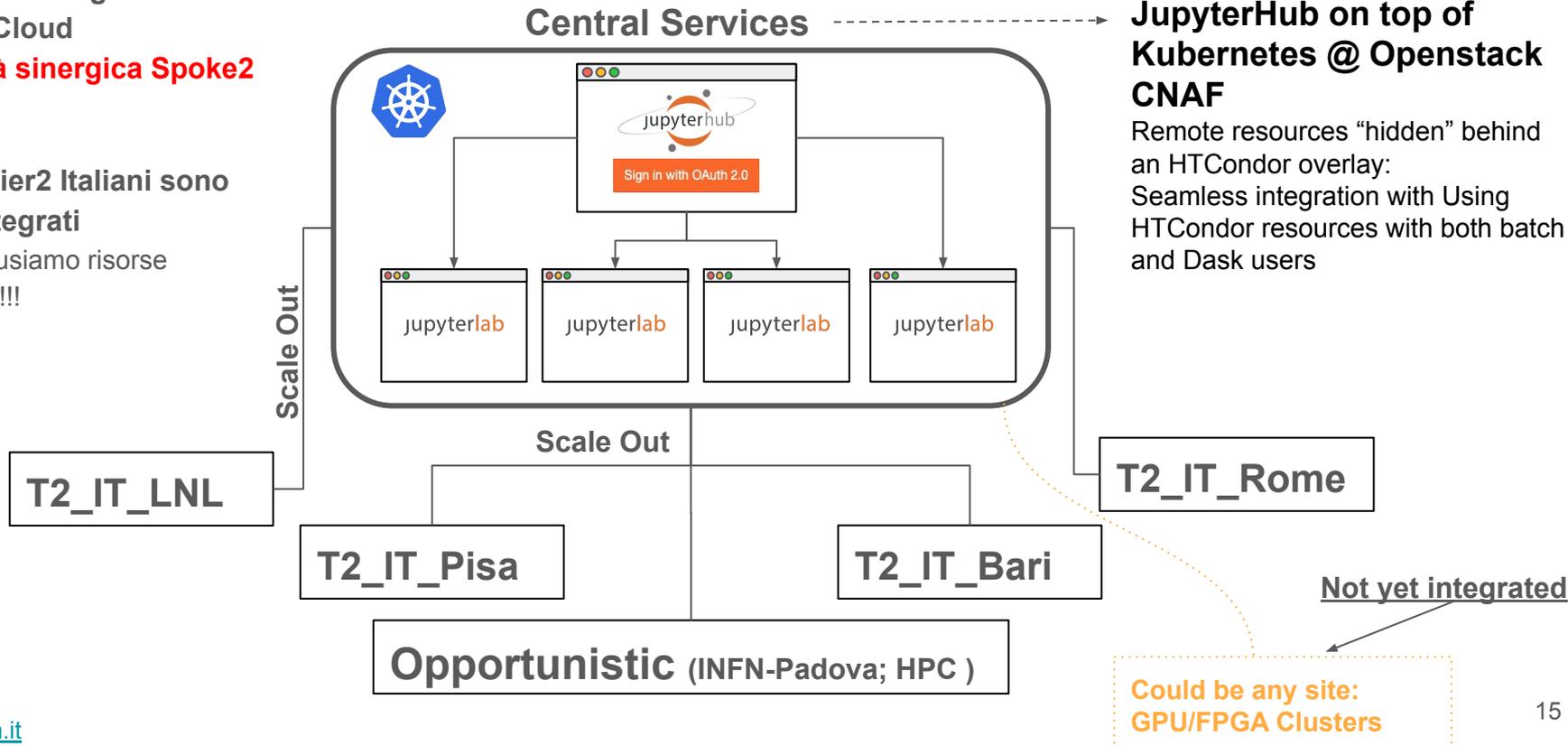


Esempio integrazione  
GRID-Cloud

Attività sinergica Spoke2

Tutti i Tier2 Italiani sono  
stati integrati

Ma non usiamo risorse  
dedicate!!!



**JupyterHub on top of  
Kubernetes @ Openstack  
CNAF**

Remote resources “hidden” behind  
an HTCondor overlay:  
Seamless integration with Using  
HTCondor resources with both batch  
and Dask users

Not yet integrated

Could be any site:  
GPU/FPGA Clusters

# Attività R/D integrazione HPC: Stato



Abbiamo integrato VEGA (Slovenia) come estensione logica di T1\_IT\_CNAF.

- Grant CMS usato per contribuire alla campagna di validazione di Alpaka (GPU) per HLT
- Utilizzo di risorse offline per “attività” online

Abbiamo integrato Leonardo Opportunistico nel sistema calcolo CMS

- Prime validazioni sono ok. Non ancora in “produzione”

### The 2023 process in a nutshell

**First quick&dirty tests**

**Two main runs, mainly functional tests**

Number of running cores T1 IT CNAF - VEGA

2.8T cores

All tests have been successful also by ANL or VEGA side (the failures were expected)

Readout accuracy (read) (P1 L1)

**Next objective: A development Grant**

Since there is no CMS institute in Slovenia so a possible next step would be to apply for a development grant from EuroHPC

- first week of every month
- access granted to the HPC within days and no peer review
- Not a huge allocation + 1M core hrs??

↳ I'm already on this with Andrej. The idea then is that

- CRB post as the European national leads the proposal preparation and the application
- DFP+ deals with the integration and first operations activities (I can take care of this)

CRB discussion about a VEGA grant

**EuroHPC Application**

Project Application - Jose Hernandez

The Project

Project details

Project title: Running CMS simulation workflow as large performance computing pipeline

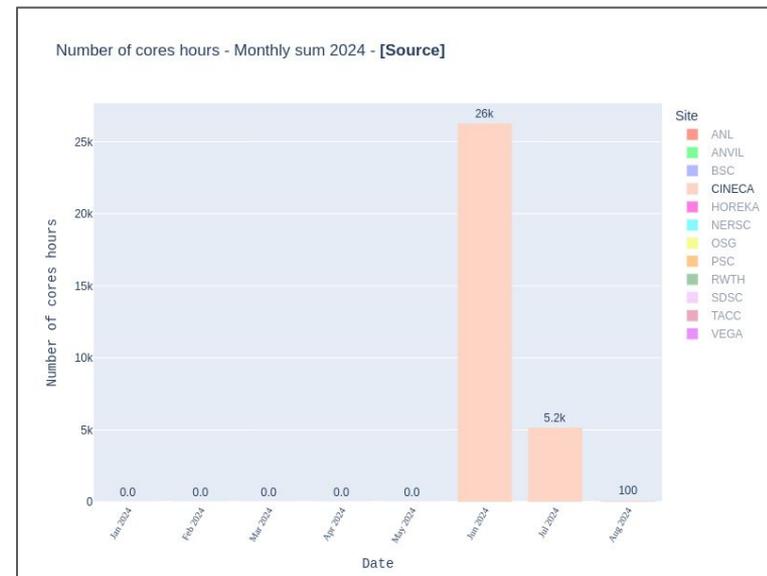
Project acronym: (short)

The project has been selected as one of the top grant proposals within the larger Horizon Europe (H2020) call for proposals. The project is a joint effort between INFN and the European Commission. The project is a joint effort between INFN and the European Commission. The project is a joint effort between INFN and the European Commission.

CRB, Feb 17th 2023

CRB, March 21th 2024

Feb. 2023      July 2023      Dec. 2023



# Responsabilità Offline & Computing

e relative missioni...



## CMS Offline Software and Computing - September 2024



Stato richieste missioni calcolo CMS



Anno	Sigla	Sezione	Capitolo	keur	SJ	Richiesta
2025	cms	PG	missioni	4.0	0.0	CALCOLO-RESP L2 Computing dyn resource provisioning 1 mp*3.95 KEuro/mp / CMS-452
2025	cms	PG	missioni	4.0	0.0	CALCOLO-RESP L2 Responsabile nazionale Computing 1 mp*3.95 KEuro/mp / CMS-451
2025	cms	TO	missioni	3.5	0.0	CALCOLO-RESP L2 mp*3.7 KEuro/mp - Monitoring and Analytics co-coordinator / CMS-414
2025	cms	PI	missioni	5.5	0.0	CALCOLO-M&C/Missioni interne ed estere per gestione Tier-2 1 mp*3.8KEuro/mp / CMS-371
2025	cms	PI	missioni	4.0	0.0	CALCOLO-RESP L2 Facility Service Coordinator 1 mp*3.8 KEuro/mp / CMS-366
2025	cms	BO	missioni	4.0	0.0	CALCOLO-RESP L2 PPD AICaDB convener, 1 mp*3.8 KEuro/mp / CMS-286
2025	cms	TS	missioni	4.0	0.0	CALCOLO-RESP L2 mp*3.95 KEuro/mp (analysis infrastructure and support group co-coordinator) / CMS-122

D.Spiga

A.Perrotta