Stato e uso risorse ATLAS@CNAF
Migrazione al tecnopolo

ATLAS PLEDGE

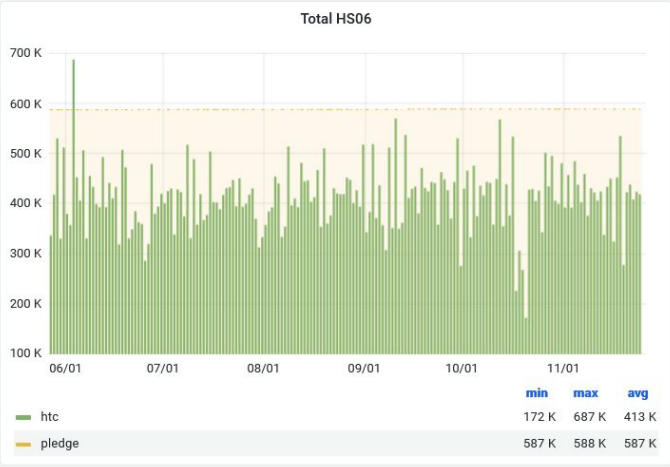
	2021			2022		
	CPU	DISK	TAPE	CPU	DISK	TAPE
	HS06	TB-N	TB	HS06	TB-N	TB
ATLAS (9%)	105300	9450	21150	117000	10440	24480

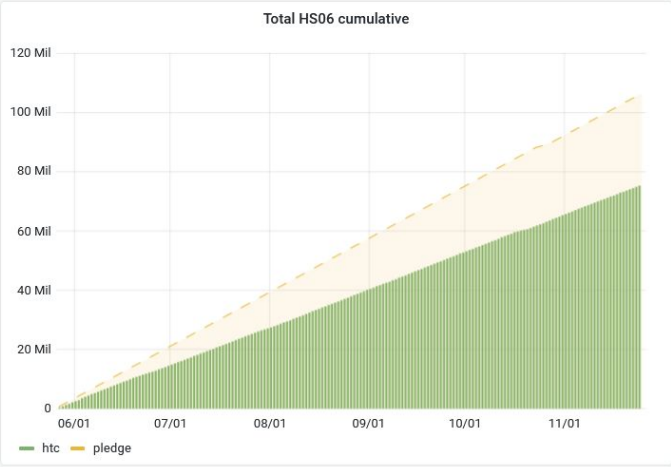
Preliminary 2022?

TOTAL CNAF 2021 CPU pledge = 530kHS06
TOTAL provided (current) = 430kHS06

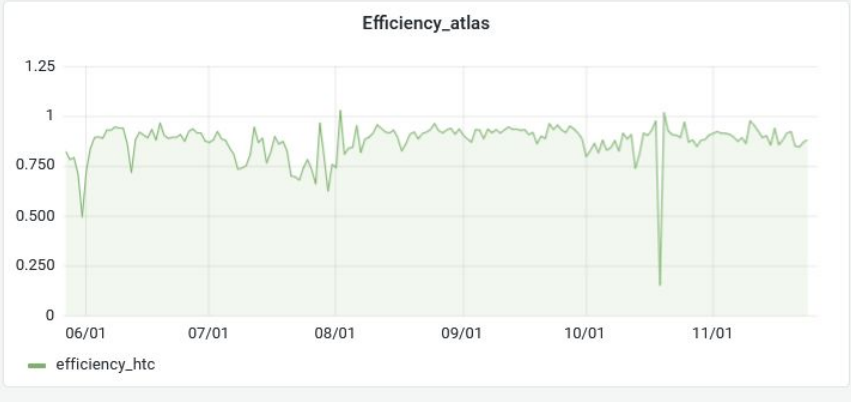
- Fornitura di 240kHS06 da CINECA ancora non arrivata e non prima del 2022

ATLAS CPU





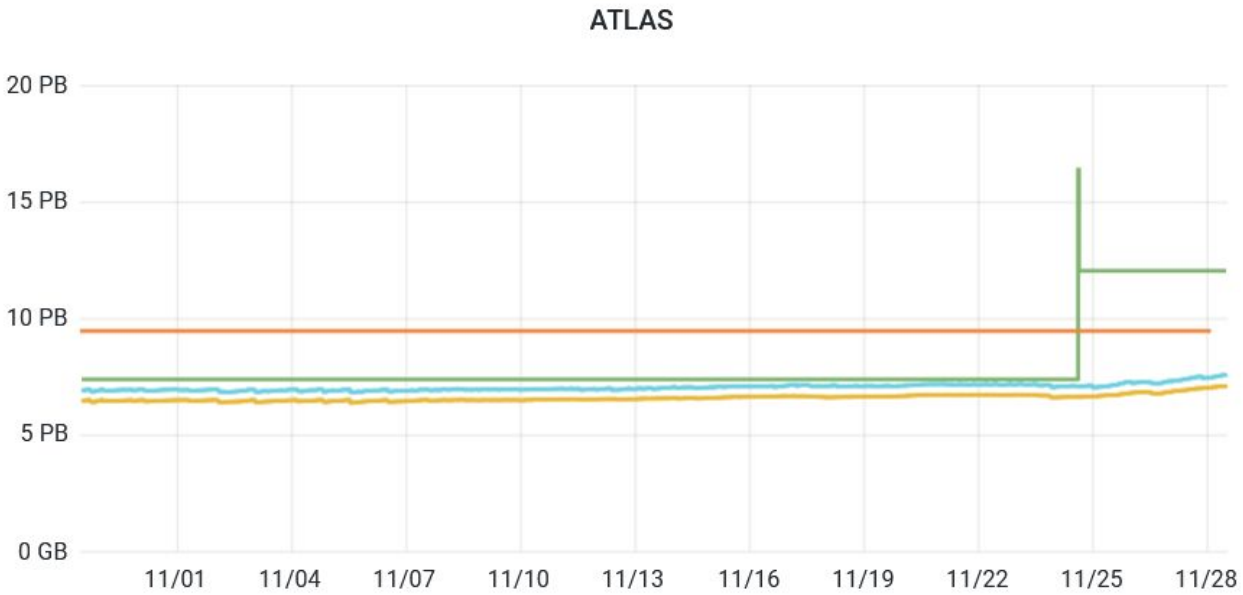
- Underpledge significativo
- Macchine cineca ancora non arrivate



Nuove risorse

- Consegna nodi CINECA prevista ~~Giugno/Luglio non prima di fine Agosto :(non prima di metà ottobre~~
  - ~~speriamo a novembre~~
  - ~~Uscita gara per le parti, scadenza 29/7~~
  - ~~Approvazione cda fine settembre~~
  - ~~Partita richiesta parti a Lenovo~~
  - Non prima del 2022

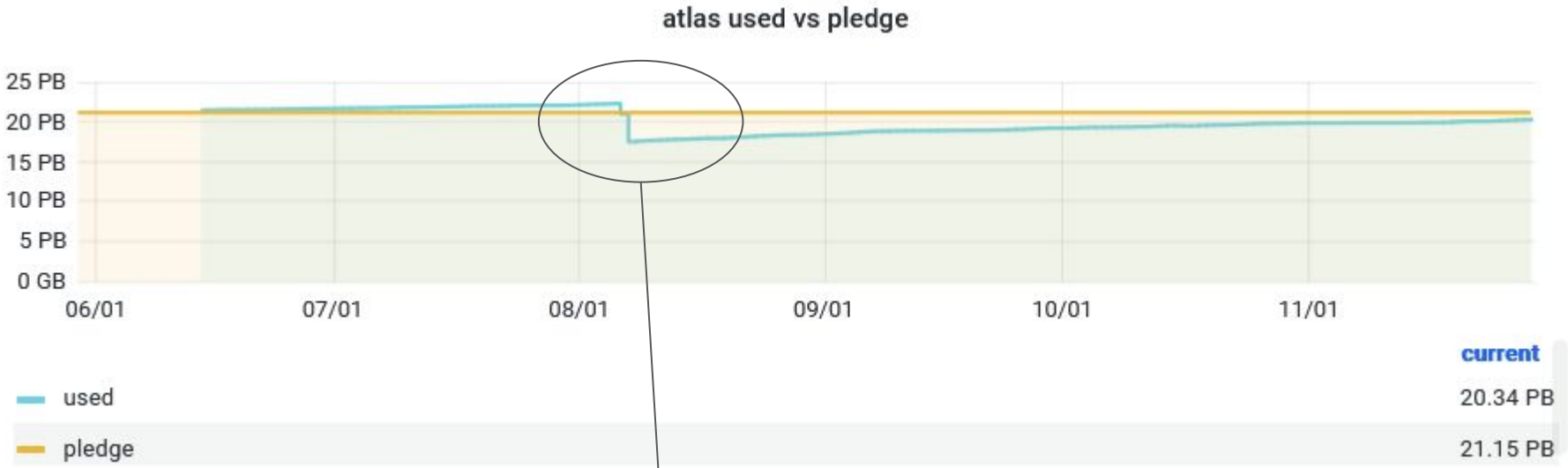
ATLAS DISK



	min	max	avg	current
quota	7.377 PB	16.376 PB	7.984 PB	12.031 PB
pledge	9.450 PB	9.450 PB	9.450 PB	9.450 PB
used+buffer	6.805 PB	7.572 PB	7.033 PB	7.572 PB
used	6.367 PB	7.091 PB	6.586 PB	7.091 PB

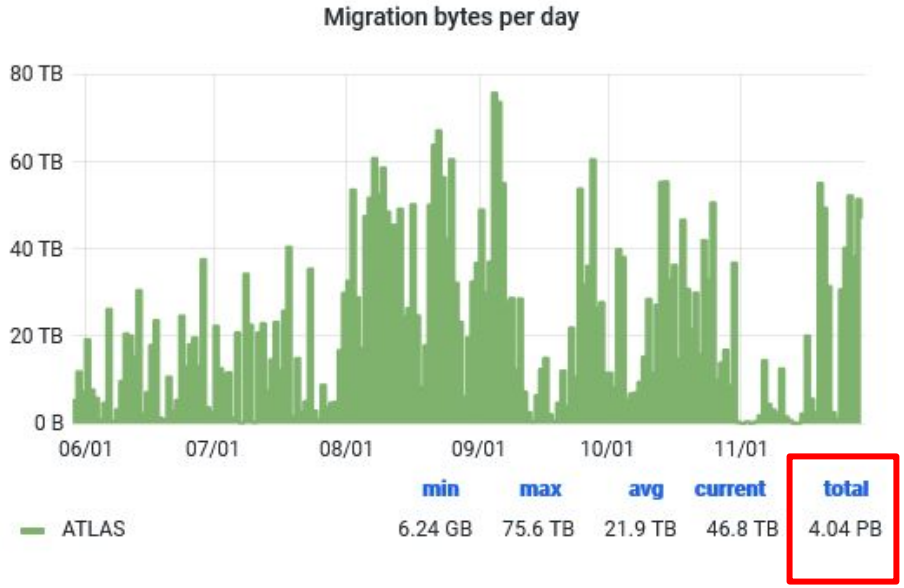
- Installazione e collaudo gara storage 2020 terminato la scorsa settimana
- Pledge 2021 in via di assegnazione ad ATLAS
- Migrazione da vecchio sistema in corso

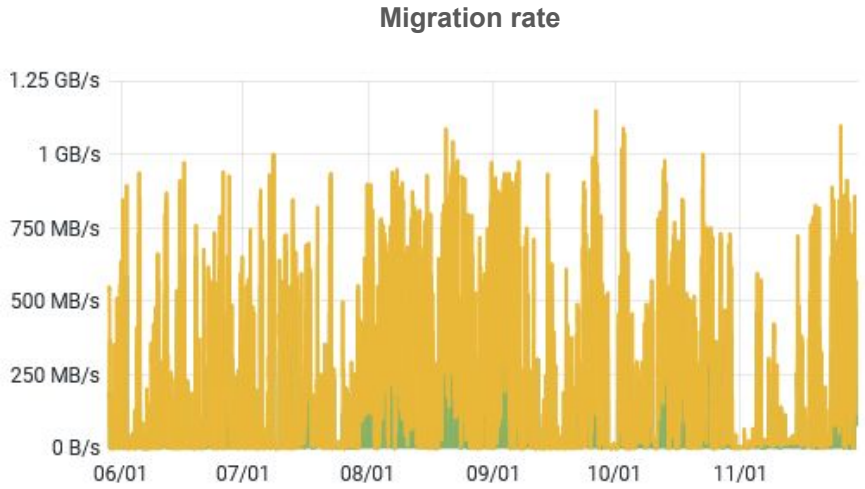
ATLAS TAPE



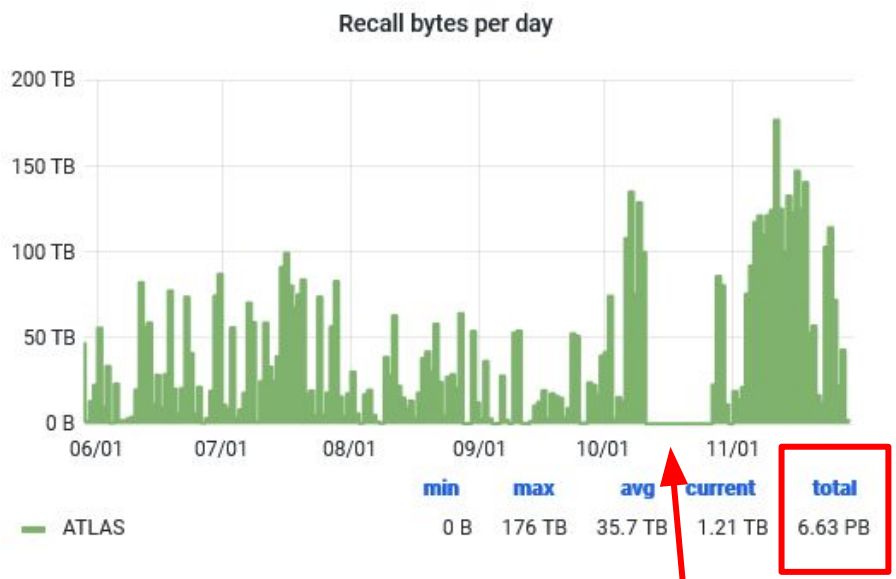
Reconcile era stato fermo per qualche settimana prima di agosto

Scritture su tape: ultimi 6 mesi



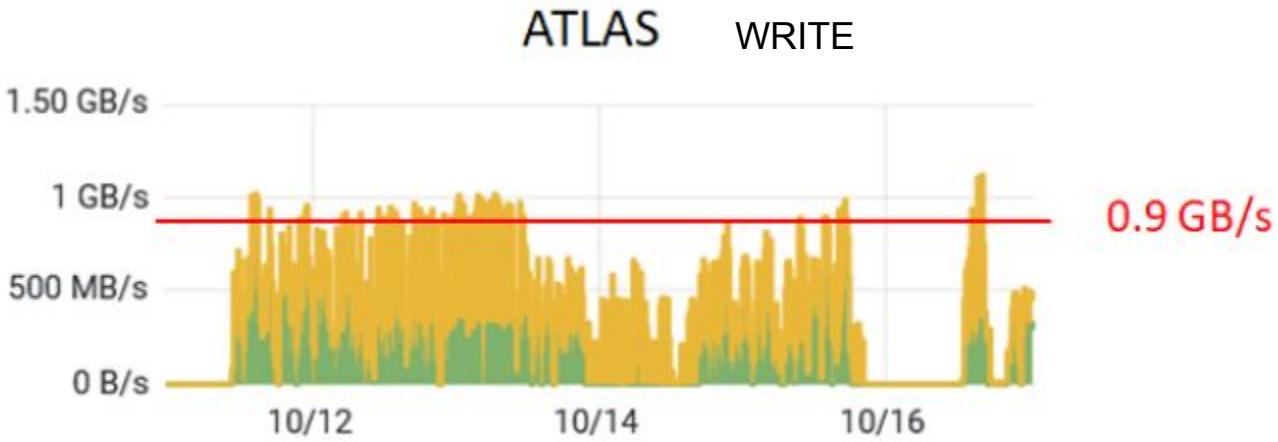


Letture ds tape: ultimi 6 mesi



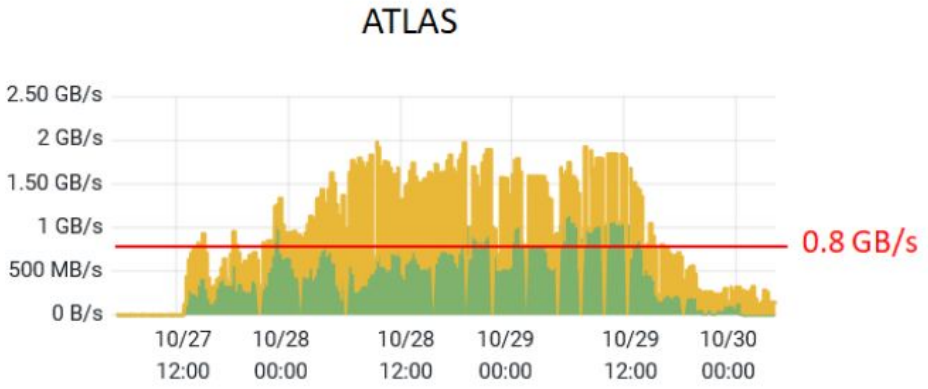
Problema configurazione lato CNAF

Tape challenge: ATLAS



READ

- Trasferimento buffer-tape
  - Ok primi due giorni
- Problema con cassette esaurite nuova libreria
- Spostato su vecchia ma in competizione con elevata attività di prod



TAPE requirements

RUN 3: rate richiesti

VO	Reads (DT) GB/s	Writes (DT) GB/s	Reads (A-DT) GB/s	Writes (A-DT) GB/s
ALICE		0.8	0.3	0.8
ATLAS	0.2	0.9	0.8	0.5
CMS	0.1	1.2	1.9	0.2
LHCb		2.24	0.86	
Total	0.3	5.14	3.86	1.5

Total throughput Data Taking (DT): 5.44 GB/s

Total throughput After Data Taking (A-DT): 5.36 GB/s

Se i rate sono questi per noi non ci sono problemi

Ma se ATLAS scrive sul buffer ad un rate più alto, al momento non abbiamo controllo e si potrebbe riempire il buffer

Se questi valori cambiano anche per un periodo limitato è bene discuterlo assieme

Sulla lettura reggiamo quel rate, ma se ci sono drive disponibili possiamo andare anche più veloci grazie all'orchestratore automatico

INFN and CINECA joint initiative for Tecnopolo (1/2)

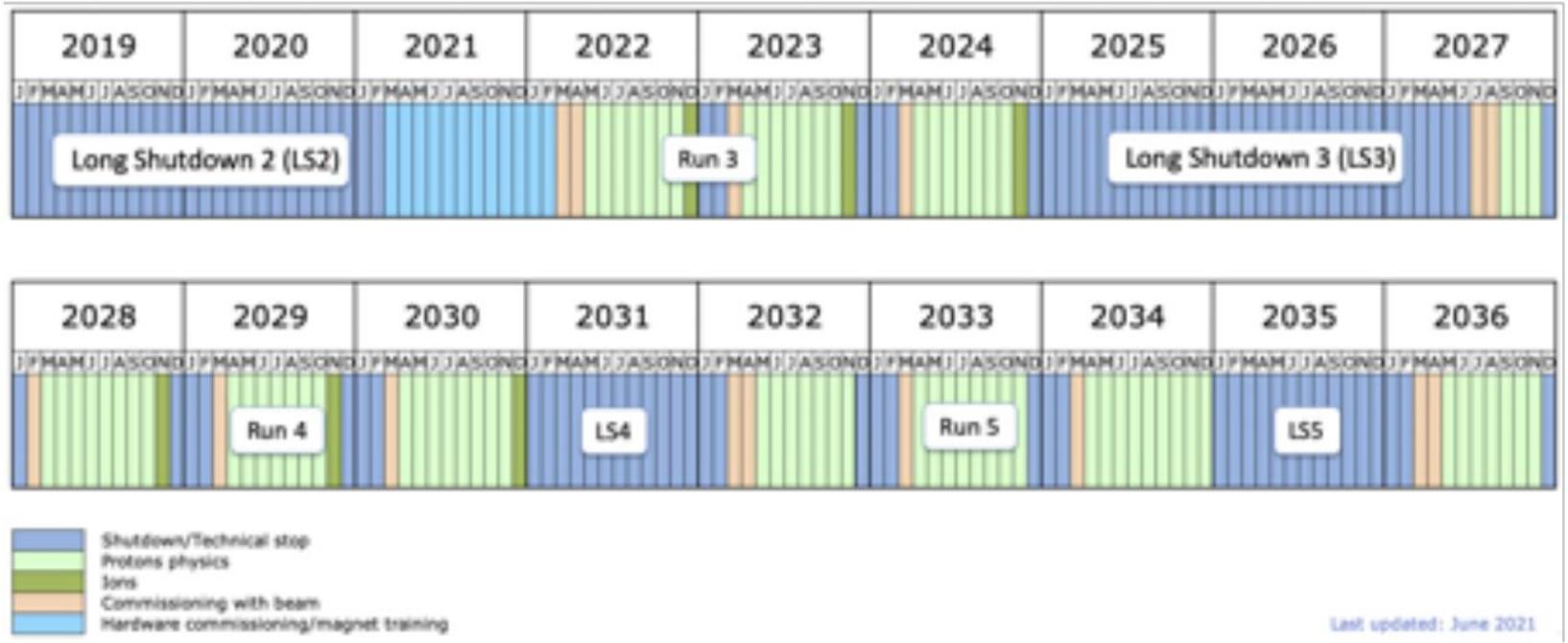
- In 2019 ER Region decided to promote a new district, the Tecnopolo, devoted to research, innovation and technological development
- Former "Manifattura Tabacchi"
  - Distance of ~ 2km from CNAF
  - Area of 100,000 m^2
  - 5 halls (B1-B5) + 1 shed (C2) usable as data halls
  - "Ballette" building for offices
- 3 halls (B1-B3) assigned to ECMWF
  - Renovation completed
  - B4 reserved for future expansion
- B5 and C2 assigned to INFN and CINECA to host INFN Tier1 and Leonardo pre-exascale machine
- Also, ~15000 m^2 (for IT and technical plants) allocated for two data centers suitable to host both Leonardo and the INFN Tier1

INFN and CINECA joint initiative for Tecnopolo (2/2)

- The pre-exascale machine ***Leonardo*** will be installed in the hall C2 (2022)
- INFN Tier1 will be migrated to the adjacent hall B5 (2023)
- INFN and CINECA data centers will share
  - Technological infrastructure (power and cooling)
  - Security and surveillance services
  - On-call and emergency response shifts
  - Emergency management
- Possible use of Leonardo as pledges for INFN experiments
- A direct network interconnection will be available between the two data centers

Tecnopolo vs. LHC schedule

- Long term project to satisfy computing needs of INFN for several years
  - 1st phase driven by LHC Run 3 (2023-2026) - 3 MW of total power needed
  - 2nd phase driven by HL-LHC (2027-) – up to 10 MW of total power needed

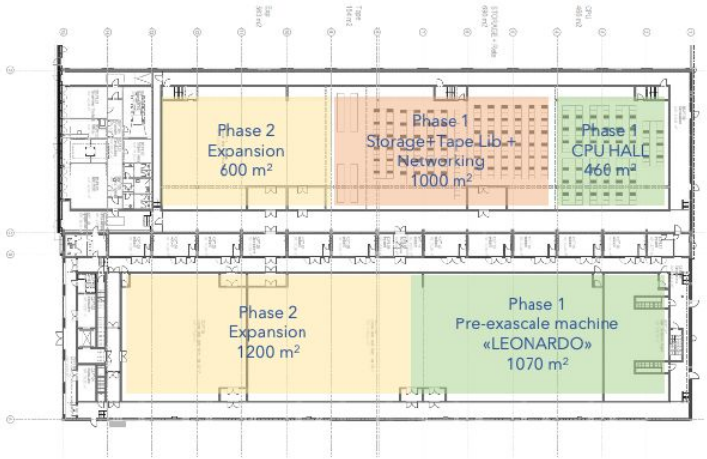


The main characteristics of the two phases

IT power [MW]	Phase 1	Phase 2
Years	2021-2026	2027-2030
INFN	3	3-10
CINECA	9,9	10
Total	12.9	13-20

Tier1@CNAF:
- *800 m² for IT*
- *Power:1.4 MW*
- *PUE: 1.6*

PUE@Tecnopolo: 1.1
(PUE@Leonardo 1.08)



B5

DATA HALL INFN

C2

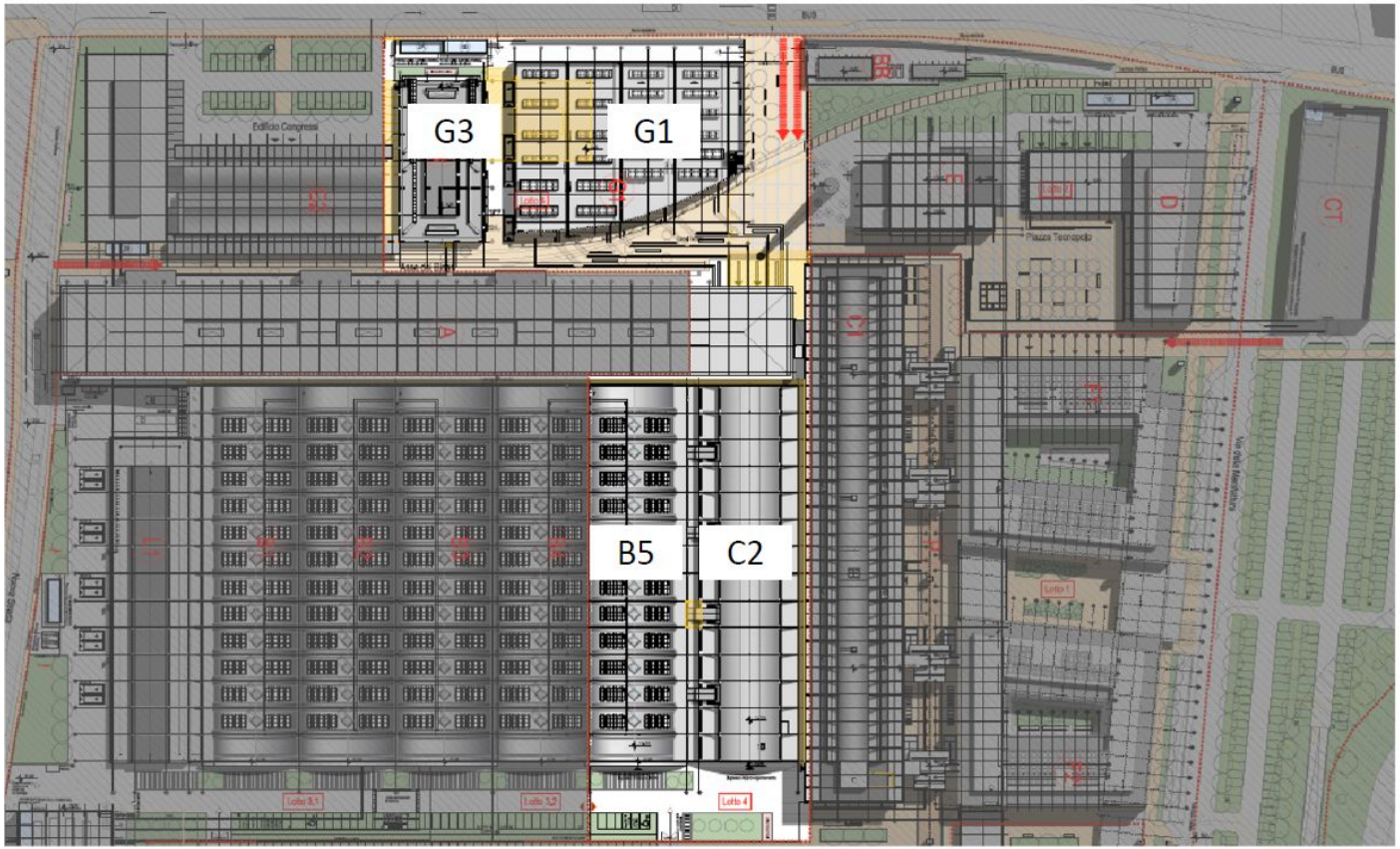
DATA HALL CINECA

IT surface [m²]	Phase 1	Phase 2	Future Expansion (requested)
Years	2021-2026	2027-2030	Beyond 2030
INFN	1560	2060 (+500)	3060 (+1000)
CINECA	1000	2200 (+1200)	3200 (+1000)
Total	2560	4260 (+1700)	6260 (+2000)

Surface for Technical Infrastructures

Plants [m²]	Tunnels [m²]
9460	3525

Aerial view of Tecnopolo area



G1 – chillers + dry coolers
G3 – UPS + generators
B5 – INFN data hall
C2 – CINECA data hall

G1 – new building
G3 – to be renovated
B5, C2 – renovation undergoing

Technological infrastructure

Central infrastructures (sized for both phase 1 and phase 2)

- Primary electrical and hydraulic distribution in data halls B5 and C2
- Located in halls G1, G3 and on the second floor of C2
- 9460 m^2 in the halls (G1,G3,C2) + 3525 m^2 of tunnels to data halls

- Secondary infrastructures
  - Power distribution, hydraulic distribution for temperate and cold water, the ventilation and conditioning system, security systems and access control
  - Located within data center (or near it)
- Power distribution: 4 main branches (3+1 redundancy) consisting of 4x3200 A busways
  - Phase 1: up to a maximum of 3 MW under UPS with (3+1) redundancy (4x1 MW UPS)
- Hydraulic distribution (3+1 redundancy)
  - Temperate water (40-50 ^{0}C) for racks with DLC (40-80 kW/rack)
  - Chilled water (19-26 ^{0}C) for racks with plenum cooling (up to 40 kW/rack)

The road to Tecnopolo

- Two parallel activities
- Preparation of data halls
  - Building consolidation and renovation works
  - Realization of main infrastructural systems shared with Leonardo
    - Cooling equipment, energy distribution and UPS
  - Preparation of hall C2 for Leonardo
  - Preparation of hall B5 for INFN Tier1
  - Realization of proximity systems (water and power distribution in hall B5)
  - Validation of the overall system
- Preparation of the migration of INFN Tier1 to Tecnopolo
  - CNAF Reloaded Project
    - Review of all services
    - Tests and evolution of IT infrastructure
  - Activities covered in a Technical Design Report

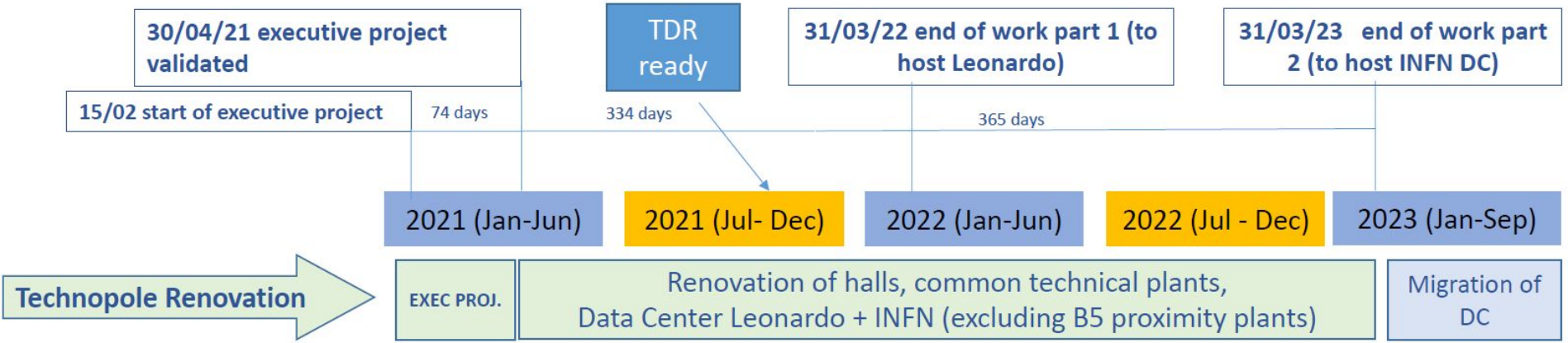
Part 1

Part 2

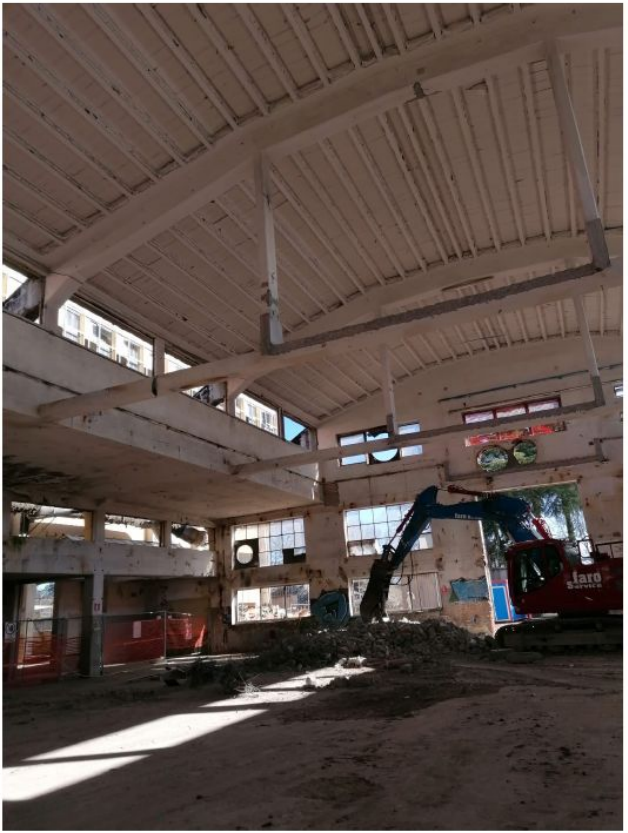
Leonardo will be installed at the end of 1st part of works

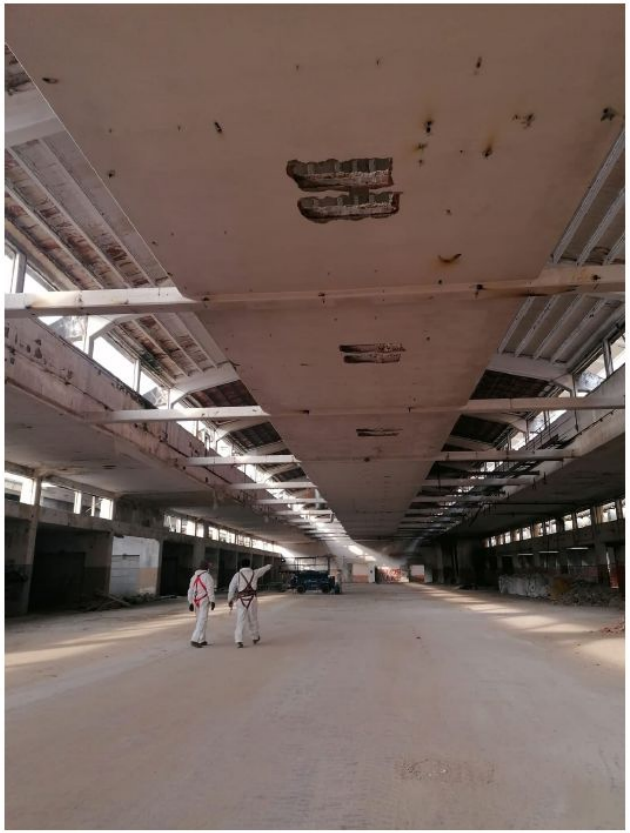
Preparation of data hall

- Tender carried out together with CINECA
  - December 2020: start of preliminary works (building consolidation)
- Executive project finalized Q1 2021
- April 30, 2021: validation of executive project
- Works part 1
  - May 2021: renovation works started
  - March 2022: expected end of phase 1 activities
- Works part 2
  - March 2023: expected end of phase 2 activities


30/04/21 executive project validated
TDR ready
31/03/22 end of work part 1 (to host Leonardo)
31/03/23 end of work part 2 (to host INFN DC)
15/02 start of executive project
74 days
334 days
365 days
2021 (Jan-Jun)
2021 (Jul- Dec)
2022 (Jan-Jun)
2022 (Jul - Dec)
2023 (Jan-Sep)
Technopole Renovation
EXEC PROJ.
Renovation of halls, common technical plants,
Data Center Leonardo + INFN (excluding B5 proximity plants)
Migration of DC

Preliminary works (December 2020)





B5 status (September 2021)

Migrazione al tecnopolo

- Migrazione Farm trasparente
  - Nuove cpu installate al cineca (~400kHS06) mentre le vecchie ancora in prod al cnaf
  - Spostamento delle vecchie dal CNAF (~120kHS06)
  - CPU from Leonardo a pledge?? (~300kHS06)
- Migrazione disco trasparente
  - 32PB disk buffer at tecnopolo
  - Spostamento dati dai sistemi che devono essere migrati sul buffer
  - Spostamento dei sistemi hw
- Tape:
  - Spostiamo una libreria alla volta
    - scritture ok sulla libreria che rimane online (liberiamo abbastanza spazio sulla vecchia)
    - Letture dipende da cosa viene richiesto, circa una settimana di down per libreria
  - Da capire se possiamo spostare le librerie nei momenti di shutdown e after data taking

Risorse al tecnopolo

If we assume that the growth profile of installed resources is within the "flat budget", in 2023 we will have to install at the new data centre about 820 kHS06 of computing power, 78 PB-N of disk and 170 PB of tapes (see section 5.2).

YEAR	CPU	DISK	TAPE
	kHS06	PB-N	PB
2023	820	78	172
2024	990	94	206
2025	1320	110	247

Table 25 - Growth profile of installed resources