

# T1 highlights

## Luglio 2023

# T1 highlights - stato gare Luglio 2023



- CPU
  - Gara da 60kHS06
    - Da installare nel CNAF attuale
    - ~~In arrivo entro fine anno~~ In arrivo Q1 2023 → ~~INSTALLATA, non ancora in prod~~ → **IN PROD**
- Disco
  - Aggiudicata gara da 14PB per GPFS
    - ~~Da installare nella sede attuale~~ → 2 rack
    - ~~Graduatoria da approvare lunedì 19/12~~ → aggiudicazione provvisoria a sistemi Lenovo ThinkSystem DE6600
    - ~~Contratto in fase di firma a giorni~~ → Contratto firmato
    - **Materiale consegnato – Installazione effettuata → Collaudo in corso**
  - Approvato in GE ~~19 Ottobre~~ ~~11 Novembre~~ 26 Novembre AQ per disco 2023 e 2024 (64+16PB)
    - Da Installare al tecnopolo
    - ~~Bando pubblicato, scade il 27/02/2023~~ In fase di valutazione tecnica da parte della commissione → aperte buste economiche → fase di verifica ~~anomalia~~ ==> Aperta busta amministrativa, necessario soccorso istruttorio (15gg) - puntiamo a GE di Settembre per aggiudicazione
  - Pubblicato bando per sistema CEPH su Cloud ISO27001
    - 2PB raw HDD + 700TB NVMe → gara conclusa
- TAPE
  - Da pubblicare Q1 2023 gara per nuova libreria da installare al tecnopolo – approvata (GE13421) → Gara Indetta
    - Bando scade il **15/05/2023** Da pubblicare Q1 2023 gare per nastro pledge+repack (53PB) – approvata (GE13420) → Gara Indetta → Fase di valutazione tecnica delle offerte
    - Bando scade il **08/05/2023** → **fornitore individuato, in attesa di delibera aggiudicazione ==> In attesa di contratto**

# T1 highlights - stato gare Luglio 2023



- RETE
  - Gara apparati attivi del tecnopolo
    - aggiudicata definitivamente GE (13416) → Contratto firmato
    - Per i core: VISTA Technologies con apparati ARISTA
    - 2M core core switch+mgmt
  - Gara Cablaggio passivo per il tecnopolo
    - Aggiudicata definitivamente GE13496 il 13/04/2023 → Fase di verifica requisiti per contratto → Contratto firmato
    - Prossima settimana sopralluogo per approvvigionamento materiali da parte della ditta ==> Materiali ordinati a parte una piccola parte per cui non è ancora definibile il computo metrico
      - 40% ribasso su 600k + iva
      - **Necessaria una variante per collegamento sala K2 (probabile sesto quinto)**
- Altre Gare
  - «HPC Boubles» su progetti PNRR Terabit+DARE
    - CPU + DISCO + InfiniBand
    - Gara Nazionale
      - Per il CNAF 6Meuro su 13Meuro → Inviata ieri per revisione Intellera/AC → Bando pubblicato la prossima settimana ==> scadenza 03/08

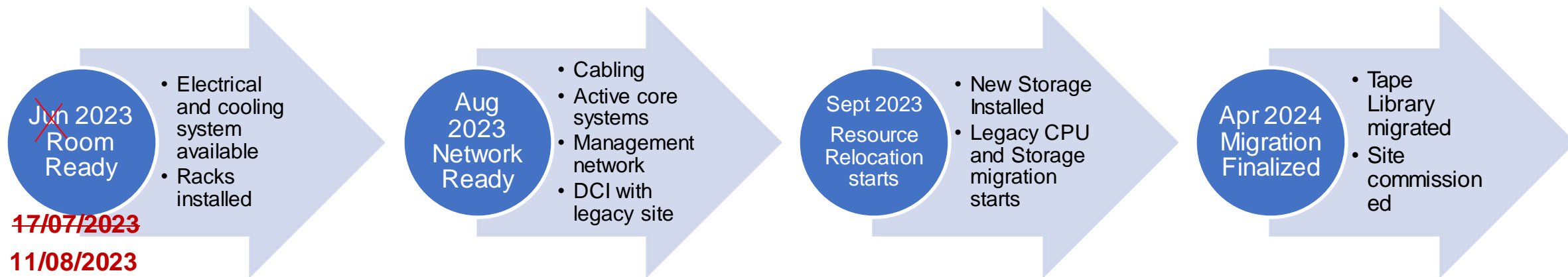
- Infrastruttura
  - Prolungata manutenzione per entrambi i KS fino a fine 2023
  - Effort su lavori infrastrutturali al Tecnopolo
    - Variante lavori edili, apparati meccanici+elettrici + rack, approvata → lavori in corso – nuovo GANTT stima fine lavori **17/07/23 ==> stimata 11/08/23**
    - In preparazione gare:
      - trasloco apparati (cnaf)
      - manutenzione pluriennale dei sistemi (cineca)
- Rete
  - Interconnessione B.Pichat-Tecnopolo
    - Portati due rack in sale K2 (comuni con CINECA)
    - Il 4 aprile sono state rilasciate le 6 coppie Tecnopolo(Ferrarese)-BO04.
    - Completate anche le 6 coppie provvisorie tra Tecnopolo(Ferrarese)-BO01
    - Installati apparati GARR



# The new INFN Data Center at Bologna Tecnopolo



# Live Relocation Timeline



- **Live Migration**
  - Legacy site “extended” through a DCI channel 1.2Tbit/s
  - Data moved to a new storage
  - CPUs moved in chunks
- Down only for tape libraries
  - Need dismantle and re-assembling

# A brand-new data center for CNAF

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- Renew infrastructures to be ready for the HL-LHC era
  - up to ~ 2035 and beyond
- Use more compact computing
  - from today's ~ 20 kW/rack to 80 kW/rack DLC
  - Integration with CINECA-Leonardo Supercomputer
- Lower the PUE (*power usage effectiveness*)
  - Targeting 1.08-1.10
- Extend and expand networking for a future-proof infrastructure

# The opportunities ....

- In **2017**, Bologna won a bid to host the datacenter of the “*European Centre for Medium-Range Weather Forecasts*” - ECMWF
- The Emilia Romagna region decided to repurpose the “*Manifattura Tabacchi*” area to host a technology district, hosting ECMWF and more

Roughly  
250x250 m<sup>2</sup>

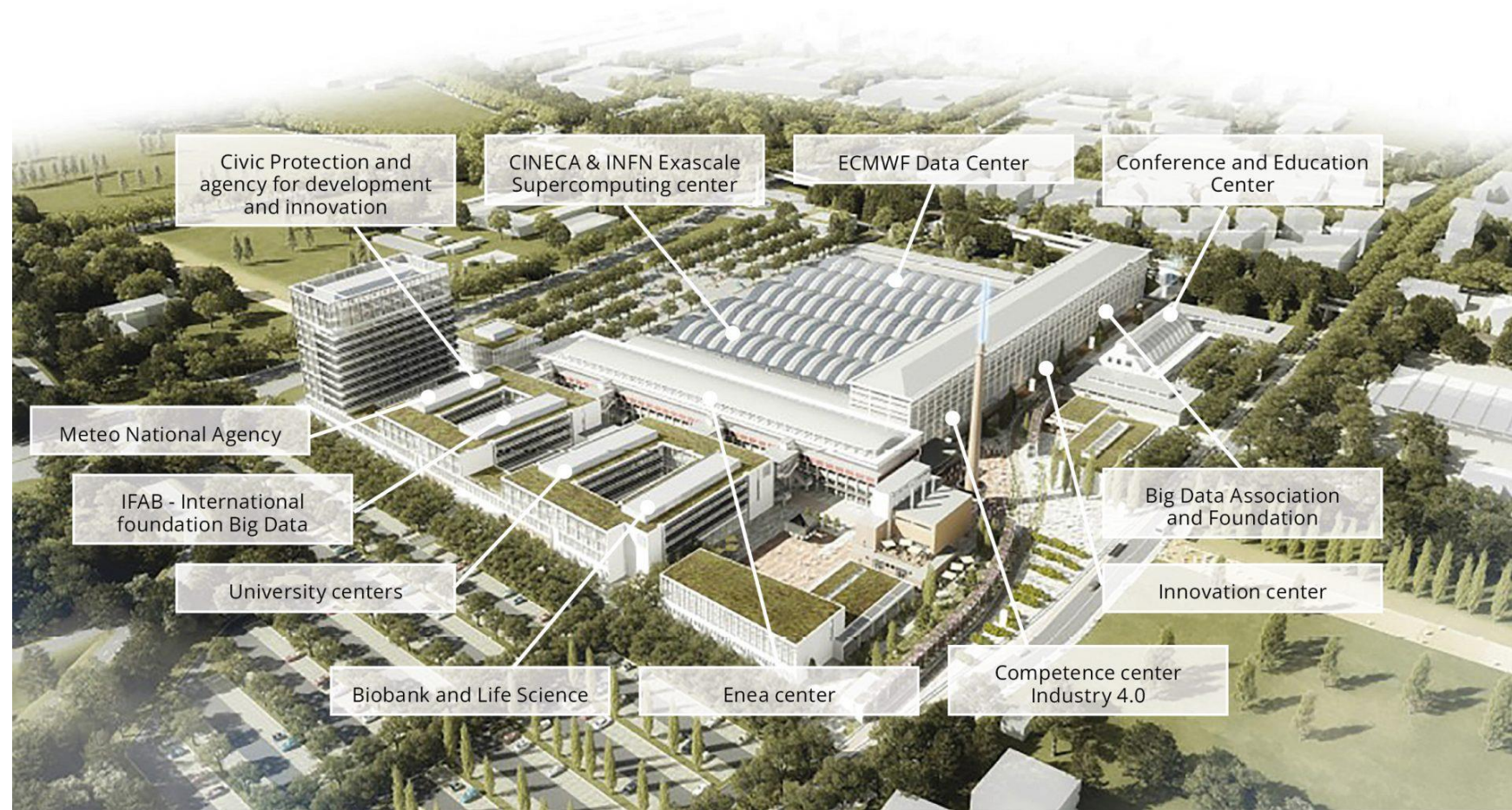


How it will be



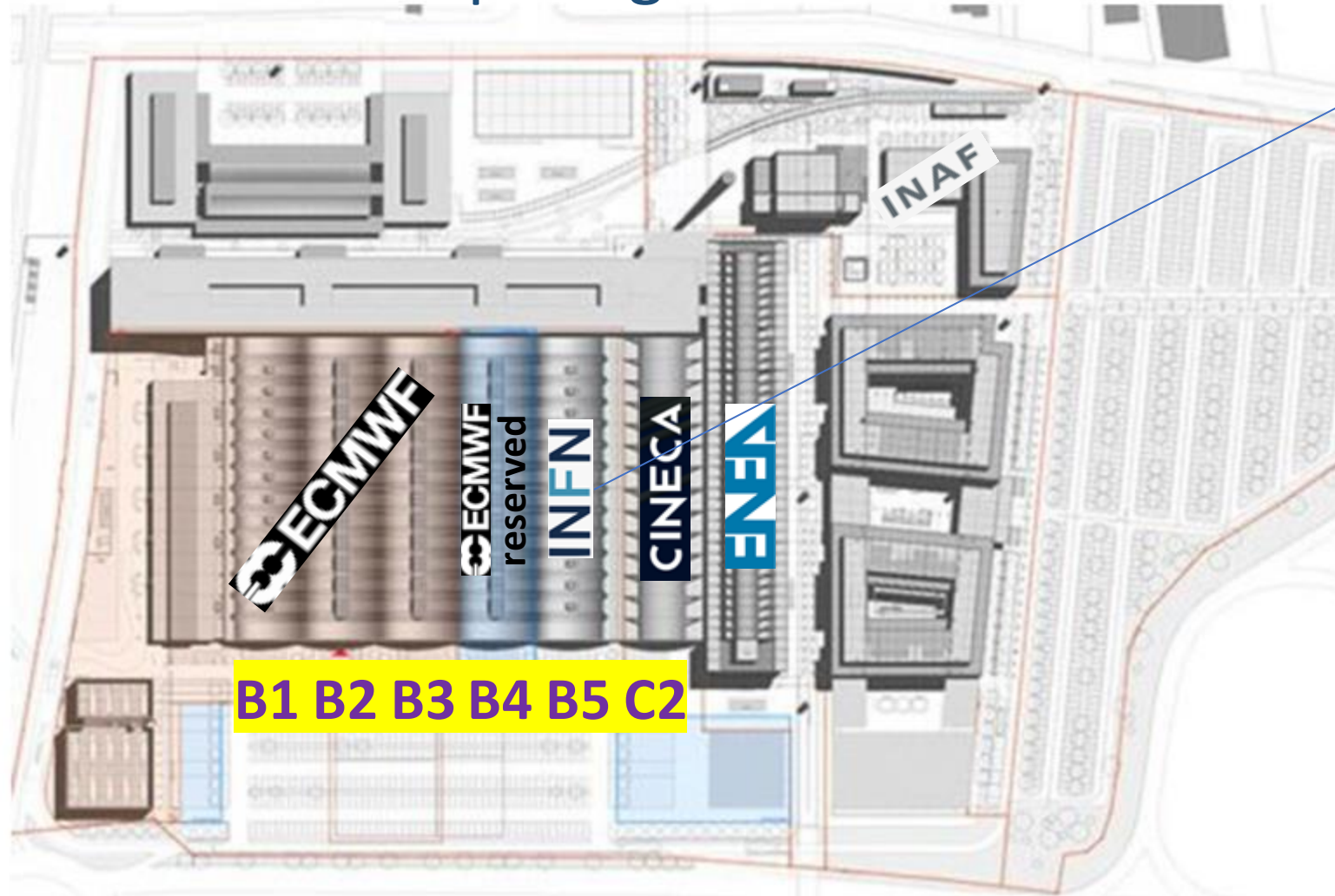
# What can the Tecnopolo host?

- Not only research infrastructures and supercomputers
- Areas for
  - Technological institutions
  - university
  - innovation hubs
  - technology transfers
  - Industry 4.0
- Restaurants



# What can the Tecnopolo host?

## The computing infrastructures



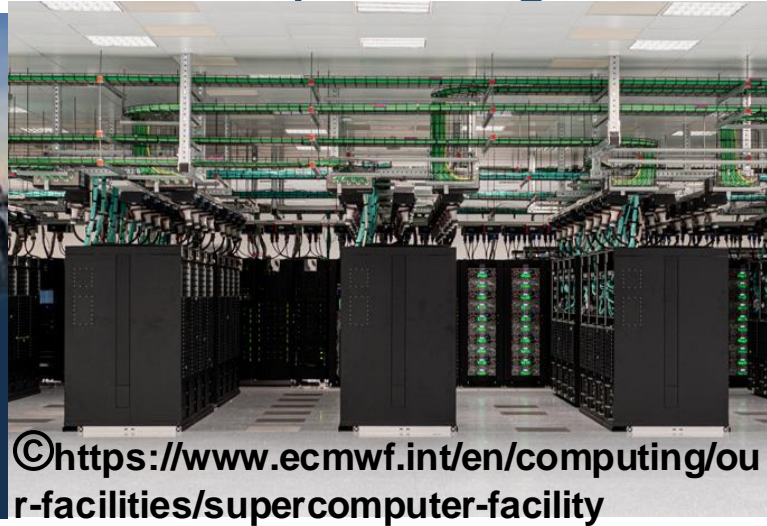
Each of the 6 “botti” (barrels) is  
~5000m<sup>2</sup> of usable IT space



Same architect and design of the  
“Sala Nervi” in the Vatican

# The INFN+CINECA project

- The ECMWF is already running!



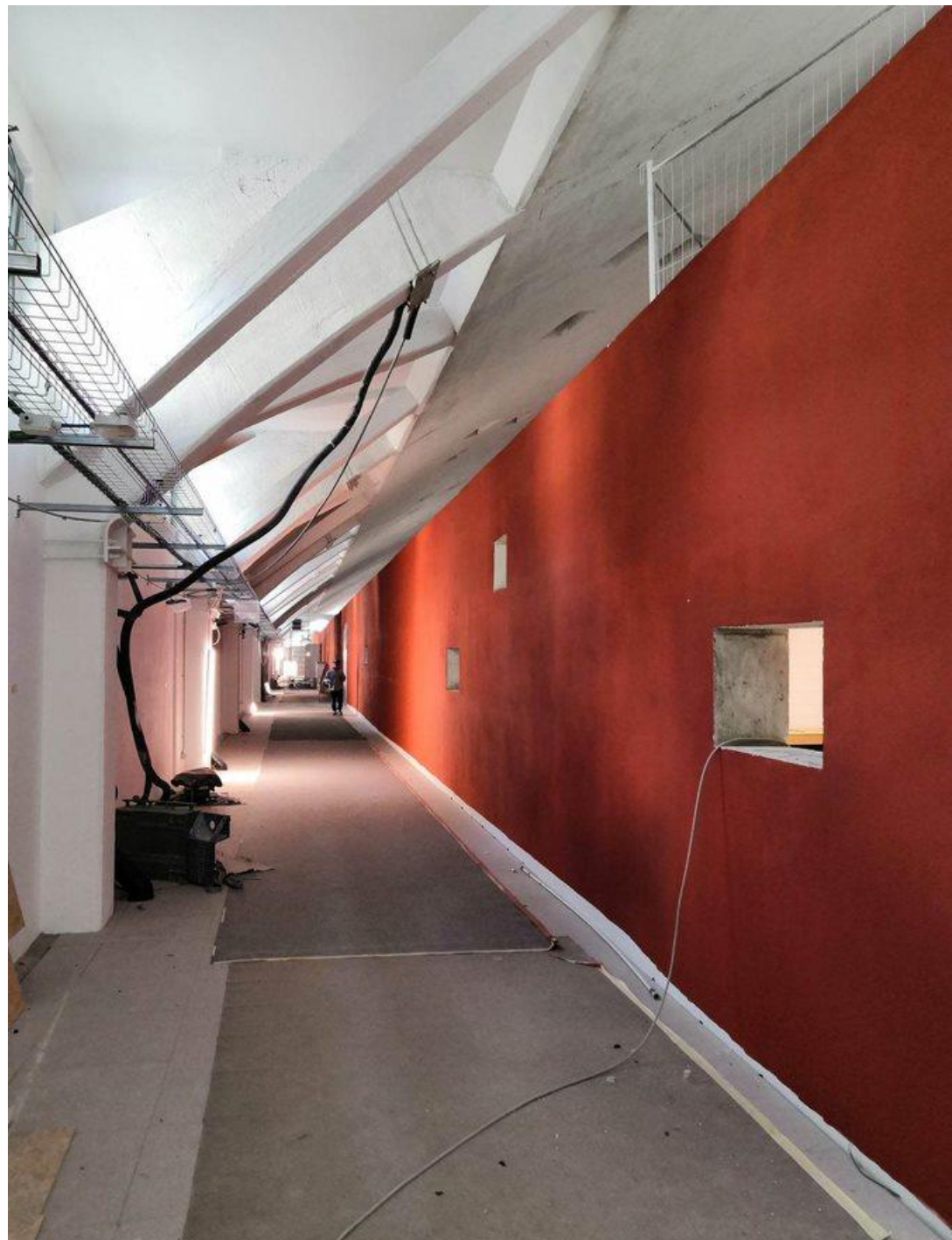
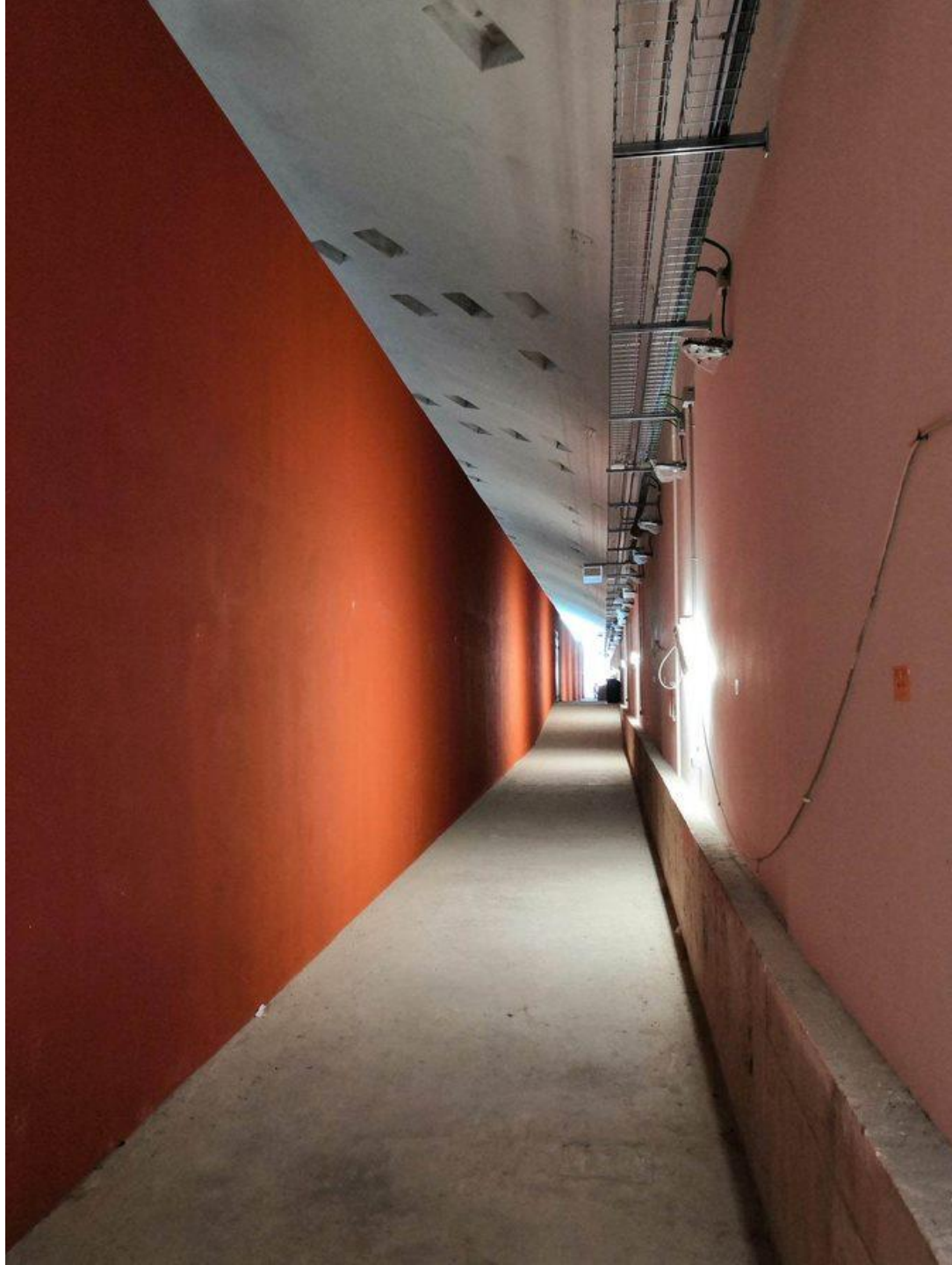
- CINECA Leonardo was commissioned in October 2022
  - 4<sup>th</sup> in top500.org Nov22

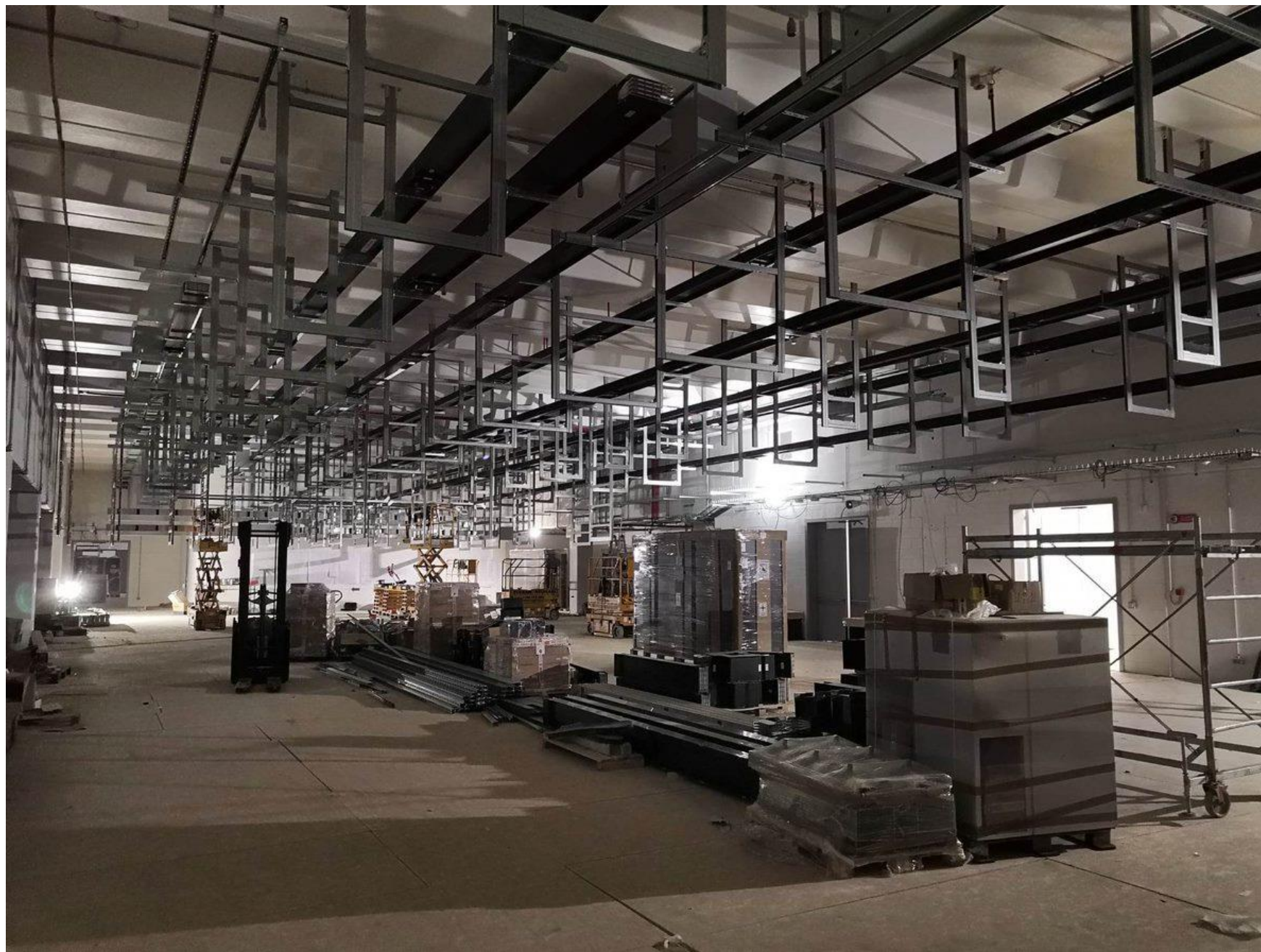


- CNAF “B5” Barrel expected to be ready by mid 2023
- Two phases expected
  - **Phase-1 (2023-2025)**
    - Leonardo + T1-CNAF → 13 MW
  - **Phase-2 (2025+)**
    - infrastructure up to 25 MW ready for post-exascale and for HL\_LHC

20 Aprile 2023





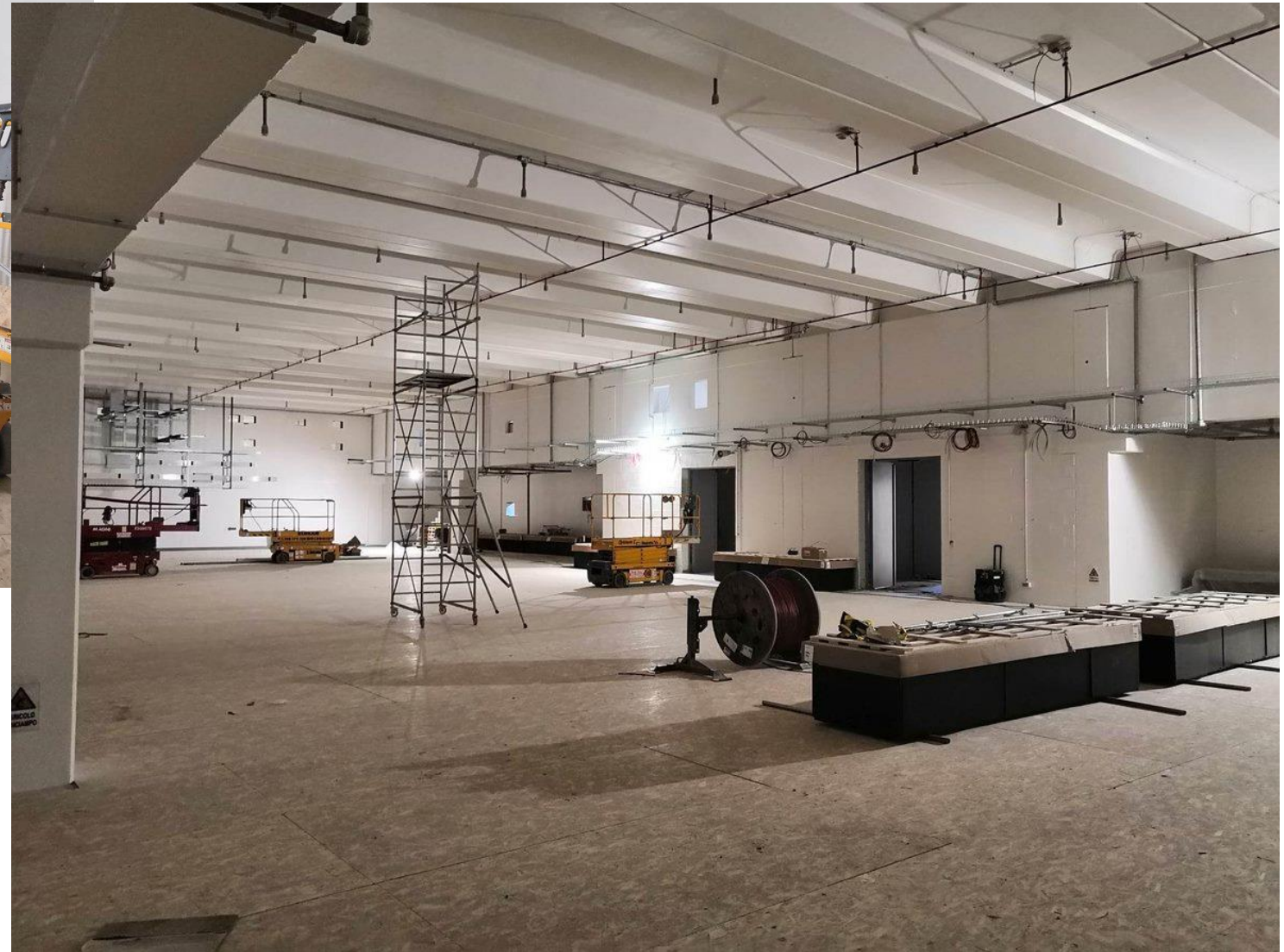


Storage 26/05

Zona Tape

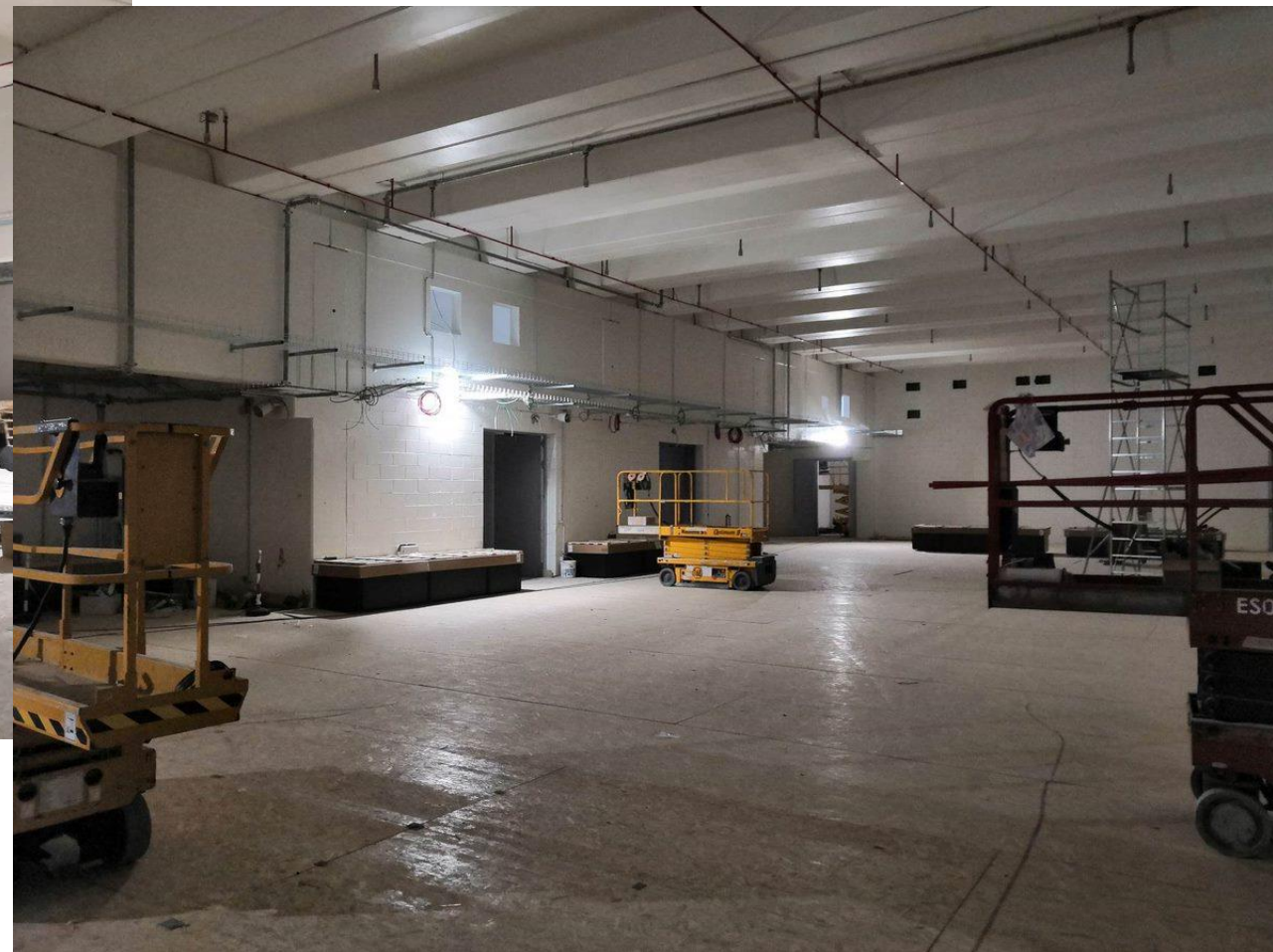
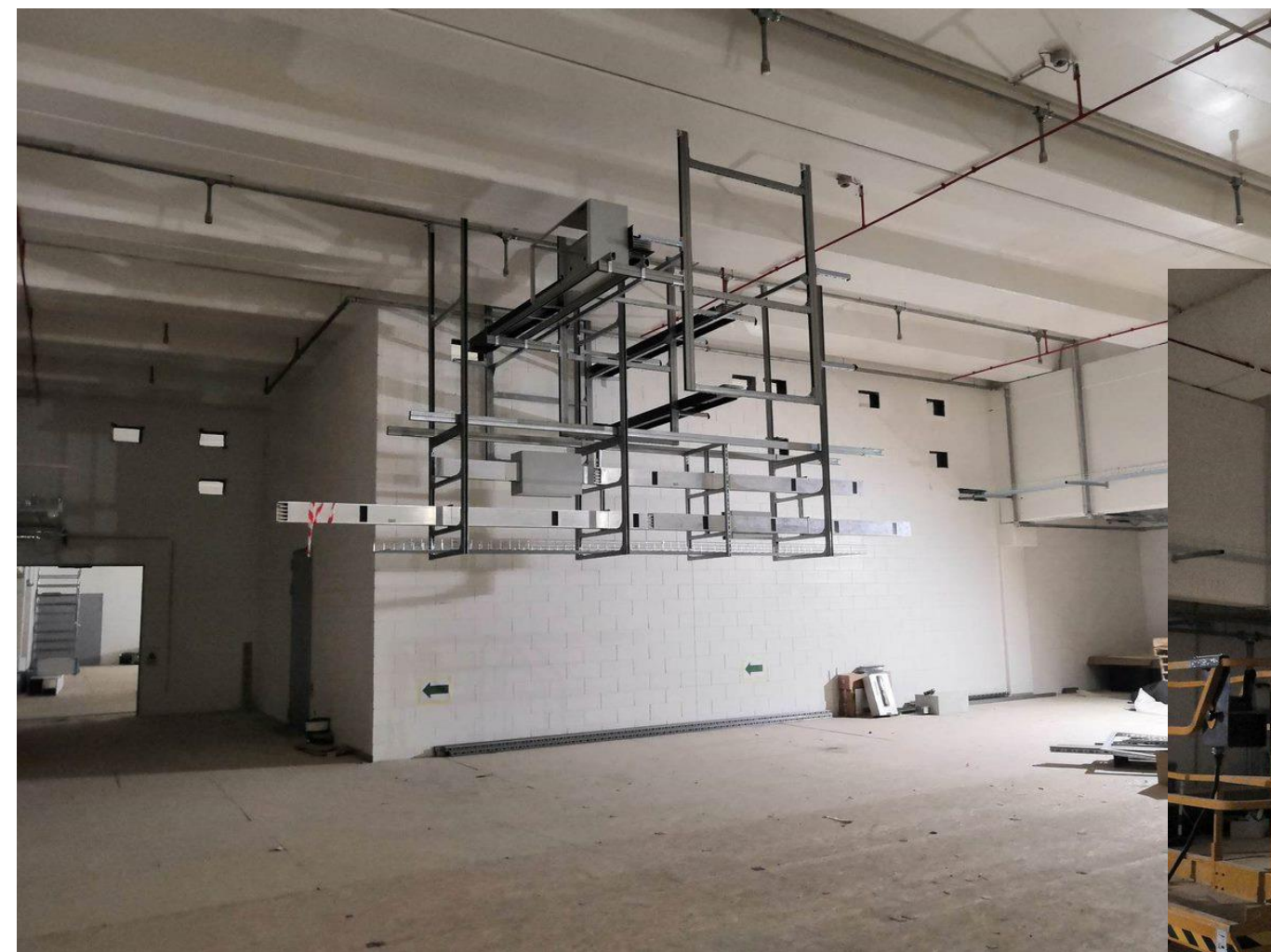


Zona Storage

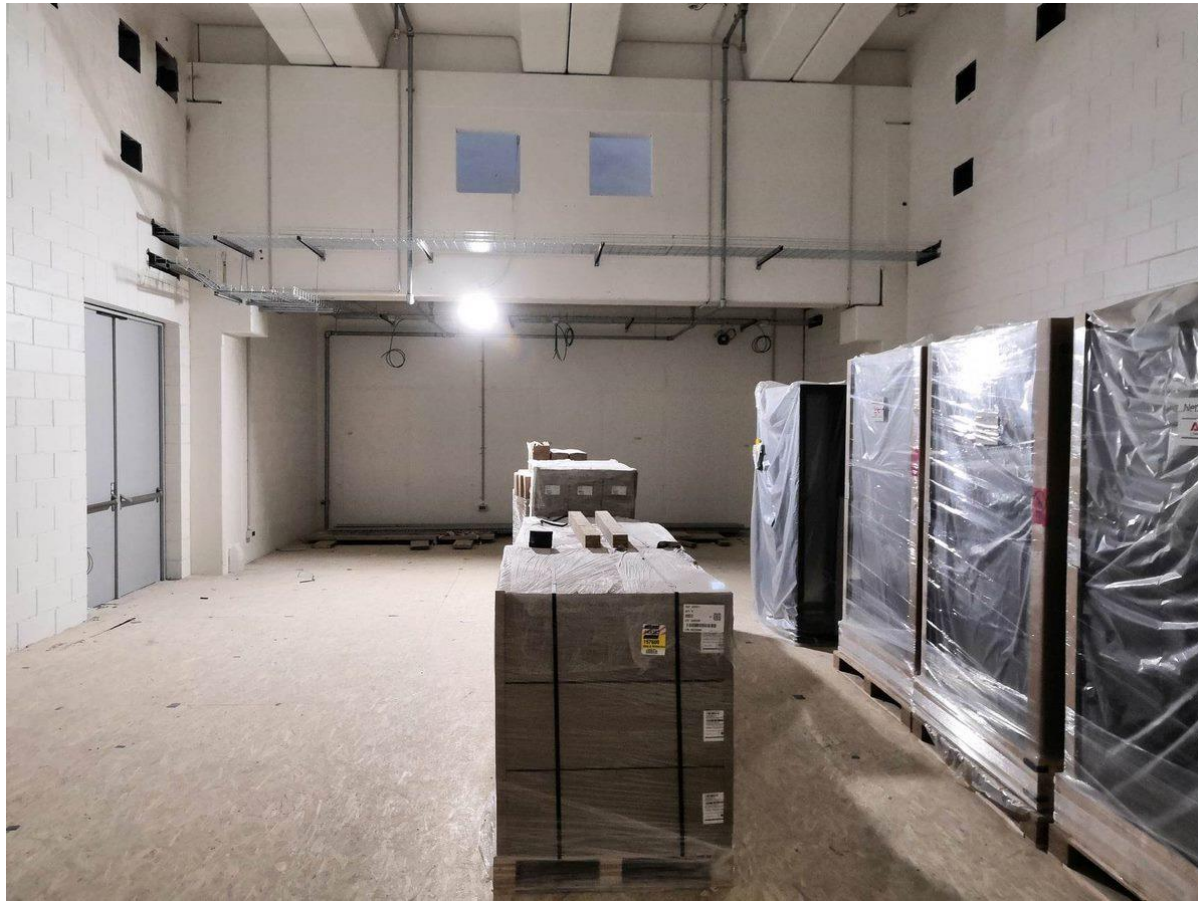




## Zona Storage con Blindo



Zona Rete



Zona CPU



Zona CPU  
Sotto il pavimento

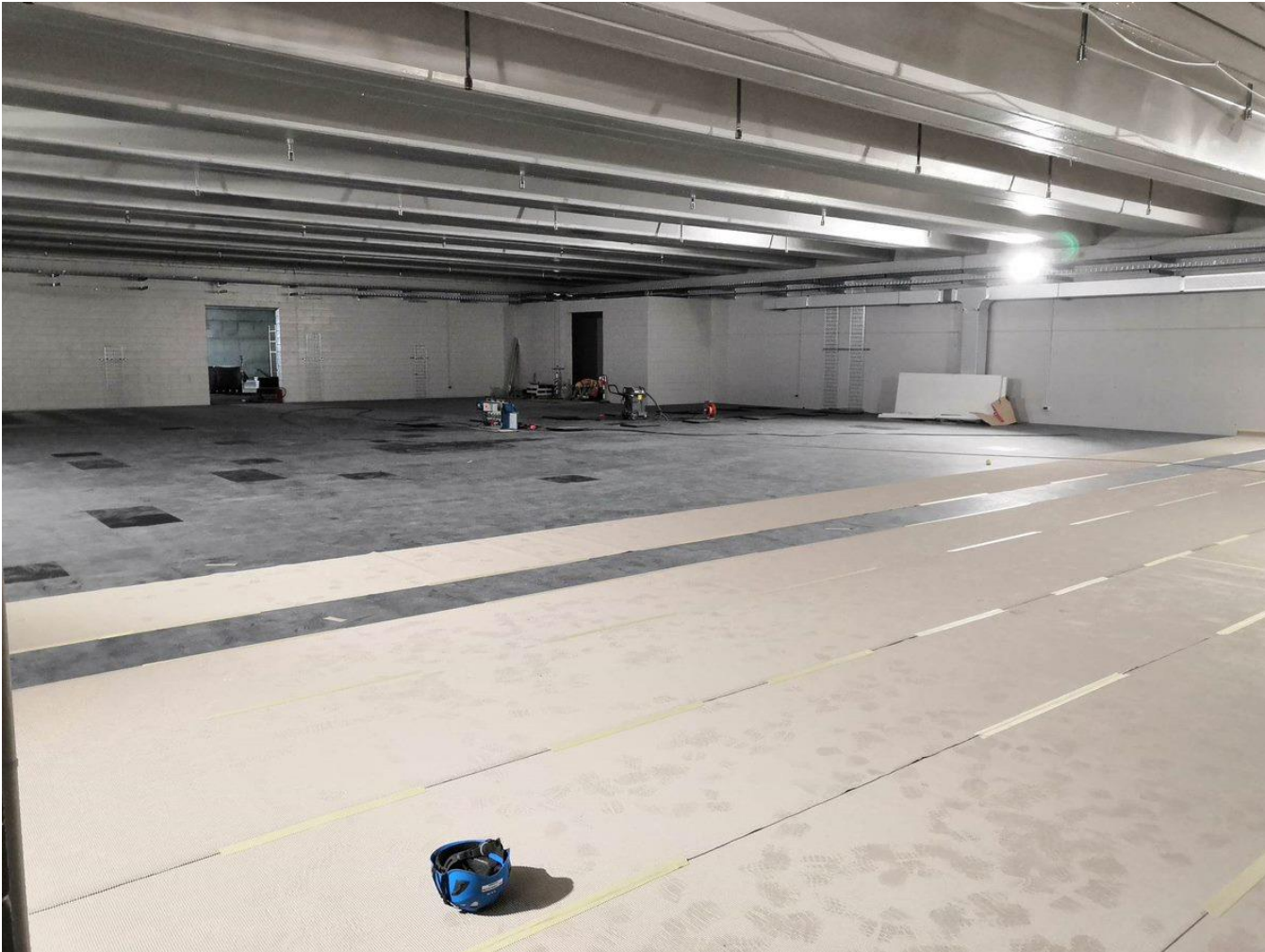


Zona Espansione



Febbraio 2023

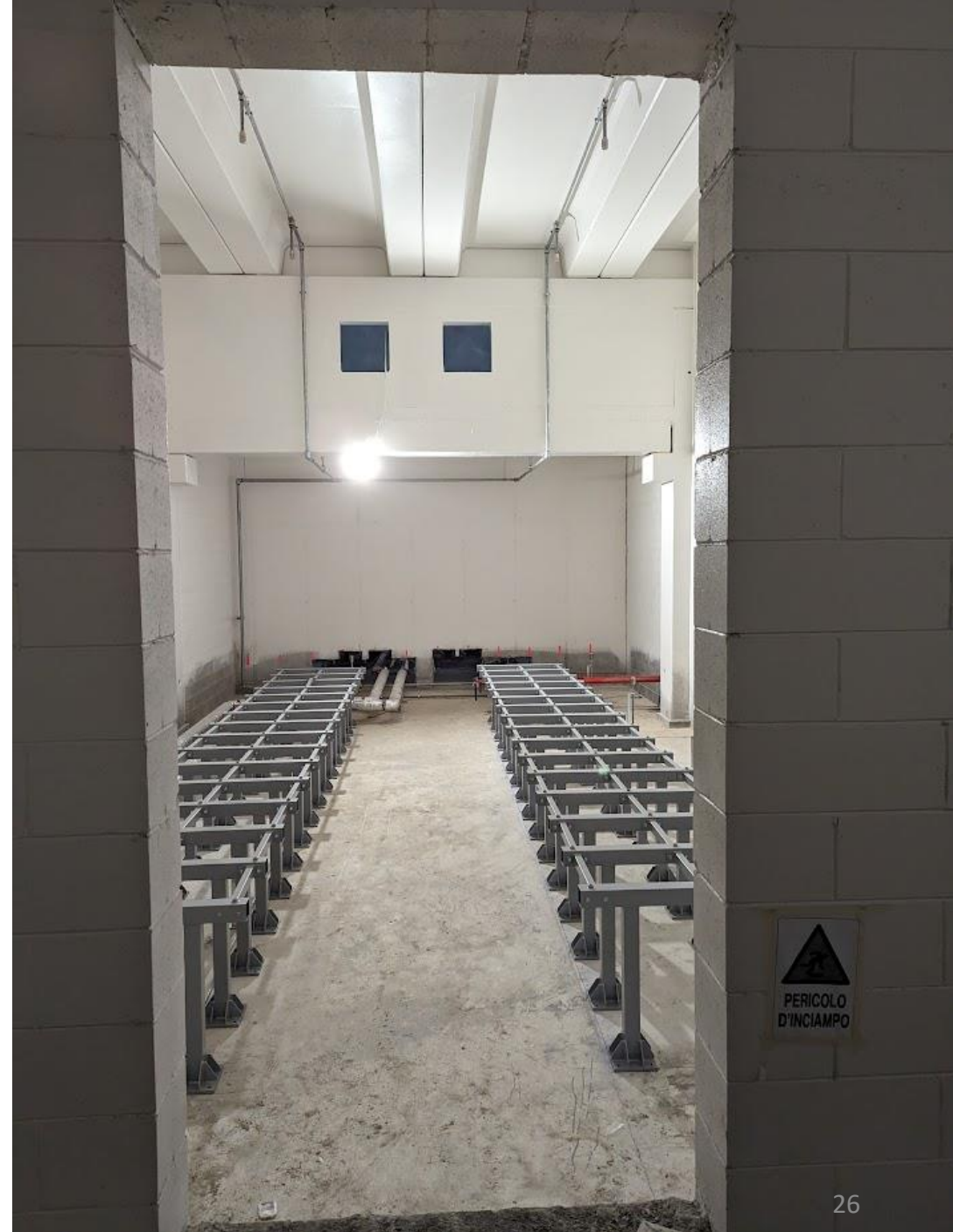
Zona Espansione 01/02/2023  
+ blindo Espansione



Sala bassa densità  
09/02/23



Sala bassa densità 09/02/23



Sala alta densità 09/02/23





Vasca raccolta acqua  
esterna 09/02/23





Dicembre 2022









Zona Uffici 09/02/23







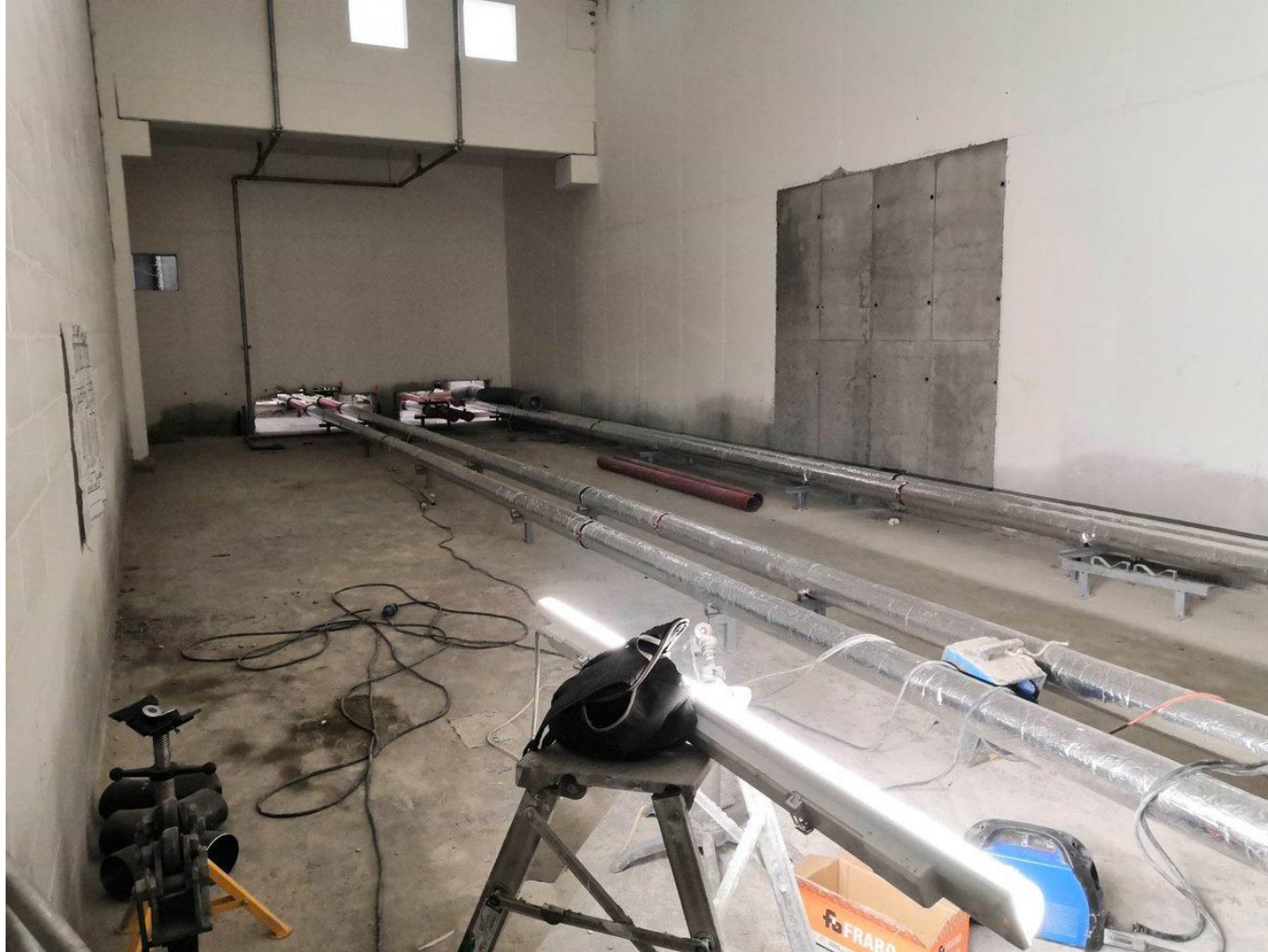


Zona Espansione 15/12/2022



Sala bassa densità 15/12/2022

Sala tape 01/02/23





Zona Alta densità 15/12/2022

Giugno 2022

Current status.....



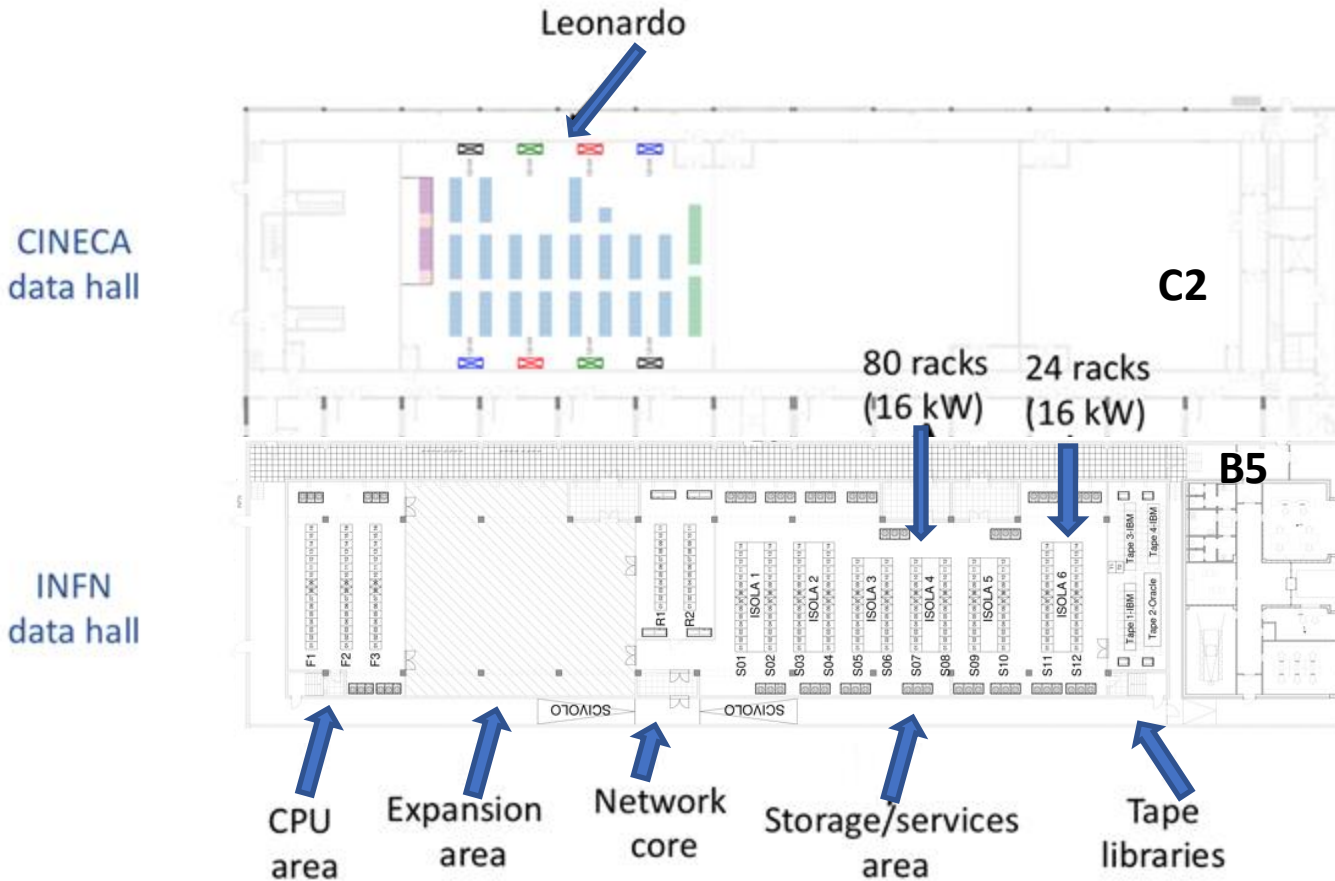
CNAF Barrel







# CNAF and CINECA data halls



**DLC 80kW**



- The new CNAF Datacenter will feature the following main areas
  - High Density – 2-3 rows for 80kW racks
  - Low density – 80+24 16kW racks
  - Expansion area
  - Tape libraries areas
    - Up to 4 libraries
- The CPU area can host up to 3MW of CPUs via 42 DLC high density racks
- The low-density area will be used to host
  - Storage systems
  - CNAF Cloud Infrastructures
  - ISO certified Cloud racks
- Cooling
  - Air cooled Cold Corridor aisles
  - Direct Liquid in High Density
- 3+1 redundancy in all the infrastructure facilities

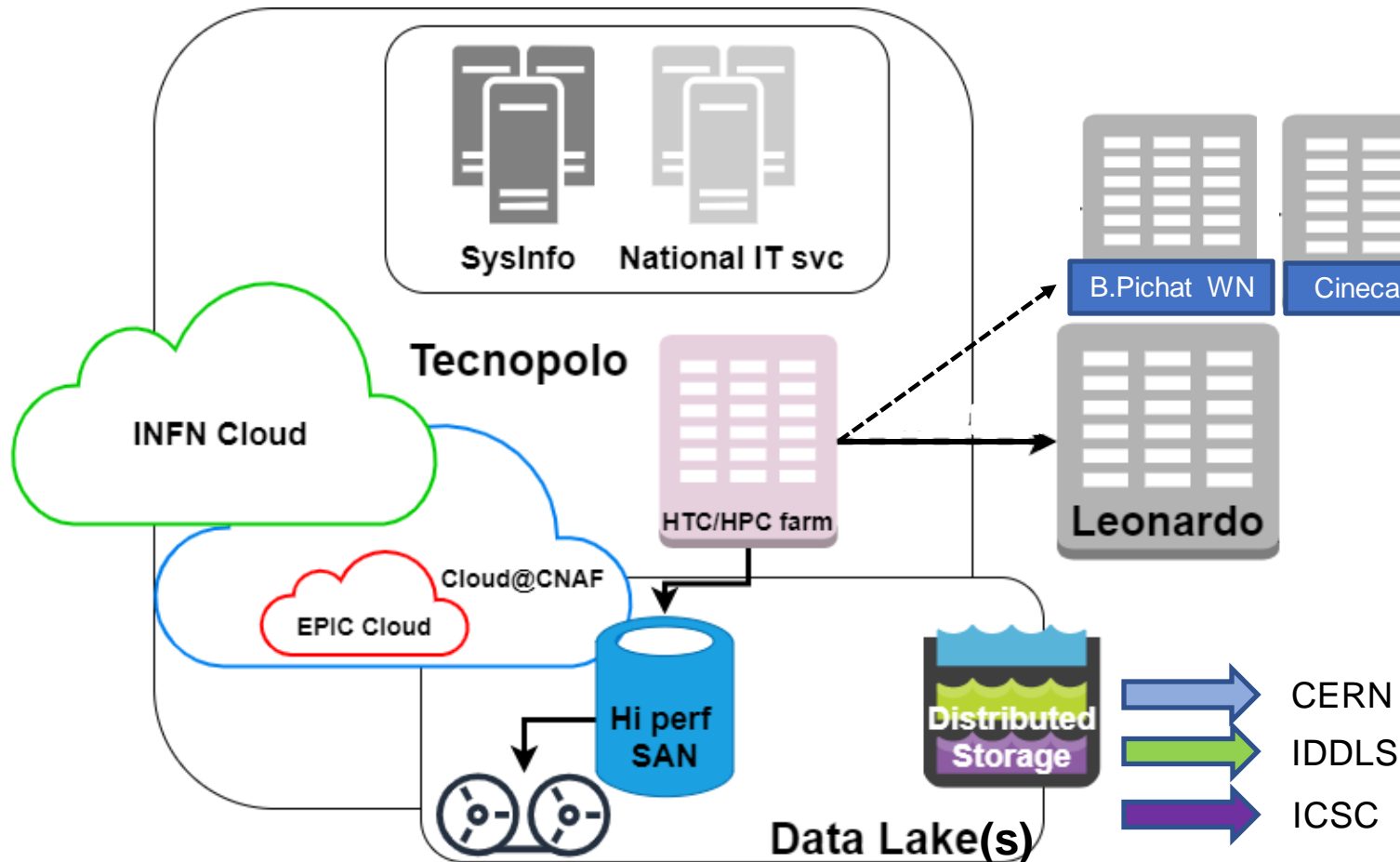
# The cooling system and the PUE

- 4 central refrigerator Units
    - 3+1 redundancy
  - Chilled water 19-26 °C for the low density air cooled racks
    - 2 MW Chillers
    - Total/partial free cooling is possible
  - Warm water 37-47 °C for DLC racks
    - 2,25 MW Chillers
  - To be doubled in the second phase
- **High Density CPU Area**
    - 4 CRAH - 200 kW each (3+1)
  - **Network Area**
    - 4 CRAH - 75 kW each (3+1)
  - **STORAGE Area**
    - 16 CRAH - 200 kW each (12+4)
    - Cold corridor aisles
  - **TAPE Area**
    - 4 CRAH - 25 kW each (3+1)

$$\text{PUE}_{\text{DLC}} \approx 1.08$$

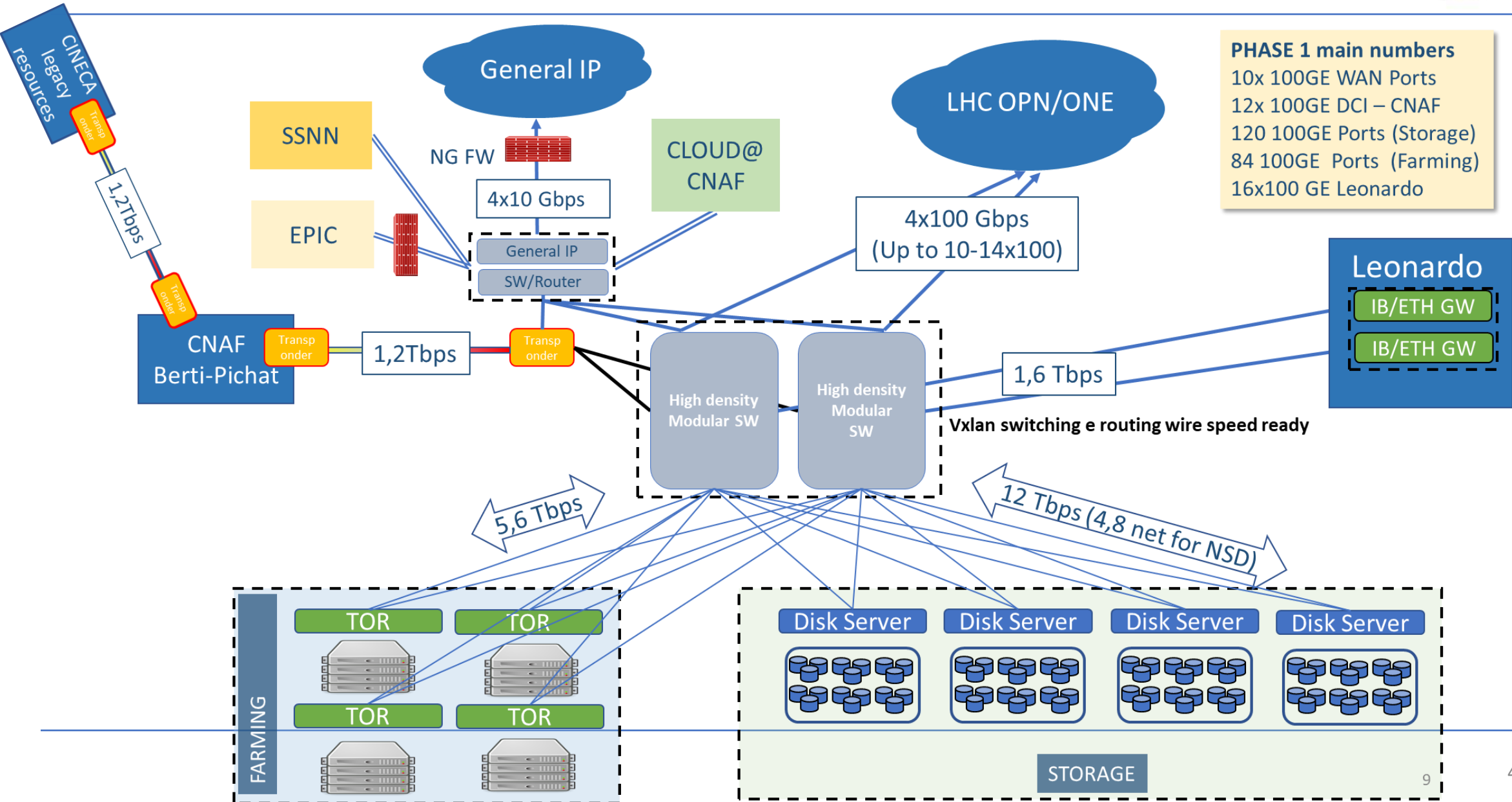
$$\text{PUE}_{\text{Tot}} \approx 1.2 - 1.3$$

# A “distributed” datacenter



- Multiple “locations”
  - CNAF Technopole
  - CINECA Leonardo CPU access
  - INFN-CLOUD federated cloud
  - Data-lake(s)
    - DCI with INFN sites
    - DCI with CERN
    - New national data lake for the ICSC project
      - The ICSC headquarter will be at the Technopole

# A Complex Networking Infrastructure



**PHASE 1 main numbers**  
 10x 100GE WAN Ports  
 12x 100GE DCI – CNAF  
 120 100GE Ports (Storage)  
 84 100GE Ports (Farming)  
 16x100 GE Leonardo

**Leonardo**  
 IB/ETH GW  
 IB/ETH GW

**FARMING**  
 TOR  
 TOR  
 TOR  
 TOR

**STORAGE**  
 Disk Server  
 Disk Server  
 Disk Server  
 Disk Server

# Communication



But since I was curious, I asked: what can you actually do with these supercomputers?

**Data Valley:**

<https://www.youtube.com/watch?v=96TfXHCWxf8>



They answered: everything you can think of... and other things you can't even imagine.