

T1 highlights

Giugno 2023

T1 highlights - stato gare Giugno 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
 - 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**

T1 highlights - stato gare Giugno 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
 - 40% ribasso su 600k + iva
- 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

- 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**
 - 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
 - Ieri installati apparati GARR



TECNOPOLO
MANIFATTURA
DATA VALLEY HUB

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

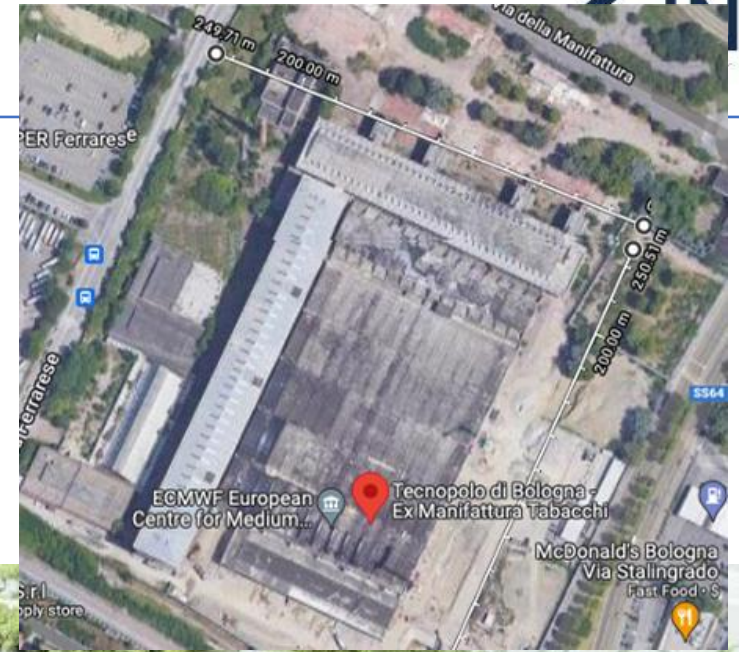


- Renew infrastructures to be ready for the HL-LHC era
 - up to ~ 2035 and beyond
- Use more compact computing
 - from today's ~ 20 kW/rack to 80 kW/rack DLC
 - Integration with CINECA-Leonardo Supercomputer
- Lower the PUE (*power usage effectiveness*)
 - Targeting 1.08-1.10
- Extend and expand networking 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 m²

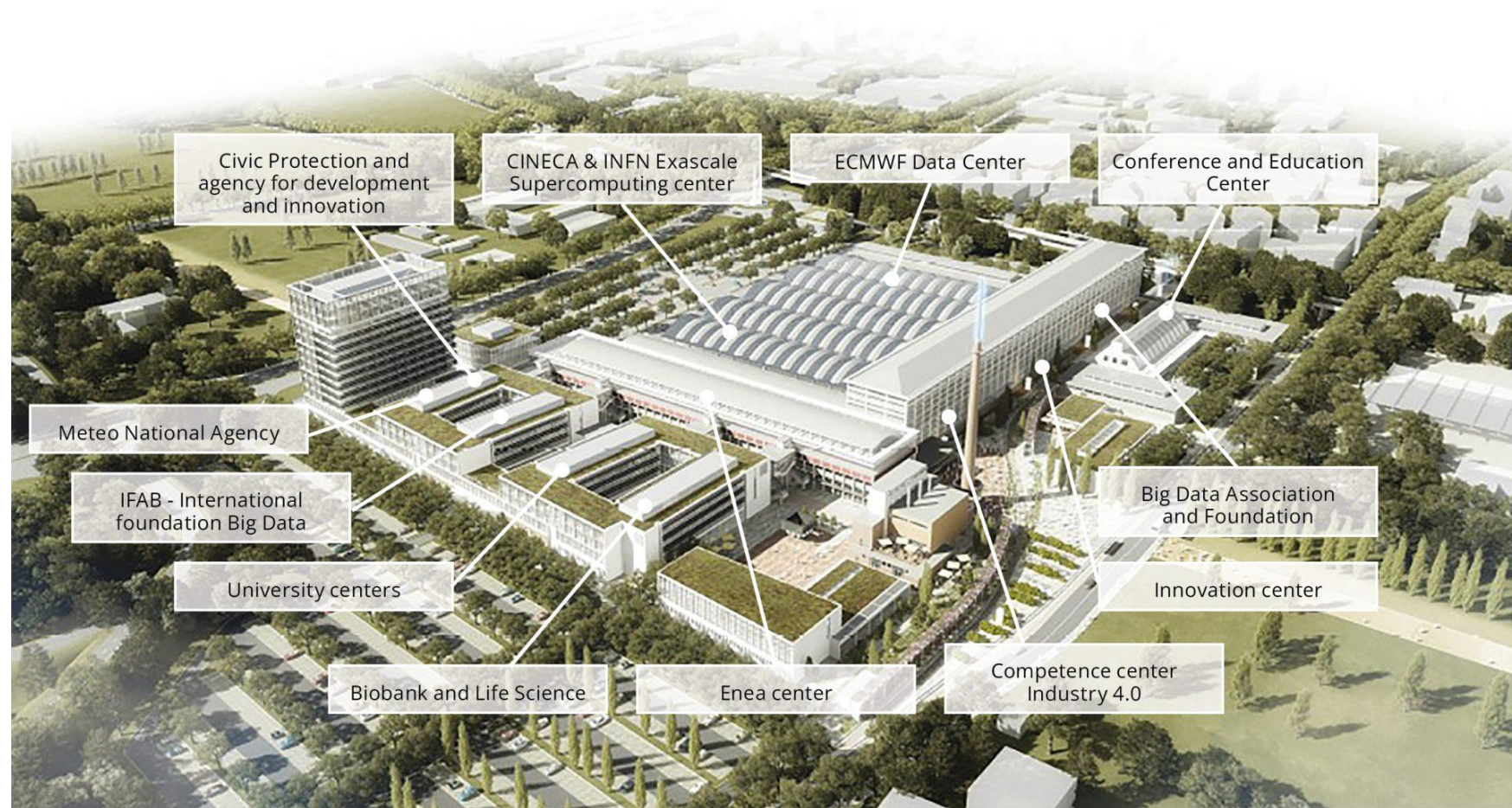


How it will be



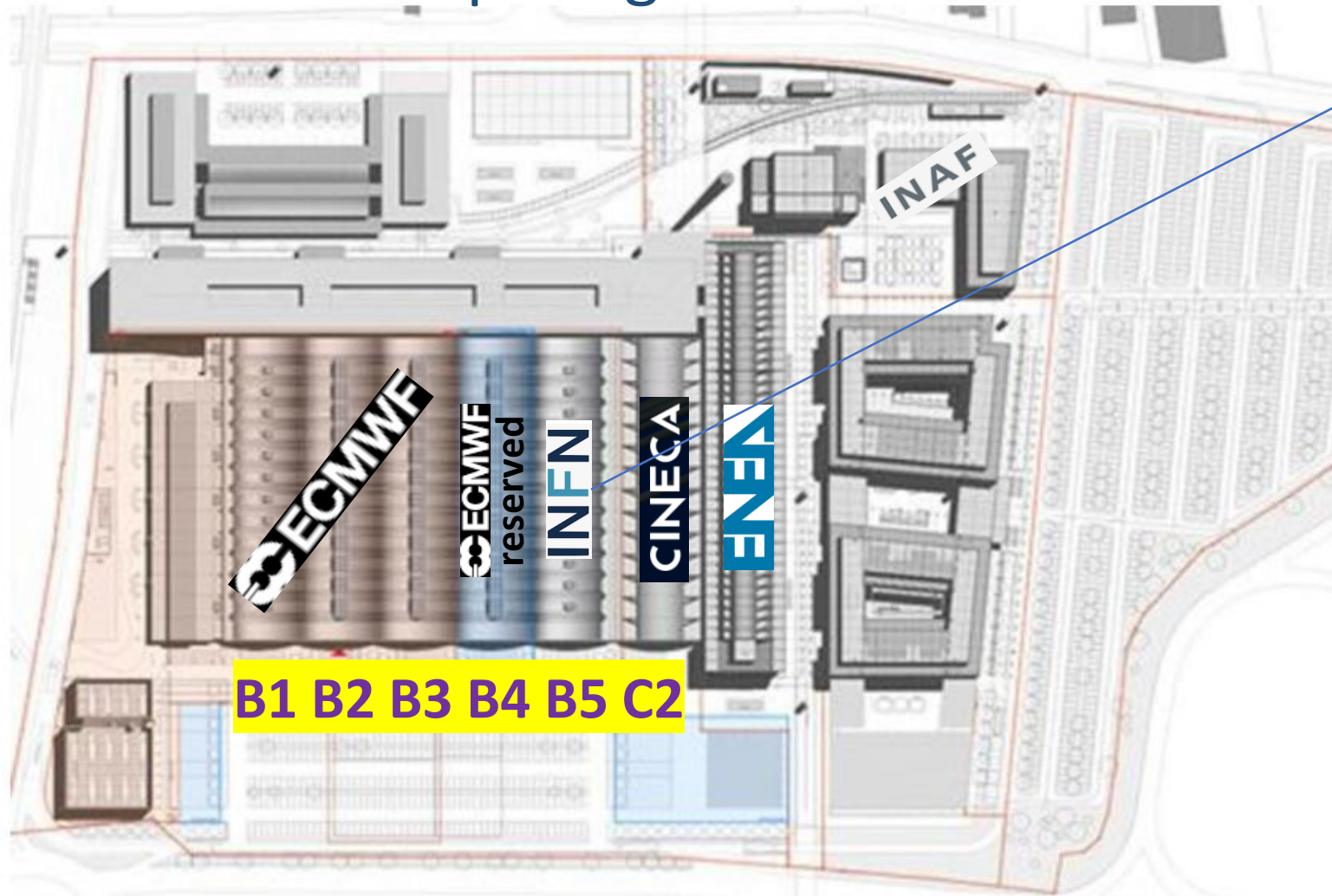
What can the Tecnopolo host?

- 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



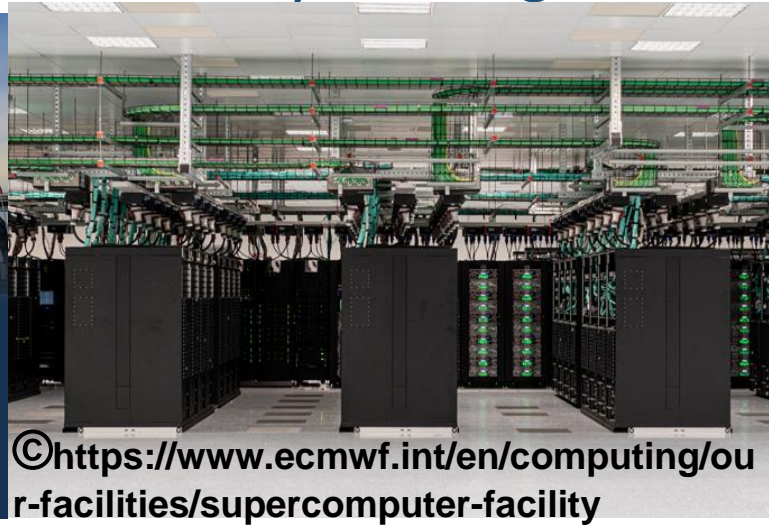
Each of the 6 “botti” (barrels) is
~5000m² of usable IT space



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

The INFN+CINECA project

- The ECMWF is already running!



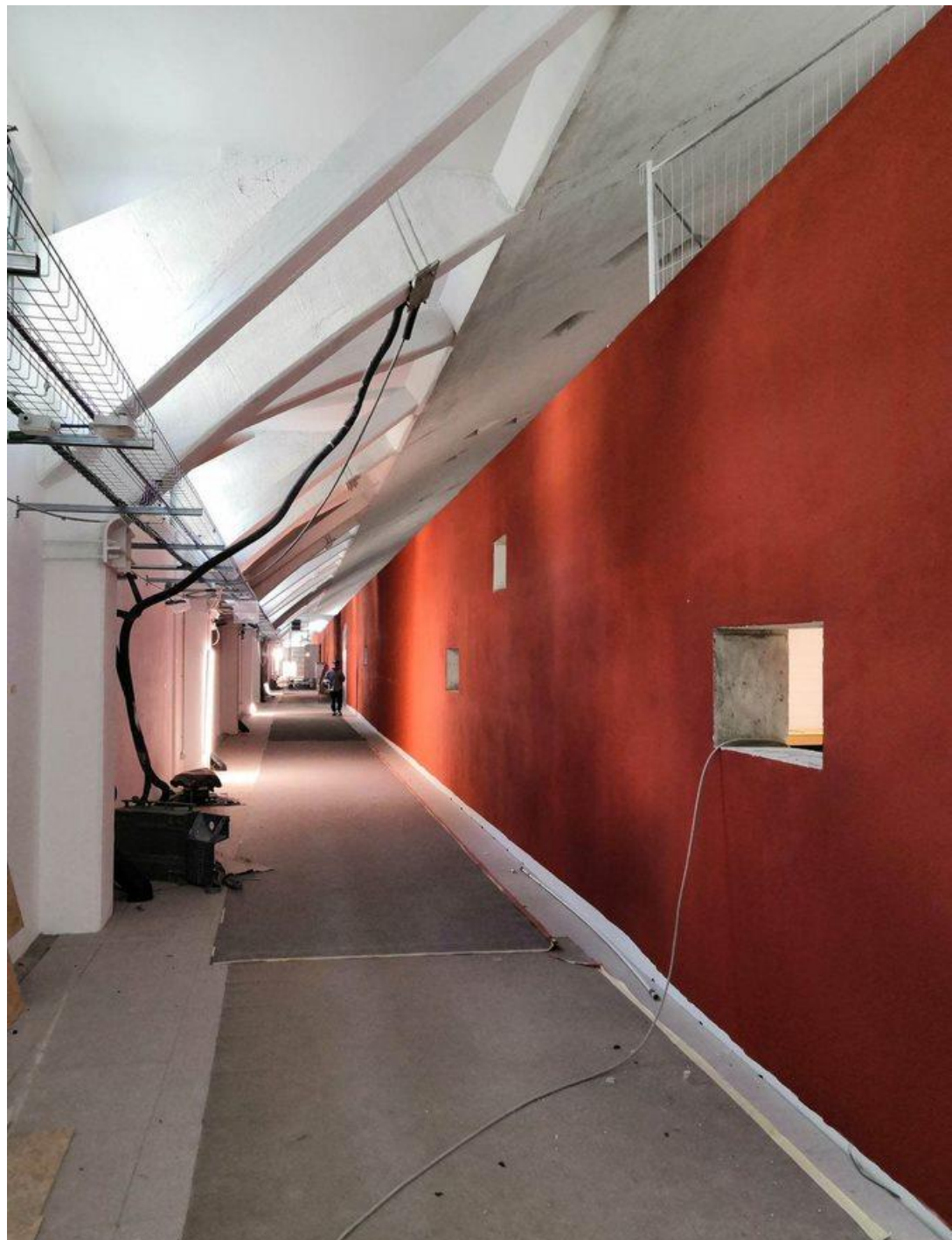
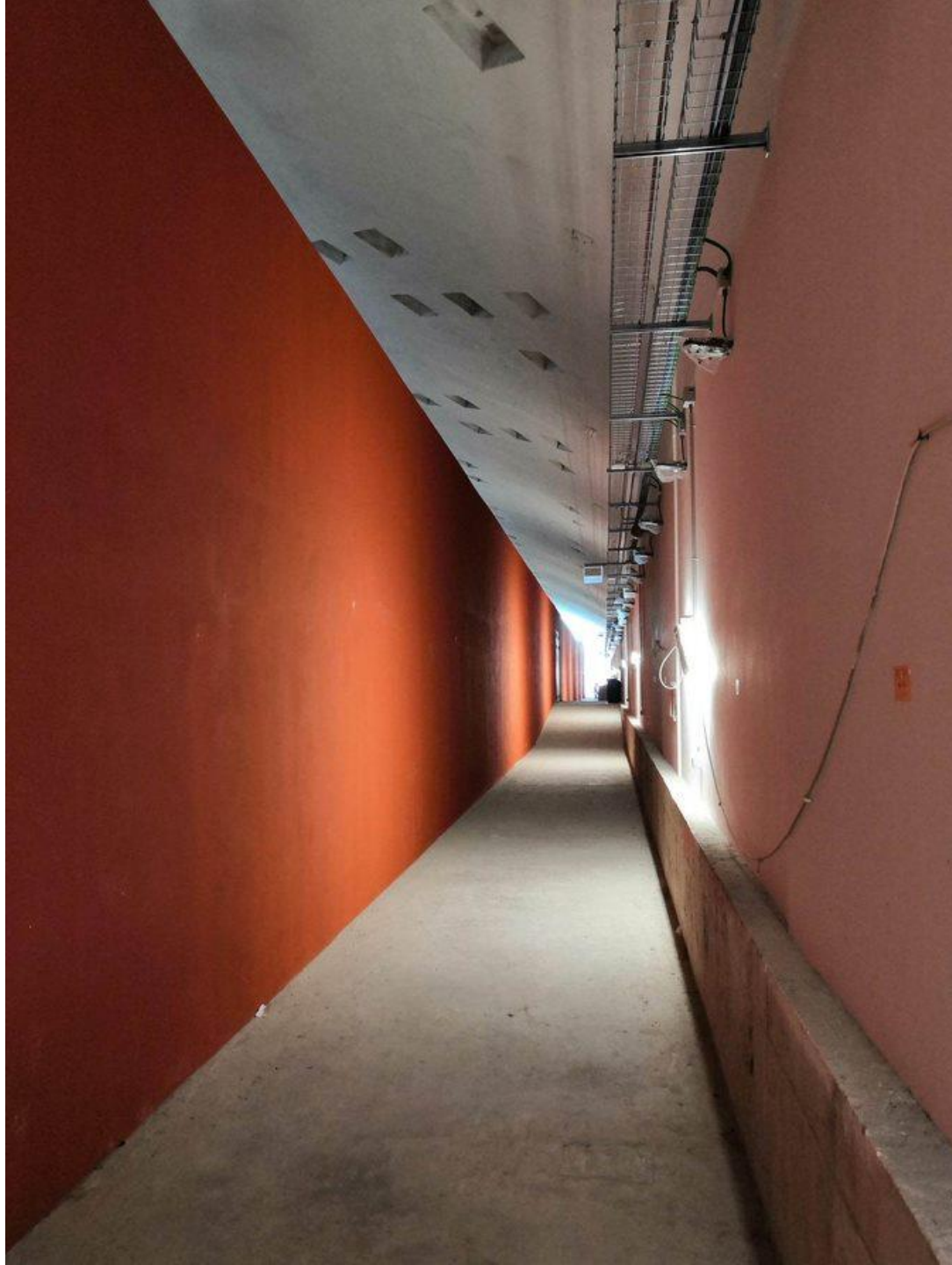
- CINECA Leonardo was commissioned in October 2022
 - 4th in top500.org Nov22

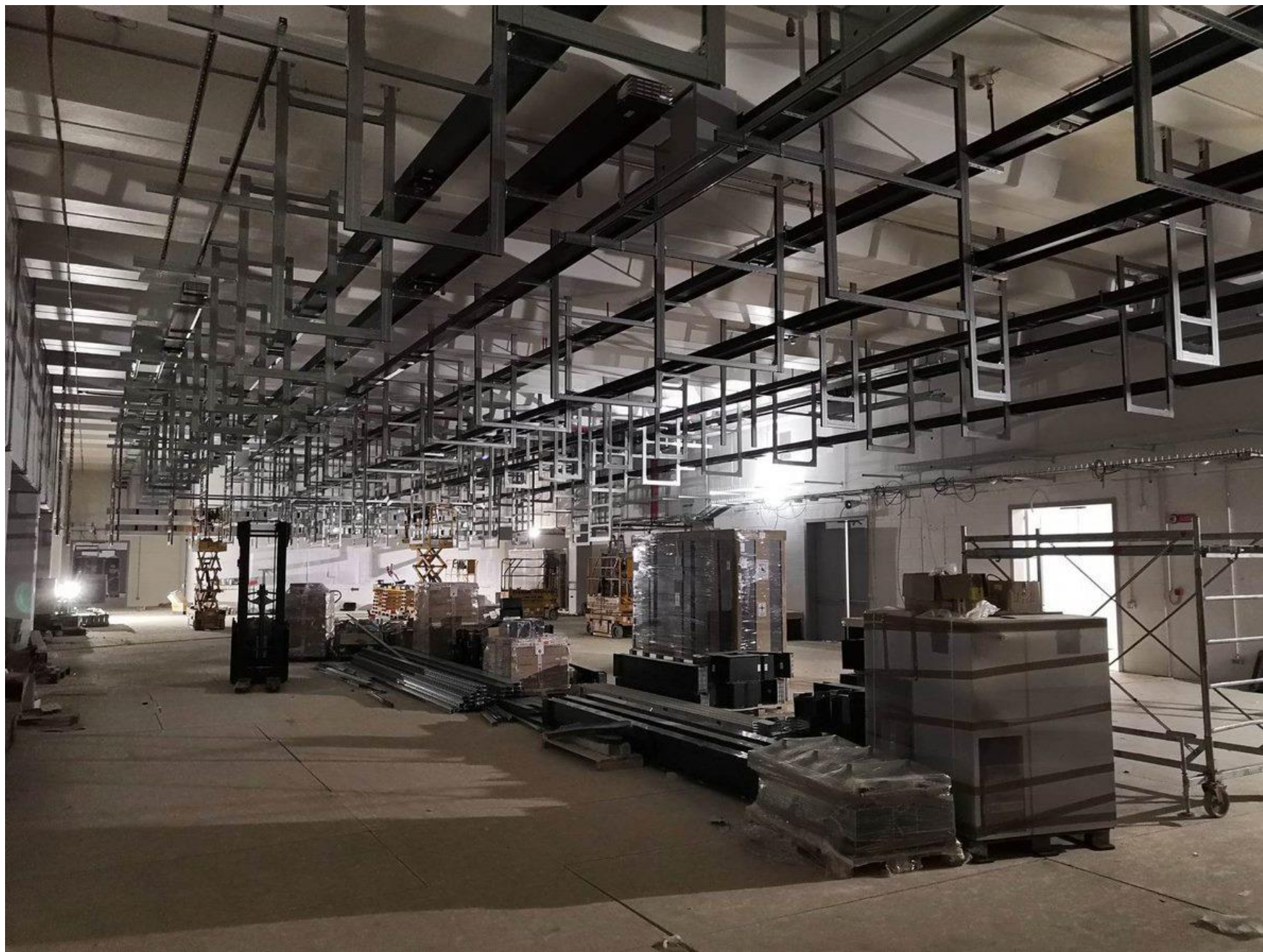


- CNAF “B5” Barrel expected to be ready by mid 2023
- Two phases expected
 - **Phase-1 (2023-2025)**
 - Leonardo + T1-CNAF → 13 MW
 - **Phase-2 (2025+)**
 - infrastructure up to 25 MW ready for post-exascale and for HL_LHC

20 Aprile 2023







Storage 26/05

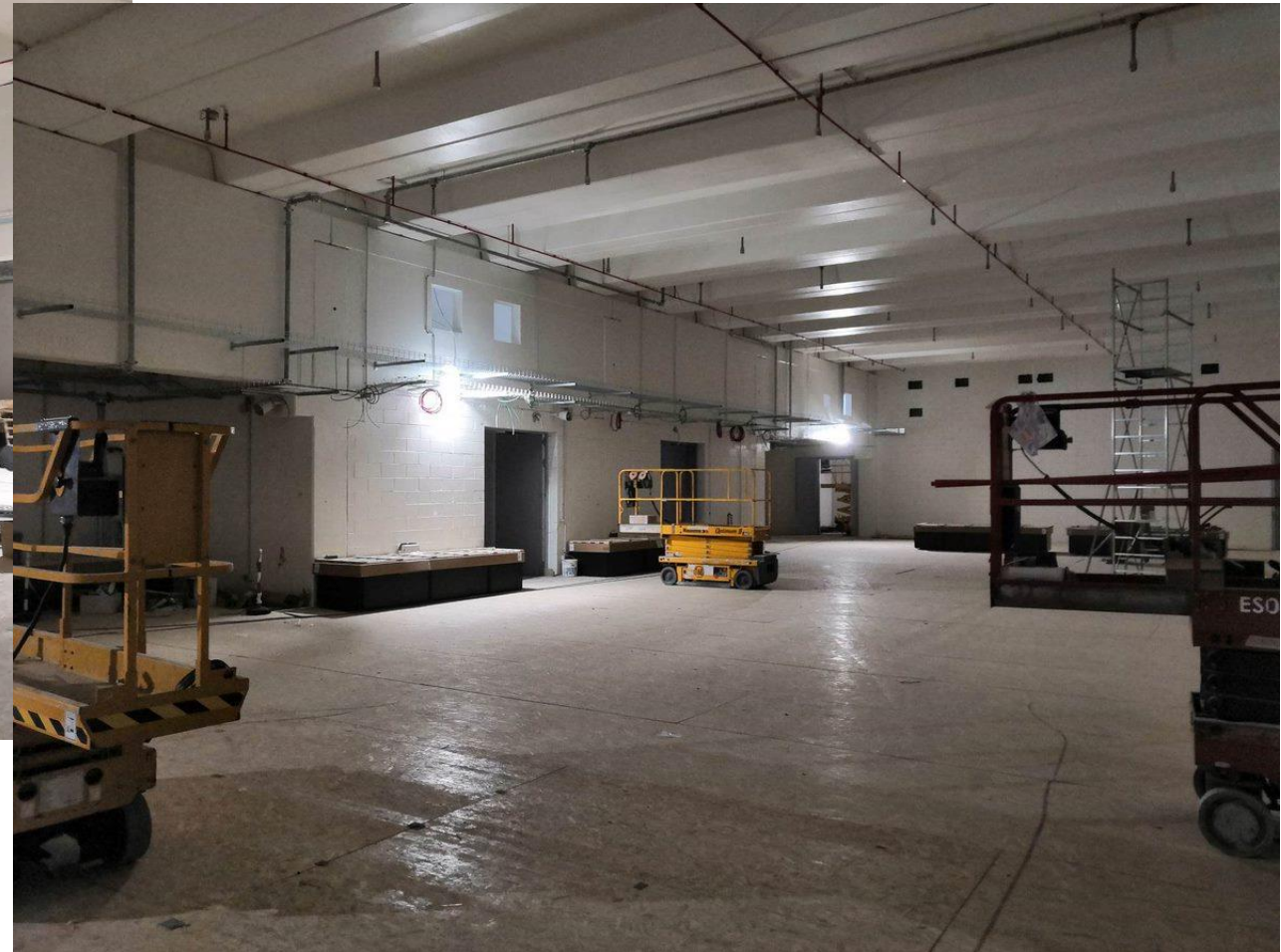
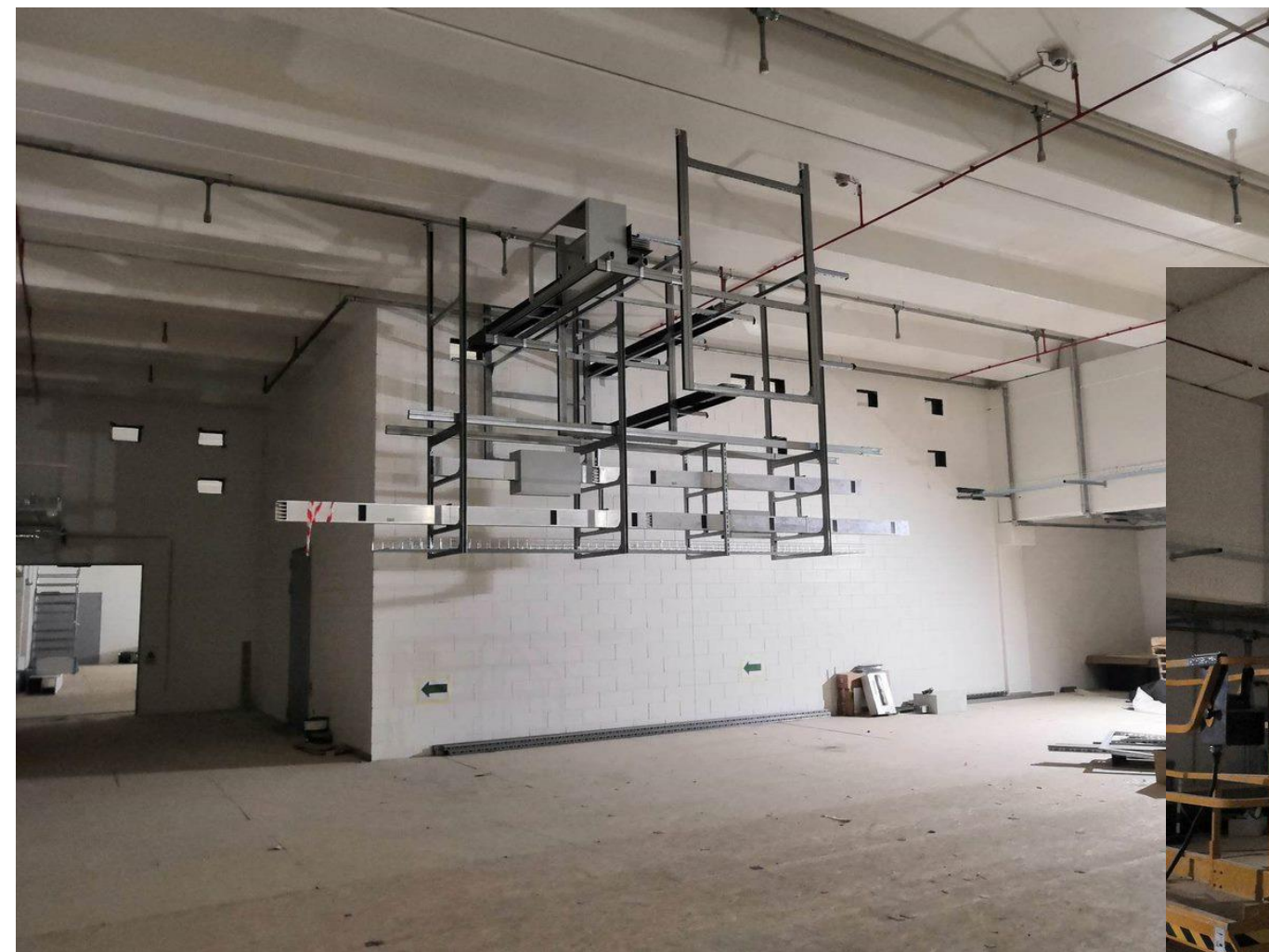
Zona Tape



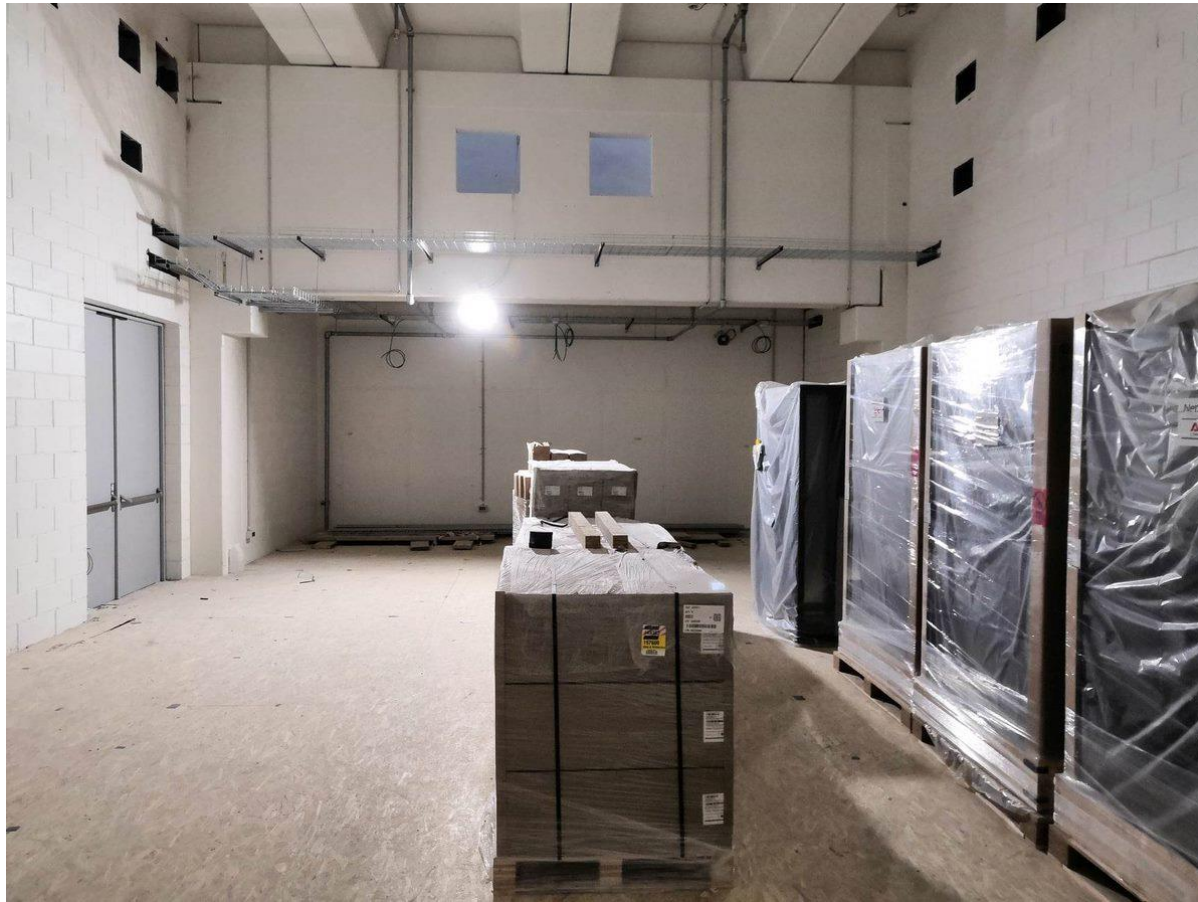
Zona Storage



Zona Storage con Blindo



Zona Rete



Zona CPU



Zona CPU
Sotto il pavimento

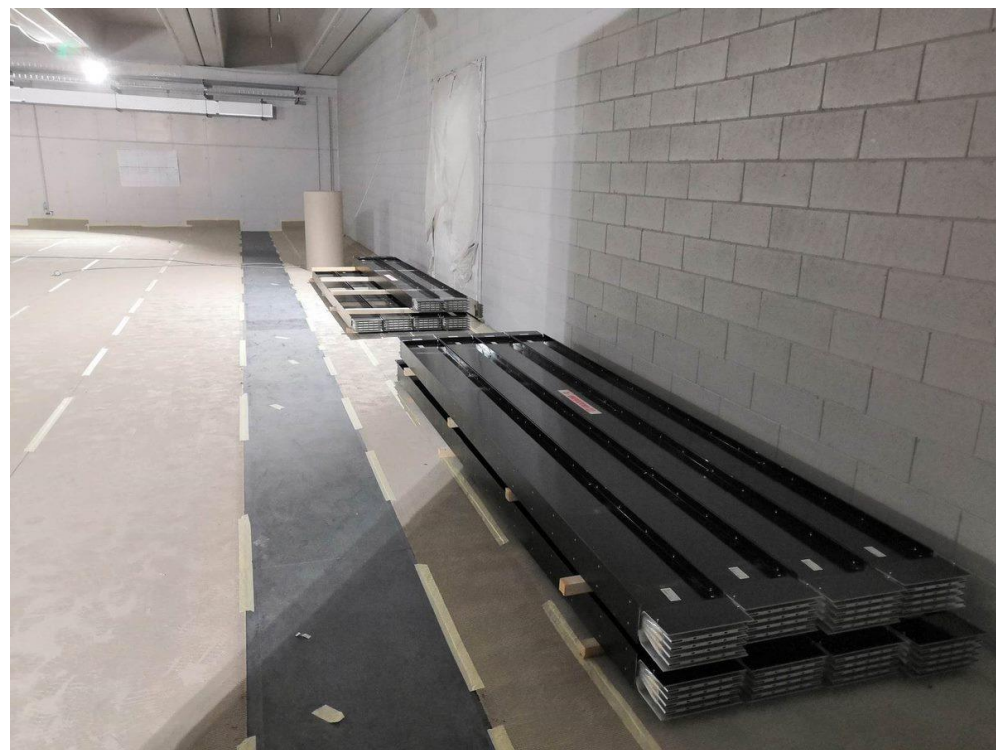
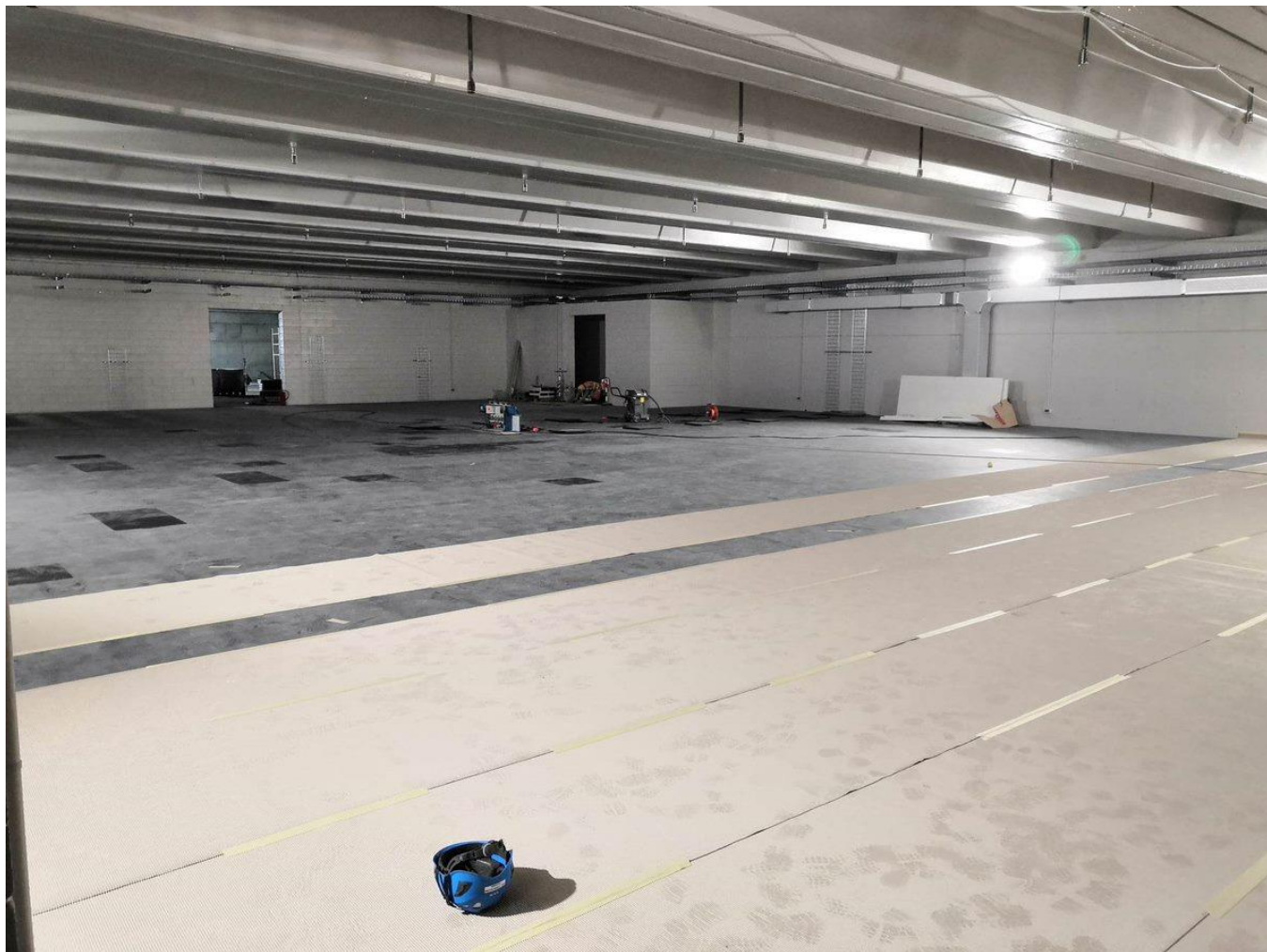


Zona Espansione



Febbraio 2023

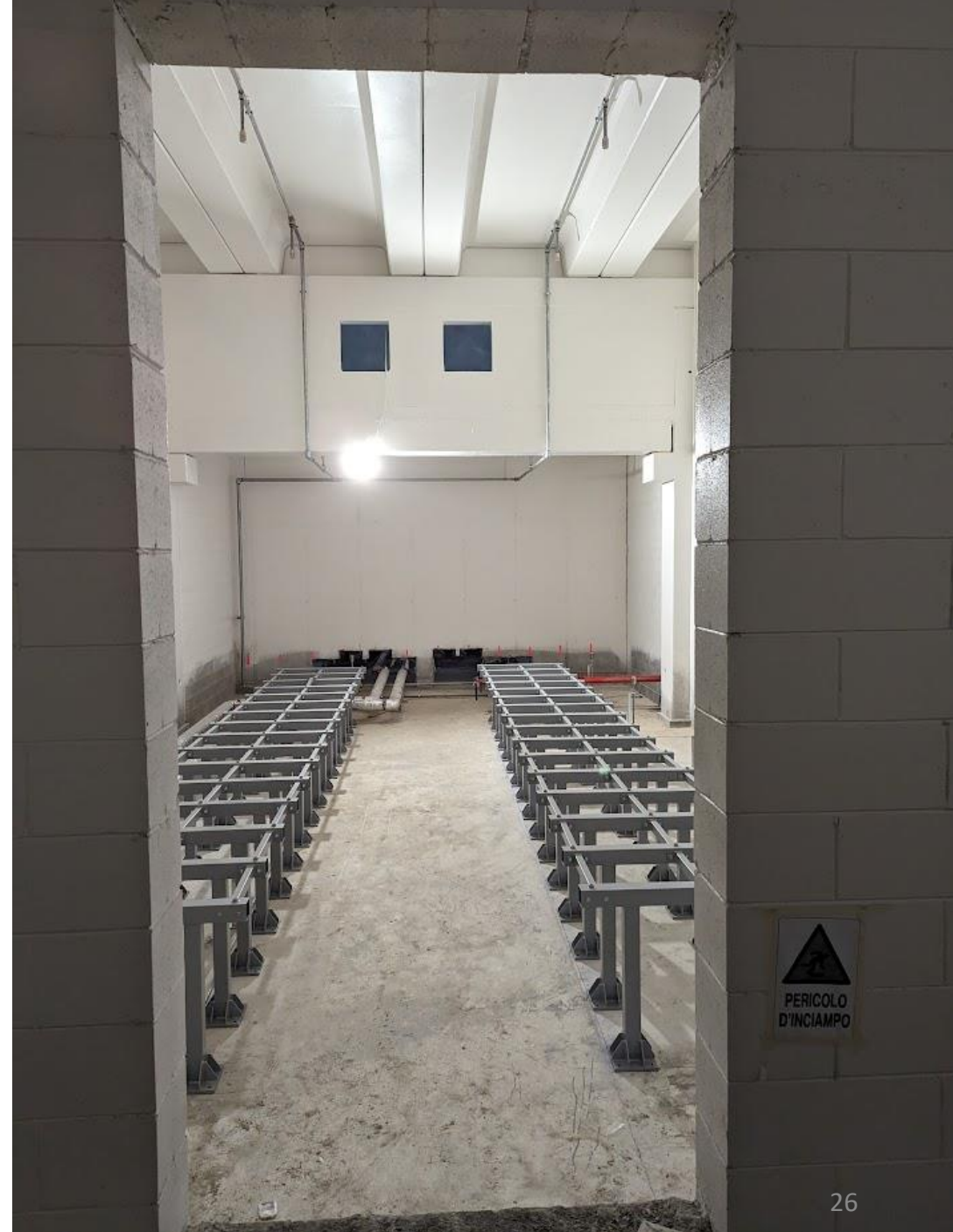
Zona Espansione 01/02/2023
+ blindo Espansione



Sala bassa densità
09/02/23



Sala bassa densità 09/02/23



PERICOLO
D'INCIAMPO

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....

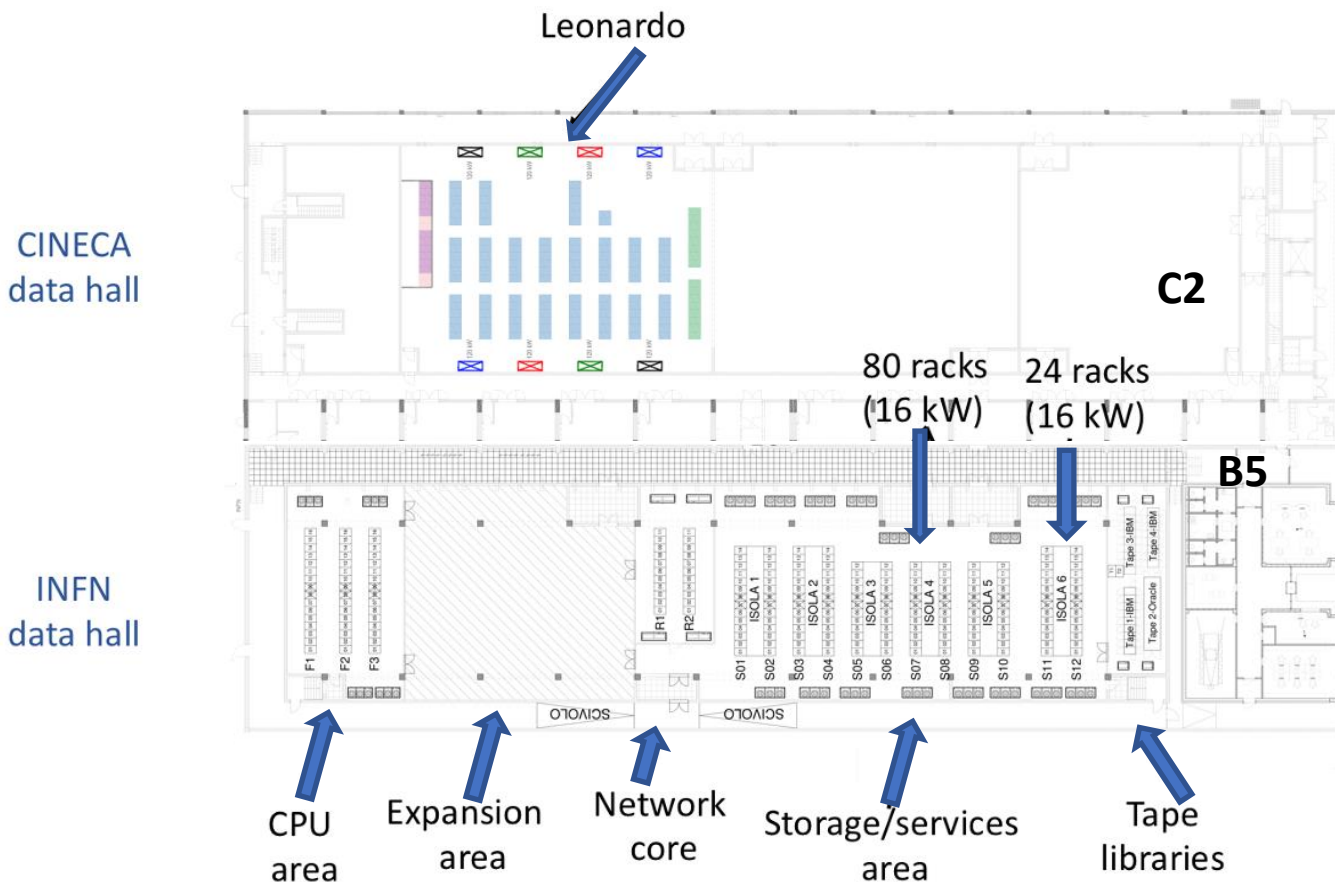


CNAF Barrel





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

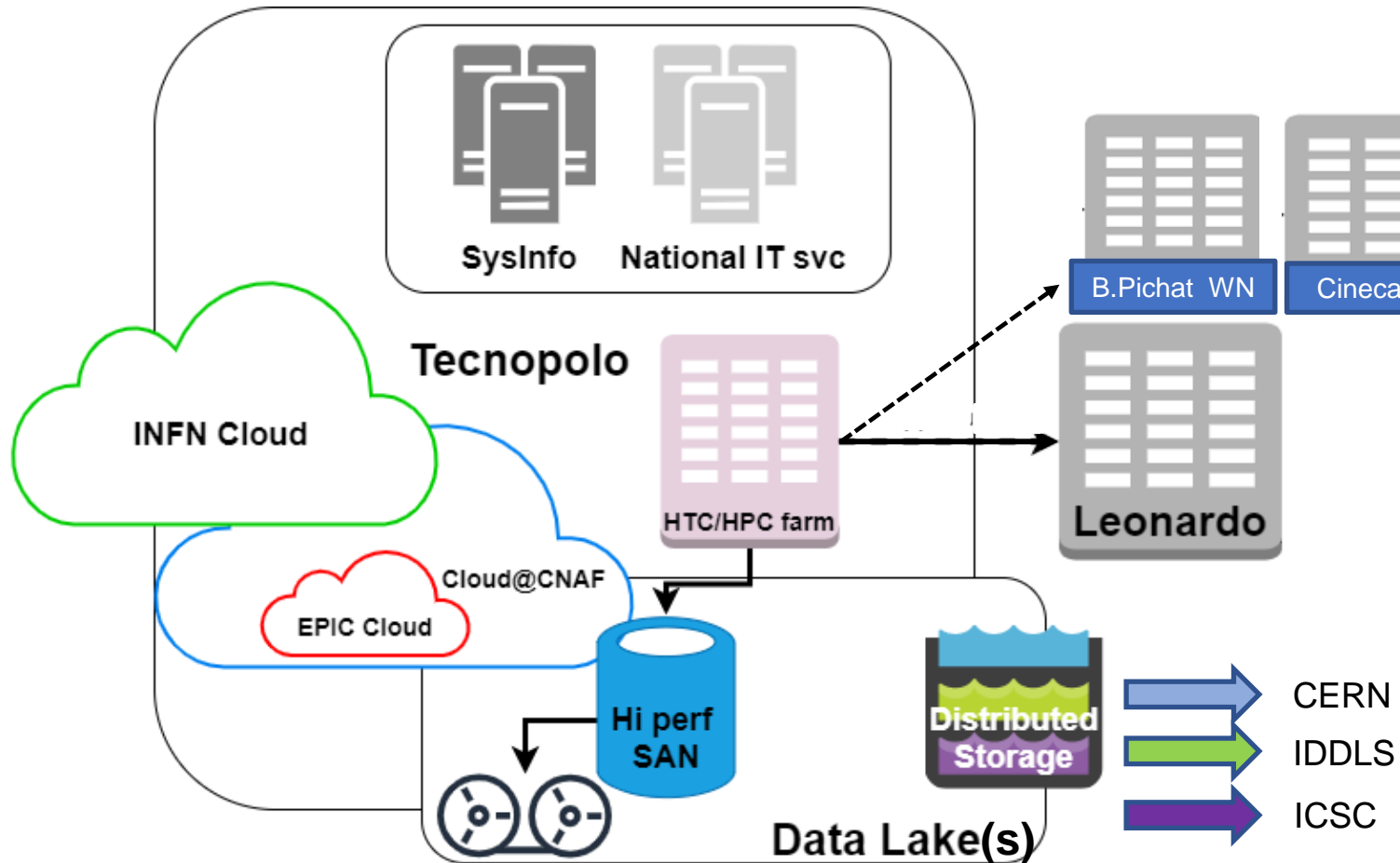
The cooling system and the PUE

- 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)

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

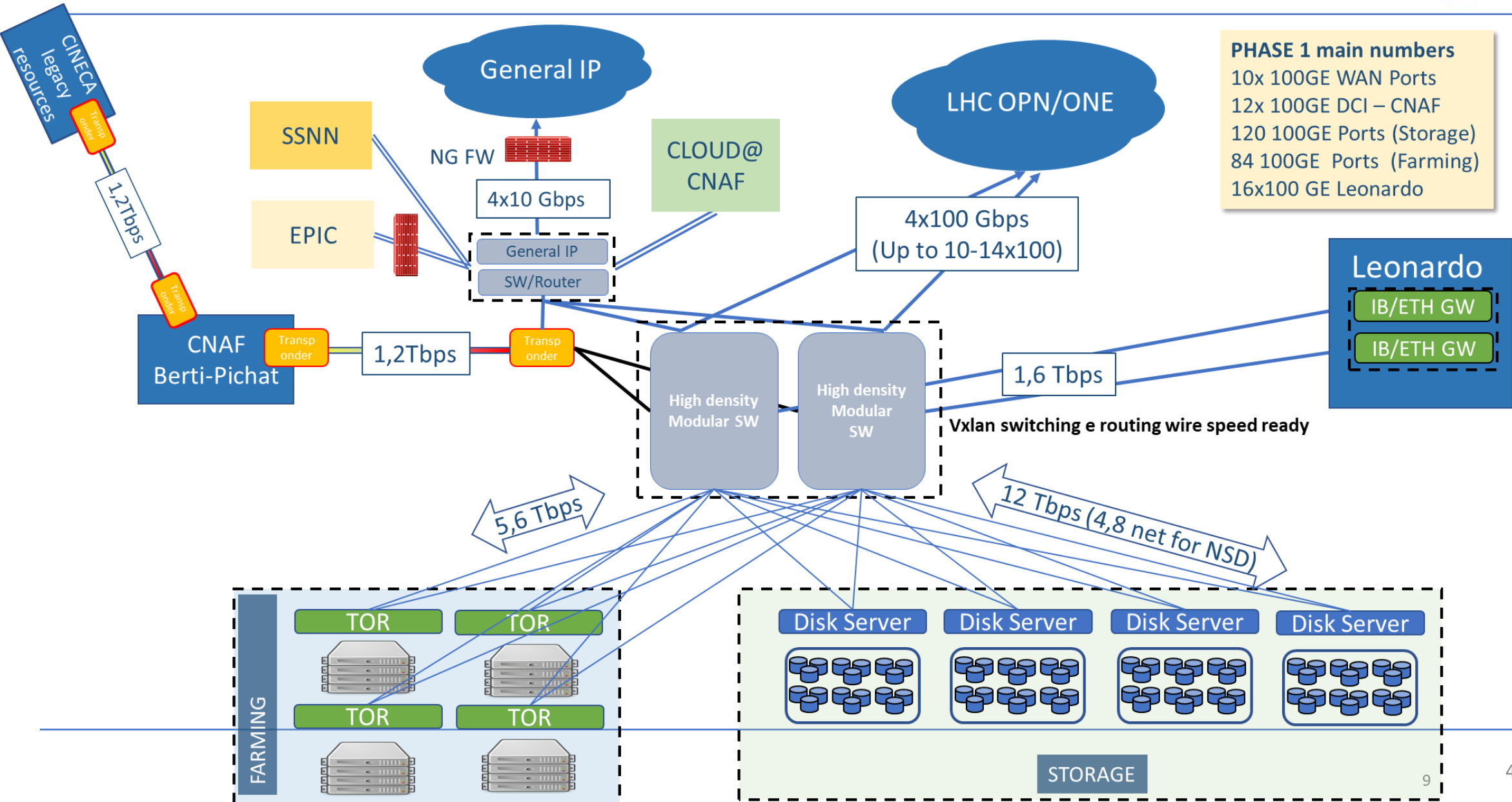
$$\text{PUE}_{\text{Tot}} \approx 1.2 - 1.3$$

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.