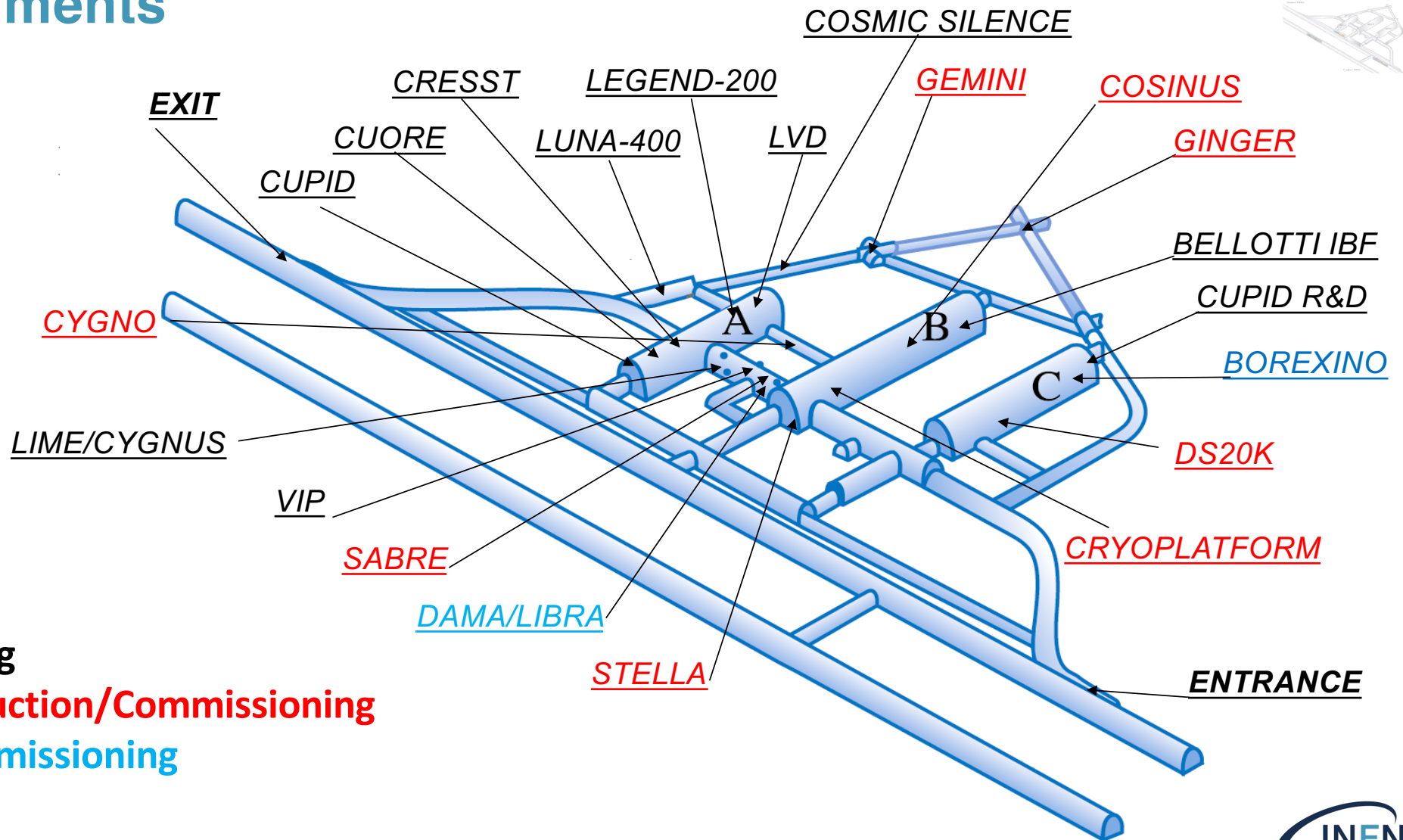


Gran Sasso National Laboratory **Status** and **perspectives**



**2025 Future Projects Workshop
SNOLAB, 29 April - 1 May**

Experiments



- Running
- Construction/Commissioning
- Decommissioning

LNGS People

128 staff personnel

Researchers: 15

Engineers: 41

Technical : 44

14 post doc

Direct connection with LNGS for
associated members:



University of L'Aquila



Gran Sasso Science Institutes
(doctorate school)



LNGS involved people: **260**
(128 staff + 132 associated)

On going activities

Replacement lightning system



Cryoplatfrom Facility ->
Building phase

CYGNO -> Building phase

Helium Liquefier ->
Major Upgrade phase

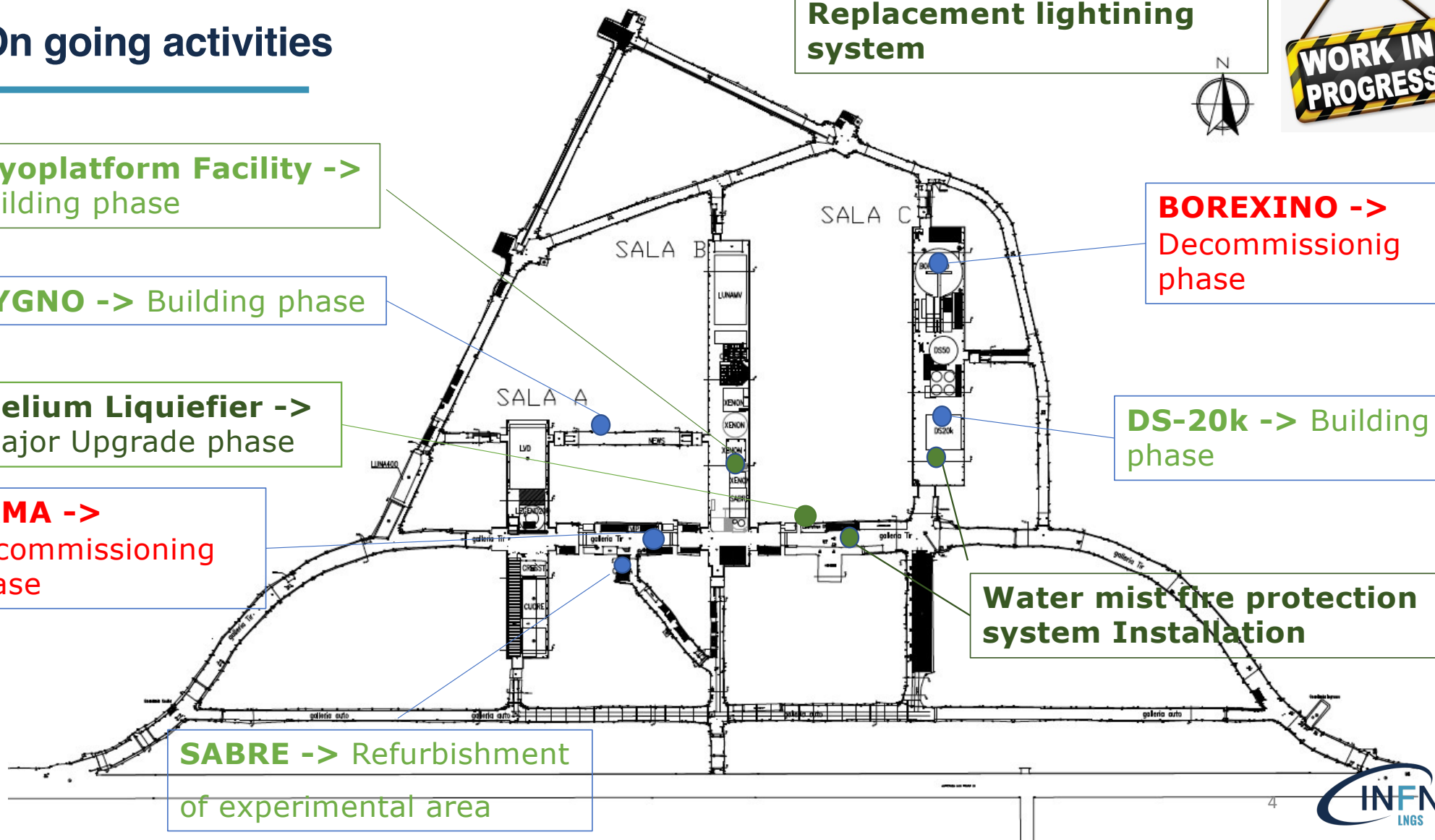
DAMA ->
Decommissioning phase

BOREXINO ->
Decommissioning phase

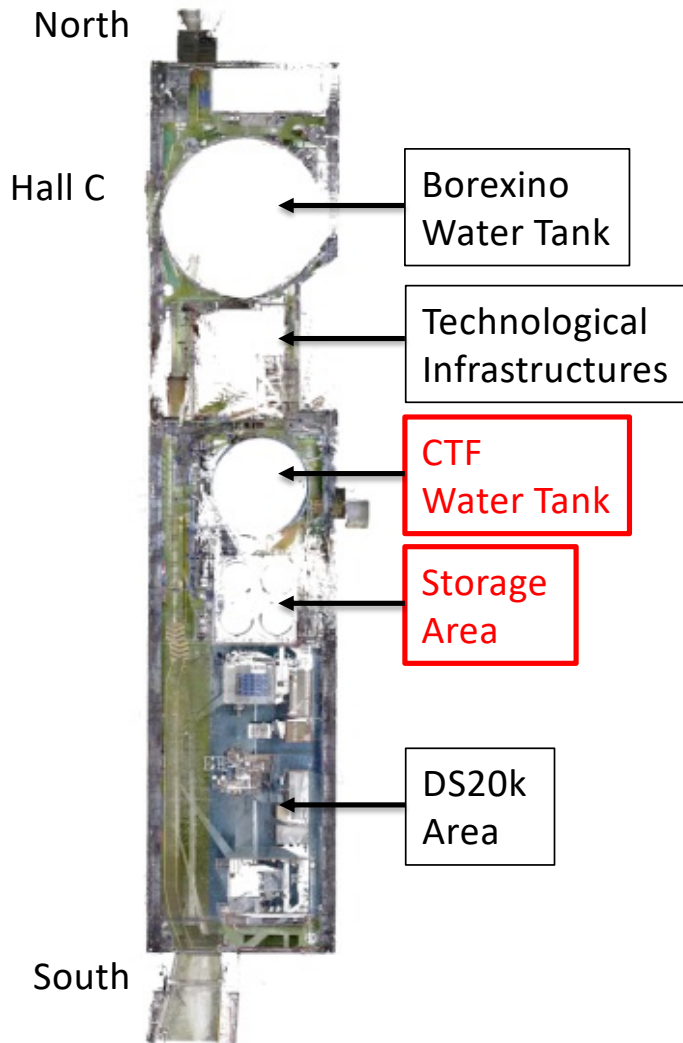
DS-20k -> Building phase

Water mist fire protection system Installation

SABRE -> Refurbishment
of experimental area



Decommissioning of Borexino



Water and scintillator removal from Borexino and CTF completed

The dismant program for Borexino

- Dismount activities will be organized to minimize interferences
- Many plants will not be available in hall C
- Reconfiguration of safety infrastructures will be necessary
- Dismounting will start before the end of the year

The new design for the hall C imply:

- LEGEND-1000 in the North part
- Discussion ongoing to install a new experiment in the central part
- New infrastructures to support experiments

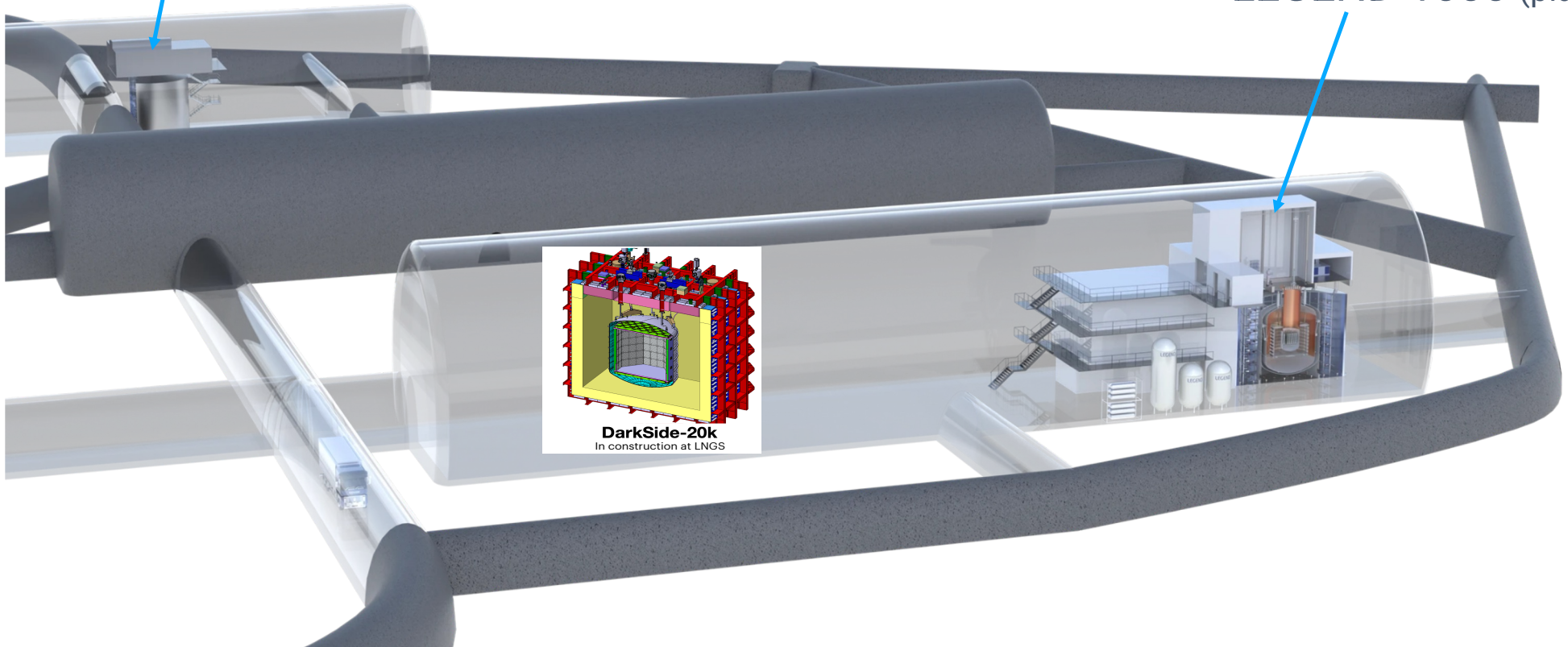
A new big cryogenic plant for LN production will be realized

- Located south of hall C just outside the hall
- Design completed
- Construction will start soon

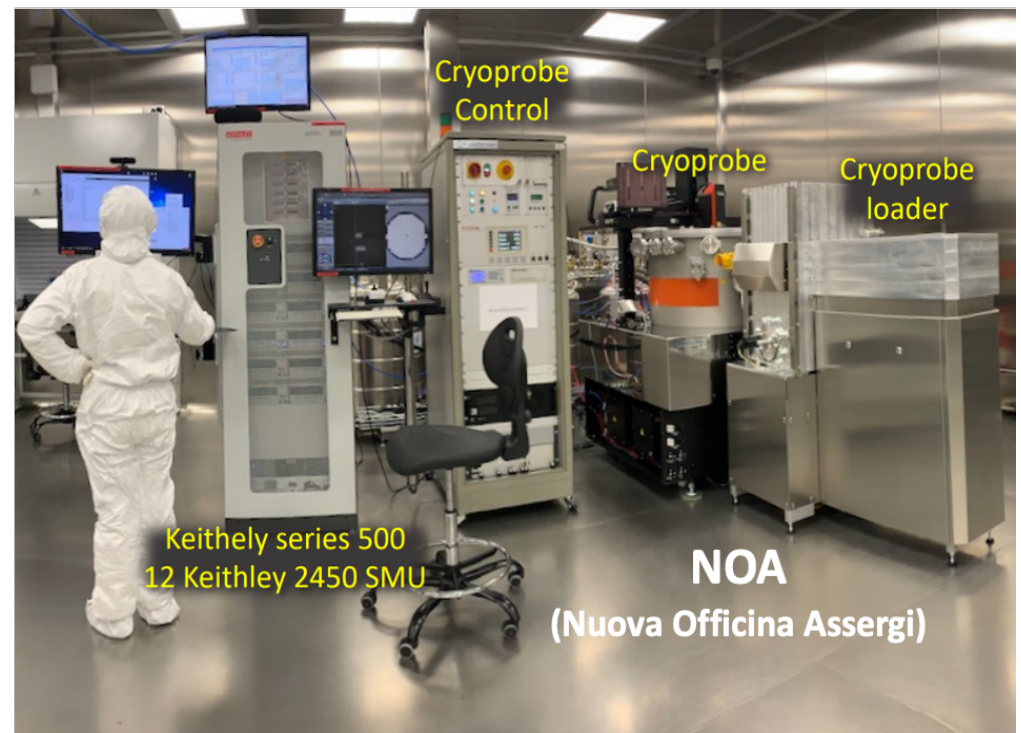
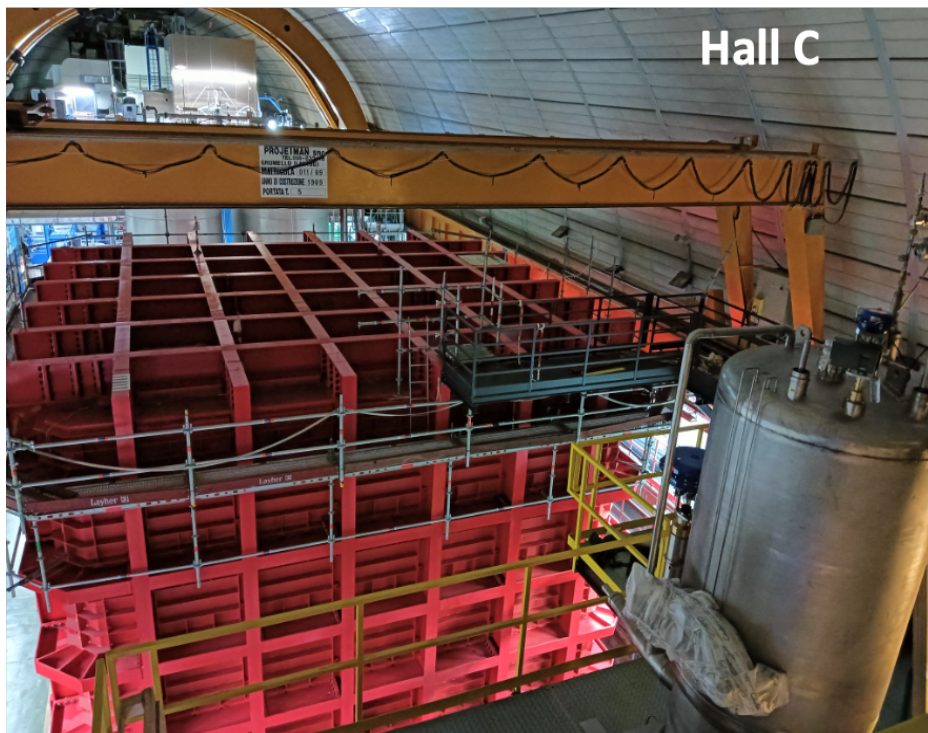
LEGEND @ LNGS

LEGEND-200 (operational)

LEGEND-1000 (planned)



DarkSide-20k @ LNGS



Present situation DBD experiments @ LNGS



LNGS is involved in supporting two experiments

CUPID (^{100}Mo)

- The reconfiguration of the CUORE infrastructure is supported by European Resilience Programme
- New CRYOPlatform facility of LNGS could support the R&D phase of CUPID
- A detailed program has to be defined also considering the funding profile

LEGEND (^{76}Ge)

- LEGEND-200 started in 2023, stopped end of 2024 for hardware upgrade, a new physics run will start soon
- Design of the configuration of LEGEND-1000 experiment is ongoing
- The CD1 @ DoE will be discussed before the end of the 2025

Requests for new experiments @ LNGS



During the last few years LNGS received many requests for new activities:

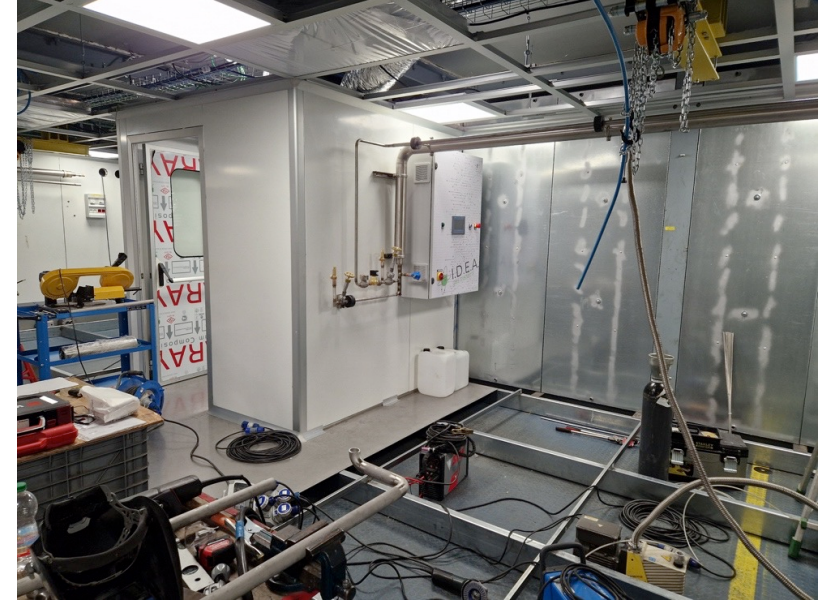
- **RESNOVA** (cryogenic archaeological-Pb in PbWO_4 crystals with TES for supernova neutrinos by CEvNS)
- **BULLKIDS** (prototype for a phonon detector with Si wafers equipped with Kinetic Inductance Detectors)
- **D2R2** (demonstrator for a DBD experiment with gas ^{136}Xe with a spherical proportional counter)
- **GINGER** (Ring He-Ne laser gyroscope for GR tests wfor Lense-Thirrin effect, measurement of Earth's rotation with $1/10^{10}$ precision, based on a prototype ith 3.6m on a side square)
- **GEMINI** (Seismic isolation facility: 2 vacuum chambers connected with inertial platform inside each one for low frequencies <0.1 Hz; connection with GW noise study)
- **OPOSSUM** (R&D for DBD with MKID deposition on TeO_2)

Many of them are **EU grants or supported by the European resilience program**, some proposed by foreign institutions, few from INFN Astroparticle Committee

New facilities: STELLA in Hall B

STELLA: Sub TErranean Low Level Assay

- Building completed in 2024 with upgraded facilities
- HPGe moved from Low Activity to STELLA
- Full commissioning middle of 2025
- HPGe detectors inside water and polyethylene shieding
- Refurbishment funded by Ministry of Research

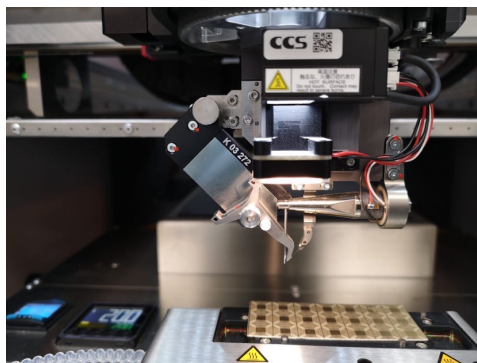
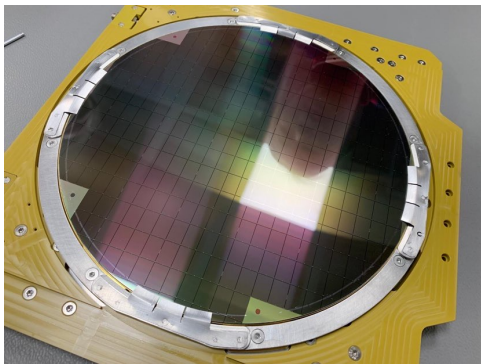


New facilities: NOA - Nuova Officina Assergi



400 m² ISO6 Clean Room on surface
Designed to be operated as Rn-free CR
Two sectors: detector assembly + SiPM laboratory
Completed in 2022
SiPM-based photosensors production for DS-20k ongoing
Funded by Ministry of Research and Regional Government

Some requests for possible access to the NOA facility were received
The access protocol is not yet established



New facilities: “Enrico Bellotti” Ion Beam Facility



Enrico Bellotti IBF **first physics run June 2023 in Hall B**
PAC is in charge to evaluate **future experimental requests**
LNGS accelerator service is supporting the beam delivery
Open call for projects every year

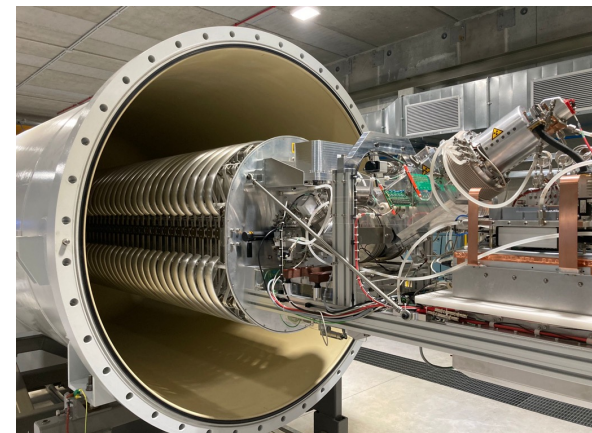
Discussion on **the future of 400 kV accelerator** ongoing
A possible new accelerator is under discussion with LUNA collaboration
Refurbishments of the top of the IBF building is possible



Accelerator room during construction



Control room building during construction



LNGS Future: project funded by Italian resilience program

Refurbishment and upgrading LNGS

- Electrical distribution plant
- Safety Infrastructures
- Underground Ventilation optimization
- New cryogenic plants for LN and LHe
- New optical links for data management
- Reconfiguration of CUORE cryostat
- Optimization of *external* labs to support future experiments
- **Increase of technical staff, new engineers and technicians**

During 2025 LNGS plan to complete the reconfiguration of the laboratory

The project is designed to prepare LNGS for next-generation of DBD and DM experiments

LNGS Future - Cryogenics

CryoPlatform – Hall B

New cryogenic laboratory for **low temperature** test detectors and sensors for cryogenic applications.

Helium Liquefier – Truck tunnel (B – C)

New LHe plant with a capacity of **20 l/h**

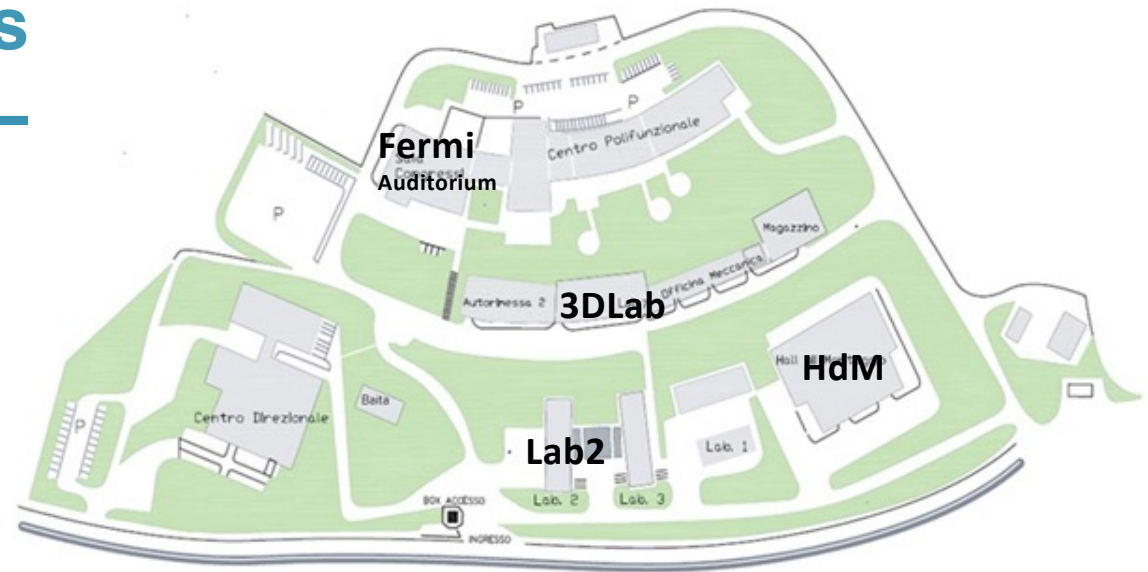
Nitrogen Liquefier – Truck tunnel (B – C)

New LN plant with cryogenic power of **50 kW @ 77k**



LNGS Future – External Labs

- **Requalification of Lab2 and assembly Hall (HdM) Buildings**
- **Upgrade of the 3D Lab workshop**
- **Upgrade of the Fermi Auditorium**



Reinforcing connections between DULs



- In the last several years LNGS with LSC, LSM, Boulby and CLAB has undertaken a strong program to reinforce collaboration and share workload (for large projects) between DULs
 - ✓ At LNGS special office to take care of this matter since 2021
 - ✓ Submission of EU funding support (INFRA-TECH, MSCA)
 - ✓ Establishment of a TA network (COST Action proposal under evaluation)
 - ✓ LNGS and LSC have an already operational TA program for sharing and facilitate use of facilities
 - ✓ Agreement with Yemilab under development
- Ongoing interactions with SNOLAB, SURF, Yemilab, SUPL, and PAUL outside Europe
 - ✓ Under evaluation a TA proposal (Eu funding) which includes SNOLAB, SURF, Paul, SUPL, and EU DULs
 - ✓ Meeting between DULs representatives at TAUP 2023
 - ✓ SNOLAB, LNGS, LSC, Boulby have coordinated a special issue on Frontiers on Science and Technology in DULs (editors: Jeter, Sean Paling, Carlos Pena-Garay, Aldo)

<https://www.frontiersin.org/research-topics/43423/science-and-technology-in-deep-underground-laboratories/magazine>

- Joint proposal for biology in DULs (thanks to C. Thome!): SNOLAB, LNGS, LSM, LSC, Boulby, SURF

Reinforcing connections between DULs



- Main objectives
 - ✓ Workload sharing on radiopurity assay for large collaborations
 - Need to compare sensitivities, errors treatment, methodology
 - Optimize coordination and facilitate submission of requests
 - ✓ Avoid duplication of key facilities to support next-generation projects and new developments
 - ✓ Optimize science output
 - ✓ Coordinate dissemination programs
 - ✓ Coordinate and reinforce funding applications

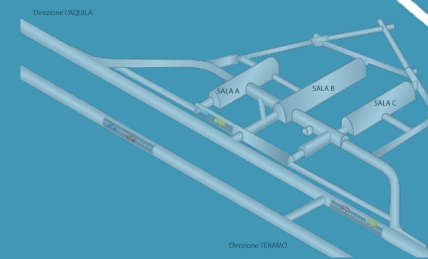
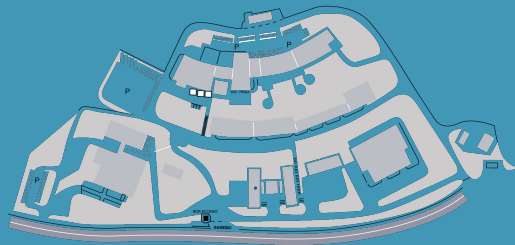
Take away message



- LNGS scientific program in coming years focuses on: DBD, DM, rare processes, and nuclear astrophysics
- LNGS facilitates new developments to support GW search, biology in underground environments, and geophysics
- LNGS has an ongoing renovation work to face next-generation experiments in DBD and DM
- LNGS is making an effort to reinforce connections between DULs

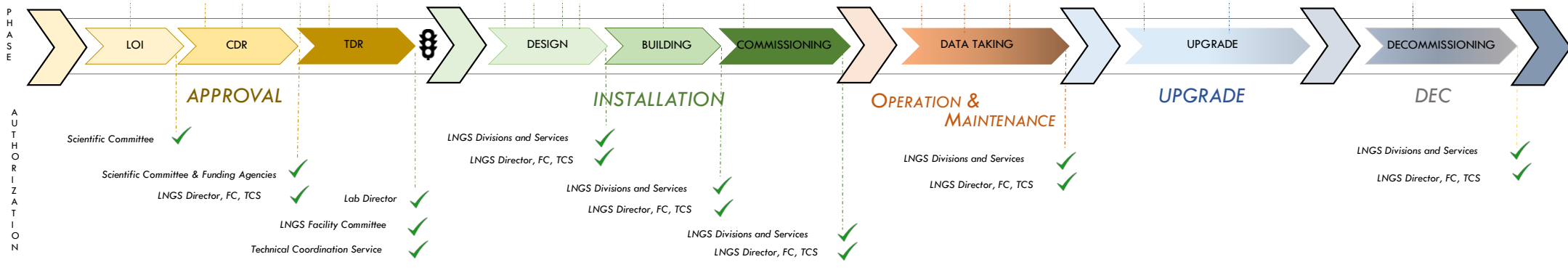
INFN

LNGS



LNGS Experiments Management System

LNGS LIFECYCLE of the Experiment



International Community @ LNGS

During the 2024
Registered LNGS users

Total:	650 (~1334*)
Italian:	359 (~482*)
Foreign:	291 (~852*)

* Total scientists involved in LNGS research



LNGS Experiments Management System

Experiment Organization:

- Spokesperson
- Technical Coordinator (TC)
- Local Responsible
- GLIMOS Group Leader in Matter of Safety
- RAE Environmental Experiment Responsible

NOTE: the Spokesperson and of the TC must be appointed since the LOI (Letter Of Intent)
TC is the official reference person for all interactions with the Laboratory

LNGS Organization:

- Director
- Technical Coordination Service (TCS)
- LNGS Facility Committee (FC)
- LNGS Services

NOTE: LNGS FC is composed by Research Division Head, Technical Division Head, Environmental Service Head and Prevention & Protection Service Head