LNGS Laboratories
Technical infrastructures

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Outline

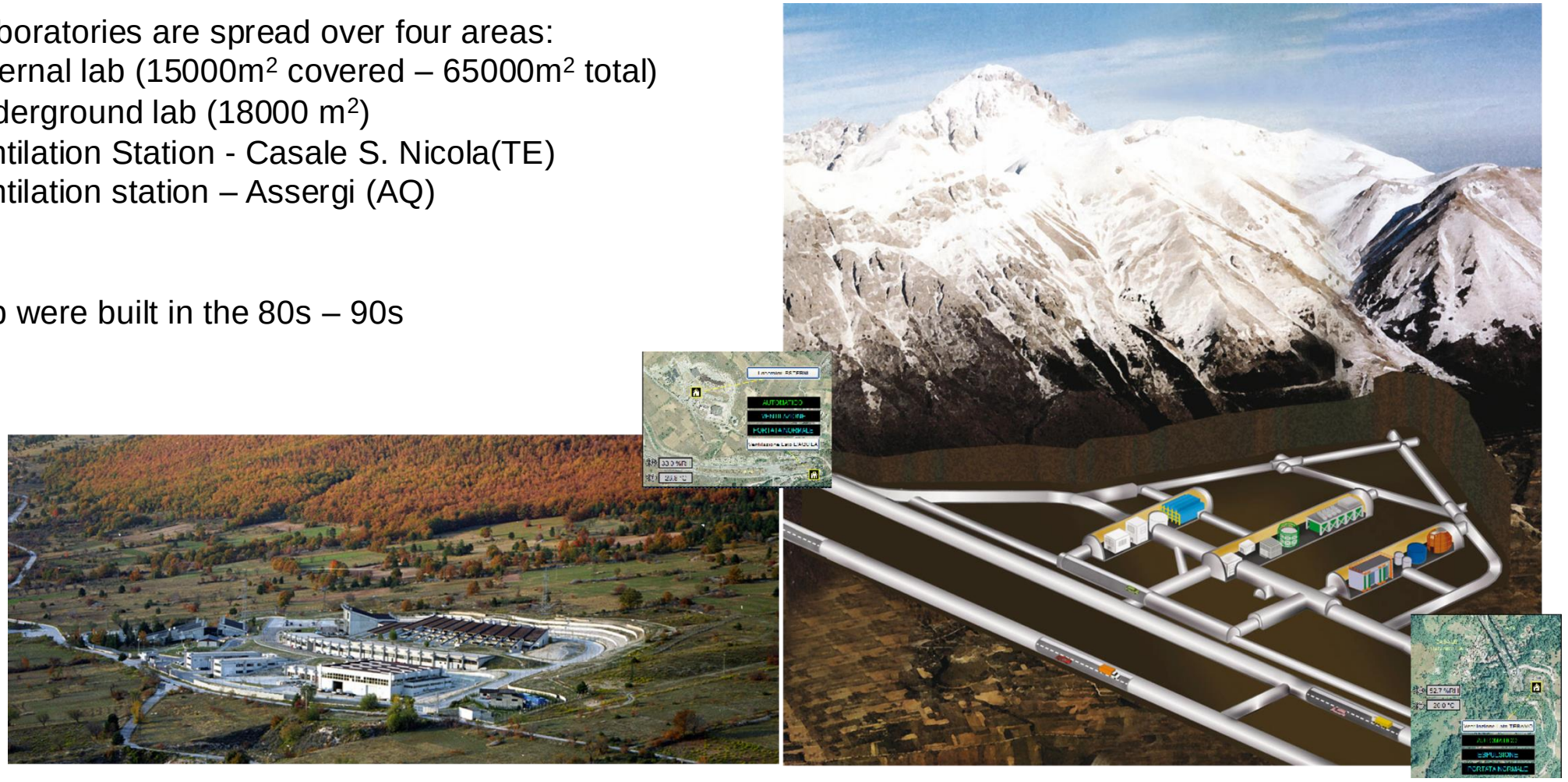
- Infrastructures
- Main electrical systems
- Ventilation system
- Cooling system
- Safety systems and supervision
- Conclusions

Infrastructures

The laboratories are spread over four areas:

- External lab (15000m^2 covered – 65000m^2 total)
- Underground lab (18000 m^2)
- Ventilation Station - Casale S. Nicola(TE)
- Ventilation station – Assergi (AQ)

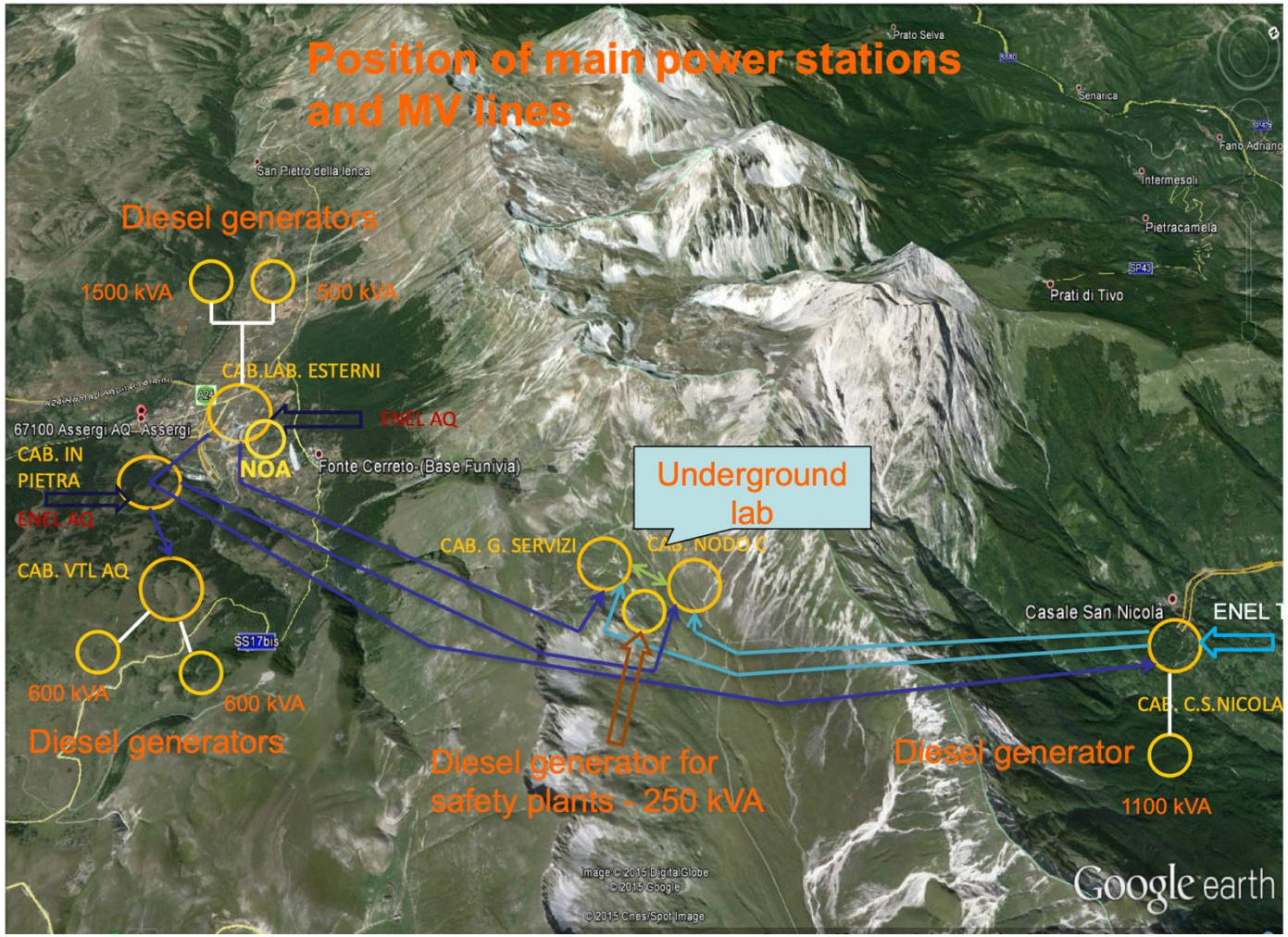
The lab were built in the 80s – 90s



Main electrical systems

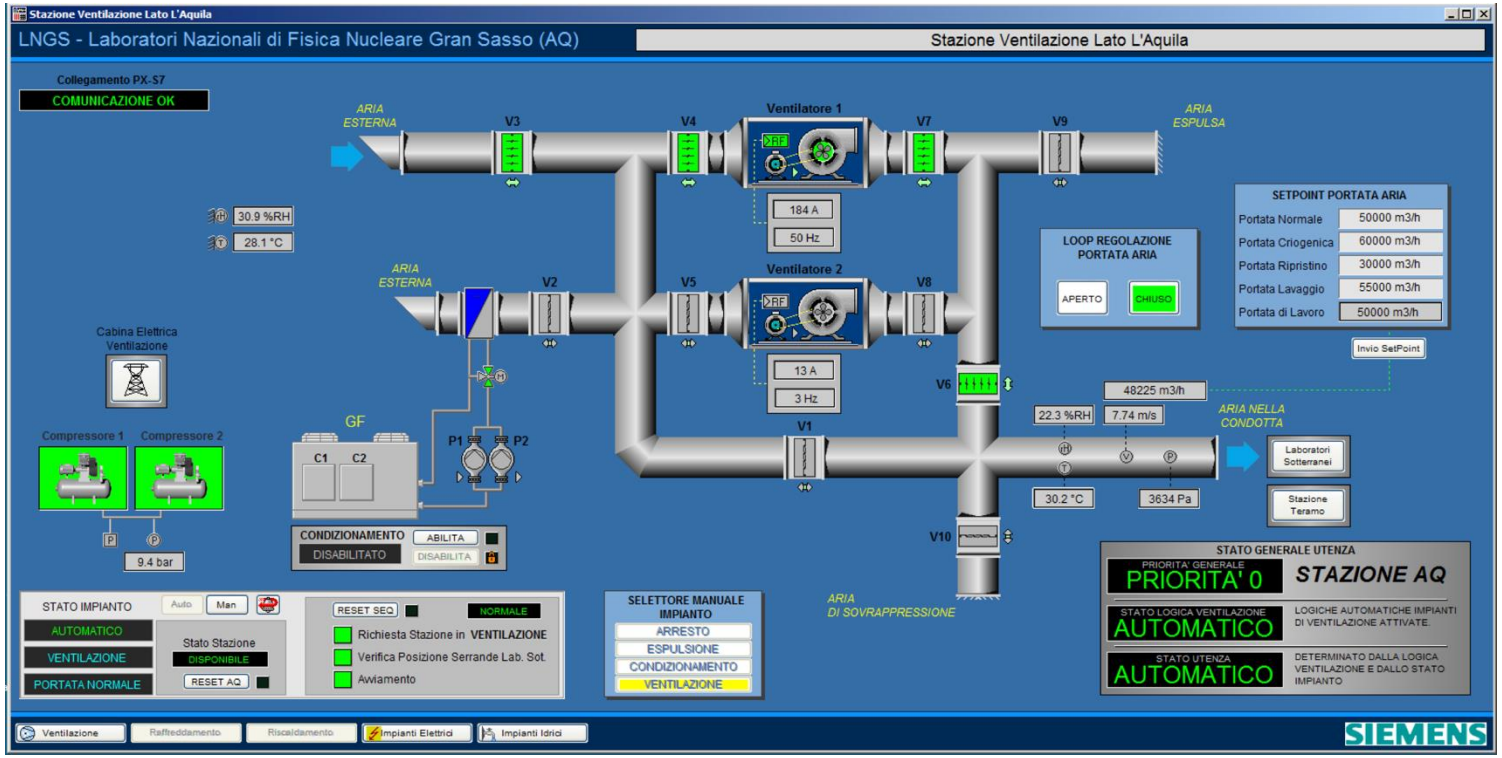
- Installed power 2.15 MW
- 6 Transformer substations MV/LV
- 10 Resin transformers MV/LV (from 630 to 1600 kVA)
- 28 UPS (from 10 to 300 kVA)
- 6 Diesel generator (from 250 to 1500 kVA)

Main electrical systems - layout



- The underground lab are powered at 20 kV from both the Tyrrhenian and Adriatic electric backbones, with automatic transfer between the two backbones
- ~ 50 km MV lines
- Backup diesel generator on Tyrrhenian backbone (in the future also on the Adriatic one)
- Underground Diesel generator for safety plants
- Diesel generators for the ventilation stations

Ventilation system



The station can operate on both pushing and suction mode.

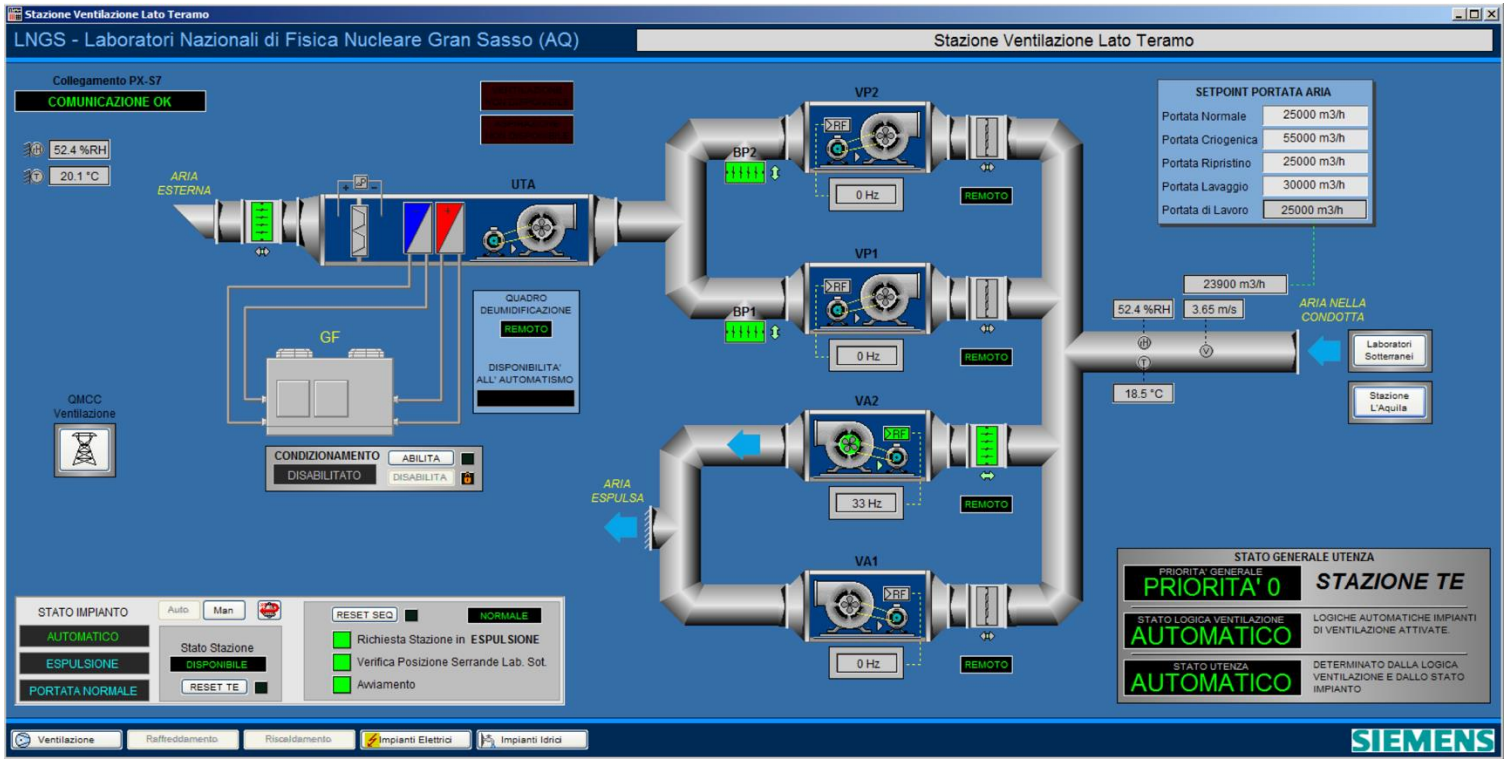
The connection to the underground lab is done by ~4.5 km of 1,5 m diameter pipes

In the Underground Laboratories, air distribution is done through 4 AHUs (one for each experimental hall and one for safe places)

Assergi station (AQ)

- Max air flow: 60.000 m^3/h
- 2 Redundant fans
- 2 diesel generators as electrical backup

Ventilation system



The station can operate on both pushing and suction mode.

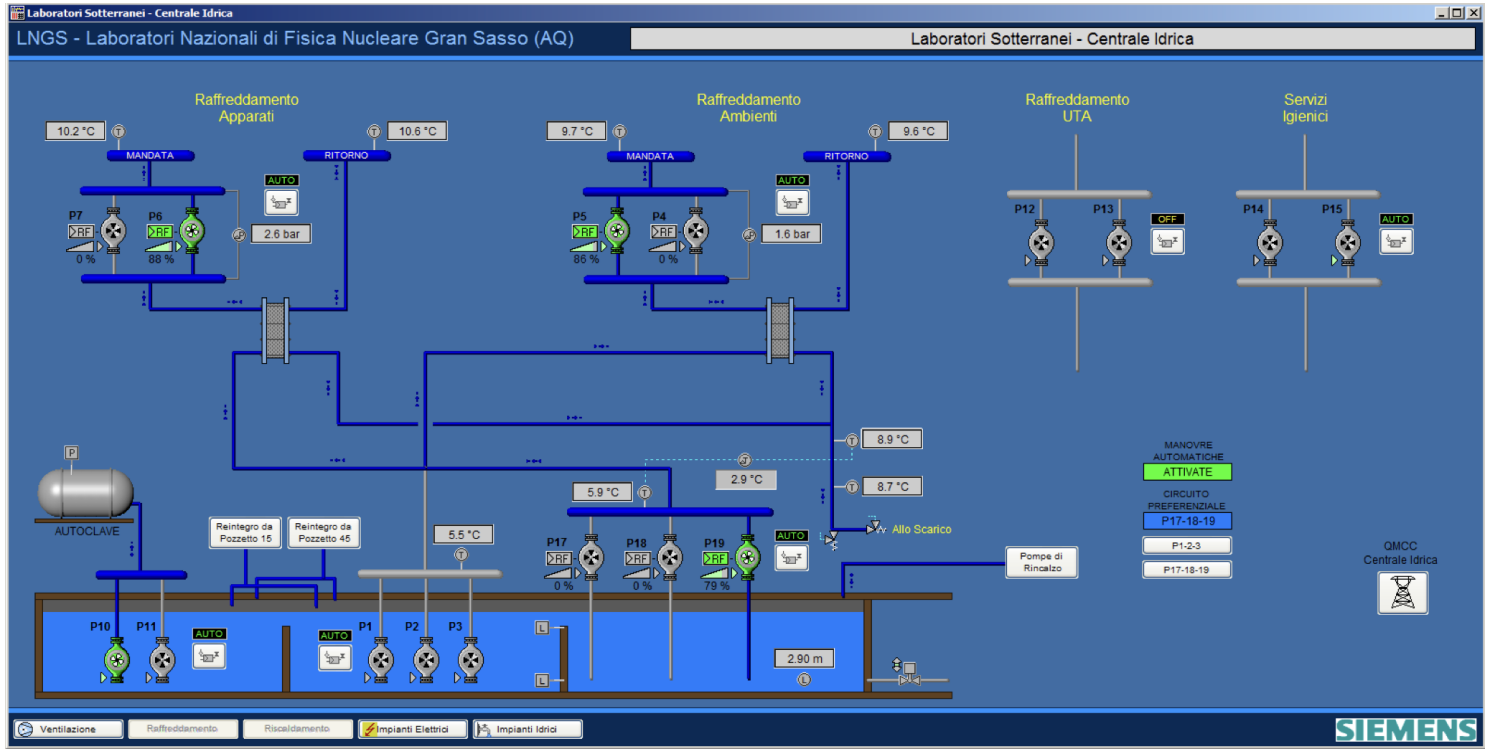
The connection to the underground lab is done by ~4.5 km of 1,5 m diameter pipes

In the Underground Laboratories, air distribution is done through 4 AHUs (one for each experimental hall and one for safe places)

Casale S. Nicola station (TE)

- Max air flow: 50.000 m^3/h
- 2 pushing redundant fans
- 2 suction redundant fans
- 1 diesel generator as electrical backup(+ MV line from Assergi station)

Cooling system



Heat power 1.1 MW

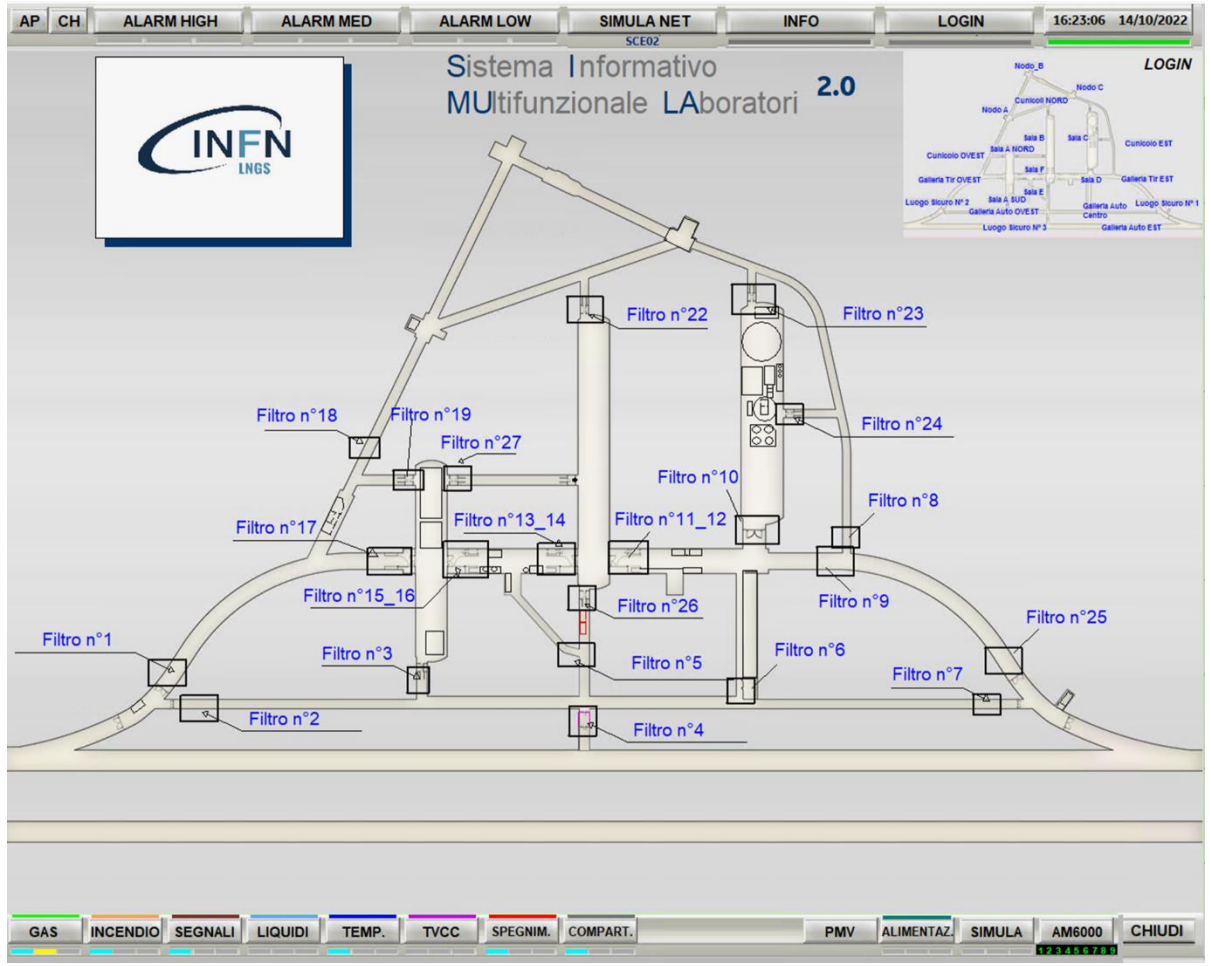
Primary circuit water flow: 90 l/s

Secondary circuit water temperature: 9-12 C

The secondary circuit consists in 6 rings (one per Experimental Hall for apparatus and one for air conditioning)

All pumps are redundant

Safety systems and supervision



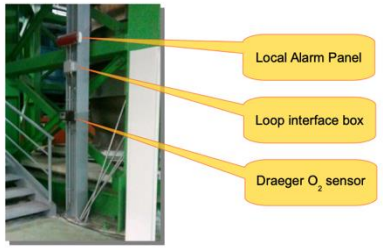
Scada iFix – Safety
Desigo CC – Plants

12 fire compartments
24 pressurized filters REI 120

Safety systems and supervision

Various gas sensors:

- CO, CO_2, NO_X
- VOC
- O_2
- LEL
- Multiparameter portables sensors



Various fire detection technologies:

- Laser Scanner VESDA
- Laser Scanner QUADRA
- Smoke sensors
- Temperature sensors
- Flame sensors (UV)

Safety systems and supervision

Various fire fighting systems

Water mist
- LVD
- Borexino
- Hall A A
- Tir tunnel
- Car tunnel

Red Devil in Hall B

Niagara on the entrance/exit gates

Foam in Hall C e Borexino (almost totally removed)

In addition:
- Hoses UNI 45
- Innergen
- 190 fire extinguishers of various types

Conclusions

- LNGS is an underground international lab hosting complex physics experiments from worldwide collaborations
- The infrastructures were built in the 80s – 90s (always maintained and partially renewed)
- Changes in regulations and experimental needs result in an upgrade of facilities and/or the construction of new infrastructure

PNRR LNGS-FUTURE IS A BIG OPPORTUNITY TO

- Renew/upgrade the infrastructures to match the actual/future needs
- Upgrade some facilities to improve safety, reliability and energy efficiency
- Take advantage of solar energy by installing photovoltaic panels
- Create new infrastructures for the next generation experiments
- Become even more attractive than now

LNGS Facility Upgrade To Unveil Rare Events

IS NOT ONLY AN ACRONYMUS

Thank you

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