

LSM Experiments Meeting SuperNEMO

Newly elected!

A.Jeremie, Ch.Marquet, Ch.Patrick

Technical coordinator

Co-spokespersons



Outline

- **Detector status**
 - Commissioning
 - Helium supply
- **Shielding**
 - Gamma Shielding
 - Neutron shielding
- **Anti-radon Tent**
- **Schedule**
- **Questions**

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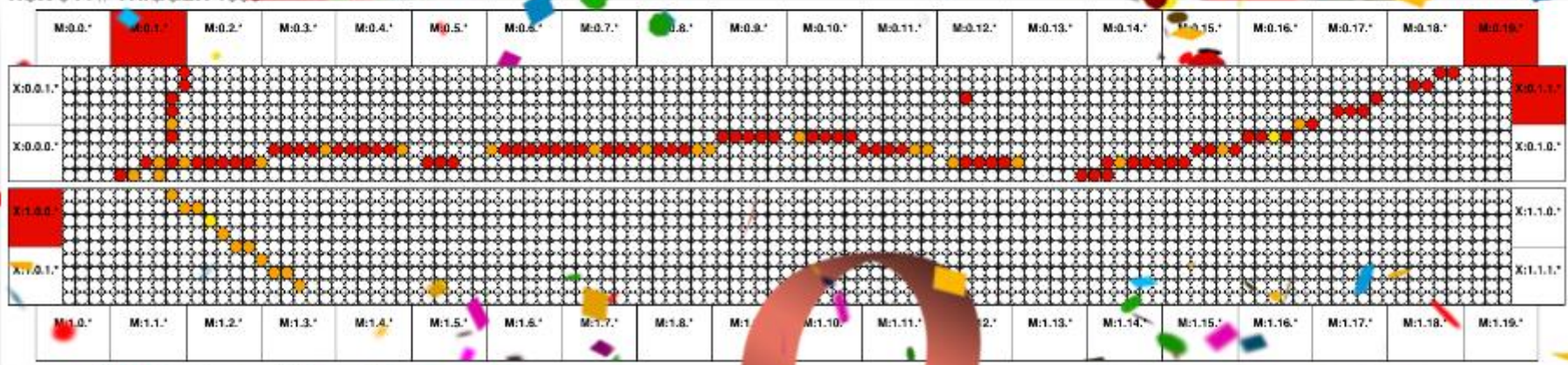
Huge step!

December 2022



Huge step!

Happy New Year !



Huge step!

Happy New Year !

Full tracker & calorimeter operational !
Full detector commissioned !

Helium supply

- Tracker gas mixture: **helium** (95% at 5.0 purity level), ethylic alcohol (4%) and Argon (1%)

Running phase	He Flux
Commissioning	3.6 m ³ /day
Nominal (2beta)	28 m ³ /day

- Stop of Helium supply by Air Liquide (and Messer) due to the global shortage

Running with Argon:

- IF total shutdown of the He supply => run with Ar ?
- Demonstrated on the technical point of view
- **BUT performance deterioration** on the electron tracking, electron energy resolution, and some background separation (e-/e+)
- The impact on double beta sensitivity is under study

Recycling system:

Main issue: presence of ethanol in the gas mixture
=> radon trap saturated with ethanol instead of radon
=> alcohol separation is required before radon trapping and reinjection into the detector

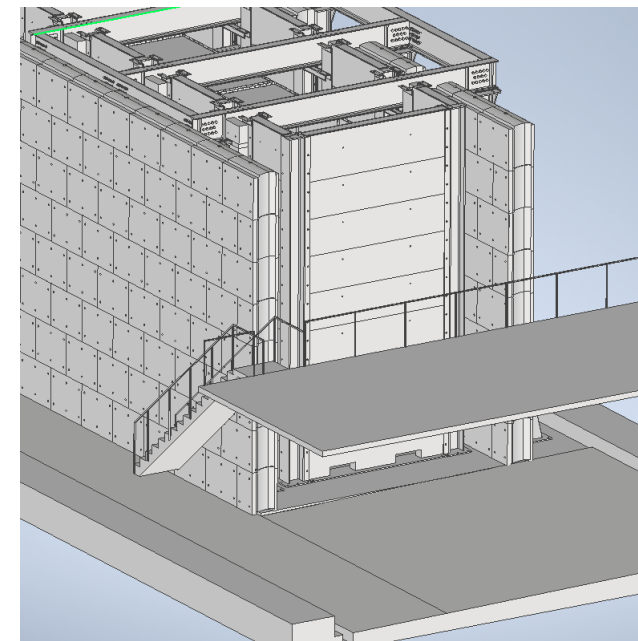
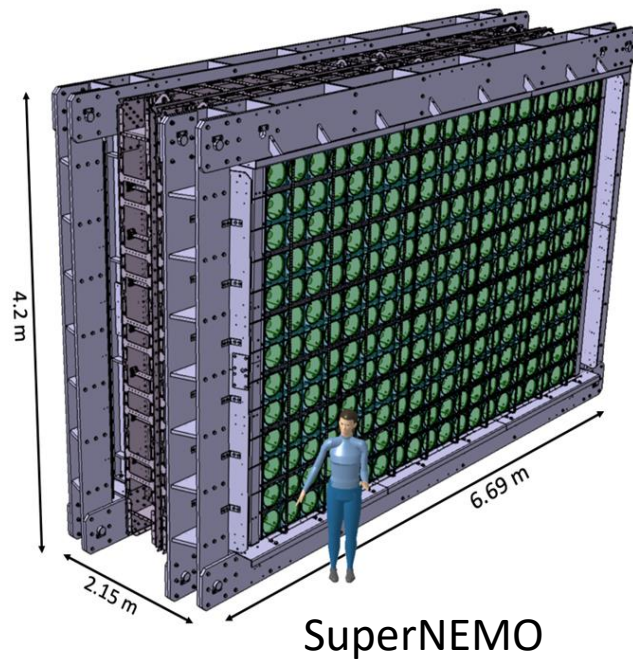
Today discussions are under progress with ATEKO Cie (Cz)

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Gamma Shielding: design

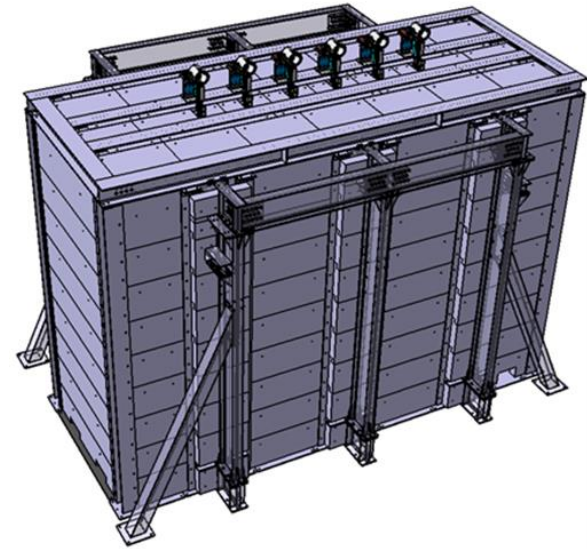
- 1 **gamma** shielding (18 cm Fe)
- 1 **neutron** shielding (24 cm Polyethylene plates and 46 cm PE tanks filled with water)



Gamma Shielding: Design

Different suppliers:

- **35.5 tons:**
 - **NEMO3:** reusable from NEMO-3 shielding=> **ready**
 - **Trivero (73):** NEMO-3 machined and new parts => **ready**
- **0.5 tons:**
 - **IJCLab/IP2I/LAPP:** machined “in house” non standard shapes => **to be started**
- **225 tons:**
 - **Daming & Tisco (China):** 225 tons (277 pieces) => **ordered, production under progress**

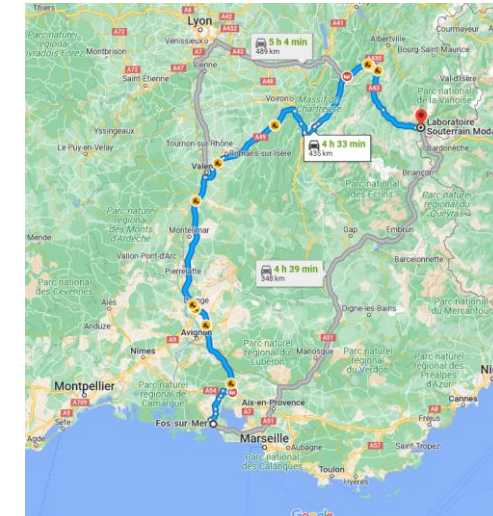


STATUS

- Very long procedure to define the needs, finalize the call of tender and launch the production : **OK since June 2022**
- Radiopurity tests on cutting/machining : **OK** (September 2022)
 - $<8 \text{ mBq/kg } ^{238}\text{U}$, $<5 \text{ mBq/kg } ^{232}\text{Th}$, $<20\text{mBq/kg } ^{40}\text{K}$
- Radiopurity tests on Iron final batches : **samples should be received soon**
- Production and Machining : **3 months from Radiopurity approval**

Gamma Shielding : transport

- **Tisco/Daming -> Chinese port:** all iron plates delivered at a port in China (Shanghai FOB)
- **Chinese port -> Fr port:** Ulisse for 10 x 25 ton open-top containers
- **Fr port -> Modane:** different options are being studied: direct containers on trucks without unloading/reloading will need a few days storage in Fos sur Mer until delivery to Modane complete
- **Modane -> underground:** smaller trucks (10t) with escort (2/week during 12 weeks)



Gamma Shielding : storage in Modane/LPSC, installation

- On site, the containers with iron plates will be unloaded and stored in a **rented space** for 3 months
- A team is responsible for assembling the shielding and preparing space for the next truckload.
A technician is hired by LP2I (financed by UCL,UK) for the shielding (+anti-Rn tent) installation.

Rented storage for the shielding

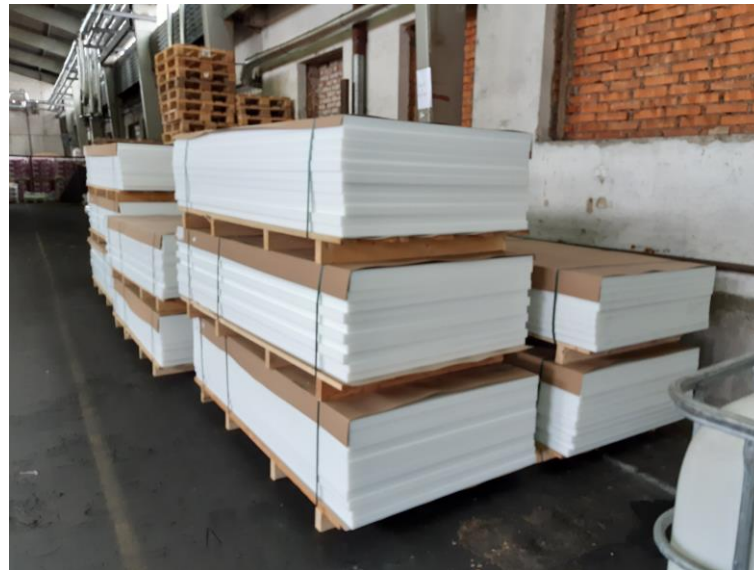
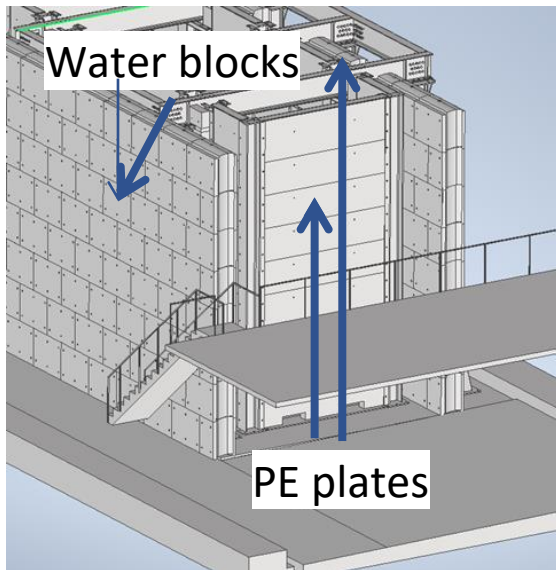


Entrance of the LSM



Neutron shielding

- Neutron shielding installed around the gamma shielding
- 2 main walls covered with PE blocks (46 cm) with pure water, other surfaces covered with PE plates (24 cm)
- Already 250 PE plates delivered at LSM
- Water tanks are ordered (or almost)
- Need to purchase ~40 PE plates
- The footprint of this shielding has already been approved by LSM.



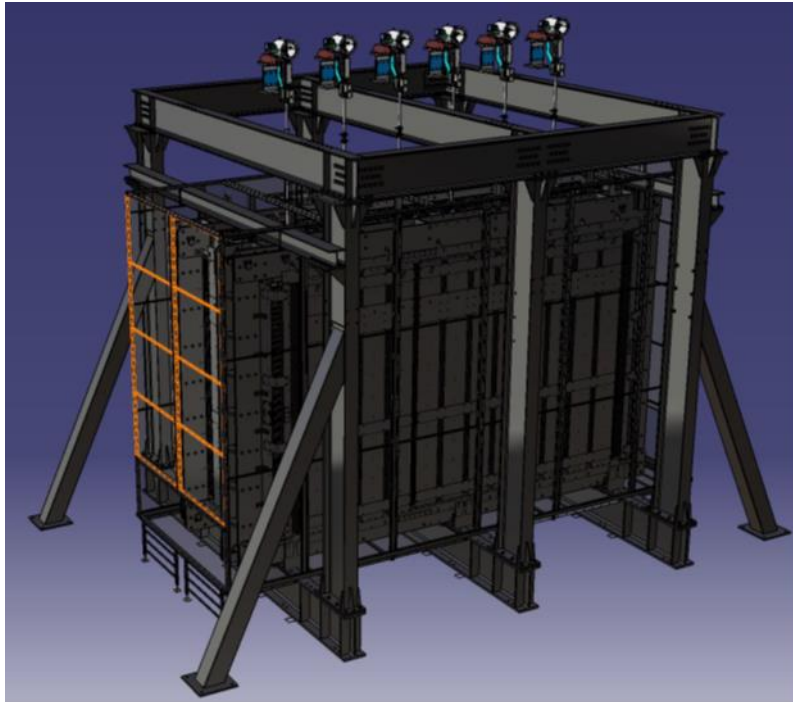
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Anti-radon: ART tent

- Around SuperNEMO: **Anti-Rn tent** flushed with Rn-free air provided by the LSM facility
- The anti-radon tent is almost completely installed (top and bottom sides are left open until the end of the tracker commissioning)
- The tent is made of black Polycarbonate that has been tested for radiopurity.

Anti-radon tent



Installation of tent wall



Outline

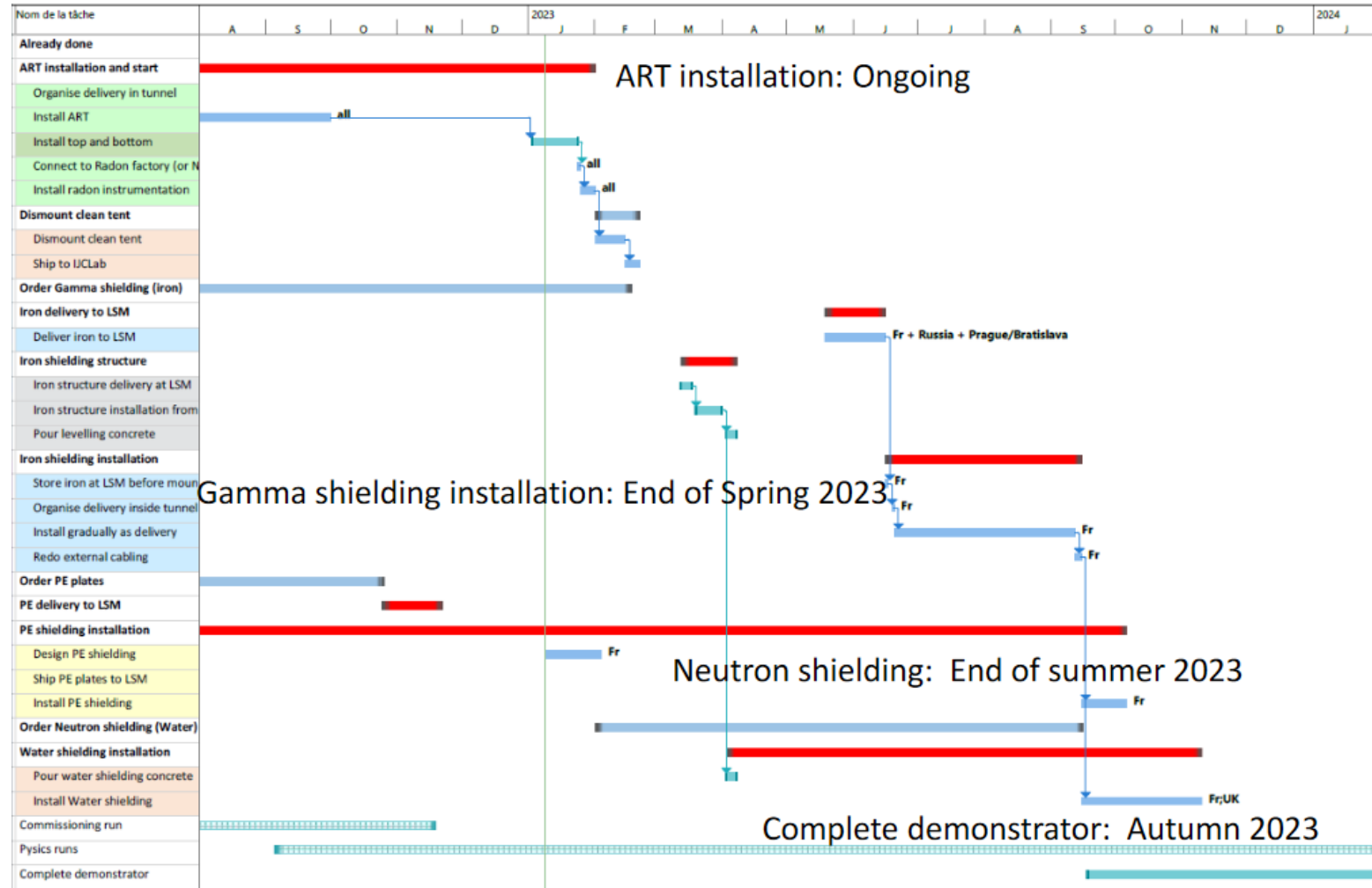
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Schedule

The demonstrator is completely installed and is being commissioned

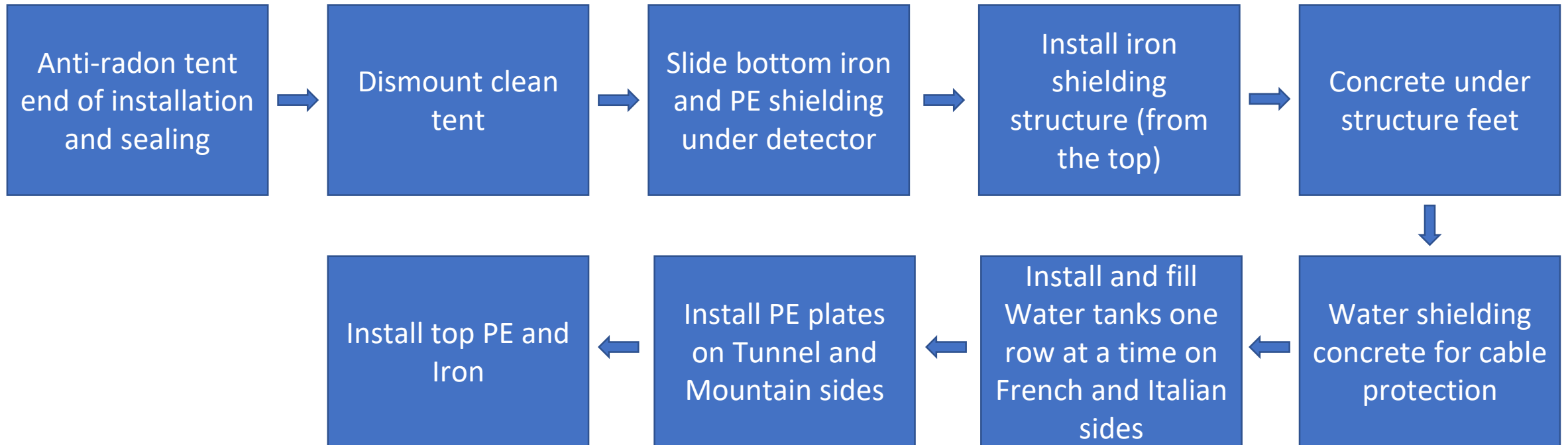
To complete the detector:

- **Anti-Radon Tent (ART)** installation, finished except the top and bottom during tracker commissioning
- **Gamma shielding (Iron)**, installation planned spring/beginning summer 2023
- **Neutron Shielding (PE and Water)**, design approved by TB last week, installation end of summer 2023
- **Anti-radon facility (LSM):** installation schedule is planned by LSM.



In parallel of these integration steps, **physics data runs are taken** to analyze the different background contributions (radon, gammas and neutrons) and its effective suppression by the dedicated screenings

Installation sequence



Data taking during whole process to evaluate effect of screenings

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Questions

- **LSM Environmental parameters:**

Can LSM provide:

- particle count in air
- radon rate
- temperature
- pressure



- Effect of truck exhaust in LSM?
- Important fast pressure variations (~10 mbar). Origin? Will air enter our detector?
- Fresh air entering lab at much lower flowrate (~1500 m³/h) than before tunnel construction (~5000 m³/h). Repercussion on radon rate in lab?

- **Communication between LSM users:**

- SuperNEMO will have many heavy operations and storage needs in coming months
- Bingo construction



Find a practical way to communicate on heavy operations or radioactive source movements...

- **Access to our electronics racks:** will Bingo construction impact what was decided for access?
- **More phones in strategic/remote places**
- **Anti radon factory status?**

Thank you to all LSM staff

And particularly to Zak, Jean-Lou, Manu and ... Lascar

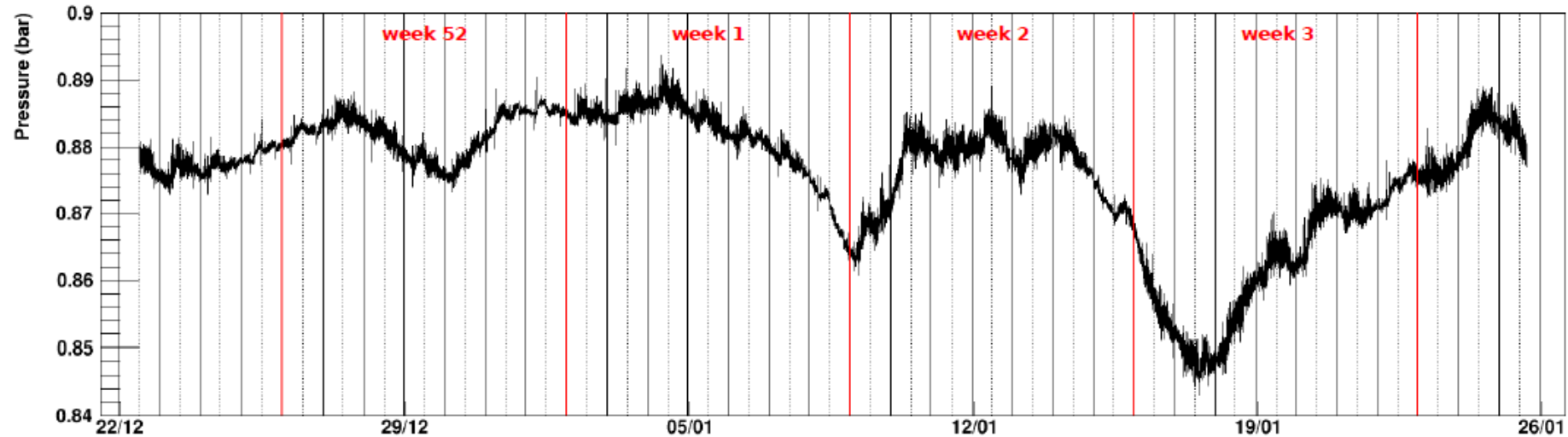


Environmental absolute pressure monitoring in Modane underground laboratory

Emmanuel Chauveau
LP2I-Bordeaux CNRS/IN2P3

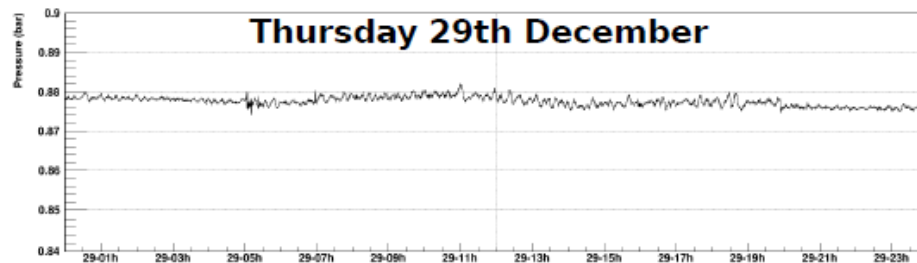
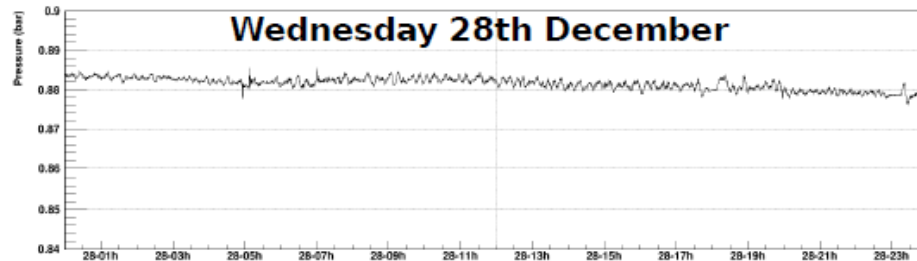
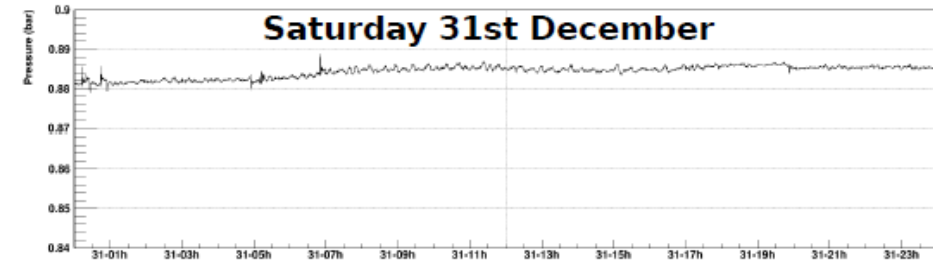
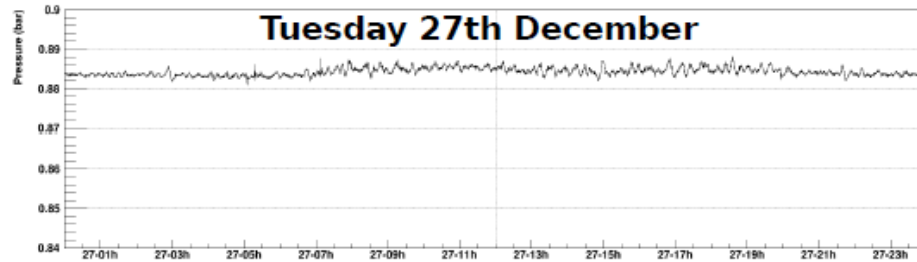
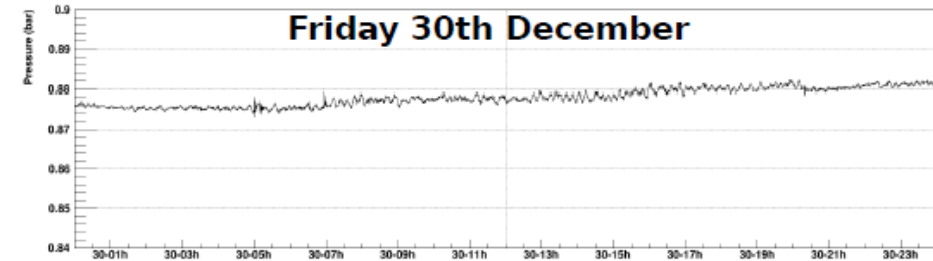
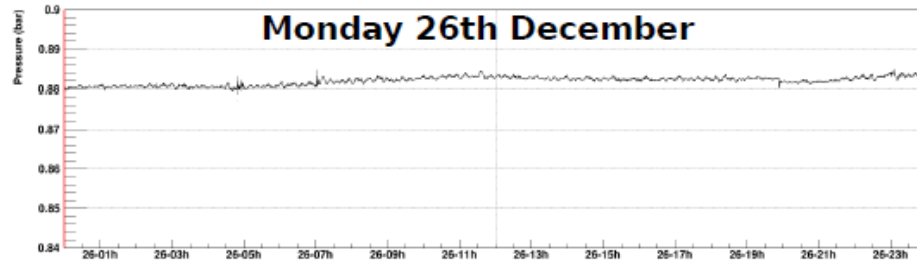
January 26th, 2023

Environmental absolute pressure monitoring

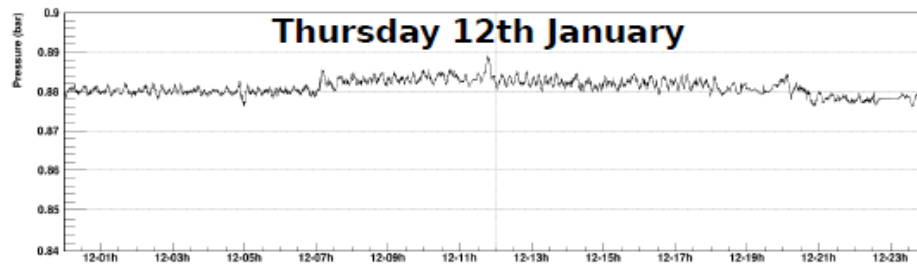
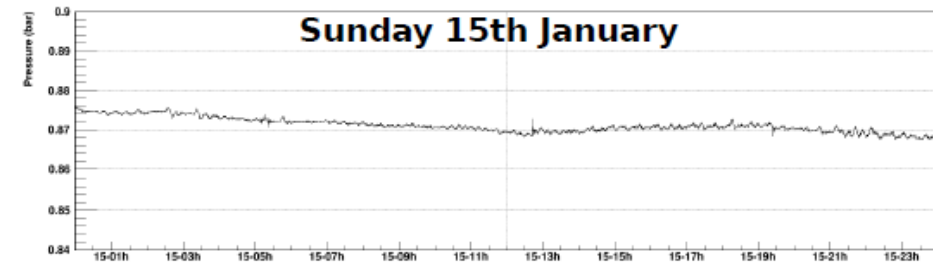
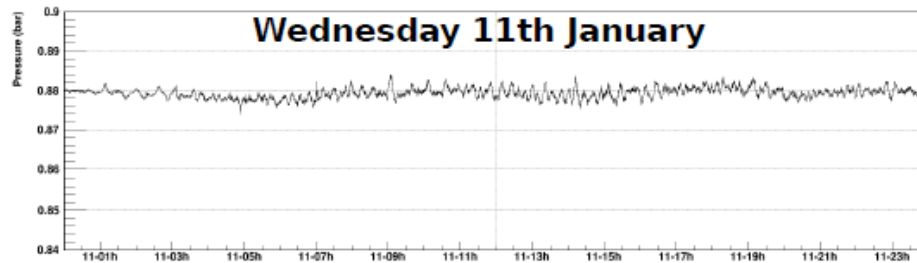
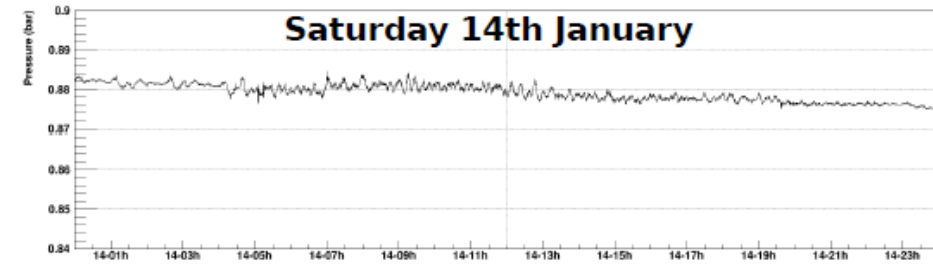
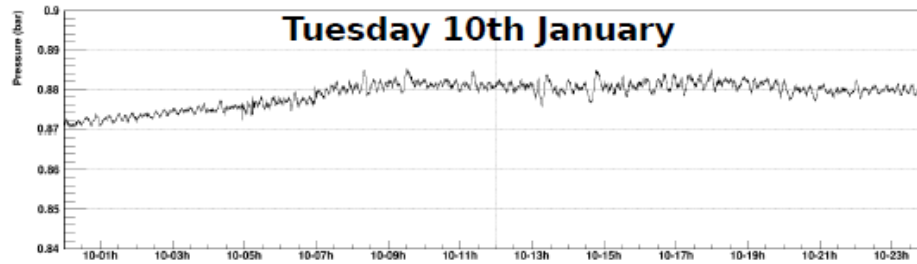
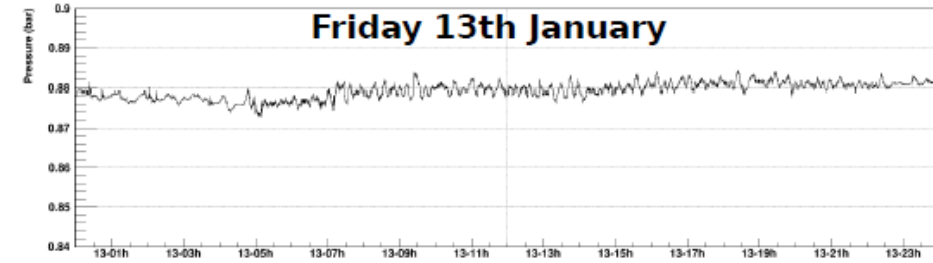
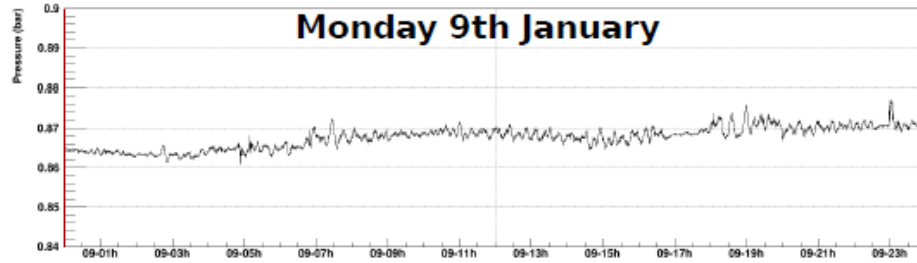


- Environmental absolute pressure and temperature being monitored by SuperNEMO gas system using commercial USB sensors GCDC B1100
 - regular fluctuations of absolute pressure are being observed with significant amplitude (**5-10 mbar**) over rather fast time scale (**10-15 min**)
 - it looks to be correlated with fluctuation of fresh air input flux inducing “inflation” and “deflation” of the laboratory
 - usually from 5-7h to ~ 20h on all week days except Sunday
- ⇒ see details with daily zoom on next slides

Daily pressure (week 52)



Daily pressure (week 02)



Daily pressure (week 03)

