



Crystals Handling Glove Box

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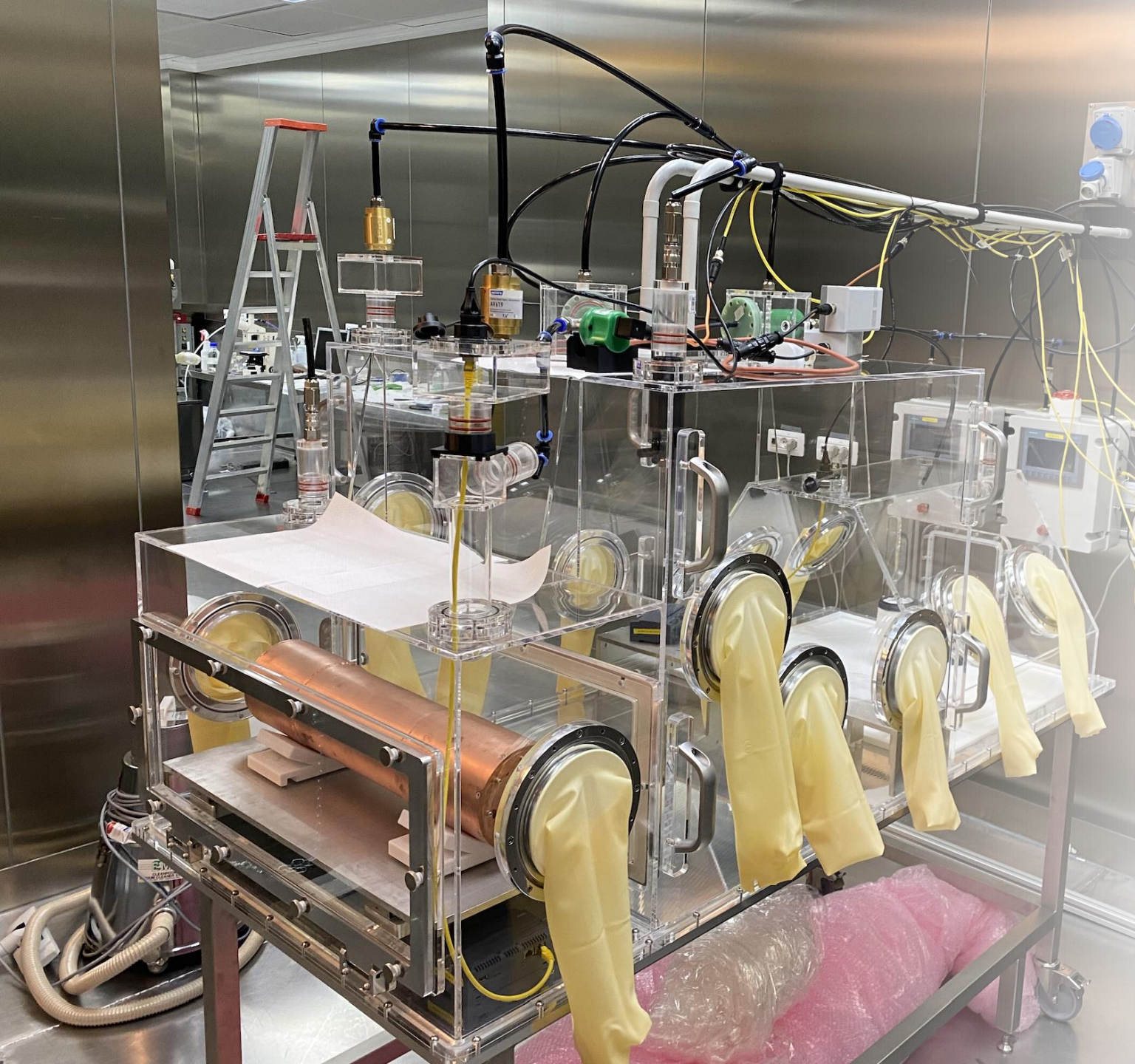
Overview

- Crystal handling Glove Box: functional recap
- Upgrade for humidity further abatement
- Next instruments for humidity monitoring

Crystal Handling Glove Box (CHGB)

Designed to make it possible to safely operate with base NaI(Tl) crystals; it is hermetically sealed and flushed with nitrogen to suppress moisture, radon, and other contaminants.

The glove box is located in the Radon-free clean room (CR1) in Hall C, whose Radon abatement system has been restored with dedicated maintenance in September 2022.



Crystal Handling Glove Box (CHGB)

The glove box consists of two volumes:

- A. the **antechamber (AC)** for the insertion of materials and tools;
- B. the **main chamber (MC)** for the actual operations.

Two different fluid handling modes are possible:

- **PURGE.** Continuous flux of nitrogen. This is used - for several hours (depending on the time of non-use) - before the experimental operations in order to establish a low radon and humidity environment within the volume of the glove box.
- **FLOW.** It dynamically maintains a slight overpressure with respect to the external environment (0.4 mbar and 0.8 mbar respectively in AC and MC, with respect to clean room pressure).

The system is conceived to maintain a constant overpressure relative to the clean room and between the main chamber and the antechamber.



Crystal Handling Glove Box (CHGB)

The system, through automated flowmeter and valves, regulates nitrogen flow to reach the pressure goals.

The general quality of the internal atmosphere is continuously monitored through Oxygen Sensor (*SST Zirconia O2 Sensors* – accuracy 0,5%) installed on the exhaust lines and through an internal Humidity Sensor (*SHAW Superdew 3 hygrometer* ± 2 °C dewpoint) ensuring to keep the relative humidity below 4% level.



Upgrade: Nitrogen dehumidifier (N2DH)

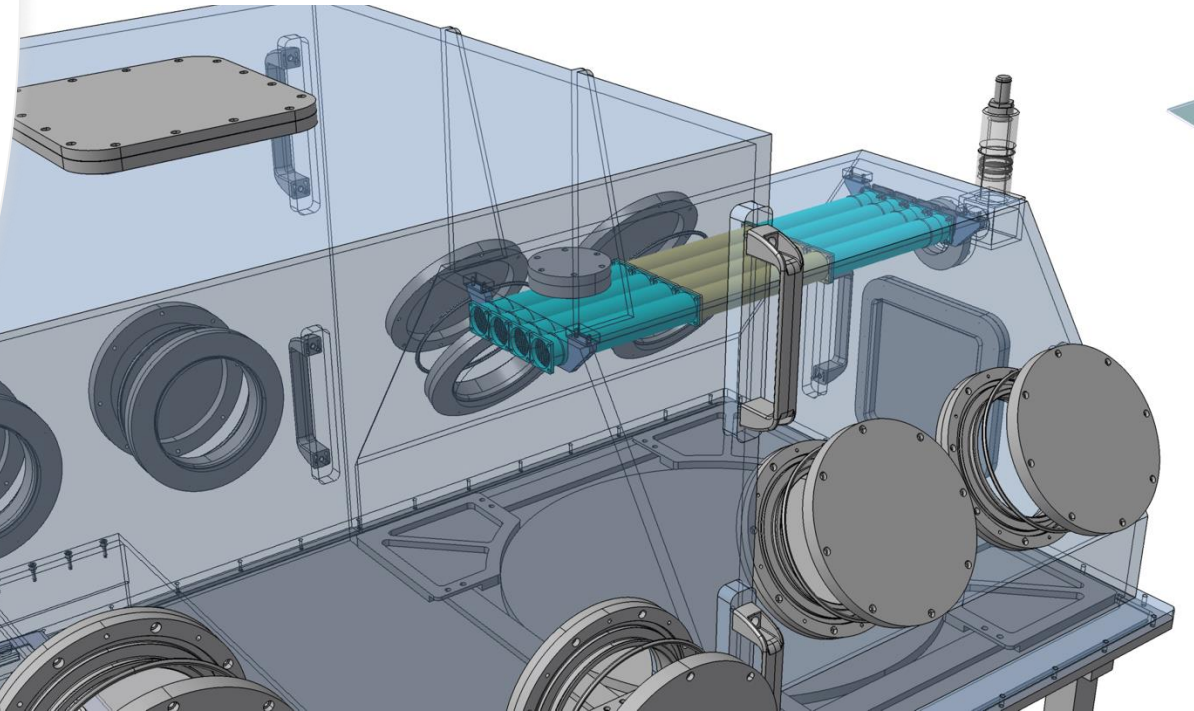
A specific solution has been developed and installed to further reduce internal humidity, setting a forced recirculation of internal nitrogen inside charges of highly hygroscopic material (molecular sieve).

More extensive tests are needed both to measure the maintenance of moisture achieved during typical operations and to measure the improvement in purging time. **Initial results showed a faster rate of moisture descent.**

Examples:

- **N2DH OFF:** RH(%) 12.7 → 12.2 in 7 mins [0,07/min]
- **N2DH ON:** RH(%) 9 → 6.7 in 15 mins [0,15/min]

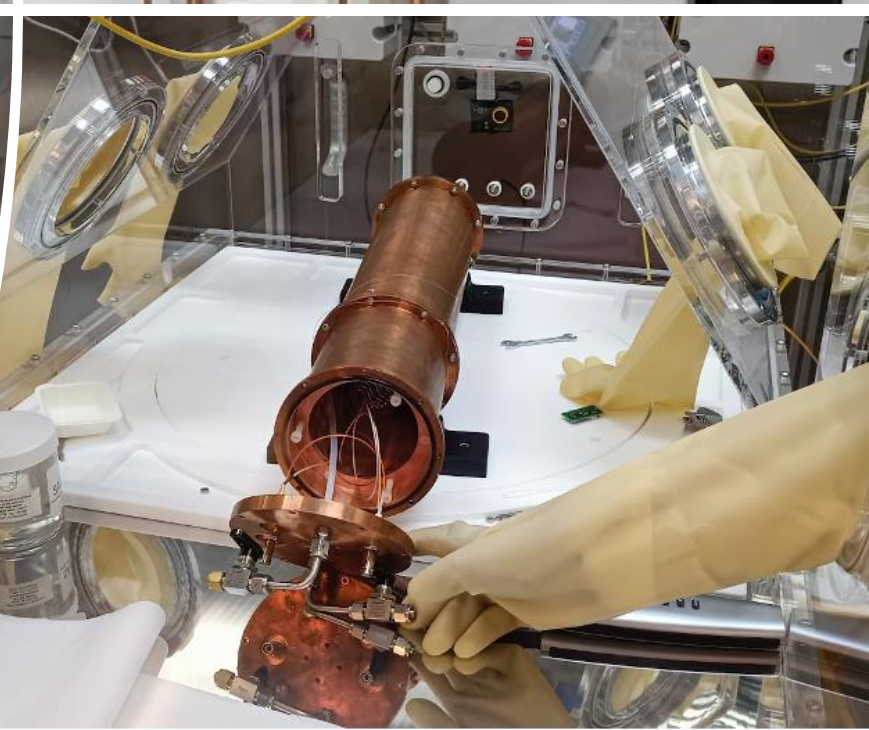
Note: a tape was installed on the exhaust of the dehumidifier to collect possible particles coming from the molecular sieve: analysed by Chemistry Dpt of LNGS and no evidence was found.



Crystal operations in Glove Box: 2022- 23

- 27/09/2022 change of PTFE reflector in Nal-33
- 29/11/2022 change of PTFE reflector in Nal-33
- 7/12/2022 first assembly of Nal-37
- 24/01/2023 second assembly of Nal-37

All operations successful
and moisture level in the
glove-box kept always
below 5% RH



New hygrometers

- Precision Hygrometer: Superdew 3 from Shaw Moisture Meters
 - accuracy of better than ± 2 °C dewpoint
 - to be installed inside the glovebox with external power supply
- Rotronic Hygropalm HP32
 - accuracy ± 0.5 %RH at 10-90 %RH
→ corresponds to ± 1 °C dewpoint at our working point (~5% RH)
 - battery powered, can be moved easily inside and outside the glovebox



Conclusions and next steps

- The CHGB system works as expected and ensures a safe area for crystal handling
- N2DH: very promising initial results with a clear improvement in the humidity reduction process of the internal atmosphere. Next test to be planned:
 - Purging efficiency (expected faster)
 - Humidity level maintaining during operation
- New hygrometers to be installed and tested

