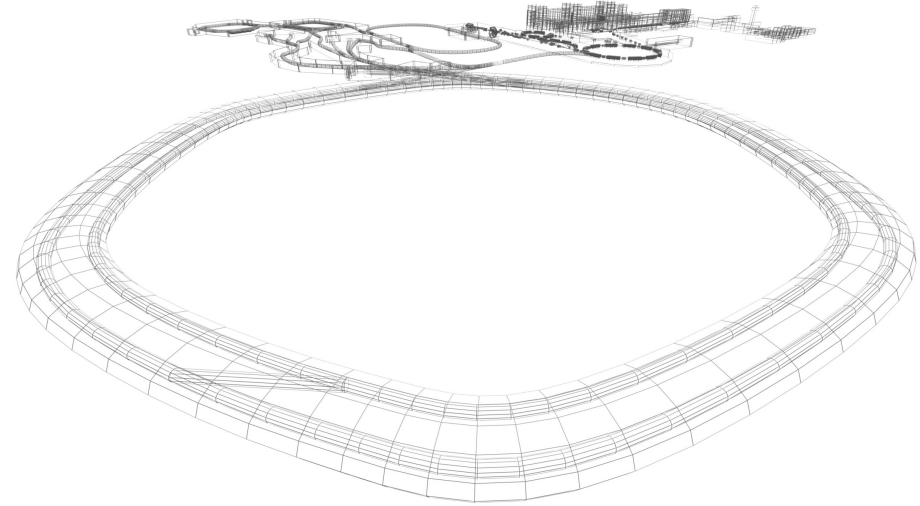


THOR (Test in HORIZontal): SIS 100 SAT quadrupole modules



THOR team:

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Umberto Gambardella, Gerardo Iannone, Enrico Leo, Aniello
Saggese, Claudio Severino, Fabio Severino

A description of the infrastructure and
its purposes in the framework of SIS100

With the support of
GSI test & Measurement Team

External contribution:
Mechanical engineering: Buonora engineering office
Workshop: G. Fiore, INFN Lecce

Index

- Where we come from
- The MoU with GSI/FAIR
- The installation phase
- The commissioning
- The foreseen test phase
- Conclusion

Where we
come from



FONDI
STRUTTURALI
EUROPEI

pon
2007-2013



Ministero dell'Istruzione, dell'Università e della Ricerca
Dipartimento per la Programmazione
D.G. per gli Affari Internazionali - Ufficio IV
Programmazione e gestione dei fondi strutturali europei
e nazionali per lo sviluppo e la coesione sociale

COMPETENZE PER LO SVILUPPO (FSE) - AMBIENTI PER L' APPRENDIMENTO (FESR)

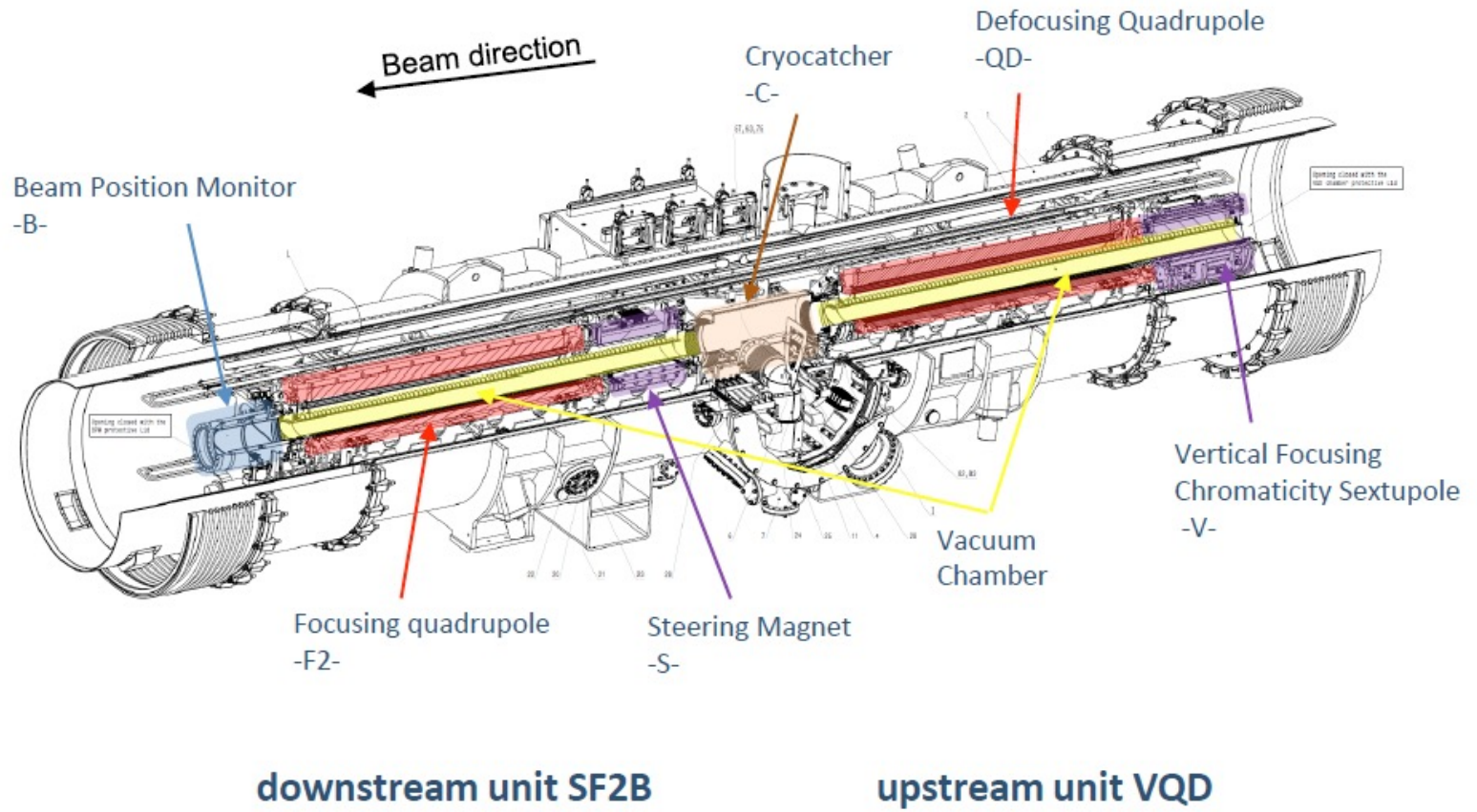


Istituto Nazionale di Fisica Nucleare



We took the opportunity of PON funding to put the basic core of the infrastructure.

- ▶ On May 31st, 2019 the MoU was approved
- ▶ It contains an Annex with 38 pages describing the SoW, i.e. the description of the work to be done in order to realize a SAT of the integrated modules. We will perform the SAT on behalf of GSI, and after this SAT the QDM will be ready to be installed into the SIS100 tunnel.
- ▶ In summary we have to check both the basic features (mechanical collisions, leak tests, pressure test, isolation of all the parts and components, integrity of cables, etc.) and specific items, like LCL and Cryocatcher which have never been tested as a single item.
- ▶ The power test are limited to the corrector magnets, being the quadrupole units fully tested by the manufacturer in Dubna.



Module type 2.5 (FoS)

The path



Development of the facility

Development
work



From 2019

Development work



... to now

Development work



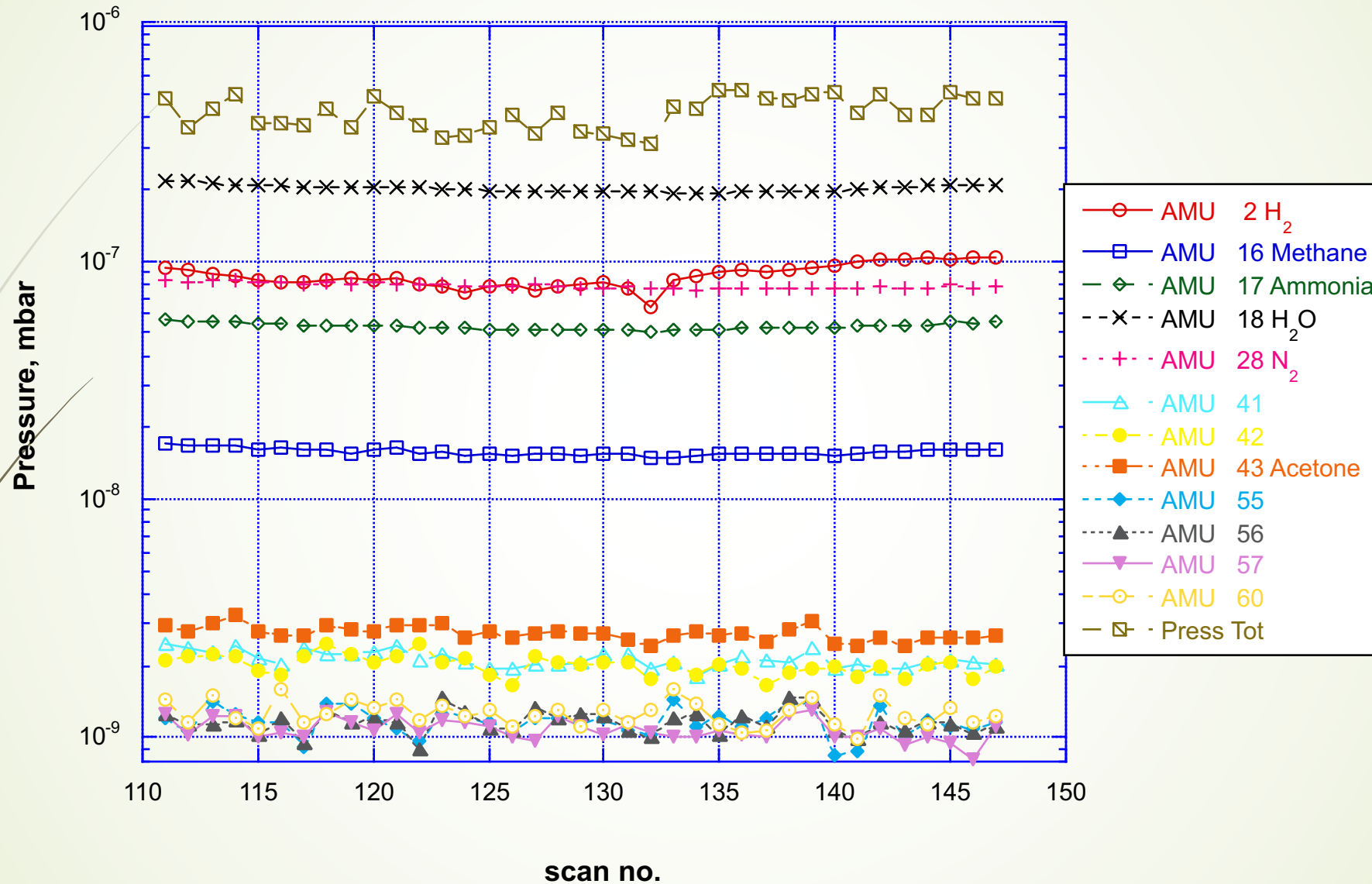
Pumping systems and quality controls from the end box for either the beam pipe vacuum and for the isolation vacuum

-300K situation-

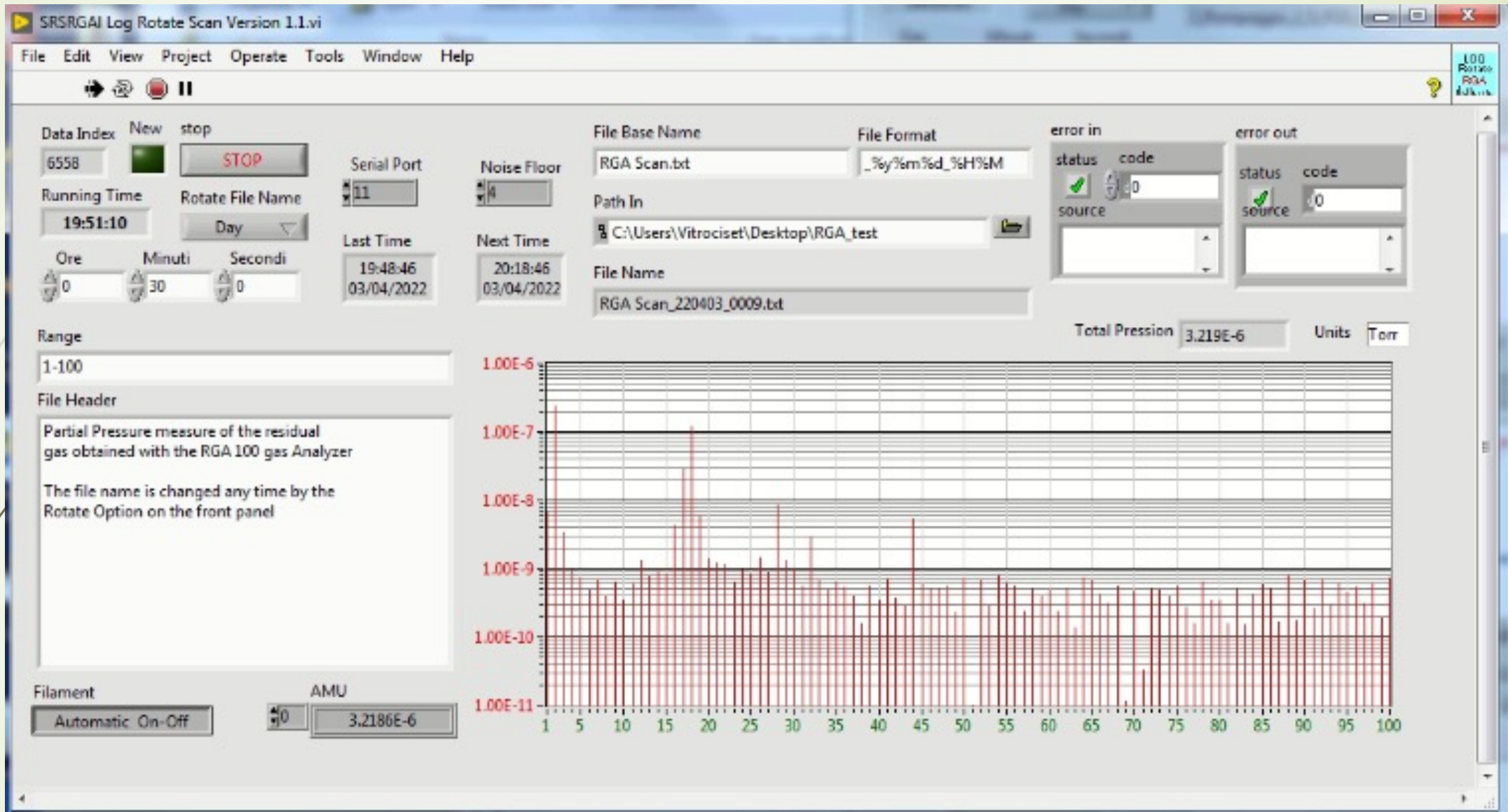
Presently we are at 10^{-5} mbar in the isolation vacuum (leak detected at 10^{-9} mbar \cdot l \cdot s $^{-1}$). The beam pipe pressure is at 10^{-8} mbar.

beam pipe RGA
warm test

RGA Scan_220321_0012

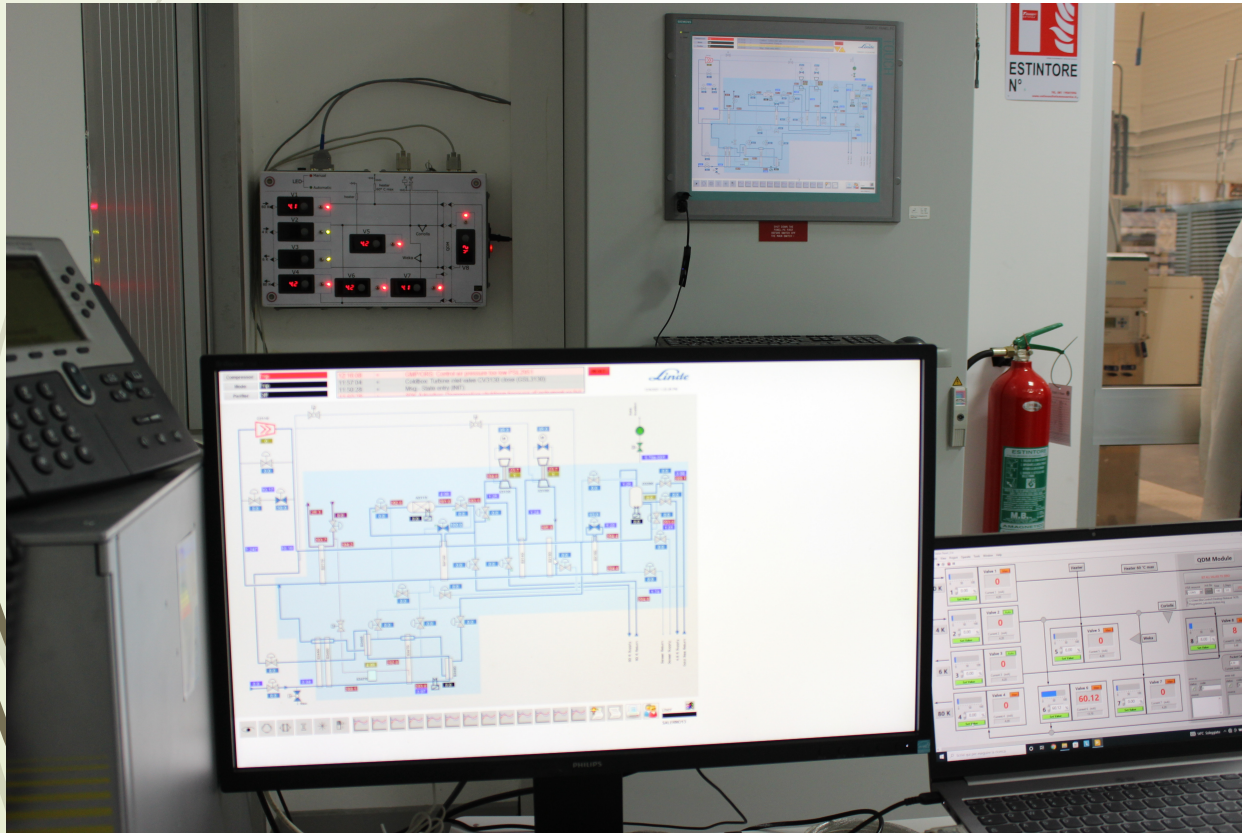
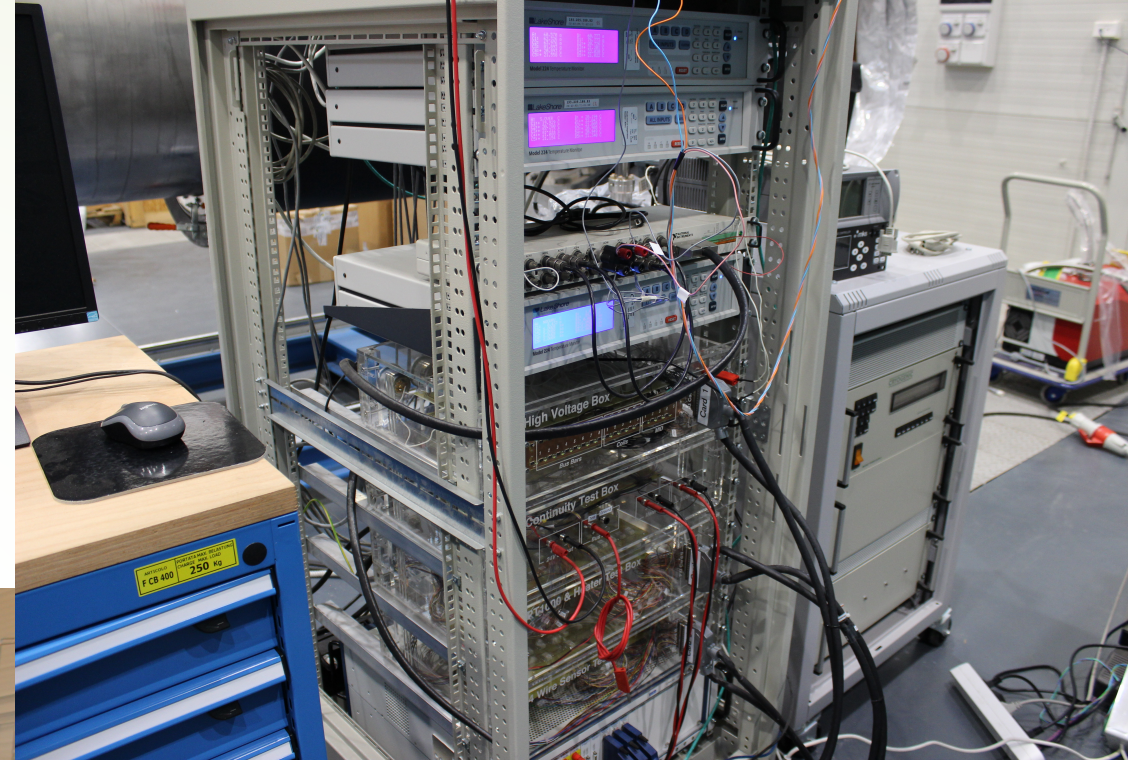


Isolation vacuum
RGA warm test



Development work

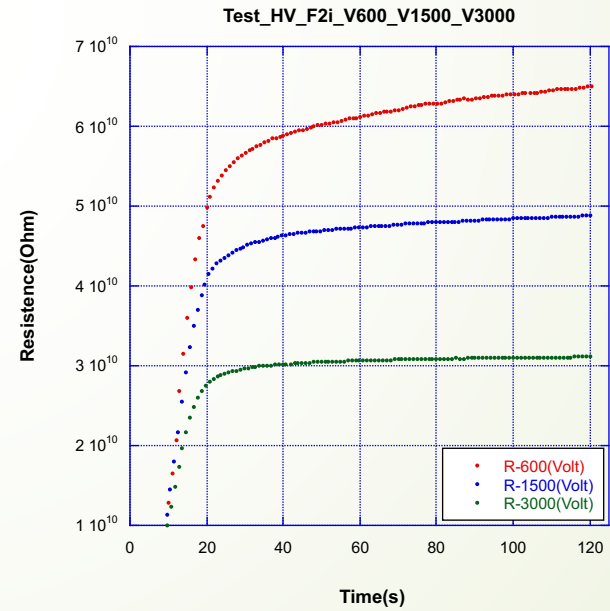
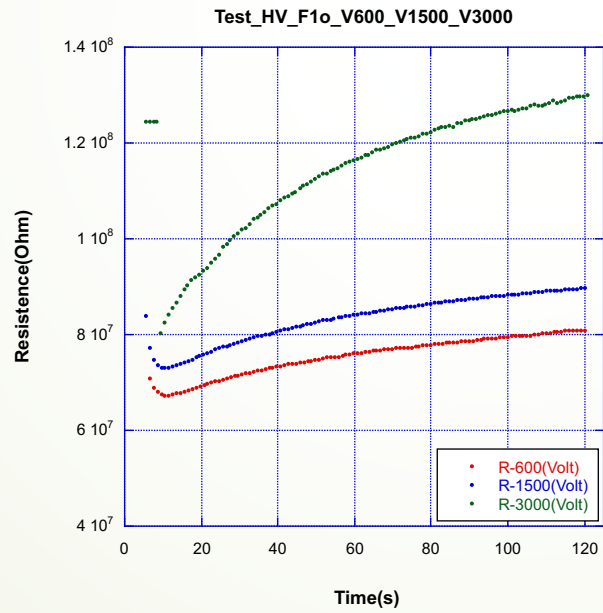
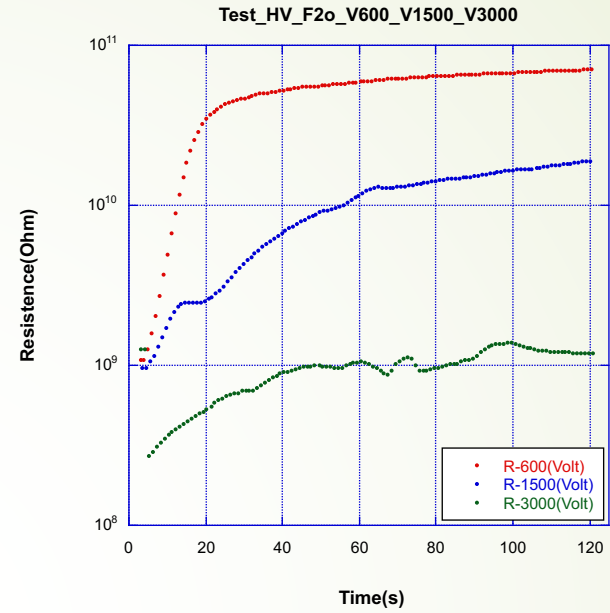
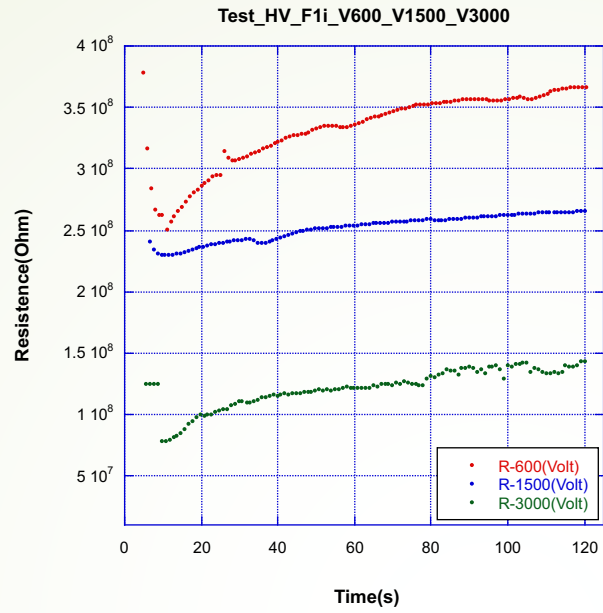
Including special electronics (switch boxes for HV and LV isolation test, continuity & functionality tests) →



← h/w and s/w development for the Feed Box cryovalves



Some warm test



Feed Box 1st cooldown

The screenshot displays a LabVIEW control interface for a feed box system. The main window, titled "Prova_controllo_temperature_feed_box_tetra_buona2.vi", features a 3D CAD model of the feed box with several components labeled and their temperatures displayed on gauges:

- Flangia DX (CB):** 112.409
- Tappo:** 198.624
- Flangia SX (II linea):** 114.807
- Carcassa:** 109.341
- Mandata schermi:** 47.194
- Ritorno schermi:** 58.7445

A "stop 2" button is present in the upper left. A data array "Array 6" is shown with the following values:

| | |
|---|----------|
| 0 | +112.409 |
| | +114.807 |
| | +58.7445 |
| | +47.1940 |
| | +198.624 |
| | +00.0000 |
| | +00.0000 |
| | +109.341 |
| | +00.0000 |

A "Log_Feedbox_Temperatura" window is open, showing a graph of pressure over time and a table of data points:

Note: log pressione 10/07/19 h 16:10

The graph shows Amplitude vs Time. The pressure starts at approximately 1.0E-5 and drops to about 1.0E-7 after 10,000 seconds.

Below the graph, the following data is displayed:

| | | | |
|-------------|----------------------|----------|----------|
| Secon | Testa a Ionizzazione | Pressure | 1.422E-7 |
| Delay (sec) | Sensor | | |
| 10 | Testa a Ionizzazione | | |

At the bottom right, a table "Array 5" shows the following data points:

| | data out |
|----|------------------------|
| A | Flangia DX +112.409 |
| B | Flangia SX +114.807 |
| C1 | Linea Ritorno +58.7445 |
| C2 | Linea Mandata +47.1940 |
| C3 | Tappo schermo +198.624 |
| D1 | Carcassa +109.341 |
| C5 | C5 +00.0000 |

Two "error out" status indicators are shown at the bottom, both with a status of "0" and a source field.

Conclusion

- ▶ We have realized the first test line for the QDM (despite pandemic, war...).
- ▶ First cooldown of the FoS module is in progress, with the aim to make a full commissioning of the facility at 4.5 K.
- ▶ This month we are going to receive one series module to be tested (with the help of GSI colleagues).
- ▶ As agreed we are procuring the 2nd line and related equipment, which is needed to increase the testing rate.
- ▶ The 2^o line hardware is expected in June, while other parts will be ready by the end of the year.
- ▶ We expect to be ready and fully operational in 2023, up to the end of the SIS100 program (but war could actually delay the QDM manufacture).