CRYOGENIC FACILITY SET UP FOR *SUPERCONDUCTING ACCELERATOR MAGNETS* AND *POWER TRANSMISSION LINES* AT INFN

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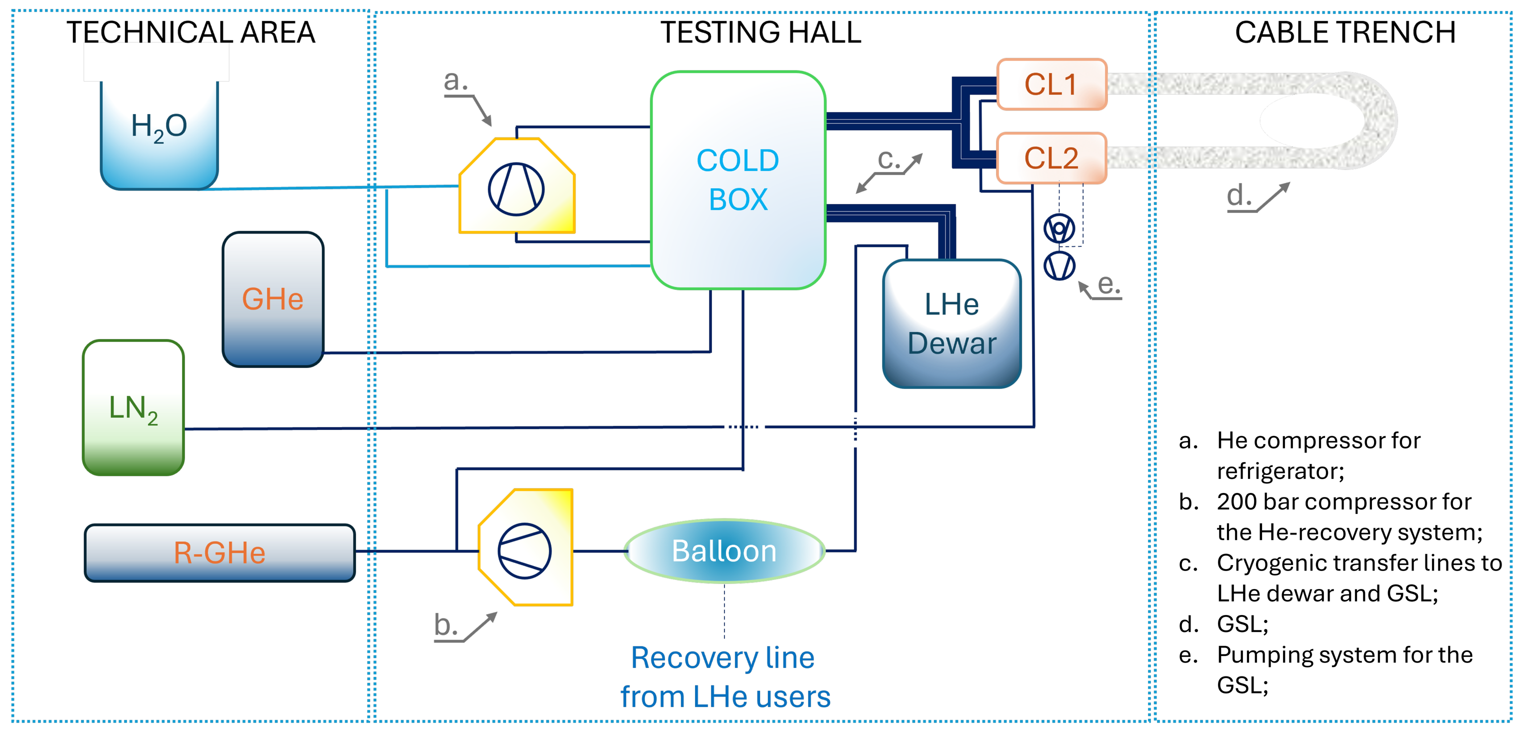
The Innovative Research Infrastructure on Applied Superconductivity, *IRIS*, program, led by the National Institute for Nuclear Physics (INFN) has been approved and funded under the National Recovery and Resilience Plan of the Italian Ministry for University and Research. It **involves several Universities** (Genoa, Milan, Naples, Salento and Salerno) and **Italian Research Institutes such as INFN and the National Research Council** (CNR) [1,2] . All the partners and research groups have a strong background and tradition in the field of superconductivity and its applications. Among its targets, the program will **set up a new Test Facility for large Magnets and superconducting Line** (TFML) at the Department of Physics of the University of Salerno (IT). The TFML will extend over **two buildings**, set side by side, dedicated to the tests of large superconducting magnets, the one, and superconducting power transmission lines, the other. Each building will be equipped with **independent cryogenic systems**. The part of the facility dedicated to the tests of superconducting magnets, Test in HORizontal (THOR), is already in operation and will be consolidated under IRIS. Nowadays, THOR is committed into the site acceptance tests (SAT) of the quadrupole doublet modules (QDM) of the SIS100 synchrotron, under construction in Germany for FAIR at GSI Darmstadt. On the other side, the new part of the facility where the tests of superconducting power transmission lines (or green superconducting lines, GSL) will be established is under construction. The TFML design enables for future adaptations/extensions, being **open for future test programs and ensuring the sustainability of the facility** beyond the term of IRIS project. A review of the facility is given in this poster.

SUPERCONDUCTING POWER TRANSMISSION LINE TEST PROGRAM

The new part of the facility for GSL testing will be erected in the area close to THOR. The Department of Physics of the University of Salerno superintends the construction of the new building, with a testing hall (~600 m²) designed for hosting high current/voltage tests for the GSL. The surrounding area of the building will include high pressure tank for He storage (18 m³ at 200 bar for impure recovered He, and 30 m³ at 15 bar for pure He), a liquid Nitrogen tank (to be defined), the water-cooling tower (to be defined) and several technical services.

A sketch of the new test infrastructure is presented, focusing on cryogenic equipment. The first GSL to be tested will be a demonstrator acquired by INFN in the framework of IRIS. Cable specifications are given elsewhere [3]. Some fundamental parameters of the cryogenic system and of the GSL are summarized here.

Refrigerator mass flow at 18 K	22 g/s at 7~10 bar
Superconducting cable material	MgB_2
Cable Length	130 m
Required cooling power for GSL	500 W at 20 K
Operating parameters of GSL at 20 K	1 GW (40 kA/25 kV)



Ackowledments.

IRIS program is supported by the NextGeneration EU-funded Italian National Recovery and Resilience Plan (Project IR0000003) with the Decree of the Ministry of University and Research number 124 (21/06/2022) for the Mission 4 - Component 2 - Investment 3.1.

References.

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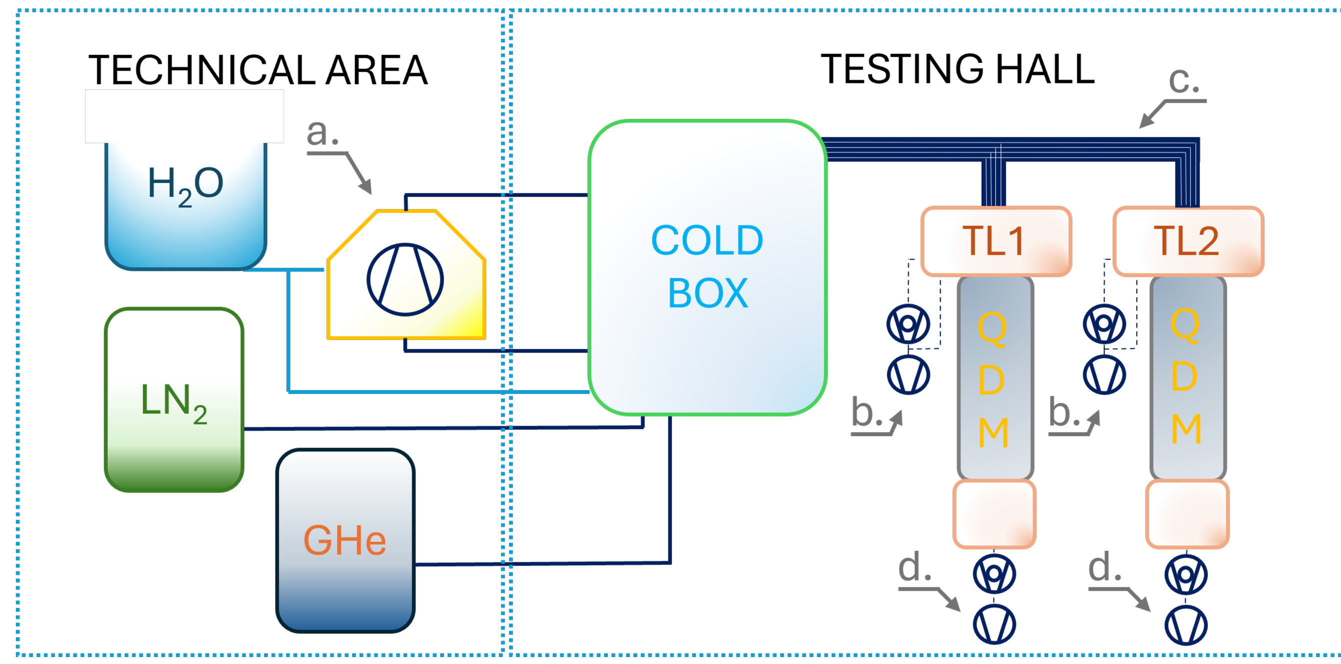
SIS100 QDM SAT AT THOR

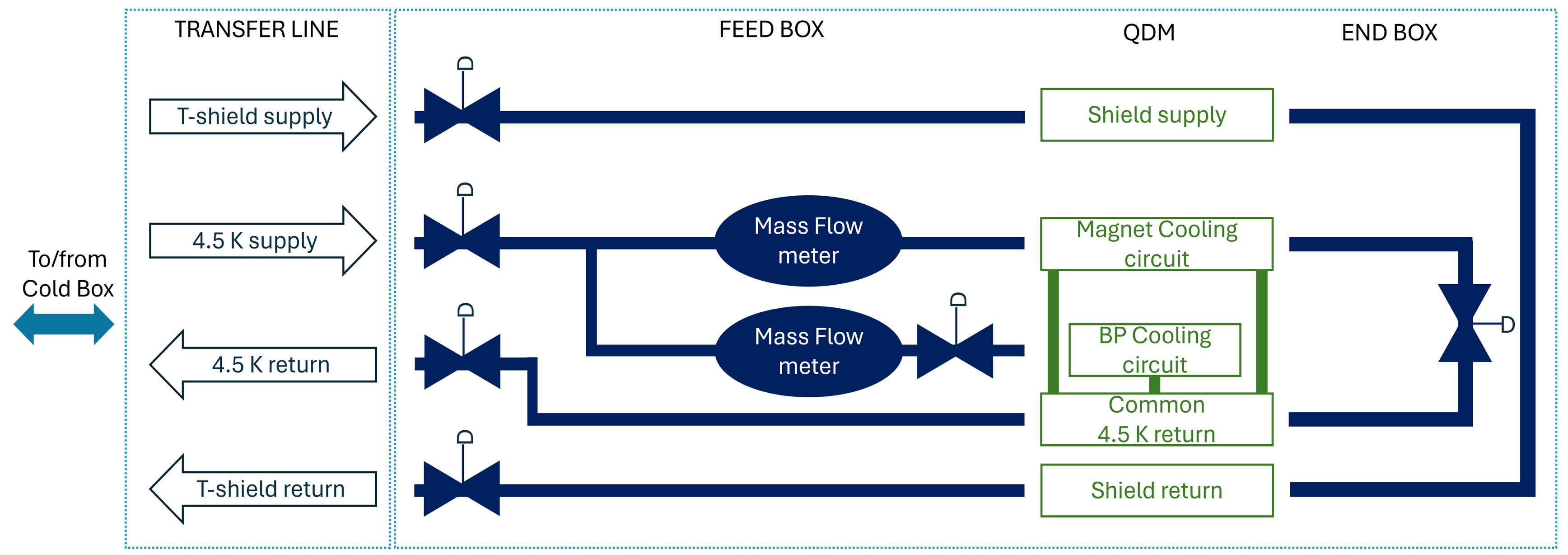
THOR [4,5] hosts the SATs of the QDMs to be integrated in the new SIS100 synchrotron. Total number of QDM to be tested is 81, plus 2 special modules, divided by THOR and the series test facility at GSI (STF). The available space in the testing hall is ~450 m², and the available He inventory is 30 m³ at 14 bar while the LN_2 tank has a capacity of ~3 m³. A sketch of the cryogenic equipment at THOR is presented here, with some cryogenic fundamental parameters.

Test temperature	4.5~5 K
Total cryogenic mass flow per QDM	~5 g/s at 3 bar
Cryogenic gas type	Supercritical Helium
Measured static heat load per QDM	6~10 W (at THOR and STF)



a. He compressor for the refrigerator;
b. Pumping system for the two test lines TL1 and TL2;
c. Cryogenic transfer line to TLs;
d.Pumping system for the UHV of the beam pipe;

The refrigerator (a Linde-Kryotechnik LR280) supplies the cryogenic gas to the QDM under testing through a transfer line and an interface cryostat. Two test lines are foreseen, one is presently in operation, while the second one is under construction. The cryogenic flow distribution in each line is obtained by using several cryogenic valves. A set of two cryogenic mass flow meters is also present at the supply side of the magnet and beam pipe cooling circuits.



An indicative cooldown is reported. This is referred to the downstream unit cooling circuit of the QDM with short CID 48-1.

The cooldown lasted for about 10 days, while the steady state conditions at about 5 K were kept for 17 days. During this period, a full set of tests has been carried out, including corrector superconducting magnets powering, HV insulation tests, temperature sensors and heaters functionality, and beam instrumentation integrity check.