Testing of magnets and components at cryogenic temperatures, report from TNA WP9¶

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For the ARIES ANNUAL MEETING APRIL 2021

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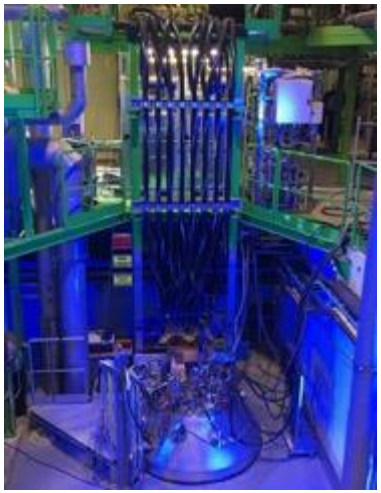
THE STAUS IN April: WP9.1 – The *MagNet TNA*

MagNet (@CERN) is operational,
but entering in the phase of SERIES MAGNET TESTING for the HL-LHC project and so more and more difficult to allocate the projects



4 projects has been completed by performing tests thanks to the required access

Facility	No. of aproved projects	Total no. of projects for which we have engaged Magnet	No. of users till today	Total no. of users for which we have engaged MagNet	No. of given access units	Total no. of access units for which we have engaged MagNet	Total no. of access units after re-distribution*
MagNet	5	~~8~~ 5	27 +3 =30	~~40~~30	1090	1,920	1300

* This is ***the agreed engagement of the MagNet*** after the COVID19 and the extension of ARIES TNA

THE STAUS IN April: WP9.2 – The *GERSEMI TNA*

GERSEMI (@FREIA) is operational,
and entering in the phase of TESTING also for the HL-LHC project

4 projects has been completed by performing tests thanks to the required access

Facility	No. of aproved projects	Total no. of projects for which we have engaged Magnet	No. of users till today	Total no. of users for which we have engaged MagNet	No. of given access units	Total no. of access units for which we have engaged MagNet	Total no. of access units after re-distribution*
GERSEMI	5	~~8~~ 5		~~56~~30		2880	1800

* This is ***the agreed engagement of the GERSEMI*** after the COVID19 and the extension of ARIES TNA

Score vs Evaluation criteria

Latest MagNet Projects

	Evaluation criteria	Meets criteria (1-low, 2-medium, 3-high)		
		RADES	CORC	UCN
a.	Scientific interest for our community or more specifically for our test stands	3	3	2
b.	Coming from universities or Institutes not having easy access to our facility	2	2	2
c.	Coming from small countries not yet well represented in big EU projects	2	1	1
d.	Young researchers, students. Equal opportunities and diversity.	1	1	1
e.	Collaboration of different countries or different institutes	3	3	2
f.	Potential to make a patent or export its know how towards industry	2	3	2
	Total score	13	13	10
	Average score	2.2	2.2	1.7

In preparation DONE Approved

<u>International User Selection Panel</u>

GianLuca Sabbi	LBNL
Tatsu Nakamoto	KEK
Roger Ruber	GERSEMI

Performed project at CERN

ReBCO-CORC-CIC 77 K test with 20 kA

For the purpose of future superconducting detector magnets and busbars for accelerator application, a development is on-going of ReBCO-based Conductor-On-Round-Core Cable-In-Conduit (ReBCO-CORC-CIC) conductors. This activity has already been on-going for some five years, and in the coming months it is foreseen to test a prototype conductor in the SULTAN test facility at EPFL, location PSI, in a 12 T magnetic field back-ground and at variable temperature.

Before shipping the conductor to EPFL/PSI for test at 4.3 K, the test of the conductor at 77 K (in liquid nitrogen) is foreseen and without back-ground field, which involves running some 20 kA current through the sample, measuring the voltage taps on the conductor, and checking the sensors.

+ 5 users and aprox + 140 access

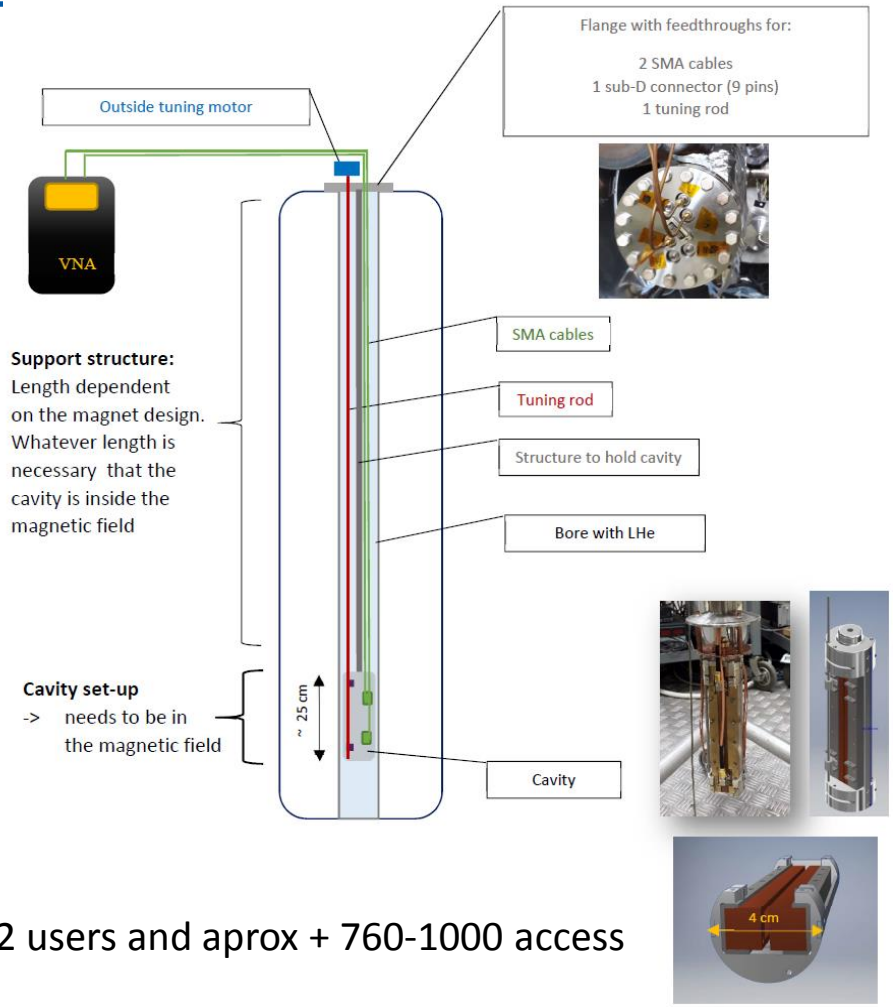
It has been performed successfully October-November 2020

Project at CERN in preparation

RADES
(Relic Axion Detector Exploratory Setup)

is a project with the goal of directly searching for axion dark matter employing custom-made microwave filters in magnetic dipole fields.

We profit from the 11T dipole HL-LHC model magnet program. The SP107 is a single aperture magnet that has been tested several times in the HFM test stand and cooled down to LHe 6 times. The magnet achieved several times Ultimate performance > 12 T field and powered for 2.5 h in continues manner at Nominal field of 11 T.



+ 12 users and aprox + 760-1000 access

Technical feasibility check: 02. 2020 → 04.2020 Application completed → 10.2020 Application fully aproved → 11.2020 Test Planned → 03.2021 Test Prepared → 04-05.2021 TEST

Approved new project at CERN

SUPE Sun

[…] magnet is part of a large ultra-cold neutron source called SuperSUN, which will first be used to search for the electric dipole moment of the neutron and later to measure the lifetime of free neutrons.

This magnet is going to be built by Elytt Energy (Spain) for the ILL (France). ILL is part of EIROforum with CERN.

The goal is to test and train the magnet in a test cryostat before installing them inside the final cryostat.

The magnet consists of a solenoid surrounded by 8 coils inside a yoke. The field will act as a magnetic trap of ultra-cold neutrons (**2.1 T max** on the perimeter and a few mT on the axis). The **8 NbTi coils** will be energised with **432 A** and a switch heater will allow us to work in persistent mode. The solenoid, which prevents the loss of neutrons through depolarisation, will be energised with a lower current. We shall test the persistent switches and joints at our facility before testing the coils.

The whole length of the 4 K magnet is a bit more than 3 m and the diameter is ≈ 220 mm. As we shall need space to attach the persistent joints and switches, the instrumentation and the LN2 precool loop, we estimate that we shall need a ≈Ø350 x 4000 mm^3 4 K cylinder.

As for the schedule, Elytt should complete the construction of the magnet in January 2021. The drawings are completed and they are preparing the mockup coil.

We did project approval in October 2020

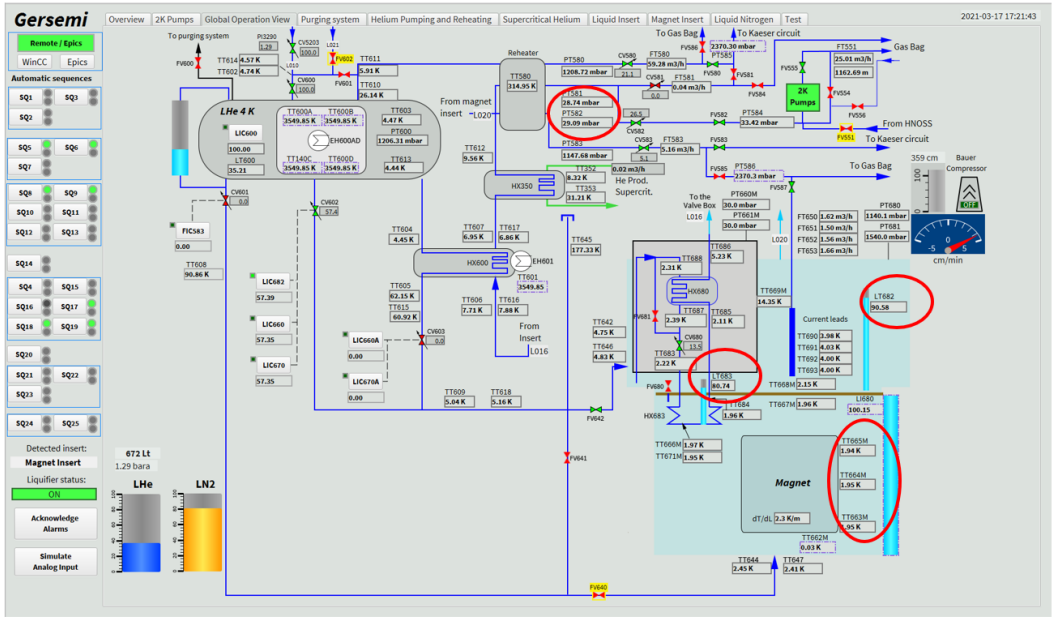
FREIA TEST STAND FULLY operational @ 1.9 K

This is areal great milestone although is quite late in the ARIES TNA: outside CERN but as a real extension of the Vertical test stands of ***MagNet*** we have a fully operational vertical magnet test cryostat in FREIA!

UPPSALA UNIVERSITET

Reached 1.9K and stable situation

17 Mar 2021 (8 weeks after the beginning, a COVID interruption and He constraints)



Gersemi was ready, 90% of LHe above the lambda plate and 1.95K on the magnet (30 mbar)

Courtesy of K. Pepitone

Potential projects at GERSEMI

- TEST of MCBXF-A/B magnets ***DONE for the HWC, but this is not a project***
- Test of the Metrosil varistor at cold ***to be confirmed***
- Test of the Scanditronix 50 cm short model CCT magnet ***has been cancelled as the magnet has a short!!!***

We have to see how in the remaining short time we can spend the 1800 accesses……