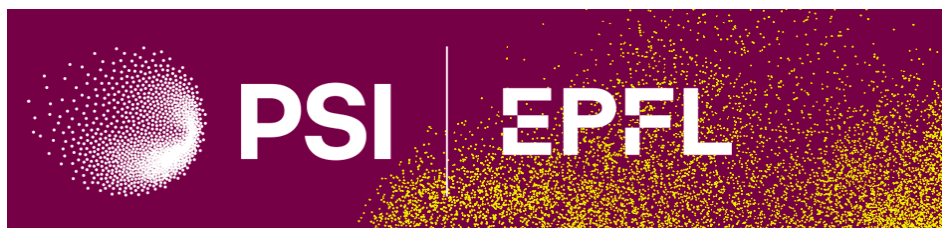


# 5th SMTF and 3rd IDSM 2025



## Report of Contributions

Contribution ID: **11**

Type: **not specified**

## Welcome to the 5th SMTF Workshop

*Monday 31 March 2025 09:00 (20 minutes)*

Oral presentation (10 min) + Q&A (10 min)

**Primary author:** BAJKO, Marta (cern)

**Presenter:** BAJKO, Marta (cern)

Contribution ID: 12

Type: **not specified**

## Test and diagnostic: priorities for high field magnets program

*Monday 31 March 2025 09:20 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The high field magnet program is an R&D activity focused on the construction of 14 T dipole prototypes in Nb<sub>3</sub>Sn, proving the HTS technology for main accelerator dipoles in the 14-20 T range, and developing the superconducting technology for particle physics.

In this talk we will outline few R&D guidelines that concern test and diagnostics. The recent studies and proposal for an FCC-hh operated at 4.5 K, as in the baseline for the SppC, would require the ability to measure the temperature margin in magnets tested at 4.5 K. Another critical aspect is the measurements of hysteresis losses during ramp, that are one of the main bottlenecks for the energy consumption and dimensioning of cryogenic system. Finally, the measurement of the stability of transfer function and low order multipoles during magnet ramping for both HTS and LTS is a fundamental proof of the viability of both technologies for main magnets in accelerators.

**Presenter:** TODESCO, Ezio (CERN)

Contribution ID: 13

Type: **not specified**

## US MD Program - Road Map. Test Infrastructures

*Monday 31 March 2025 16:20 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The US Particle Physics community has completed its decadal planning process, culminating in the Particle Physics Project Prioritization Panel (P5) report [1]. Over the last year the US Magnet Development Program has worked to update its research roadmap to align with the P5 strategy, and in particular is focusing on developing magnet technology that can enable the primary 10TeV Parton Center of Mass colliders such as the FCC-hh and the muon collider.

We will provide an overview of the updated MDP roadmap, and describe progress over the last couple of years in both LTS and HTS accelerator magnet technology in the US. A major thrust of the program in the coming years will be the testing of HTS “inserts” in Nb<sub>3</sub>Sn “outsert” dipoles, requiring advances and improvements in MDP test facilities to enable independent powering and energy extraction of the HTS and LTS magnets. Advances are also required in our ability to model and diagnose quench initiation and the energy extraction process, and to determine design and test parameters that enable safe operation without degradation to the conductor, and program elements are designed to help address these issues.

**Presenter:** PRESTEMON, Soren (LBNL)

Contribution ID: 17

Type: **not specified**

## Muon Collider Magnet Programme: Test and Measurement Requirements

*Monday 31 March 2025 09:50 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The muon collider requires advanced magnet systems to meet the demands of muon production, acceleration, and storage. The key targets for magnet R&D include achieving field levels up to 20 T in dipoles, quadrupoles and combined function accelerator magnets, up to 40 T in solenoids, and very fast ramping, up to 3 kT/s, in resistive accelerator magnets. R&D presently focuses on integrating high-temperature

superconductors (HTS), developing efficient cooling systems, required to manage heat loads from muon production and decay at the level of kW, ensuring radiation resistance at the level of tens of MGy, and developing efficient MJ-scale energy storage and GW-scale power management for the pulsed accelerators.

These exceptional challenges will require intense test and measurements with tailored and advanced techniques, from materials, to magnets, to systems. In this presentation we will outline the magnet challenges, the proposed R&D program and the time scale of the development, prototyping and series production towards a muon collider. Based on the proposed R&D and production programme, we have identified some specific challenges for test and measurements that will need dedicated new methods, sensors

and infrastructure. Examples are:

- Characterization of HTS material performance at cryogenic temperatures and ultra high field (up to 40 T), including in relevant radiation environment;
- High current conductor testing with capabilities up to 20 T, currents up to 60 kA and variable temperature in the range of 4.2 to 100 K;
- Characterization of magnet performance, quench detection and protection of NI HTS magnets, including at temperatures above liquid helium (e.g. 10 to 20 K);
- Measurement of field quality, stability and reproducibility of NI HTS dipoles and quadrupoles, which can rely on the standard methods of harmonic expansion, as well as combined function accelerator magnets and solenoids, for which a non-standard field representation is required.

The presentation will provide a first evaluation of the measurement needs and tentative range of operation, useful to guide future developments and investments in test methods and infrastructure.

**Presenter:** BOTTURA, Luca (CERN)

Contribution ID: **18**Type: **not specified**

## JORDI test facility (SPC, EPFL)

*Wednesday 2 April 2025 09:30 (35 minutes)*

Oral presentation (25 min) + Q&amp;A (10 min)

An extensive characterization of cable-in-conduit conductors (CICC) at the EPFL Swiss Plasma Center led to the construction of the JORDI test stand in the 2000s, initially used for JOint Resistance DIstribution measurements in CICC immersed in a liquid helium bath [1]. The test stand is connected to a cryoplant supplying helium in a supercritical state at ~10 bar pressure and ~4.5 K temperature, as well as a DC power supply rated for 10 kA and 2 V. Consequently, it was used for testing sub-scale HTS current leads designed for fusion magnets; however the helium flow was still expanded to relatively low pressures, close to 1 bar [2]. Currently, we aim to upgrade JORDI in terms of cooling conditions, operating currents, and background magnetic fields to expand the testing capabilities at SPC within a testing zone of 0.7 m in diameter and 1 m in length. The latest developments, including a list of components required for the upgrade (e.g., mass-flow orifice, superconducting transformer, background field coils, etc.), as well as the first test samples, such as superconducting switches and HTS coil windings, will be discussed in this work.

**Presenter:** BYKOVSKIY, Nikolay (PSI - Paul Scherrer Institut)

Contribution ID: **19**

Type: **not specified**

## **BNL test facility**

*Monday 31 March 2025 15:50 (30 minutes)*

Oral presentation (20 min) + Q&A (10 min)

**Presenter:** PIYUSH, Joshi (BNL)

Contribution ID: 20

Type: **not specified**

## CEA test facility (including fusion)

*Monday 31 March 2025 11:40 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The STAARQ cryogenic test station is designed to test and characterize magnetically 2 series of quadrupole magnets for the LHC accelerator: 6 MQ magnets running at 13kA for the LHC consolidation project and 2 MQYY magnets running at 6kA for the HiLumi project. The pressurized superfluid bath required to run those magnets in the station at 1.9K and 1.4 bars can accommodate magnets up to 640 mm in diameter, 5.5m in length and 12t in mass. Among its notable characteristics, the station is equipped with a hermetic cold pumping system (up to 3.5g/s) to run the 1.9K heat exchangers. It enables the recycling of the helium exhaust in the LP circuit of the liquefier without additional purification. The full magnetic characterization of the magnets is achieved through a magnetic probe system running inside 2 anticryostats (50mm diameter and 7.35m length) inside the apertures of the magnets. Finally, the cryostat of the station is equipped with prototype hybrid superconducting current leads running liquid nitrogen to cool the resistive/superconductive junction in order to mitigate the heat leaks the liquefier has to deal with.

In this presentation, we will present the results of the initial successful commissioning of the station. We successfully tested the prototype hybrid current leads at their maximum rated current. We also fully characterized the cryogenic process and 1.9K cooling system through an additional heating element enabling the demonstration that the station can provide more than double the 1.9K cooling power than required by the future tests of the MQ and MQYY magnets.

**Presenter:** VALLCORBA, Roser (CEA Saclay)



Contribution ID: 21

Type: **not specified**

## SM18 magnet test infrastructure upgrades

*Monday 31 March 2025 13:30 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The test capabilities of the SM18 vertical magnet test station is growing alongside the more diverse magnets that will be tested there. An overview of the status of the test station will be presented, and the main upgrades will be summarized in this presentation. These include: a new insert with ~3 m long anticryostats for the Cluster D cryostat, a new setup in the HFM cryostat for (cryostated) magnet tests in a helium gas “bath”, the rehabilitation of the Cluster G feedbox for force flow gaseous helium cooled magnets, and a future new insert for the HFM cryostat for magnet tests in forced flow helium gas up to ~3-5 bar, and up to ~50-70 K.

**Presenter:** MANGIAROTTI, Franco (CERN)

Contribution ID: 22

Type: **not specified**

## STRING test facility at CERN for HL-LHC

*Monday 31 March 2025 14:00 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The High-Luminosity Large Hadron Collider (HL-LHC) Inner Triplet (IT) STRING aims to faithfully replicate, within a surface building, the collective behavior of various systems in the new HL-LHC IT zone. These systems include superconducting magnets, magnet protection, cryogenics for both the magnets and the superconducting link, powering, vacuum, alignment, magnet interconnections, and the superconducting link itself.

The construction of this test bed, designed to be completed years ahead of the actual equipment installation in the LHC tunnel, is now well advanced. Initiated in 2016, the project has taken significant shape: most of the hardware is in place, and parts of the control and software systems are already operational. By the end of 2025, we expect the entire STRING to be cooled to 1.9 K, marking the readiness for the String Validation Program.

In this talk, we will provide an update on the installation status, describe the major components, outline the test program, and discuss the next steps.

**Presenter:** BAJKO, Marta (cern)

Contribution ID: 23

Type: **not specified**

## FNAL test facility

*Monday 31 March 2025 15:20 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

This presentation will focus on the current testing capabilities for superconducting magnets at Fermilab, highlighting existing systems, recent upgrades, and future plans. The Vertical Magnet Test Facility (VMTF) remains a cornerstone for testing superconducting magnets in R&D applications, maintaining its established capabilities. Stand 4 continues to support the Hi-Lumi AUP production line of magnets in cryostats and has achieved significant improvements through a redesign of lead connections, resolving issues with liquid helium levels and resistance, culminating in a successful endurance test without interruption. Similarly, Stand 7 underwent commissioning and a lead redesign to reduce heat load, while its core testing capabilities remain unchanged. Looking forward, Stand 3 is undergoing a redesign, with plans to restart and begin commissioning by the end of 2025, introducing new features such as background magnetic field testing and upgraded power supplies. Fermilab is also advancing the High Field Vertical Magnet Test Facility (HFVMTF), designed to support the fusion and magnet R&D program, with commissioning scheduled for 2025 and critical components, including the cryostat and power supplies, being delivered. Enhancing all operations, the newly commissioned IB1 cryoplant now offers automated overnight helium production and efficient transfer to a 10,000-liter dewar, streamlining support across all test stands. This talk will provide a comprehensive overview of testing capabilities, and showcasing how Fermilab is advancing its capabilities to meet the evolving demands of superconducting magnet testing.

**Presenter:** NICOLIC, Vladica (FNAL)

Contribution ID: 24

Type: **not specified**

## The INFN Test Facility for Large Magnets and Superconducting Lines

*Monday 31 March 2025 10:40 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The Test Facility for Large Magnets and Superconducting Lines (TFML) in Salerno, Italy, is a state-of-the-art laboratory dedicated to the development and testing of superconducting technologies. Established and operated by the National Institute of Nuclear Physics (INFN) in collaboration with the University of Salerno's Physics Department TFML supports the THOR (Test in Horizontal) program since 2020. This is dedicated to the Site Acceptance Tests (SAT) of quadrupole doublet modules for the SIS100 synchrotron, part of the FAIR facility under construction at GSI in Darmstadt. The existing facility includes a cryogenic plant capable of cooling magnets to 4.5 K using a supercritical helium stream at 3 bar.

Since 2022, within the IRIS (Innovative Research Infrastructure on Applied Superconductivity) program, a second building is under construction in Salerno, adjacent to the already existing facility. The new facility will be dedicated to the test of a 130m long superconducting cable based on MgB<sub>2</sub>, capable to carry up to 40 kA at 25 kV operating at 20 K Helium gas.

The unique features and technical specifications of the facility, along with an overview of its current infrastructure, ongoing activities and developments are presented.

**Presenter:** CHIUCHIOLO, Antonella (Istituto Nazionale di Fisica Nucleare)

Contribution ID: 25

Type: **not specified**

## Superconducting magnet String Test for the SIS100 accelerator of FAIR

*Monday 31 March 2025 11:10 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The SIS100 accelerator, currently under construction in Darmstadt (Germany), consists of six arc and straight sections. Each of the six cryogenic arc sections comprises fourteen regularly repeating optical cells (lattice). Each standard cell includes two dipole magnets and two quadrupole units integrated in a quadrupole doublet module. The SIS100 String Test technically represents one standard cell of the arc section of the SIS100, terminated by an End Cap and a Bypass Line as a representation of the end of the arc section. The purpose of the SIS100 String Test is to validate all technical systems such as cryogenics, vacuum, interlock and quench detection and investigate their collective behavior. A wide spectrum of tests are performed during cool down, powering at operational conditions and warm up. Additionally, the experience gained during the SIS100 String Test will be crucial for the installation, commissioning and operation of the SIS100. The planning, installation process and first experimental results of the String Test will be presented.

**Presenter:** BARTOLOME, Patricia (GSI)

Contribution ID: 26

Type: **not specified**

## GSI Test facility at CERN

*Tuesday 1 April 2025 11:50 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

As part of the FAIR project and within the GSI and CERN collaboration, the superferric magnet production series —key components of the Superconducting FRagment Separator (SuperFRS) under construction at GSI Darmstadt, Germany—are undergoing rigorous testing at CERN in a dedicated cryogenics test facility.

The tested magnets include dipoles and various types of multiplets (composed of different numbers of quadrupoles, steering dipoles, sextupoles, and octupoles, housed inside a shared vacuum vessel), which must be qualified for cryogenics, electrical and magnetic field performances.

For this workshop, we will present the actual status of the cryogenics facility that is composed of three test benches. Each bench can be connected up to nine power converters for the purpose of multiplet testing. The cryogenics, the quench detection and the energy extraction systems will be shown.

The status of the SuperFRS magnet testing will then be exposed along with the main results obtained so far. A quick discussion around magnet training will be launched.

At last, the future of the test facility will be presented in terms of possible improvements and upcoming upgrades.

**Presenter:** BAJAS, Hugo (GSI)

Contribution ID: 27

Type: **not specified**

## Latest progresses of cold test facilities development for fusion SC magnet technology at ASIPP

*Tuesday 1 April 2025 14:40 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

Supported by the national project CRAFT, which aims to explore and master fusion DEMO level key technologies and establish testing facilities for key material, components and system for CFETR, serials cold test facility for SC material, conductor and magnet are under construction and planned to be completed this year. The SC material testing facility has already been accomplished, mainly consists of a self-developed superconducting background magnets with field of 19T and aperture of 70mm, and multifunctional sample holders. The conductor test facility (Super-X), aims to evaluate the reliability of engineering technology and safe operation for CICC in operation environment, mainly consists of a 15T split solenoid background DC magnet, a 100kA superconducting transformer, and auxiliary system. For the fusion magnet testing, two large-scale facilities will be used. The one with dimension of  $\varphi 7.7\text{m} \times \text{H}11\text{m}$ , current capacity of 60kA and refrigerator of 1000W@4.5K, has already been used for the CFETR CSMC coil test in 2024. The current of CSMC reached to the design parameter 48kA. The other with dimension of 25m×15.5m×10m has two pairs of current leads with capacity of 100 kA and 60 kA respectively, will be used for CFETR TF and BEST TF magnets tests. Up to 4 BEST TF magnets can be tested at once using this facility.

**Presenter:** LIU, Fang (Chinese Academy of Sciences)

Contribution ID: 28

Type: **not specified**

## LASA test facility

*Tuesday 1 April 2025 13:40 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

LASA laboratory at INFN Milano unit have been testing superconducting magnets and conductors at 4.5 K for several projects, including ATLAS, DISCORAP (SIS300) and HL-LHC high order correctors by three test stations. An update of those test stations is ongoing in the framework of the next generation EU project IRIS (Innovative Research Infrastructure on applied Superconductivity). The updated tests area will provide three variable temperature conduction-cooled test beds, one system also provides a background field up to 8 T. The powering and protection systems are updated up to 30 kA with a fast switch. A detailed description of testing capabilities and the schedule of the update are presented.

**Presenter:** STATERA, Marco (INFN - LASA)



Contribution ID: 29

Type: **not specified**

## Cryogenic developments for very high field magnets

*Tuesday 1 April 2025 15:30 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

Very high permanent magnetic fields, i.e., over 20 T, are produced by superconducting magnets made partially, or fully, with high-temperature superconducting (HTS) conductors. These specific magnets generally operate at liquid helium temperatures to take full advantage of the HTS properties. Very high-field magnets, usually immersed in a saturated liquid helium bath, experience an excessive temperature increase in working conditions above 20 T. Beyond this threshold, it has been demonstrated that the magnetic force is strong enough to interact with helium molecules due to their diamagnetism. The magnetic field distribution can cause this body force to compensate for gravity, creating zones of levitation around the magnet. It either degrades the boiling heat transfer, preventing bubbles from developing freely and leaving the magnet surface, or traps helium vapor structures on the magnet surface, thus creating a film at the liquid and the magnet interface. To avoid jeopardizing the long-term operation of superconducting high-field magnets cooled by liquid helium at 4.2 K beyond 20 T, heat transfer in liquid helium under these conditions must be fully understood and quantified. An alternative solution is to use a non-gravity-assisted cooling system, such as a capillary heat pipe. This talk presents the recent experimental studies carried out at CEA Paris-Saclay on the helium pool boiling heat transfer under reduced gravity and the development of gravity-independent heat pipes for cooling a 10T class HTS magnet.

**Presenter:** BAUDOUY, Bertrand (CEA Saclay)

Contribution ID: 30

Type: **not specified**

## **A test facility for cryocooler-based superconducting magnets and advanced cryogenics**

*Tuesday 1 April 2025 14:10 (30 minutes)*

Oral presentation (20 min) + Q&A (10 min)

A test facility has been developed at the Paul Scherrer Institut to test cryocooler-based LTS and HTS magnets and develop novel cryogenic devices for their cooling. This contribution describes the experimental set-up, different tests of insulated and non-insulated HTS magnets and shows the results of the, to our knowledge, first ever cooldown and operation of an HTS coil using neon pulsating heat pipes as thermal bus with a cryocooler.

**Presenter:** GORIT, Quentin (PSI)

Contribution ID: **31**

Type: **not specified**

## **FRESCA and FRESCA2 facilities**

*Monday 31 March 2025 14:30 (30 minutes)*

Oral presentation (20 min) + Q&A (10 min)

**Presenter:** FLEITER, Jerome (CERN)

Contribution ID: 32

Type: **not specified**

## Design and progress status of the ITER Magnet Cold Test Bench to test TF and PF1 coils (fusion, DTT, ITER)

*Tuesday 1 April 2025 09:00 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The 19 Toroidal Field (TF) coils, including one spare, have been manufactured by Japan and Europe and have been delivered on ITER site. The PF1, procured by Russia has also arrived on site. The delay in the ITER machine assembly has led the Project to take the opportunity to build a magnet test bench (MCTB) on site in order to test some of the ITER TF coils and the PF1 coil taking into account the new assembly schedule. The most complete magnet integrated tests will be performed by the teams to gain experience for the tokamak commissioning.

The main objective of the tests is to check the overall magnet performance (joint resistance, mechanical deformation, operating conditions). One major risk mitigation is the check of the ground insulation and ground protection. The TF coils and PF1 coils will be energized at full current, 68 kA for TF and 48 kA for PF1, and will be cooled with supercritical helium at 4.75 K and 0.46 MPa. Most of the components of the test facility will be ITER relevant and will allow the test of the instrumentation chains and control logics foreseen for the ITER operation. An ITER Cold Terminal Box will be connected to the coil for the helium and electrical supplies. The cryogenic system will provide enough refrigeration capacity with one out of the three ITER refrigeration cold boxes and will supply supercritical helium to the TF winding pack, casing and busbars. One important system to be tested will be the magnet protection system to demonstrate the quench detection capabilities (primary, secondary and safety class detection).

A 21 m - 11 m large and 6 m height cryostat is being manufactured to position horizontally either a TF coil or PF1 coil. A dedicated power supply will energize the coil and a Fast Discharge Unit will protect the coil in case of Fast discharge and quench.

The presentation will give an overview of the design of the test facility, the progress status of the main components and the testing program.

“The views and opinions expressed herein do not necessarily reflect those of the ITER Organization”

**Presenter:** HOA, Christine (ITER)

Contribution ID: 33

Type: **not specified**

## Challenges of test infrastructures for fusion in the US ( MIT, CFS)

*Tuesday 1 April 2025 10:00 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The Superconducting Magnet Test Facility (SMTF) at MIT's Plasma Science and Fusion Center provides a range of capabilities to support development of HTS magnet technology. Constructed between 2019-2021 around the SPARC Toroidal Field Model Coil (TFMC) –a non-insulated HTS magnet –it has subsequently been upgraded and employed to service a broader range of test objectives, including those of insulated magnet systems. The main facility provides a large cryostat with power supply and binary HTS current leads capable of continuous operation at 50 kA. Cooling is provided by a closed-loop supercritical helium cryogenic infrastructure that provides ~600 W of cooling at 20 K. The facility also provides a large amount of instrumentation for data acquisition and control. The SMTF has been used to test the SPARC toroidal and central solenoid model coils, as well as a smaller forerunner to the CSMC, and will host the “Magnet 0” test coil of Type One Energy in 2025. In support of these later experiments, a quench detection and fast discharge system has been deployed, with response times on the order of 100 ms. Presently, discharges are limited to 125 V, with further hardening of the system desired to increase this ceiling. Moreover, proposals have been prepared to install a set of pulsed power supplies at 800 V and 16 kA, together with new current leads and other ancillary systems.

A satellite facility services testing in liquid nitrogen. A 16 kA, 10 V power supply is available for testing a wide variety of coils, cables, and other samples. Several liquid nitrogen cryostats host these samples, and custom cryostats may be built for form factors that exceed the parameters handled by these, while direct connection to a 26000-liter (7000 gallon) LN2 tank provides for substantial volumes of liquid nitrogen for long-duration, large-scale tests. Desired upgrades to this facility include an expansion of the instrumentation and control system, the addition of a small cryostat and helium circulation loop for test articles of a scale not appropriate to the larger facility, and a further increase in available voltage and fast discharge capabilities.

**Presenter:** GOLPHINOPOULUS, Theodor (MIT)

Contribution ID: 34

Type: **not specified**

## Demo4 HTS Magnet System

*Tuesday 1 April 2025 10:50 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

Tokamak Energy is pursuing commercial fusion energy based on the development of spherical tokamaks with high temperature superconducting (HTS) magnets. We have embarked on a broad magnet development programme, addressing technologies including coil manufacturing, quench protection, modelling and simulation, HTS irradiation, and other aspects. Part of this programme is the Demo4 demonstrator project. This is an ambitious high-field HTS magnet built in a full tokamak configuration.

The system consists of 28 toroidal-field and 16 poloidal-field coils, reaching a total of 44 HTS coils. This will provide a world-first demonstration of the operation of a representative array of coils in a toroidal and poloidal configuration, operating at fusion-relevant magnetic fields and temperatures. The magnet is instrumented with over 600 temperature, hall, voltage and FBG sensors, generating over 3 TB of diagnostic data per day. This data will give detailed validation of the predicted operational margins of the 44 coils in steady state, transient scenarios and system fault conditions. This talk will provide an overview of the Demo4 project, with a focus on the instrumentation, data-acquisition and quench detection systems.

**Presenter:** GHANNADZADEH, Saman (Tokamak Energy Solutions)

Contribution ID: 35

Type: **not specified**

## Development of the Magnet System for the Gauss Fusion Stellarator

*Tuesday 1 April 2025 09:30 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

Gauss Fusion is developing the magnet system for a conventional 4-module QI Stellarator based 1GW electrical plant with realistic and commercially viable component maintenance routes and nuclear life times. Such a choice produces a design so that the magnetic systems do not require very high field strength (up to about 13 T). However, they have complex shaping and support requirements, and need to be developed to better match the requirements of the nuclear systems, as regards access for maintenance, repairability, reliability and efficient structural design while exploiting the advantages of a steady state stellarator configuration. Gauss Fusion will summarise the major parameters of the stellarator and the associated conceptual design of the magnet system, and the ongoing technical activities in the areas of coil structures, demountable coils, and quench protection leading to verification by a model coil programme and test platform requirements.

**Presenter:** MITCHELL, Neil (Gauss Fusion)

Contribution ID: 36

Type: **not specified**

## ITER CS Magnet Module Test Facility Status Report

*Tuesday 1 April 2025 11:20 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

General Atomics (GA) is under contract by US ITER organization (UT-Battelle c/o Oak Ridge National Laboratory) for the fabrication of ITER Central Solenoid (CS) Magnet Modules. GA will provide seven modules to ITER Organization (IO), six of which will be assembled in a stack that forms the ITER Central Solenoid. All CS Modules are required to pass factory acceptance testing (FAT) at General Atomics' Magnet Technology Center (MTC) test facility prior to shipment to IO. Currently, CS Modules 1, 2, 4, and 5 have completed FAT and have been delivered to IO. CS Module 7 has completed FAT and is being prepared for shipment to IO. CS Module 6 has completed the FAT powered testing portion and CS Module 3 will repeat FAT after repairs are completed on the Module.

The MTC test facility was designed and built to conduct factory acceptance tests on low-temperature superconducting magnets for fusion research, i.e. CS Modules. The test facility consists of the test chamber, high vacuum system, 4.5 K recirculating supercritical helium refrigeration plant, 50 kA direct current power supply, counter-pulsed direct current circuit breakers, 1 GJ discharge resistor, high-temperature superconducting current feeders, data acquisition system, supervisory control logic, and magnet quench protection system.

Each CS Module FAT campaign comprises of a pre-cooldown 30 kV electrical insulation test at ambient pressure, pre-cooldown 15 kV electrical insulation tests at sub-atmospheric (Paschen) pressures, pre-cooldown 30 bara global helium leak test, controlled cooldown to 4.5 K, hydraulic impedance tests at 4.5 K, AC loss measurements (6.8 and 23.4 second decay time constants) at currents up to 40 kA, current cycling from 0.5 kA to 40 kA, coil height displacement and surface strain measurements, cold (<20 K) 30 bara global helium leak test, controlled warmup to room temperature, post-cooldown 30 kV electrical insulation test at ambient pressure, and post-cooldown 15 kV Paschen tests. Additionally, temperature-current sharing tests up to 8 K were performed on CS Module 6 and are planned for CS Module 3.

A summary of the test facility equipment and operational lessons, upgrades, and modifications developed and implemented from tests performed on CS Modules 1-7 (thus far) will be discussed. This work was supported by UT-Battelle/Oak Ridge National Laboratory under sponsorship of the US Department of Energy Office of Science under Awards 4000103039 and DE-AC05-00OR22725.

**Presenter:** KHUMTHONG, Kenneth (General Atomics for ITER)



Contribution ID: 37

Type: **not specified**

## Close Out

*Tuesday 1 April 2025 16:50 (30 minutes)*

Contribution ID: 38

Type: **not specified**

## **Challenges in Instrumentation and Diagnostics for Nb<sub>3</sub>Sn magnets**

*Thursday 3 April 2025 09:00 (30 minutes)*

**Presenter:** WILLERING, Gerard (CERN)

Contribution ID: 39

Type: **not specified**

## **Challenges in Instrumentation and Diagnostics in the Hybrid Magnet Program**

*Thursday 3 April 2025 09:30 (30 minutes)*

**Presenter:** PRESTEMON, Soren (LBL)

Contribution ID: 40

Type: **not specified**

## **Challenges in Instrumentation and Diagnostics in HTS magnets**

*Thursday 3 April 2025 10:00 (30 minutes)*

**Presenter:** TBC, -

Contribution ID: 41

Type: **not specified**

## **RF quench detection in HTS magnets**

*Thursday 3 April 2025 11:00 (30 minutes)*

**Presenter:** MARCHEVSKII, Maxim (LBL)

Contribution ID: 42

Type: **not specified**

## **HTS quench detection using optical fibers, co-wound wires and thermocouple arrays**

*Thursday 3 April 2025 11:30 (30 minutes)*

**Presenter:** BYKOVSKIY, Nikolay (PSI)

Contribution ID: 43

Type: **not specified**

## **Advanced DAQ and Quench Detection using FPGA based UQDS systems**

*Thursday 3 April 2025 14:00 (30 minutes)*

**Presenter:** STECKERT, Jens (CERN)

Contribution ID: 44

Type: **not specified**

## **Use of UQDS for various HTS coils**

*Thursday 3 April 2025 14:30 (30 minutes)*

**Presenter:** DUDA, Michal (PSI)



Contribution ID: 45

Type: **not specified**

## **Fiber optics for quench detection**

*Thursday 3 April 2025 12:00 (30 minutes)*

**Presenter:** KRAVE, Steve (FNAL)

Contribution ID: 46

Type: **not specified**

## Digital Integrator development

*Thursday 3 April 2025 15:00 (30 minutes)*

**Presenter:** BADGLEY, Karie (FNAL)

Contribution ID: 48

Type: **not specified**

## **Status of work on a Non-rotating Magnetic Field Harmonics Probe**

*Thursday 3 April 2025 16:00 (30 minutes)*

**Presenter:** DI MARCO, Joe

Contribution ID: 49

Type: **not specified**

## **Voltage array measurements for probing HTS CORC<sup>®</sup> conductor current sharing**

*Thursday 3 April 2025 16:30 (30 minutes)*

**Presenter:** TEYBER, Reed

Contribution ID: 50

Type: **not specified**

## Quench Antenna for Nb3Sn racetrack coils

*Friday 4 April 2025 09:00 (30 minutes)*

**Presenter:** FISCARELLI, Lucio (CERN)

Contribution ID: 51

Type: **not specified**

## **Building training data set and semi-supervised models for magnet quench detection.**

*Friday 4 April 2025 09:30 (30 minutes)*

**Presenter:** KHAN, Maria (FNAL)

Contribution ID: 52

Type: **not specified**

## **Novel method for quench initiation using ESC**

*Friday 4 April 2025 10:00 (30 minutes)*

**Presenter:** RAVAIOLI, Emmanuele (CERN)

Contribution ID: 53

Type: **not specified**

## **Advances in superconducting magnet monitoring via in-situ fiber optic sensing techniques including effects of ionizing radiation**

*Friday 4 April 2025 10:50 (30 minutes)*

**Presenter:** SCURTI, Federico (NCSU)



Contribution ID: 54

Type: **not specified**

## **AC current transients in Nb<sub>3</sub>Sn magnets - TBC**

*Friday 4 April 2025 11:20 (30 minutes)*

**Presenter:** KRAVE, Steve

Contribution ID: 55

Type: **not specified**

## **Investigation methods on quench source for flattop quenches in LTS coils - discussion topic - TBC**

**Presenter:** WILLERING, Gerard (CERN)

Contribution ID: 56

Type: **not specified**

## **Close-out session - workshop feedback**

*Friday 4 April 2025 12:50 (20 minutes)*

Contribution ID: 57

Type: **not specified**

## **Welcome/IDSM program overview**

*Thursday 3 April 2025 08:45 (15 minutes)*

**Presenter:** MAXIM MARCHEVSKY, Gerard Willering,

Contribution ID: 58

Type: **not specified**

## Status update from the FREIA Laboratory

*Tuesday 1 April 2025 16:00 (30 minutes)*

Oral presentation (20 min) + Q&amp;A (10 min)

The FREIA Laboratory, which is part of the Department of Physics and Astronomy at Uppsala University in Sweden, is a research facility that focuses on R&D on superconducting accelerator technology. As part of the lab, there is the vertical cryostat Gersemi with an associated test-stand for superconducting magnets. We are currently upgrading the test-stand by adding a system for magnetic field measurements. It is based on rotating coils and an anticryostat, in order to keep the sensor warm while operating the magnet at cryogenic temperatures. We will report on the latest updates of the lab, our magnet development activities, and the plans ahead.

**Presenter:** OLVEGÅRD, Maja (Uppsala University)

Contribution ID: 59

Type: **not specified**

## **Lectures on Superconducting Magnet Test Stands, Magnet Protections and Diagnostics**

*Tuesday 1 April 2025 16:30 (20 minutes)*

Oral presentation (15 min) + Q&A (5 min)

Presentation of the updated online lectures on superconducting magnet test stands, protection, and diagnostics, scheduled for June 3rd–13th, 2025.

**Presenter:** BAJAS, Hugo (GSI)

Contribution ID: **61**

Type: **not specified**

## **Quench detection using cryogenic electronics**

*Friday 4 April 2025 11:50 (30 minutes)*

**Presenter:** JOSHI, Piyush (FNAL)

Contribution ID: 62

Type: **not specified**

# **Cryogenic Tests of Electronic Components and Sensors for Superconducting Magnet Instrumentation**

*Friday 4 April 2025 12:20 (30 minutes)*

**Presenter:** DI CAPUA, Vincenzo



Contribution ID: **64**

Type: **not specified**

## **EDIPO test facility**

*Wednesday 2 April 2025 10:05 (35 minutes)*

Oral presentation (25 min) + Q&A (10 min)

**Presenter:** SARASOLA, Xabier (EPFL - SPC)

Contribution ID: 66

Type: **not specified**

## Women in Science

*Wednesday 2 April 2025 11:00 (1 hour)*

Join us for a free exchange regarding the Women in Science and Technology on the 2nd of April 2025 at PSI.

Are you passionate about the future of science and technology? Don't miss this engaging discussion on the role of women in superconductivity and cryogenic measurements!

- Meet female scientists who are pioneering in superconductivity and cryogenic research.
- Connect with professionals and enthusiasts who share your passion for science and innovation.
- Discuss how we can foster a more inclusive and supportive environment for the next generation of scientists.

The participation of female scientists in the SMTF workshop is steadily increasing, as reflected in the growing number of talks given by women. But how can we sustain and further this positive trend?

Key questions we'll explore:

- How can we continue to inspire and support young women in the field?
- What motivated us to join this field, and would those same factors appeal to the next generation?
- How do our male colleagues view the impact of diversity?
- What unique perspectives and strengths do female scientists bring to research teams, collaboration, and scientific progress?

Join us for a session of inspiration and insight. Together, we can shape the future of superconductivity and technology by fostering an inclusive and diverse scientific community.

**Presenter:** BAJKO, Marta (cern)

Contribution ID: 67

Type: **not specified**

## **Sponsor's presentation**

*Wednesday 2 April 2025 12:00 (20 minutes)*

Contribution ID: **68**

Type: **not specified**

## **Introduction and Welcome PSI**

*Wednesday 2 April 2025 13:20 (30 minutes)*

**Presenter:** BRAUN, Hans-Heinrich (PSI - Paul Scherrer Institut)

Contribution ID: 70

Type: **not specified**

## **Introduction and Welcome EPFL/SPC**

*Wednesday 2 April 2025 13:50 (30 minutes)*

**Presenter:** SEDLAK, Kamil (PSI - Paul Scherrer Institut)

Contribution ID: 71

Type: **not specified**

## **Organisation of groups and walk to first station**

*Wednesday 2 April 2025 14:50 (15 minutes)*

**Session Classification:** Visit PSI

Contribution ID: 72

Type: **not specified**

## Test station 1

*Wednesday 2 April 2025 15:05 (40 minutes)*

**Session Classification:** Visit PSI

Contribution ID: 73

Type: **not specified**

## Test station 2

*Wednesday 2 April 2025 15:45 (40 minutes)*

**Session Classification:** Visit PSI



Contribution ID: 74

Type: **not specified**

## **Test station 3**

*Wednesday 2 April 2025 16:25 (40 minutes)*

**Session Classification:** Visit PSI

Contribution ID: 75

Type: **not specified**

## Test station 4

*Wednesday 2 April 2025 17:05 (40 minutes)*

**Session Classification:** Visit PSI

Contribution ID: 76

Type: **not specified**

## Transfer to Gala Dinner

**Session Classification:** Visit PSI