WP3 - Access to RI for Accelerators

Task 3.2 - Technology Infrastructures

This project has received funding from the European Union's Horizon Europe Research and Innovation programme under Grant Agreement No 101057511.

S. Leray – CEA/Irfu

2nd Annual Meeting, Krakow, October 2023

Task 3.2 – Technology Infrastructures

General context:

- The **European accelerator and magnet Technology Infrastructure (TI)** is the ensemble of Technological Facilities (TFs), encompassing **large-scale Technical Platforms (TPs)** for development, fabrication, integration and performance verification of accelerator and magnets components, with large concentrations of dedicated, highly-skilled personnel.
- To ensure the long-term sustainability of the TI, the **H2020 AMICI project** (2017-2019) investigated how the TI could be reinforced, harmonized and made more efficient, and industry could benefit more from the possibilities offered by TPs, fostering industrial innovation potential.

ACCELERATOR AND MAGNET INFRASTRUCTURE FOR COOPERATION AND INNOVATION
https://eu-amici.eu/

After the end of the H2020 project, the AMICI collaboration continues:

- Within the H2020 **I.FAST project**, in **WP13-ETIAM (European Technology Infrastructure for Accelerators and Magnets)** with objectives of
  - Establish a roadmap for the TI in view of the construction of future accelerator-based RIs.
  - Extend and strengthen the cooperation with industry in order to foster innovation in related technologies.
  - Develop and promote services for the benefit of RIs, future scientific projects and high-tech industry

https://ifast-project.eu/

- **EURO-LABS - Task 3.2:**
  - Provide access to some of the TPs of AMICI
  - Contribute to service improvements if necessary

➥ AMICI-I.FAST Workshop on Facilities for beam test of accelerator components
Thursday 12 at IFJ-PAN
https://indico.ifj.edu.pl/event/1122/

Task 3.2 – Technology Infrastructures

- The partners: CEA/Irfu, CERN, CNRS/IJCLab, INFN/LASA and U. Salerno, UU

Partner	Laboratory	TP	Platforms available for EUROLABS	Service improvements	Facility representative
CEA	Irfu	**SYNERGIUM**	MACHAFILM: Characterization facilities of thin film of superconducting layers on radiofrequency cavities	A new coil and structure of the magnetometer.	Thomas Proslier
			CRYOMECH: Characterization, analysis and measurement facilities for materials at low temperature.	New software for the tensile machine.	Roser Vallcorba-Carbonell
CERN		**XBOX**	Klystron-based X-Band test stands.	None	Roberto Corsini
CNRS	IJCLab	**SUPRATECH**	Equipment and technical area for the development, the preparation, assembling and testing SRF cavity.	None	David Longuevergne
INFN	LASA (Milano)	**LASA (Milano)**	Four test installations devoted to: i) Superconducting Magnets, ii) Superconducting RF cavities, iii) High Brightness Photocathodes for Electron Sources, and iv) Laser Applications to High Power Fabry Perot Cavities and Advanced Timing Systems.	Improvement of control system performances, new data storage and analysis networks, more comfortable HMI facilities, improvement of user related common instrumentation.	Dario Giove
	Universita di Salerno	**THOR**	Technological facility for horizontal test of Superconducting Magnet modules.	Improvements in the field of cryogenic flow control and measurements, easy and reliable cryogenic connections, and links	Umberto Gambardella
Uppsala University	FREIA	**GERSEMI**	Vertical cryostat for superconducting magnet and cavity testing.	More general purpose instrumentation	Rocio Santiago Kern
		HNOSS	Horizontal cryostat for superconducting cavity tests.		

Task 3.2 – User Selection Panel

- The User Selection Panel has been established and is composed of:
  - The WP3.2 coordinator
  - The 5 representatives of the platforms:
    - CEA: Thomas Proslier
    - CERN: Roberto Corsini
    - CNRS: David Longuevergne
    - INFN: Dario Giove
    - UU: Rocío Santiago Kern
  - 5 external members:
    - Jose Manuel Perez, CIEMAT
    - Marc Wenskat, DESY
    - Robert Zierold , Hamburg University
    - Bernard Auchmann, PSI
    - Robert Laxdall, Triumf
- Up to now, the USP has analysed 4 applications

Task 3.2 – List of Users' projets

List of Users' Projects										
Periodic Report	Installation	TA Project Acronym	Project Title	Objectives	Achievements	General Discipline	Specific Discipline	Continuation from previous reporting periods		Access Units
								Project completed (Y/N)	Date - when project completed	
1	Gersemi	EURO-LABS-UU-2023-01	FCC SuShi septum testing	Test the performance of the first CCT magnet impregnated with wax and its quench behaviour, at this stage without the shield.	Objectives were met	*Physics*	Accelerator	Y	avr-23	314
1	Gersemi	EURO-LABS-UU-2023-02	Prototype crab cavity testing for HL-LHC	- Transport influence on beam vacuum cavity influence - Reproducibility of cavity performance with respect to beam vacuum quality	Objectives were met	*Physics*	Accelerator	Y	févr-23	166
1	*SUPRATECH*	*EURO-LABS-SUPRATECH-2023-01*	*Quadrupole resonator sample rejuvenation*	*BCP cleaning and mechanical polishing of 2 Niobium sample for quadrupole resonators (QPR)*	*BCP etching done. Mechanical polishing under processing*	*Material science*	*surface treatment*	*N*	*31/10/2023*	*12*
1	*MACHAFILM*	*EUROLABS-MACHAFILM-2023-01*		*Electropolishing and heat treatment*	*Waiting finalization of work at supratech*			*N*	*15/12/2023*	*48*

Task 3.2 – List of Users

List of TA USERS									
Periodic Report	Researcher			Employing organisation/Home institution			TA Project Acronym	Activity Domain (Discipline)[2]	Installations used by the researcher
	Name	Gender	Nationality	Name	Legal Status[1]	Country			
1	Daniel Barna	M	Hungarian	Wigner Research Centre for Physics	RES	Hungary	EURO-LABS-UU-2023-01	[Physics]	Gersemi
1	Kristof Brunner	M	Hungarian	Wigner Research Centre for Physics	RES	Hungary	EURO-LABS-UU-2023-01	[Physics]	Gersemi
1	Katarzyna Turaj	F	Polish	CERN	RES	Switzerland	EURO-LABS-UU-2023-02	[Physics]	Gersemi
1	Kugeler Oliver	M	German	Helmholtz Zentrum Berlin	RES	Germany	EURO-LABS-SUPRATECH-2023-01 and EUROLABS-MACHAFILM-2023-01	material science	SUPRATECH/MACHAFILM (remote)
1	Keckert Sebastian	M	German	Helmholtz Zentrum Berlin	RES	Germany			

CEA/Irfu-Synergium platform – CRYOMECHA

CRYOMECHA is a platform devoted to the characterization, analysis and measurement of materials at low temperature. It includes:

- A test station (MECTIX) dedicated to the measurement of thermal conductivity of insulators and conductors at low temperature with the following specification : diameter < 0.5 m, 3.8 K < T < 300 K
- A mechanical test Laboratory: traction, compression, bending and slippage (T=4.2 K or 77 K or 300 K), hydraulic press with a compression capacity of 1600 kN, two Instron electromechanical machines : 300 kN and 150 kN which is coupled with two cryostats:
  1. One with a traction and flexion capacity of 45 kN, and
  2. The other with a traction capacity of 80 kN, and a compression capacity of 150 kN.
- A mechanical Test Bench at variable cryogenic temperature (from 10 K to 4.2 K) currently under development.

CEA/Irfu-Synergium platform – CRYOMECHA

✓New software driving the tensile machine (Logiciel Bluehill Universal): ~16 k€

The new software enables to retrieve larger signals than before, thus expanding our measurement possibilities. More pragmatically, the old software was no longer compatible with the Windows upgrade imposed by the CEA.

✓Two dynamic extensometers 12.5 mm +- 5mm and 10 mm +- 1 mm: ~12 k€

- The 12.5 mm ± 5 mm allows double the measured elongation: 40% instead of 20%.
- The 10 mm ± 1 mm allows finer measurements, particularly on superconducting strands.

✓One Load Cell 2 kN: ~6 k€

The 2 kN force cell improves the measurement accuracy in the low-load ranges used mainly for measurements of superconducting strands and other materials with a low breaking load compared with the machine's capacity: 150 kN.

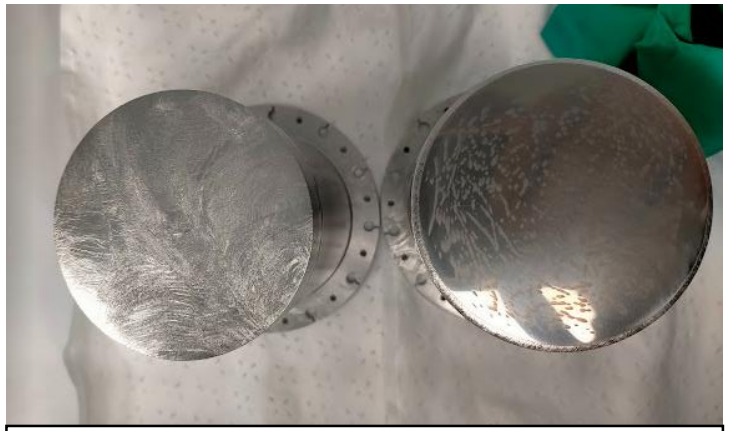
➥ 34 k€ spent out of a total of 40 k€

➥ No requests for access to the platform from EURO-Labs external users in 2023

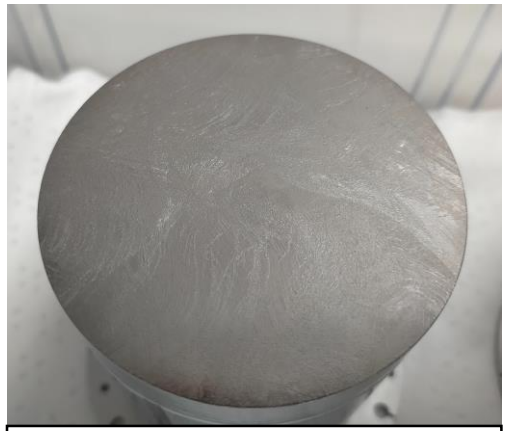
CEA/Irfu-Synergium platform – MACHAFILM

- 1 application for remote access to MACHAFILM platform: Surface treatment of 2 Niobium samples for quadripole resonators (QPR) following the cleaning and electropolishing at SUPRATECH (48h)
  - ✓Waiting for the samples from SUPRATECH
- Service improvement : a new coil and structure of the magnetometer used to measure the critical field of SC samples
  Investments to improve service made in 2023 :
  - ✓Upgrade of the acquisition system ~ 2.3 k€
  - ✓a little behind schedule due to lack of manpower, but that the planned development will be completed and the rest of the budget spent by 2024

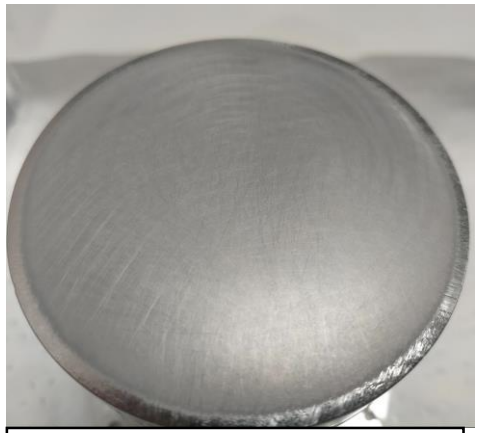
- 1 application for remote access to SUPRATECH platform
  - From HZB (Germany) : QPR Sample rejuvenation
  - Application in April 2023
  - Project still ongoing at Supratech (significant delays but discussed with HZB)
  - Work will be finished end of October
- INFN came in July for Supratech video clip
- 1 new application under discussion to be submitted to USP in October
  - It will consist in testing 3 prototypes cavities for PIP-II project



2 QPR samples to be processed at SUPRATECH for HZB



QPR sample as received



QPR sample after first polishing step

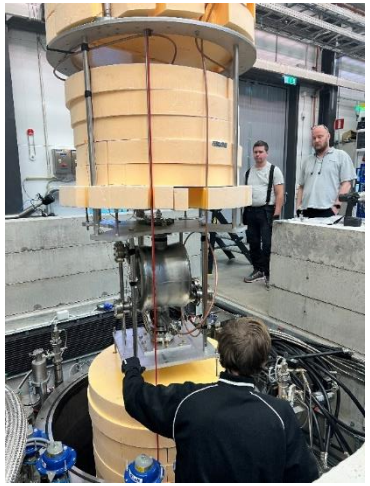
QPR sample after second polishing step

Uppsala University (FREIA)

EURO-LABS-UU-2023-01:
FCC SuShi septum testing

- **Request from**: Wigner Research Centre for Physics (Hungary)
- Provided 314 AU

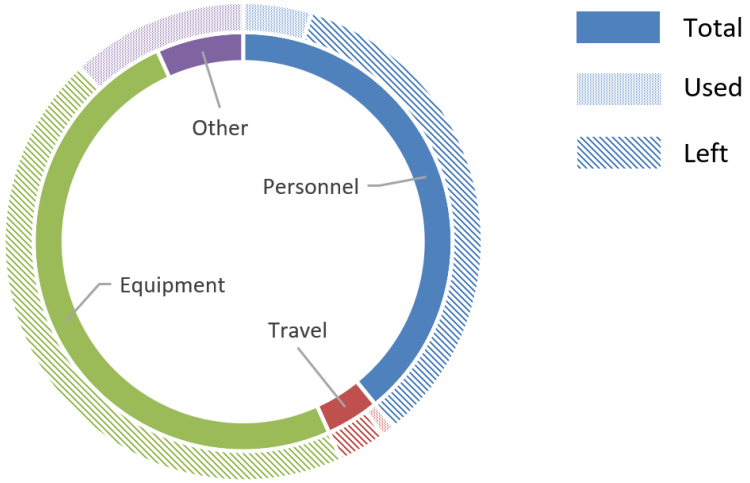
EURO-LABS-UU-2023-02:
Prototype crab cavity testing for HL-LHC



- **Request from: CERN** (TA was remote)
- Provided 166 AU

- 480 access units provided (960 AU total, for all 4 years)
- TA for next years: currently under discussions with CEA Saclay to test a N-doped cavity with fundamental power coupler in HNOSS. Strong constraints on magnetic field.

Uppsala University (FREIA)



- Service improvements
  - None acquired during R1 period
  - Expect to purchase by the end of this year
    - Magnetometer sensors (x3)
    - Broadband High power RF amplifier
- 2 Deviations in budget:
  - Budget allocated to ”Other costs” too small: high prices for LN2 and Ghe
    → Will make a motivation letter to move funds after R1 period is over
  - Changed PM/personnel costs to reflect actual costs from University’s accounting.

Task 3.2 – Publications

List of Publications										
Periodic Report	TA Project Acronym	Publication Year	Authors	Title	References	Publication type	Peer reviewed (yes/no)	DoI (Digital Object Identifier)	Open Access (Y/N)	Link
1	EURO-LABS-UU-2023-01	2023	Rocio Santiago Kern	Gersemi tests with the DQW Crab Cavity Niowave 001 at FREIA	no	Other	N		Y	https://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-497703
1	EURO-LABS-UU-2023-02	2023	Mykhailo Zhovner	Progress report for the second cold test of crab cavity for the HL-LHC Project experiments	no	Other	N		Y	https://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-511830
1	EURO-LABS-UU-2023-01	2023	D. Barna, K. Brunner, J. Borburgh, M. Atanasov, F. Lackner, M. Olvegard, K. Pepitone, R. Santiago Kern, C. Svanberg, T. Bagni	Training-free performance of the wax-impregnated SuShi septum magnet	to be published in Superconductor Science and Technology Journal	Article in Journal	Y		Y	

Task 3.2 – Status

Partner	Laboratory	TP	Platforms available for EUROLABS	Facility representative	Unit	Nb of units to be provided	Nb of units used	Fundinf for access (k€)	Service improvements	Requested funding (k€)	Used funding (k€)
CEA	Irfu	**SYNERGIUM**	MACHAFILM: Characterization facilities of thin film of superconducting layers on radiofrequency cavities	Thomas Proslier	1 h	960	48	236,55	A new coil and structure of the magnetometer.	10	2,3
			CRYOMECH: Characterization, analysis and measurement facilities for materials at low temperature.	Roser Vallcorba-Carbonell					New software for the tensile machine.	40	**34**
CERN		**XBOX**	Klystron-based X-Band test stands.	Roberto Corsini	1 h	400		45,51	None		
CNRS	IJCLab	**SUPRATECH**	Equipment and technical area for the development, the preparation, assembling and testing SRF cavity.	David Longuevergne	1 h	672	12	81,85	None		
INFN	LASA (Milano)	**LASA (Milano)**	Four test installations devoted to: i) Superconducting Magnets, ii) Superconducting RF cavities, iii) High Brightness Photocathodes for Electron Sources, and iv) Laser Applications to High Power Fabry Perot Cavities and Advanced Timing Systems.	Dario Giove	1 h	6400		440	Improvement of control system performances, new data storage and analysis networks, more comfortable HMI facilities, improvement of user related common instrumentation.	100	
	Universita di Salerno	**THOR**	Technological facility for horizontal test of Superconducting Magnet modules.	Umberto Gambardella	1 h	272		87,5	Improvements in the field of cryogenic flow control and measurements, easy and reliable cryogenic connections, and links	20	
Uppsala University	FREIA	**GERSEMI**	Vertical cryostat for superconducting magnet and cavity testing.	Rocio Santiago Kern	1 h	960	**314**	191,191	More general purpose instrumentation	200	
		HNOSS	Horizontal cryostat for superconducting cavity tests.				**166**				


EURO-LABS
EUROPEAN LABORATORIES
FOR ACCELERATOR
BASED SCIENCES