I.FAST IAB Meeting – 4 May 2022

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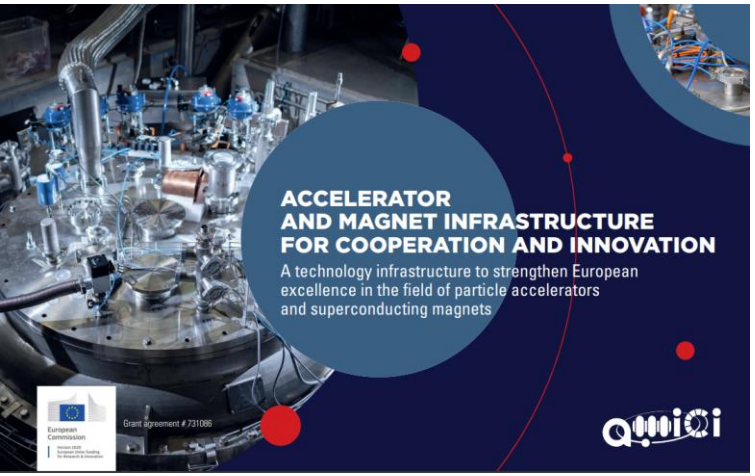
European Technology Infrastructure for Accelerators and Magnets

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, assembly, integration and performance verification of accelerator and magnets components, together with large concentrations of dedicated, highly-skilled personnel.
- To ensure the long-term sustainability of the TI, the H2020 AMICI project (Jan.2017 to Oct.2019) investigated how the TI could be reinforced, harmonized and made more efficient, and industry could benefit more from the possibilities offered by TPs, favoring a more effective knowledge transfer and fostering industrial innovation potential (see http://eu-amici.eu/).
- **I.FAST/WP13 allows and provides funding to realize some of the actions defined by AMICI, during 2 years**
- Other actions are supported in WP2 and WP3

Propositions of the H2020 AMICI project



THE ACTIVITIES OF THE AMICI COLLABORATION

Development and optimization of the capabilities of the TFs to support the construction of future accelerator-based RIs and ensure their sustainability:

- maintain an up-to-date list of the TPs open to external partners with their characteristics and functionalities;
- define the roadmap for the strategic evolution of the AMICI TFs, in view of the possible opportunities of engagement in new projects, in Europe, and outside Europe, with the goal of maximizing and optimizing the involvement of the TFs and their industrial partners ;
- Contribute to harmonize standards specific to the domain ;
- Set up and maintain a database for materials and components ;
- provide services to TFs for evaluating to what extent and under which conditions new or upgraded TPs can be exploited also by Industry ;
- Identify adaptations needed to satisfy the requests from Industry ;
- Explore the different possibilities for financing the necessary developments and upgrades of the TPs ;
- promote the possibilities that resources from the EC are earmarked at regional level to support the development of TPs ;

Services to industry:

- central information and contact point for industry and other external partners to access TPs with the aim to ensure the dissemination of information, analysis of requests and contacts to the appropriate TP ;
- promote the use of TPs by organizing regular dissemination initiatives ;
- simplify the use of the TPs by industry with the adoption of well defined procedures, regulations, IP management schemes, cost evaluation schemes, quality standards, etc. based as much as possible on common models adopted by the TI ;
- develop models for engaging industry in the low TRL phases of development still preserving the ownership by the TFs of the developed technologies ;
- provide services to investigate if industrial partners may be willing to take some responsibility in the design and/or implementation and/or operational phases of new TPs ;
- Setting up common training programs and promoting funding for student internships ;
- establish permanent relationships with Association of companies that are active in the Big Science field to implement some of the above actions ;

http://eu-amici.eu/download/Brochure_AMICI.pdf

Technology Infrastructure for Accelerators and Magnets

WP13 General objectives:

- Propose a strategic approach ensuring the long-term sustainability of the TI and the development of its capabilities in view of the construction of future accelerator-based RIs.
- Extend and strengthen the cooperation with industry to exploit opportunities of fostering innovation in related technologies.
- Develop and promote services, within a common approach, for the benefit of RIs, future scientific projects and high-tech industry.

Technology Infrastructure for Accelerators and Magnets

WP13 Tasks:

- **Task 13.1:** Strategy for the development of the AMICI TI(M1-M24) Partners: CEA,CIEMAT,CNRS,DESY,IFJ-PAN,INFN,KIT,PSI,UKRI,UU
- **Task 13.2:** Developing and promoting services to industry in AMICI TFs (M1-M24) Partners: DESY,CEA,CIEMAT,CNRS,DESY,IFJ-PAN,INFN,KIT,UKRI,UU
- **Task 13.3:** New RF amplifiers based on GaN semiconductors(M1-M24) Partners: UU,CERN
  - ↪ An example of an upgrade of a TP allowing to keep the TF at the forefront of the technology in a Key Technical Area (presentation by D. Dancila)

Task 13.1: Strategy for the development of the AMICI TI

- Sub-Task 13.1.1 (CEA): Define the roadmap for the strategic evolution and development of the AMICI TI, in terms of key TPs in key technological areas, required in view of the possible opportunities of engagement in new projects, in and outside Europe.
- Sub-Task 13.1.2 (CEA): Optimize the complementarity between the different TFs and maximize the involvement of their industrial partners by defining which interventions are needed to adapt the European TI in order to satisfy the requests from Industry.
- Sub-Task 13.1.3 (CEA): Raise awareness about the AMICI TPs and promote their use by external users in particular industry.

Task 13.1: Roadmap for the development of the AMICI TI

- 1st part (nearly completed): analyzing the landscape of the different scientific fields with regard to RIs or other facilities under construction, improvement or planned, that could need the AMICI TPs, as far as possible based on roadmaps or reports prepared by the communities concerned (in particular ESPPU).
- 2nd part: identify the key TPs in key technological areas that should be sustained, developed, or upgraded, taking into account also the needs from industry.

  ↪**Question 1 to IAB: How to organize the consultation with industry in order to better take into account its needs and the balance between what can be done in industry and what needs to be done in TIs?**

  ↪**Final discussion at the 2nd Annual Meeting Industry Day**

Roadmap for the strategic evolution and development of the AMICI TI

Categorization of the TPs : Final list

- **Facilities for beam tests of accelerator components**
- **Test stations for magnets**
  - Test stations for superconducting magnets
  - Test stations for normal conducting magnets
  - Magnetic measurement facilities
- **Test stations for RF equipment**
  - Test stations for superconducting cavities
  - Test stations for normal conducting cavities
- **Test stations for high power RF components**
  - RF wave guides
  - RF power sources
  - Power transistors
  - High power amplifiers
  - Solid State Power Amplifiers with their combiners and control system
- **Test stations for mechanical manufacturing and tests (at cryogenic temperatures)**
- **Platform for characterization, treatments and tests of materials**
  - Thermal treatment platforms
  - Chemical treatment platforms
  - Facilities for surface analyses
- **Characterization, analysis and measurement facilities**
  - Magnetic measurement facilities
  - Facilities for surface analyses and material tests
- **Platforms for clean assembly, alignment and tests of accelerator components**
  - Complete accelerator modules
  - RF power couplers

Categorization of the TPs

Categories	*Sub-categories*	CEA	CERN	CIEMAT	CNRS	DESY	IFJ-PAN	INFN	KIT	UKRI	UU
A. Facilities for beam tests of accelerator components		-IPHI -BETSI		IST (Ion Source Test bench for cyclotrons) Electron Van de Graaff Accelerator facility			CCB, AIC-144	Electron BTF (Frascati)	- KARA - FLUTE	Compact Linac, Front End Test Stand, Versatile Electron Linear Accelerator	
B. Test stations for magnets	***B.1 - Test stations for superconducting magnets***	-STAARQ, -JT-60SA Station	SM18 SC magnets test facility	CIEMAT Superconducting Magnet Lab		small SC quadrupoles		-MARISA (Genova) -SOLEMI (LASA) -NAFASSY (Salerno)	-CASPER I -CASPER II		Vertical cryostat + istrumentation
	B.2 - Test stations for normal conducting magnets		SM18 SC magnets test facility						LASMagLab		
	B.3 - Magnetic measurement facilities		Magnetic Measurement Laboratory	CIEMAT Superconducting Magnet Lab	BML-Magnetic Measurement Bench				-Magnetic Field Lab	Magnet Test Laboratory	Anti-cryostat probe in development
C. Test stations for RF equipment	***C.1 - Test stations for superconducting cavities***	Vertical cryostats for cavity tests, horizontal cryostats for cavity tests, Cryomodule test station	SM18 SC cavities test area		Cryogenic test facilities and tests stands	vertical cavity test stands		Test station (LASA)			Horizontal and vertiucal cryostat
	C.2 - Test stations for normal conducting cavities							-Test stations (LNL) -Test station (LNF)			
D. Test stations for High Power RF components	***D.1 - RF wave guides***										352 MHz
	D.2 - RF power sources	-352MHZ RF Platform -704 MHZ RF Platform		CIEMAT High Power RF lab (175 MHz 200 kW)					- High power millimeter wave gyrotron test stand - Low power millimeter wave quasi-optical measurements		3252 MHz 400 kW pulsed
	D.3 - Power transistors										352 MHz
	D.4 - High power amplifiers										352 MHz
	D.5 - Solid State Power Amplifiers with their combiners and control system			200 kW 175 MHz CW SSPA + Cavity combiner (under development); 400 kW 750 MHz 0.2% d.c. SSPA (under development)							352 MHz in development
E. Test stations for mechanical manufacturing and tests (at cryogenic temperatures)		Pressurized superfluid helium cryostat, MECTIC		CIEMAT Superconducting Magnet Lab					-COOLSORP -TRANSFLOW - Cryogenic High Voltage Lab -Cryogenic Materialtests Karlsruhe (CryoMaK)	Cryogenic Test Laboratory	
F. Platform for characterization, treatments and test of materials	***F.1 - Thermal treatment platforms***	Chemical treatment cabinets, vertical electropolishing cabinet	vacuum furnaces	High T furnaces (1700 C) Vacuum furnace; Tubular furnaces for heat treatments under controlled atmosphere	Oven for cavity heat treatment			-Vacuum furnace (LNF) -High Vacuum Treatments (LNL)			
	F.2 - Chemical treatment platforms	Surface characterization laboratory (LABCAS)	chemistry laboratory B.10	Electropolishing, sputtering ; Chemistry laboratory : Analytical techniques (spectroscopy, thermal analysis, elemental analysis, chromatography)	SUPRATECH facility: Cavity preparation	Cavity preparation incl. chemistry, bake, CO2 cleaning etc		-Chemistry lab and clean rooms (LNL) -Chemical treatments Lab (LASA)			
	F.3 - Facilities for surface analyses		surface analysis laboratory	Surface characterization lab: SEM, SIMS, confocal microscope and profiler, XPS and Auger Spectroscopy	Vacuum and surface characterization lab	Surface examination of Nb sheets, matallurgical lab				Vaccum and Surface Science Laboratory	
	F.4 - Electromagnetic, mechanical, thermal and associated material characterization Platforms	CETACES, H0, Mechanical test laboratory, insulation laboratory, LABCAF		MECHANICAL TEST LABORATORY: high T, fracture, fatigue, Charpy, tensile, fracture ...			Test-stand for characterization of superconductors, two vacuum chambers for termal fatigue tests		Cryogenic Materialtests Karlsruhe (CryoMaK)		
G. Platforms for clean assembly, alignment and tests of accelerator components	***G.1 - Complete accelerator modules***	-Cryomodule assembly platform -ISO4 Clean room -ISO5 Clean room -Thin film deposition laboratory -DIVA	Magnet Laboratory B.927		SUPRATECH facility: Cryomodule assembly and test	Cryomodule assembly and disassembly platform, horizontal cryomodule test stand, preparation and assembly of partical free vac. components			-Accelerator Technology Platform	Engineering Technology Centre	
	G.2 - RF power couplers	RF Coupler test platform			Power Couplers infrastructure						
H. Platforms for Manufacturing, treatments and test of Magnet components for accelerator		Magnet winding workshop	Large Magnets Assembly facility B.180 and B.181	CIEMAT Superconducting Magnet Lab			Test-stand for characterization of superconductors		- Robotic magnet workshop - VPI facility - Karlsruhe-CERN Collaboration on Coated Conductor (KC4) - KARA (test of wigglers /undulators up to 2.5 GeV e-beam) - FLUTE (magnet systems low energy 40-90 MeV e-beam)		

Update of information and promotion of the TPs

- AMICI web site
  1. Update of information for each TP keeping only the TPs really open or to be open to external users
  2. Classification of the TPs according to the newly defined categories
  3. Possibility to search for TPs by category
  4. Identification of needed adaptation, upgrade, improvement

Task 13.2: Developing and promoting services to industry in AMICI TFs

- Sub-Task 13.2.1 (CEA): Organization and operation of a central information and contact point for industry and other external partners to access TPs.
- Sub-Task 13.2.2 (DESY): analysis of the different procedures in different TFs, corresponding to different cases, and propose a set of standardized rules, making the access simpler and faster for external partners.
- Sub-Task 13.2.3 (INFN): At least two small workshops dedicated to a particular type of TP will be organized per year

Sub-Task 13.2.2: TF Access Procedures & Rules

- Analyze different procedure to access TFs
- Propose a set of standardized rules
  - this may proof difficult, in particular:
    - intelectual property, compensation schemes, taxes, etc
    - but also access rules (of client to a TP) are (probably) very lab specific
  - compromise could be:
    - concentrate of “technical aspects” like reporting, service provisions, change requests
    - DESY‘s Service Term as a starting point
    - explicitly list “access regulations” which have to be obeyed by external personnel

Sub-Task 13.2.2: TF Access Procedures & Rules

- As regards the access to the AMICI TPs, the different rules, procedures in the different labs are being analyzed in order to identify common features and, as far as possible, propose standardized procedures to make the access simpler and faster for industry.

↪Question 2 to IAB:

- **From industry‘s point of view, what are the biggest obstacles when contracting services at TFs?**
- **Are different “Terms of Service” at different TFs actually an issue when signing contracts or are those “daily business”?**
- **Which topics / articles in particular if any?**

Workshops dedicated to a particular type of TP

- **14-15 September 2022 at DESY: test benches for SRF cavities**
  - Target group are people from labs with testing infrastructure, project delegates, who need their cavities tested and industrial companies involved in the process.
  - TFs introducing and discussing the measurement infrastructures of the different labs, including the actually planned upgrades concerning diagnostic and test systems, as well as test capacities (DESY, STFC, CEA, IJCLAB, INFN LASA, Uppsala, HZB)
  - Projects reporting on their needs and schedules for cavity testing
  - Industry participants invited to tell about their needs and plans.
  - Possibility to invite people from other fields.

Workshops dedicated to a particular type of TP

- **October-November 2022 at INFN-Milano: test benches for superconducting magnets**

Day 1		
13:00		Participants arrival - brief buffet
	50’	Talks about "Long and Short Term Roadmap and Future Projects involving SC Magnet" Particle physics, fusion, health applications…
	45'	Open Discussion
15:30		Coffee Break
	8x15'	Presentation of Technological Infrastructures: Potential, access, future R&D Projects
17:30		Visit to LASA Infrastructure
		Social Dinner
Day 2		
09:00	6x20'	Talk by Industry Key Player: Future Developments - Innovative Collaboration Projects - Interaction with TI
11:00		Coffee Break
11:30		Round Table “The Present and Future Interaction between Industry and Research Institutes"
13:00		Greetings and free lunch

Technological Infrastructures

1. CERN
2. CEA
3. INFN
4. CIEMAT
5. GSI
6. IFJ-PAN
7. Uppsala
8. KIT/Twente

Industrial Key Players (Talk)

1. ASG Superconductors
2. Bilfinger Noell
3. Elytt Energy
4. Saes Real Vacuum
5. Sigmaphi
6. Tesla Engineering

Industrial Partner (Poster Session)

- ANTEC Magnets
- Danfysik
- Oxford Instruments Nanoscience
- Scanditronics
- Cryogenics Ltd.
- + Other Industries involved in the satellites activities of SC Magnet (ex. Power solutions, Control System etc..)

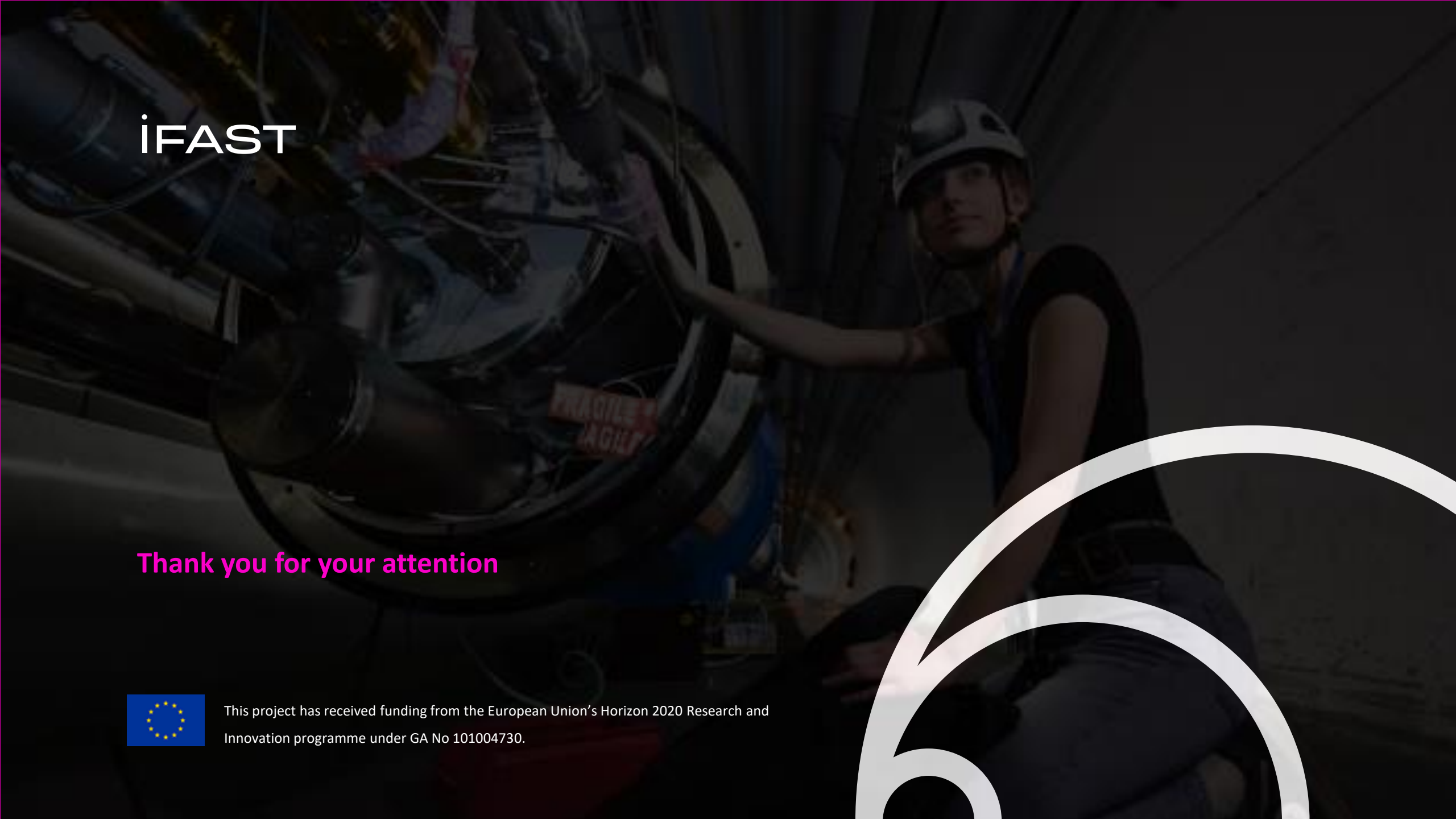
Workshops dedicated to a particular type of TP

- **Beginning 2023**: Mechanical tests at cryogenic temperature organized by CEA.
- **Last workshop:** subject and location to be defined

➥**Question 3 to IAB: Does the IAB have recommendations on how to reach a maximum of potential industry users?**

Other actions in relation with AMICI

- **HORIZON INFRA-SERV project EURO-LABS - EUROpean Laboratories for Accelerator Based Science** (coord. INFN): 2022-2026
  - Task WP3.2 Technology infrastuctures: Access to some of the TPs of AMICI for testing of SC magnets, SC and normal RF cavities, and associated material and mechanics.
- **RITIFI (RIs and TIs For Impact) Project** submitted to the call HORIZON-INFRA-2022-DEV-01-02 - Cooperation, synergies and networking between RIs and TIs (coord. CEA)
  - Strategic analysis of the current RI and TI landscape in selected areas, towards an RIs-TIs Integrated Landscape, TI-RI Governance models
  - 5 case studies among which AMICI TI



Thank you for your attention

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