



DE LA RECHERCHE À L'INDUSTRIE

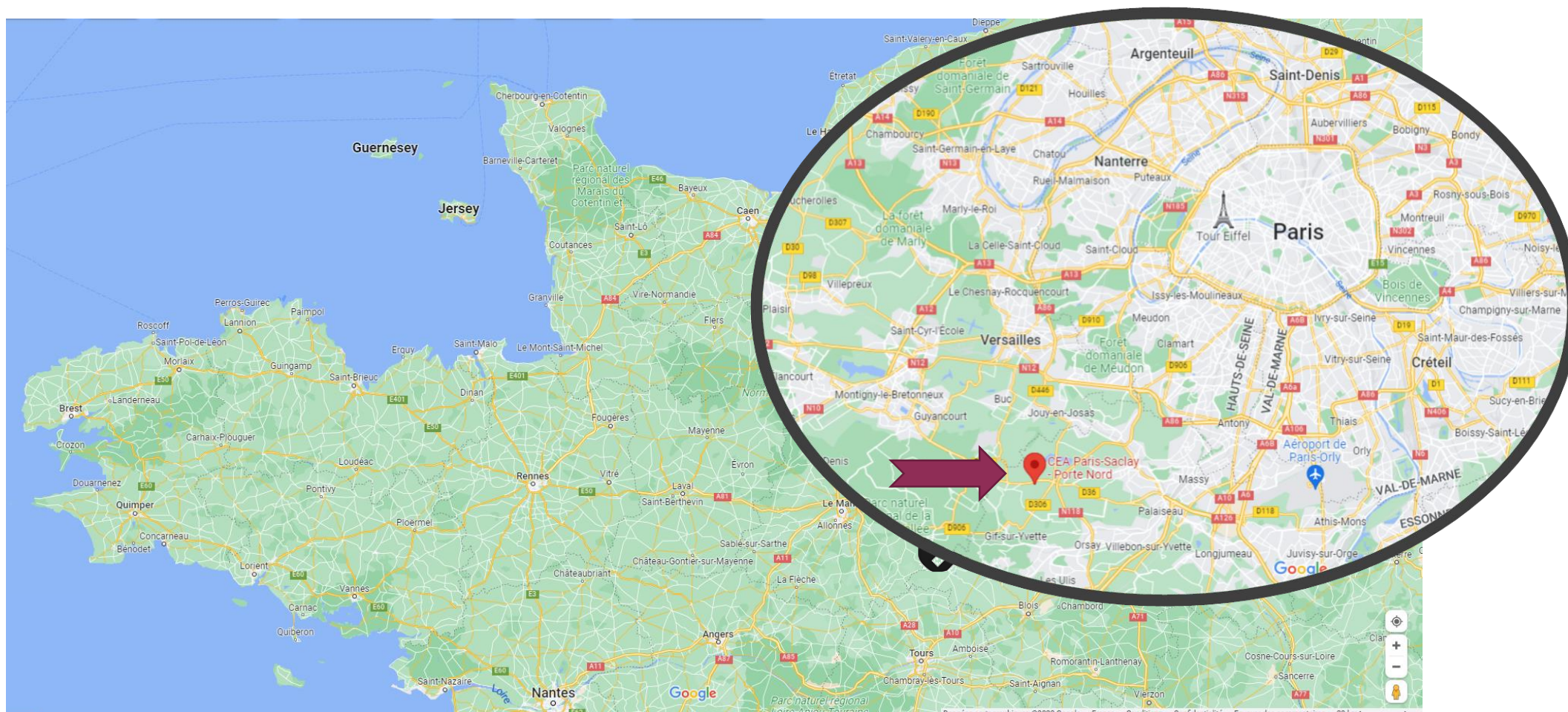
CEA – Technological Infrastructures

iFAST – WP13 – Milano – 2022-11-17

T. Genestier on behalf of DACM team

Localization

► CEA - Saclay



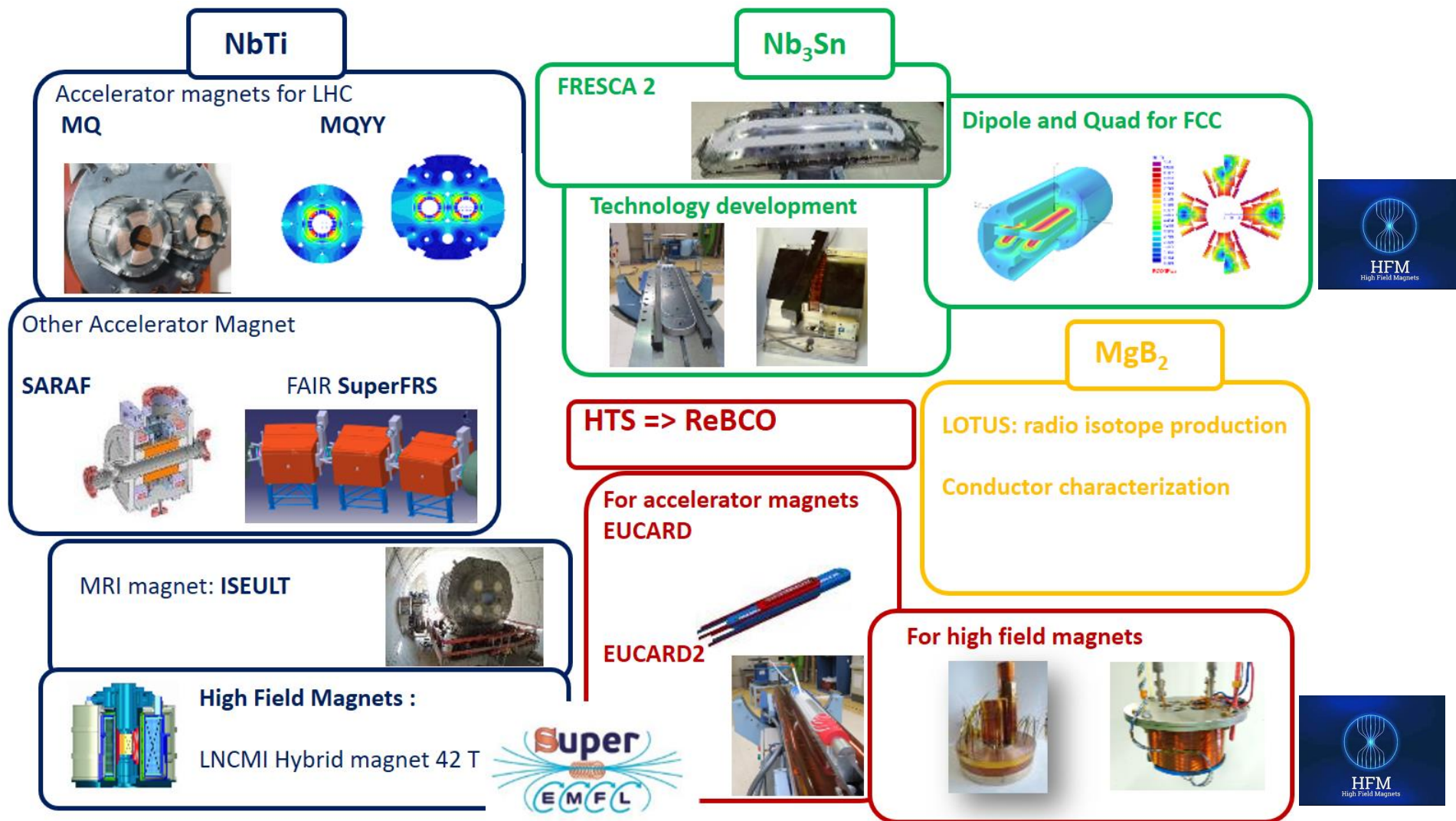
CEA missions in Fundamental Research

- The French Alternative Energies and Atomic Energy Commission (CEA) is a key player in research, development and innovation in four main areas:

- defence and security,
- nuclear and renewable energies,
- technological research for industry,
- **Fundamental research in the physical sciences and life science.**



Superconducting magnets

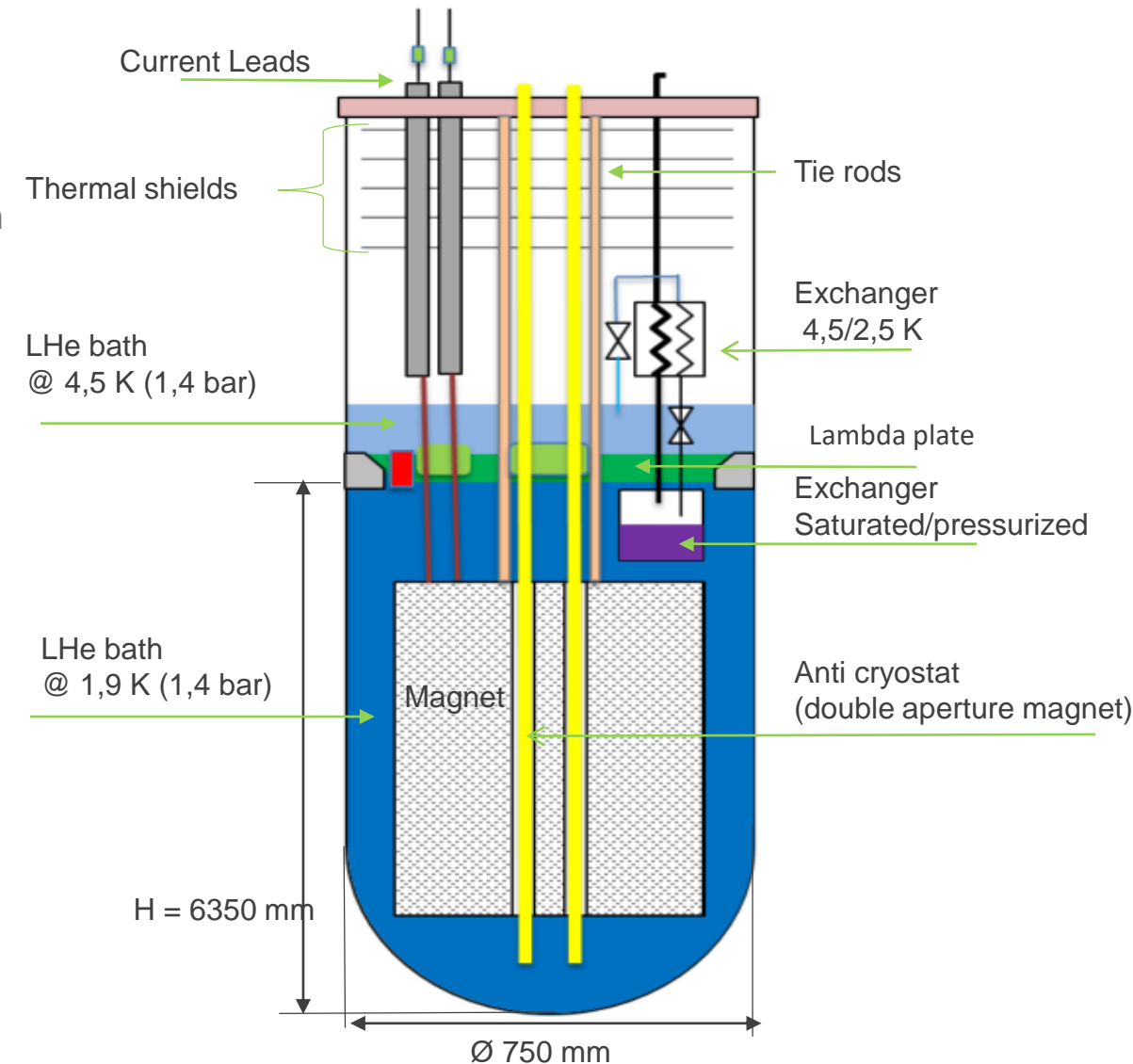
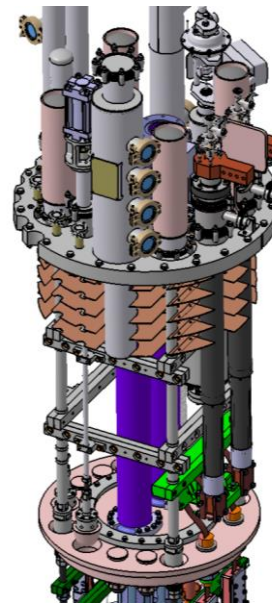


► Magnet Test Stations – STAARQ



Magnet Test Stations – STAARQ

- ▶ Able to test MQ and MQYYM magnets (HL-LHC)
- ▶ Double bath cryostat with pressurized superfluid bath
- ▶ Compatible with other type of magnets:
 - $\varnothing < 640$ mm ; $H < 5$ m, $W < 12$ t
 - 1.9 K $< T < 300$ K
 - $I < 20$ kA



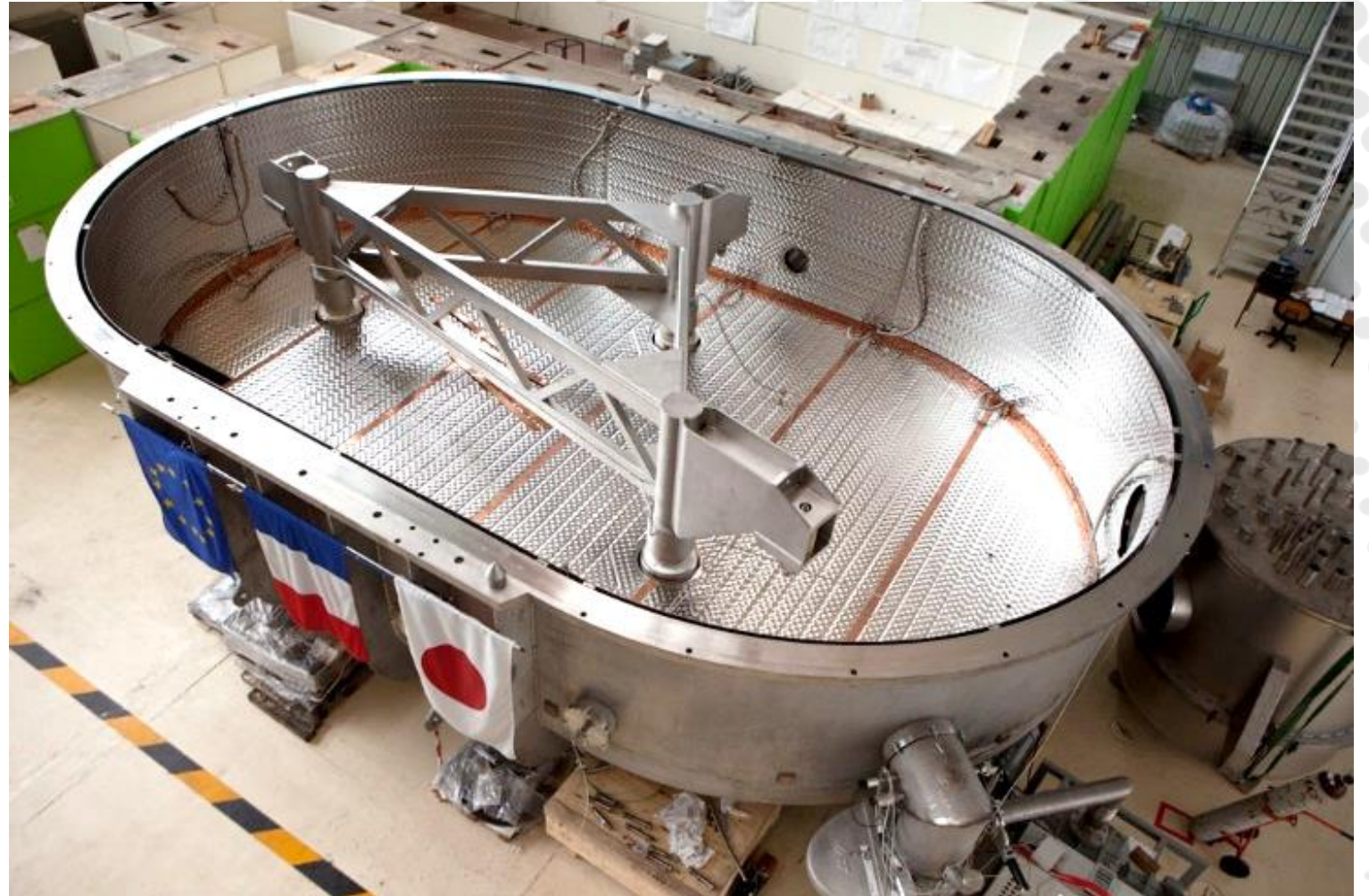
Magnet Test Stations – STAARQ

- ▶ Operating pressure for the cryostat between 1.3 and 1.4 bars (imposed by the cold box / Dewar system operation)

- ▶ LHe flows:

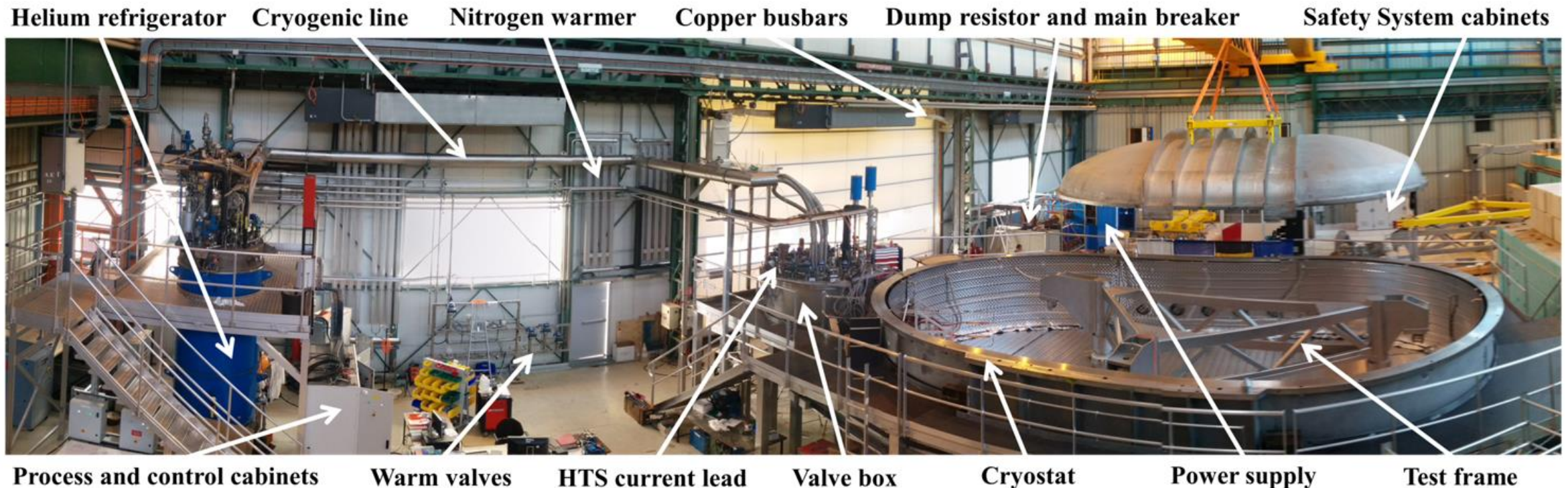
	13 kA	0 kA	4.2K standby
Current Leads (g/s)	1 x 2	0.6 x 2	0.6 x 2
Cryostat P regulation (g/s)	1	1	1.6
1.9 K sat. pumping (g/s)	1.25	1.25	0

► Magnet Test Stations – Big Magnets



Magnet Test Stations – Big Magnets

- ▶ Test cryostat of large magnets: oblong shape: $L < 10\text{ m}$, $W < 6.5\text{ m}$, $H < 2\text{ m}$, $5\text{ K} < T < 7.5\text{ K}$, $I < 26\text{ kA}$
- ▶ Cryogenic:
 - 500 W @ 4.5 K, +3.6 g/s from 50 K to 300 K
 - Coils cooled with supercritical forced helium flow (cold circulator) between 5 K and 7.5 K



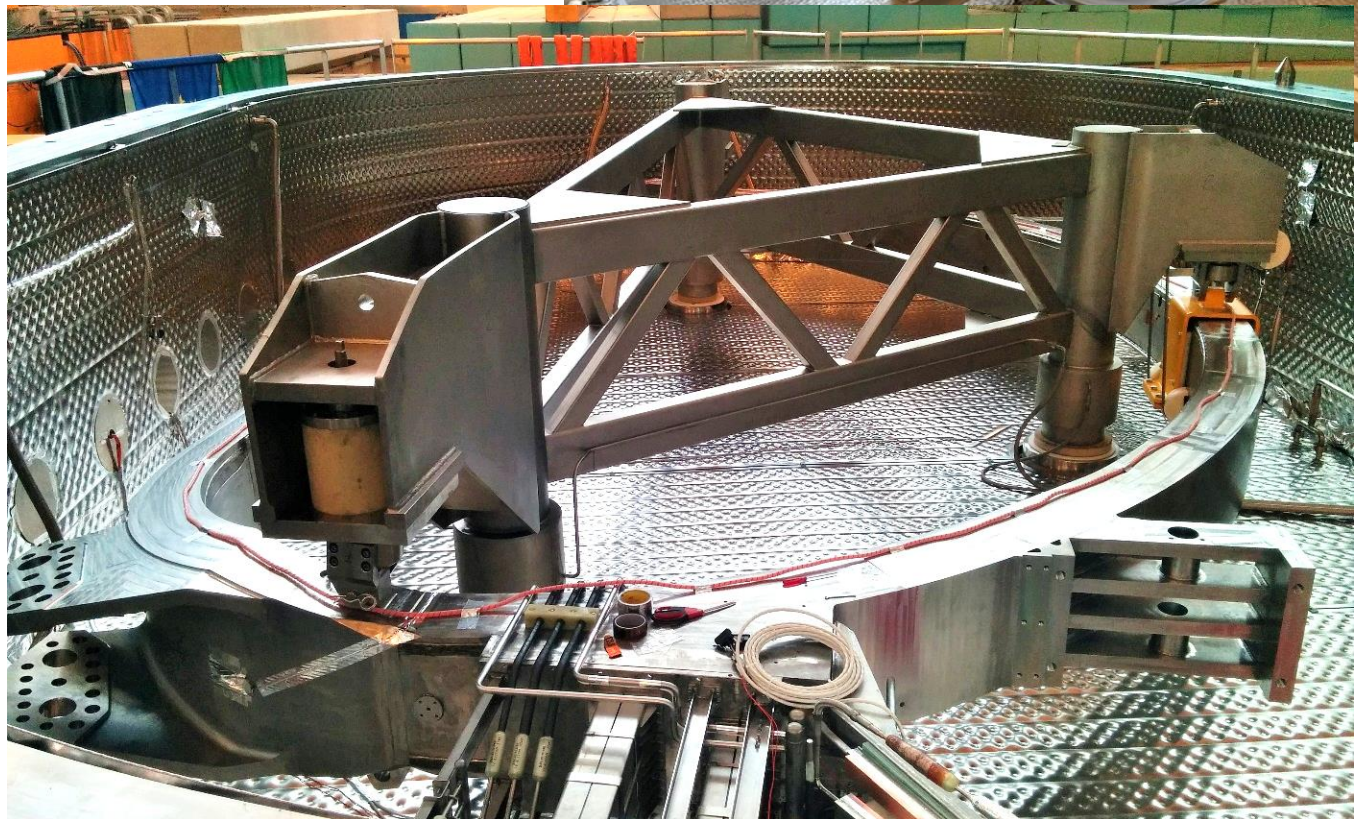
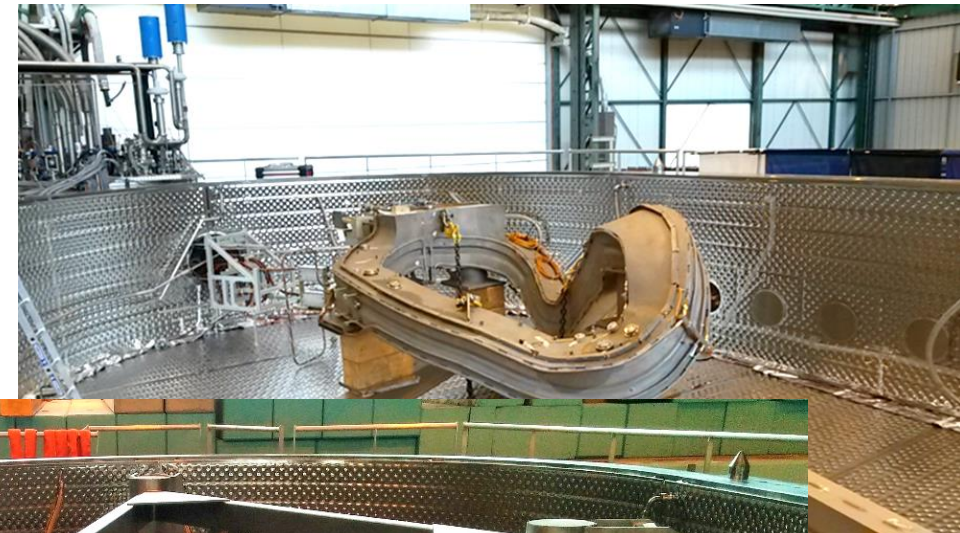
Magnet Test Stations – Big Magnets

► Used for fusion:

- W7X demo coil
- 20 JT-60SA TF coils

► Used for detector magnet:

- MACOU
- MACOUMBA



Insulation laboratory

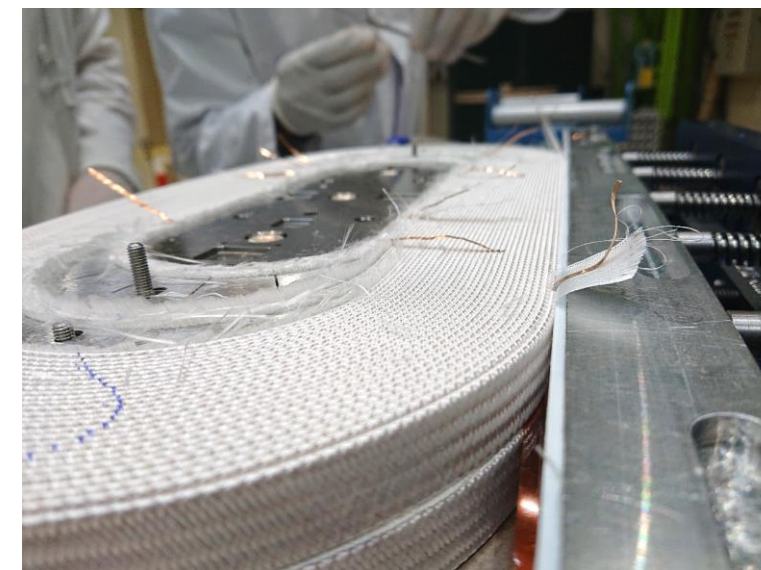
- ▶ **Small winding machine**
 - $L < 750 \text{ mm}$, $\varnothing < 400 \text{ mm}$
- ▶ **Precision weighing (mmax = 220 g à 0,1 mg)**
- ▶ **Binocular**
 - Magnification 40x
- ▶ **Liquid-solid tensiometer**
 - KRÜSS
- ▶ **Differential Scanning Calorimeter (DSC)**
 - NETZSCH DSC 3500 sirius
- ▶ **Rheometer**
- ▶ **Viscometer**
- ▶ **Chemistry lab with fume hood**
- ▶ **Ovens and furnaces of different size**



A few words about coils manufacturing capacities

► From winding to impregnation

- Limited to coils $L < 3$ m and $\varnothing < 400$ mm ($\varnothing < 2$ m for solenoids)
- Reaction heat treatment (800°C in argon flux, initial vacuum purging)
- Polymerization press for NbTi coils
- 8-axis FaroArm® with scanner & PolyWorks software



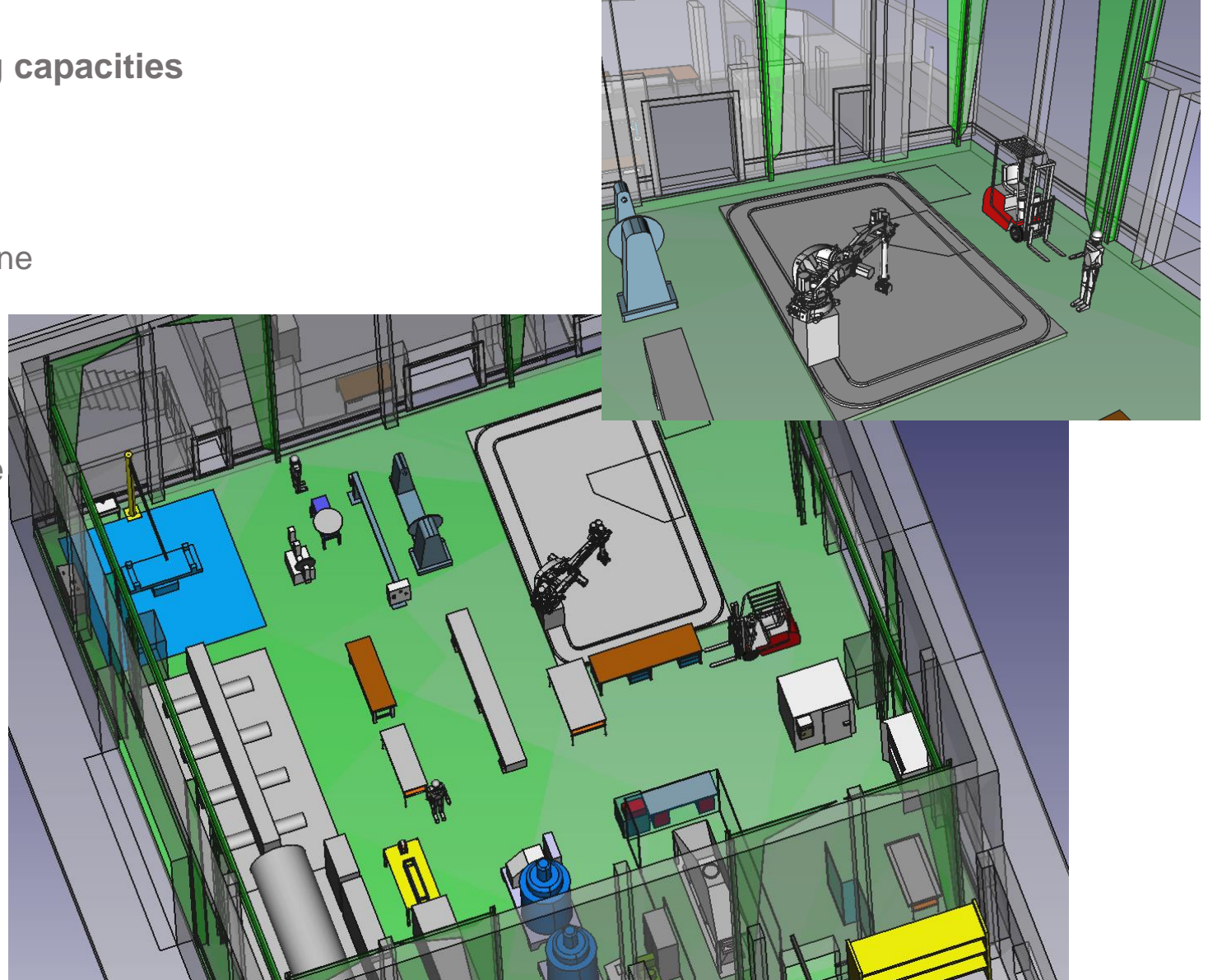
A few words about coils manufacturing capacities

► Will be increased in the near future

- Up to 5.5 m long coils
- Modular and Robotic winding machine
- Reaction heat treatment oven
- Impregnation bench

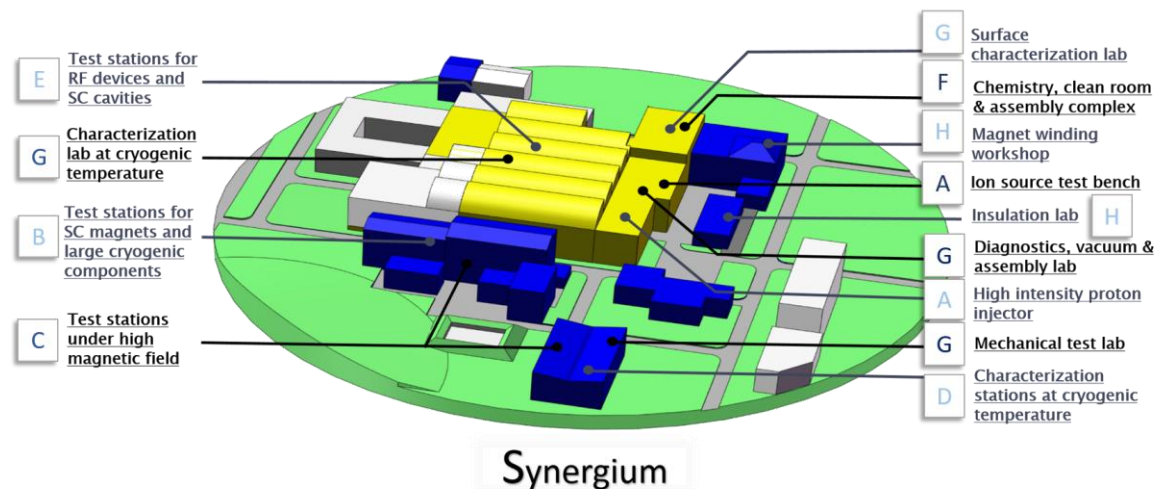
► Be ready for next generation of large colliders

- Nb₃Sn – HTS
- Cos-Theta – Block type coils
- ...

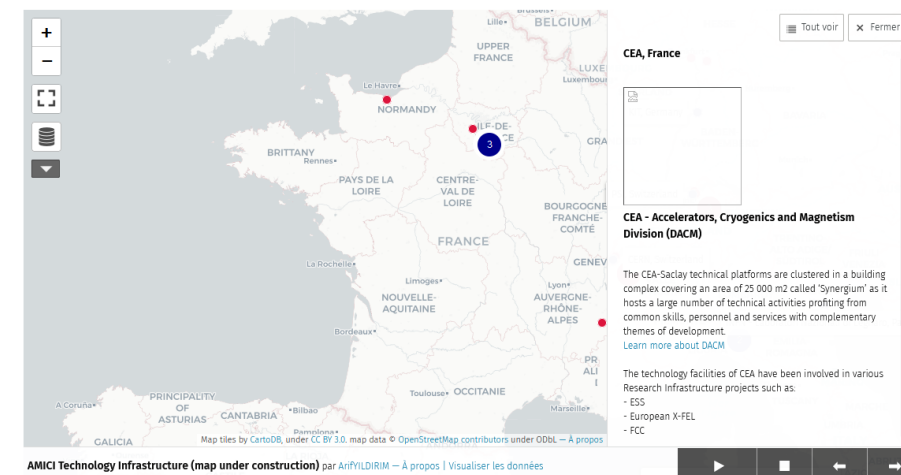


How an industry may profit from machine-time?

- ▶ Equipment are available on request
- ▶ Contact using the AMICI website:
 - https://amici.ijclab.in2p3.fr/technology_infrastructure
- ▶ Focus on CEA:
 - https://amici.ijclab.in2p3.fr/technology_infrastructure/cea

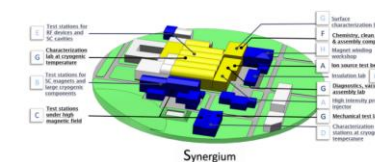


TECHNOLOGY INFRASTRUCTURE



COMMISSARIAT À L'ÉNERGIE ATOMIQUE

TECHNOLOGICAL FACILITIES AT CEA SACLAY, FR



In which R&D activities Industry can collaborate with your facility?

- ▶ Magnets testing
- ▶ Insulation definition
- ▶ Coils & Magnets manufacturing

Examples

► AMICI

- https://amici.ijclab.in2p3.fr/industry_involvement/success_stories

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WE SUCCEED ____

The collaboration between European Technological Facilities and Industry has been seminal for the realization of unprecedented endeavors, like LHC, EU-XFEL, ESS and ITER, which have recently projected Europe to an undisputed position of worldwide leadership. This web page presents examples of such successful collaborations.

SUCCESS STORIES ____

INNOVATION



INDUSTRIALIZATION





Thank you for your attention

Question?

AMICI: <https://amici.ijclab.in2p3.fr/>