



SIGMA PHI
ACCELERATOR TECHNOLOGIES

SIGMAPHI WHO WE ARE

DEDICATED TO
Accelerate the future
DESIGN | MANUFACTURE | TEST | MEASUREMENT | ALIGNMENT



Presentation by:

Dr Emmanuel Voisin

R&D Engineer / Calculation Group

+40
years of expertise

+150
employees

20 M€

Combining the best of both Scientific & Industrial Worlds

SIGMAPHI WORLDWIDE

■ ■ SIGMAPHI FRANCE

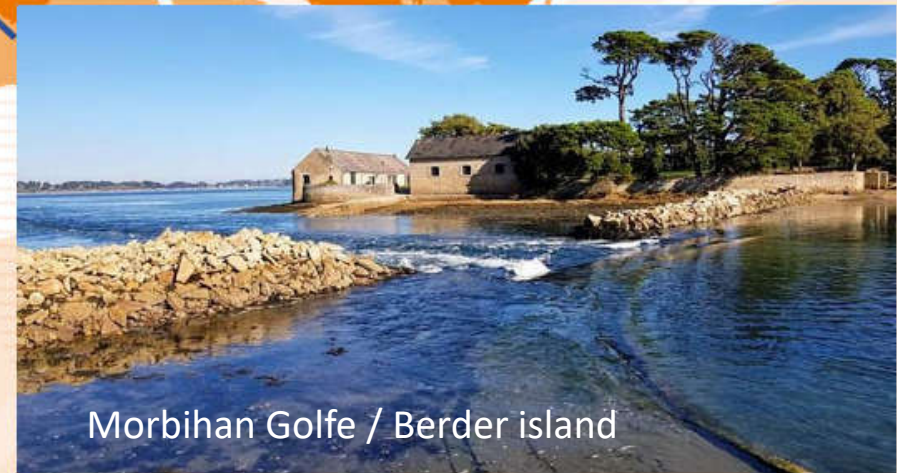
Vannes
130 people
95% exported

■ SIGMAPHI CHINA

Beijing
20 people
100% Sigmaphi owned
Same quality and management as in France

● SIGMAPHI JAPAN

Tokyo
Sales branch



Morbihan Golfe / Berder island

Markets & Projects



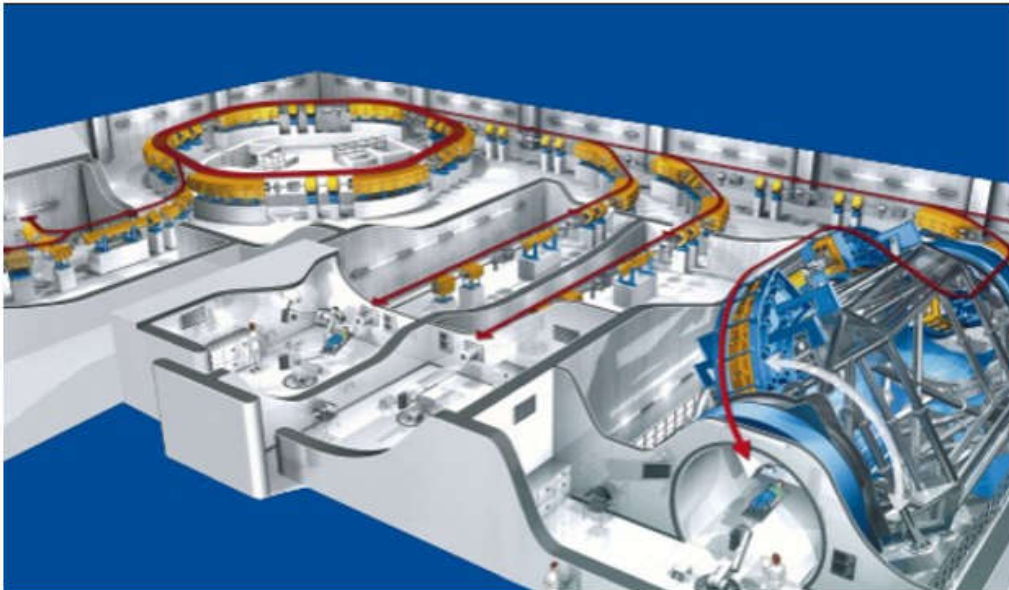
Delivering
Particle Accelerator magnets and Beam Lines
for:

📍 PARTICLE THERAPY FUSION 📍 RESEARCH INSTITUTES

Hadrontherapy

Supply of all magnets for a carbon therapy facility

- Quadrople and sextupole magnets
- Linac triplets
- Bending magnets
- 90° gantry bending magnet



Heidelberg Ion-Beam Therapy Center
(HIT),
Germany



Beamline



Fusion

Poloïdal Field Coils for the National Spherical Torus eXperiment Upgrade (NSTX-U)

Supply of Poloïdal Filed Coils

- 1 prototype inner PF1A
- 2 inner PF1A
- 2 inner PF1B
- 2 inner PF1C

Resin/Primer **CTD425/CTD450**

Weight **80 to 350 kg**



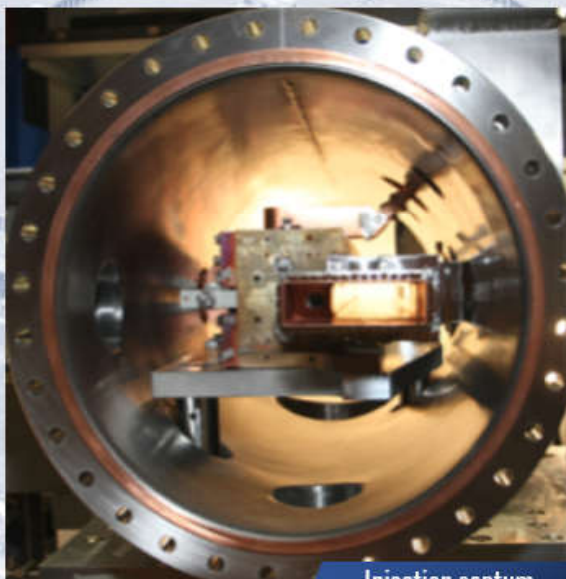
Poloïdal Field Coils



Light sources



124 storage rings sextupoles



Injection septum



Injection pulser



SIGMAPHI
OUR VALUES

Excellence

Collaboration

Responsibility

Friendliness

Superconducting magnets

Special dedicated projects



Sigmaphi is a leading company which has the know-how and skills to manufacture superconducting magnets based on :

- NbTi
- MgB₂
- HTS
- Liquid or Helium free
- Solenoid, Racetrack or Cos Theta coils



Examples of Superconducting magnets built by Sigmaphi



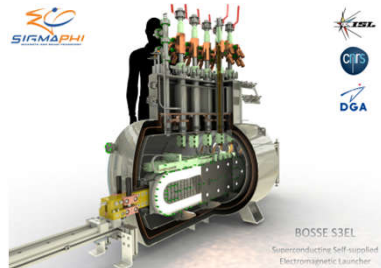
Vector Magnet CEA



Solenoid KEK



YBCO SMES -Launcher



FCL (YBCO)



Cyclotron
PMB



Quadrupole
CERN



Quadrupole
JLAB



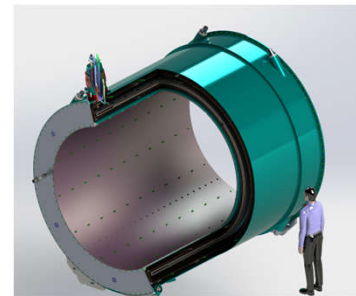
Dipole
JLAB



Solenoid
(MgB2)



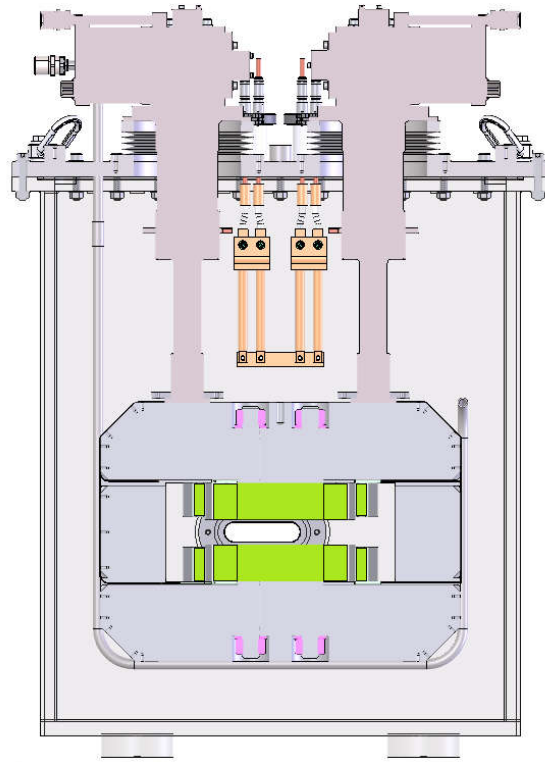
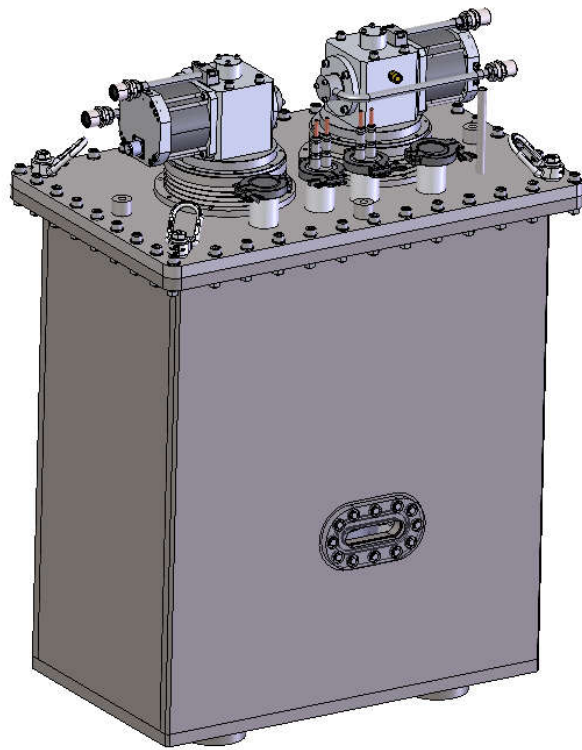
Cyclotron
NHA



Solenoid
Mainz University

Examples of products : NbTi

Superconducting Dipoles for PSI Lightsource



Superconducting Magnet NbTi
180 A – 5.5T
Super ferric design
Cryogen free

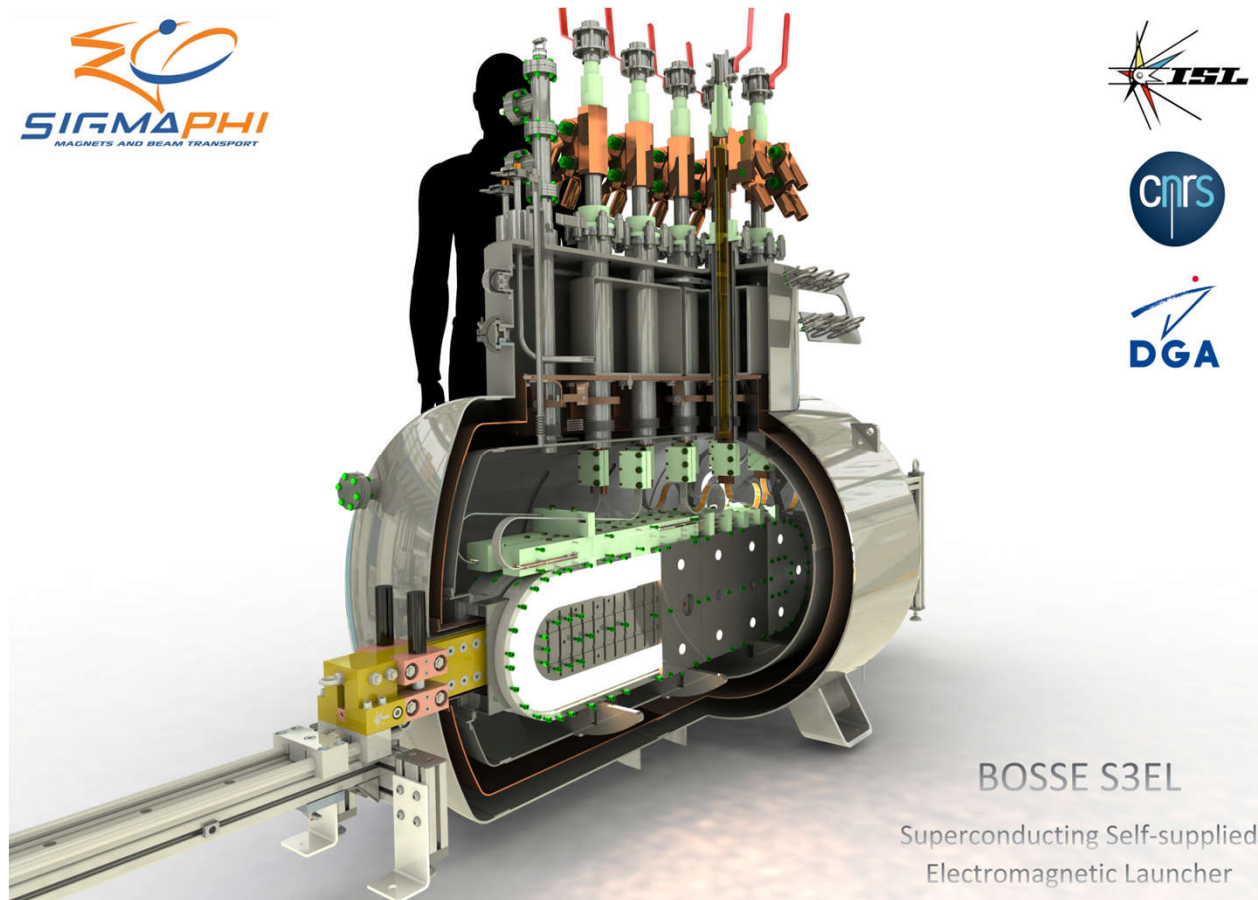
Examples of products

HTS - YBCO



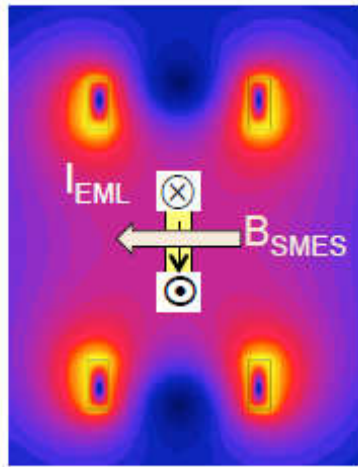
Examples of products : HTS

BOSSE Electromagnetic Launcher | CNRS for DGA partnership

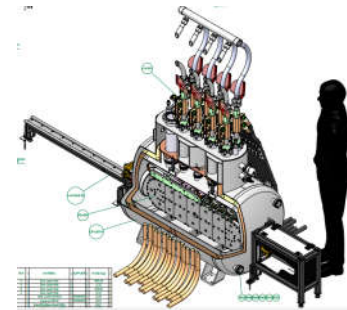
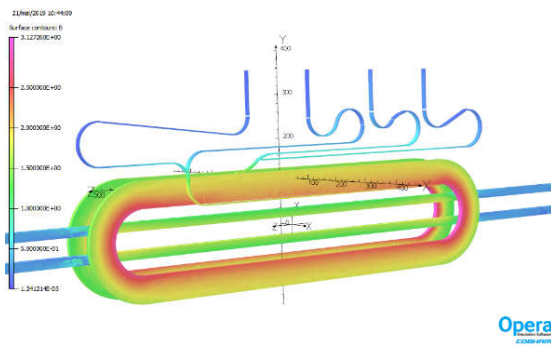


Examples of products : HTS - YBCO

BOSSE Electromagnetic Launcher | CNRS for DGA partnership

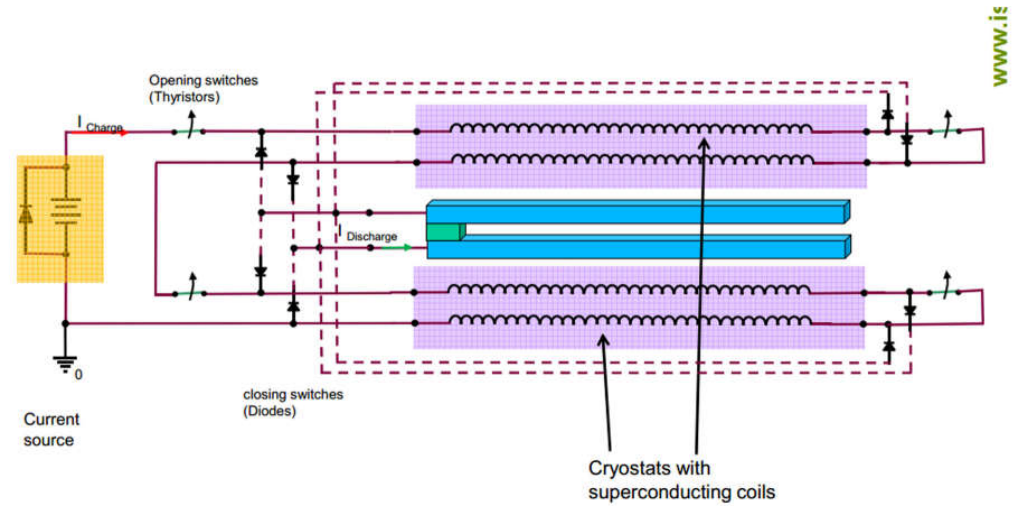
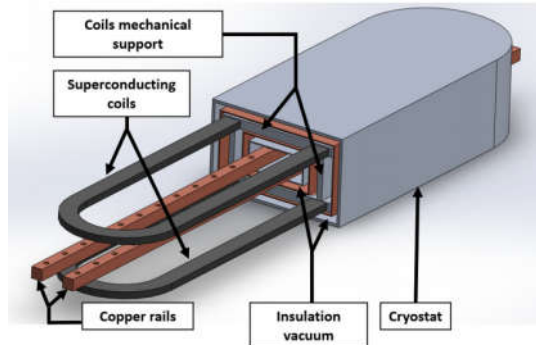
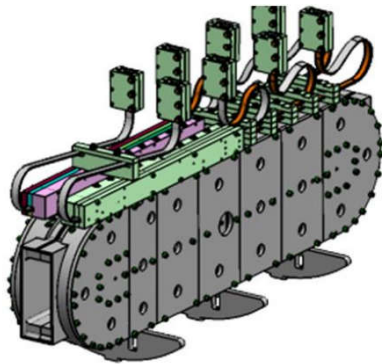
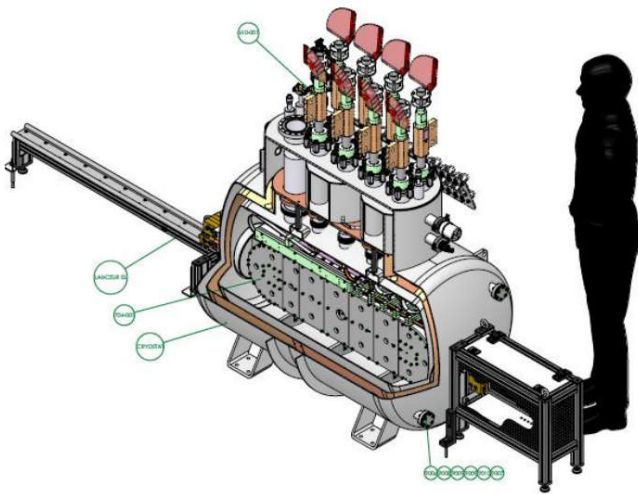


HTS2G (YBCO) dipole
10 kA
1,2 T
100 gr projectile at 100 m/s
4 stages XRAM concept
(current multiplier)



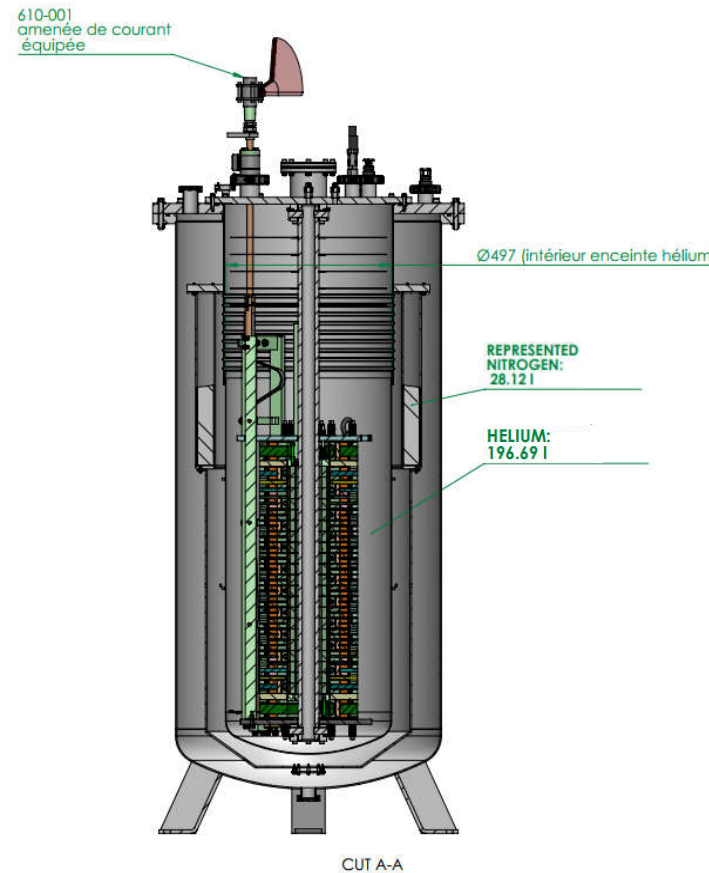
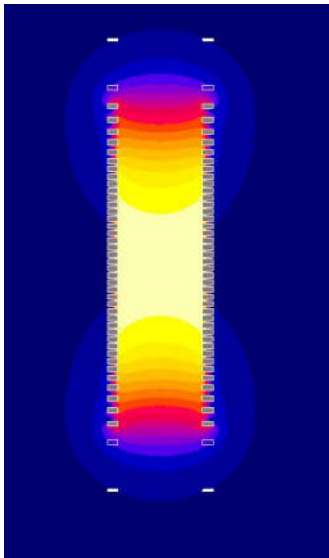
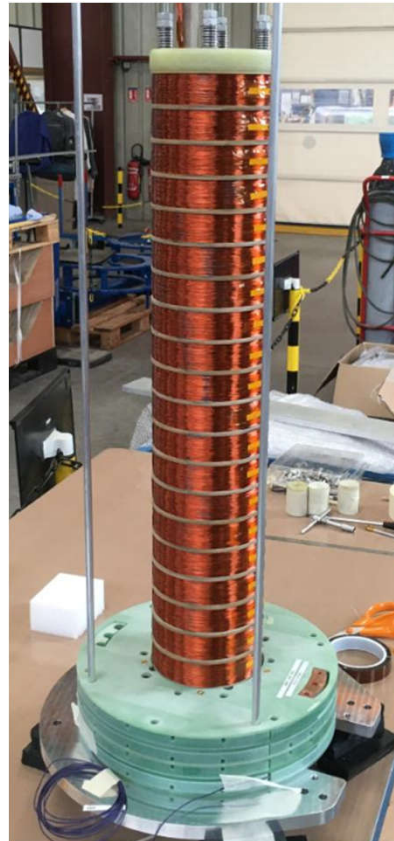
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More views



Examples of products : HTS - YBCO

BOSSE Solenoid for Energy Storage | CNRS for DGA partnership



HTS2G YBCO solenoid
bore 180 mm
13,1 T
972A
1,3MJ



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Examples of products : HTS - YBCO

BOSSE Solenoid for Energy Storage | CNRS for DGA partnership

All details and results are available:

J Ciceron's thesis (<https://theses.hal.science/tel-02336977>)

HTS2G YBCO solenoid
bore 180 mm
13,1 T
972A
1,3MJ

Main Challenges

- Lack of quality of a number of tape lengths which needed replacement
- winding tension which needs careful adjustment to avoid too high looseness leading to tape movement and instability, against too large tension which leads to internal junction too large resistivity.

Main Achievements

=> **SigmaPhi** has realised

- Blank assembly of the Launcher and Smes
- Delivery of all the necessary elementary bricks of the launcher and also the 21 wafers of the Smes for the final testing at CNRS

=> **CNRS** has realised

2/3 of the wafers which were tested at CNRS were **ok** wrt test nominal current but a number of them failed, and about 1/3 would need to be rebuilt



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Examples of products : HTS - YBCO

Fault Current Limiter | Supergrid Institute



Manufacturing of
HTS2G (YBCO) windings for
a 50 kV Superconducting
Fault Current Limiter
demonstrator
(Fastgrid project)
cooled at 65K



FastGrid
SIGMAPHI

Examples of products

MgB₂

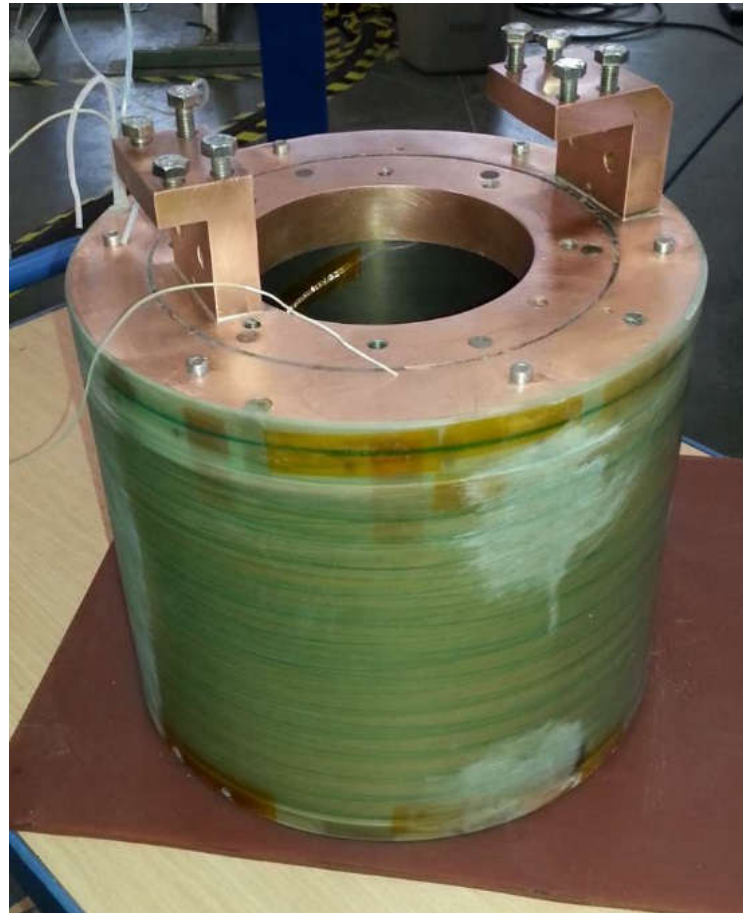
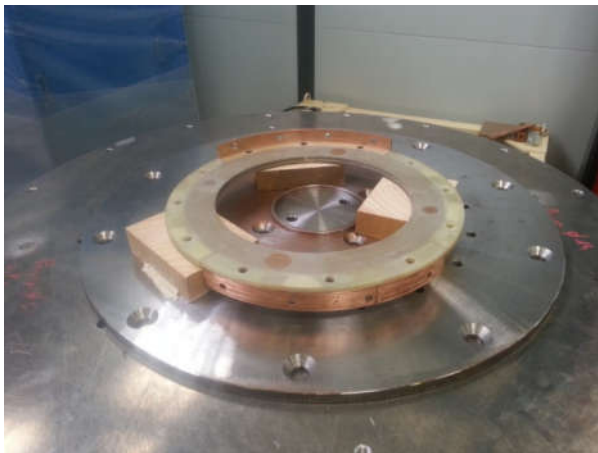
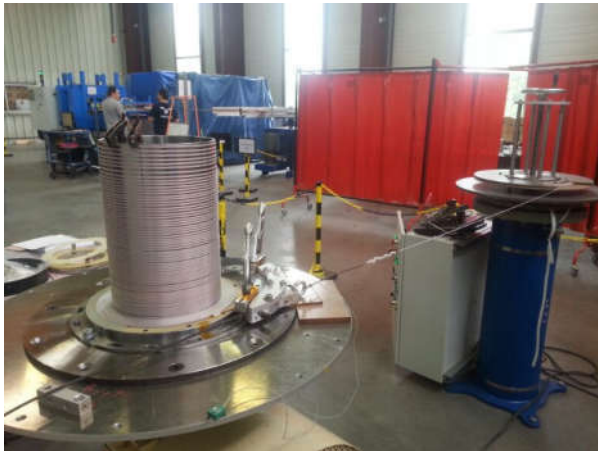


Examples of products : MgB₂

MgB₂ Double Pancake and Solenoid | CEA R&D partnership

All details and results are available:

R Pasquet's thesis (<https://theses.hal.science/tel-01133373v1/document>)



Double pancakes and
Solenoid in MgB₂ - 1T
in 3T background field
Conduction cooled



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Thank you for your attention

