

French industry for Large Research Infrastructures

The SIGMAPHI example

Dr Matthieu CAVELLIER – Sigmaphi



Overview

- Sigmaphi presentation (hopefully short)
- French industrial taskforce for Large Research Infrastructures: PIGES association
- Lessons learned through 3 examples of projects for US labs



SIGMAPHI in a nutshell

French group, 200 people, 25M€ sales, 90% worldwide

Particle accelerator technologies and magnetic systems since 1981

Sigmaphi Headquarters

Vannes, FRANCE

R&D, Design

Magnetic and special products



Sigmaphi Electronics
Haguenau, FRANCE
Power electronics products



Sigmaphi China (PAS)
Beijing, CHINA
Magnets manufacturing
Sales team for Asia

Sigmaphi Japan
Tokyo, JAPAN
Sales office

SIGMAPHI in a nutshell

Products and services

Turnkey particle beamlines from optics to installation and alignment

High quality and innovative magnets : resistive, permanent, superconducting, AC...

Electrostatic and in-vacuum components

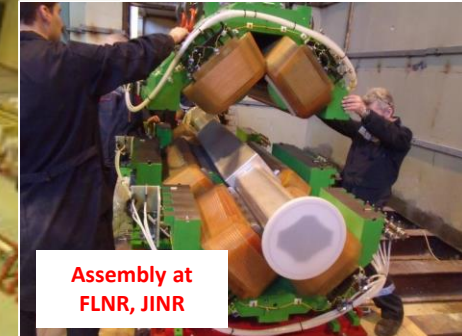
Highly stable power supplies, including C&C and quench detection for SC

RF power solutions : amplifiers, Klystron modulators

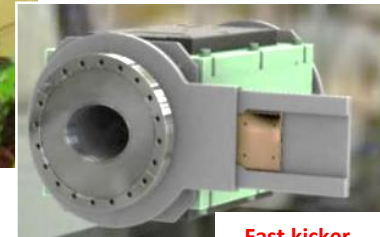
Ultra-fast injection/extraction systems



70m beamline for
FLNR, JINR



Assembly at
FLNR, JINR



Fast kicker
for GSI



UHV Septum



Superconducting correctors
for LHC, CERN



Power supplies
for FLNR, JINR



RF Power amplifier for
HZDR



SIGMAPHI in a nutshell

Physics research labs (colliders, light sources, high energy,...)



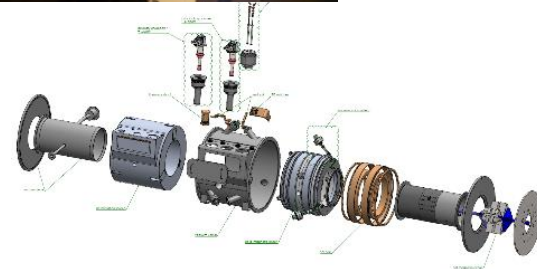
CERN, ANL, JINR, Diamond, JLAB, BNL, MSU, SLAC, FNAL, GSI, FAIR, INFN, STFC, CEA, CNRS, KEK, CIAE, VECC...

Hadron / Proton Therapy centers manufacturers



but also: Heidelberg IT, MedAustron, CNAO, PSI, MGH,...

Other industries (ion implantation, spectrometers, transport...)



PIGES association

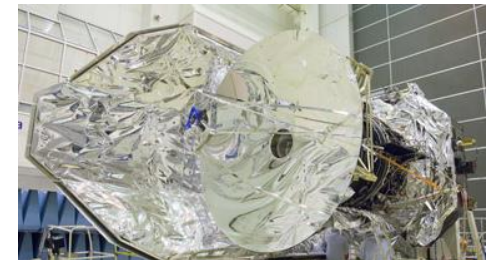
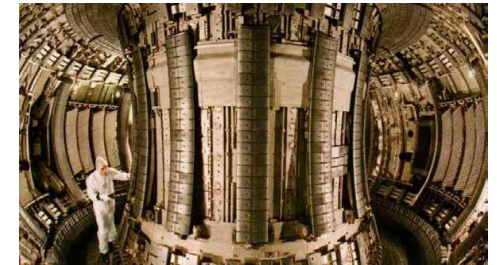
PIGES (*Partenaires Industriels des Grands Equipements Scientifiques*)

is an association created in 2010 gathering French companies involved in Large Scale Research Infrastructures, with the following aims:

- Promoting activities of the members
- Enhancing links with research labs (training, internships...)
- Initiating common R&D programs with Research Institutes
- Liaising with French administration

PIGES association

- Areas :
 - Accelerators
 - Biology and Medicine
 - Nuclear Energy: Fusion and Fission reactors
 - Space programs
 - Astrophysics
 - High power lasers



PIGES association

Fields of expertise of PIGES Members:

- Projects & Programs Management
- Technical Engineering and certification
- Particle accelerator engineering
- Nuclear safety
- Advanced materials
- Metallurgy and Superconductivity
- Opto Mechanical optronics
- Optical beam
- Electrical Engineering, Electronics
- Magnetism
- Microwaves
- High Pulsed Power
- High voltage, high current
- Power Electronics
- Vacuum & Ultra-high Vacuum
- Cryogenics
- Precision Mechanics Engineering
- Micro positioning
- Assembling Technologies
- Integration in a clean environment
- Metrology and non destructive testing



Working with US labs

- Sigmaphi experience on 3 projects achieved recently:
 - Superconducting magnets for Jefferson Lab
 - Superconducting power supplies for MSU
 - Prototype coil for PPPL



MICHIGAN STATE
UNIVERSITY



Working with US labs

JLAB project

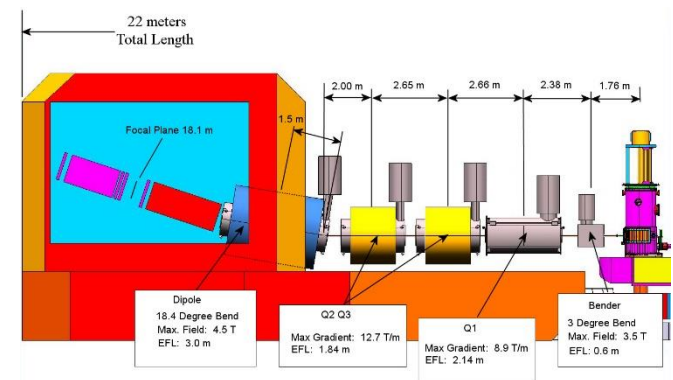
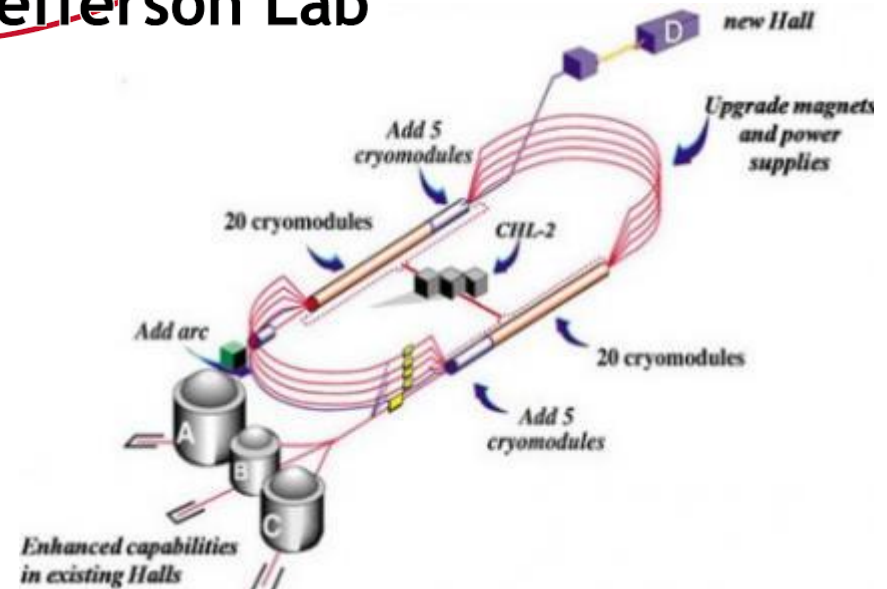
Overview

- CEBAF Upgrade - Hall C
- Superconducting magnets

Scope of Sigmaphi's work

- Complete design
- Performances responsibility
- 1 dipole and 2 quadrupoles

Jefferson Lab

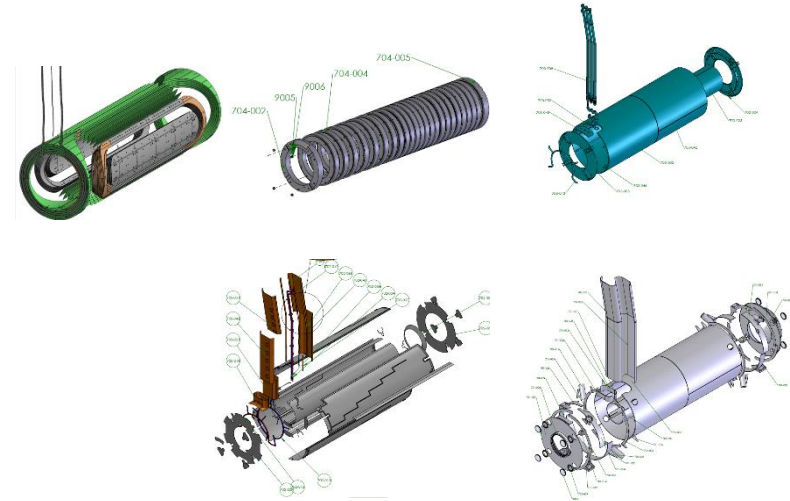


Working with US labs

JLAB project

Challenges

- Sigmaphi 1st « not build-to-print » contract for SC magnets
- SC cable supplied by customer
- Responsibility for performances without testing
- Transport (tunnel on site)



Working with US labs

JLAB project

Lessons learned from this project

- Communication to learn, grow and solve issues together (on-site presence),
- Engineering cross-check involving 3rd institute (CEA) and experts,
- Handling final works (brazing) on site,
- Careful manufacturing/alignment: time saved at JLAB facility,
- Institutes must trust industrial companies on their potential, not only on their references and experience.



Working with US labs

MSU project

Overview

- FRIB @MSU



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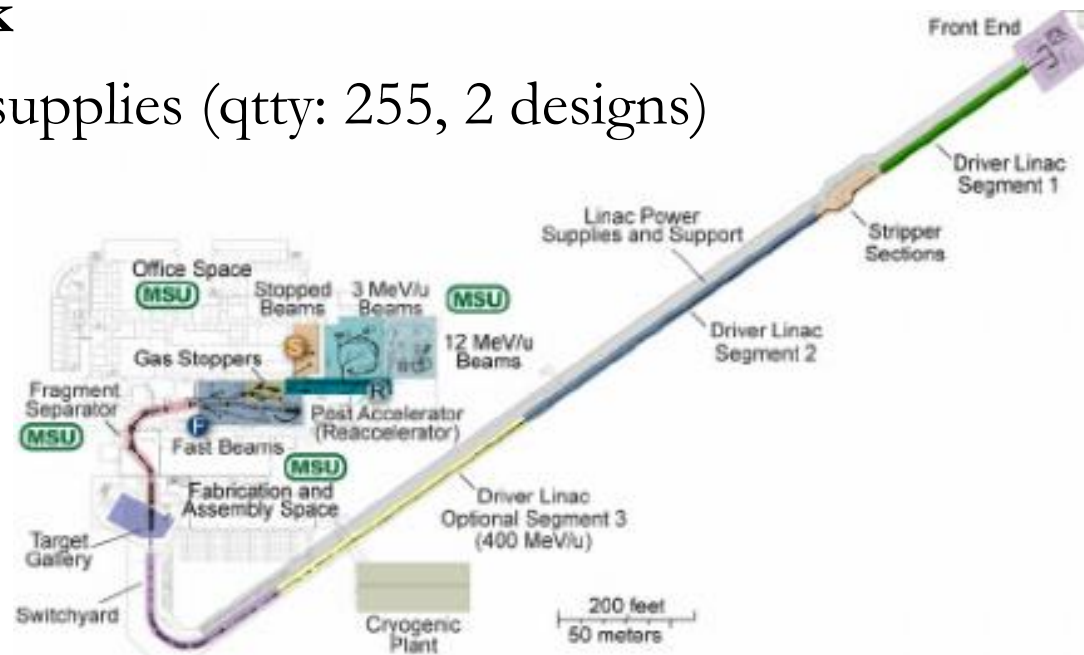


Scope of Sigmaphi's work

- Superconducting power supplies (qty: 255, 2 designs)

Challenges

- New design
- Schedule

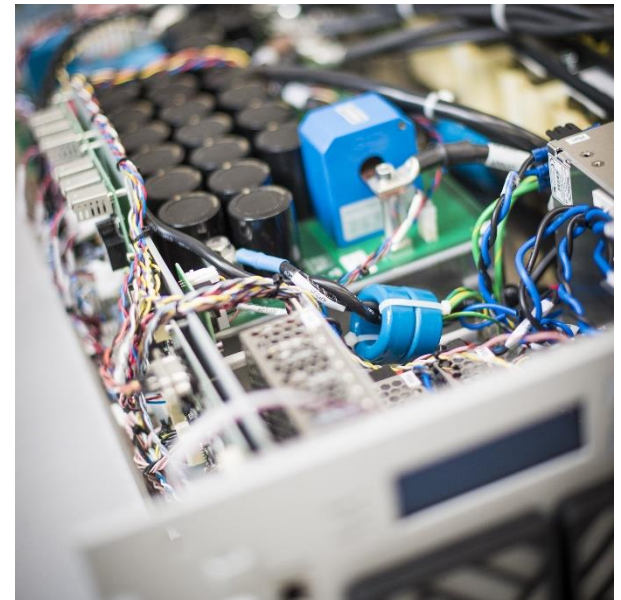
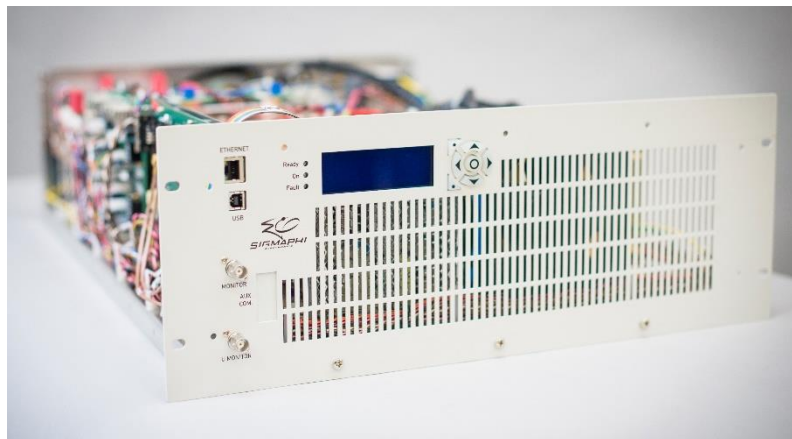


Working with US labs

MSU project

Lessons learned from this project

- New standard products (6V / 20 or 100A)
- Reference project for SC power supplies
- Internal organization improvement
- Fruitful collaboration with MSU team



Working with US labs

PPPL project

Overview

- NSTX-U : prototype coil



Scope of Sigmaphi's work

- 1 prototype coil with toolings

Challenges

- Unusual conductor insulation
- Requirement for clean manufacturing area beyond our standards
- Approval step by step during manufacturing

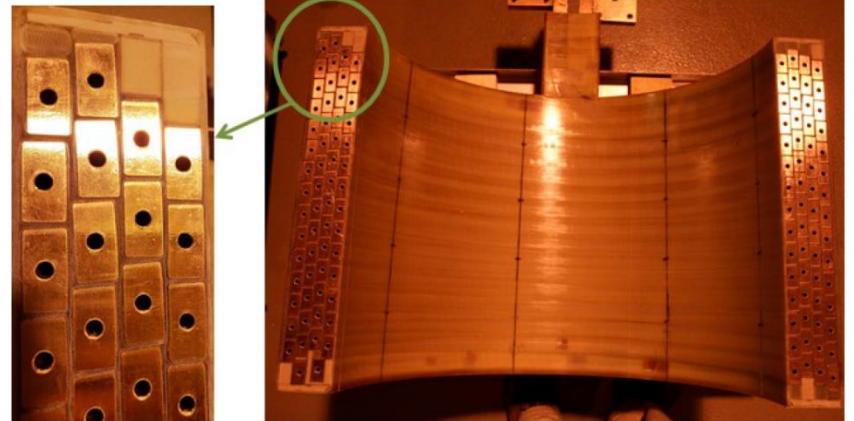


Working with US labs

PPPL project

Lessons learned from this project

- Setting up a restricted manufacturing area
- Documenting every details of manufacturing process
- Handling unknown resin
- Raising our standards



Conclusion

- French/European industrials companies are historic partners of large international science projects
- Institutes must trust industrials companies not only on their references, but also on their potential
- Sigmaphi experience : face-to-face meetings are essentials
- Socializing helps to understand other culture and work behavior : knowing and understanding « the other » helps to manage project difficulties together, towards success!





Thank you for your attention

SIGMAPHI

Rue des frères Montgolfier

F-56000 Vannes FRANCE

Phone: +33 297 01 08 80

E-mail: contact@sigmaphi.fr