The PIGES association

Jean-Luc LANCELOT – President

www.piges.eu

contact@piges.eu

Soleil – 17/09/2014

Piges is an association created in 2010 gathering French companies involved in Research Infrastructures

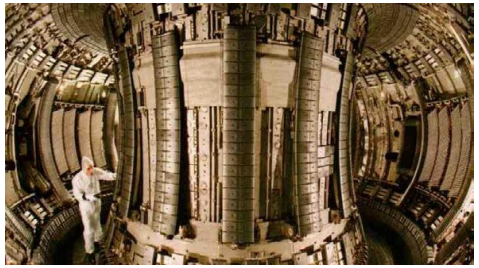
- To promote their activities
- To enhance links with research labs (training…)
- To initiate common R&D programs with Research Institutes

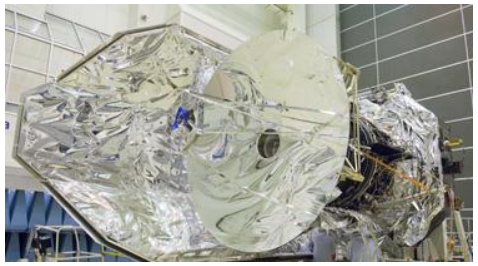
PIGES

- Areas of actions:
  - Setting R&D projects
  - Developing Technology Platforms
  - Managing the “national pole of excellence”
  - Strategic monitoring of technologies
  - Promoting knowledge and experiences
  - Sharing investment

PIGES

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





PIGES

Many skills and know how

A large capacity to
Undertake R&D projects

ACCELERATORS AND CRYOGENIC SYSTEMS

AIR LIQUIDE ADVANCED TECHNOLOGIES

ALCEN

Bodycote

CNIM Innovate and Act

MECACHROME

SIGMAPHI ACCELERATOR TECHNOLOGIES

SDMS la chaudronnerie blanche®

sominex Défense • Energies • Industries • Sciences •

Symétrie

THALES

PIGES

ACCELERATORS AND CRYOGENIC SYSTEMS

AIR LIQUIDE ADVANCED TECHNOLOGIES

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

ALCEN

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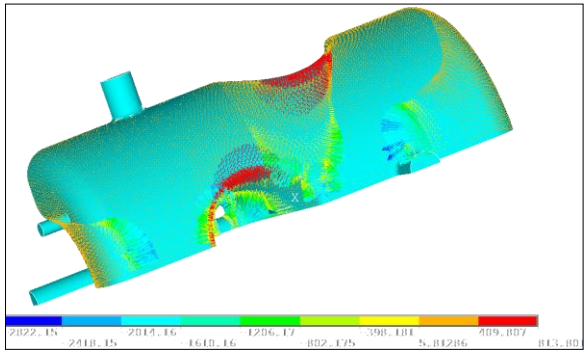
THALES

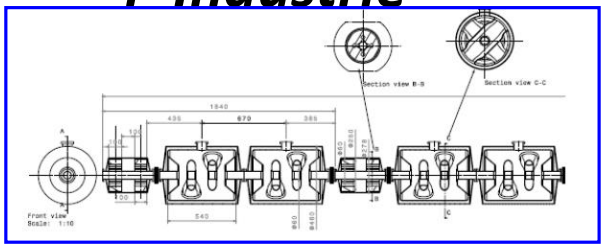
❖A glance at our know-how and references

PIGES

ACCELERATORS AND CRYOGENIC SYSTEMS

Ingénierie d'Accélérateurs de Particules pour la Recherche, la Santé, l'Energie et l'Industrie





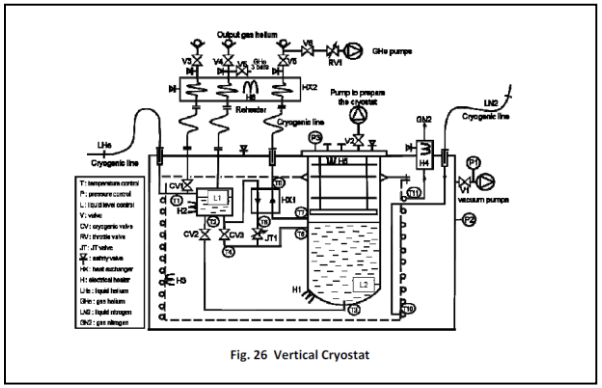


Fig. 26 Vertical Cryostat

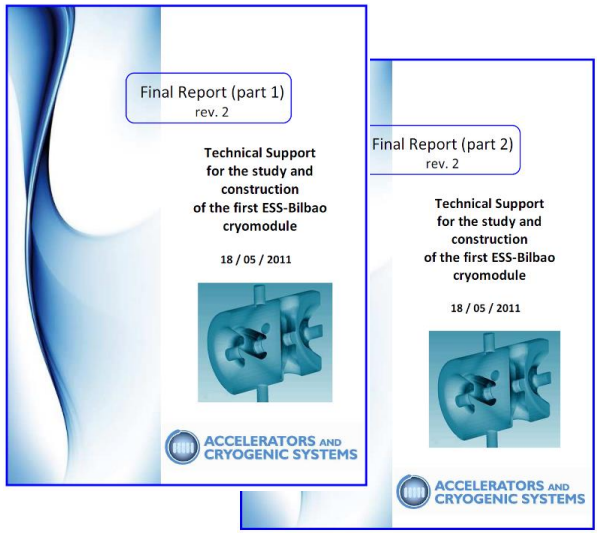
Our expertise:

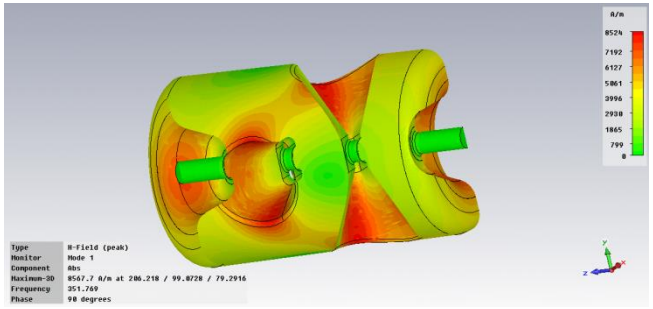
- General accelerators and cryogenics systems conceptual studies
- SC cavities and ancillary equipment design (e.m. and thermo-mechanical)
- Cryogenic systems detailed studies (thermal and mechanical)
- Prototyping (follow-up, controls, tests, …)

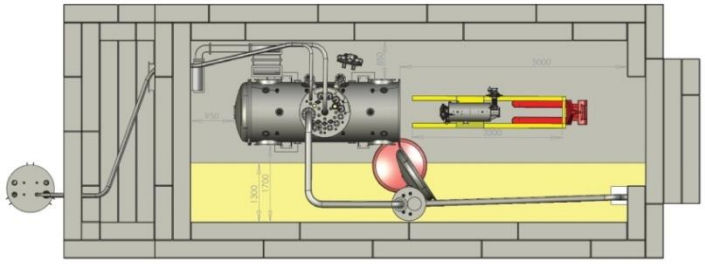
Un accord de coopération avec des laboratoires du CNRS permet à ACS de proposer des prestations pour la préparation et le test des composants accélérateurs

PIGES

ACCELERATORS AND CRYOGENIC SYSTEMS







Our first one partners :

- Techno Fusión
- GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN — Ciemat, Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
- GANIL — Spiral2 — cea — CNRS, Centre National de la Recherche Scientifique
- ESS bilbao
- MAX, MYRRHA Accelerator eXperiment, research & development programme — EURATOM
- SCK·CEN, Studiecentrum voor Kernenergie, Centre d'Etude de l'Energie Nucléaire — MYRRHA
- Uppsala Universitet — FREIA

PIGES

AIR LIQUIDE™

- Helium liquefaction and refrigeration systems (1.8K – 80 K) :
  - Liquefiers : 20 l/h to 8 000 l/h
  - Refrigerators : 100 W to 30 kW
  - Cryogenic storages
  - Cryogenic transfert lines
  - Gas driers and purifiers

PIGES

AIR LIQUIDE™

- Helium liquefaction and refrigeration systems (1.8K – 80 K) main references :
  - LHC, Atlas, CMS at CERN
  - Tore supra, IPR, KSTAR, and now building JT60SA, and ITER Cryoplants
  - Qatar I and II plants: 28% of the helium production World Wide (purification and liquefaction for export)
  - SOLEIL, Diamond, SSRF, NSRRC, NSRC
  - ILL, ISIS, SNS

KSTAR

A multi-technology Group acting in five domains

- Defence & Security – Energy - Medical Machines – Aeronautics - Research Infrastructures

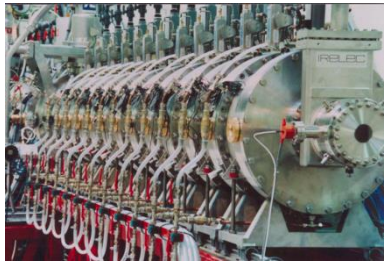
More than 30 subsidiaries mastering a large portfolio of key technologies in

- Materials, Mechanics, Assembly, Power, Thermics, Electro-magnetism, Radioactive environments….

A long history of collaboration with Research Institutes

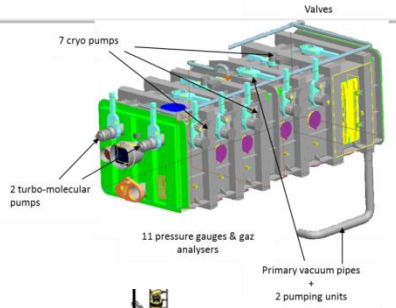
A wide range of roffers for Research Infrastructures

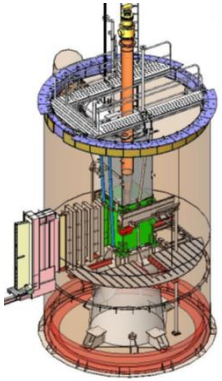
- ❖ Complex mechanical systems & assemblies
- ❖ RF components
- ❖ Ceramic / metal assemblies
- ❖ Accelerating sections
- ❖ High Voltage components & sub-systems
- ❖ Beam line components

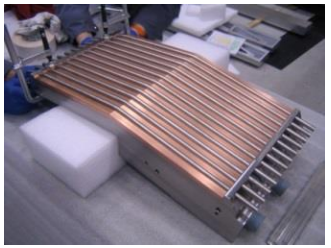


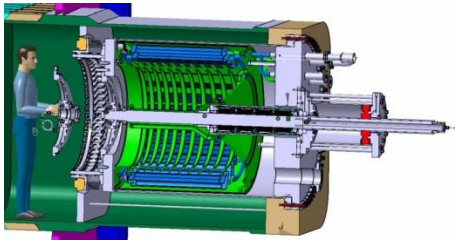
Our references

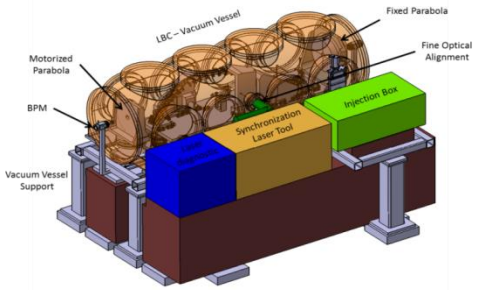
- Petal High Power Laser Compression Vessel
- Linear accelerators & cyclotrons
- CABRI experimental fission reactor core rack
- Tore Supra ICRH antenna Faraday screen
- ITER First Wall Panel prototype
- ITER pre-production cryo-pump
- XFEL cryomodule assembly
- ELI-NP Gamma Source laser-electron interaction chamber
- Mirror systems, Monochromators, KB systems, …











Brazing RFQ IPHI

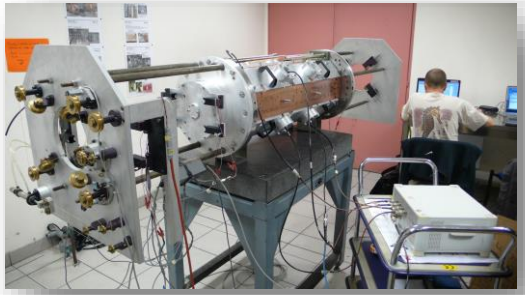
1. *Cleaning CEA*

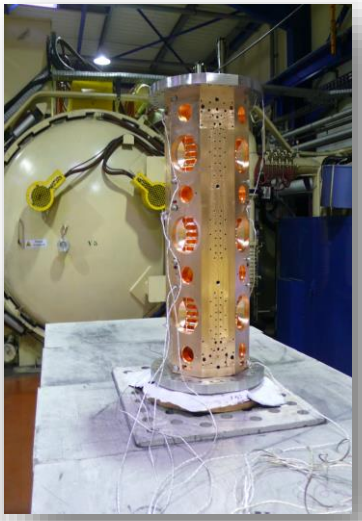
2. *Assembling Mecachrome*

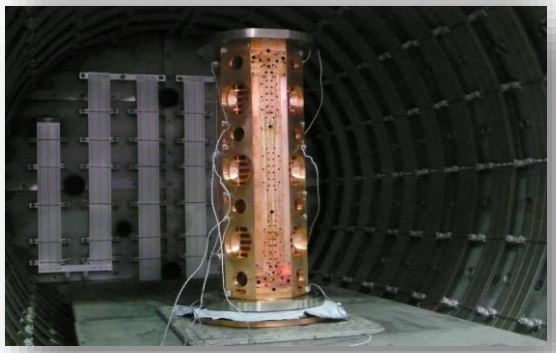
3. *Dimensional measurement Mecachrome*

4. *Radio frequency measurement Bodycote*

5. *Vacuum brazing Bodycote*







Brazing CLIC: Accelerating structure

Assembling and Brazing in BODYCOTE plant

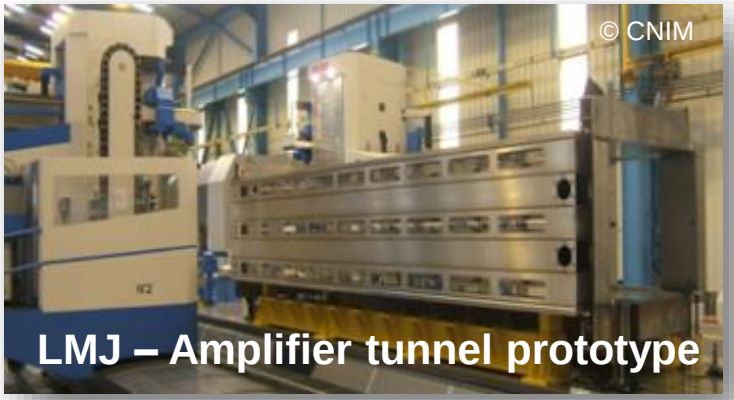
Positionning in CERN

PIGES

CNIM
Innovate and Act

Manufacturing of large mechanical components

- Expertize in Electron Beam welding process
- Big size components machining
- Large facilities located at La Seyne-sur-Mer, with sea access

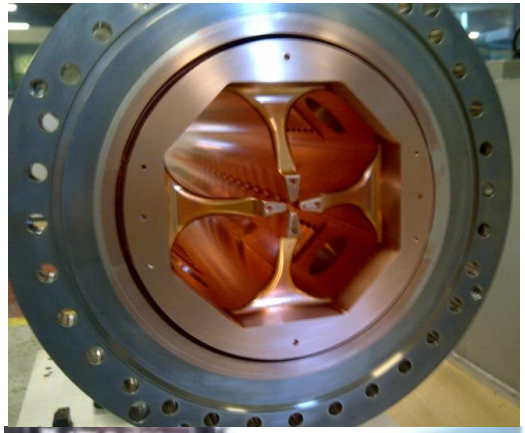


Design, manufacturing & installation of complex systems

PIGES

MECACHROME

❖ High precisionMachining



Radio Frequency Quadrupole RFQ

Project CEA SACLAY

Radiotelescope NOEMA

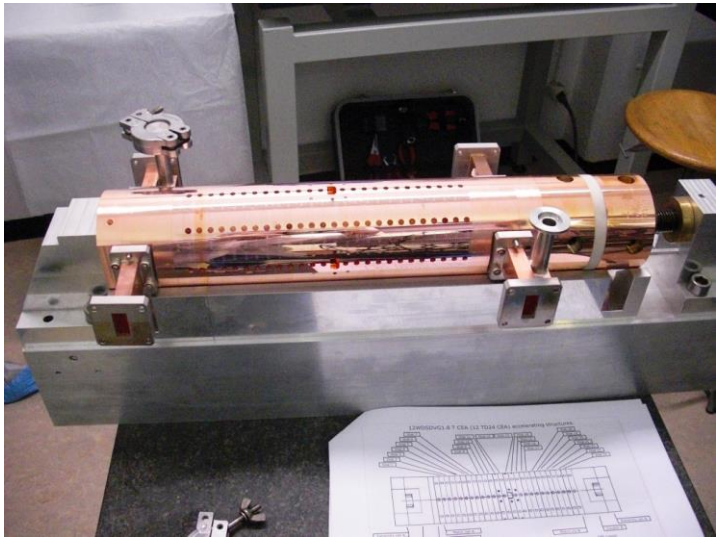
Project IRAM

Tanks for spatial applications

PIGES

MECACHROME

- Sub micronic Machining
  - CLIC cavities
  - Coupleurs



Disk Ø 65, Ra : 2 nm

Cavity

CNC Nano-machining at common R&D center CEA / MKA – Vibraye (72)

PIGES

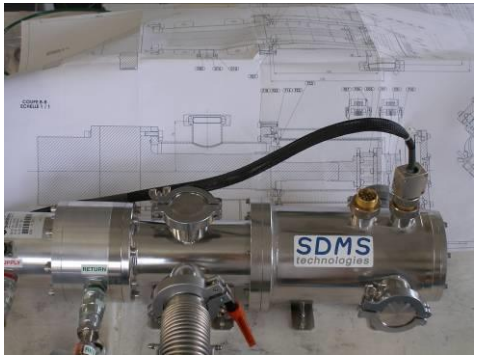
SDMS
la chaudronnerie blanche®

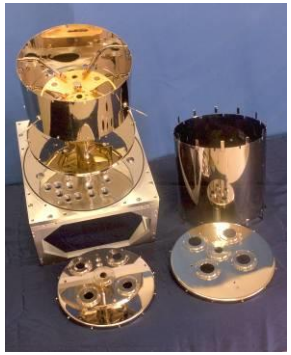
Manufacturing of welded mechanical boilermaking metalwork assemblies and components from noble materials (SS, copper, aluminum, niobium, titanium & nickel alloys,…)

❖ Vacuum & UHV Chambers and Equipment




❖ Cryogenic Systems & Components





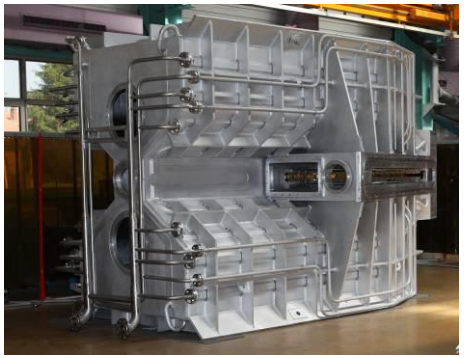
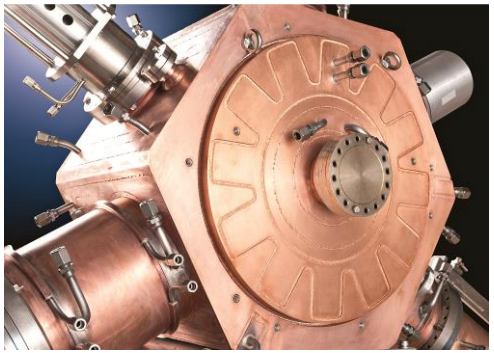
PIGES

SDMS
la chaudronnerie blanche®

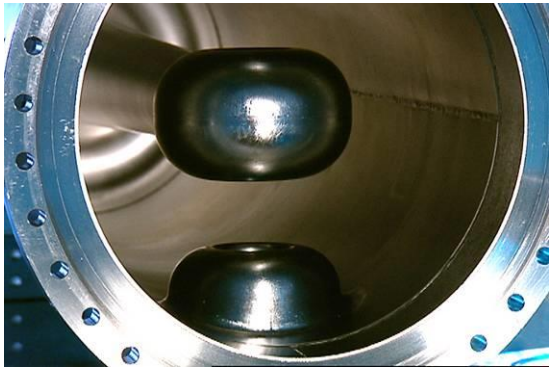
Manufacturing of welded mechanical boilermaking metalwork assemblies and components from noble materials (SS, copper, aluminum, niobium, titanium & nickel alloys,…)

❖ Normal RF Accelerating Cavities



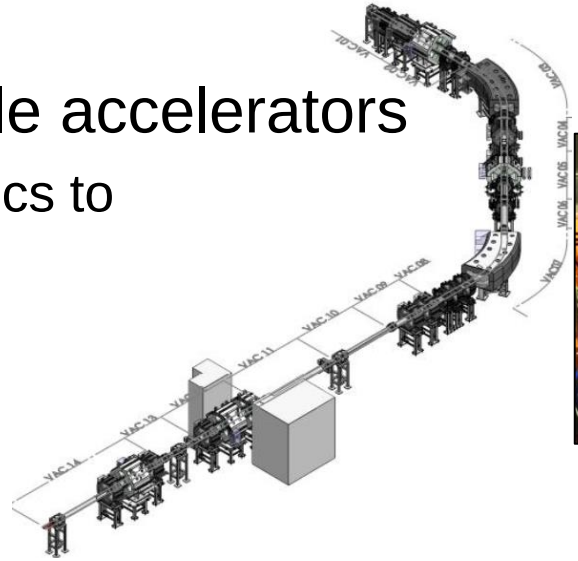
❖ Niobium superconducting RF Accelerating Cavities

PIGES

SIGMAPHI
ACCELERATOR TECHNOLOGIES

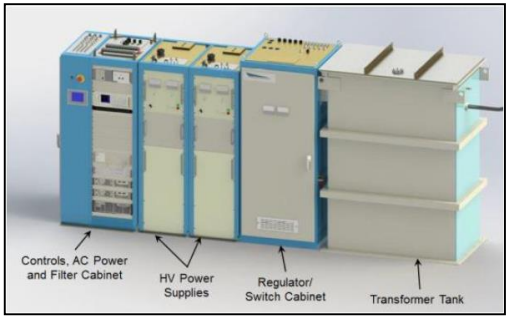
- Turnkey systems for particle accelerators
  - Particle beamlines (from optics to installation and alignment)
  - Injection/extraction systems
  - RF sources solutions



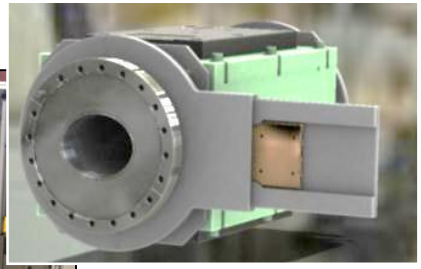
Acculina complete beamline

Installation at Tohoku University

RF amplifier for FZD
10kW @1.3 GHz



Klystron modulator for
IPN Orsay 115kV / 50A



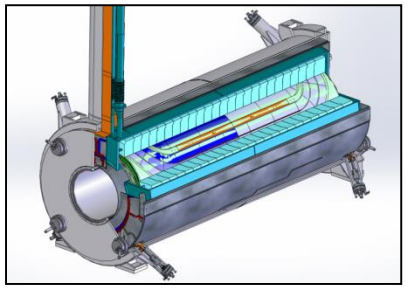
CRYRING Kicker
magnet and pulser

PIGES

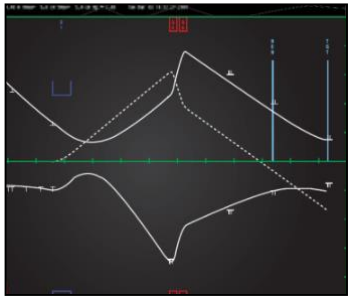
SIGMAPHI
ACCELERATOR TECHNOLOGIES

- Technologies
  - Magnetic systems
  - High stability power converters
  - Command and control systems
  - Vacuum / Ultra High Vacuum
  - High voltage
  - RF

Soleil light source sextupoles



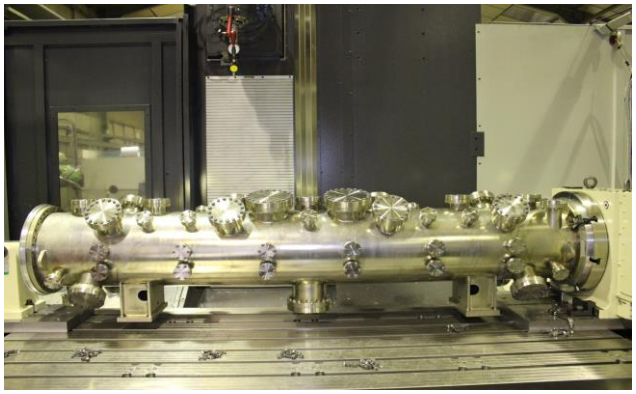
JLAB 4,2T SC dipole



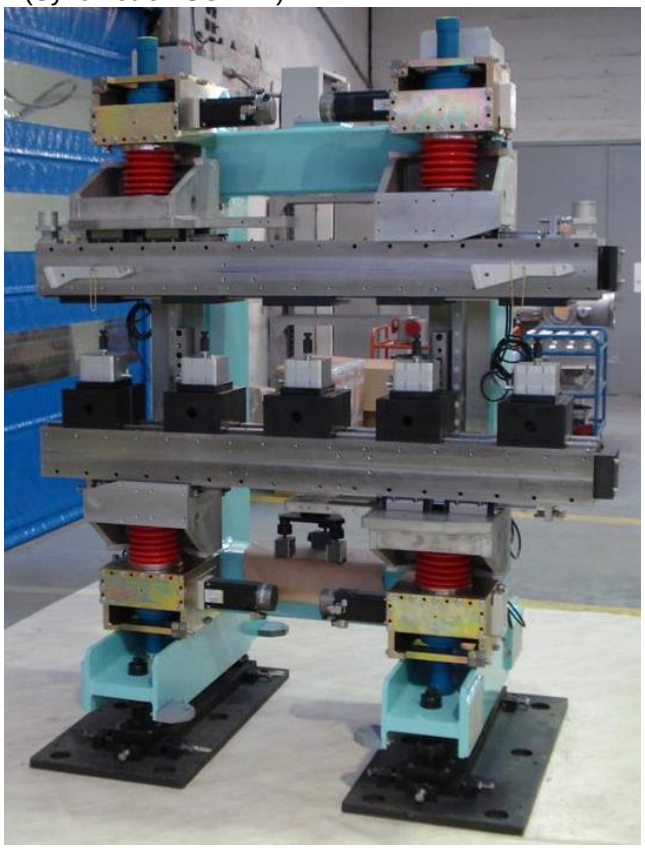
Beam optics calculation

SOLEIL ramped power supplies for booster magnets

- Many R&D collaborations
  - Soleil TT
  - CEA (collaborative agreements, PhD student, …)
  - …



Vaccum chamber in the course of manufacturing
(Synchrotron SOLEIL)



Onduleur (Synchrotron SOLEIL)

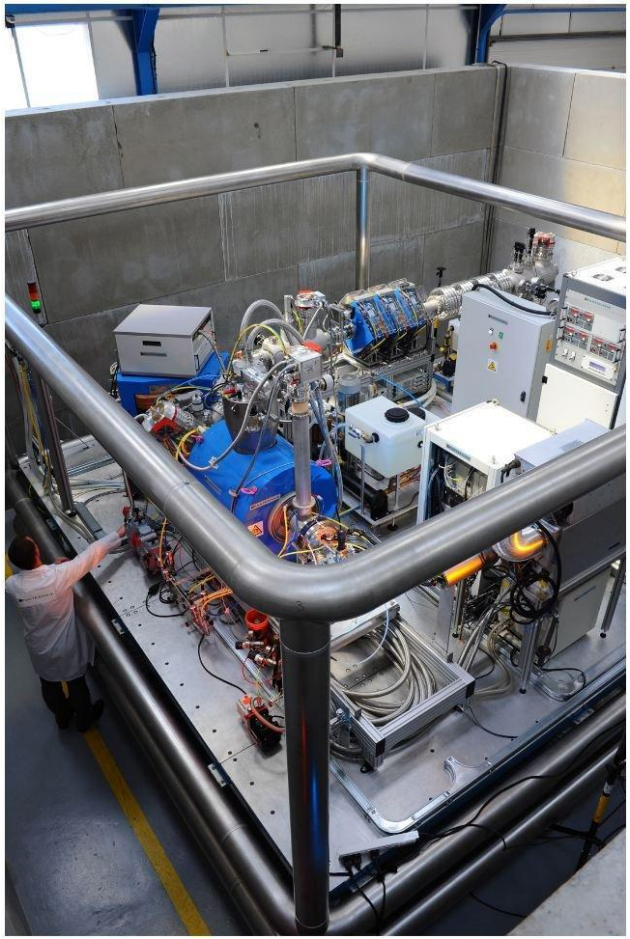
sominex

Défense • Energies • Industries • Sciences •

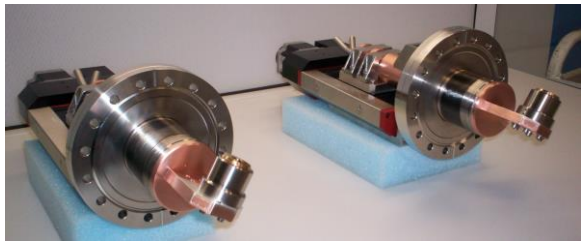
Supplier of vaccum chambers and precision engineering for particle accelerators.

Design,
Manufacturing,
Weld,
Assembly,
Integration,
Programming,
Wiring,
Helium test
Vaccum drying
And RGA

Absorber copper/stainless steel
(Synchrotron ESRF)



ECR source bench (Pantechnik / BARC, India)
Magnetic elements SIGMAPHI



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Some references :
-CERN
-Synchrotron SOLEIL and ESRF
-CEA Saclay
-IPN Orsay
-GANIL

Located in Bayeux (Normandie)
90 peoples
5500 m² workshops
ISO 9001
ISO 14001
www.sominex.fr

PIGES

Symétrie

❖ High precision hexapods and diffractometers

Positioning samples, mirrors, polarimeters, magnets…

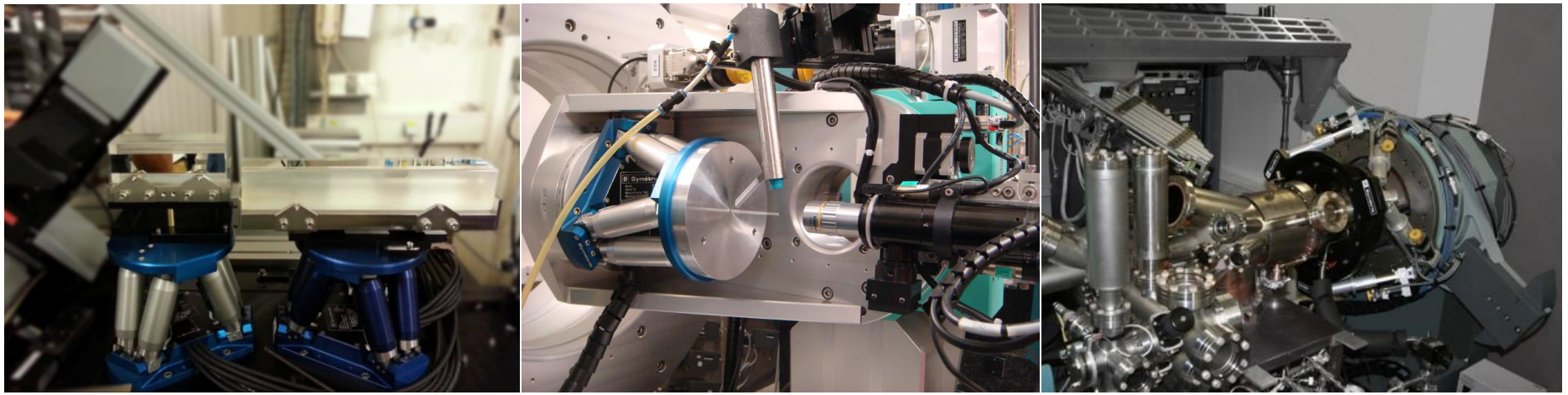
Typical resolution: 0.1 µm or 0.5 µrad

Vacuum compatibility in option

DLS: GI-SAXS

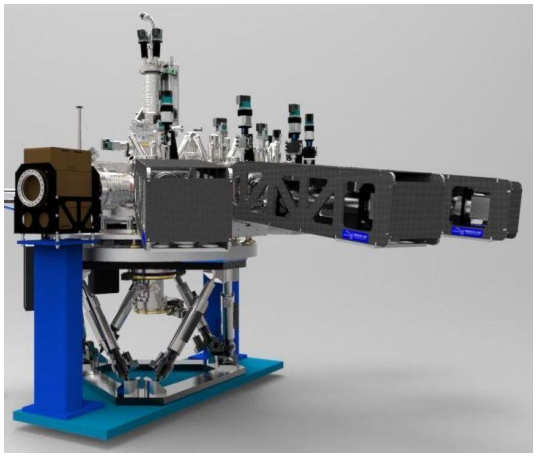
❖ Synchrotrons references

APS - Australian Synchrotron - CEA - ESRF - LBL - MAX-LAB - SLAC - SOLEIL

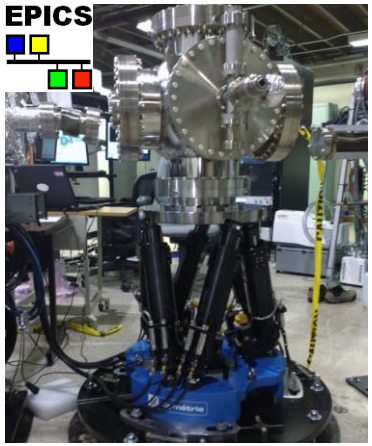


ESRF

❖ Examples of hexapods and diffractometers

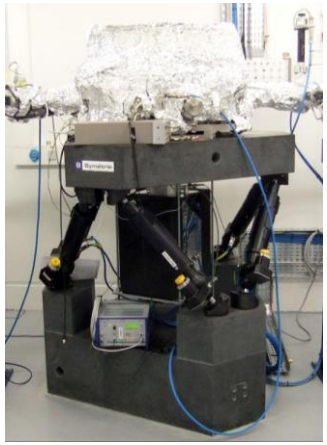


LBL: qRIXS experiments (3200 kg payload)



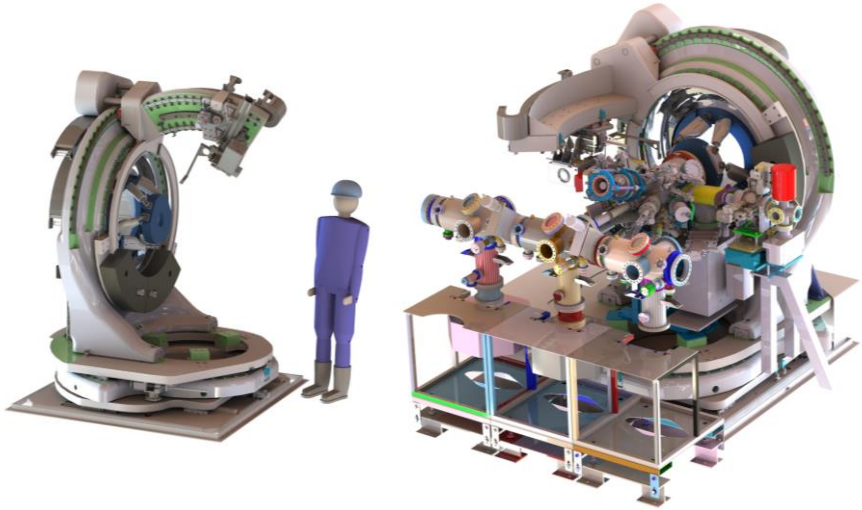
SLAC

APS



ESRF

Australian Synchrotron



CEA: diffractometer to study nanostructures growth

PIGES

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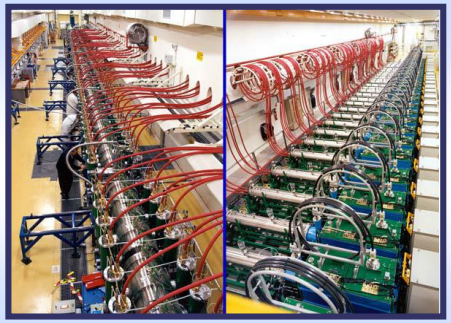


Services

- System Architecture & Engineering
- Industrialization based upon Customers' specification or design
- Realization, integration, Commissioning
- Servicing & Support of operation

Sub-Systems

- Complete RF Chain
- Power amplifiers
- Test and conditioning benches
- Accelerator sub-assemblies
- Mechanical Infrastructures in highly constrained environment
- Control and Command and automated systems
- Instrumentation and Diagnostics sub-systems

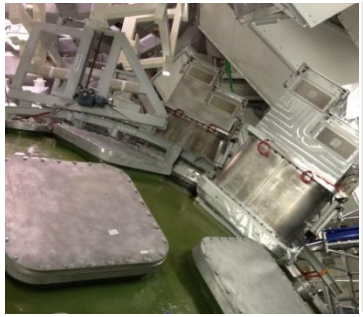
RF Components

- Electron tubes
- Cryogenic couplers
- Solid-state drivers
- RF Windows
- LLRF

Example of Recent References

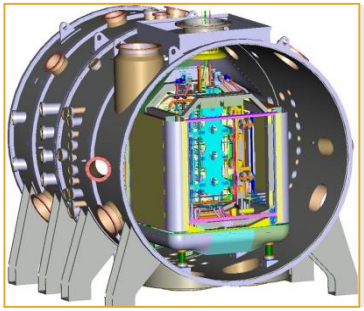
PIGES

THALES



Laser Mega Joule (LMJ)
Supply of many sub-assemblies: supporting elements of the experience hall, chamber nose, the Mechanics System, first plasma diagnostics and energy bank.

CEA-DAM
(SIMULATION Program)
Modification, new Control-Command System design and geographical Transfer of the AIRIX Accelerator with production and qualification monitoring of sub-systems.



ITER/F4E

Realization and integration of the Neutral Injection Heating sub-assembly and a prototype of the system (SPIDER).

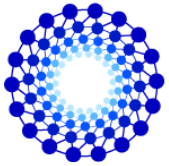
ITER-India
Prototype amplifier for the Ion-Cyclotron Resonant Heating (ICRH).

Industry

Study, supply and installation of an high-speed production line of electric bulbs.

Cryogenic RF Couplers

1.3 GHz couplers for the XFEL accelerator with associated conditioning bank.



PIGES

Marty Consultants SARL

Objet

- Conseils en ingénierie, assistance et organisation aux entreprises dans les domaines de la science et la technologie,
- Services et conseils en matière de communication dans ces domaines.

Champs d'activités

Fusion thermonucléaire,
Fission nucléaire.

Clients

- CEA,
- Agence Iter France,
- Onet Technologies, Comex Nucléaire,
- CS Systèmes d'Information,
- Institut pour la Maîtrise des Risques (IMdR),
- Development of Advanced Engineering Solutions (DAES SA).

Marty Consultants SARL au capital de 1 000 Euros
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PIGES

- All these companies can link and work together to manage complex R&D projects
- Piges is also defining common actions with Société Française de Physique to develop recruitment and training
- Piges can help finding funds for common R and D between its members / CEA / CNRS

Thank you for your attention

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