French industry capacity and interest in Large Research Infrastructure

PIGES association

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www.piges.eu
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Piges is an association created in 2010 gathering French companies involved in Large Scale Research Infrastructures

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

- Accelerators
- Biology and Medicine
- Nuclear Energy: Fusion and Fission reactors
- Space programs
- Astrophysics
- High power lasers
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
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, …)
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 transfer lines
- Gas driers and purifiers

References
- LHC, Atlas, CMS at CERN, JT60, Tore Supra, Diamond, SSRF, Qatar I and II plants: 28% of the helium production World Wide (purification and liquefaction for export), SOLEIL…
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 offers for Research Infrastructures

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

References

- XFEL cryomodule assembly
- ITER First Wall Panel prototype
- ITER pre-production cryo-pump
- ELI-NP Laser-electron interaction chamber
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
Manufacturing of large mechanical components

- Expertise 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

LMJ – Transfer vehicle © CNIM

LMJ – Diagnostic insertion module © CNIM

EPR – Spent fuel cask transfer facility © CNIM
High precision Machining

Radiotelescope NOEMA Project IRAM

Radio Frequency Quadrupole RFQ Project CEA SACLAY

Tanks for spatial applications
Sub micronic Machining

- CLIC cavities
- Coupleurs

Disk Ø 65, Ra : 2 nm

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

- Niobium superconducting RF Accelerating Cavities
Turnkey systems for particle accelerators

Particle beamlines
- from optics to installation and alignment
- magnets, power supplies, vacuum, diagnostics, control system

Fast Injection/extraction and UHV systems

CRYRING Kicker magnet and pulser 3500A, 200 ns
Ultra High Vacuum Septum for Soleil
RF amplifier for FZD 10kW @1.3 GHz
Klystron modulator for IPN Orsay 115kV / 50A
Superconducting magnets

- 4.2T dipole and quads for JLAB
- He free SC cyclotron
- MgB2 solenoid

Permanent magnets

- Variable gradient quadrupoles
- Quadrupoles For ELI (INFN)
- 1.4 T dipole for LOA

Resistive magnets
Supplier of vacuum chambers and precision engineering for particle accelerators.

Design, Manufacturing, Weld, Assembly, Integration, Programming, Wiring, He test, Vacuum drying, RGA
High precision hexapods and diffractometers
Positioning samples, mirrors, polarimeters, magnets…
Typical resolution: 0.1 µm or 0.5 µrad
Vacuum compatibility in option

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

LBL: qRIXS experiments (3200 kg payload)
Australian Synchrotron
SLAC
Toyama
**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
Best realizations of PIGES members in Japan

- Super KEK-B
- Tohoku, Kobe, Osaka Univ.
- Toyama (Max IV)
- IFMIF/EVEDA
- RIKEN
- Kanagawa & Yamagata carbon therapy centers
Thank you for your attention

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