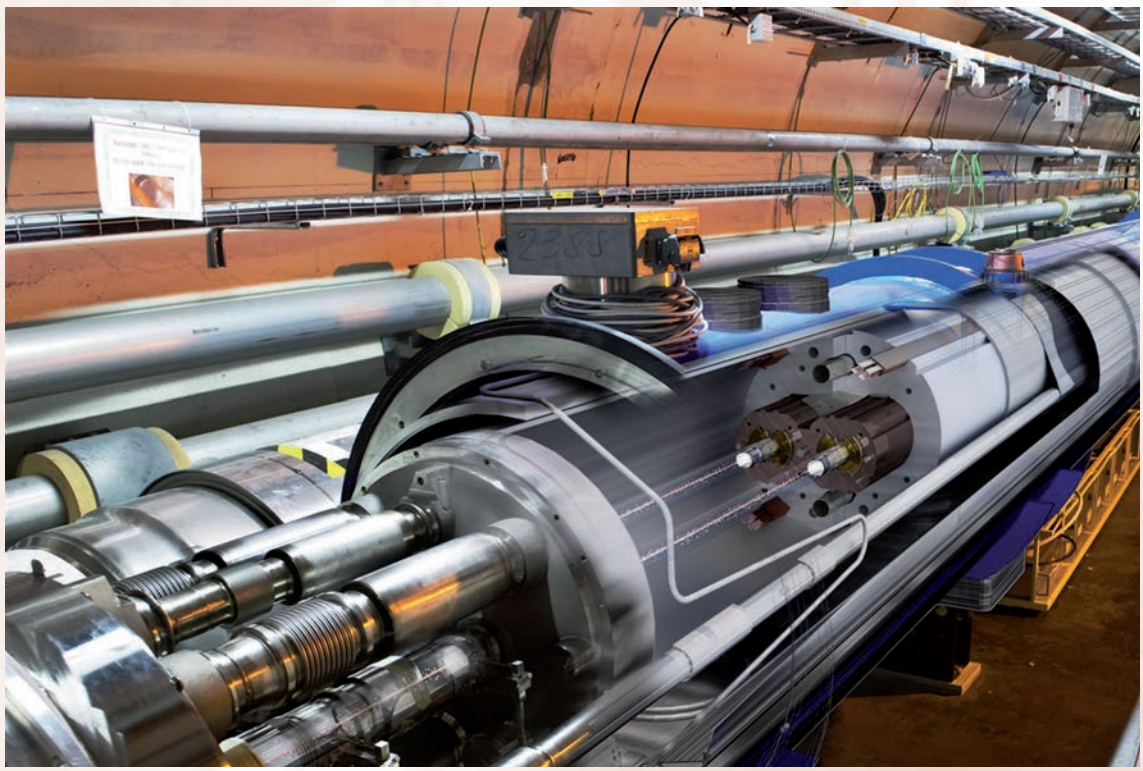
SPANISH INDUSTRY CAPACITIES AND ACTIVITIES IN PARTICLE PHYSICS



MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD
CDTI Centro para el Desarrollo Tecnológico Industrial

Index

Foreword

The discovery of the Higgs boson has been an emblematic example of how Europe has led a collective effort to explain the origin of mass, one of the most profound mysteries of Physics.

For this reason, the European Organization for Nuclear Research (CERN) along with researchers François Englert and Peter W. Higgs received the Prince of Asturias Award in 2013. At that same year, on October 8th of that same year, the Nobel Prize in Physics was jointly awarded to both François Englert and Peter W. Higgs.

The aim of CERN is to intensify scientific and technological cooperation between European countries in the area of High Energy Physics. To this end, CERN designs, builds and operates accelerators and detectors of particles with a high technological content. Participation in CERN is an investment for countries resulting in important scientific, technological and industrial benefits.

In collaboration with CERN, the Spanish Industry participates in the development of high added value activities in a competitive and international environment. This allows Spanish companies to prepare to bid for future contracts at CERN or other European Research Infrastructures. Most importantly, it allows transferring Spanish technology, acquired or developed through CERN, to other industrial sectors such as aeronautics, health sciences, power, etc, increasing our country's competitiveness in high technology global markets.

CERN, as well as other relevant scientific infrastructures, is contributing to the development in Spain of a sector of highly qualified technology companies, "the Science Industry", which improves our companies' benefits and increases competitiveness.

This catalogue showcases the capacity of Spanish industry to produce technology for accelerators and detectors of particles. It includes a description of the main Spanish companies working on different domains within the High Energy Physics field with a selection of success stories.

We hope that scientists and engineers of research infrastructures, as well as future partners will find this catalogue useful and will be encouraged to face the numerous challenges and opportunities ahead in the years to come.

Marisa Poncela García
General Secretary for Science, Technology and Innovation
President of the Spanish Innovation Agency (CDTI)

CDTI (CENTRE FOR THE DEVELOPMENT OF INDUSTRIAL TECHNOLOGY)

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28001 Madrid (SPAIN)

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www.cdti.net

Contact Person: Manuel Moreno Ballesteros, *CERN Spanish ILO (Industrial Liaison Officer)*
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CDTI main activities

CDTI is a public entity, under the Spanish Ministry of Economy and Competitiveness, supporting industrial research and innovation of Spanish companies. This includes activities that are targeted to applications in the fields of Space and Large Research Infrastructures, primarily within Europe. Our main objectives are defined as follows:

- To foster the Spanish industrial competitiveness by financing national R&D projects.
- To encourage the Spanish participation in international technological co-operation programs.
- To support technology transfer.

CDTI and Large Research Infrastructures

CDTI promotes the participation of Spanish Industries in Large Research Infrastructures such as CERN, ITER, ESRF, ESO, FAIR, XFEL, ESS and ILL acting as ILO "Industrial Liaison Officer" for all of them.
ILO activities are oriented to give support in 3 areas:

1. Industry:
   - Raising awareness and informing potential suppliers about medium-term plans of the Research Infrastructure and forthcoming call for tenders.
   - Assisting companies in their understanding of the technical, contractual and financial requirements to become a supplier of the Research Infrastructure.

2. Research infrastructures:
   - Advising Research Infrastructures on the national industrial capacities.
   - Supporting the international/national research organization to create collaborations and partnerships with Industry in the R&D phase and promoting technology transfer activities.
   - Providing advice on the definition and implementation of the organization purchasing rules.

3. Delegations/funding agencies
   - Collaborating with the Spanish delegation to the Research Infrastructure as the nominated

expert for industrial matters
- Advising national funding agencies in the definition of in-kind contributions.
- Following up the evolution of awarded contracts.

CDTI and CERN

CDTI fosters the participation of Spanish companies in CERN´s industrial program. To this regard, the activities are focused on medium and long term opportunities such as the HL-LHC (High Luminosity LHC upgrade) that will require an investment of 850M€ in the period 2015-2022; the future accelerators LINAC 4 and HIE-ISOLDE; and the upgrade of the injectors PS, SPS.

In 2013, the Spanish companies obtained contracts for about 35M€ at CERN.

SPANISH ACTIVITIES

ALIBAVA SYSTEMS S.L.

Address: Edifici Eureka, Campus Uab-Bellaterra,
08193 Barcelona, SPAIN

Web: www.alibavasystems.com/

Turnover: 84,590 € In Year 2013

Contact Person: Eulàlia Clos, *Manager*
+34 932 222 777
info@alibavasytems.com

Company activities:

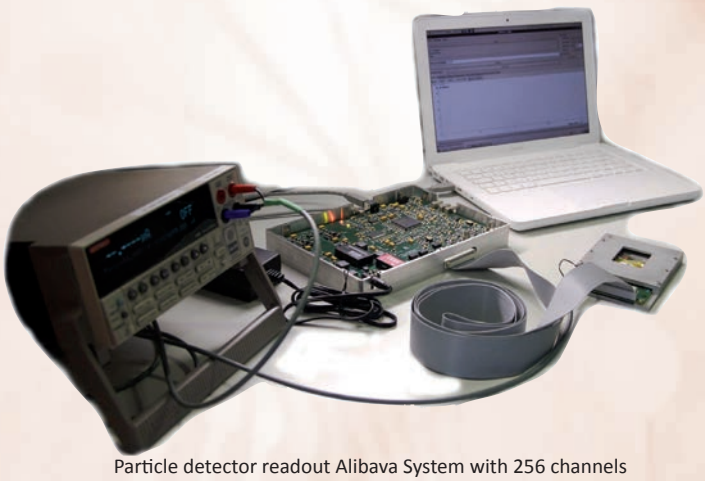
ALIBAVA SYSTEMS S.L. is dedicated to the development and commercialization of technological solutions for particle and radiation detector systems, specially but not only, in the field of Nuclear and Particle Physics research. The company commercializes the Alibava System, a system of reference for the characterization of microstrip silicon detectors. The company also develops custom-made solutions for detector systems like electronic parts or mechanical structures, including the design and fabrication of custom silicon sensors for particle, nuclear and medical applications.

Particle Physics Activities & Particle Physics Interest:

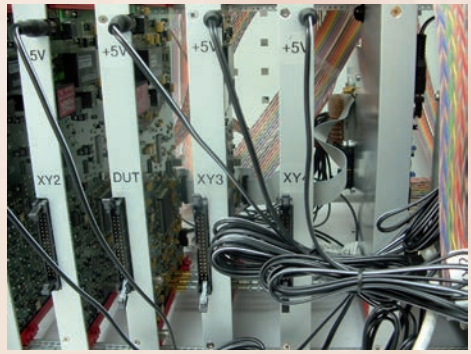
We commercialize the Alibava System, the first compact and portable system for the characterization of microstrip semiconductor radiation detectors, which is currently a system of reference in the characterization of silicon strip detectors (SSD) in the sensor development research community associated with CERN. We have also activities related to the development of custom-made solutions for the readout and characterization of Particle Physics silicon detectors. We can also provide whole-system solutions including mechanics and detector developments.

Particle Physics main contracts awarded and R&D Projects:

Alibava Systems has supplied readout systems for microstrip particle detectors to most of the main laboratories working in High Energy Physics in the world: CERN, DESY, BNL, KEK, INFN, CNRS-LPNHE, CSIC, Max-Planck Institutes, SCIPP, and 40 more universities and research institutes.



Particle detector readout Alibava System with 256 channels



Partial view of a particle telescope with 4 planes based on the Alibava System

ALTRAN INNOVACIÓN,S.L.

Address: C/ Campezo,1
28022 Madrid, SPAIN

Web: www.altran.es

Turnover: 143 M€ In Year 2013

Contact Person: Delfín Rodríguez, *Business Manager*
915504066
delfin.rodriguez@altran.com

Company activities:

Altran is an international group and global leader in innovation and high-tech engineering consulting. The Group's mission is to assist companies in their efforts to create and develop new products and services.

As a R&D and innovation actor, Altran has contributed to some of the major technological advances in recent decades: speed, precision, security, communication, practicality, interoperability, artificial intelligence...

Our solutions cover four major technological domains: Lifecycle Experience, Intelligent Systems, Mechanical Engineering, Information Systems.

Particle Physics Activities & Particle Physics Interest:

Mechanical design studies
Stress and thermal analysis
Mechatronics

Particle Physics main contracts awarded and R&D Projects:

2009-2014: ESRF (Grenoble, France):Framework Contract for the Mechanical Design of the Accelerator and Source Equipment

2006, AlBA-CEllS (Barcelona, Spain): ALBA Vacuum Chambers Analysis

APLICACIÓN NUEVAS TECNOLOGÍAS, ANTEC,S.A.

Address: Ramon y Cajal, 74
48920 Portugalete (Vizcaya), SPAIN

Web: www.antecsa.com

Turnover: 16 M€ In Year 2013

Contact Person: Rafael Iturbe, *R&D Manager*
+34 94 472 41 64
r.iturbe@antecsa.com

Company activities:

WIND TURBINE BRAKES: Design and production of Wind turbine brakes. Rotor, yaw and rotor lock brakes. Fail safe and active hydraulic breaks.
INDUSTRIAL BRAKES: Electro hydraulic drum and disc brakes, emergency hydraulic brakes and electromagnetic drum and disc brakes, hydraulic actuators.
MAGNETIC SPECIAL APPLICATIONS: Design and production of magnetic precision systems, for use in nanotechnology, particle accelerators, medicine, magneto-rheology and electromagnetic forming.

Particle Physics Activities & Particle Physics Interest:

Design and manufacture of magnetic devices warm, superconducting or permanent magnets.

Particle Physics main contracts awarded and R&D Projects:

WARM MAGNETS (Main Projects since year 2000)
3.2 M LONG MAGNETIC CORES (2 units), MSN SEPTUM
MAGNETIC FIELD SHIELDS for the above SEPTUM magnets (12 units).
COMBINED DIPOLE. Prototype for ALBA Synchrotron
2 DIPOLAR MAGNETS for scanners in the CNA (Centro Nacional de Aceleradores at Sevilla)
1 DIPOLE MAGNET for a mass spectrometer in the Universidad Autónoma of Madrid.
5 CORRECTOR DIPOLE MAGNETS for the CLIC project of the CERN. Year 2006.
70 QUADRUPOLES for the Booster and the transfer line to the storage ring for ALBA.
5 CORRECTOR DIPOLE MAGNETS for the ISOLDE project of the CERN.
6 CORRECTOR DIPOLE MAGNETS for the LINAC4 project of the CERN.
12 QUADRUPOLE MAGNETS for the ESRF storage ring (upgrade 7m low beta long sections).
1 Combined (2dipolos+1 Quadrupole) prototype magnet for the MEBT of IFMIF
1 Quadrupole warm magnet prototype for ESS Bilbao.
Permanent magnet Quadrupole prototype for ESS Bilbao.
4 Quadrupolar magnets for Gantry 3.
13 HIE ISOLDE Corrector Dipolar Magnets.
5 Series Combined (2dipolar+1 Quadrupole) MEBT

APPLIED SUPERCONDUCTIVITY (Main Projects since year 2000)

During years 1998 to 2000 ANTEC has collaborated with CERN in the fabrication and testing of different prototypes of Superconducting Corrector Magnets for the LHC Project as Sextupoles, Octupoles and Decapoles mainly. In collaboration with CIEMAT manufactured the Prototype of the MQTL Quadrupole for LHC (CERN) at CIEMAT (Madrid). For this Project a winding Machine and curing devices and tools were developed.

Manufacturing and testing (magnetic and cold) of 1.600 Corrector Sextupole Magnets for LHC (CERN)

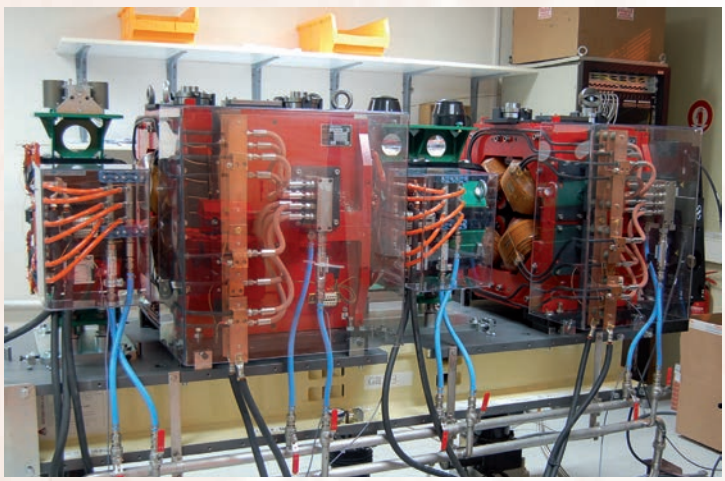
Manufacturing and testing (magnetic and cold) of 200 Twin Corrector Octupole for LHC (CERN)

Prototype of a 600 Amps HTS Current Lead for LHC (CERN).

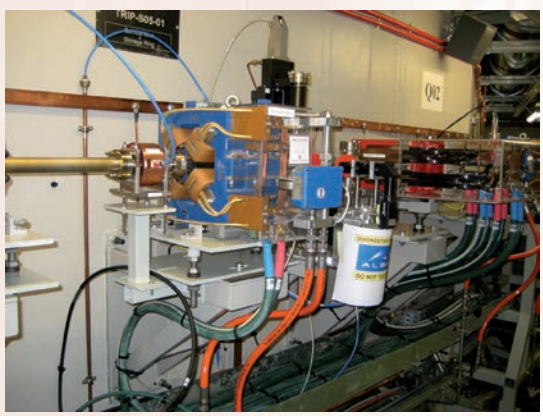
Manufacture of a series of 103 combined superconducting magnets (2 dipoles + 1 superferric quadrupole) for X-FEL finished in June 2014.

Manufacture and design of new superconducting materials coils (MgB2

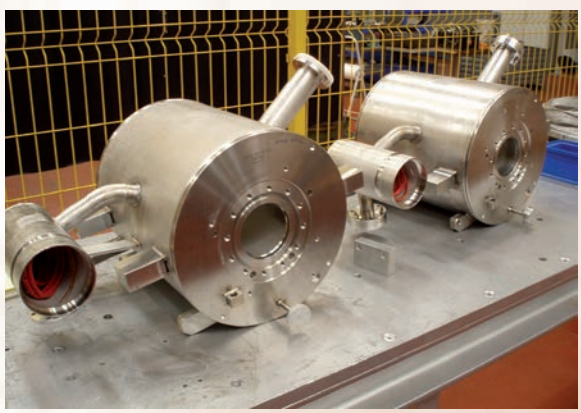
Design and manufacture of a Superconducting compact mini-cyclotron for radioisotope production for PET medical applications with Ciemat in an internal R&D Project funded by CDTI.



Cuadrupolo ESRF



Cuadrupolo ALBA



Cuadrupolo-Dipolo Superconductor X-FEL - ANTEC-TRINOS

Sextupolo SUPERCONDUCTOR_LHC-CERN

ARQUIMEA INGENIERIA S.L.U.

Address: c/ Margarita Salas, 16
28919 Leganes (Madrid), SPAIN

Web: www.arquimea.com

Turnover: 1.051.978 € in year 2013

Contact Person: Francisco Gutiérrez Macías, *General Manager*
+34 91 6898094
fgutierrez@arquimea.com

Company activities:

Radiation hard microelectronic components developement, SMA based actuators, application specific sensors and robotic components.

Particle Physics Activities & Particle Physics Interest:

Radiation hard ASICS and readout microelectronics for electronic system working under radiartion conditions, SMA actuators and robotic joints to work at high temperatures.

Particle Physics main contracts awarded and R&D Projects:

Microelectronics:

- PARTICLE PHYSICS:
- DETECTA: Feasibility study for read out electronic for high energy particles detector for HYDE. Customer: Industria para la Ciencia (CDTI)
- R&D:
- Mixed signal reconfigurable rad hard ASICS for COSMIC VISION (Medium Frequency and High Frequency ASICS). Customer: ESA
- ELSA/REDSAT: rad hard Mixed Signal ASIC chipset for antenna array, RF chain control: Customer: EADS CASA
- LVDS repeater development. Customer: ESA
- Development of a rad hard Mixed Signal AISC for avionics. Customer: IHP/SpaceTech/DLR

SMA actuators:

- R&D
- European Pin Puller (based on SMA technology). Customer: ESA
- Resettable Hold Down and Release Actuator (based on SMA technology). Customer: ESA

Sensors:

- R&D:
- Dust sensor based on IR interferometry: Customer: INTA/Finish Meteorological Institute/ METNET project.
- LDEPP: Dust plasma sensor based on electromagnetic fields. Customer: ESA

Robotics:

- R&D:
- ESMAT : Development of artificial muscles for astronauts support. Customer: EU (FP7)
- MANFRED: Development of a Robotic Arm with 7 degrees of freedom. Customer: UC3M

ARRAELA S. L.

Address: Rúa Peteiro,Parcela M-3, Polígono Vilar Do Colo
15621 Cabanas (A Coruña), SPAIN

Web: www.arraela.com

Turnover: 350 000 € In Year 2014

Contact Person: Juan Manuel Caruncho Rodado, *CEO*
+34 981 39 64 54
jmcr@arraela.com

Company activities:

ARRAELA S.L. is a company dedicated to Engineering and R&D in Materials.The work areas are:Radiological Protection, Energy, Maritime and Security. In the Radiological Protection Area we have developed and patented 4 new materials each of them designed specifically to shield against different types of radiation (energy and particles} under the commercial brand CONTEK®.

Each of these materials can be manufacture as poured concrete or tailored precast to adapt to specific necessities of customers.

So,we have a light material, CONTEK®-RNH (2 g/cm^3) ,enriched with H and B to shield against neutrons. Another material has a very high density, CONTEK ®-RFH (4 g/cm^3) ,with high percentage in Fe, with optimized shielding against electrons/photons of medium and high energy. Besides, this material shields against neutrons more than standard concrete. The other two materials, CONTEK ®-RX (3. 2 g/cm^3) and CONTEK ®-RV (3 g/cm^3) are very appropriated to shield against X-rays and y-rays of low and medium energy. Besides, for energies ranges of 6-18 MV,CONTEK®-RV (3 g/cm^3) have better TVL parameters than CONTEK ®-RX (barite concrete) and is cheaper than this one.

Particle Physics Activities & Particle Physics Interest:

We are very interested in participate and collaborate with R&D facilities and any other company that need any kind of Radiological Protection. We work with “tailored materials”
so we can offer the best solution to both, shield appropriately against radiation and reach the best functionalities adapted to work.

Sincrotrón ALBA Barcelona

Particle Physics main contracts awarded and R&D Projects:

- Sincrotrón ALBA (Barcelona)
- Laboratorio de Patrones Neutrónicos (Madrid, CIEMAT)
- Hospital do Meixoeiro (Vigo - GALARIA)
- Centro de Láseres Pulsados CLPU (Universidad de Salamanca, FERROVIAL)
- Instituto Catalán de Paleontología (Sabadell)

ASTURFEITO S.A.

Address: Area industrial de Tabaza B-9
33438 Carreña (Asturias), SPAIN

Web: www.asturfeito.com

Turnover: 24 M€ In Year 2014

Contact Person: Victor Menendez, *Sales Executive*
+34985514024
vmenendez@asturfeito.com

Company activities:

Manufacturing of capital good for scientific industry among others. High precision machining of large components. Welding and special joining processes. Mechanical, electrical, hydraulic assembly, complete testing in house. Engineering support and project management.

Particle Physics Activities & Particle Physics Interest:

We are very interested in participate and collaborate with R&D facilities and any other Mechanics and mechatronics, manufacturing of large mobile structures, support structures.

Particle Physics main contracts awarded and R&D Projects:

In 2013 we were awarded with the contract for the fabrication of the J-60 Cryostat Body for the Japan Atomic Energy Agency. Fabrication of a 250 Ton AISI 304 Stainless steel structure more than 13 m diameter and 14 meters height.

Antennas VLBi-RAEGE Project

ADDED VALUE ENGINEERING SOLUTIONS S.L.U.

Address: Poi. Ind. Sigma Xixilion Kalea 2, Bajo Pabellón 10
20870, Elgoibar (Gipuzkoa), SPAIN

Web: www.a-v-s.es

Turnover: 3 M€ In Year 2013

Contact Person: Miguel Ángel Carrera, *CEO*
34 943 821 841
macarrera@a-v-s.es

Company activities:

AVS is an international company, which aims at providing technology-based services to innovative and challenging projects. Strongly focused on development of outstanding devices, instruments, mechanisms and structures, our expertise covers from design, manufacturing, assembly, tests and supply under ISO 9001EN 9100, providing our customers all the way up from the conceptual design to the turnkey.

AVS skills on engineering design, mechatronic, diagnostics and instrumentation, high precision positioning systems in UHV, high magnetic fields and cryogenics, micro mechanisms, opto-mechanical systems and neutron detection, provided the path to successfully deliver projects in the fields of Particle Accelerators, Nuclear Fusion, Astrophysics and Space, Aeronautics, Renewable Energies, Large Machine Tools (e.g. 500 Tons articulated machines) and more.

Particle Physics Activities & Particle Physics Interest:

AVS experience in project development for large-scale facilities e.g. RAL-1515,ILL,ESRF,CERN, ILL,HZB, FAIR, CIEMAT, Berkeley Lab (BNL), ESA,IFMIF (LIPAc), ESS-8... serves as a qualified reference for future project developments. Being involved not only in particle accelerator field but in additional challenging areas (i.e.Fusion, Space, Neutron Sources...),AVS' projects certainly benefit from the cross experiences between areas, adding a noticeable value to our developments.

In the particle accelerator field, AVS activities gathers on mechatronics, beam instrumentation and diagnostics, high precision systems for UHV & hostile environments operation and accelerating structures.

AVS' interest is to join innovative projects and contribute to its successful development by means of our high qualified and motivated staff, together with AVS' top notch project implication.

Particle Physics main contracts awarded and R&D Projects:

A brief summary of the last contracts awarded in the frame of Particle Accelerators:
Beam Instrumentation and diagnostics for a high current (125 mA), 9 MeV Deuteron beam (LIPAc-IFMIF) involving outstanding requirements (high precision and repeatability on positioning),operated in UHV with high radiation background:

- Design of a Transverse Halo Monitor diagnostic: Five independent movable probes linked

with the Machine Protection System for tails/halo measurements. A fast probe retractable system was designed.

- Design, manufacturing, assembly, tests, calibrations and final supply of Beam Scrapers. With four movable and cooled scrapers, the really compact design (8 cm along beam axis).

- Design, manufacturing, assembly, tests, calibrations and final supply of Scanning Slits for Emittance Measurements, with replaceable plates (TZM and graphite), cooled and an innovative alignment system.

HIE-ISOLDE (CERN) Short Diagnostic Boxes (between Cryomodules): Six compact diagnostic boxes including different instruments as a scanning slit (with an outstanding performance),a Faraday cup, and a set of collimators with a really compact design (58 mm along the beam axis).
ESS-B proton extraction column (ISHP):With 75 keV,70 mA,20-50Hz and 4 electrodes (one fixed,three movable) provide a wide range of tuning.
Small Angle X-Ray Scattering Beamline -SAXS- (ESRF): 33 m long, 2 m diameter, X&Y&Z sample movement (larger SAXS in the world)
Design of POLARIS tank (20.000 liters) and Design & Manufacturing of Beam defining jaws for POLARIS (ISIS): POLARIS Instrument is a high intensity, medium resolution powder diffractometer,optimized for rapid characterization of structures.
Beam defining jaws for PEARL (ISIS)
Neutron Monocromator for THALES Instrument (ILL)
Casemate and monocromator shielding for THALES Instrument (Ill)for safety operation
Casemate for PEARlInstrument (ISIS) for safety operation
CHIPir (ISIS):Instrument (TS-2) for simulating SEE effects induced by neutrons in microchips
NEAT (HZB):A Time of Flight neutron Spectrometer for sample analysis
Neutron Optics for THALES Instrument (ILL)
FETS RFQ (RAL-ISIS): 3 MeV,324 MHz and 60 mA four vain RFQ fully bolted with 16 segments and 4 m long each.
Superconducting ECR source (LINCE- UHU):Design of a double frequency,100 W-3 kW,multi gap electrode ion source for a multi-ion accelerator. CALIFA calorimeter structure (FAIR)


Small Angle X-ray Scattering Beamline (33 m long) - ESRF


LIPAc MEBT Beam Scrapers, Linear IFMIF Prototype Accelerator (F4E, CIEMAT, JAEA). Rokkasho, Japan

BROAD TELECOM, S.A. (BTESA)

Address: Margarita Salas, 22. Parque Leganés Tecnológico
28918 Leganés (Madrid), SPAIN

Web: www.btesa.com

Turnover: 4,8 M€ In Year 2013

Contact Person: Carlos Rosa, *Sales Manager*
+34 913274363. Ext.411
c.rosa@btesa.com

Company activities:

BTESA is a leading technological group with long experience in the design, manufacturing and installation of radiofrequency equipment.
The key of our successful record of RF equipment delivered all over the world is our powerful R&D department: 30% of BTESA staff, with specialization in all systems related with Solid state RF power amplifiers:

- Radiofrequency: experience for reliable transistor circuits
- Software: for internal logic control system and remote control
- Electrical: we design our own power supplies, with special care for surge protection
- Mechanical: careful cooling extends lifetime

The experience gained by our System Engineering department through the installation of RF equipment which should work 24/7 in the most extreme environments helped to improve the robustness and reliability of all our equipment, and built up the ability to integrate any RF power system, either with tube or with solid state technology.
The skill of the R&D team to design any RF product together with the flexibility of the System Engineering department to adapt to any project, allowed BTESA to easily jump into the Scientific applications.

Particle Physics Activities & Particle Physics Interest:

Design/manufacture of RFpreamplifiers and amplifiers.
Integration RF power systems

Particle Physics main contracts awarded and R&D Projects:

IFMIF/EVEDA: awarded contract by CIEMAT Exp. 248.977: 2x16kW SSPA
Design, Manufacturing and supply of RF Solid State Power amplifiers at 175 MHz, for the Buncher cavities of the MEBT of the IFMIF/EVEDA Accelerator Prototype (LIPAc), presently under construction in Rokkasho (Japan).
Including Design, Manufacturing, installation and commissioning of:

- 2 RF Power Chains (16kW, full Solid State) at 175MHz, with High efficiency (> 70%) liquid cooled modules working in Active redundancy for TOTAL availability (even when 1 or 2 PA transistors are out of order, the Amplifier chain will operate at nominal power). To achieve this maximum efficiency of 70% even having additional PA modules for redundancy, an Intelligent management of power supplies has been implemented. Selection of working

modes (degraded, high availability, high efficiency) can be automatic or manual.

- LLRF integration
- EPICS based remote communications via PLC, and integration within Accelerator central control system.
- RF Coaxial Lines and arc detectors

AMIT Project: awarded contract by SEDECAL: 8kW SSPA

The objective of the AMIT (Advanced Molecular Imaging Technologies) project is to design and implement a superconducting mini-cyclotron.

BTESA was in charge of the design and manufacturing of a SSPA for ion cyclotron frequencies, modular in power (delivered with 8kW but capable of easy upgrading to 12kW by adding more power amplifier modules) and frequency agile (capable of working in any frequency between 40 to 70MHz). Besides it should be compact and self-contained, and therefore the liquid cooling system (with redundant pumps) was designed to be located inside the same SSPA rack. Each power amplifier module is hot-pluggable and includes their integrated AC/DC switch mode converters.

ALBA/CELLS: awarded contract by CELLS Exp. 12/14: 5x80kW IOT

Manufacture, supply and installation of 1 prototype and a series of 4 units of IOT, with all their accessories, for the storage ring RF transmitters of ALBA synchrotron Light Laboratory.

Including site survey, Integration design, manufacturing and installation of:

- Five 80kW IOT tubes at 499,654MHz
- IOT assemblies,
- Adaptation kit, including cooling, cabling, control software/firmware, output coaxial line and all the modifications needed to ensure reliable operation of the system

R&D projects

- Design of an integrated test bench for checking liquid-cooled amplifiers used in Accelerators.

SSPA 16kW for IFMIF-EVEDA

Hot-plug liquid-cooled module 2kW

CADINOX, S.A.

Address: Okobio 32
20491 Belauntza (Gipuzkoa), SPAIN.

Web: www.cadinox.com

Turnover: 10.000.000 € In Year 2013

Contact Person: Andoni Isasti, *Managing Director*
+34 656 751 715
a.isasti@cadinox.com

Company activities:

Cadinox is a medium familiar company founded in 1966 dedicated to the fabrication of mechanowelded components with very high requirements, in mechanical tolerances, in vacuum and radiation environments.
The company is composed by 60 employees with 8.600 covered squared meters and lifting capacity up to 60 tons.
In Science, Cadinox has renowned experience for particle physics, neutron science, synchrotrons and astrophysics.

Particle Physics Activities & Particle Physics Interest:

Cadinox has a great experience in the fabrication of structural parts and vacuum vessels for different scientific installations: CERN, ISIS, ESRF, ILL and ESS among others.
We perform all the processes involved with sheet metal fabrications: cutting, forming, welding, Non Destructive Test, final machining, 30 metrology, surface treatment and final tests (vacuum, Helium, mass spectrometer...) with high reliability.

Particle Physics main contracts awarded and R&D Projects:

CERN: DTL tank and girder: fabrication and testing of 1O DTL tanks and 1 girder with very high accuracy in geometrical tolerances, tested with 30 metrology tools.

CERN: NA 62 RICH vessel: 17 meter length and 4 meter diameter formed by 4 vacuum vessel. Complex geometrical tolerances, vacuum tighten weldings and vacuum exposed surface painting.

CERN: NA 62 Straw Stations: vacuum containing support structures with geometrical tolerances, vacuum tighten weldings and vacuum exposed surface painting both in carbon and stainless steel

CERN: HIE-ISOLDE cryomodules: vacuum and He vessel fabrication and testing, high accuracy in geometrical tolerances, vacuum tighten weldings and extreme cleanless of vacuum and cryo exposed surfaces.

ESRF: Small Angle Scattering Beamline SAXS: design, study, fabrication, testing and installation of 33 meter length formed by 5 vacuum tanks with high accuracy in geometrical mobile tolerances

and vacuum tighten weldings.
ILL: IN16B vacuum chamber: fabrication and testing of huge Aluminium vacuum vessel with high accuracy in geometrical mobile tolerances and vacuum tighten weldings.

ILL: IN168 deflector chamber: fabrication and testing of vacuum vessel with high accuracy in geometrical mobile tolerances and vacuum tighten weldings.

ESS: DTL tank: fabrication and testing of 2 DTL tanks with very high accuracy in geometrical tolerances, tested with 30 metrology tools.

NA62 RICH vacumm vessel - CERN

IN16B Vacuum Chamber - ILL

CRISA

Address: Torres Quevedo 9,
28760 Tres Cantos (Madrid)

Web: www.crisa.es

Turnover: 44 M€ In Year 2013

Contact Person: Jose A. Moreno Álvarez, *Head of Technical Directorate, Strategic Programs and Improvement*
+ 34 91.806.8662
Jose.Moreno@astrium.eads.net

Company activities:

Crisa, a company of the Airbus Defence and Space group founded in 1985, is one of the leading providers of high reliability / high performance electronics systems and real time control / processing software for demanding applications: launchers, satellites, science instrumentation, defence, etc. More than 28 years of experience, half a ton of equipment launched to Earth orbit and hundreds of industrial equipment operating worldwide, supports the Crisa capabilities in the design, development manufacturing, installation and maintenance of complex electronics systems for this kind of applications.

Our activities are covered by a quality system certified under EN 9100, AQAP 2110 and ISO 9001 international standards. The company is also certified according to UNE- EN-ISO14001 environment standard.

Particle Physics Activities & Particle Physics Interest:

Design, Development, manufacturing, integration and testing of electronics systems in the following domains:

- Power Control and Distribution Units
- Low Voltage, High Current Power supplies
- HV power supplies
- Cryogenic Magnet power supplies
- Cryogenic instrumentation
- CCD & CMOS detectors instrumentation
- Monitoring and Control Systems
- Electrical Ground Support, Test & Diagnostic Equipment
- Real Time Software

Electronics control and power systems engineering and project management

Particle Physics main contracts awarded and R&D Projects:

Ciemat/ETHZ
Cryomagnet Current Sources and Alpha-Magnetics Avionics unit design, development, test and

qualification for AMS-02 experiment.

Crisa was in charge of the design and manufacture of the Cryomagnet Avionics Box (CAB) of the Alpha Magnetic Spectrometer (AMS-02), a particle physics detector for the International Space Station (ISS). AMS will perform accurate measurements of energetic cosmic rays from 0.1 GeV to 2 TeV energy range.

The core of this spectrometer was a superconducting dipole magnet to be powered and monitored by the CAB electronic unit. The CAB electronics comprise four major subsystems: cryomagnet current sources, cryomagnet self-protection, command, control and monitoring subsystem and the power valves subsystem.

The development of CAB is one of the major challenges Crisa has faced to date. Made up of 22 electronic circuit boards, with 64 kg and almost 1 m, it is the largest space- qualified electronic equipment that the company has designed and produced, and one of the most complex as well.

The project was carried out under the technical supervision of CIEMAT, with funding provided by CIEMAT, CDTI and ETH-Zürich

CIEMAT
RICH detector electronics manufacturing for AMS-02 experiment

Manufacturing of the PCBs for the high voltage detectors of the RICH (Ring Imaging CHerenkov detector) of the AMS-02 experiment

CERN
Waveform Surveillance and Diagnostics for the LEP (Large Electron-Positron Collider) Injection Kickers

This installed system comprises hardware and software tools to select, acquire, log, retrieve, and visualise signals from the LEP beam pickup and the kicker magnets, to analyse them, and to compare them with stored reference pulses. This equipment was able to operate either on request for on-line diagnostic and adjustment or run continuously in the background for automatic equipment surveillance.

ITER
Support Framework Contract ITER/CT/6000000014

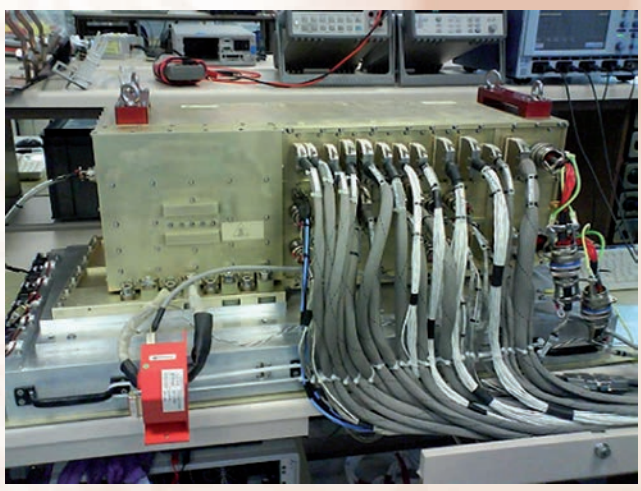


foto AMSCAB

CRYOVAC S.L.

Address: C/Arquímedes 40
28946 Fuenlabrada (Madrid), SPAIN

Web: www.cryovac.es

Turnover: 391,200 € In Year 2013

Contact Person: Samuel Gilliland, *Technical Director*
+34 916065463
info@cryovac.es

Company activities:

Cryogenics, vacuum, fabrication and installation of high pressure equipment and precision machining and welding.

Particle Physics Activities & Particle Physics Interest:

Vacuum chambers: We manufacture custom made chambers with a variety of materials, shapes, sizes, openings and vacuum levels (up to UHV). We also provide auxiliary systems such as lifting mechanisms, tables, pumps and instrumentation.
Cryogenic transfer lines: We fabricate and install one customisable vacuum insulated lines for all cryogenic liquids (including helium). Our lines have low thermal losses and easy to connect invar junctions.
Cryogenic and vacuum engineering: Our technical office is able to perform calculations and simulations using finite element analysis to design a range of cryogenic and vacuum components.
Cryostats: We make cryostats with customisable size, materials, thermal insulation, openings and auxiliary equipment for cooling by cryogenic liquid or mechanical cooler.

Particle Physics main contracts awarded and R&D Projects:

Vacuum chambers: We realised CERN project DO-27581 for the supply of 5 stainless steel tanks with 1000 liters capacity for H2 at pressures between vacuum and 5 bar. We also fabricated stainless steel UHV chambers for magnetron sputtering and magnetic measurements for UCLM and IMA respectively. We are currently fabricating a 12m3 thermal vacuum chamber for Iberespacio.
Cryogenic transfer lines: Among our projects are a 4" cryogenic line installation at an Air Liquide production plant, a 1" and 3/4" cryogenic line installation at foreign manufacturing facility and an installation of 3/4" and 1/2" lines and valves for the bank of cryogenic freezers at CNIO.
Cryogenic and vacuum engineering: We designed an automatic cryogenic filling system for the infrared telescope at Sierra Nevada Observatory, provided engineering calculations and designs for the cryogenic line installation at a Messer production plant and maintain an ongoing contract for vacuum services related to an INDRA military project.
Cryostats: Cryovac fabricated a Cryostat for Tecnalia with dimensions 2000x1200x400mm. We also realised the INTA planetary simulation chamber and control system for temperatures between -200 and 600ºC, pressures up to 10kbar and volumes up to 10cm^3. We are currently fabricating the radiation shield for the CARMENES Exoplanets project.

D+T MICROELECTRONICA A.I.E

D+T Microelectrónica, A.I.E.

Address: CNM. Campus UAB, Bellaterra
08193 Cerdanyola del Vallès (Barcelona), SPAIN

Web: www.cnm.es/dt/

Turnover: 1,400,000 € In Year 2013

Contact Person: Manuel Lozano, *Administrador de la agrupación*
935947700 ext. 2108
manuel.lozano@csic.es

Company activities:

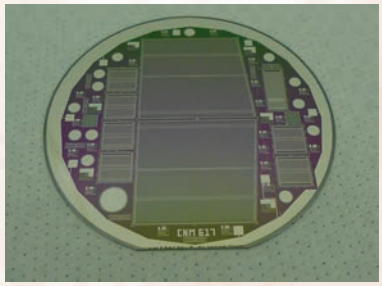
D+T Microelectrónica, A.I.E. is an Association of Economic Interest charged with managing the commercial exploitation of the Clean Room of the Spanish National Microelectronics Centre (CNM). The company places within reach of the industry and users, microelectronic solutions that follow the cycle Design - Development - Production. The mission of D+T Microelectrónica, A.I.E. is to facilitate the incorporation of microelectronic technologies into industrial products, designing, developing and manufacturing chips tailored to specific needs. The technologies available are in a wide range going from chemical, bio, mechanical, or radiation sensors to power devices or nanosystems.

Particle Physics Activities & Particle Physics Interest:

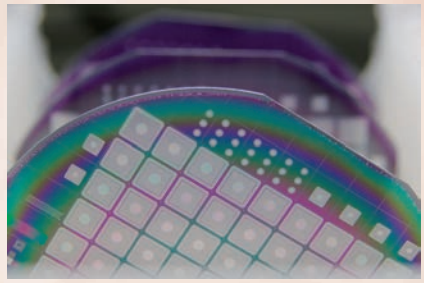
D+T Microelectrónica, A.I.E. has provided a variety of technological products to Particle Physics experiments. The company provided the pitch adapters for the End-Cap section of the current ATLAS Semiconductor Tracker (SCT) at CERN. The company is now providing standard and state-of-the-art devices to CERN, ALBA, and many other research laboratories.
The range of detectors fabricated range from p-on-n and n-on-p strip sensors, 3D sensors, active-edge sensors, Low Gain Avalanche Detectors (LGAD), etc.

Particle Physics main contracts awarded and R&D Projects:

- Procurement of the Pitch adapters for the End-Cap of the SCT: total 430 keuros
- About 10 small fabrication contracts of custom metal-on-glass pitch adapters for Particle Physics groups
- More than 10 R&D fabrication contracts of custom radiation detectors for the RD50 CERN's Collaboration and other Particle Physics groups
- 3D pixel detectors for the ATLAS IBL at CERN. The installation finished in June, 2014
- Fabrication of radiation detectors for research projects



Particle detectors manufactured by D+T for ATLAS upgrade



Wafers with radiation detectors manufactured by D+T

DESARROLLOS MECÁNICOS DE PRECISIÓN S.L.

Address: Pol. Ind. Kurutz Gain 12 – 13
20850 Mendaro (Guipúzcoa) SPAIN

Web: www.dmp.aero

Turnover: 16,000,000 € In Year 2013

Contact Person: Iosu Aguirrezabala, *Sales Manager*
0034 943 757 040
iaguirrezabala@dmp.aero

Company activities:

Customized solutions in:
Components of accelerating structures
Devices for particle accelerators
High precision positioners

Particle Physics Activities & Particle Physics Interest:

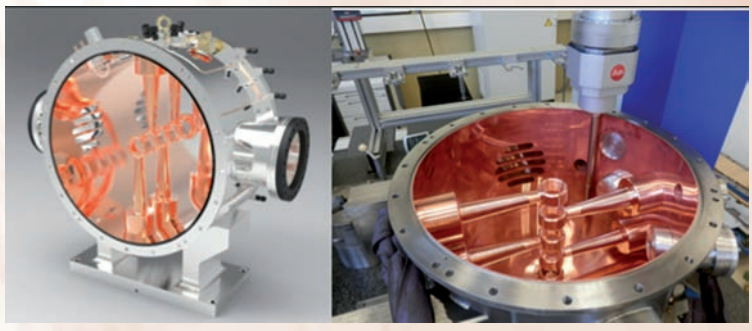
BUNCHER (CIEMAT – IFMIF)
- RF & Cooling & Mechanical design vs FEA
- Manufacturing flow
- Design of tuners, couplers and external devices
- Control Interface as defined by the customer

SUBMICROMETRIC MOVER (CIEMAT-XFEL)
- Static deformation lower than 1 micron with 75 kg.
- Repeatability better than 1 micron in both axes.
- Intelligent control strategy.
- Control Interface as defined by the customer.

DRIFT TUBES (ESS, CERN)
- Improved lifetime.
- Low ohmic loses.
- Handling and cleaning procedures.
- Full metrology in clean areas.

Particle Physics main contracts awarded and R&D Projects:

DISCS (CERN – CLIC)
Geometric tolerance within 4 microns.
Flatness within 1 micron.
Surface roughness (Ra) in 0,025 microns.



ELYTT ENERGY, S.L.

Address: Paseo de la Castellana 114,
28046 Madrid

Web: www.elytt.com

Turnover: 6,5 Million € In Year 2013

Contact Person: Angel García-Franco, *Sales Manager*
+34619039199
angel.garcia@elytt.com

Company activities:

Elytt Energy designs and manufactures resistive and superconducting electromagnets for particle accelerators of all types.
The company provides a complete electromagnetic engineering, design, manufacture, and test service.
Designs standard and custom-built resistive magnets, reaching from small correctors, to very large magnets, 2D and 3D is used for magnetic field modeling.
Our workshop have all manufacturing facilities necessary, winding machines, vacuum system, oven, inert gas oven and all measurement equipment.
Elytt Energy offers complete magnet systems including vacuum chambers, supporting stands and matching power supplies, Dipole magnets, Quadrupole magnets, Multipole magnets, Spectrometer systems, Kickers, Septums and Bumper magnets, Scanning magnets.
Also the following related services are available: Mechanical calculations, Beam optical calculations, Vacuum calculation and design, On-site Installation.

Particle Physics Activities & Particle Physics Interest:

Designs and manufactures resistive and superconducting electromagnets for particle accelerators of all types.

Particle Physics main contracts awarded and R&D Projects:

- Manufacturing of 10 Toroidal Field Coils for ITER. 110 Tones each.
- Design of a Superconducting European Dipole for ITER project developed by EFDA.
- Design of MRID (Magnetic Residual Ion Dump) for the NBI (Neutral Beam Injector) for EFDA. ITER Project.
- Design, manufacturing and test of septa magnets for CTF3 facility at CERN.
- Design and manufacturing of 70 permanent magnet quadrupoles for CERN.
- Design of a Superconducting Dipole & Comparison study between normal conducting and superconducting solutions for FAIR Project developed by GSI.
- Design and manufacturing of a superconducting magnet module, Quadrapole & Dipole for the X-ray Free Electron Laser (XFEL) at DESY.
- Design & Manufacturing of Beam focusing solenoid & dipoles for new ISIS H- FETS.
- In Vacuum Undulator, ALBA Synchrotron.

- FOR ESS BILBAO:
  - Ion Source, ECR Source.
  - Design of a combined solenoid-steering dipole system for a Low Energy Beam.
  - Transport Line.
  - Extraction lines of the ESS-B proton linac.
  - Cold model of a double spoke resonator.
  - RF structures Design & Manufacturing & Integration.
  - Ion Torrent of Ultimate Reliability ITUR.
  - Permanent Magnet Quadrupole, magnet design and manufacturing.
- Design of a bending dipole for EVEDA, The focusing is provided by two quadrupole triplets and a doublet.
- Warm Dipole for Spectrograph CMAM.
- Switching magnet design & manufacturing CMAM.
- Window-Frame Warm Dipoles for Scanner CAN.
- Design of transfer lines for Technofusión.
- Design and manufacturing of focusing solenoids for very large Klystrons for CPI.
- TF Coil Terminal Region Design and Analysis for ITER.
  - Study of the loads of the joint region during normal operation conditions.
  - The design of the support system capable to withstand the loads induced in the 2 worst case scenarios
- TF conductor case specification for ITER.
  - Review and update the specification of austenitic steel forgings and plates, the specification of welding and the specification of non destructive testing
  - Review and update the design description of the TF Coil Structures.
- Mechanical engineering for ITER/EFDA: 28.800 engineering hours & 28.800 CAD hours. TF superconducting coils, PF superconducting coils, Design of TF coil without radial plate.

  TF superconducting coils:
  - Helium inlet/outlet new design.
  - Design of TF coil without radial plate.
  - Manufacturing tool design (winding, insulation, impregnation…)
  - PF superconducting coils:
  - Precompression ring
  - Manufacturing QA definition
- Blanket attachment design. EFDA/ITER

Insulation Station

VPI Machine

EMPRESARIOS AGRUPADOS INTERNACIONAL, S.A.

Address: Calle Magallanes, 3
28015 Madrid, SPAIN

Web: www.empre.es

Turnover: 42,979 K€ In Year 2013

Contact Person: Maria Teresa Domínguez Bautista, *Advanced Projects Director*
0034 91 309 8022
mdb@empre.es

Company activities:

Empresarios Agrupados Internacional, S.A. (hereinafter EAI), founded in 1992 as part of the EA Group (EA). EA is a leading Spanish engineering organisation with significant international experience founded in 1971. EA is a leading engineering and systems company in the areas of Energy (including nuclear power), Information Technologies Space and Defense Systems, with a strong presence in the international markets. EA provides a full range of engineering procurement, construction, plant testing and commissioning services for nuclear and conventional power plant projects and related nuclear facilities, such as for radwaste management, disposal and storage, spent fuel storage and decommissioning. In the field of nuclear power generation, EA has been the primary or sole engineering company for six (6) 1000- MWe nuclear units in Spain, of both PWR and BWR types. EA provides engineering support services internationally to the new build of nuclear power plants performing feasibility studies, preconstruction activities and licensing support. EA also provides engineering support services to the nuclear units currently in operation in Spain and is involved in modernisation, uprating and life extension programmes for these plants. EA is an innovative company involved in several R&D EURATOM programmes for development of advanced nuclear technologies in fission reactors. EA is part of the consortium that has been selected as a preferential bidder for developing the Front Engineering Design of MYRRHA.

Particle Physics Activities & Particle Physics Interest:

Empresarios Agrupados Internacional, S.A. (EAI) activities in particles physics are concentrated in the fusion technology. In this field EAI has participated in the following areas:
Empresarios Agrupados Internacional, S.A., (EAI) has been participating in the European fusion programme since 1994 as a partner in the EFET consortium (European Fusion Engineering Technology). This consortium was awarded the contract with the European Union under the 5th an 6th Framework Programmes for the development of the design of the ITER facility IFMIF and other projects. Following completion of the design phase, and after the construction of ITER was approved in November 2006, EAI has awarded several contracts below indicated.
In the execution of these projects, EAI has acquired large experience in Safety, Remote Handling, Mechanical and Electrical System Design, Building Design, Integration, Machine Assembly and other specialties required for ITER completion in which EAI has interest to participate in future activities.

Particle Physics main contracts awarded and R&D Projects:

F4E-2009-0PE-020 (SB.PS): Support in tendering the Design and Build (DB) ITER PF Coil Building Contract. Empresarios Agrupados was responsible in the support to F4E in the preparation of the technical specification, including Design, Safety and Health Protection Coordination (SHPC), Legal lnspection (LI) and Support to the Owner (SO) for this building in which the PF Coil will be manufactured at Cadarache site.

CIEMAT contract: "Servicio para el diseño detallado del sistema de refrigeración por agua para el sistema de radiofrecuencia de IFMIF-EVEDA". Empresarios Agrupados has been responsible of the development of the feasibility study for the cooling system for the radiofrequency IFMIF-EVEDA.

GRANT F4E-2010-GRT-254 (PNS-TBM): "Tritium Migration Modeling and Conceptual Design of the Tritium Accountancy Systems for the European Test Blanket Systems" (Actions 1 & 11). Empresarios Agrupados has developed the software libraries to simulate the tritium transport with ECOSIM software package.

F4E-GRT-542: "UPGRADE OF THE TRITIUM TRANSPORT SIMULATION TOOL BASED ON ECOSIMPRO ANO GENERATION OF NEW SIMULATION RESULTS".

F4E-2009-0PE-058 {SB-PS): Architect Engineer Contract for ITER Buildings and Civil lnfrastructures. The scope of the contract includes the design and procurement of the central safety system (CSS) and the design of the plant safety system (PSS) of ITER. As part of the design activities, the environmental qualification of the product is also inside of the scope. This qualification will include environmental, electromagnetic protection compatibility and seismic resistance. Empresarios Agrupados is leader of the consortium formed with INABENSA. The project has a duration of 6 (six) years.

ITER contract: 10-12-CFN-70000045-BGD "Design, manufacture, qualification and installation of the Nuclear Safety Control System (SCS-N) of ITER"
The scope of the contract is the design and construction supervision of the ITER buildings, power distribution system and also power supply. The scope also includes the procurement processes of the different tender batches in which the procurement of the buildings has been splitted. Empresarios Agrupados is a member of the consortium ENGAGE. The contract was signed in 201O with a duration of ten years. The team is located in Cadarache.
F4E-OPE-0500: Preliminary Design for the WDS Tanks. Design Engineering Activities for tritiated water holding tanks and emergency tanks of the water detritiation system for ITER with ENSA.

ITER Organization Contract 10/CT/14/4300000968 - Engineering support to perform dynamic simulation of ITER cryogenic system.
The objective of this service contract is providing the engineering support for the Tokamak cryogenic system simulator development, including the cooldown/warm-up of Tokamak, the re-cooldown after fast discharge of CS, PF/CC. The development of superconducting coil models are foreseen, which wounded by Cable-ln-Conduit Conductors (CICCs).

ITER Organization Contract 10/CT/14/4300000976- Smartplant project Technical support. Support in defining requirements and providing expertise for the design, definition and treatment of interfaces for data loading into SPFoundation from the different applications and formats.

ITER Organization Contract ITER/CT/13/4300000935 and Amendment Contract. Support for Definition of Documentation and Data for Construction: support the ITER Organization in identifying and categorizing the complete detailed list of documentation and data that must be provided by suppliers and service contractors to ITER in order to support the Construction, Operations and Maintenance phases. Support the ITER Organization in a) defining the standard labeling for parts, components and equipment for each discipline that will be shipped to the ITER Site at Cadarache, and b) provide support to implementation of the defined set of documents and data that must be provided by suppliers and service contractors to ITER in order to support the Construction, Operations and Maintenance phases.

IDOM INGENIERÍA Y CONSULTORÍA, S.A.U.

Address: Avda. Zarandoa, 23
48015 Bilbao, SPAIN

Web: www.idom.com

Turnover: 176 Million € In Year 2013

Contact Person: Amaia Zarraoa, *Business Development* (IDOM-ADA)
+34 944797676
amaia@idom.com

Company activities:

IDOM is an independent firm of Engineering, Architecture and Consultancy services that operates globally in areas such as power generation, oil & gas, renewable and alternative energies, manufacturing industry, civil infrastructures, nuclear facilities and large technological and scientific projects.
IDOM has put particular effort and is currently significantly active in providing advanced engineering services to large technological and scientific projects. References in those fields range from world-wide outstanding wind turbine test facilities (CENER in Spain, Clemson University in the US, NaREC in the UK, DyNaLab in Germany), the largest of their type telescopes in the world (the European E-ELT in Chile; the ATST in the US), and currently active international projects in particle physics and materials science (ESS, SNS, GANIL/Spiral2, ITER, JHR).
IDOM provides engineering services all through the project, from initial conceptual stages, through detail design and construction plans, to the manufacturing, assembly and commissioning of systems (e.g., instruments, test benches/plants, dome-like complex structural/mechanical systems).

Particle Physics Activities & Particle Physics Interest:

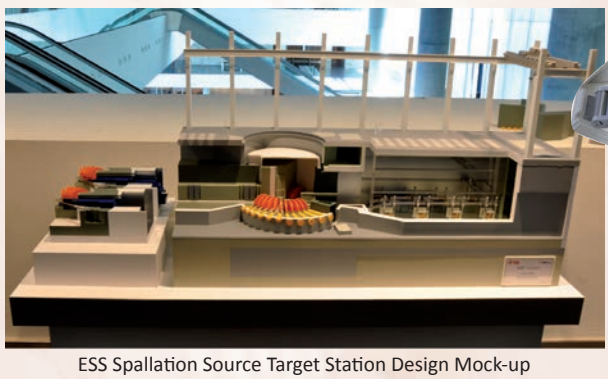
IDOM has a broad expertise in different areas, such as applied mechanics, structural design, electronics & control. We deal with optics, thermo-hydraulics, vacuum/cryogenics, radiation/remote handling, electromagnetism, precision control, large movable structures, seismic design, etc. Advanced computer simulation techniques are used routinely, often together with in-house prototype & testing techniques to predict the performance of a final design, avoid early failures and ensure manufacturing or construction success.
The activities and interests of IDOM in particle physics involve, among others, scientific instrumentation design & manufacturing, complex systems integration and nuclear engineering services.

Particle Physics main contracts awarded and R&D Projects:

– Design of a Rotating Target for ESS, based on a tungsten disc cooled by cold-plates. IDOM performed the engineering design for these hydraulically cooled elements, involving design for manufacture (up to production of the built-to-print drawings), weld engineering and

simulation/modeling for mechanical, thermal and hydraulics engineering analyses. Under this contract, IDOM designed a test bench for the verification and validation of rotating cooled targets - RTTF – Rotating Target Test Facility capable of simulating operational conditions and with advanced flow visualization capabilities (PIV). In addition, the project included the fabrication of two full-scale prototypes, followed by an extensive test campaign at Oak Ridge National Laboratory.

– UGXR Bench for the JHR (Jules Horowitz Reactor): contract awarded by VTT for the design and manufacturing of the UGXR Bench Underwater Part. The system is composed of two main assemblies: the test device manipulator and the X-Ray camera support & container. The design is based on rather proven mechatronics and robotics systems set out in a highly integrated and compact arrangement, and easily accessible for maintenance. Apart from this contract, IDOM is currently preparing a separate proposal for the Gamma and X-Ray Collimator design and manufacturing.
– Integration design of diagnostics into ITER ports: the scope of this contract, recently awarded to IDOM by F4E, includes the integration design of about 20 port-based diagnostics into 7 ITER ports, including the built-to-print design of the housing structures. This value of this contract, of 4 year duration, is in the range of 20 million euros.
– IDOM has also collaborated with F4E in other contracts, supplying diverse engineering services for ITER. Those works include, among others, the Design of the frontend Cryopumps Cryodistribution System; Fluid dynamic analysis for Tritium Detection within the Process Rooms; Design studies for Test Blanket Modules (TBM); Update of calculations for the validation of the ITER Cryostat Design; Blast of He and N2 tanks.
– Feasibility study on the incorporation of two particles accelerator in the liquid metal laboratory of Technofusion, in collaboration with national research centers and universities such as CIEMAT and UPM, related to the development of the fusion technology and financed by CDTI. Monte-Carlo, CFD and hydraulic calculations have been applied for the choice of the accelerator parameters and installation dimensioning.
– GANIL/SPIRAL2 Production Module Thermomechanical Studies: analysis of the heat transport and cooling conditions, followed by calculations of mechanical deformations/stresses and vacuum sealing performance analysis. In addition, IDOM performed accidental scenarios studies for the system oven.
– Other activities, framed as R&D projects inside the company, include the assessment of advanced– granular, cannelloni –rotating targets cooled by helium; a feasibility study on rotary mechanisms in cryogenics; and the research on design & manufacturing technologies for superconducting linear accelerators, all these projects partially funded by CDTI.



ESS Spallation Source Target Station Design Mock-up

Design of Underwater Gamma and X-ray Measurement Bench for the JHR

INSTALACIONES INABENSA, S. A.

INABENSA

Address: C/ Energía Solar,
14014 Sevilla, SPAIN

Web: www.inabensa.com

Turnover: 426,300,000 € In Year 2013

Contact Person: Pablo Infante, *Business Development Manager*
+34 954 93 6111
pablo.infante@inabensa.abengoa.com

Company activities:

Inabensa and its abroad subsidiaries are integrated in Abeinsa Abengoa's engineering and industrial construction business group, and they are developing their activities in the engineering market through construction and industrial maintenance and infrastructure in the energy, industry, transport, service and communications sectors.

Inabensa provides overall solutions to the satisfaction of its customers, who identify our company by the quality and services offered. These solutions enable the creation of value for its shareholders and employees, ensuring its international and future projection and the profitability of its investments.

Our vision is to be an international leader in engineering and industrial construction and high value added infrastructure, which will contribute to sustainable development.

Areas of activities are:

1.- Transports and Networks: We construct large transmission lines as well as communication networks and railway infrastructure.
2.- Installations and Infrastructures Business Line: We develop any type of electrical or mechanical installation for the all of industrial sectors.
3.- Manufacturing: From our workshops in Spain (Seville and Alcalá) and China (Tianjin), we manufacture innovative, high added value products.
4.- Concessions and Services: We provide the promotion, construction, operation and maintenance of infrastructures and public services within the singular buildings, renewable energy and energy efficiency sectors.

Particle Physics Activities & Particle Physics Interest:

1.- Electrical and mechanical installations associated to particle physics infrastructures.
2.- Supply of electrical and electronic equipment associated to particle physics installations.

Particle Physics main contracts awarded and R&D Projects:

CERN: AC Voltage regulators 0-1.000A, 1.500kW. Qty 40 units
OC Power supply 0-20.000A, 25V.Qty 1unit OC Power supply 0-20.000A, 17V. Qty 1unit OC Power supply 0-24.000A, 17V.Qty 2 units

Commuted OCPower supply -10 --> +10V,.-2.000 --> +2.000A. Qty 1
OC Power supply 0-5.400A, 1.800V. Qty 1
Commuted OC power supply, input 24V, output 40-4.000V, max current 10.000A. Qty 100.
Commuted AC/DC power supply, input 220Vac, output 1-300V, current O-SA. Qty 30

ITER:
Supply of nuclear safety Instrumentation and Control system SCS-N (in consortium)

INDUSTRIAS MECÁNICAS DE PRECISIÓN S.A. (INMEPRE S.A.)

INMEPRE, S.A.
INDUSTRIAS MECÁNICAS DE PRECISIÓN

Address: Miravalles,37,Polígono Industrial de Betoño
01013-Vitoria (Álava), Spain

Web: www.inmepre.com

Turnover: 1,250,000 € In Year 2013

Contact Person: Osear Musitu lriberri, *Manager*
34945264755
direccion@inmepre. com

Company activities:

INMEPRE S.A (www.inmepre.com) is a SME specialised on manufacture of precision components for high quality demanded customer of different markets such as Aerospace, Pharmacy,Hight precision Moulds and Packaging Systems,Special Machines,Toolings and so on.
We are highly skilled in complex and delicated grinding machining and EDM. This has been our natural business since the last 40 years.
We traslated all this experience to new market niches, and are ready to supply precision components for Research Projects and lnfrastructures.
We are IS09001 certificated.

Particle Physics Activities & Particle Physics Interest:

During the 10 last years we have been involved in High Radio-Frequency Communication Systems Research Pro?ects, delivering prototype units of filters and other devices in the range of Ghz.
This experience was applied to the delivery of special purpose designed filters for the CIEMAT TJ-11 Fusion Nuclear Project Research. This work was part of a radar application.
Following thŜsŜ works we established one collaboration with ESS-Bilbao and CERN to supply linear Accelerator components in OFE copper with good results.

Particle Physics main contracts awarded and R&D Projects:

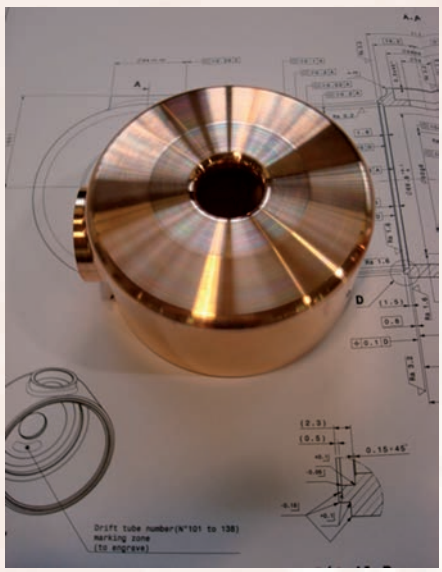
2009-2010. CIEMAT TJ-11 Nuclear Fusion Research Project.
In this two years we industrialized, manufactured, and delivered three radio-frequency filters for the TJ-11 project.
All of them were parts of a radar application to study the evolution of the hydrogen plasma atoms inside the TJ-11 fusion ring. The first was a band pass filter to eliminate all the lower frequencies. The other two were filters designed specifically to eliminate 26 Ghz and 53 Ghz, the frequency of the excitation power sources.

2011-2013.CERN Linac 4 Linear Accelerator Project/ ESS-Bilbao.
In 2011 we were required to study the possibility of supply OFE copper components for Particles Linear Accelerator.
We start one R+D Project and in 2012 developed one successfully methodology to manufacture

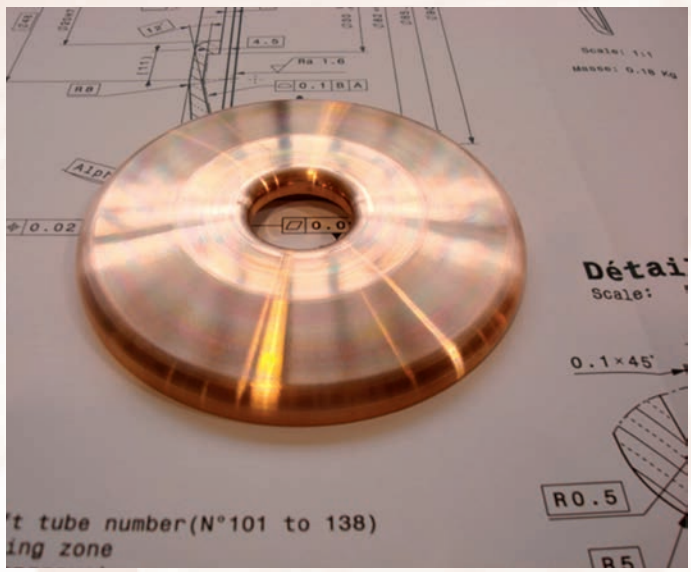
OFE copper Dritf Tubes for this type of linear accelerators, with the restrictions that working at high vacuum imposed. We managed the CERN approval.

In 2013 we delivered and homologated the first pre-serie units for the ESS-Bilbao Tank 1 Linear Accelerator.

Also in 2013 we delivered to CERN the 2.5 Tons Jacks for support and alignment of the LINAC 4 high vacuum tanks structures.



OFE Coper Drift Tube Body



OFE Copper Drift Tube Cover

JEMA ENERGY

Address: Paseo del Circuito 10,
20160 Lasarte-Oria (Guipúzcoa), SPAIN

Web: www.jemaenergy.com

Turnover: 22 M€ In Year 2013

Contact Person: Bas Eikelboom, *Sales Manager*
+34 607406471
b.eikelboom@jemaenergy.com

Company activities:

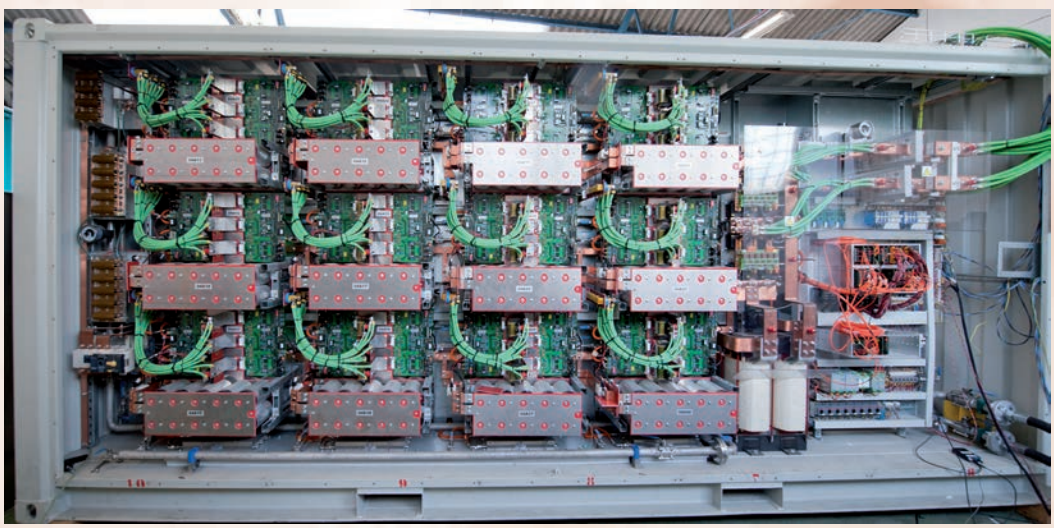
Design and manufacture of power conversion systems based on power electronics, such as UPS systems, Solar inverters, Reactive Power Compensation systems such as SVC and STATCOM and customized power conversion systems such as High Voltage and High Precision power supplies for RF systems or magnets.

Particle Physics Activities & Particle Physics Interest:

Any kind of power conversion system or part thereof using power electronics.

Particle Physics main contracts awarded and R&D Projects:

IFMIF - Tetrode HVPS
ESS Bilbao - klystron modulator
SNS Oak Ridge - klystron modulator
RAL FETS ISIS - high precision magnet power supplies
RAL ISIS - Tetrode HVPS
GSI DESY-II - high precision magnet power supplies
CERN SPS/LHC - high precision magnet power supplies



SNS - Oak Ridge National Laboratory - 85kV160A pulsed power supply

NORTEMECÁNICA

Address: Area Industrial de Tabaza 1,parcela E-5
33469 Carreña (Asturias), SPAIN

Web: www.nortemecanica.es

Turnover: More than 5 M€ In Year 2013

Contact Person: Susana Fernández, *Export Manager*
+34985579857

Company activities:

Nortemecánica is a reference in manufacturing, assembly and commissioning of capital goods, machinery and spare parts for the industry, with over 20 years' experience.

Nortemecánica, posted sales in excess of €5 million, more than 80% of which comes from its intensive activity with countries all around the world.

In its own facilities (7.150m^2), following activities are developed:

- BOILER MAKING AND WELDING
- MACHINING AND ADJUSTMENT
- ASSEMBLY AND TESTING
- QUALITY CONTROL
- VERIFICATION

Nortemecánica currently employs 32 people and is equipped with the high technology standard. We incorporate the latest technical advances, like for example, two Laser Trackers that have been recently incorporated.

Heated area for verification and assembly at constant temperature has been recently built at our premises. This area and the heated room in which the 6 meter-long-milling machine is located, allows us to achieve tolerances without precedents (30 microns in 5 meters length).

Particle Physics Activities & Particle Physics Interest:

Manufacture and supply of more than 150 ondulator carriages, called "Insertion Device Support Systems" for Synchrotron radiation laboratories all around the world.

Manufacture and supply of different mechanical components for the LHC (Large Hadron Collider), like vacuum vessels, girders or support structures for the calorimeters in the LHCb.

Particle Physics main contracts awarded and R&D Projects:

• XFEL Project:

Description: Manufacture, assembly, alignment, commissioning and supply of 36

Ondulators Support Structures and its 4 prototypes. The Support Structures consist of 5 meters long ondulator segments with a weight of 8 tons each and a height of 2,5 meters.
Customer: European X-Ray Free Electron Laser Facility (XFEL), Hamburg (Germany).

• ALBA Synchrotron:
Description: Manufacture and supply of 33 support structures for the Storage Ring of the ALBA Synchrotron at Barcelona.
Customer: CELLS (Barcelona, Spain).

• ESO Project:
Description: Manufacturing, testing and supply of 21O plates for the foundation of antennas for the Atacama Large Millimeter Array (ALMA), international astronomy facility located in Chile.
Customer: European Southern Observatory (ESO).

• ESRF Contracts:
Description: Manufacturing and supply of different types of Insertion Devices Support Systems (Apple 11, In vacuum ondulator mobile carriages, etc). Parallelism between girders below 0.05 mm.

Support Structures designed by the European XFEL and DESY

• CERN contracts:
Description: Manufacturing and supply of 130 girders for the ATLAS detector at the Large Hadron Collider (LHC) at CERN. Customer: Argonne National Laboratory (Chicago) and Instituto de Física de Altas Energías (IFAE, Barcelona).
Description: Manufacturing and supply of 14 Schuffling Module Vacuum Vessels and
2 prototypes for the Large Hadron Collider (LHC).

Ondulator Carriages - ESRF

PROACTIVE R&D

Proactive R&D
Research and Development Support

Address: Av. Diagonal, 429, 3r
08036 Barcelona (SPAIN)

Web: www.proactiverd.com

Turnover: 130 K€ In Year 2013

Contact Person: Juan Herranz, *CEO*
34669556004
jherranz@proactiverd.com

Company activities:

Proactive R&D is a company based in Spain which provides valuable expertise, equipment and leadership in the field of Research and Development.
Our core competencies are Mechanical Design for High Technology Project, such as High Precision Mechanics, UHV, New Materials and Large Infrastructures Integration. We have broad experience in High-Technology projects and strong technical and management competencies.
Our company can participate in the different phases of the project: conceptual design, pre-design, manufacturing design, cost estimation, design reviews, manufacturing follow up, also we can provide turnkey devices based on the client specifications.

Particle Physics Activities & Particle Physics Interest:

Proactive R&D can provide valuable support in the following fields:

- High Precision Mechanics: design and procurement of positioning and alignment systems, supports or special linear or rotational stages,
- Experimental Setups: design and procurement of experimental setups, integrating different components such as beam conditioning systems, sample positioning devices and detectors,
- Beam Instrumentation: design and procurement of devices, as beam position monitors, Faraday cups or slits,
- Vacuum Technologies: design and procurement of vacuum pipes lines, vacuum vessels, and in-vacuum devices,
- Large Infrastructures Integration: integration of complex projects within different fields such as large apparatus, large metallic structures, vacuum and cryogenic systems.

Particle Physics main contracts awarded and R&D Projects:

R&D project in the field of magnetic measurement instrumentation for accelerator magnet devices – ESRF.
We have participated for more than 2 years in an R&D project in the field of magnetic measurements instrumentation for accelerator magnet devices with ESRF (Grenoble - France). In this project we have provided mechanical engineering support from the conceptual design phase until the manufacturing design and the procurement of the equipment.
The most relevant engineering tasks performed are:

- Thermal FEA, involving radiation and conduction, as the system has to operate at cryogenic

temperatures (140 K).

- Structural FEA to optimize the most critical parts of the system under gravity and vacuum related loads.
- Design and integration of multi-degree of freedom alignment systems in the range of the micron.
- Design and integration of high precision and long travel translation stages for vacuum environments, consisting in UHV optical encoders, optical interferometry, stepping motors and vacuum compatible guiding systems.

At the end of the engineering phase of the project, ESRF decided to entrust to Proactive R&D the procurement of the system. Although Proactive R&D has no means of production and integration to deal internally with such supply, we established suitable contracts and partnerships to perform satisfactorily this task. In particular the works of integration and commissioning were performed at the facilities of the company SENER in Barcelona (Barcelona - Spain) by staff of both companies while the vacuum chambers were supplied by the company Trinos Vacuum Projects (Valencia - Spain).

Fig. 1, shows one of the vacuum supporting systems developed in the framework of this R&D project. This device consists in a vacuum chamber UHV compatible and a high precision aligned system with 3 displacements (X,Y,Z) and 3 rotations (around the X, Y, Z axis). Left, digital mock-up of the device, right, final device during the commissioning phase.

Fig. 2, shows FEA results in a long vacuum chamber, 300 mm diameter performed in order to evaluate the misalignment induced by the vacuum loads in the equipment installed in end flanges.

We can provide more details and references about this project upon request.

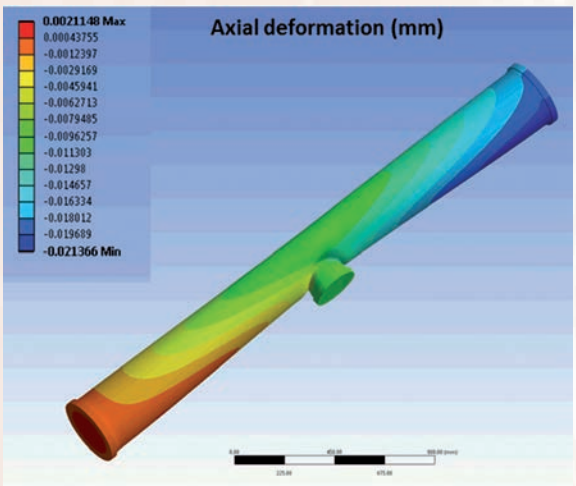


Fig. 1. FEA - vacuum chamber axial deformations

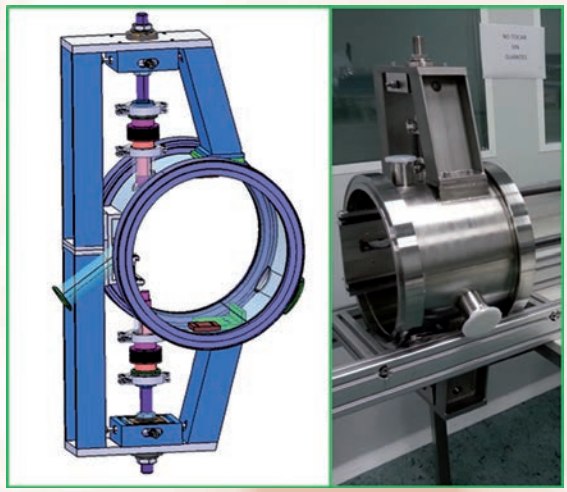


Fig. 2. In vacuum alignment system

PROCON SYSTEMS, S.A.

Address: Arquímedes 26
08918 Badalona (Barcelona), SPAIN

Web: www.proconsystems.net

Turnover: 8,7 M€ In Year 2013

Contact Person: Daniel Marchante, *Sales Manager*
+34 93 460 99 40
marchante@proconsystems.net

Company activities:

PROCON SYSTEMS is an industrial engineering company specialized in process automation, instrumentation and control. We are in the market since 1995 and our headquarters are located in Badalona (Spain).
The team of PROCON SYSTEMS is formed by a group of young engineers and technicians with a wide expertise and experience. The staff of about 40 employees is composed by an 80% of engineers and technicians. PROCON SYSTEMS has adapted its organization to the growth achieved due to the continuous confidence of our customers during the last years.
Our project teams are based on qualified professionals with expertise in various technologies, and are responsible for the total integration of the project.
Thanks to the confidence of our customers, PROCON SYSTEMS has consolidated as one of the leading companies in the market, developing its activities both in the domestic and international market (80% export sales).
PROCON SYSTEMS is a very dynamic company, oriented to the quick utilization of the last available technologies in the market. The projects developed by the company include a wide range of services for the industry.
The main business areas are the automotive and the big scientific facilities, including CERN, EFDA, ITER, CELLS-ALBA...

Particle Physics Activities & Particle Physics Interest:

As a control engineering company, PROCON SYSTEMS is interestted in projects where the following fields of expertise are required:

- I&C Hardware Engineering
- I&C Software Engineering
- I&C Cubicle Fabrication
- I&C Electrical Installation and Commissioning

Particle Physics main contracts awarded and R&D Projects:

1. – PERSONNEL SAFETY SYSTEM (PSS), ALBA CELLS, (2007-2012).
The purpose of the project is Personnel Safety System (PSS). The PSS ensures that nobody gets irradiated during operation. This comprises access control to bunkers, intrusion and malfunction detection as well as radiation level monitoring.

- Complete PSS for the Linac, Booster and Storage Ring and 7 Beam Lines.

- System based on Safety Programmable Logic Controllers (PLC) from Pilz, following the Safety Integrity Level 3 (SIL3) specified in the norm IEC 61508.
- Safety Systems implemented by 9 CPUs Pilz Compact Safety PC PSS 3047.

2. - PROTOTYPING INTERLOCK CONTROL SYSTEM FOR ITER (2010-2012).

The purpose of the contract was to design and implement Interlock Control Systems (ICS) prototypes, to design and implement an ICS Test-Platform and to perform the assessment of the ICS Prototypes to validate standard components and architectures to be included in the future releases of the Plant Control Design Handbook (PCDH).

3. - INTERNAL CONFIGURATION GUIDELINES FOR I&C CUBICLES AND SUPPLY SMALL BATCH OF I&C CUBICLES, ITER, (2010-2012).

The scope of services included in the PROCON SYSTEMS project included two main milestones:

a) Definition of internal mechanical and cabling configuration guidelines to be used for all I&C cubicles of the ITER plant. At the last stage, this document was a part of the satellite documents of PCDH.

b) As example of the result of the guideline done, a small batch of I&C cubicles were supplied to several DA.

All these services were done according to PCDH (Plant Control Design handbook) and they help to illustrate the ITER standards and support to the plant system I&C prototyping activities.

4. – HVAC SYSTEM FOR PS ACCELERATOR RING, CERN, (2012-2014).

The purpose of the project was the renewal of the HVAC System in the PS (Proton Synchrotron) Ring accelerator, located on the Swiss part of the Meyrin site of CERN. In the scope of the project were included:

- Complete hardware design
- Fabrication and FAT for the control and power cubicles.
- Installation on site
- Commissioning jointly with CERN Technical personnel and SAT.phase until the manufacturing design and the procurement of the equipment.

The most relevant engineering tasks performed were:

- Thermal FEA, involving radiation and conduction, as the system has to operate at cryogenic temperatures (140 K).

I&C Cabinets Procon Systems

S.A DE ELECTRIFICACIONES Y SUMINISTROS "SADES"

Address: calle Fontanella, 14
08010, Barcelona, SPAIN

Web: www.sades.es

Turnover: 12,521,182€ In Year 2013

Contact Person: Luis Segarra, *General Manager*
+34 93 301 87 00
lsegarra@sades.es

Company activities:

SADES is a private company specialised in design, supply, commissioning and maintenance of installation systems. We have large experience in a wide range of projects as well as in the use of state-of-the-art technologies. Our company has carried out during the last 55 years a great number of projects as contractor on site.
The main fields of our activities are the following: HVAC, cooling systems, electrical installations, fire risk protection, pneumatic and mechanical installations.
The main areas of our activities are the following: Large scientific facilities, laboratories, hospitals, retail, sports centres, hotels and office buildings.

Particle Physics Activities & Particle Physics Interest:

SADES has proven experience in HVAC, cooling systems, electrical installations, fire risk protection, pneumatic and mechanical installations in the PS accelerator at CERN.
SADES is interesŭed in developping his experience in other scientific infrastructures in particle physics.

Particle Physics main contracts awarded and R&D Projects:

SADES has developed at CERN the design, supply, installation and commissioning for the contract named as PS VENTILATION PROJECT, whose goal was the renewal and upgrade of the HVAC and the smoke ventilation system for fire safety, including also the development of the electrical and control system (together with our partner PROCON SYSTEMS), and the implementation of a pneumatic control system to avoid problems with the ionization radiation.
The responsible for this project at CERN was the EN/CV department.
The main challenges of this project were:

- Strict project completion dates
- Working on radioprotection controlled areas
- Working on existing premises with few possibilities of intervention on civil works

The main achievements of this project have been:

- Compliance with the planning
- Reduction of the intervention time on radiation areas

- Development of design and working strategies to fulfill the new requirements of the HVAC system integrated in the existing premises

The principal data of this project are:

- 260.000 m^3/h total recirculating airflow installed at 8 AHU
- 96.000 m^3/h total fresh airflow installed at 5 AHU
- 100.000 m^3/h total extracted airflow installed at 4 AHU
- 180.000 m^3/h total smoke extraction airflow installed at 6 Smoke ventilators
- 1320 kW cooling power through water exchangers installed at AHU's
- 560 kW heating power through water exchangers installed at AHU's
- 740 kW heating power through electric exchangers installed at AHU's
- 1.130 kW of electric power installed and distributed on 24 cubicles
- 1.032 control signals installed and distributed over 1 cubicle with 3 PLC
- 32 pneumatic signals installed and distributed over 1 cubicle

This project has obtained an R&D Innovation certificate from EQA organization

VALVE

AHU

SCIENTIFICA INTERNATIONAL, S.L.U.

Address: Xixilion 2 bajo, Pabellón 10
20870 Elgoibar (Guipúzcoa) SPAIN

Web: www.scientifica.es

Turnover: 500K€ In Year 2013

Contact Person: Lander González Larrea, *Business Development Manager*
+34943127285
lglarrea@scientifica.es

Company activities:

SCIENTIFICA INTERNATIONAL, S.L.U. is a company devoted to the development and manufacturing of instrumentation equipment for the science market.
With experience and technical skills in 3 main core technologies, such as precision mechanics, electronics & signal processing, and composite materials, SCIENTIFICA has collaborated with several European scientific facilities and institutions, like, ISIS, CIEMAT, ESS-Bilbao, ILL, HZB and CERN.
It has and important activity in the development of position sensitive neutron detectors for neutron scattering applications. It has delivered detectors for neutron scattering facilities, like ISIS (UK), and has developed its own Position Sensitive Neutron Detector technology.

Particle Physics Activities & Particle Physics Interest:

Additionally, it has also activities in other fields of particle physics developing applications in the fields of detectors, functional and structural composite materials and instrumentation in general.

Particle Physics main contracts awarded and R&D Projects:

• Position Sensitive Neutron Detectors for neutron scattering applications:
Supply of a complete PS Neutron Detector for a diffraction instrument (PEARL) for ISIS, and ESS Bilbao, including a low angle scattering module.
In this area SCIENTIFICA has developed also, based on several R+D projects, in collaboration with ISIS and others, its own PS Neutron Detection technology based on Wavelength Shifting fiber optic technology.

• Neutron detectors for spectrometry applications:
SCIENTIFICA is collaborating with CIEMAT in the development of liquid scintillator neutron detector cells for FAIR in a joint R+D project.

• Functional and structural composite materials for radiation related applications.
S/L9b¢LCL/! has developed, tested the feasibility and manufactured 6 units for the ILL of a new concept of neutron analyzer structure in composite materials, which enables a high end, big size, geometrically complex, very precise and stable, and very low weight analyzer structure, to

hold the silicon crystals precisely with enhanced neutron absorbent capabilities to reduce the scattering to the minimum.
It has also developed other applications in the field, like the design of lamination of doped composites for vacuum carters of neutron guides for the ILL and the supply of radioactive shielding parts for neutron detectors and various mechanical systems, for ISIS.

• Other research projects include applications like:
Manufacturing of a semi automated test bench for CALIFA's calorimeter scintillator cristals' quality control in collaboration with University of Santiago de Compostela for FAIR.
Design and simulation of a Faraday cup of a beam diagnostics system for HIE ISOLDE at CERN.

High Pressure neutron difracctometer (PEARL) at ISIS, UK. Position sensitive neutron detector modules during instrument installation

Units of neutron back-scattering analyzer's support structures made in carbon fiber, for IN16B instrument at ILL

SENER, INGENIERÍA Y SISTEMAS, S.A.

Address: Avda. Zugazarte, 56
48930 Las Arenas (Vizcaya), SPAIN

Web: www.sener.es

Turnover: 556.7 M€ In Year 2013

Contact Person: Joan Manel Casalta/Mª Rosa Sacristán,
Science & Astronomy Business/Nuclear Business
+34 932276563/+34 932283380
joanmanel.casalta@sener.es/mrosa.sacristan@sener.es

Company activities:

•SENER Ingenieria y Sistemas, S.A. is an Engineering and Construction company backed by more than 50 years of experience. Innovation, commitment to quality and independence are our corporate values. International leader in Civil Engineering and Architecture, Aerospace Engineering, Aeronautics and Vehicles, Actuator and Control Systems, Power and Processes and Marine Engineering.
•SENER carries out projects from design to construction of complete facilities regarding all technical disciplines: Project Management, HVAC, System engineering, Electronics / avionics, Process Analysis, Software Development, Mechanisms, Mechanical Systems, Fluid Dynamics, Structural Design & Analysis, Electric systems, Pneumatic systems, Vibrations and acoustics, Testing Support & Test, Quality control and assurance, System integration, etc.

Particle Physics Activities & Particle Physics Interest:

•Due to the multidisciplinarity of the company, SENER can provide services for different areas of technological expertise needed in the Particle Physics Projects related to Civil Engineering, Mechanics and Mechatronics, Electrical Systems, Cryogenics and Vacuum, Targets, Detectors, Instrumentation and Sources and Software and Control.
•Possible Project scopes: Conceptual, preliminary and detail design, procurement and construction and verification and commissioning.
•SENER is a member of some technological platforms and associations relevant to the particle physics area as INEUSTAR, INDUCIENCIA, etc.

Particle Physics main contracts awarded and R&D Projects:

ESS:
For the Univ. of Cantabria: Together with another firm, SENER developed the detailed design/ engineering work for the ESS (European Spallation Source) mercury circuit. FZ Jülich assisted the UC for this project (2000-2001).
Regional spallation facility: Several studies have been carried out by SENER for the Basque administration between 2002 and 2007 aimed at analyzing the feasibility and conceptually defining (uses, budget, etc.) a regional spallation source facility, with a beam power of 250 kW. Its main blocks would be a proton synchrotron and a solid rotating tungsten target.
Transmutation Laboratory: Optimization of a spallation target for CIEMAT in 2006.

ESS-Bilbao Consortium: SENER has carried out several studies evaluating various siting alternatives. Apart from that, SENER has also participated in several tasks of the ESS Preparatory Phase Project, pertaining also to the 7th Framework Programme (2006-2010).
ESS-Bilbao Accelerator Technology Plant: SENER has prepared the Preliminary Report for the definition of all the auxiliary systems (2011-2012).

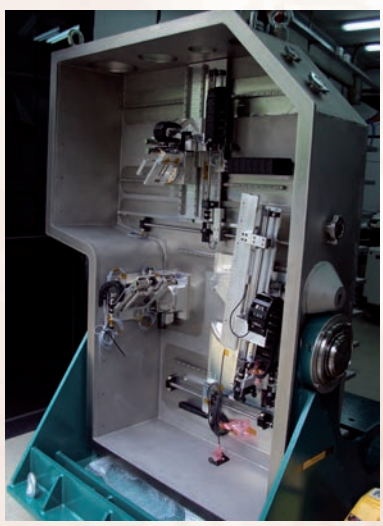
CERN:
CIEMAT, together with MIT (U.S.) and NIKHEF (The Netherlands) was in charge of the design and supply of the L3 experiment for the LEP accelerator. SENER acted in this project as the technical arm of CIEMAT. The scope of its design included Muon detector chambers 6 m long, each with 400 wires of 0.075 mm dia, a rigid, but very light, metallic structure (octant) to support and align in space groups of five chambers and a rigid tube 6 m long and 4 m in diameter to fix the octants in a circular array. The final position in space of each single detection wire was to be known with a precision of 150 µ.
Under a long direct contract with CERN, SENER has designed and engineered many mechanical equipments and systems for the LHC facility.

ALBA:
Detailed design, integration and verification of this X-Ray spectrometer instrument based in a preliminary design performed by ALBA. This spectrometer is placed at end station of BL22, the CLÆSS beamline of ALBA synchrotron.
The spectrometer has around 20 different step motors, most of them with a resolution of 5 µm and a repeatability of 10 µm. It consists of 3 main subassemblies, slits (3 different movements), detector (5 different movements) and analyser (6 different movements). They are installed inside a vacuum chamber (3 different movements) of 1.8m high, and 1.3m width, made of stainless steel and with a total weight around 1600 kg. This vacuum chamber is fixed to a granite stone of 5.5m long (2 different movements).
The main challenges of this project were:

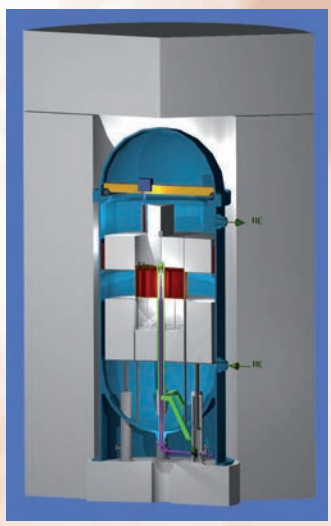
- Strict project completion dates
- Working at radioprotection controlled areas
- Working at existing premises with few possibilities of intervention on civil works

The main achievements of this project were:

- Compliance with the planning
- Reduction of the intervention time on radiation areas
- Development of design and working strategies to fulfil the new requirements of the HVAC



ALBA X-RAY



Transmutation Laboratory

SERTEC SL

Address: c/eric kandel 1, 28906 getafe (Madrid)

Web: www.sertec.net

Turnover: 5.3 M€ In Year 2013

Contact Person: Eduardo Cano Corral, *Business Manager*
+34 917241775
Eduardo.cano @sertec.net

Company activities:

Mechanical engineering, civil engineering, turnkey projects in aeronautics, naval, energy and defence industries.
R&D

Particle Physics Activities & Particle Physics Interest:

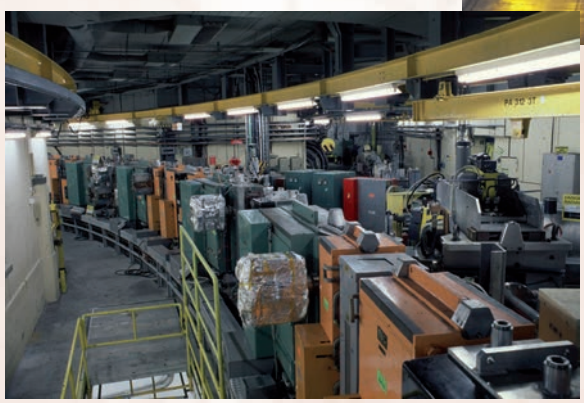
Activities: Civil engineering design in buildings and for accelerator facilities
Interest: Mechanical design of structures for accelerators, structural testing, handling, unmanned vehicles for tunnels.

Particle Physics main contracts awarded and R&D Projects:

Mechanical and civil works design of different buildings and installations for CERN highlighting LHC, booster and Alice detector design works

ALICE Mechanical Design

LHC Mechanical Design



psBOOSTER Mechanical Design

SEVEN SOLUTIONS SL

Address: C/Baza, Parcela 19, Nave 3
Polígono Industrial Juncaril
18210 Peligros (Granada), SPAIN

Web: www.sevensols.com

Turnover: 495.873 € In Year 2013

Contact Person: Javier Díaz Alonso, *Executive Director*
+34 958285024
Info@Sevensols.com

Company activities:

Seven Solutions, S.L. is a technology-based company specialized in the design of embedded systems and specific purpose hardware development for two main sectors:

Industry for Science (I4S): Seven Solutions contributes to major scientific projects (High Energy Physics, Aerospace, Astrophysics, …) in partnership with different research institutions, facilities and groups. We develop custom-made systems to fulfill our customers needs such as precise and synchronize control systems, timing and synchronization systems, artificial vision, robotic systems…

Industry (RnD): We provide technology and knowledge for several application fields such as distributed instrumentation control, safety critical systems, automobile, biomedicine, machine vision, surveillance, etc.

We are one of the original developers of the White Rabbit Technology and an active developer at the Open Hardware Repository. We have a large expertise in time transfer over distributed facilities.

Particle Physics Activities & Particle Physics Interest:

We participate in hardware and firmware developments related to the FPGA based boards and electronics related to signal transmission and communications (with precise timing and synchronization capabilities) in different scientific institutions such as CERN and GSI and facilities such as KM3Net, IFMIF, FAIR and different accelerators at CERN. We also participate in other international initiatives such as CTA and SKA. We have a large expertise in the development of timing, synchronization, A/D and control electronics.

Our interestts and potential contributions can be based around three topics:

a. Open Hardware. Electronics and firmware development and fabrication adopting and taking benefit of an open hardware scheme. We are actively participating in the Open Hardware Repository (http://www.ohwr.org/).

Some of our developments and products adopt an Open Hardware strategy, we intensively participate and contribute to the OHWR (Open Hardware Repository) (http://www.ohwr.org/).

In this way, depending on our funding source or contractor, we may open new designs to a wider community in order to have a wider support and avoid vendor lock-in scenario. Furthermore, in many cases we can also provide support, customize and fabricate hardware systems from the OHWR (even if they were not originally designed by us).

Open Hardware is having a large impact in the particle physics and High Energy Physics (HEP) community, many institutions adopt these open hardware systems and platforms to avoid vendor lock-in with specific customers and better share developments (with common interestts) with other scientific institutions. In this way, different research facilities can benefit from developments done by other research groups. SMEs can further customize these systems, provide support and fabricate them for third parties or other scientific facilities.

b. White Rabbit Technology (http://www.whiterabbitsolution.com/). Timing and Synchronization Technology based on an extended Ethernet protocol. It is an extension of the standard Ethernet (thus fully compatible with conventional Ethernet communication networks). It allows deterministic, robust and precise timing (with sub- nanosecond accuracy). We participated in the original White Rabbit Switch development in collaboration with CERN, GSI and other institutions. Currently, to the best of our knowledge we are the only White Rabbit Switch manufacturers and actively provide support and customization of this technology to adapt it to different requirements.

c. Electronic and firmware development related to High Energy Physics facilities. EPICS control development, Low Level RF (LLRF) control system.

d. Time transfer over optical fibers. Application to distributed sensor and instrumentation facilities (CTA, SKA, HI-SCORE, etc).

Particle Physics main contracts awarded and R&D Projects:

CERN (White Rabbit Switch development and other firmware development). CERN subcontracted part of the design of the White Rabbit Switch, the electronics and basic production tests.

CERN (Electronic boards production, FMC-TDC, FMC-DIO, SPEC, SPEC100, etc). Seven Solutions was awarded with different electronic board productions.

GSI (Switch CE labelling and WR Switch providers). Seven Solutions was subcontrated to test and modify the White Rabbit Switch towards the CE label.

KM3Net (White Rabbit communication customization). Seven Solutions was subcontracted (through Nikhef) for White Rabbit customization for KM3Net facility.

CTA (White Rabbit compliant data acquisition board). Seven Solutions was subcontrated to design a data acquisition board capable of providing accurate timing based on White Rabbit Technology.

CIEMAT (Electronic providers and firmware development). Seven Solutions was subcontracted to design different electronic boards for accurate control with precise timing.

Electronic boards provider for HISCORE, ELI-ALPS, ALBA, SOLEIL, SIRIUS, DESY, ESS Bilbao, Nikhef, LAAHSO, etc).

TAIM WESER S.A.

Address: Carretera de Castellón Km. 6,3
Pol. Ind. La Cartuja, 50013, Zaragoza (SPAIN)

Web: www.taimweser.com

Turnover: 64 M€ In Year 2013

Contact Person: Luis Monge, *Sales Director*
+34 976 500 006
info@taimweser.com

Company activities:

Activities of TAIM WESER are focussed on 4 business units/product ranges:
- Cranes: high capacity and responsibility EOT and gantry cranes.
- Bulk materials handling: conveying systems, stockyard machinery and shiploaders.
- Waste treatment plants: Composting plants.
- Renewable energy: Biomass plants and Wind Energy.

Particle Physics Activities & Particle Physics Interest:

TAIM WESER is specialized in the development of high technological degree turnkey projects all around the world. We ensure the best fulfilment of the whole projects through our design, manufacture, delivery, commissioning and after sales departments.
TAIM WESER is an international point of reference and is able to offer their clients the most advanced and, at the same time, the most competitive solutions.
TAIM WESER is interested in large mobile structures projects related to high capacity bridge and gantry cranes as well as stockyard and conveying machinery.

Particle Physics Activities & Particle Physics Interest:

CERN- TAIM WESER supplied 3 cranes for the assembly and lowering of the detector at the Large Hadron Collider (LHC). In a first stage, TAIM WESER supplied 2 gantry cranes with 80 t capacity and 20,6 m. span, but the main characteristic was a lifting height of 115 m, necessary to the lowering process of the detector to the cavern. In a second stage the supply included an EOT crane for the assembly process inside the cavern.
ALBA – TAIM WESER supplied 2 Orbital EOT cranes with 12 t capacity and 33 m. span for the experimental hall of the Synchrotron Light facility.

ALBA Orbital cranes

CERN gantry crane

TALLERES PIEDRAFITA S. L.

Address: Ctra de Jaca km 2,3
22.600 Sabiñánigo (Huesca) SPAIN

Web: www.tallerespiedrafita.com

Turnover: 1,400,000 € In Year 2013

Contact Person: Julio Monge, *Technical Department*
+34 974480670
oftecnica@piedrafitasl.es

Company activities:

- Welding and installation of aluminum, steel and stainless steel pipes.
- Manufacturing and installation of tanks, vessels and heat exchangers of aluminum and steel
- Mechanical maintenance of industries

Particle Physics Activities & Particle Physics Interest:

Manufacturing of welded aluminum waveguides

Particle Physics main contracts awarded and R&D Projects:

Supplying of aluminum waveguides for CERN in several quantities up to batches of 600 units, including straight tubes, E bends, H bends, magic tees, Full height/Half height tapers, in sizes WR2300 and WR1150

TEKNOSERVICE S.L.

Address: Avda. Albaida 1, P.i. Pibo
Bollullos de la Mitacion (Sevilla), SPAIN

Web: www.teknoservice.es

Turnover: 12M€ In Year 2013

Contact Person: Itza Martínez, *Purchase Manager*
+34 954 54 12 12
itza.martinez@teknoservice.es

Company activities:

TEKNOSERVICE is a 100% Spanish-owned company with over 20 years of experience in the new-technology sector. We provide comprehensive technology solutions while taking great care to ensure the quality and excellence of our services.
The fact that we have become a benchmark company for the ICT sector and the high standard services that our team provides to each of our customers are testimony of our position as market leader.
Under our TTL brand, we use cutting-edge technology to produce a wide range of professional desktop computers, laptops, Ultrabooks, tablets, graphic workstations and servers. Our products are constantly monitored and updated by the Engineering and Networking Laboratory, which manages the R&D projects.
TEKNOSERVICE's comprehensive technology maintenance service and our country-wide AUTHORISED SERVICE CENTRE NETWORK allow our IT equipment to be kept up to date and operational at all times.

Particle Physics main contracts awarded and R&D Projects:

TEKNOSERVICE is the only Spanish CERN supplier of High Performance Desktop PC's (supply contract - 3.000 PC's along 3 years) and Storage Systems (30 Petabytes - Storage Enclosures) for Servers.

TRINOS VACUUM PROJECTS

Address: Parque Empresarial Táctica, calle Velluters 17
46988 Paterna (Valencia), SPAIN

Web: www.vacuum-projects.net

Turnover: 1,993,998 € In Year 2013

Contact Person: José Gómez Fernández, *General Manager*
+34 96 134 4830
j.gomez@vacuum-projects.net

Company activities:

Trinos Vacuum Projects carries out several business lines within its activity:

- Manufacturing, assembly, testing and integration of vacuum chambers and cryostats.
- Development of turnkey projects, from design until delivery.
- Supply of standard components, instrumentation and pumping equipments for vacuum systems.
- Industrial services like ultrasound cleaning and leak testing.

Particle Physics Activities & Particle Physics Interest:

Trinos Vacuum Projects counts with several departments to carry out its activity:

- Commercial Department: contact with customers and preparation of tenders.
- Purchases and Administration Department.
- Technical & Quality Department: design, manufacturing engineering, quality control and project management.
- Workshop: lathe machining, milling and broaching machining, TIG/MIG welding, adjusting, assembly and ultrasound cleaning.
- Laboratory: dimensional control and vacuum tests.

The chambers and other components manufactured by Trinos can be made in several materials (stainless steel, aluminium, copper, etc…) and in wide spectra of dimensions and geometries, according to the designs specified by the customers.
From a long time, Trinos has taken part in different projects for Particle Physics customers like CERN, ESRF, XFEL or ALBA supplying different types of vacuum chambers and other related components.
This is a very strongly established working line for Trinos for these customers, and the new challenge is participating in the development of turn-key vacuum systems and projects based on cryogenic technology applied to Particle Physics facilities.

Particle Physics main contracts awarded and R&D Projects:

- Supply of the He Vessel for the cryostat of the High Field Magnet (HFM) vertical test station at CERN. It is a welded stainless steel chamber, more than 4m high and 1.5m diameter.

- Supply of 9 Diagnostic Boxes for the HIE-ISOLDE project at CERN. It is a mechanical system formed by a stainless steel main vacuum chamber with instrumentation integrated, like

stepper motors or electrical feedthroughs.

- Supply of 74 transition tubes, made in oxygen free copper from sheet rolled and machined flanges. Electro beam technology was used for welding.

- Supply of 21 Beam Positioning Monitors (BPM), prototype, series and spares, for the Test Beam Line (TBL) for the Compact Linear Collider (CLIC) Test Facility (CTF3), at CERN. They are a small vacuum chamber that joins materials like ceramic, stainless steel and Kovar. Brazing, electron beam and TIG welding were used.

- Supply of several customized components for several departments at CERN. They are stainless steel TIG welded chambers with several geometries and dimensions used for testing or coating processes.

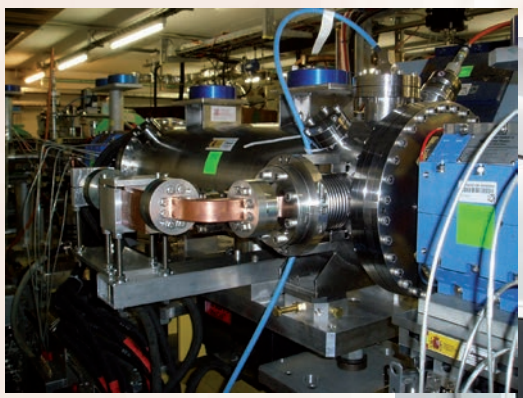
- Supply of 105 Superconducting Magnets for the XFEL accelerator. Trinos was the main contractor and has carried out the manufacturing of the vacuum vessel, the integration of the magnets and the final validation tests.

- Supply of two stop beam chambers for ESRF formed by a TIG welded vacuum chamber housing two lead containers moved by a pneumatic cylinder.

- Supply of one Light Visible Mirror for ALBA (optomechanic instrumentation).

R&D projects:

- Development of a prototype Stripline Kicker for the Clic Damping Ring at CERN. From design to manufacturing, this stainless steel chamber provides a good functionality with high energy beams (until 2.86 GeV).



PETS Vacuum Chamber

Niobium Deposit Machine nº2

TTI NORTE S.L.

Address: C/ Albert Einstein 14,
39011 Santander (SPAIN)

Web: www.ttinorte.es

Turnover: 8 M€ In Year 2013

Contact Person: Miguel Peña, *Commercial Manager*
+34 942291212
mpena@ttinorte.es

Company activities:

TTI works in the technological forefronts of space, military, telecommunications, science, and information technology sectors. TTI designs equipment in the radiofrequency and antenna technology area developing new products (detailed design, prototyping, testing and validation) for its later mass production, as well as integrating complex communication systems, providing turnkey solutions.

For Particle Physics activities, the main areas of expertise are:
Solid State Power Amplifiers: based on LOMOS Solid State Technology, up to tens of kWs and covering a wide range of frequencies. The equipment is developed according to reliability, technical efficiency and lower cost criteria

RF Passive Devices: For any devices, TTI develops conceptual, detailed and manufacturing designs, Quality Control Protocol design according to operating conditions and Operation Testing design

- Development of waveguide components for Multi-Megawatt Particle Accelerators and for a lot of applications in Ultra-High Vacuum conditions at different working frequencies (S, C, and X Band)
- Coaxial High Power Coupler for RF Cavities
- High Power Test-Box RF Cavities for RF coupler conditioning (Capacitiva and Inductiva type)
- Coaxial Power Combiner
- RF cavities for linear accelerator both normal conducting and super conducting designed to work both in CW and pulsed mode operation.

Particle Physics Activities & Particle Physics Interest:

TTI has experienced technical staff for defining the conceptual, detailed and manufacturing design related to particle physics installations, is able as well to take over the responsibility of the integration, testing, validation, commissioning and starting-up. TTI can also provide staff for maintenance and diagnostic for controlling related installations.

Main areas of interest within particle physics activities are:

- Diagnostics, plasma heating and control Systems, Power Amplifiers
- RF Passive Devices

- RF and LLRF Devices
- Test Bench and other similar equipment o Machine Assembly
- Auxiliary Systems
- Engineering and Services o Remote Handling

Particle Physics main contracts awarded and R&D Projects:

IFMIF/EVEDA:

- Design and manufacturing of the prototype RF chain
- Detailed design of protection system/devices HW/SW of RF module.
- Design and manufacturing of Test Bench for High Power RF coupler conditioning.

CERN:

- Design and supply of the X-band Bi-directional coupler with RF pickups.
- Supply of driver amplifiers of the new power amplifier for the SPS 200 MHz RF system

UNAC RESEARCH FACIUTYfor HUELVA UNIVERSITY

- Design and Manufacturing of a standalone 1.2 kW Solid State Power Amplifier @80Mhz.
- Design and manufacturing of high gradient superconducting quarter-wave resonator RF cavity.

R&D projects:

- ACELTEC (INTERCONNECTA-CDTI): Design and development of High Gradient Superconducting RF Cavities for Particle Accelerator Applications
- GASP (INTERCONNECTA-CDTI): GASP (INTERCONNECTA-CDTI): Superconducting Gantry development for proton therapy

ESSBILBAO:

- Detailed design of high power inductive coaxial couplers water cooled and air cooled, capable to stand up to 400 kW for a RFQ.
- Detailed design of a coaxial cavity for the high power conditioning of the coaxial coupler

SSPA 1,25KW 200MHz

INDUSTRIAL COMPANY	CIVIL ENGINEERING						MECHANICS AND MECHATRONICS				ELECTRICAL SYSTEMS				ELECTROMAG-NETISM AND SUPERCON-DUCTIVITY			RADIOFREQUEN SYSTEMS				
	Site Adaptation Works For Particle Accelerators	Design and construction of buildings for accelerator facilities	Clean rooms	HVAC systems(heating, ventilation, air conditioning)	Fire detection and safety	Electrical systems for buildings	High precision mechanics and mecatronics	High precision alignment and metrology	Design and manufacturing of large mobile structures	Design/manufacturing support structures: girders, insertion devices supports,etc. RF power systems design	Design/manufacture of power convertors for accelerators	Design/manufacture of high stability power supplies for magnets	Pulsed power technology	Manufacturing of superconducting cabling	Design/manufacturing of warm magnets	Design/manufacturing of superconducting magnets	Design/manufacturing of permanent magnets	Design/manufacturing of RF warm cavities	Design/manufacturing of RF superconducting cavities	Design/manufacturing of RF accelerator structures	Design/manufacturing of waveguides	Design/manufacture of RF preamplifiers and amplifiers
ALIBAVA SYSTEMS																						
ALTRAN INNOVACION							●															
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CY			CRYOGENICS AND VACUUM				TARGETS, DETECTORS, INSTRUMENTATION AND SOURCES								SOFTWARE AND CONTROL							RADIOACTIVITY PROTECTION		SPECIALIZED MANUFACTURING PROCESSES		
Design/manufacture of RF modulators	High voltage power supplies for RF structures	Integration RF power systems	Design/manufacturing of vacuum vessels	Design/manufacturing of ultra high vacuum systemscavities	Design/manufacturing of cryomodules	Cryogenic plants and systems	Particules targets for experiments	Optomechanic instrumentation	Semiconductor and Gaseous type detectors	Scintillation--type detectors	Beam diagnostics systems	Low--noise electronics	Design/manufacturing of proton/ion sources	Lasers	Advanced data storing and processing	Design of simulation tools	Accelerators/storage ring control systems	Timing and synchronization systems	Machine protection systems	Personal safety systems	Remote handling for radioactive environments	Radioprotection materials	Radiation monitoring and safety	Radiation monitoring and safety	Welding and special union processes (EBM brazing, bonding..)	Special materials manufacturing (Niobium, Boron Nitride, CU (ex O2,) ..)
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