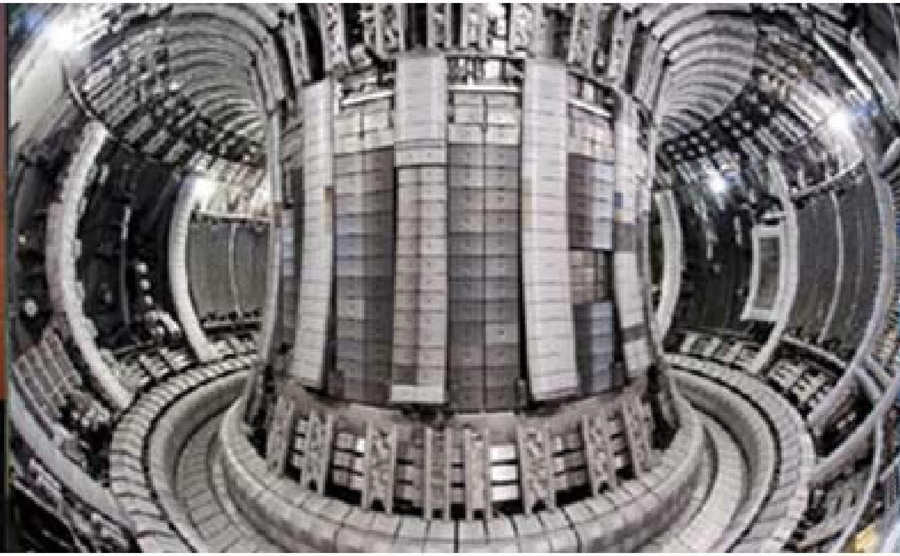
LEADING
METAL-MECHANIC SOLUTIONS

Evolving
With You

Experience in Science Facilities of
L E A D I N G   G R O U P


BRIEF HISTORY

1971 Located in San Felices de Buelna, Cantabria, Spain, Leading Enterprises Group, formerly Mecánica Industrial Buelna SL, started the activity in precision machining parts and industrial maintenance.

1985 Leading expands its local market at a regional level. Progresses towards the manufacturing of casting molds and tools.

1993 Leading incorporates precision machining and supply chain management related to molding. The market expands nationally.

2005 Leading expands the supply chain management, initiating a corporate sale process, developing specific investments for them and for the incorporation of finishing operations such as induction hardening.

2007 Leading experiences a qualitative leap forward in the quality of documentation management and specialization in two strategic sectors: Oil & Gas and Defence.

2010 Leading started working in the industry of science with engineering design, engineering and manufacturing engineering, calculation and machining of special materials (Be). Together with clients, product innovation in terms of design, materials and processes are developed.

2015 Aerospace market drives us towards a new evolutionary step, incorporating mechanical and electrical applications for metal solutions. Leading investments develops in a clean room where encapsulation processes, such as HIP and joining are performed.

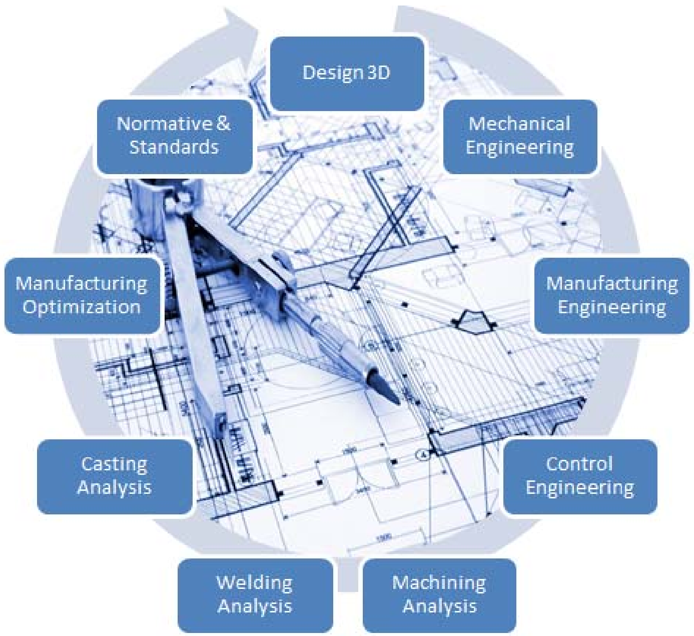
2019 Leading in association with ENGIE (France), ANSALDO ENERGIA (Italy), ORTEC GROUP (France) and SIMIC (Italy) is awarded with the ITER ASSEMBLY CONTRACT. The ITER (International Thermonuclear Experimental Reactor) is an international nuclear fusion research and engineering megaproject.

2021 Leading in cooperation with EAI is awarded with the series fabrication of the ITER First Wall Panels that completely cover the inner walls of the ITER vacuum vessel isolating the fusion reactor from the heat and high-energy neutrons produced by the fusion reactions.

Leading
Holding

- **LMMS** — Machining Joining Coatings (Spain)
- **SMM** — Beryllium Technics (Spain)
- **LI** — PM & QA Engineering (Spain)
- **EPS** — Oil & Gas Systems (Spain)
- **LS** — Industrial Services (Spain)
- **FBL** — Fusion Technologies (Spain)
  - LEADING METAL-MECHANIC SOLUTIONS
  - EMPRESARIOS AGRUPADOS
- **DYNAMIC** — Nuclear Assembly (France)
  - ENGIE
  - ANSALDO
  - ORTEC
  - SIMIC S.p.A.
  - LEADING METAL-MECHANIC SOLUTIONS


Facilities
1.Headquarters, Engineering, R&D
2.Machining Workshop
3.Special Materials Workshop
4.Joining Technics Workshop
5.Cleaning Rooms Area
6.Coatings Area
7.FAT Area
8.On-Site Services
9.Warehouse
LEADING GROUP
Facilities



+

Engineering

Integrated Manufacturing

Management

Project Management
Supply Chain Management (SCM)
Quality Assurance Management (ISO 9001)
Safety Management (ISO 45001)
Continuous Improvement Process (CIP)
Environmental Management (ISO 14001)
Total Productive Maintenance (TPM)

Standards Management

Nuclear Standards (RCC-Mx and ASME)
Military standards,
ISO, ASTM, PED, ESP/ESPN

Product engineering

Manufacturing Engineering
Tooling Modelling 3D & FEM
Manufacturing Process Engineering
- CAM (Computer-Aided-Machining)
. Casting
- Welding
- Complex Joining

Innovation

Business Innovation
Product Innovation

Machining Technologies:

Precision Machining of Exotic Materials: Duplex, Inconel, Hastelloy, Titanium....
Beryllium Machining

Joining Technologies

Welding Machines: GTAW, SMAW, GMAW, SAW
Orbital Welding Laser Welding System
Canning for HIP Process

Coatings

PVD

Assemblies

Assembly in a Clean Room under Controlled Conditions of Humidity and Temperature

FAT Testing

Metrology
Leak Testing
Pressure Test
Hot Helium Leak Test Chamber
Ultrasonic Testing

Precision Machining of Exotic Materials
Casting Models
(4.000 m²)

CNC MACHINING CENTERS (10): 3, 4 and 5 axes. Turning capacity, size 1m³
CNC BORING MACHINE (3): Max. axes length 3m
CNC TURNING CENTERS (6): Ø1000 x 3000
CNC VERTICAL LATHE(1): Ø2000x 2000. Milling capacity
ELECTRICAL DISCHARGE MACHINE (2)
Wire erosion and die sinking
SURFACE GRINDER

5 axes CNC Machine Center

CNC Boring Machine

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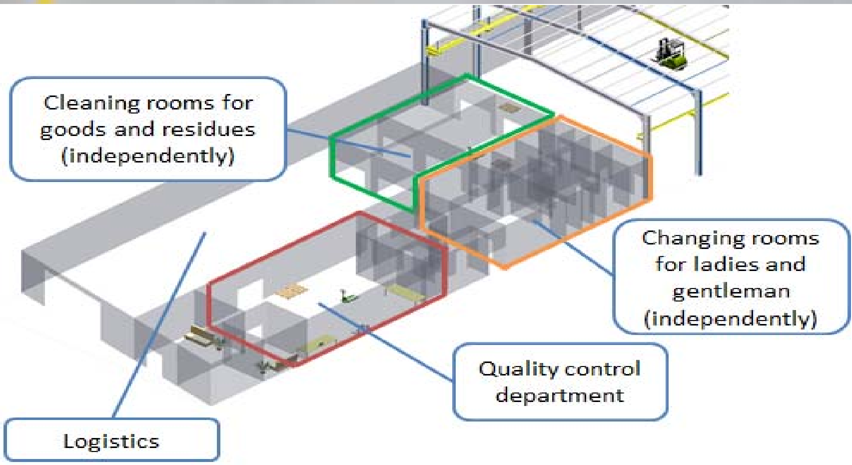
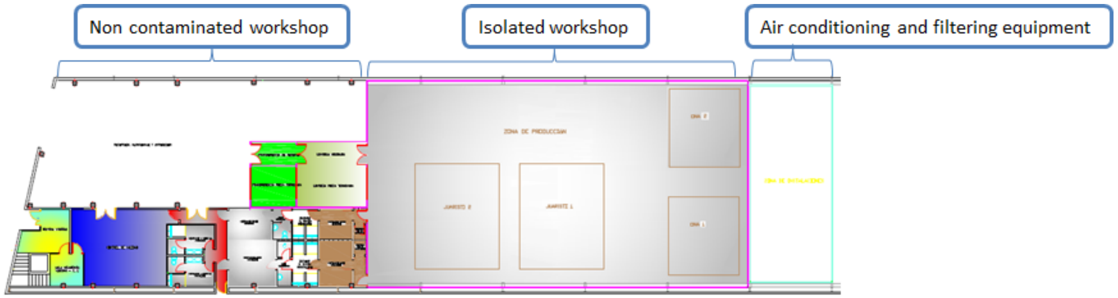
MANUFACTURING CAPABILITIES
Beryllium Machining & Assembly

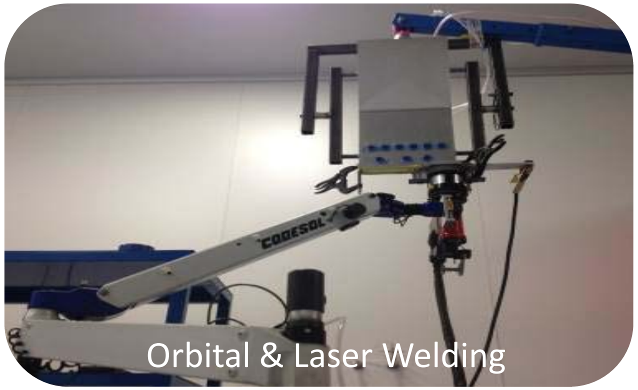




Joining Technics
Complex Welding Technics: Orbital & Laser Welding
Coatings
Assemblies
FAT Testing
(3.000 m²)

Welding Machines dc/ac (MIG/MAG/GTAW), Welding Machines dc (SMAW), Welding TIG, Inverter Welding TIG Hf pulse, Welding Positioners (1Tn, 5Tn, 10Tn), Roller (3.5Tn), Crane (20Tn), Ovens.....
Orbital & Laser Welding
PVD Coatings
Clean Rooms

MIG, MAG, GTAW, SMAW and TIG Welding



Orbital & Laser Welding

Mechanical & Mechatronics Assembly

Physical vapor deposition (PVD) is a vacuum deposition method which can be used to produce thin films and coatings for mechanical, optical, chemical or electronic elements.
The deposited material goes from a condensed phase to a vapor phase and then back to a thin film condensed phase.

Technical characteristics:

- HiPIMS technology
- PVD capacity thicknesses: up to 12µm
- Max rate of 2 µm per hour
- Deposition technique used: sputtering
- Vacuum chamber size: Ø400mm x 400mm
- Wide variety of materials can be coated.

CLEAN ASSEMBLY

3 x 240 m2 clean room
Class 8 under ISO 146441
Class 100.000 under Federal Standard 209D

GEOMETRIC & DIMENSIONAL CONTROL

- ✓ 1 Automatic 3D CMM GLOBAL 2500 x 2500 x 1400
- ✓ 1 Automatic 3D CMM Brown & Sharpe (3) 1500 x 1000 x 900
- ✓ 1 Digital Measuring Column MAUSER V5 O6
- ✓ 1 Roughness tester HOMMEL ETAMIC W20
- ✓ 2 Mitutoyo roughness tester SURFTEST-301-mod
- ✓ 1 Future-tech micro-hardness tester FM700 A mod
- ✓ All type of manual measuring equipment (internal and external micrometers……)

NDT

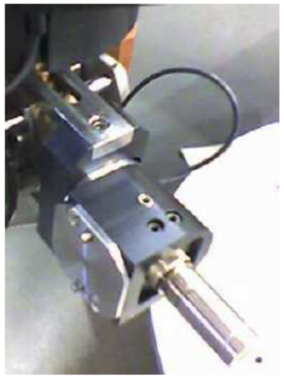
- ✓ Pressure Test
  - 1 Automatic Valves Test Bench Up to 12" ANSI 300
  - 1 Manual Test Bench Up to 15000 PSI (1050 bars)
- ✓ Ultrasonic Testing Equipment for series production
- ✓ Hot Helium Leak Test Chamber (HHLT)

VISUAL & LIQUID PENETRANT

- ✓ Certificate of Visual and Liquid Penetrant Inspection Level II.
  - Method MSS-SP-55/ASME V Art. 9
  - Scope: Castings, forgings and welds
  - Standard SNT-TC-1A
- ✓ Certificate of Liquid Penetrant Examination Level II.
  - Method ASTM E165/ASME V Art 6
  - Scope: Castings, forgings and welds. Visible & Fluorescent technique
  - Standard SNT-TC-1A/ UNE-EN-ISO 473 & 9712

Suitable inspection and NDE techniques have already been developed and employed in LEADING. The level of automation of the NDE examination can help to reduce the whole manufacturing times, in this regards the proposed system are fully automated solutions and consists of one inspection zone improving the inspection process to allow a full processing of all parts in a single facility, taking into account health & safety surveillance to avoid cross contamination with beryllium and the components without this material.

The UT inspection facility will consist in a single robot system and tanks for immersion of tests parts. The robot system is a versatile solution able to hold different tools (end-effectors) for inspection and teaching of the parts. The system has two dedicated tanks so components with different materials can be separated from the rest to avoid the cross contamination.The control software application includes built-in functions that execute the required movements and operation sequences, so the system picks and releases each inspection tool in an automatic way, from the operator desk.



Parameter	Values
Frequency	1 – 10 MHz
Diameter	6 – 25 mm
Focal depth	20 – 200 mm

The system uses a conventional mono-element UT probe for pulse-echo inspection installed in the end-effector with characteristics adapted to each specific bonded line inspected. In the following figure is included some reference parameters as an example

HHLT is a test to ensure acceptable leak tightness of the internal hydraulic circuit of a component. It's performed within a vacuum chamber.

Technical characteristics:

- External: L 5500 x W 3670 x H 4000mm.
- Internal: L 2000 x W 1600 x H 3000mm.
- Stainless steel chamber (1.430 l) with one large sliding door for easy access to the process equipment.
- Double O-Ring sealed stainless steel door with interspace evacuation.
- Inner and outer surfaces are glass-blasted and in clean vacuum compatible conditions.
- Galvanized gratings for better access into the chamber.
- Including all required flanges and connections. Outer chamber wall equipped with water loops for cooling.


LEADING METAL-MECHANIC SOLUTIONS
LEADING METAL-MECHANIC SOLUTIONS, S.L.
FUNDACIÓN LEADING INNOVA (CT INNOVA)
ISO 9001:2008

ISO 9001: 2008


LEADING METAL-MECHANIC SOLUTIONS, S.L.
ISO 14001:2004

ISO 14001: 2004

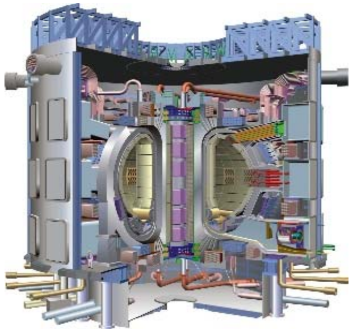

LEADING METAL-MECHANIC SOLUTIONS
LEADING METAL-MECHANIC SOLUTIONS, S.L.
FUNDACIÓN LEADING INNOVA (CT INNOVA)
EN9100:2009

EN 9100: 2009


LEADING METAL MECHANIC SOLUTIONS, S.L.(LMMS)
OHSAS 18001:2007

OSHAS 18001: 2007

NUCLEAR FUSION



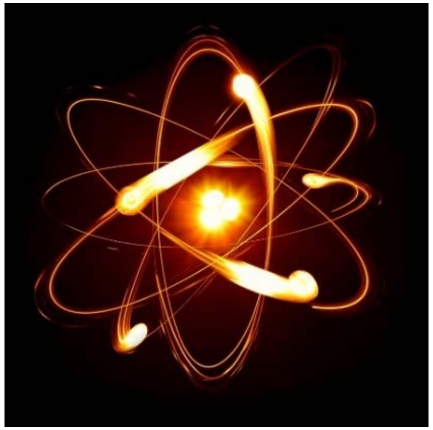
ITER Engineering Support (F4E-2008-OPE-17) – ITER (2009)
Manufacturing of the Semi-Prototype ITER FIRST WALL PANELS - F4E-OPE-394 – ITER (2012)
Manufacturing of the Full Scale Prototype ITER FIRST WALL PANELS F4E-OPE-443 (IV-PT) – ITER (2014-Present)
F4E-OPE-0805 - Splice Plate Custom Machining for the JT-60SA Magnet – ITER (2016-Present)
F4E-OPE-0833 - Manufacturing of Prototypes of the Supports of the Blanket Cooling Manifold System and Application of Coatings on Different Items – ITER (2018-Present)
Sub-assemblies for ITER Vacuum Vessel – AMW (Ansaldo Nucleare & S.p.A, Mangiarotti S.p.A) (2017-Present)
IO/17/CFT/10015153/ABN - Tokamak Assembly Preparation Building Engineering – TRACTEBEL (2018-Present)

NUCLEAR FISION

Olkiluoto Limonite Ring Engineering – AREVA (2009)
ESBWR Generator Engineering – ENSA (2009)
Design of tooling for road transportation for KRSKO Reactor – ENSA (2009)
Platform for Lifting – ENSA (2009)
Design and calculation of component for helium leaking test in WATERFORD steam generators – ENSA (2010)
Jules Horowitz Reactor Engineering Manufacturing Support – AREVA (2013)

OIL & GAS

FEN JIE – HAYWARD TYLER (2015)
HE LIN – HAYWARD TYLER (2015)
Colectores Kaombo – SIEMENS (2015)
K2G3G – SIEMENS(2015)
Hot Stab Test Frame Assembly – FREUDENBERG OIL & GAS TECHNOLOGIES (2015)
Brutus – FREUDENBERG OIL & GAS TECHNOLOGIES (2015)
Exhaust Collector – SIEMENS (2016)
TZN – FAURE HERMAN (2016)
Kambo Scope 1– FREUDENBERG OIL & GAS TECHNOLOGIES (2016)



NEUTRONS SCIENCE

Manufacturing 1St Prototype Target Cassette – ESS Lund (2015)
Manufacturing 2nd Prototype Target Cassette – ESS Lund (2016)
Target Shaft Engineering Design – ESS Lund (2016)
Target Bricks Manufacturing – ESS Lund (2016)
Target Dummies Manufacturing – ESS Lund (2016)
Manufacturing 36 Series Target Cassettes – ESS Lund (2016-2018)
Target Monolith Vessel Engineering Design – ESS Lund (2016-2017)
3 x Proton Beam Window Prototypes – ESS Lund (2018-2019)
Aluminum blades for XTREMED detector project – ILL (2018)
TS1 Beryllium Reflector – ISIS (2018-2019)

ASTRONOMY

ESO Alignment Tool - PR025174/PQ006875/CNIE – ESO (2009)

AEROSPACE

Hubtail for T900 motor for Airbus 380 - Inconel 718 – AIRBUS (2007)
Motor part for aeronautics -Cobalt X-40 – ITP (2008)
Components for Airbus 380-Titanium – AIRBUS (2009)
Fabricación UMT 1710 – ITP (2016)
Bellmounth – ITP (2016)
Util Torno Fresa T1000 – ITP (2016)
Util mecanizado conexión de tubos T-1000 – ITP (2016)
STD1674 – ITP (2016)
Ultima fase II 1ª Pala – ITP (2016)
Mecanizado 2ª Pala Hub – ITP (2016)
Componentes de la salida de escape – TECHNOMECA (2017)
Utillaje para molde de resina de cola de un avión – MTORRES (2017)
Utillajes para Montaje y Punteado de Álabes - ITP (2018)

SPACCE & DEFENSE

Rocket Components & Systems MBDA (2007)
Critical Lifting Supports – NEXTER (2008)
ESO Alignment Tool - PR025174/PQ006875/CNIE – ESO (2009)
Submarine Collectors – NAVANTIA (2010)
Naval antenna Radome Base Support – INDRA (2015)
Machining Analysis; Naval antenna Radome Base Support – INDRA (2015)
Base for Navy Guns – MSI (2006-Presente)
MMR Radar – INDRA (2014-Presente)
LTR 25 Radar – INDRA (2014-Presente)

LEADING
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RAILWAY

Cast + machined Spares – RENFE (Regular supply since 1987)
Cast + machined Spares – METRO MADRID (Regular supply since 1999)
Cast + machined Spares – VOSSLOH AG (Regular supply since 2010)

CAR INDUSTRY

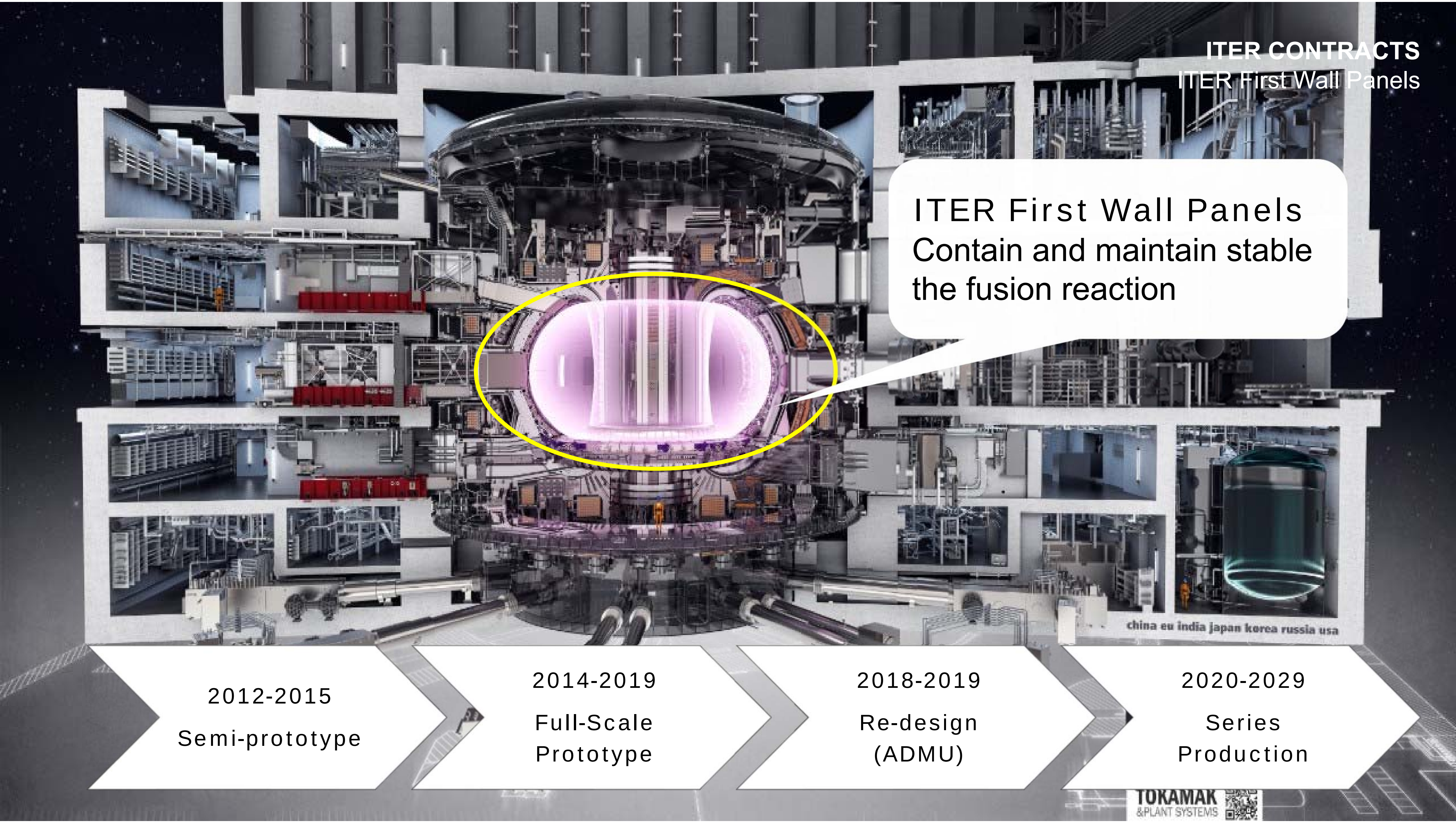
Machined components – NISSAN (Regular supply since 1971)

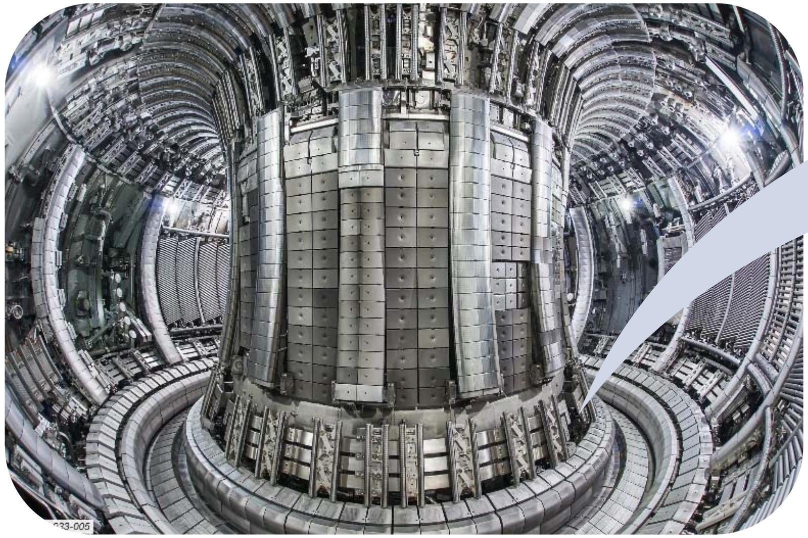
INDUSTRIAL VEHICLE

Mechanical systems– HAULOTTE (Regular supply since 2007)
Mechanical systems – CARTERPILLAR (Regular supply since 2012)

LIFTING

Motor Casings – ZARDOYA OTIS (2015)
Casings, pulleys, brake shoes and other components – SCHINDLER (Regular supply since 2005)
Motor Casings – ORONA (Regular supply since 2008)
Casings, Supports MACPUARSA (Regular supply since 2010)


ITER CONTRACTS
ITER First Wall Panels
ITER First Wall Panels
Contain and maintain stable the fusion reaction
china eu india japan korea russia usa
2012-2015
Semi-prototype
2014-2019
Full-Scale Prototype
2018-2019
Re-design (ADMU)
2020-2029
Series Production
TOKAMAK
&PLANT SYSTEMS



As the neutrons are slowed in the blanket, their kinetic energy is transformed into heat energy and collected by the water coolant. In a fusion power plant, this energy will be used for electrical power production.

The 440 blanket modules of SS, CuCrZr and Beryllium that completely cover the inner walls of the ITER vacuum vessel protect the steel structure and the superconducting toroidal field magnets from the heat and high-energy neutrons produced by the fusion reactions.

ITER CONTRACTS

TAC2 (ITER Tokamak Assembly Contract)

The company DYNAMIC SNC (société en nom collectif owned by ENGIE (France), ANSALDO ENERGIA (Italy), ORTEC GROUP (France), SIMIC (Italy) and LEADING (Spain) is in charge of the assembly, installation and commissioning of the Tokamak ITER Machine Assembly in Cadarache (France) during the Assembly Phase 1 which covers the major part of the assembly work for the Tokamak Machine. The ITER Tokamak Assembly is one of the major ITER contracts in terms of resources and complexity.

The contract includes the assembly of basic Tokamak machine with systems essential for First Plasma operation; the installations comprise permanent hardware, temporary equipment, replacing permanent hardware, such as the main in-vessel components, and captive components that cannot be installed in later assembly phases.

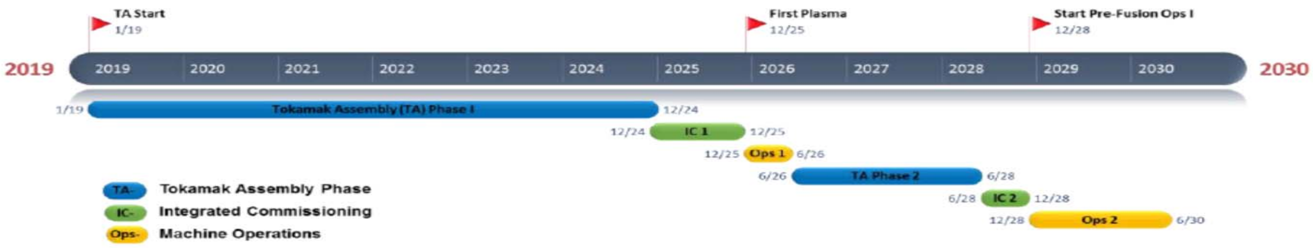
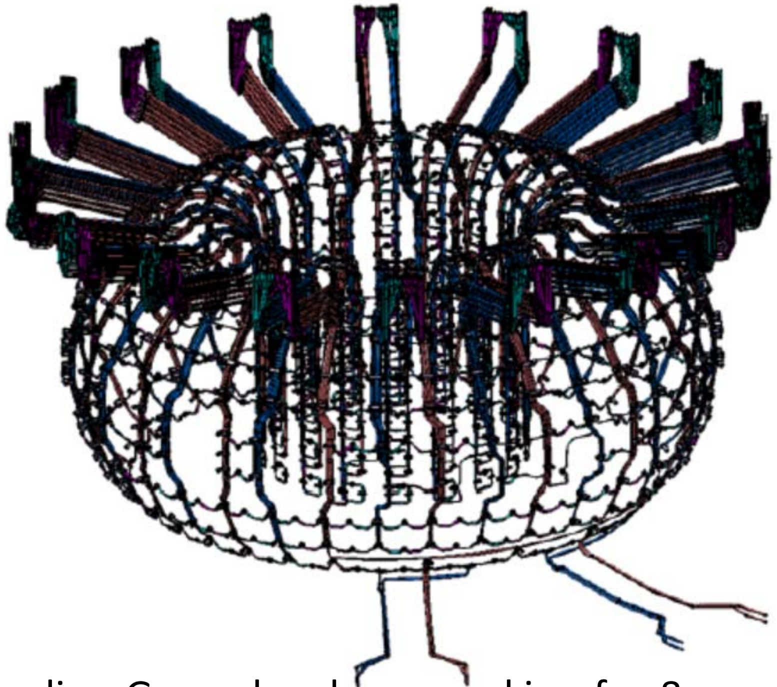
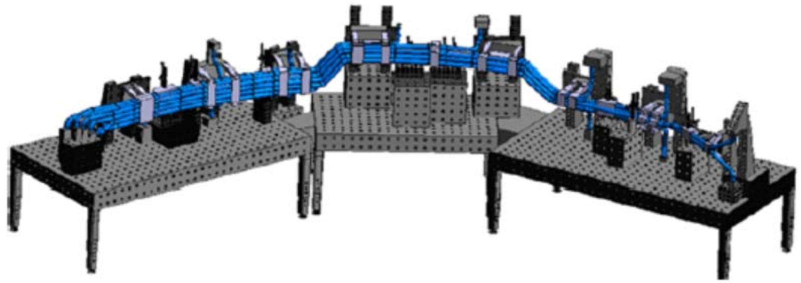
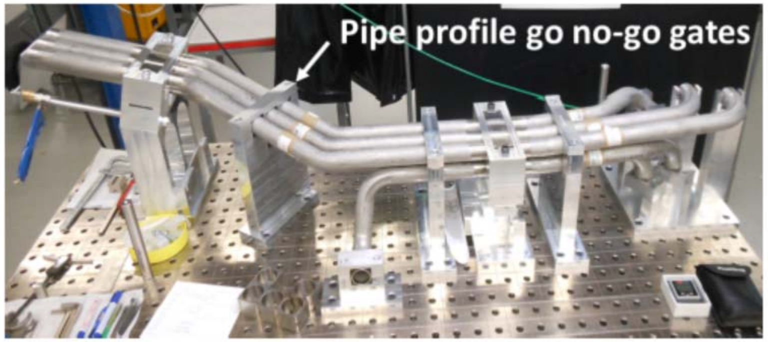


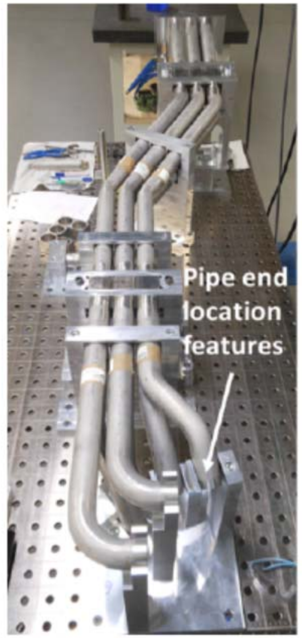
Figure 1 - Assembly Phases


ITER CONTRACTS
TAC2 (ITER Tokamak Assembly Contract)
Dynamic SNC completes ITER tokamak upending tool dry run.....
DYNAMIC



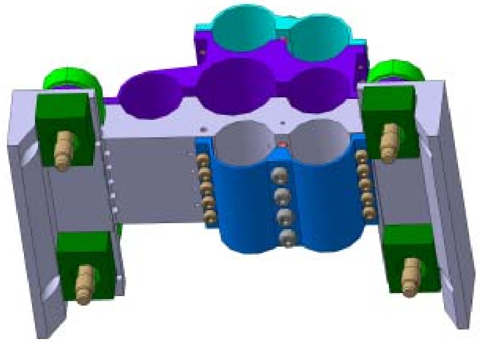


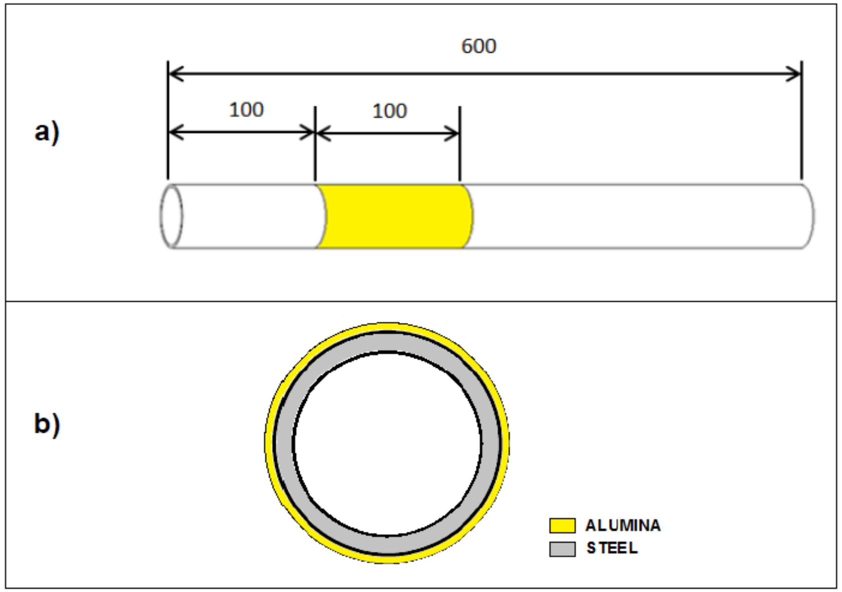




Leading Group has been working for 8 years in the Blanket Manifolds (MA). The MA are connected to the Tokamak Cooling Water Systems (TCWS) to transfer the 736 MW of energy deposited in the Blanket System. The cooling water is supplied to and returned from the independent Blanket Modules (BMs) through a piping system – the MA. The main function of this system is to transfer the heat deposited in the BMs to the outside of the VV and mitigate overheating.
The MA consists of 363 cooling circuits feeding 440 BMs which are routed through 18 Upper Ports and 2 lower ports into and out of the VV, as shown in Figure 1. Most of these circuits are connected to individual BMs, which helps achieve effective leak localization; however, some feed two or three BMs.

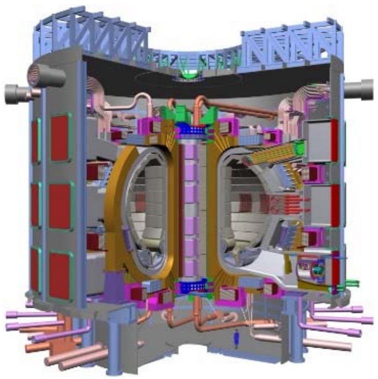
The supports of the MA include a “bridge” spanning between four anchor points, three profiled straps pressed onto the pipes by means of preloaded high strength bolts, four sleeves and spacers located between the legs of the bridge and the anchor points, and electrical grounding in the form of spiral springs.





An alumina coating was applied **by a High Velocity Oxygen Fuel process**. The detailed description of the process (including critical parameters and their values, inspection, packaging and delivery) was part of the deliverables.

Supply of engineering support in the area of plant systems. Call for tender Nº 2008-OPE-017 (ES-AC)



ITER (International Thermonuclear Experimental Reactor) is an international nuclear fusion research and engineering megaproject, which will be the world's largest experimental tokamak nuclear fusion reactor that is being built next to the Cadarache (France).
he project is funded and run by seven member entities—the European Union, India, Japan, China, Russia, South Korea, and the United States.
Construction of the ITER Tokamak complex started in 2013 and the building costs were over US$14 billion by June 2015. The construction of the facility is expected to be completed in 2025 when commissioning of the reactor can commence.

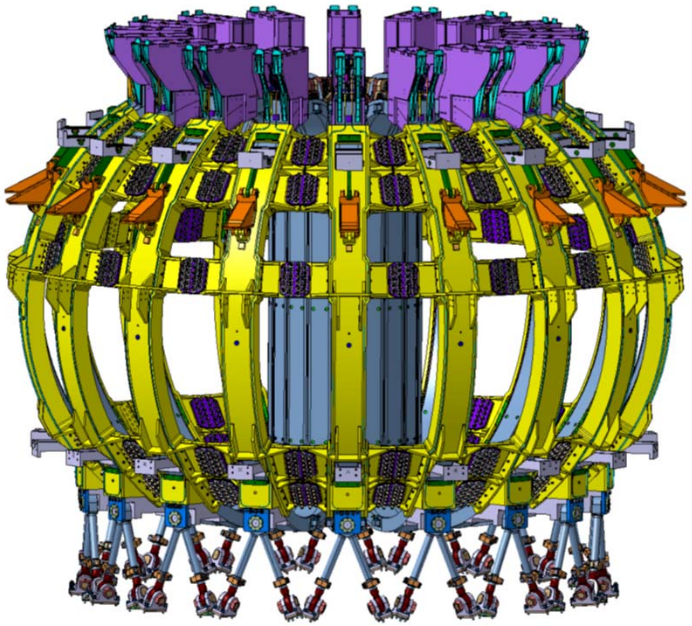
Award date:

- Contract notice: nº 2009-017074, published in the Official F4E Website on 11/02/2009.
- Consortium Agreement signed on 10/08/2009

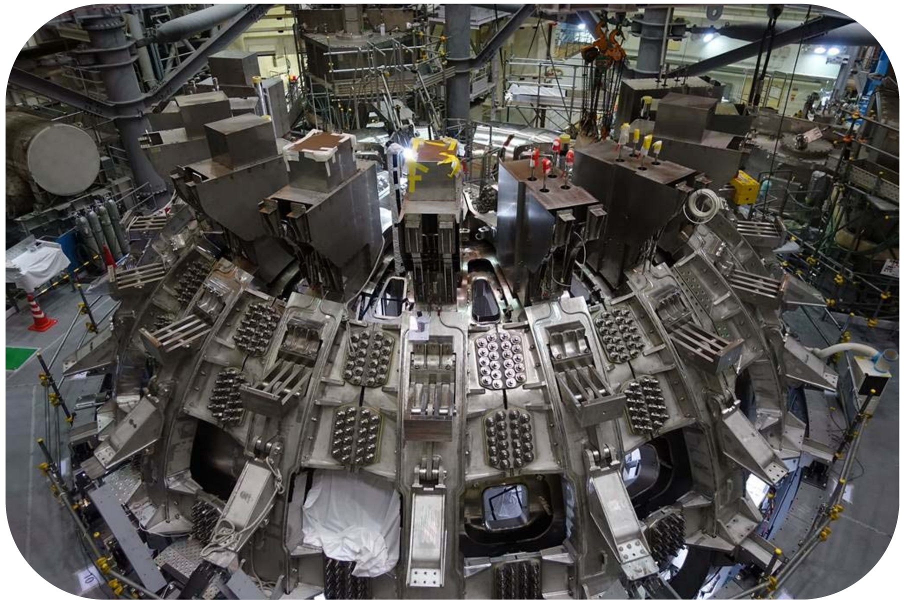
Scope of the project:

Provide plant engineering support in the fields of:

- Design of water cooling systems
- Design of heating, ventilation and air conditioning (HVAC) systems
- Design of cryoplant and cryodistribution systems and components including support for the optimization of cryoplants design, optimization of cryogens management and purification systems, preparation of cryogenics manual and process design studies
- Design of vacuum system
- Design of electrical systems, power converters (including those related to additional heating systems), emergency power supply (including seismic qualified equipment), high voltage substation and AC distribution systems at MV and LV levels.
- Support to assembly, on-site installation and commissioning of the electrical equipment and components
- Support to factory or onsite testing of the equipment and to integrated system acceptance tests; elaboration of the as Built documentation of the system
- Design of instrumentation and control systems
- Design of other plant services and networks
- Plant system integration: building and layout, interfaces…
- P&I diagrams and PFD diagrams
- Planning and budgeting for plant installation
- Integration studies of Test Blanket Module systems in ITER plant systems



Toroidal field (TF) magnet



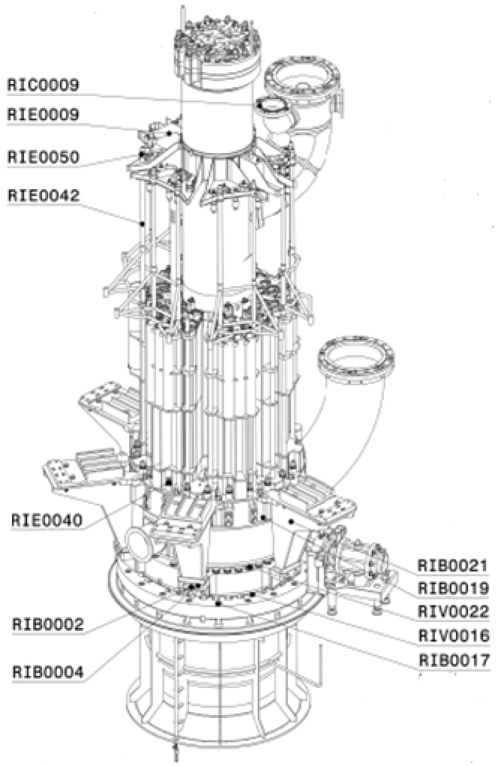
Splice Plates In TOKAMAK
Naka (Japan)

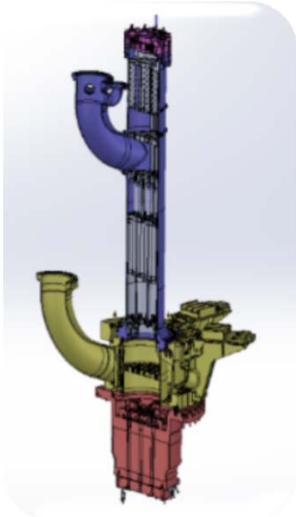
SPLICE PLATES

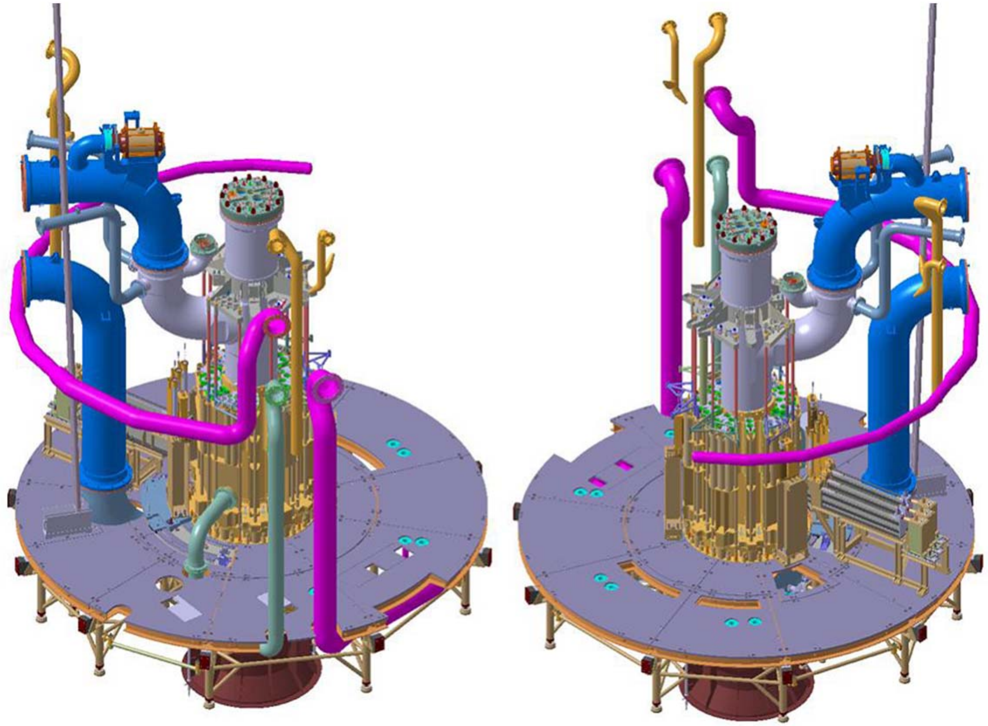
F4E must supply the toroidal field (TF) magnet for the JT-60SA tokamak. This will be made up of 18 large D-shaped superconducting coils.

Each coil will be delivered to the assembly site already pre-assembled with its Outer Intercoil Structure (OIS). During the installation of the coils, at the outer radius of the tokamak each sector of the OIS must be bolted to its neighbours using splice plates. Each pair of coils is joined by 5 pairs of splice plates.

Scope: detail design of the manufacturing process for the Jules Horowitz Reactor.





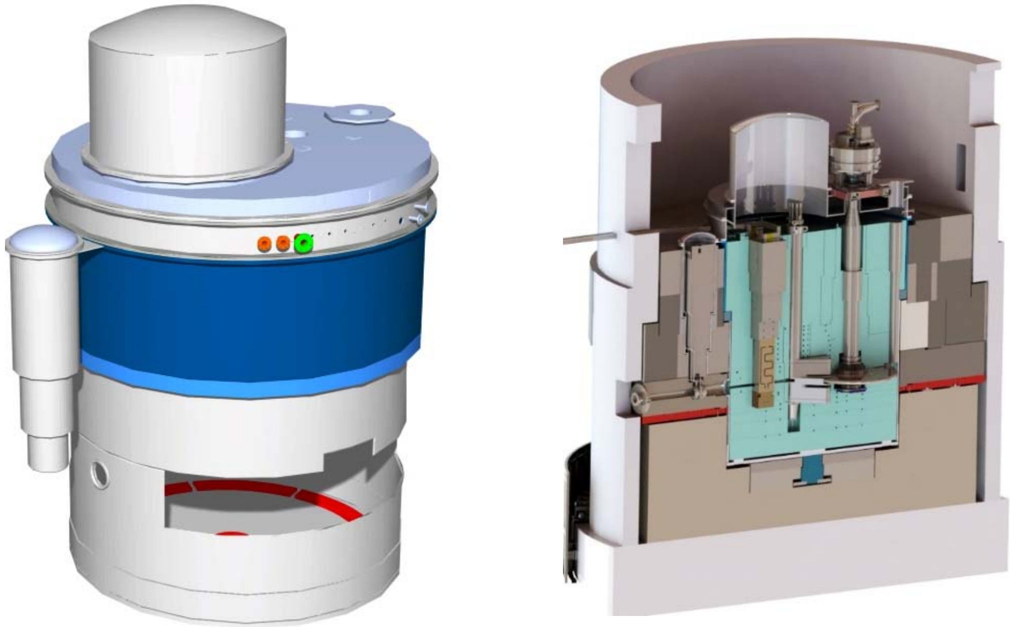


Main activities developed:

- Definition of the manufacturing process from the raw material till the assembly, control and machining operations.
- Identification of supplier for semi-finished and finished products.
- Definition of the main manufacturing phases and NDT controls according RCC code.
- FEM calculations in order to guarantee the deformations and stresses under yield strength during manufacturing operations.
- GD&T activities for all drawings to assure the manufacturability of all components.
- Definition of means associated to manufacturing (tooling, machining fixtures, etc.).
- Definition of means of assembly and adjustment.

The European Spallation Source (ESS) is a multi-disciplinary research facility based on what will be the world's most powerful neutron source. It is currently under construction in Lund, Sweden.

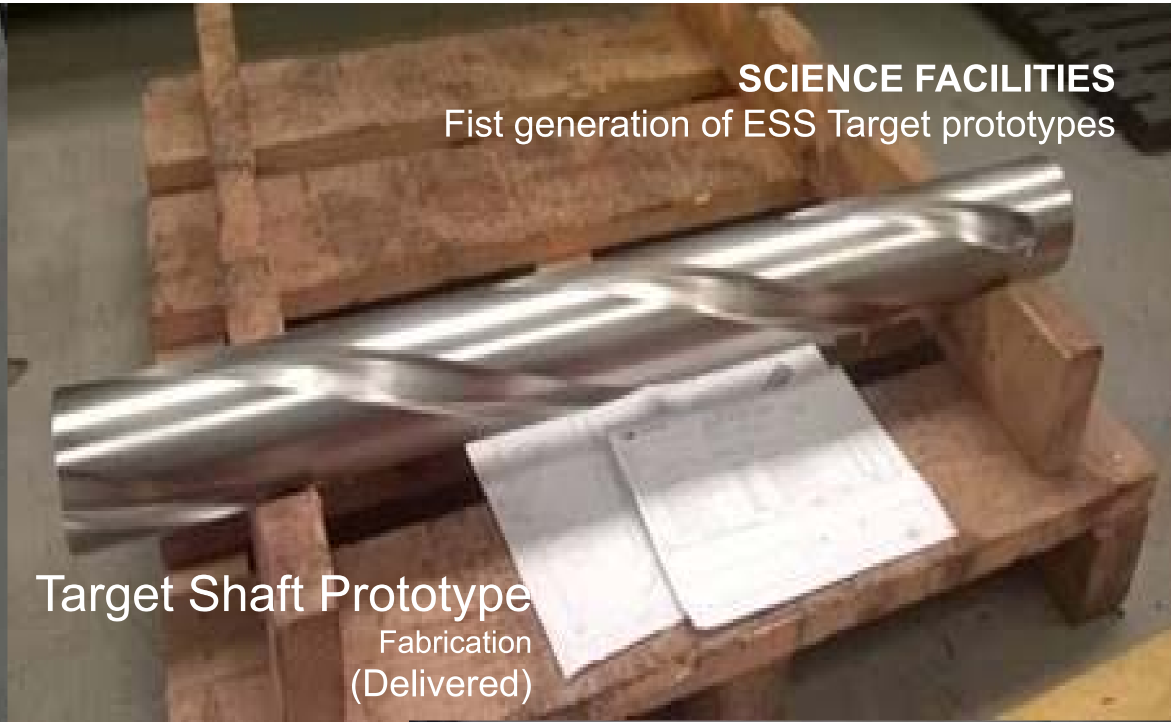
LEADING is working in **the design and manufacturing of the "ESS TARGET"** which function is to contain tungsten blocks to be impacted by the proton beam generated by setting the own neutron spallation source and to serve as a confinement, both vacuum and helium leak tight, to transfer and withstand structural loads, seismic loads and vacuum loads. The SS 316L components are manufactured by welding and precision machining technics.

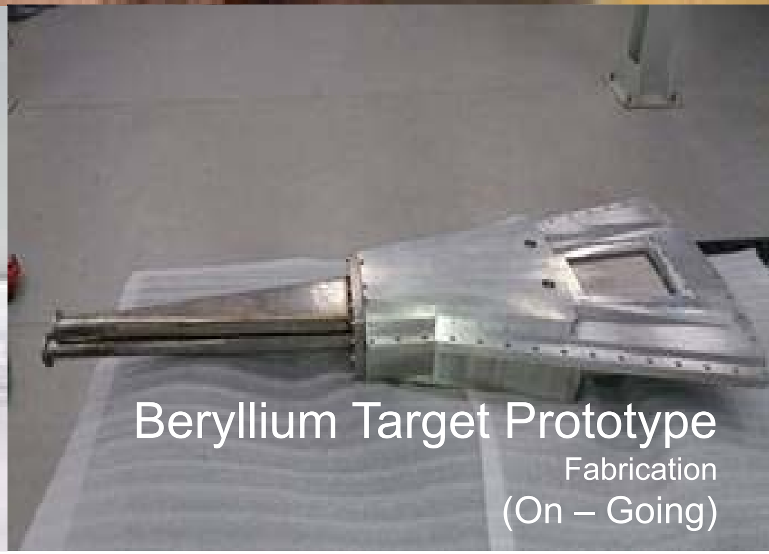


ESS Target Conceptual Design

SCIENCE FACILITIES

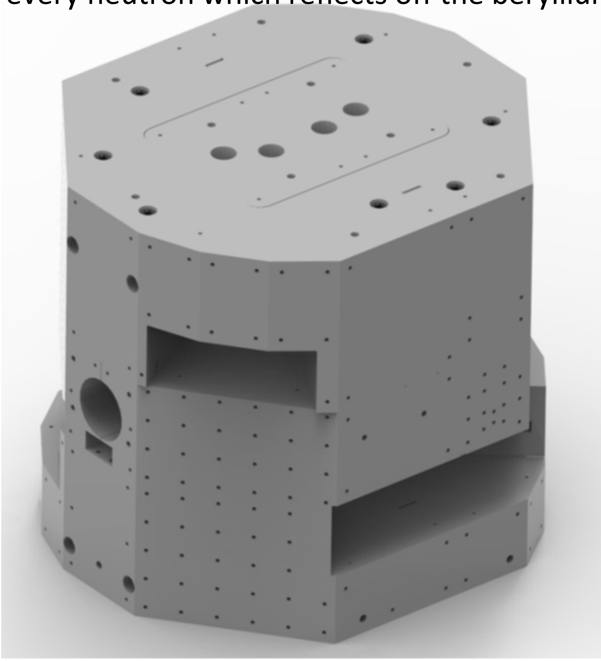
Fist generation of ESS Target prototypes



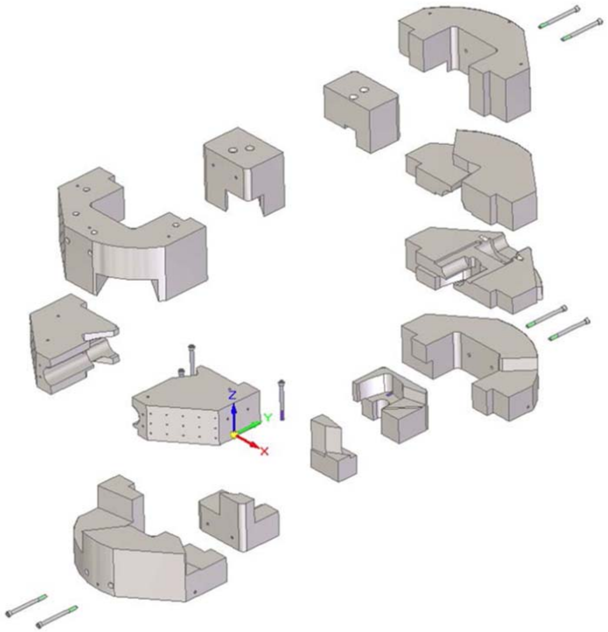


SCIENCE FACILITIES
ISIS Beryllium Reflector

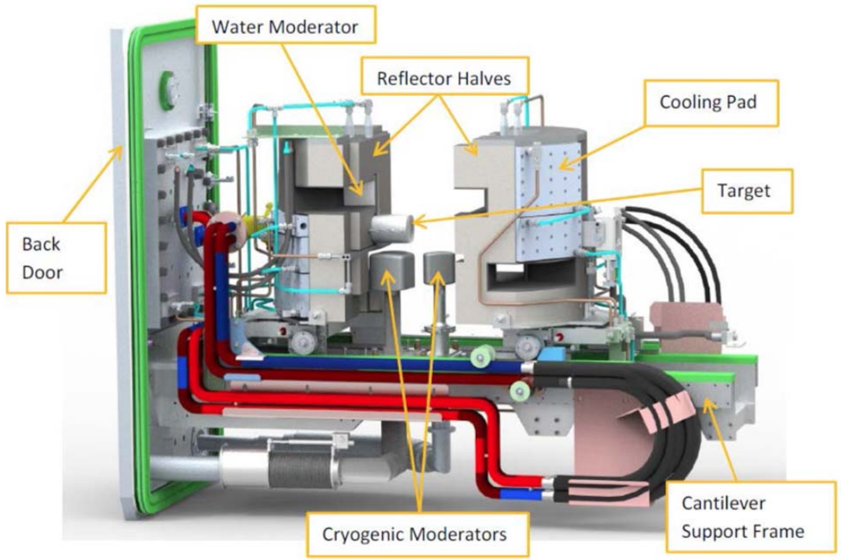
ISIS Neutron and Muon Source is a pulsed neutron and muon source. It is situated at the Rutherford Appleton Laboratory of the Science and Technology Facilities Council in Oxfordshire (United Kingdom). ISIS produces beams of neutrons and muons (sub-atomic particles) that allow scientists to study materials at the atomic level. The neutrons and muons are produced through the interaction of high energy protons (approximately 84% of the speed of light). The protons collide with the atoms in the target sending a shower of neutrons out from the target in every direction. However, in order for the neutrons to be useful, they must lose some energy by passing through the moderators. A beryllium reflector completely surrounds the target and moderators during operation, reflecting any neutrons which have escaped back towards the moderators. The beryllium also has the useful effect of multiplying the number of neutrons by two; for every neutron which reflects off the beryllium, two come back, a so called n-2n reaction.



A view of the reflector assembly in isolation. The circular hole at the front is where the proton beam enters and the cut-aways are the 'flight lines' down to the instruments



Exploded view of the modular reflector blocks



A labelled view of the TRAM assembly with the reflector in its split position, to allow the view of the target and moderators housed within it. For this image the proton beam would be entering from the right hand side

System to align the interfaces between the ALMA antenna and its station at the ALMA site in Chile, OSF and AOS. The design was done in such a way, that the tolerance requirements of the ALMA Antenna Station, Kinetic Mount Lower Part and the ALMA Antenna Station Embedded plates and vaults can be fulfilled ESO's requirements about assembly and final tolerance.

The tool was manufactured in the workshop of the Leading subsidiary company LMMS (Leading Metal Mechanic Solutions) in Buelna (Spain) according to the design of ESO:

- Completeness check of the delivery
- Verification that all parts are built according to ESO design
- Painting
- Workmanship check (no burrs, etc.)
- Dimensional control (key dimensions were measured and compared with the design)
- Functional test (possible height adjustment, equilibrium of tool without being pre-stressed).
- Site Acceptance Tests (SAT) After the completion, the unit was assembled and accepted at the premises of the manufacturer.