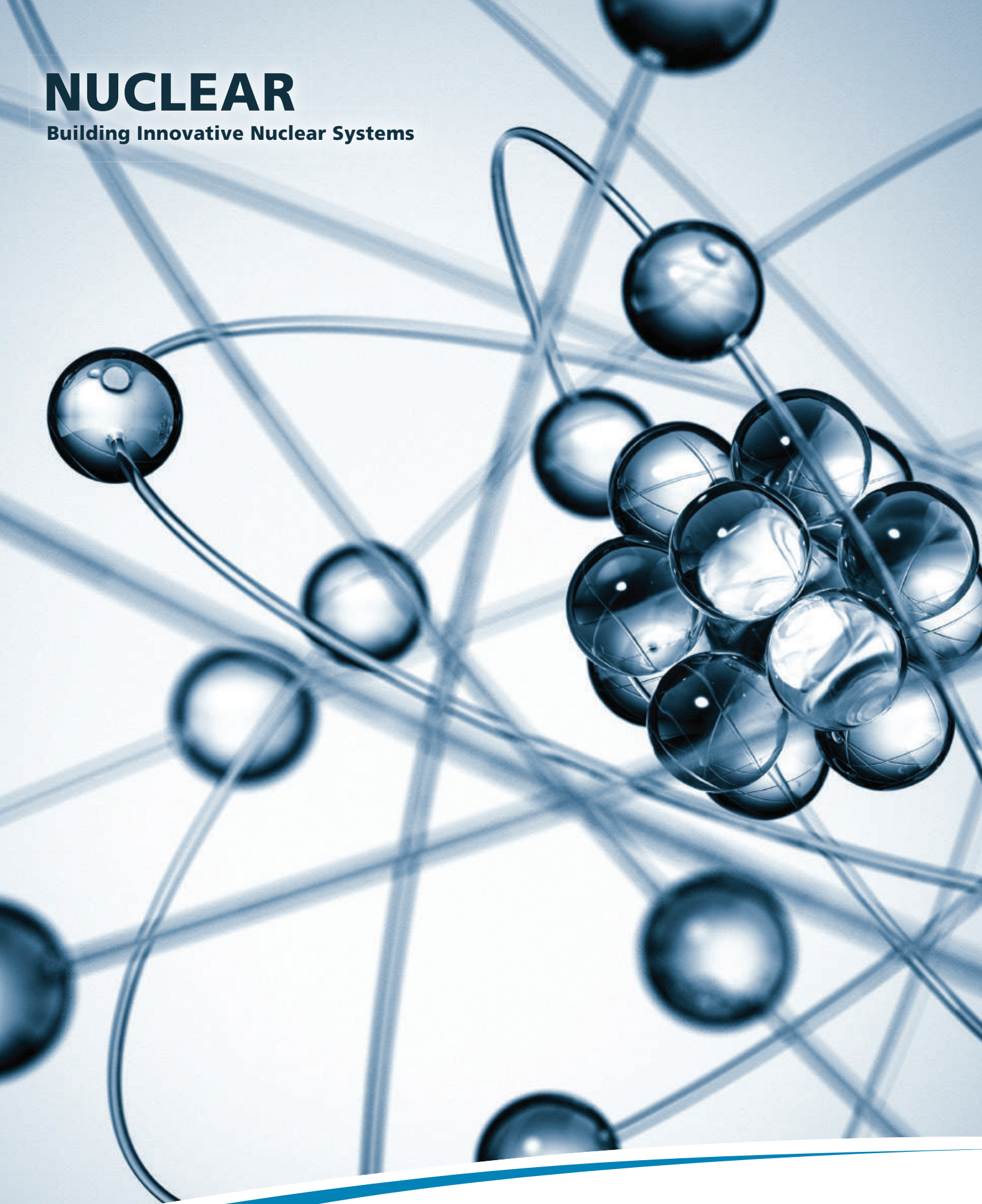


# NUCLEAR

Building Innovative Nuclear Systems



# QUALITY

# RELIABILITY

# EXPERIENCE

Established in 1856, CNIM designs and manufactures turnkey industrial systems and equipment with high technological content and provides expertise, maintenance and operation services in the Environment, Energy, Defense and Industry sectors. CNIM employs 3000 employees in 15 countries with a turnover of 727 million euros in 2015.

From design to commissioning, CNIM offers its customers tailored, competitive and quality solutions. CNIM's commitment to high-end technology products was reinforced in 2008 by the acquisition of Bertin Technologies. CNIM also owns 35% of TechnoPlus Industry (TPI), a key partner for precise machining and integration.

CNIM is present throughout the nuclear fuel cycle from uranium processing to reactor construction and maintenance, radioactive waste treatment and decommissioning. CNIM has also gained over the years extensive knowledge in supplying turnkey complex systems for Big Science. For over 40 years, Nuclear has been an integral part of the Group's strategy. It was again strengthened in 2015 with the acquisition of Saphymo, a world-recognized specialist in nuclear instrumentation.

1856

2008  
acquisition of

2015  
acquisition of

**CNIM**

**bertin**  
TECHNOLOGIES

**SAPHYMO**



## CNIM Nuclear Offer



Turnkey Nuclear  
Systems and  
Equipment



Leading-edge  
Nuclear  
Instrumentation



Engineering  
and Expert  
Services



Build-to-Print  
Nuclear  
Components



Nuclear Maintenance,  
Upgrade and  
Replacement Services



# TURNKEY NUCLEAR SYSTEMS AND EQUIPMENT

With a strong background and recognized experience of 40 years in the nuclear industry, CNIM is involved throughout the entire nuclear cycle.

From front-end engineering and design through commissioning, CNIM delivers turnkey systems and equipment for nuclear power and research reactors, and Big Science in compliance with nuclear codes and standards.

## Safe Handling & Transfer Systems

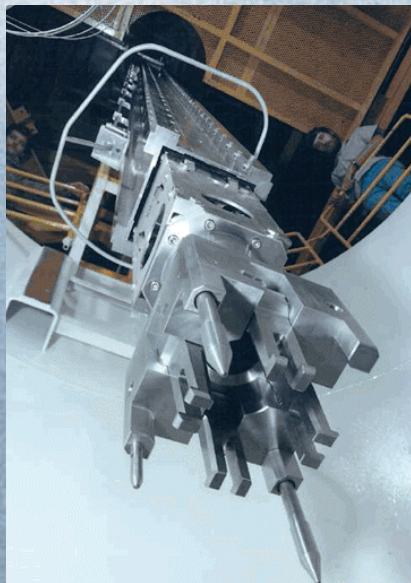
### Spent Fuel Cask Transfer Facility (SFCTF)

*Delivered to 20 Nuclear Power Plant Units in France (EDF), China (CGNPC) and Finland (AREVA)*



### Fuel Handling Equipment

*Fuel loading machine, fuel transfer system, fuel handling tools, hot cell handling equipment (Creys Malville, Tihange & Doel NPPs)*



### Automated Transfer System

*Multidirectional & Heavy Load. Remote transfer, handling and docking of safety components in a nuclear environment (CEA - Laser Megajoule Program)*



### Special Lifts

*10 lifts installed in NPP and nuclear facilities (EDF FLA3, CEA DAM)*

## Heat Exchangers & Pressure Vessels

Since its origins, CNIM has been designing and manufacturing pressure vessels, pressure tanks and heat exchangers of various materials (steel, stainless, alloys and composite) for the most demanding sectors such as Defense & Nuclear.



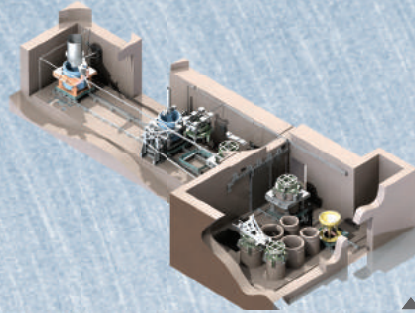
85m<sup>3</sup> - 40 T, working pressure 35 bar



Bespoke Absorption Chillers



## Radioactive Waste Processing

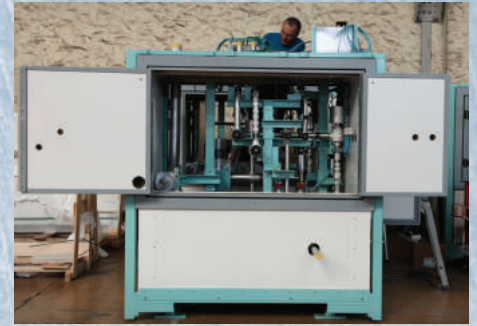


Site Radwaste Treatment Systems for Solid, Liquid and Gas Effluents  
(TES-TEU-TEP-TEG)

*Solid Effluent Treatment (TES) system for EPR NPP (AREVA - Flamanville 3)*

### UF6 Enrichment stations

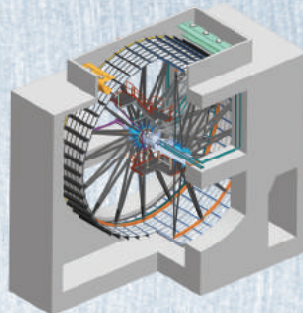
300 processing units delivered for the Georges Besse II Uranium Enrichment Plant (AREVA) ▼



## Filtration

### Sump Strainers

Classified water filtration system for the safety injection and containment heat removal systems. 30 units installed for 1300 and 1450MW French PWRs, EPR (AREVA), CPR1000 (China) and now designing Hualong HPR1000 (CNNC).



Drum screens ▲

Water filtration for cooling water intake stations. 4 sizes of equipment: 11, 15, 20, 22m diameter. Low maintenance, earthquake resistant, high anti-clogging efficiency.

### Silencers

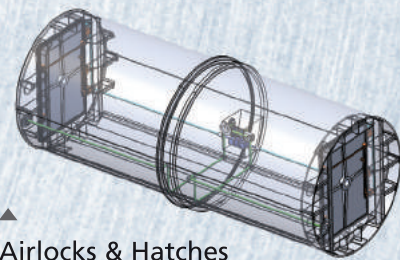
Reduce the noise generated by the steam dump valves when discharging. Over 200 units produced and installed worldwide.



## Doors, Airlocks & Hatches

### Radiological, Special & Security Doors ▶

Over 100 doors delivered for nuclear or secured facilities. Compliance to Earthquake, Fire, Tightness, Radiation, Blast, Thermal and Acoustic requirements.

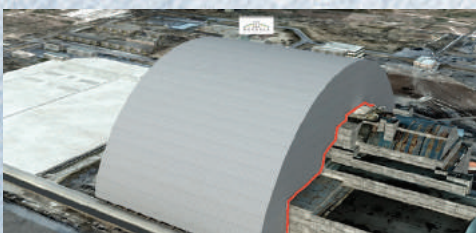


Airlocks & Hatches  
for Personnel & Equipment Access

*Personnel Airlock for Tihange NPP (Electrabel)*

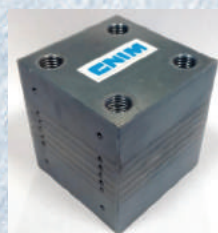
## Elastomere and Composite Material Components

CNIM offers invaluable expertise gained over 40 years of elastomere and composite material development for Defense and Nuclear programs.



Elastomere Membrane ▲

In June 2016, CNIM has started manufacturing the new 2 km long leaktight membrane for Chernobyl new safe confinement.



### Anti-seismic composite bearings

Qualified for 80 years lifetime in nuclear environment with a permanent load of 1200 T.

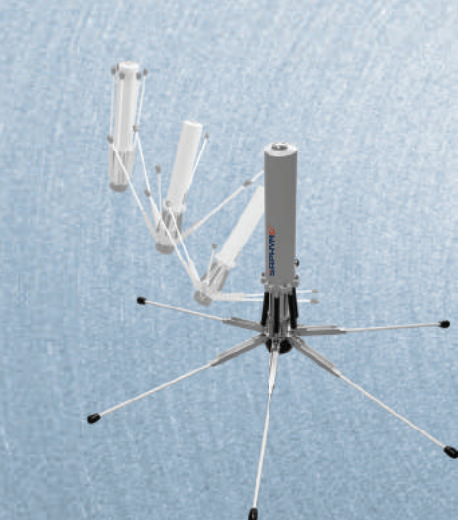


# NUCLEAR INSTRUMENTATION

For more than 60 years, Saphymo has been protecting nuclear industry workers and local populations as well as the environment, both in France and internationally. Merged with Bertin Technologies in 2015, Saphymo has developed dedicated products and systems in operational dosimetry, Radiation Monitoring Systems, contamination control, access control, environmental protection and survey meters.

## Environmental Radiation Monitoring Systems

More than 4000 sensors in operation covering over 40 countries all over the world.



### Autonomous gamma monitor for emergencies

**GammaTRACER SPIDER** is an autonomous self-erecting dose rate probe designed for emergency response enabling a fast deployment to ensure maximum protection to first responders.

### Stand-alone radiation monitoring probe

**GammaTRACER** is an autonomous probe designed to measure, record and transmit the environmental gamma radiation dose rate.



### Intelligent gamma spectroscopic probe

**SpectroTRACER** is a continuous measurement system for low contamination of air, soil or water. The device performs a spectrometric analysis to identify the radionuclides detected.



## Health Physics Equipment

Saphymo dosimetry management system safely protects people exposed to radiation. As of today, more than 20 000 dosimeters are operating in French Nuclear facilities.



### Operational electronic dosimeter for X and Gamma rays

**Saphydose** dosimeter monitors the exposure to gamma radiation in real time. It warns workers when dose or dose rate has been exceeded to allow quick reaction minimizing the exposure.

### Handheld contamination and survey meter

**MiniTrace** contamination and survey meters are designed to improve the safety of workers in control areas. Its simple use allows fast and easy detection of possible contamination spots.





# Access Control - Radiodetection for pedestrian & vehicles

A new generation of portal monitors. More than 3 000 portals already in operation in over 40 countries.

## Gamma Radiation Portal Monitor

**SaphyGATE** is a spectroscopic portal monitor designed to detect very low level of radioactive sources carried by vehicles minimizing false or innocent alarms without traffic disruption.



## C3 Portal (Vehicle or Pedestrian)

The C3 portals can detect any traces of contamination leaving an access-controlled area or site within a nuclear facility. They are designed for a quick and reliable control even for a very low activity detection.



## Advanced Gamma Spectroscopic Portal Monitor

The **DIRAD** is an automatic and real time gamma spectroscopic portal monitor. It is designed to monitor and identify radioactive sources on pedestrian.

## Professional Services

Saphymo is committed to taking part in every stage of the products and systems lifetime to ensure customer satisfaction.

After sales solutions have been set up to maintain the products in good working conditions throughout their operational lifetime (compliant with CEFRI-E & COFRAC standards). Saphymo also offers bespoke solutions to address specific customer needs.

A team of experts & specialists provides assistance on Nuclear equipment (supplied by Saphymo or other manufacturers) in the following areas:

- Technical support / Training
- Factory maintenance / Spare parts
- On-site: Assistance / Installation / Commissioning / Maintenance



**bertin**  
TECHNOLOGIES

**SAPHYMO**

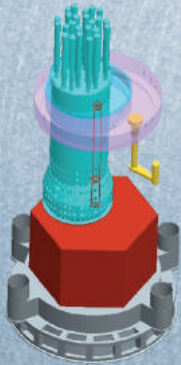
**ENIM**  
Innovate and Act



# INNOVATIVE ENGINEERING AND EXPERT SERVICES

CNIM and its subsidiary Bertin Technologies support nuclear reactor development programs in a multidisciplinary approach from Front-End Engineering Design (FEED), Optioneering, Industrial Feasibility Assessment, Modeling to Basic & Detail Design. In addition, CNIM offers unique skills and leading-edge engineering expertise in the areas of Human Factors management in nuclear programs, process modeling, value analysis and risk assessment.

## Front-End Engineering and Design



### Value Analysis

Search for innovative solutions for the 4th generation nuclear research reactor ASTRID, handling and temperature measurement of the nuclear fuel rods. (CEA)

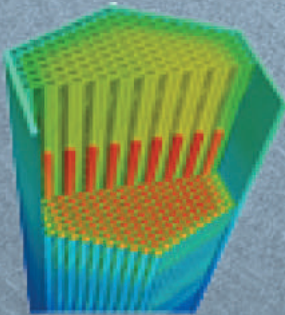


### Feasibility Studies

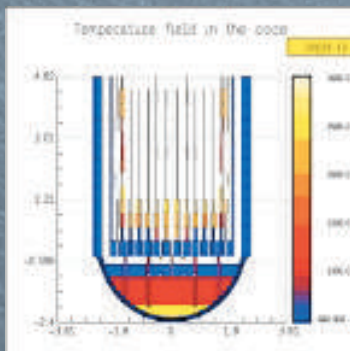
Safety inspection system for nuclear waste deep storage. (CIGEO)

## Modeling, Simulation and Calculations

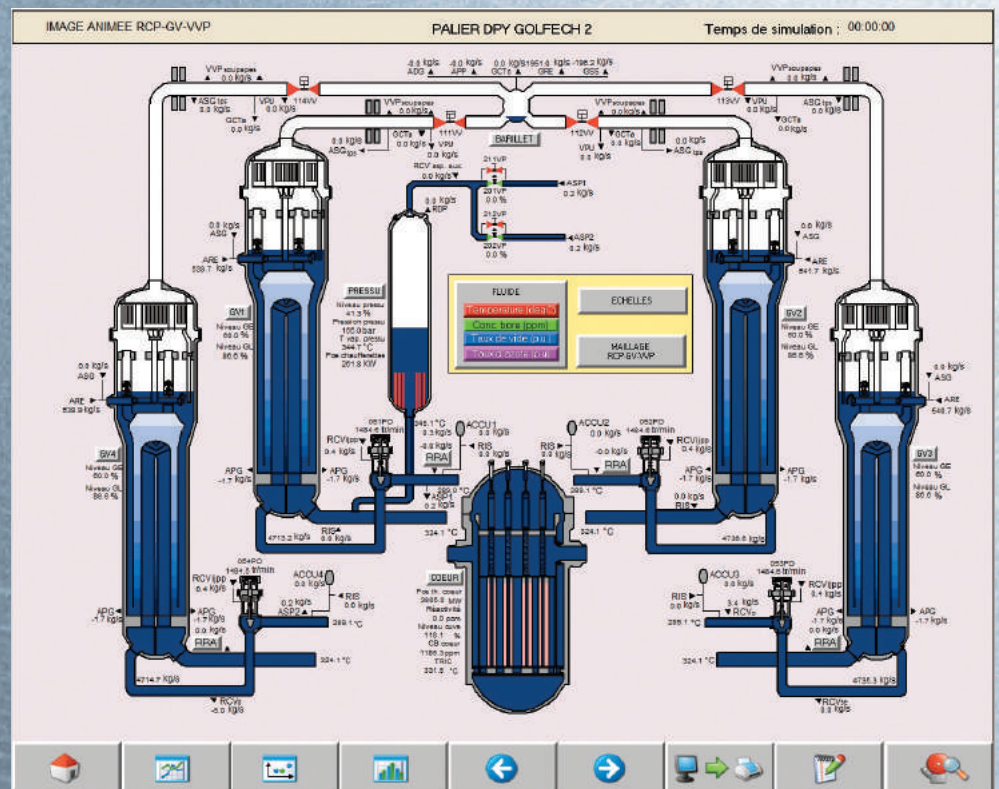
Physical modeling of nuclear plants is the only way to predict their behavior in accidental conditions, build predictive training simulators and validate operational measures in order to prevent accidents and mitigate their effects.



Thermal Study on heat transfer simulation in Sodium Fast Reactor fuel assembly (EDF)



Probabilistic safety simulation and analysis with ASTEC - Accident Source Term Evaluation Code (IRSN)



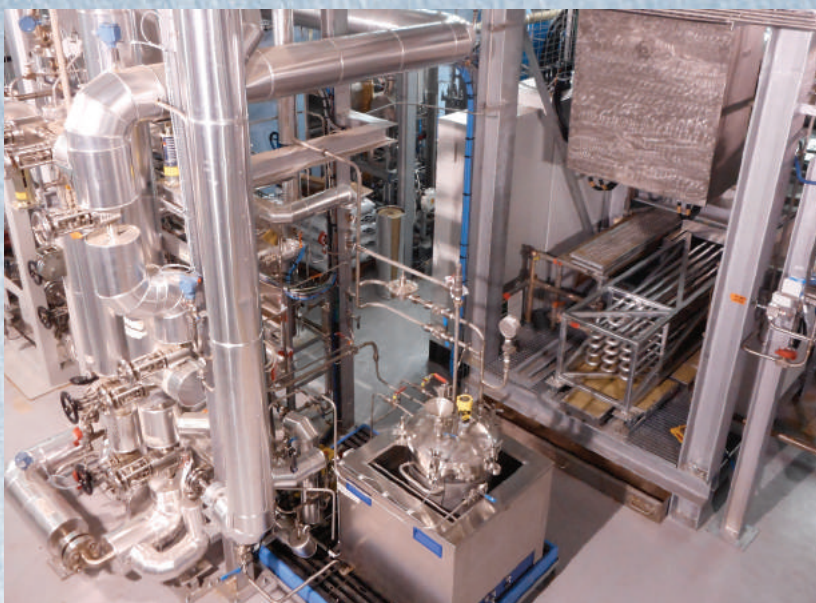
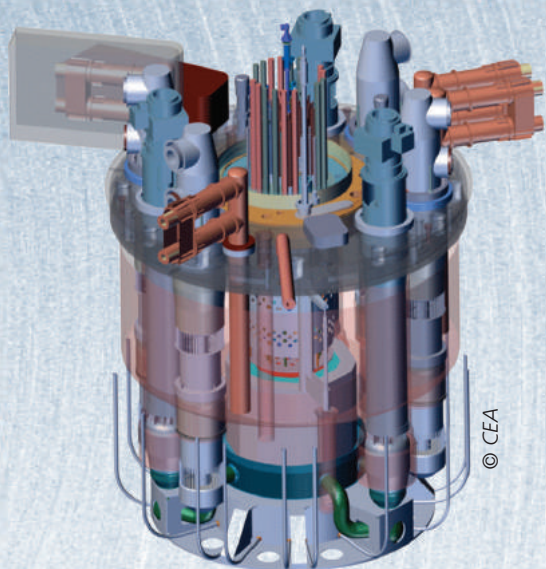
Automation & Control: Modeling and scenarios calculations with SOFIA - Simulator for Observation of Functioning during Incident and Accident (IRSN)



## Industrial Feasibility Assessment

### **Design of ASTRID reactor components**

Detail design of the Diagrid and the Fuel Arm Transfer Machine (FATM) (9m height) which are critical components of the ASTRID reactor (CEA). In collaboration with AREVA.



## Basic & Detail design



### **Turnkey supply of a bench of test and measure**

Turnkey supply of a test bench to characterize the steam generator tube fouling phenomenon for Nuclear Power Plant lifetime extension. (EDF)

### **Nuclear Waste Storage Assessment: Hydrogen Degassing in radioactive liquid effluents**

Innovative degassing process to reduce to a 100,000 factor the incondensable gas fraction contained in radioactive liquid effluents (CEA).

## Human Factors Management & User Centered Design

For **35 years**, Bertin Ergonomy has been the leader in ergonomics and human factors expertise for aeronautic, naval, energy, transport and industry. It has a long standing experience in optimizing the design of systems and organizations.



### ◀ Application of ergonomics principles into work stations & work places

Definition of a standardized control room for over 20 nuclear reactor units (EDF 1300 MWe NNPs), based on Operational Experience Feedback and user-centered methodologies. (EDF – Convergence project)



### ◀ Expertise in Human & Socio-Organizational Factors

Contribution to the design of a remote operated arm used for decommissioning of nuclear facilities, increasing human error resilience and human reliability. (CEA Marcoule – Maestro project)



# BUILD-TO-PRINT NUCLEAR COMPONENTS

CNIM offers state-of-the-art industrial facilities of more than 300,000m<sup>2</sup> located in France (La Seyne-sur-Mer) and China, featuring large scale machining (turning, boring, milling), welding, heat treatment, non-destructive examination, assembly halls and clean rooms fully compliant with ISO and nuclear codes & standards such as ASME and RCC-M.

For over 30 years, CNIM has developed a strong expertise in special welding processes such as Vacuum Electron Beam welding (230m<sup>2</sup> facility), Narrow Gap and Orbital Welding, Inconel Refilling.

CNIM is also recognized for its experience in working metallic (steel, aluminum, alloys, titanium) and synthetic materials (composites, polyurethane), providing its customers with the best technological choice.

## ITER ▶

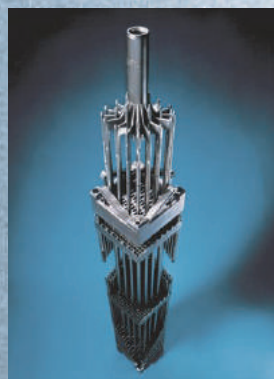
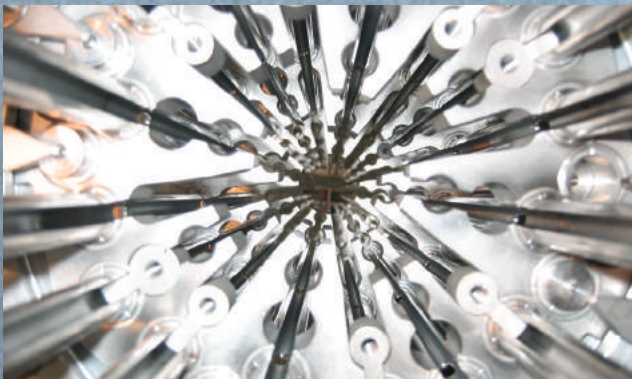
CNIM supplies 35 Radial Plates for ITER Toroidal Field Magnets. Large stainless steel structures (14m x 9m x 110mm) manufactured with tight tolerance (0.1mm) in a dedicated temperature-controlled 3000m<sup>2</sup> industrial workshop, using a local vacuum Electron Beam welding process.



© CHABERT

## Control Rod Guide Assembly (CRGA) ▼

Reactor Internals Components. 2 Series (180 CRGAs total) for the Chinese EPR Taishan 1&2 NPP supplied by TPI.

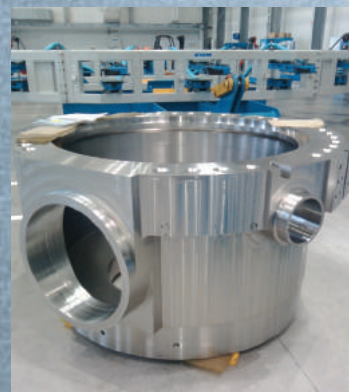


▲ Nuclear Spent Fuel Racks manufactured by TPI

## Reactor Vessels and Internals

CNIM manufactures the Reactor Vessel and primary internal components per RCC-MRx requirements for the Jules Horowitz Reactor (CEA) CNIM also supplied vessels, internals and experimental apparatus to CEA, AREVA and SIEMENS.

▶ **The «horse saddle» :**  
90° primary piping connection on the reactor shell



◀ **The «waterbox»:**  
Stainless steel vessel to collect the core cooling water.



# NUCLEAR SERVICES

CNIM designs, delivers and installs on customer sites upgrade and replacement systems and components to support life extension programs, increased performance and plant availability, in compliance with evolving environmental and nuclear standards.

CNIM also maintains and repairs nuclear components during plant outages. Our network of Regional Agencies close to our customers (mainly CEA and EDF) ensures reactivity and competitiveness.



*CNIM Regional Network*



Requalification of AHP heaters at Cattenom NPP (EDF)



Welding in controlled area of iodine air filter at Paluel NPP (EDF)

Component replacement in contaminated area (Spent Fuel Pool) at Civaux NPP (EDF)







**3 000**

Employees  
in 15 countries



**727 millions €**

2015 turnover



**61,3 %**

International



**40 years**

Track record  
in nuclear

## They trust us



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[www.saphymo.com](http://www.saphymo.com)



TECHNOPLUS INDUSTRIES  
ZAC de l'Agavon  
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13752 Les Pennes Mirabeau Cedex

### Nuclear Certifications

ISO 9001:2008 SGS - ISO 9001: 2008 - N° FQA 0944099 - OHSAS 18001 - N° FQA 4000453 - CEFRI - CEFRI E - N° 455E - COFRAC - Fusion Welded Pressure Vessel Class 2.1 - EDF UTO Qualifications (2014-2019) - EDF Qualified « High Safety Classified Cranes » - Qualified Supplier for AREVA, Toshiba, CGNPC, Electrabel

### Association Memberships

AIFEN (French Nuclear Industry Association) - Nuclear Industry Association (UK NIA) - PFCE (Partenariat France-Chine Electricité) - PFME (Partenariat France-Monde Electricité) - PNB (Pôle Nucléaire de Bourgogne) - SFEN (Société Française d'Energie Nucléaire) - ENS (European Nuclear Society) - Institut de Soudure (French Welding Institute) - The Welding Institute (UK)

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Innovate and Act

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nuclear  
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