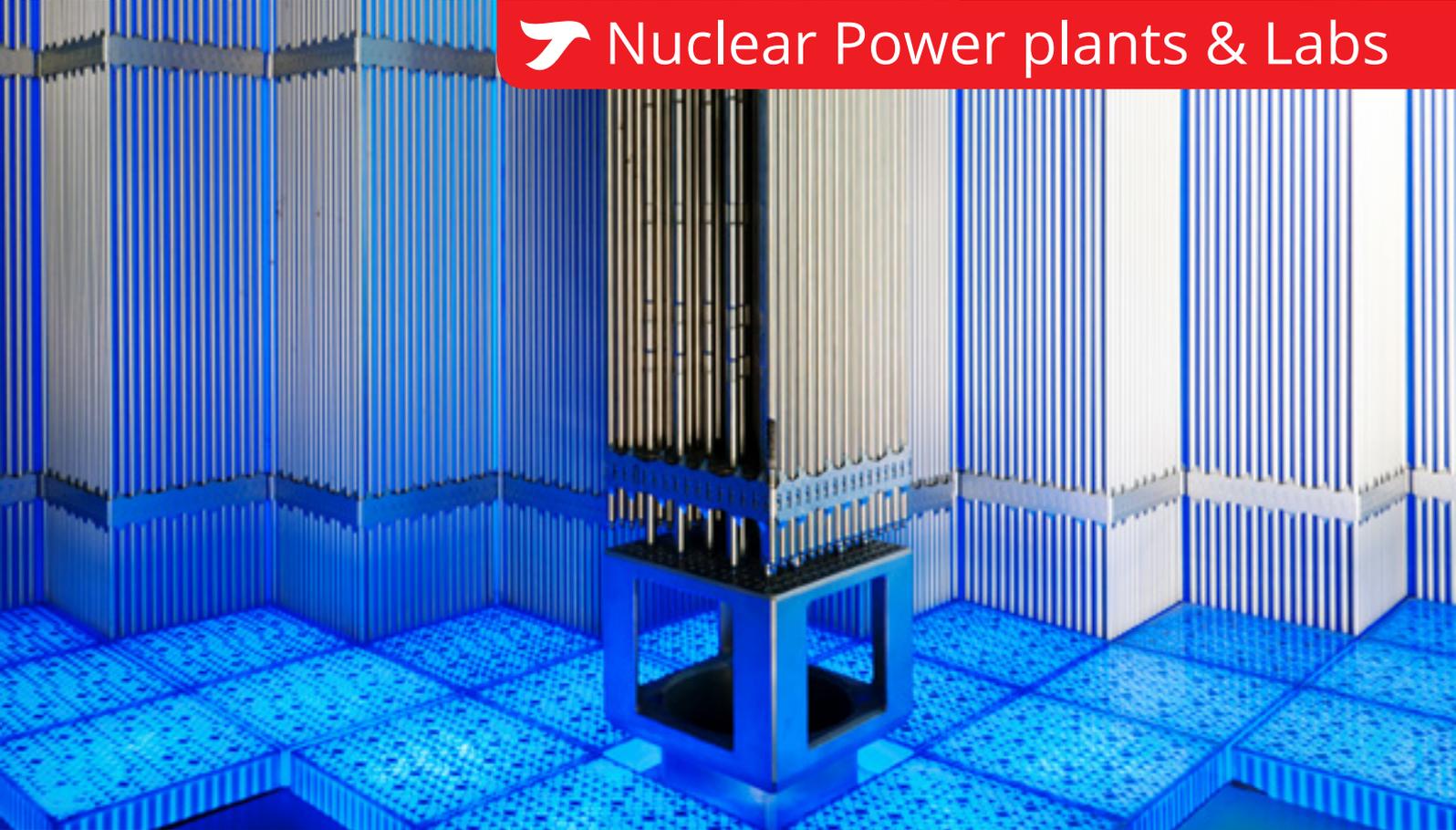




 Nuclear Power plants & Labs

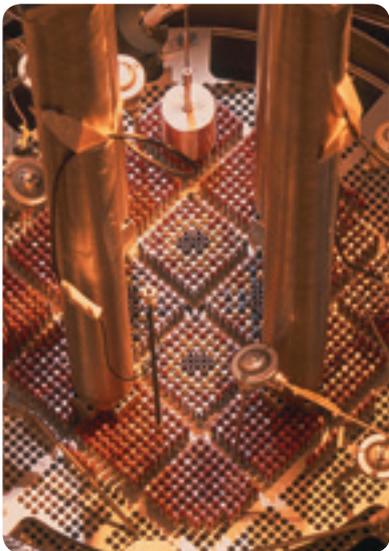




THERMOCOAX

NUCLEAR

IN-house production of MI cable



Crédit : P.Stroppo/CEA

Applications

➤ **CABLING SYSTEMS:**

- Transmission cable
 - Connectors qualified severe accident
 - Organic coated MI cable
-

➤ **SENSORS:**

- In-core thermocouples
 - Resistance thermometers Rtds
 - Self Powered Neutron Detectors
 - Gamma thermometers
 - Level sensors
-

➤ **HEATING SOLUTIONS:**

- Pressurizer heaters
- Fuel pin simulators
- Trace heating
- Customized ovens

Our capabilities

THERMOCOAX has supported the players in the civil nuclear market throughout the cycle: from fuel design, plant components to reprocessing.

➤ OUR MISSION

THERMOCOAX **offers** complete **solutions based on MI cables** through advanced innovation. From conception, prototype development to **qualification**, all the way through to production.

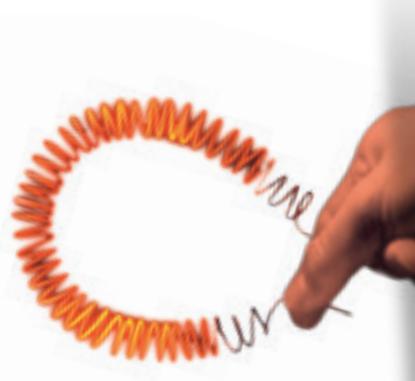
Our custom systems provide cleaner, cost effective and safer solutions.

➤ OUR OFFERS

- Feasibility studies
- Project management
- Reengineering
- Transfer of Technology
- Quality Assurance System (NQA-1, ISO 9001 v 2008, ISO 14001 v 2004)
- Dedicated Nuclear work shop
- On site service

➤ OUR EXPERTISE

- 3D Design / thermal modeling
- MI cable design
- Connector design resin or Ceramic metal seals
- Construction codes KTA, RCC-M, ASME
- High temperature brazing
- Welding (Laser, Plasma, TIG)
- Testing and commissioning
- Non Destructive Examination (COFREND Level 2)



The industry's
most trusted
Mineral
Insulated
Cable



Cable connector assemblies

- ▶ Best solution for high radiation, high temperature, high pressure or high vacuum
- ▶ Unlike organic cables, no thermal and radiation ageing
- ▶ Cost effective solution for organic cable replacement
- ▶ Class 1E cable application, Qualified for LOCA, Post LOCA & accident conditions
- ▶ Enhanced electrical performance at elevated temperature for Gen IV reactors



- ▶ Non organic construction only: cable and ceramic seals
- ▶ Proprietary manufacturing process resulting in unique electrical parameters
- ▶ Outer dimensions from 15.9 mm (0.625") down to 0.25 mm (0.010")
- ▶ Very high insulation resistance: up to 1E13 Ohms.m @ room temperature

Twist of conductors without impact on external sheath metallurgy



EX-CORE & IN-CORE CABLING SYSTEMS

PRECISION MI CABLE



In-house production of MI cable

Example of specific cable development: very small outer diameter but high ElectroMagnetic Immunity

- ▶ Low ALARA
- ▶ Easy routing, tight bending radius

High electromagnetic immunity MI cable

Patent CEA FR 2 909 217, Thermocoax exclusive licence





P. Stropal/CEA



**SOLUTIONS FOR
NUCLEAR RESEARCH CENTERS
SOLUTIONS FOR PWR, BWR
AND GEN IV REACTORS**

Neutron and Gamma Self Powered Detectors

- ▶ Built on years of proven design experience, performance and reliability
- ▶ In-core flux measurement
- ▶ Wide range of emitter available

Gamma detector

**Patent CEA /
SCK FR 2 943 142,**
Manufactured under licence
of the CEA – SCK CEN
laboratory

Radiation resistant thermocouples

- ▶ Highest operational experience in nuclear industry
- ▶ Individual thermocouples or assemblies
- ▶ Fuel assembly outlet temperatures measurement
- ▶ Compliance with ASTM E235 if required
- ▶ New thermoelectric materials

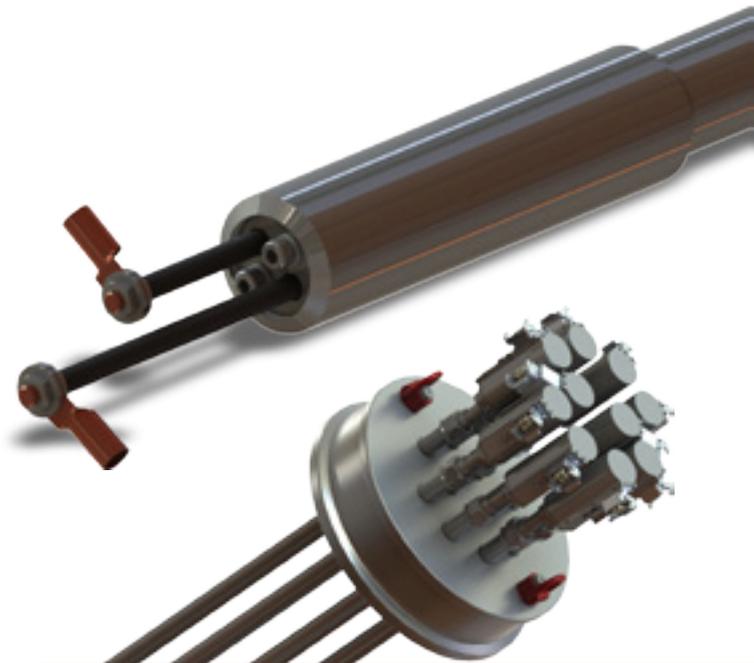
IN-CORE SENSORS



Pressurizer Heaters FOR NUCLEAR POWER PLANT AND TEST LOOP

Unique proprietary manufacturing process

- ▶ Highest operational experience in nuclear industry
- ▶ Contrary to others existing technologies, no swelling in case of water ingress
- ▶ Epoxy receptacle or high temperature ceramic receptacle
- ▶ Superior temperature uniformity
- ▶ Low thermal stress
- ▶ Thermal flux up to 40 W/cm²
- ▶ Length from 0.5 m up to 11 meters
- ▶ Outer diameter from few mm up to 31.7 mm



HIGH WATT DENSITY HEATERS

Treatment against stress corrosion
Patent EDF WO 2011/ 124846
Thermocoax exclusive licence



Fuel pin simulators

- ▶ Electrically isolated
- ▶ Thermal flux up to 240W/cm²
- ▶ High temperature connectors



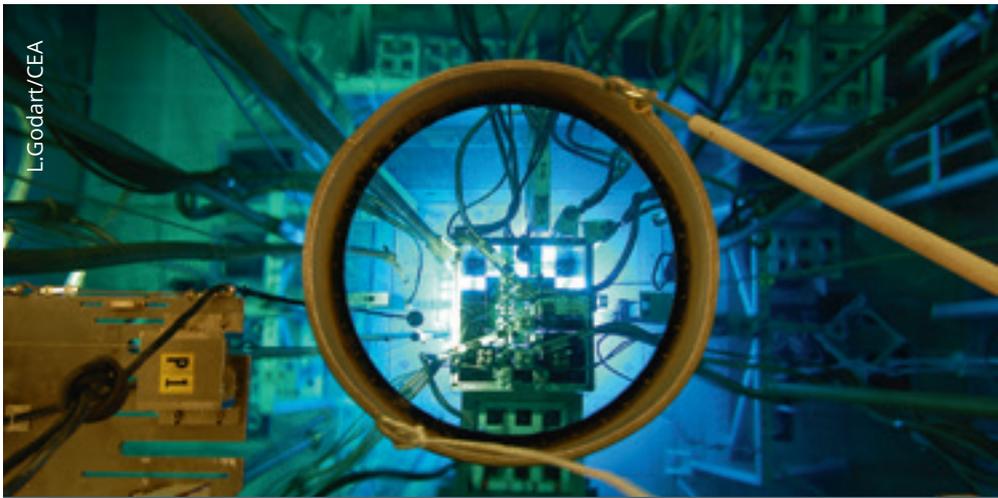
P. Stroppa/CEA

SERVICES: DESIGN, INSTALLATION, COMMISSIONING, REPAIR.

Instrumented mechanical assemblies

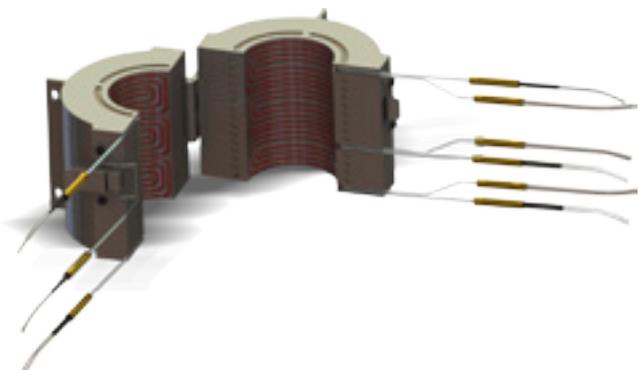
Construction according to the code: ASME, KTA, RCC-M or RCC-MRx

Welding qualification



L. Godart/CEA

PRECISION MECHANICS WITH INSTRUMENTATION



R&D department for static and dynamic 3D thermal modeling

Concept, Design using SolidWorks and computerized model techniques (CMT) simulating prototype performances.

Calibration and testing using COFRAC certified laboratory



OUR COMPANY

With nearly 60 years of experience in heating solutions and temperature measurement, THERMOCOAX has acquired a great deal of skill and expertise. THERMOCOAX products are widely used and endorsed in many industries where the highest quality and utmost reliability are essential. All our mineral insulated cables are manufactured in-house with our proprietary and unique procedures.



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Site Planguivon



Thermocouples
 & Heating Elements
 ATEX
 certified and notified

