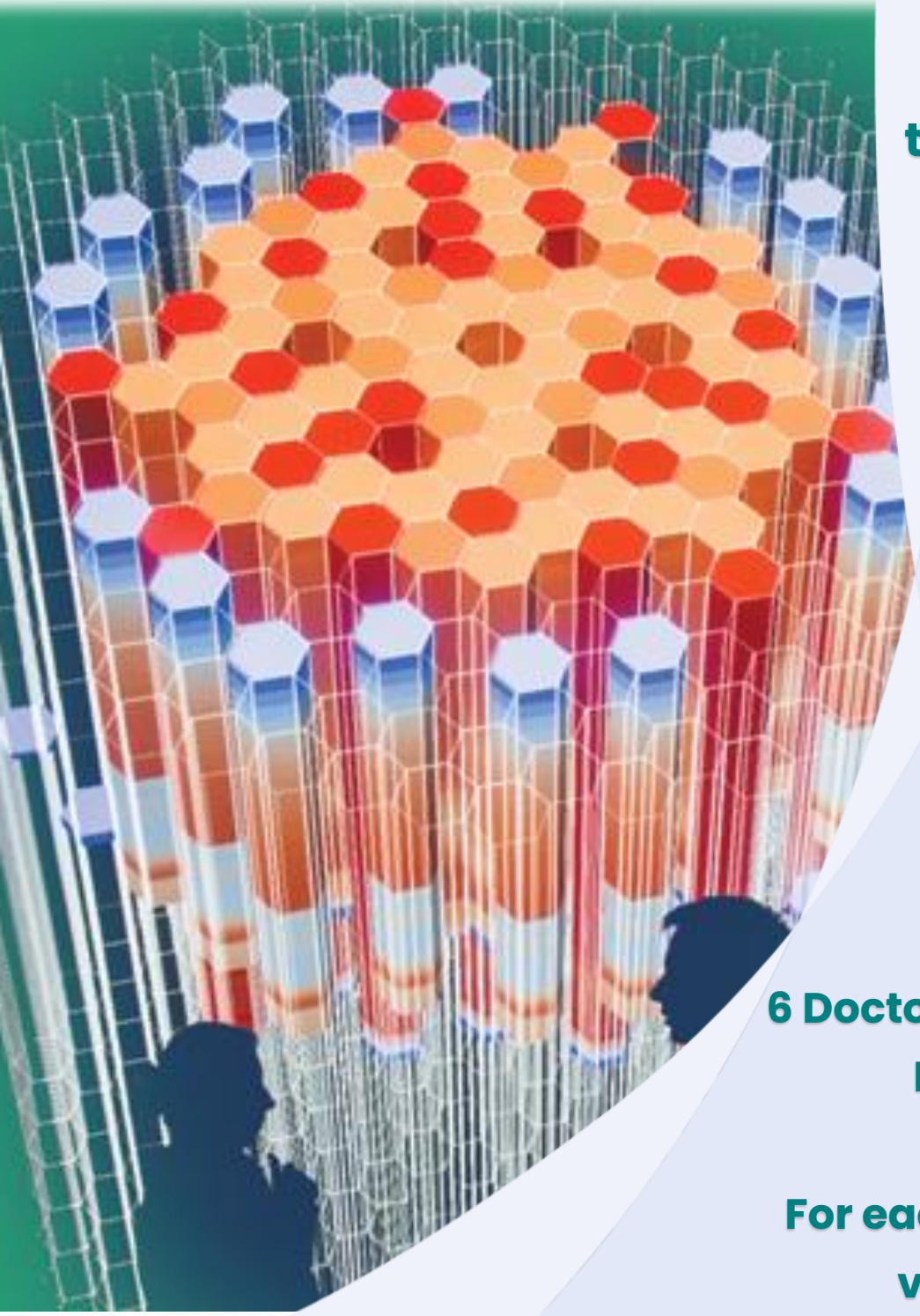
“ Internationally known expert lecturers mostly from the CEA, the leading research organization in France for nuclear energy ”

INTERNATIONAL SCHOOL IN NUCLEAR ENGINEERING

20th Edition - France



From January 19th to March 27th, 2026

6 Doctoral-level Courses in Nuclear Engineering

For each course, technical visits of CEA facilities

instn

cea

About the school

INSTN, the French National Institute for Nuclear Science and Technology is organizing the International School in Nuclear Engineering, promoting knowledge in the field of nuclear sciences at a high education level.

The 2026 edition will offer six one-week advanced courses in nuclear engineering to be held in France (Cadarache, Marcoule, Saclay), from January to March 2026. Participants have the possibility to choose the course they want to follow, from only one to all six.

The courses are designed for young researchers, PhD students, post-doctorates and engineers, already having a Master of Science in nuclear engineering as a background. They present the international state-of-the-art in the main topics of nuclear engineering: reactor core physics, thermal hydraulics, materials, fuels, fuel cycle and nuclear waste.

Three ECTS will be awarded for each successfully completed course.

The courses will be held at INSTN locations in:

- Cadarache, Saint-Paul-lez-Durance, 40 km from Aix-en-Provence,
- Marcoule, Bagnols-sur-Cèze, 30 km from Orange.
- Saclay, 20 km southwest of Paris.

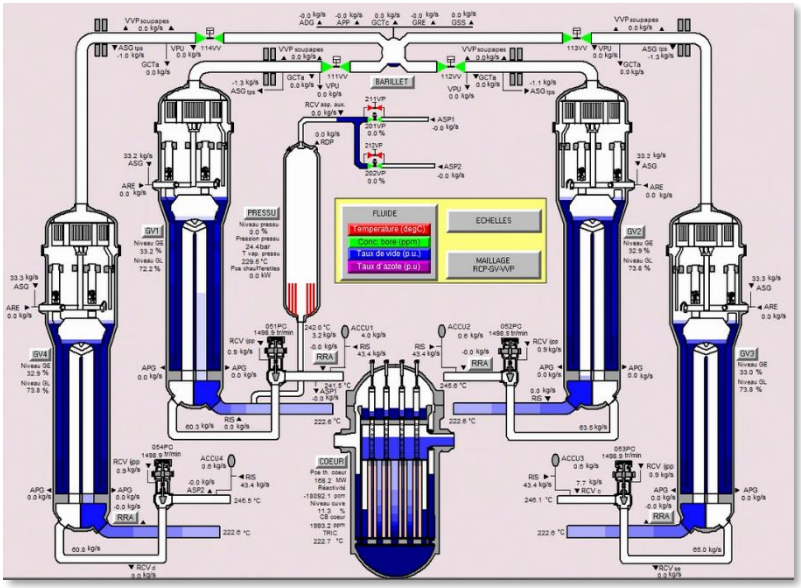
OUTLINE PROGRAMME OF COURSES

Course 1 - Thermal Hydraulics and Safety

(D. Bestion, F. Fichot, E. Studer)

Learning outcomes: give practical and relevant examples of thermal hydraulics of light water reactors (LWR) and describe modelling and multi-phase phenomenology of severe accidents in LWRs.

- ⇨ Main two-phase flow phenomena in LWRs
- ⇨ Multi-scale modelling of LWR thermal hydraulics
- ⇨ System code modelling of reactor thermal hydraulics, including advanced modelling LWR transient analysis methodology with PIRT, Scaling, Code Development, Verification and Validation plus Uncertainty Quantification
- ⇨ Application of the methodology to LOCA analysis
- ⇨ Application of one-phase and two-phase CFD to reactor thermal hydraulic issues - Multiphase phenomena and modelling of severe accidents in LWRs
- ⇨ Hydrogen risk (production, dispersion, combustion, mitigation)



"CATHARE view of the SOFIA simulator in the context of a LB-LOCA"

instn-ues-sac-af@cea.fr

February 2nd to 06th, 2026

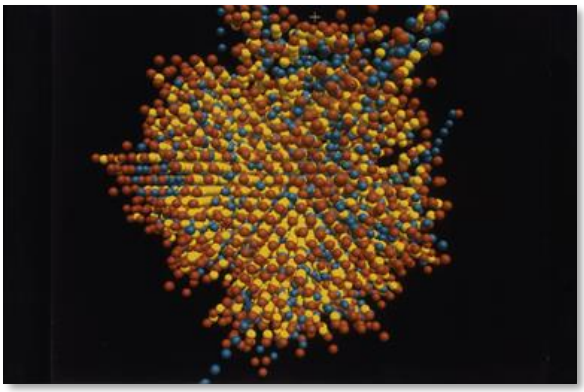
Saclay

Course 2 - Materials for Nuclear Reactors, Fuels and Structures

(E. CLOUET, E. MESLIN, J. GARNIER, G. GUTIERREZ, F. GARRIDO, A. CHARBAL, P. GOKELAERE)

Learning outcomes: identify the major materials used in nuclear reactors: Steels, Zr alloys and carbides, analysis the mechanisms of the irradiation effects on the materials, describe the evolution of the microstructure and the impact induced by irradiation on the properties of the major materials.

- ⇨ Mechanisms of irradiation damage: neutrons, photons, electrons
- ⇨ Behavior of materials under irradiation: ferritic steels for reactor pressure vessel, austenitic stainless steels for internals or fuel cladding (FBR), Zr alloys for fuel cladding and fuel assemblies (LWR)
- ⇨ Zr alloys in accidental conditions and enhanced accident tolerant fuel claddings
- ⇨ Fuel materials (UO2, PuO2): irradiation-induced effects
- ⇨ Materials for high temperature conditions: SiC, ZrC, low swelling alloys
- ⇨ Materials for fusion: low activation materials, resistance to high-energy neutrons, breading blankets



"Computer simulation of atomic displacement cascades during the irradiation of a material"

instn-ues-sac-af@cea.fr

January 26th to 30th, 2026

Saclay

Course 3 - Reactor Core Physics: Deterministic and Monte Carlo Methods

(A. Zoia, J. Tommasi, J-F. Vidal)

Learning outcomes: identify advanced numerical methods to solve the Boltzmann equation for neutron transport and recent deterministic and probalistic methods APPOLO2/3 and TRIPOLI4 codes.

- ⇨ Chain reaction and neutron balance
- ⇨ Neutron slowing-down and resonance absorption, self-shielding modelling
- ⇨ The neutron transport equation and calculation schemes: the steady-state integro differential transport equation. The neutron diffusion equation… Verification and validation of neutronics code package: process, sensitivity and uncertainty studies The Monte Carlo method for solving the transport equation
- ⇨ Monte Carlo techniques: fixed source, variance reduction, criticality, perturbation calculations, adjoin calculation, applications to shielding

"Neutronics calculation of EPR core with APOLLO3

lorena.mei@cea.fr

January 19th to 23th, 2026

Cadarache

Course 4 - Nuclear Fuels for Light Water Reactors and Fast Reactors

(J. Noirot, Coordinator)

Learning outcomes: describe the design and the fabrication of the nuclear fuels as well as the fuel thermal and mechanical behavior, reactor operation, identify the main limiting phenomena (for safety and design).

- ⇨ Nuclear fuels fundamentals
- ⇨ Fuel element thermal performance and temperature effects Nuclear fuel behavior under irradiation - Main limiting phenomena in the different types of fuels
- ⇨ Fuel challenges for the future

"Pin-type fuel element of Gas Fast-cooled Reactor (GFR)"

✉ **lorena.mei@cea.fr**

📅 **January 26th to 30th, 2026**

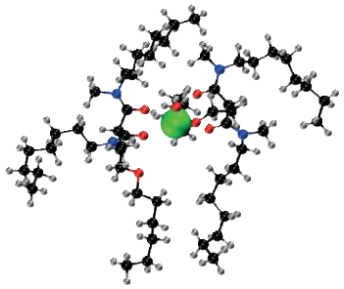
📍 **Cadarache**

Course 5 - Nuclear Fuel Cycle: from Strategy to Processes

(M. Billet)

Learning outcomes: describe the main stages in the fuel cycle and the chemical processes used for fuel reprocessing; identify the R&D and the possible improvements.

- ⇨ Fundamentals of fuel cycle: chemistry of actinides and fission products
- ⇨ Uranium and plutonium reprocessing: scientific basis and process modelling
- ⇨ Scientific and industrial challenges associated to the Pu-multirecycling
- ⇨ Minor actinide recycling as a potential option for waste management optimization
- ⇨ The spent nuclear fuels: MOX and minor actinides fuel refabrication
- ⇨ Nuclear fuels behavior under irradiation
- ⇨ Review on irradiation experiments in Europe
- ⇨ Technical visits: Atalante and G1 facilities



"Actinide complex solvated by extraction molecule"

📧 aurelie.michel3@cea.fr

📅 **March, 23th to 27th, 2026**

📍 **Marcoule**

Course 6 - Nuclear Waste Management

(C. Cau Dit Coumes, S. Mougnaud, M.Fournier, S. Gin, F.Lemont)

Learning outcomes: perform a critical analysis of the various waste management options and identify how scientific studies play a part in addressing the issues related to nuclear waste management.

- ⇨ Waste management options and related issues Treatment of radioactive organic waste
- ⇨ Waste conditioning: concrete and vitrification
- ⇨ Science contribution to economic, safety and societal issues
- ⇨ Case study

aurelie.michel3@cea.fr

March 16th to 20th, 2026

Marcoule

INFORMATION

🏷️ Registration fees

- ⇨ Professionals: €2,680 per course.
- ⇨ Special rates for each additional course, students, CEA and ENEN.
- ⇨ Member institutions: please contact us for further details.
- ⇨ Fees include lectures, digital documentation, technical visits and lunches.

⏳ **Registration deadline:** November 28th, 2025 for all courses.

📧 Contacts for registration

📍 **Saclay: instn-ues-sac-af@cea.fr**

- ⇨ **Course 1 - Thermal Hydraulics and Safety**
  - 🗓️ February 2nd to 06th, 2026
- ⇨ **Course 2 - Materials for Nuclear Reactors, Fuels and Structures**
  - 🗓️ January 26th to 30th, 2026

📍 **Cadarache: lorena.mei@cea.fr**

- ⇨ **Course 3 - Reactor Core Physics: Deterministic and Monte Carlo Methods**
  - 🗓️ January 19th to 23th, 2026
- ⇨ **Course 4 - Nuclear Fuels for Light Water Reactors and Fast Reactors**
  - 🗓️ January 26th to 30th, 2026

📍 **Marcoule: aurelie.michel3@cea.fr**

- ⇨ **Course 5 - Nuclear Fuel Cycle: from Strategy to Processes**
  - 🗓️ March 23th to 27th, 2026
- ⇨ **Course 6 - Nuclear Waste Management**
  - 🗓️ March 16th to 20th, 2026

General contact: Sylvie ESTERLIN – sylvie.esterlin@cea.fr

🌐 **Website**: www.instn.fr

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