

# Feedback: WS on International Center Based on Research Reactor (ICERR)

CEA Saclay & Cadarache  
France, 24-28 April 2017

IAEA RAS0075 ANENT  
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- Introduction
- IAEA Concept on ICERR
- CEA ICERR
- Feedback of WS on ICERR

## **The four instruments of IAEA for Nuclear Capacity Building (based on research reactors)**

- Internet Reactor Laboratory (IRL) based training  
(5-6 half-day sessions)
- Regional Research Reactor Schools  
with hands-on-training (2 weeks)
- East European Research Reactor Initiative (EERRI)  
hands-on-training group fellowship programme (6 weeks)
- Advanced training at International Centres based on  
Research Reactors (ICERR)  
(a few weeks/months)

# IAEA concept on ICERRs



Reference:  
“Nuclear Capacity Building  
based on the use of/access  
to Research Reactors”,  
*Francois Foulon*  
IAEA

*WS on ICERR*  
*France, 24-28 April 2017*

Objective: to help MSs gain timely access to relevant infrastructure based on RR facilities for nuclear R&D and Capacity Building.

Programmes: “broad spectrum”

- education and training for young professionals
- specific hands-on-training program
  - irradiation and testing services, hot cells or analytical laboratories etc.
- on-the-job training
  - research reactor operators, maintenance personnel, radioprotection specialists or regulators, etc.
- Nuclear R&D

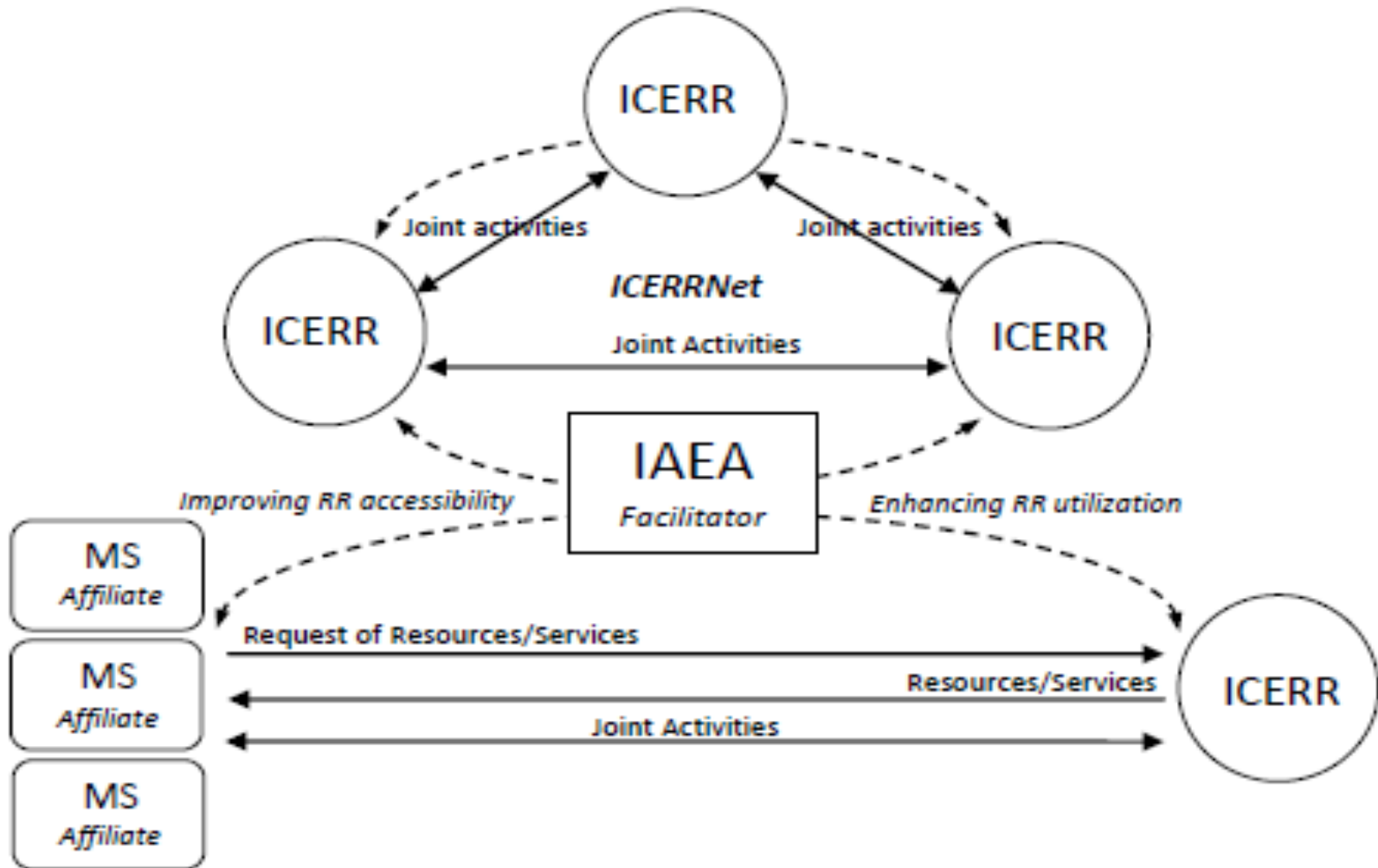
## Participation:

Access to an ICERR is carried out through an agreement signed with the ICERR (IAEA – facilitator).

# Role of the IAEA: a facilitator



*IAEA designated International Centre based on Research Reactor (ICERR) Scheme*



# IAEA-designated ICERRs



- CEA (France)
- SSC RIAR (Russian Federation)

Planned:

- SCK-CEN (Belgium) to be designated in 2017



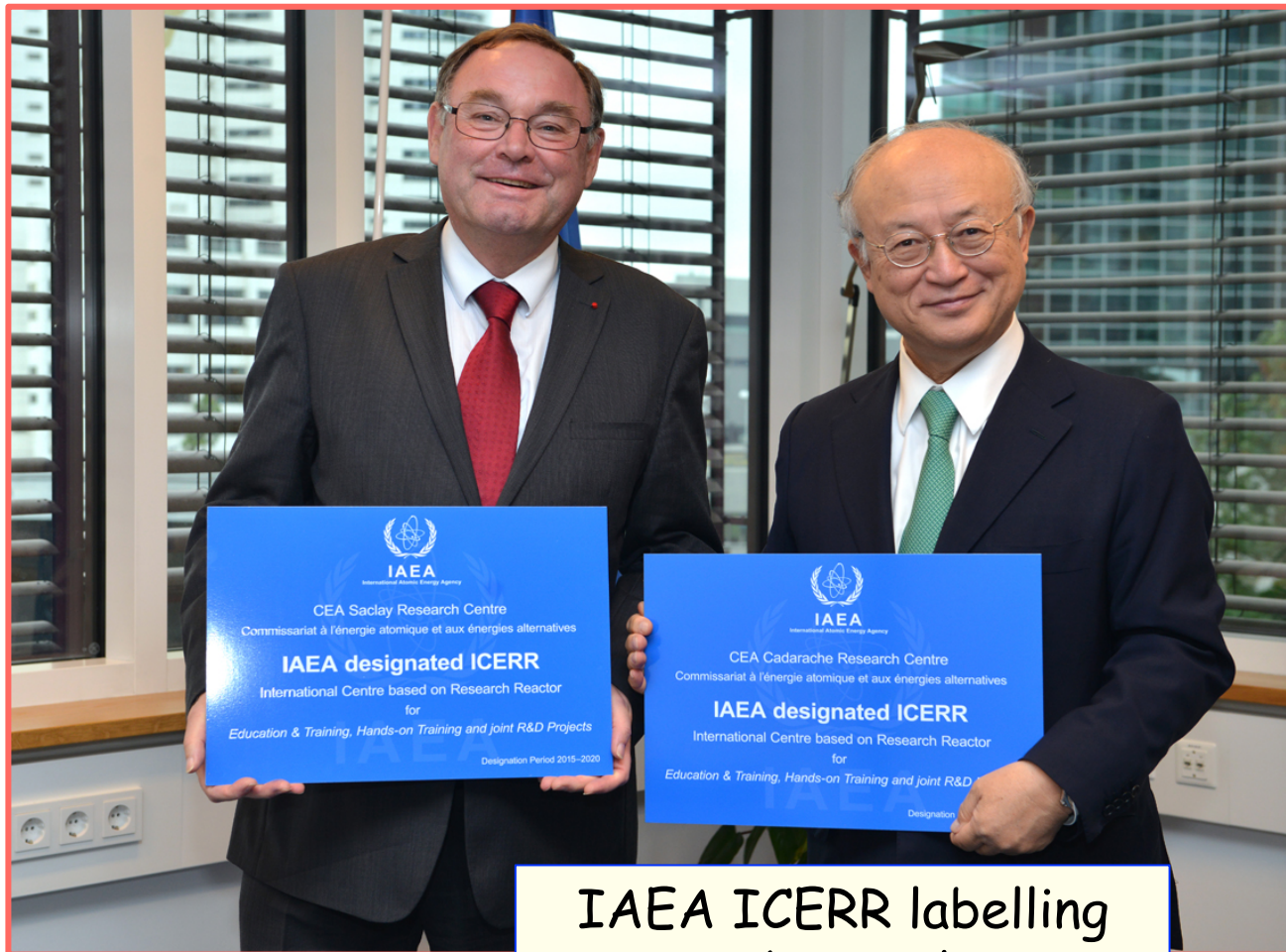
CEA ICERR



Reference:  
“Invigorating International Cooperation  
on Research Reactors: one of the pillar of  
the French Capacity Building Initiative”  
*Gilles Bignan, Philippe Corr ea*  
CEA

*WS on ICERR*  
*France, 24-28 April 2017*

# THE JHR AND ITS ANCILLARY FACILITIES AS AN “ICERR”



IAEA ICERR labelling  
obtained  
on 14th September 2015

# CEA-ICERR Concept



- ▶ Create international scientific networks
- ▶ Make available CEA facilities and experience to affiliates
- ▶ Lead innovative joint programs with shared results
- ▶ Enhance utilization of Research Reactors
- ▶ Host international scientists / engineers (visiting scientists, operators...)
- ▶ Provide “hands on” nuclear education “in the field”

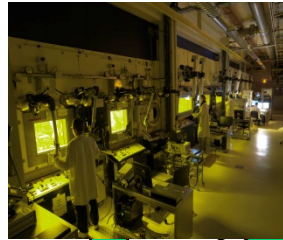


# CEA offers within IAEA/ICERR



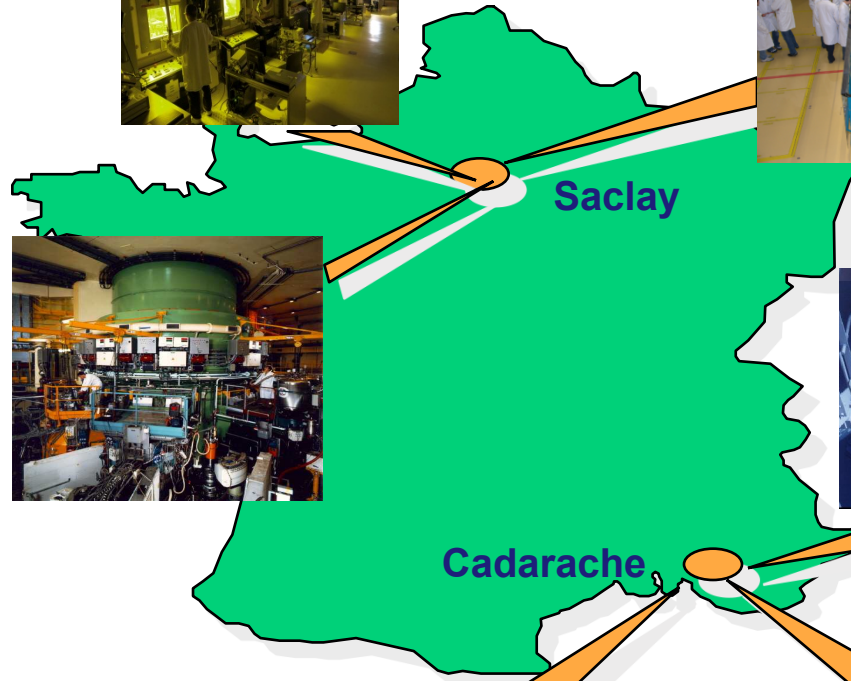
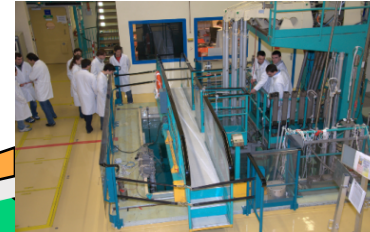
## LECI : Hot Lab on Materials

- Hands-On Training (Equipments)
- R&D Projects



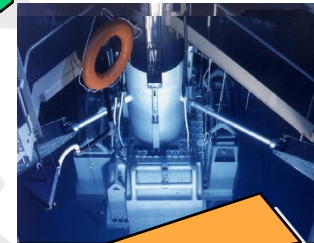
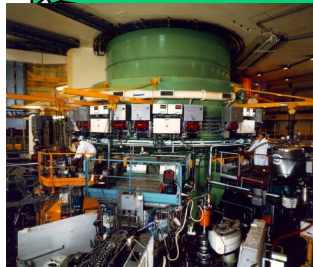
## ISIS (IRL) through INSTN

- Education & Training
- Hands-On Training



## ORPHEE : Neutron beams

- Hands-On Training (Equipments)
- R&D Projects



## EOLE/MINERVE:

- Education & Training
- Hands-On Training
- R&D Projects

## JHR : MTR

- Hands-On Training
- R&D Projects

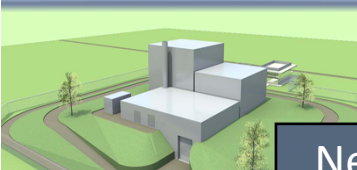


## LECA : Hot Lab on Fuel

- R&D Projects
- Hands-On Training (Equipments)



## ZEPHYR : LPR



New Projects

# Potential Areas ICERR JHR Secondee Program



Fuel Issues

Reactor  
Operation

Safety studies

Material Issues

**CEA offers for Affiliates**

Safety Culture

Core Physics

Radioprotection

Thermohydraulic

Nuclear Technology

Waste Management



# ICERR on-going (First affiliates)



- First Affiliates to CEA have signed this ICERR template during this 60<sup>th</sup> IAEA General Conference:

- Slovenia (JSI)
- Morocco (CNESTEN)
- Tunisia (CNSTN)

## **New Affiliates in 2017:**

- Indonesia (signed 29<sup>th</sup> March 2017)
- Algeria (signed 21<sup>st</sup> April 2017)
- Jordan ( under analysis- 2017 tbc)

# ICERR on-going (examples)



- **Slovenia:** Measurement, calculation, validation of Gamma heating in a high dose-rate environment.
  - Calculation with CEA code TRIPOLI4 in Saclay
  - Application of Developed Methods and Test in the Cadarache MINERVE reactor
- **Morocco:** Enhancement of the neutron Beam activities of the TRIGA research reactor from CNESTEN:
  - Expert mission of ORPHEE team in Mamoora center
  - Secondment of Safety Engineer to Saclay for performing Safety Analysis of new reactor configuration
- **Tunisia:** Secondment of Core Physics Scientists from CNSTN to Cadarache for design of sub-critical system able to become later on a critical mock-up

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Based on Research Reactor  
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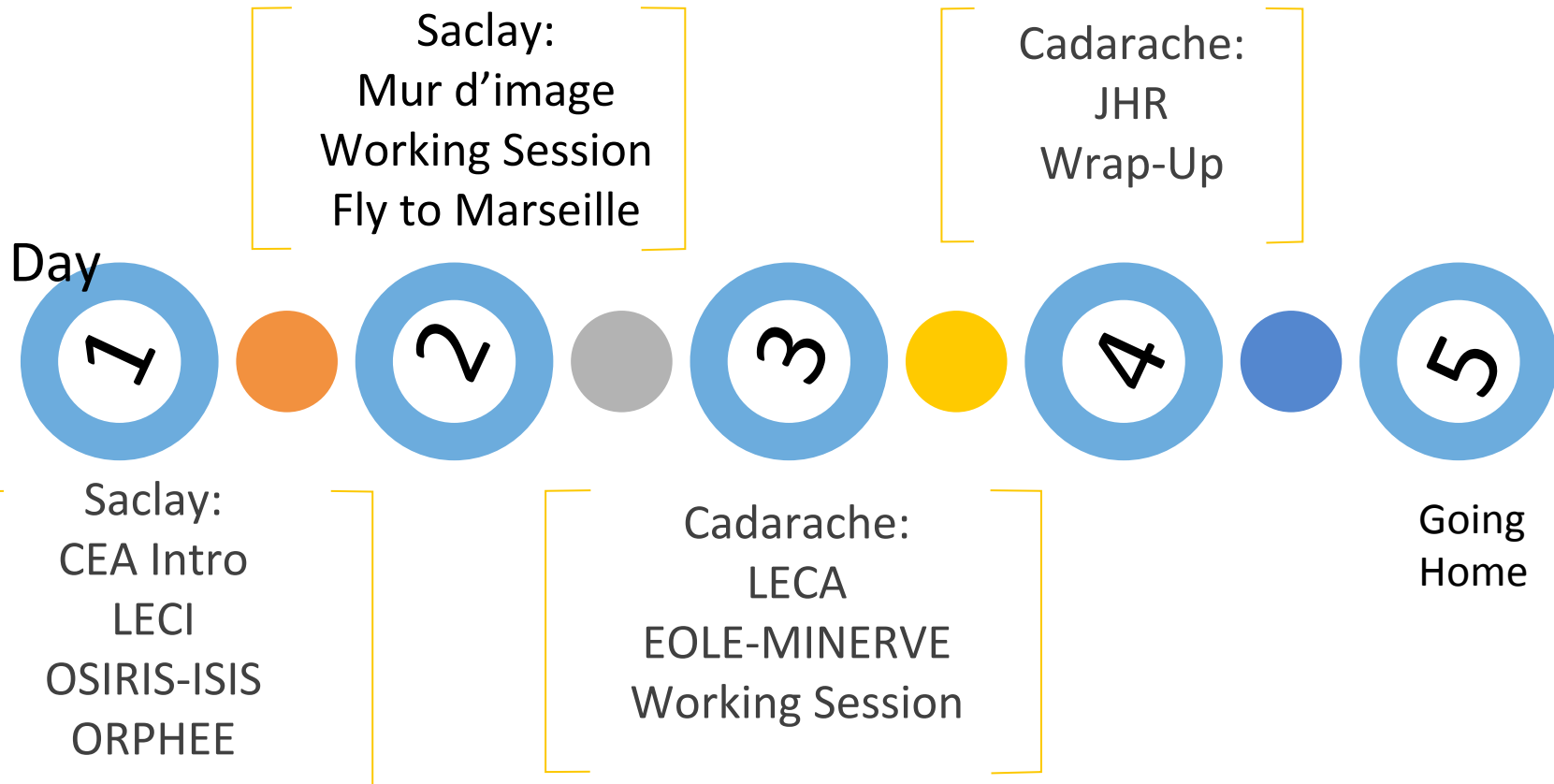




- 14 persons, 9 Member states.
- Varieties of MS RR status:
  - with RR programmes  
Bangladesh, Indonesia, Jordan, Malaysia, Thailand and Vietnam
  - with planned RR programmes in a near future  
Saudi Arabia and Philippine
  - without defined plan for RR construction  
Myanmar

- Varieties of MS needs:
  - MS with more than 30 years experience in RR
    - capacity building at technical and management levels for ageing management, life extension programme and radioisotope production.
  - MS in the phase of starting or going to start in a near future their RR
    - developing the competences related to the practical aspects of reactor operation and utilisation.

# Program of WS on ICERR



- The programme was very well-planned and effectively done
- The facilities were of very high level
- The research results contributed on the advancement of NST

- (1) series of training courses on specific topics of interest for all the MSs or for a significant number of MSs.
  - Duration: one or two weeks.
  - Complementary to other basic courses of the IAEA
  - Focused on practical aspects and include hands-on-training activities.
- (2) training of secondees, and for joint research and development activities.

specialised courses (2 week) could be jointly organised by two ICERRs at a regional level (one week at each ICERR)

- Courses could be developed in basic and advanced level to accommodate the needs of the MSs.
  - Basic: common interest to all or most of the MSs, such as radiation protection, safety analysis and operation and maintenance, planning and implementation of R&D activities using RRs.
  - Advance: more specific for limited number of participants, such as ageing management or radioisotope production.
- IAEA to carry on facilitating the establishment of bilateral agreements among the MSs and the ICERRs
- Financial support for the use of the ICERR scheme should be defined: IAEA, ICERRs, others.

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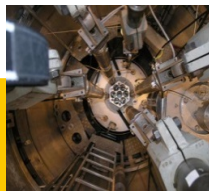
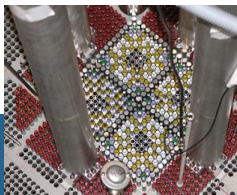
Appendix:  
CEA offers for ICERR  
In Details



# CEA-ICERR Offer more in detail: Research Reactors



- **ORPHEE** a 14 MW<sub>th</sub> research to work in the field of neutron scattering diffraction and spectroscopy for condensed matter.
- **ISIS** Research Reactor was the neutron mock-up of the OSIRIS Material Testing Reactor, max power of 700 kW: today now focused on E&T and instrument qualification used by the E&T institute INSTN (*Recently designated Internet Reactor Lab by the agency*)
- **EOLE/MINERVE** Zero Power Reactors for core physic studies:
  - The EOLE critical mock-up is a very low power experimental reactor designed to study the neutron behavior of moderated lattices, in particular those of pressurized water reactors (PWR) and boiling water reactors (BWR). MINERVE is designed for neutron studies mainly aiming to improve the nuclear database for fuel systems representative of various nuclear reactor technologies.
  - → The physical measurements recorded during the experimental programmes (gamma spectrometry, fission chambers, TLD, dosimeters...) are used to fully characterize the configurations.

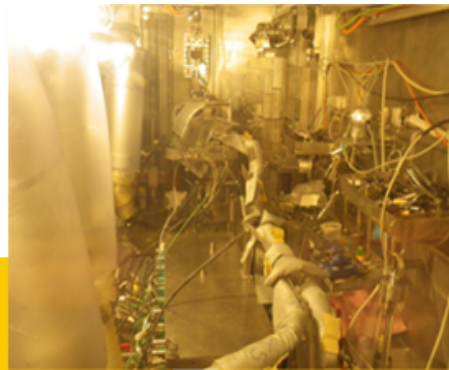




# CEA-ICERR Offer more in detail: Hot Laboratories



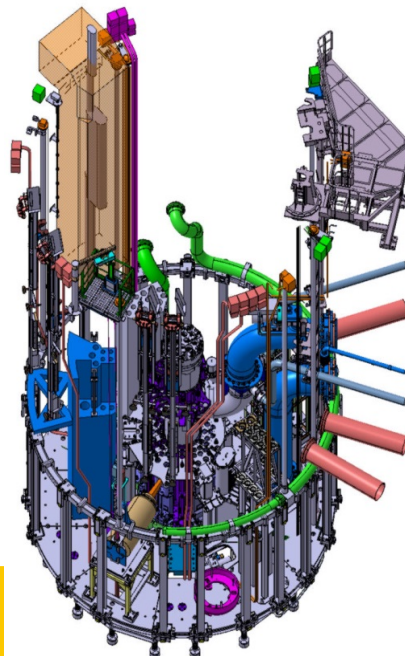
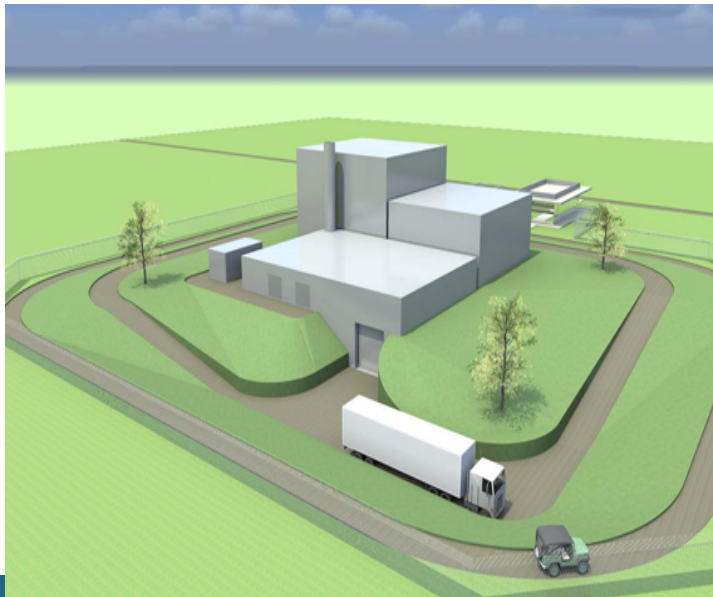
- **LECI Hot Laboratory**, is the CEA reference hot laboratory for Material testing. This laboratory is in charge of the characterization of irradiated non fissile materials. It includes about 50 hot cells, with **up-to-date scientific equipment**: metallography & optical microscopy, micro-hardness, SEM, TEM, EPMA, XRD, density, Raman spectroscopy, thermoelectric power, H<sub>2</sub> measurements, Eddy currents, metrology, 4 autoclaves (360°C, 220 bar, 1 coupled to slow tensile testing), machining (conventional, ram and wire spark erosion machining) and welding (TIG and Laser).
- **LECA-STAR Hot Laboratory** is the CEA hot laboratory in charge of the characterization of irradiated fuel materials. It includes about 20 hot cells (up to 9 m long), with all the equipment for a wide range of irradiated fuel rod examinations, namely: non-destructive examination (visual inspection, confocal, radionuclide distribution by gamma-spectrometry, diameter measurement, eddy current testing for cladding integrity and zirconia thickness, X-rays), puncturing and fission gas release measurements, cutting, macro- and microscopy examinations. A special area is devoted to micro-analysis, with fully-shielded SEM/FIB, EPMA, SIMS and XRD, all these equipment being adapted to irradiated-fuel or material examination.



# CEA-ICERR Offer more in detail: New Projects



- **JHR future Material Testing Reactor:** The Jules Horowitz Reactor (JHR) is a new Material Testing Reactor (MTR) currently under construction at CEA Cadarache research centre in the South of France. It will represent a major research infrastructure for scientific studies dealing with material and fuel behavior under irradiation (and is consequently identified for this purpose within various European road maps and forums: ESFRI, SNETP...). The reactor will also contribute to medical isotope production. JHR is designed, built and will be operated as an international user-facility open to international collaboration.
- **ZEPHYR** project as reference platform for core physics studies (ZPR) to replace EOLE and MINERVE reactors



# TERIMA KASIH THANK YOU



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