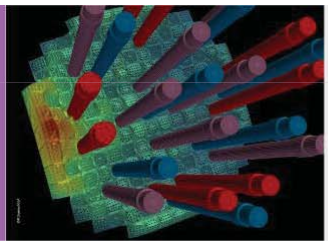


KEY EUROPEAN RESEARCH INFRASTRUCTURES AT YOUR SERVICE NOW AND IN FUTURE

Petri Kinnunen, Gilles Bignan, Gabriel Pavel and
Victor Esteban-Gran

OASIS

Open access to JRC infrastructure

Benefits to users and the ERA

- Make JRC Research Infrastructures **available to external users**
- Give **access to material** requesting nuclear licence
- Provide **capacity building** to Member States and neighbour countries
- Bridge the **gap between science and Industry**
- **Dissemination** of knowledge, education and training,
- Foster **collaboration** in Europe

Benefits to the JRC

- Expand JRC **networking** capabilities
- Enter into **new key areas** of research
- Maintain JRC **scientific excellence**
- Raise the **value and visibility** of JRC research infrastructures
- Improving **JRC's testing** procedures and instruments.

https://ec.europa.eu/jrc/en/research-facility/open-access

OASIS

Objectives: Promotion of training and mobility activities in support of maintaining nuclear competences through the open access to JRC research facilities.

Start: 07/02/2020

Duration: 48 months

Budget: 750 000 €

- Free access to JRC nuclear infrastructure
- Financial Support to the user's stay can be offered to the selected projects (travel, accommodation, subsistence)
- Two schemes: short stay users and long stay users (primarily students)
- Fair and transparent method for allocating access

OASIS

JRC nuclear research infrastructure

☞ **EUFRAT** Nuclear data (Geel, BE)

- 1. GELINA: **Neutron time-of-flight** for neutron measurements
- 2. MONNET: Tandem accelerator based **fast neutron source**
- 3. RADMET: Radionuclide **metrology** laboratories
- 4. HADES: **Underground laboratory** for γ-ray spectrometry

☞ **ACTINET** Actinides properties (Karlsruhe, DE)

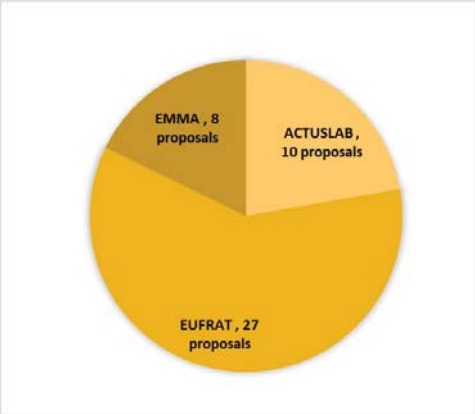
- 1. PAMEC: Properties of **actinide materials** under extreme conditions
- 2. FMR: **Fuel and materials** research
- 3. HC-KA: **Hot cells**

☞ **EMMA** Reactor materials (Petten, NL)

- 1. AMALIA: **Ageing of Materials** laboratory
- 2. LILLA: **Liquid lead** Laboratory
- 3. SMPA: **Structural Materials** Performance Assessment Laboratories
- 4. MCL: **Micro-Characterization** Laboratory
- 5. HFR-NB: High Flux Reactor **Neutron Beams** for residual stress measurements

OASIS

Open access calls: 45 proposals granted



- Call 2020: 43 proposals received (36 accepted, 6 reserve list (Userlab)
- Call 2021: 9 proposals received and accepted
- COVID restrictions had an important impact on the implementation

About 75 % of the projects include young researchers participation

TOURR

TOURR nuclear research reactors

- Towards Optimized Use Of Research Reactors In Europe

- Duration 2020 – 2023
- 9 partners out of which 6 Research Reactors (RR) operators
- Response to the challenge of coordinating the optimization of the exploitation of available research reactors in Europe
- The primary objective is to develop a strategy for RRs in Europe and prepare the ground for its implementation with specific steps

I. Assessment of the current status of European RR fleet

II. Estimation of future needs of RR and neutron sources

III. Plan for the upgrade of the RRs fleet

IV. Plan to maintain the fleet

V. Developing tools for optimal use of RR fleet

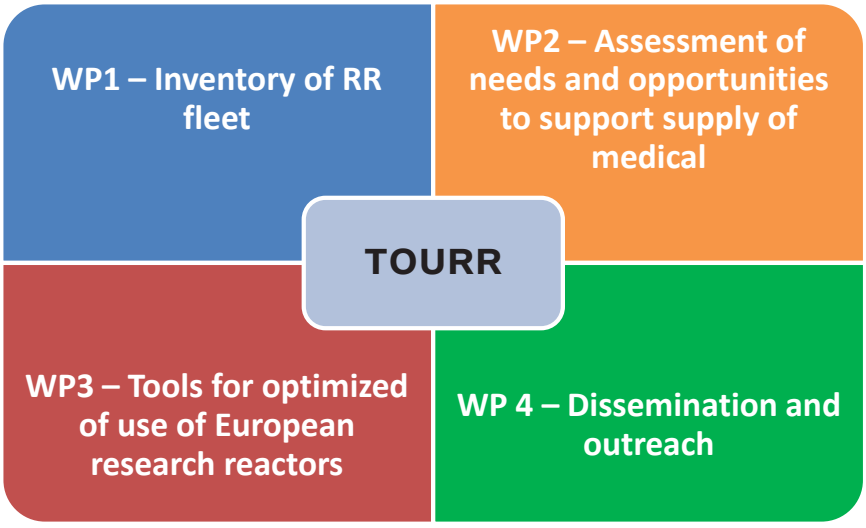
VI. Rising awareness of decision makers and the public on the role of RR

E.g. Step II: Estimation of future needs of RR and neutron sources

The main applications of the European RR fleet was classified into 5 categories:

a) Education and training,
b) Basic and fundamental research and its instruments,
c) Medical applications, including isotope R&D as well as beam applications,
d) Material testing, including fuel, structural material and related instrumentation,
e) Core physics testing for reactors in "zero power" installations

- database providing information about applications, future plans, capacities of the RRs
- to perform domains: Research & Development, Medical applications and Education & Training.



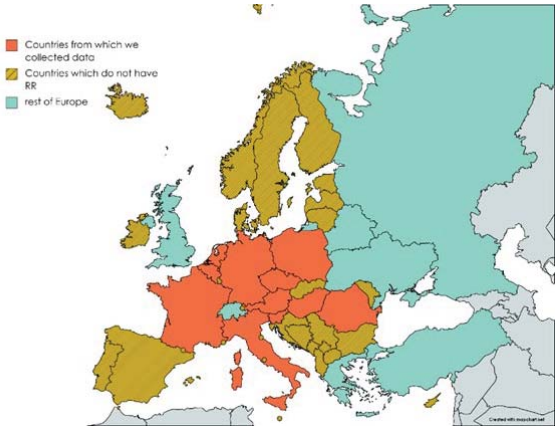
- Mapping the needs for medical isotopes linked also to the new medical techniques

- strategy for optimized use of of RRs in Europe
- tools to support the implementation of the same strategy
- support the planning of refurbishment of existing research reactors or construction of new ones

- Informing and contacting relevant stakeholders and other interest groups

TOURR

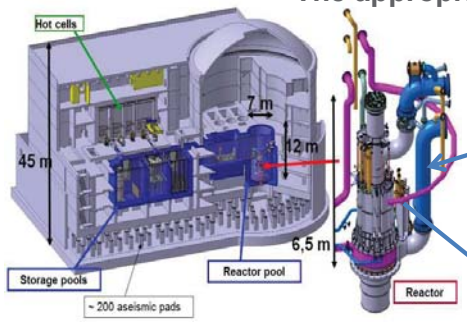
- The project is currently in the second year of its implementation.
- A survey was already conducted among European research reactors. Data received are from: Austria, Belgium, Czech Republic, France, Germany, Hungary, Italy, The Netherlands, Poland, Romania and Slovenia.
- A public report containing bulk considerations (to ensure confidentiality of the data transmitted to us by the RR) has been compiled and is available.
- Furthermore, three gap analysis on Research & Development, Medical applications and Education & Training has already been performed

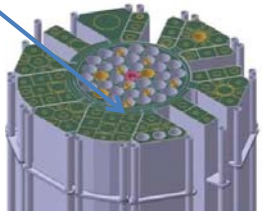


www.tourr.eu

JULES HOROWITZ REACTOR

The appropriate answer to the Industry, R&D and TSO needs





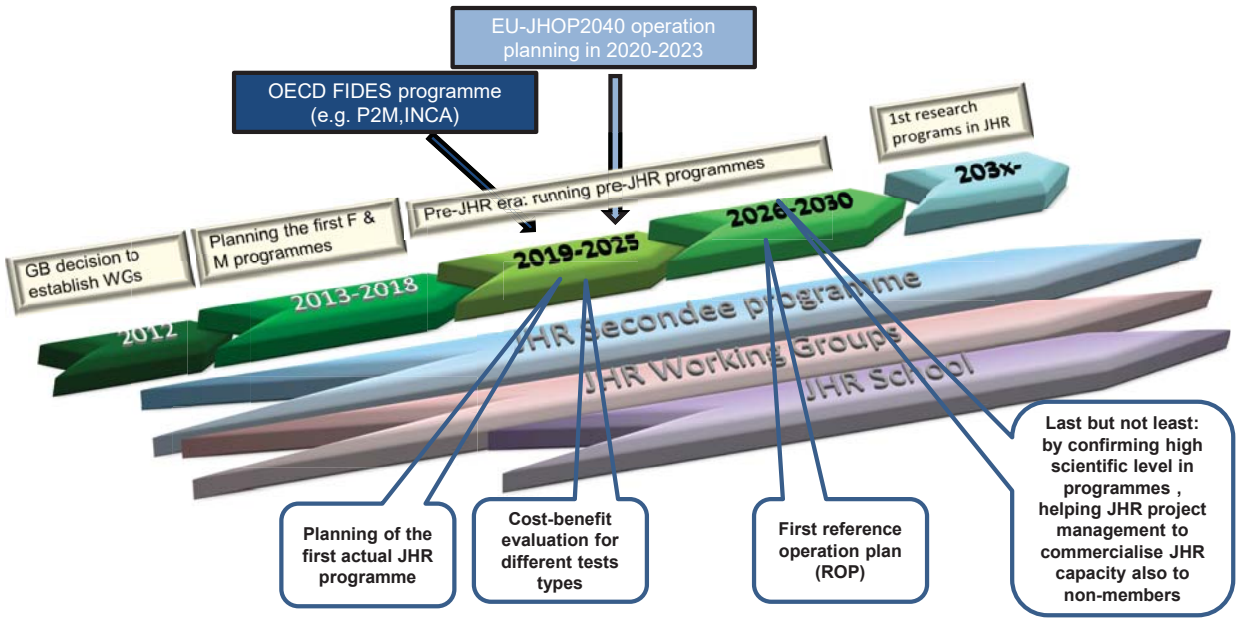
- **MTR allows to reproduce NPPs conditions for :**
  - Material screening
  - Material characterisation
  - Fuel element qualification

- **JHR Main Objectives:**

1] R&D in support to nuclear Industry (F&M studies under normal, incidental and accidental situations)
2] Radio-isotopes supply for medical application
3] A key tool to support expertise

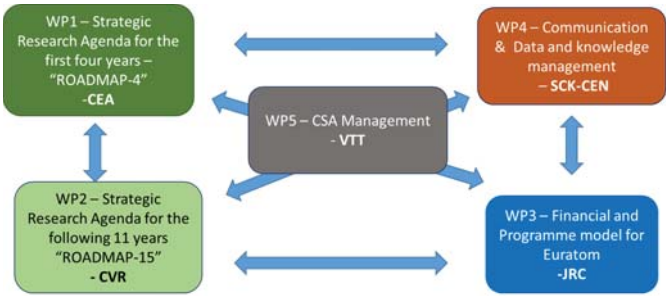
JULES HOROWITZ REACTOR

JHR time frame and tasks for co-operation (as of End-2021)



Jules Horowitz Operation Plan 2040 – JHOP2040

- Creation of the Roadmap covering at least 15 years from the start of the 1st irradiation campaign at the JHR to assure proper and effective use of the Euratom access rights (6% share)
  - Detailed irradiation plan for the 1st 4-years period.
  - Take into account availability of the specific experimental rigs at different stages of the JHR operation.
  - The Roadmap should comprise an analysis of the financial model to be used for funding irradiation experiments.



Grant Agreement No:	899360
EC Budget contribution:	1,100,501 EUR
Type of action:	Roadmap for use of Euratom access rights to Jules Horowitz Reactor experimental capacity
Duration (in months):	30
Schedule:	1st September 2020 – end 2023
Coordinator:	Petri Kinnunen, VTT Technical Research Centre of Finland Ltd

Jules Horowitz Operation Plan 2040 – JHOP2040

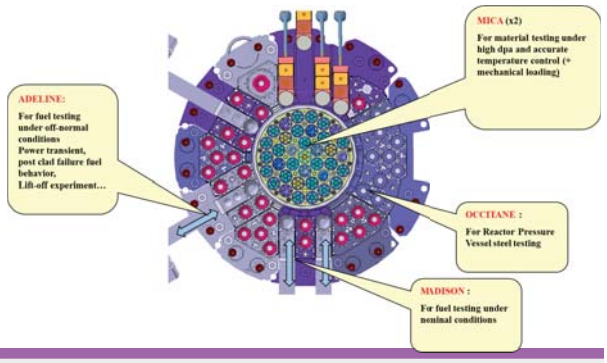
First 4-years irradiation period

- Latest information provided by the JHR consortium concerning the devices, irradiation locations, PIE facilities and transport capabilities has been created and updated – PUBLIC
- Final Synthesis Report First 4Yrs – PUBLIC

This work has been finalized.

Family	#	Topic	Type of materials	Reactor system of interest										JHR exp. device	GLOBAL PROGRAM RANKING:
				PWR	BWR	VVWER	SFR	LFR	ADS	HTR	SMR	CANDU	Fusion	Spent fuel storage (SP)	
RPV	1	Embrittlement: effect of neutron dose	low alloy steels, including MnMoNi (e.g. SA-533, Grade B, Class 1 SA-508, Class 2, 16MND5), MnMo (e.g. SA-302, Grade B), CrMoV (e.g. 15Kh2MFA base metal, Sv-10KhMFT weld metal) and NiCrMo (e.g. 15Kh2NMFA). '18-8' stainless	X	X	X	X	X	X	X	X				OCCITANE	3
	2	Embrittlement: effect of neutron flux		X	X	X	X	X	X	X	X				OCCITANE	3
	3	Embrittlement: Effect of neutron spectrum		X	X	X	X	X	X	X	X				OCCITANE	2.5

Fuel test device (first fleet)	T0 (mid N-1)	Year N (T0+1)	Year N+1	Year N+2	Year N+3	Year N+4
ADELINE		Tests for validation of the performance	Qualification of the experimental domain/non regression	Qualification of the experimental domain/non regression	Experimental programs : 2 tests dedicated to JHR Consortium (with the hypothesis of a total number of up to 6)	Experimental programs : 2 tests dedicated to JHR Consortium (with the hypothesis of a total number of up to 6)
		1 test ("ADE1" test) open to the validation of specific performance directely linked to Euratom needs	*1 test ("ADE2" test) open to Euratom participation on some specific points when qualifying the experimental domain or checking the non-regression*	*1 test ("ADE3" test) open to Euratom participation on some specific points when qualifying the experimental domain or checking the non-regression*	*1 test ("ADE4" test) more specifically oriented on Euratom topics of interests*	*1 test ("ADE5" test) more specifically oriented on Euratom topics of interests*
MADISON		Tests for validation of the performance	Qualification of the experimental domain/ non regression	Experimental programs : With the hypothesis of a total number of 6 experimental irradiation cycles per year	Experimental programs : With the hypothesis of a total number of 6 experimental irradiation cycles per year	Experimental programs : With the hypothesis of a total number of 6 experimental irradiation cycles per year
		2 cycles open to Euratom participation "MAD1"test	*2 cycles open to Euratom participation "MAD2" test*	*2 cycles open to Euratom objectives "MAD3" test*	*2 cycles open to Euratom objectives "MAD4" test*	*2 cycles open to Euratom objectives "MAD5" test*



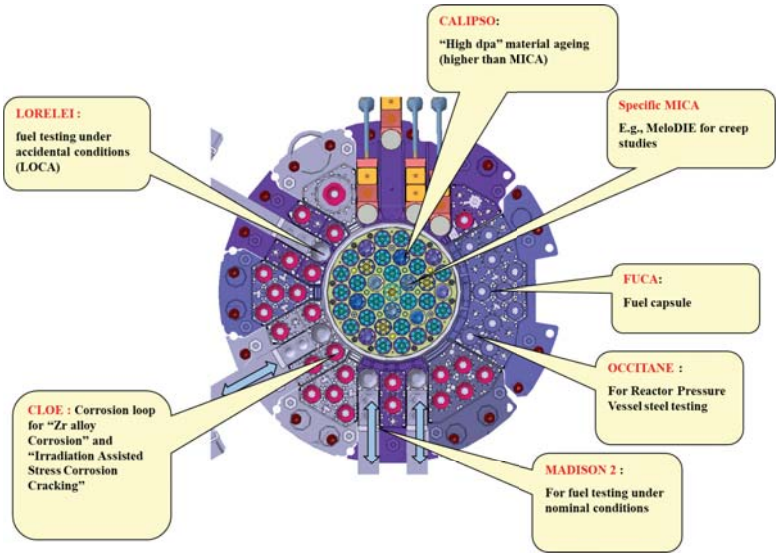
Jules Horowitz Operation Plan 2040 – JHOP2040

Long-term roadmap (after first irradiation period)

- Exposures with **intermediate discharges**, irradiations under **variable conditions**, irradiations in association with **loading or corrosion**
- Testing of nuclear fuels in **design basis accident / design extensions** conditions and innovative testing of nuclear fuels
- Testing of **sensors and other novel equipment** coming from the M&F needs

→Synthesis report on the plans for the material and fuel studies and technology development in the long term in April 2022.

This work is in progress.



Jules Horowitz Operation Plan 2040 – JHOP2040

Programme structure and Governance model

- Feedback for optimizing the next 4-year **Reference Operation Plan (ROP)**
- Resources analysis providing information on the **available and foreseen technologies**
- Guidance for the **development of new experimental devices** using first operation feedback
- **Cost breakdown model** giving the basis for evaluating the individual cost of each experiment.

www.jhop2040-h2020.eu/

JHR – Euratom stakeholders network

- Goal: to develop **stable and permanent communication links** with interested EU stakeholders ensuring the effective use of Euratom access rights
- Two groups of EU organisations; **members of the JHR consortium and non-members but interested**
- JHR-ESN objective: **structure, compile and consolidate their irradiation needs** for experiments at JHR in the frame of the available Euratom access rights
- Roles:
  - **Working groups**: mirroring the active JHR working groups
  - **Steering Committee**: EU members of the JHR Consortium and external members with geographical and functional diversity. Suggested CEA as permanent member of the SC.
  - **European Commission roles**: JRC as secretariat/coordinator; RTD as permanent observer

EURATOM ACCESS RIGHTS TO JHR

The EC (Euratom-JRC)- considering its contribution to the construction- gets:

- 6 % of guaranteed Access Rights to JHR experimental capability for the whole life of operation of the reactor
- 6 % of voting rights in the JHR Consortium.

- Access Rights can be cumulated to some extend from one year to the following in order to implement greater research programs in one specific year
- Access Rights are to be converted to Access Units, that take into account the experimental capacity of the JHR and the various factors associated to each experiment type

Preliminary weight factors of different experiment types in the JHR

Kind of experimentation	Fixed part			Variable part			Impact factor (Fuel consumption, performances,...)	"Weight" total
	Neutron flux factor	Equipment complexity factor	Utilities (water, electricity,...)	Volume factor	Operation complexity factor	Services (NDE, FP lab, hot cells,...)		
MADISON	1	3	2	1	3	2	---	12
ADELINE	1	3	1	1	2	2	---	10
MICA	1	2	1	1	2	0	1	8
specific MICA	3	2	1	1	2	1	2	12
LORELEI	2	3	2	1	3	3	---	14
OCCITANE	1	1	0	3	1	0	2	8
CALIPSO	3	2	2	2	3	3	1	16
CLOE	1	3	2	1	2	2	1	12
Fast reactor support	3	3	2	2	3	3	---	16
Boiling device	1	2	1	1	1	2	---	8

Access units per experiment and per cycle

EURATOM ACCESS RIGHTS TO JHR

Euratom access rights in practise:

- 6 % of Access Rights represents about 79 Access Units per year (6% of 1318).
- E.g., the EC with its 6 % Access Rights can have access each year to:
  - 7 to 8 Ramps type experiments using ADELINE device,
  - or 6 Fuel loop irradiation type experiments using MADISON device,
  - or 3 Material capsule type experiments.

Example of loading plan
A.U. = Access Units

Type of experiment	Associated Access Unit per experiment and per cycle	Number of JHR locations for the type of experiment considered	Cumulated number of Access Unit per year (on the basis of 7 cycles per year)
Fuel ramps studies (ADELINE)	10	3	210
Fuel loop steady-state studies (MADISON)	12	2	168
Fuel loop for LOCA studies (LORELEI)	14	0,3 (we consider only 3 LOCA tests per year)	30
Fuel capsule studies (FUCA)	10	4	280
Material capsule studies in core (MICA)	8	3	168
Advanced MICA in core	12	2	168
RPV studies in reflector (OCCITANE)	8	2	112
Corrosion studies (CLOE)	12	1	84
FR material studies	14	1	98
TOTAL	100		1318

Thank you for your attention

European Commission

TOURR nuclear research reactors

HOJ 20 40 JHR Operation Plan 2040

JHR Jules Horowitz Reactor