JULES HOROWITZ MTR OPERATION PLAN 2040 - JHOP2040

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CEA Comissariat à L'Energie Atomique et aux Energies Alternatives France

VTT Technical Research Centre of Finland Ltd.

H2020 - Coordinated Support Action

Grant Agreement 899360

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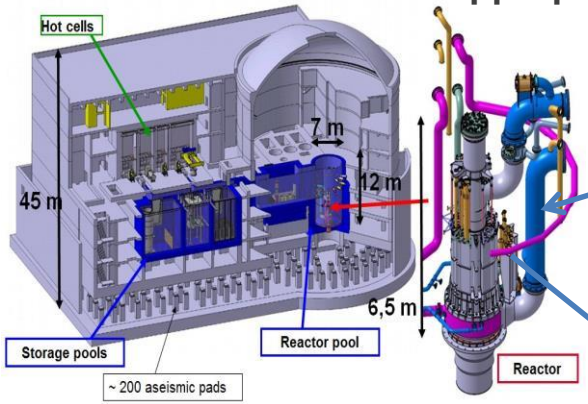
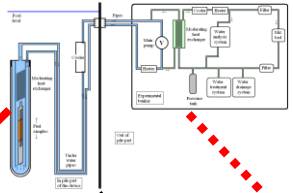
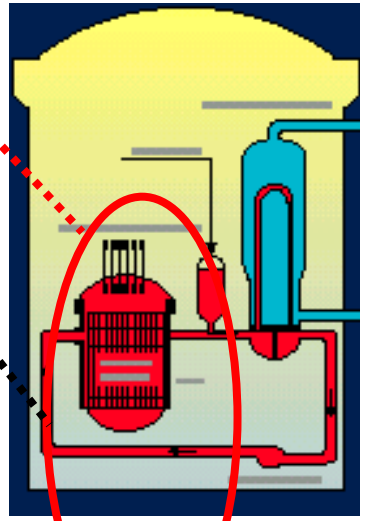
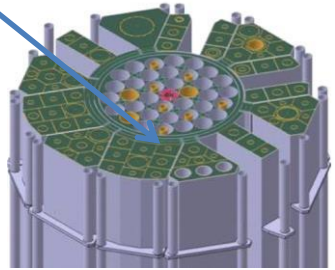
The appropriate answer to the Industry, R&D and TSO needs









- 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

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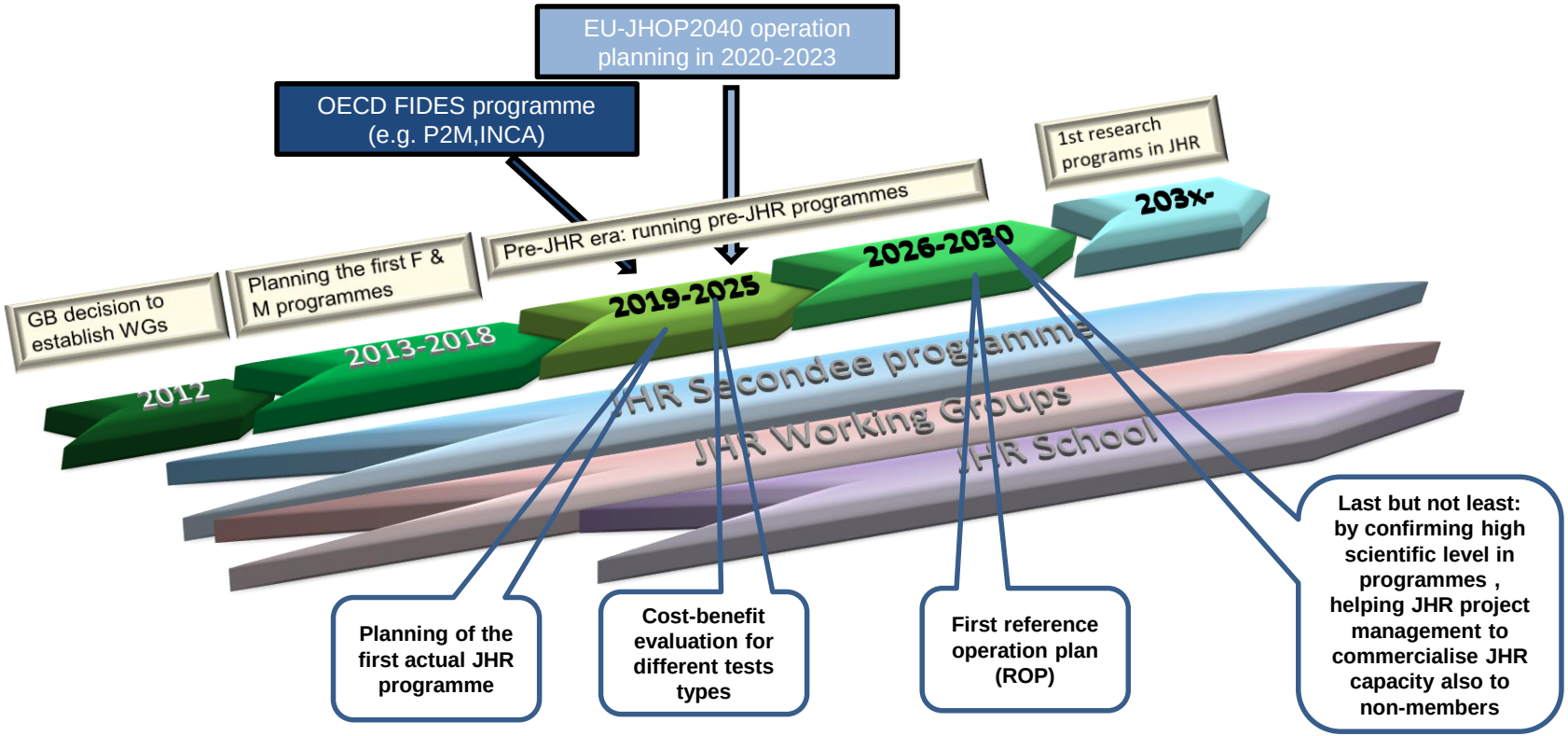
JHR time frame and tasks for co-operation



JULES HOROWITZ OPERATION PLAN 2040

SCOPE

This action should lead to the **creation of the Roadmap** covering at least **15 years** from the start of the 1st irradiation campaign at JHR (that is to say typically the period 20125-2040), with a goal to **assure proper and effective use of the Euratom access rights (6% share)** by research consortia funded through Euratom indirect actions.

This Roadmap should include more **detailed irradiation plan for the 1st 4-years period** of JHR operation. The Roadmap is supposed to take into account **availability of the specific experimental rigs** at different stages of JHR operation. The Roadmap should comprise an analysis of the **financial model** to be used for funding irradiation experiments. It is expected that the strategic research documents of the **relevant European groupings** (e.g. NUGENIA, EERA Joint Programme on Nuclear Materials 22 23 24) are taken into account for the Roadmap creation.

The Commission considers that proposals requesting a contribution from the Euratom Programme up to **EUR 1.1 million** would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

The **JRC is expected to participate** in this action to ensure that it covers the full use of the Euratom access right while taking into account the JRC planned activities. In such participation JRC staff and operational costs will be covered by JRC budget as appropriate.

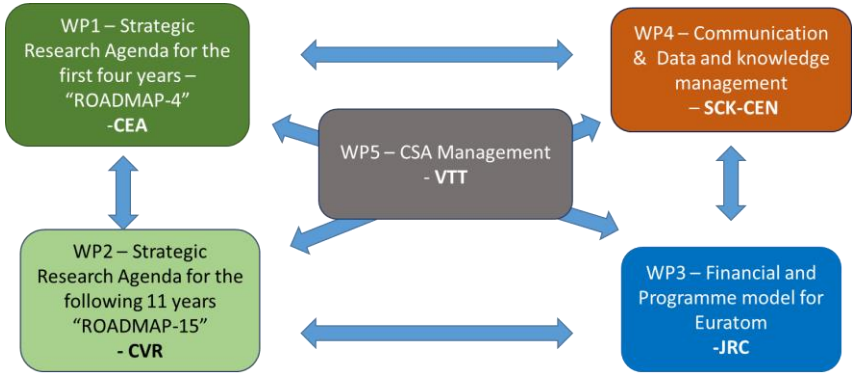
JHOP2040 is closely related to the **ORIENT NM CSA** work for planning the future European Joint Programme on nuclear materials research as well as **EU-NOMATEN CoE** established by CEA, VTT and NCBJ in Poland.

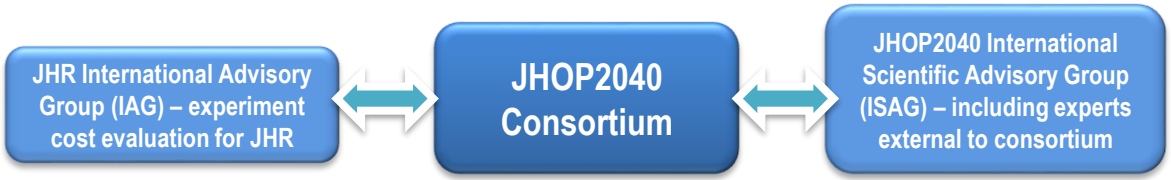
JHR Operation Plan 2040

Réacteur | Jules | Horowitz | Reactor

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

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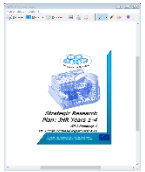
First 4-years irradiation period

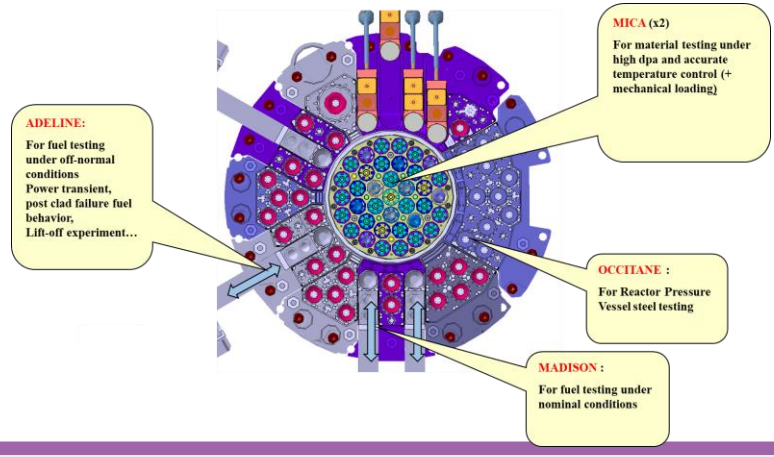
- Latest information provided by the JHR consortium concerning the devices, irradiation locations, PIE facilities and transport capabilities has been created and updated – PUBLIC
- Final Synthesis Report First 4Yrs – PUBLIC



This work has been finalized.

Family	#	Topic	Type of materials	Reactor system of interest										JHR exp. device	GLOBAL PROGRAM RANKING:
				PWR	BWR	WWER	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*



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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

→Final Synthesis report on the plans for the material and fuel studies and technology development in the long term - PUBLIC

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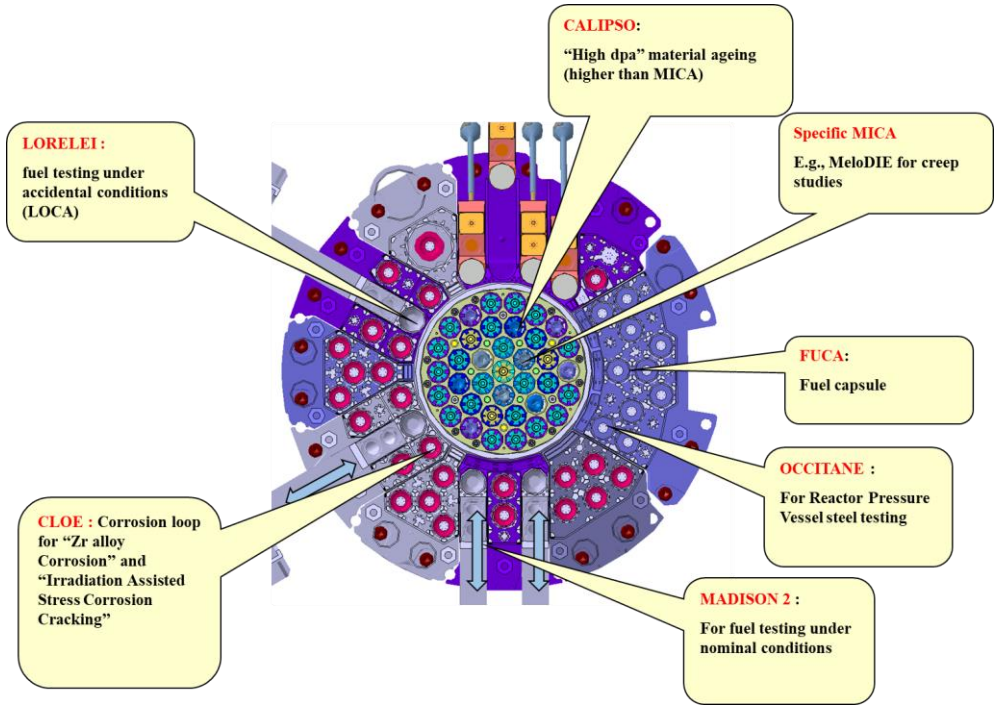
This work has been finalized.



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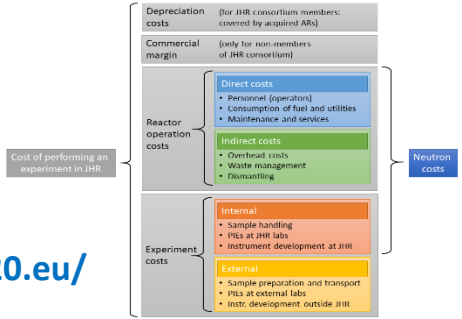
Programme structure and Governance model

- 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