

# Materials Irradiation Device (MIDI)

## Introduction

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**NRG  
PALLAS**

**Nuclear. For Life.**



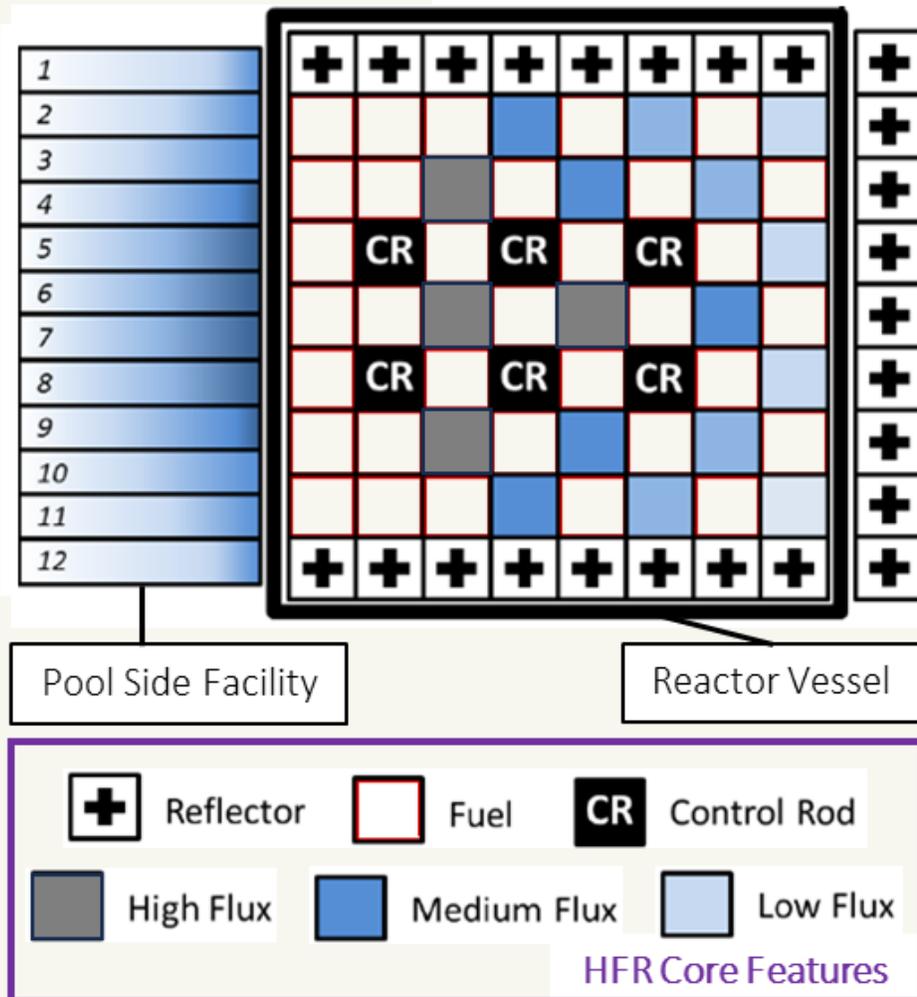
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# Content

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- HFR Irradiations
- Background to structural material irradiations
- Aims & timelines
- Irradiation requirements Specification
- Current status and Next steps

# HFR Irradiations



Name	Irradiations	Name	Irradiations
<b>CONFIRM</b>	Nitride fuels	<b>CIWI</b>	BWR core shroud welds
<b>EFFTRA</b>	Transmutation	<b>ENICKMA</b>	Ni-alloys for MSRs
<b>Fuel CREEP</b>	Online fuel creep measurement	<b>EXTREMAT</b>	High temperature advanced materials
<b>HELIOS</b>	Minor actinide fuels & targets	<b>EXOTIC</b>	Solid tritium breeder materials
<b>INET</b>	HTR-PM fuel qualification	<b>HICU</b>	Breeder materials for fusion
<b>MARIOS</b>	Minor actinide fuels	<b>IBIS</b>	Material(s) in LBE
<b>SMART</b>	Nitride fuels	<b>INNOGRAPH</b>	HTR graphite
<b>OTTO</b>	Once through Pu transmutation	<b>LYRA</b>	Reactor Pressure Vessel Steels
<b>FUJI</b>	Breeder reactor fuels	<b>PYCASSO</b>	HTR surrogate particles
<b>THORIUM CYCLE</b>	Thorium fuel	<b>SPICES</b>	RAFM steel
<b>TRABANT</b>	Fast breeder annular MOX	<b>SOSIA</b>	9Cr creep and creep fatigue
<b>SPHERE</b>	Minor actinide sphere-pac fuels	<b>STROBO</b>	Stress relaxation of bolt materials
<b>MARINE</b>	Minor actinide pellet fuel	<b>SUMO</b>	9Cr steels and joints

# Background

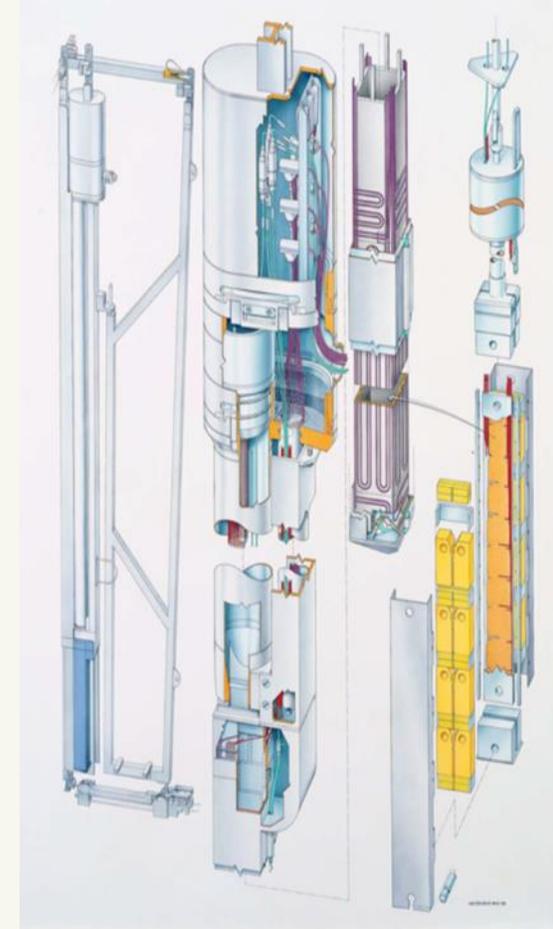


HFR has played a crucial role in irradiating structural materials, most recently using LYRA facility in PSF position

LYRA-10 was the last experiment, jointly conducted by NRG and JRC, on compositionally tailored RPV steels for LTO studies, finished in Jan 2018

New facility, replacing LYRA, is needed to continue research to support:

- development and qualification of materials for Small Modular Reactors (SMRs),
- development and qualification of new manufacturing process
- support Long Term Operation (LTO) of Light Water Reactors (LWR) and research reactors (RR).



# Aims & Timelines

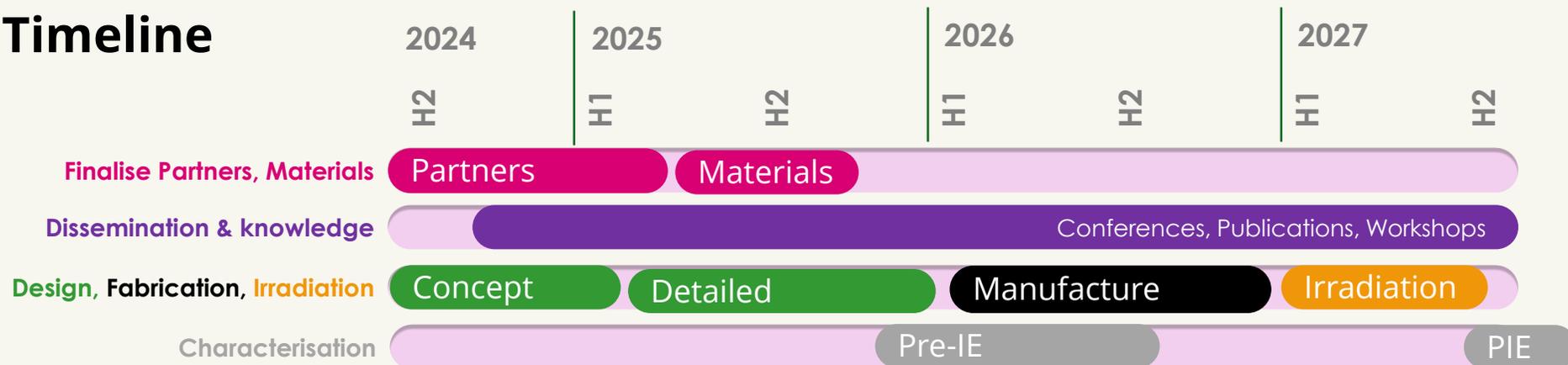


## Aims

Design and construct a new **re-usable Irradiation Facility** for materials in pool side facility (PSF) position of High Flux Reactor (HFR).

Need exists to be able to continue research on Light Water Reactor (LWR) materials in support of Long-Term Operation (LTO) and support qualification of Small Modular Reactor (SMR) materials and manufacturing processes.

## Target Timeline



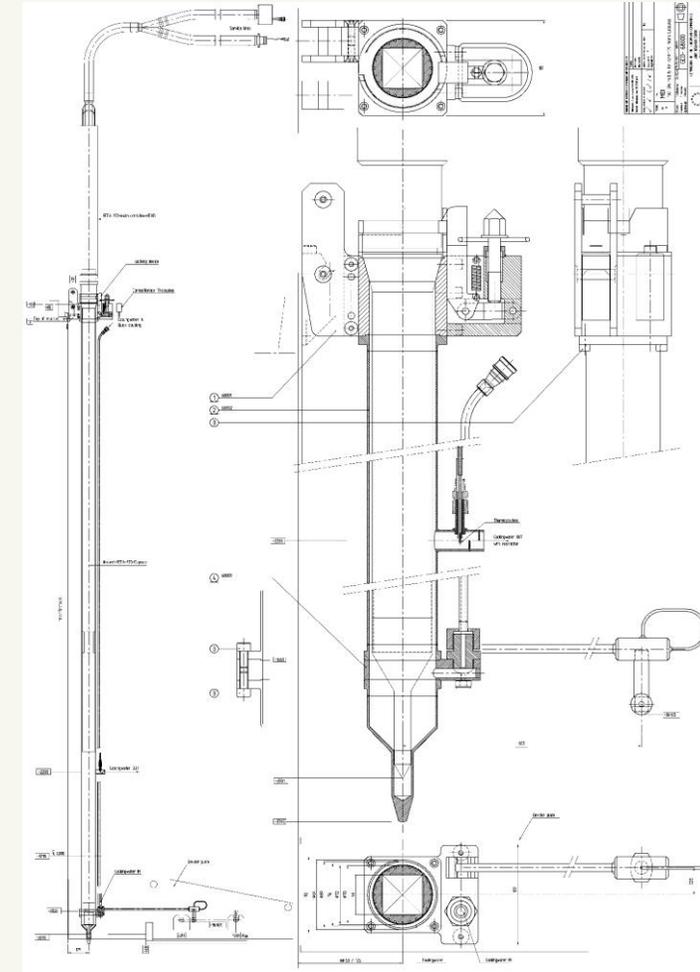
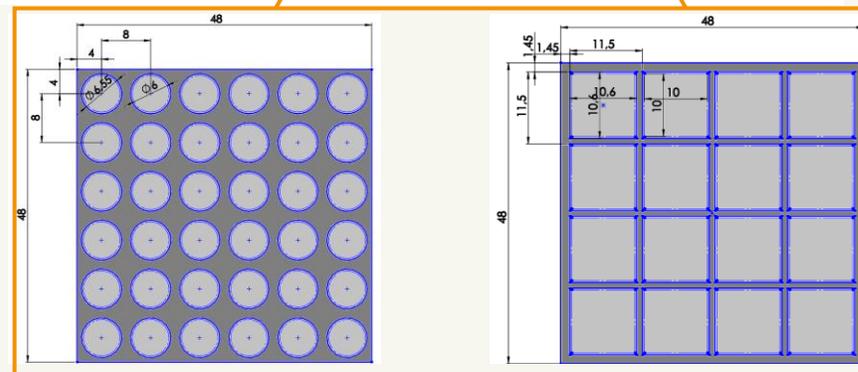
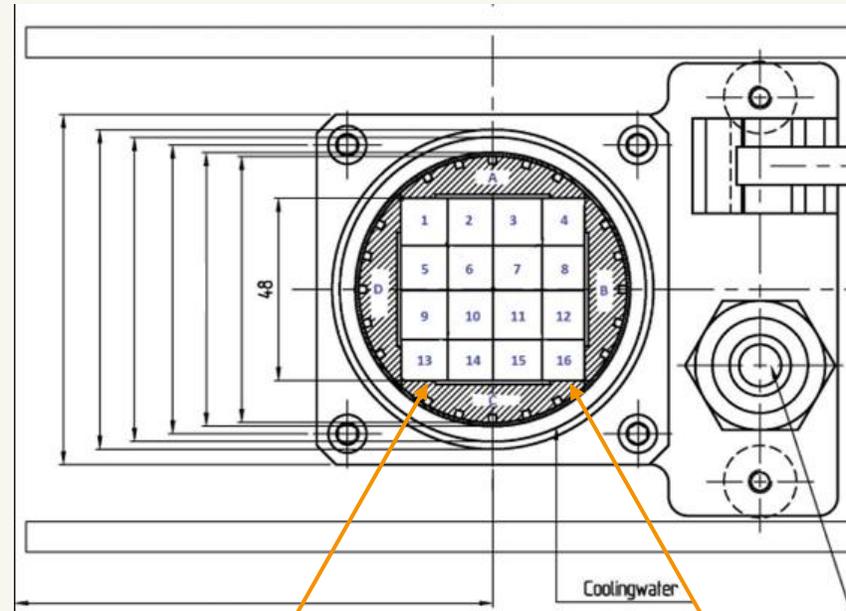
# Irradiation Requirements Specification



- Nominal Irradiation Temperature(s) 280-310°C
- Target fluence ( $E > 1$  MeV)  $\sim 6 \times 10^{19}$  n/cm<sup>2</sup>
- Inert Atmosphere (He) irradiation
- Online temperature measurement with multiple thermocouples
- Inclusion of activation monitor sets throughout for dosimetry analysis
- Loadable with reference and pre-irradiated samples



# Current Status: End of concept design



# Next steps (tentative timeline)



- Form research collaboration
- Identify materials of interest for irradiation (April 2025)
  - Filled materials templates should be sent back to us by the end of March 2025
- Definition of test matrix (June 2025)
- Identify potential funding opportunities (continuous)
- Receive materials and start of pre-IE (Sep 2025)
- Detailed design (Dec 2025)
- Manufacturing and assembly (2026)
- 1<sup>st</sup> irradiation (2027)