TRTR – IGORR 2005

JULES HOROWITZ REACTOR

GENERAL LAY OUT, MAIN DESIGN OPTIONS RESULTING FROM SAFETY OPTIONS, TECHNICAL PERFORMANCES AND OPERATING CONSTRAINTS

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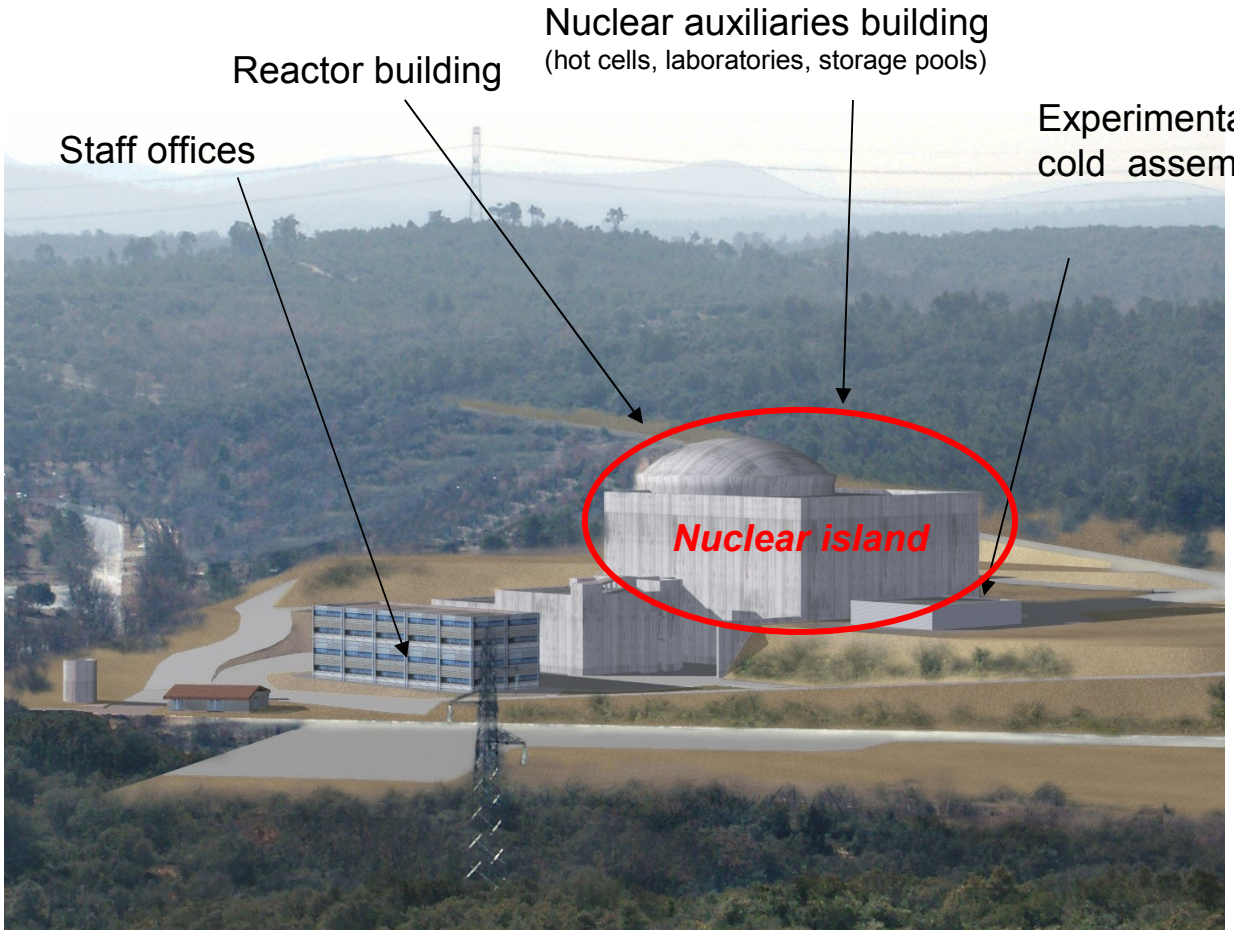
JHR TECHNICAL OBJECTIVES

- Increased fast and thermal neutron flux levels compared to previous generation European MTR reactors
- In-depth implementation of in-facility connected experimental capacities (hot cells, laboratories, NDE tools)
- Design based upon up to date safety standards with special attention to experimental constraints (eg., actinide tests, energetic irradiation loops)

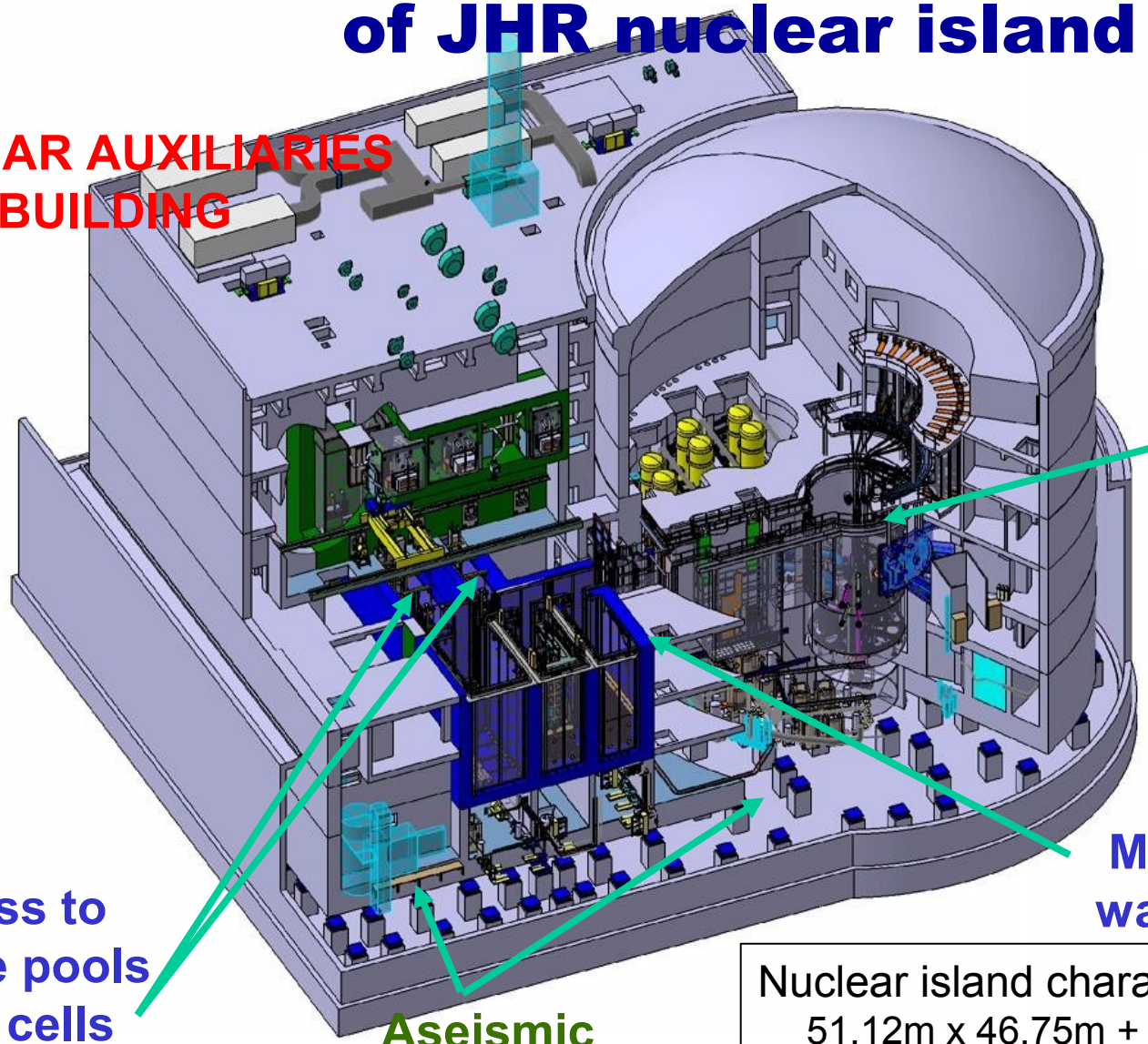
Provisional lay out of JHR facility in Cadarache centre



JHR connections with CEA Cadarache facilities

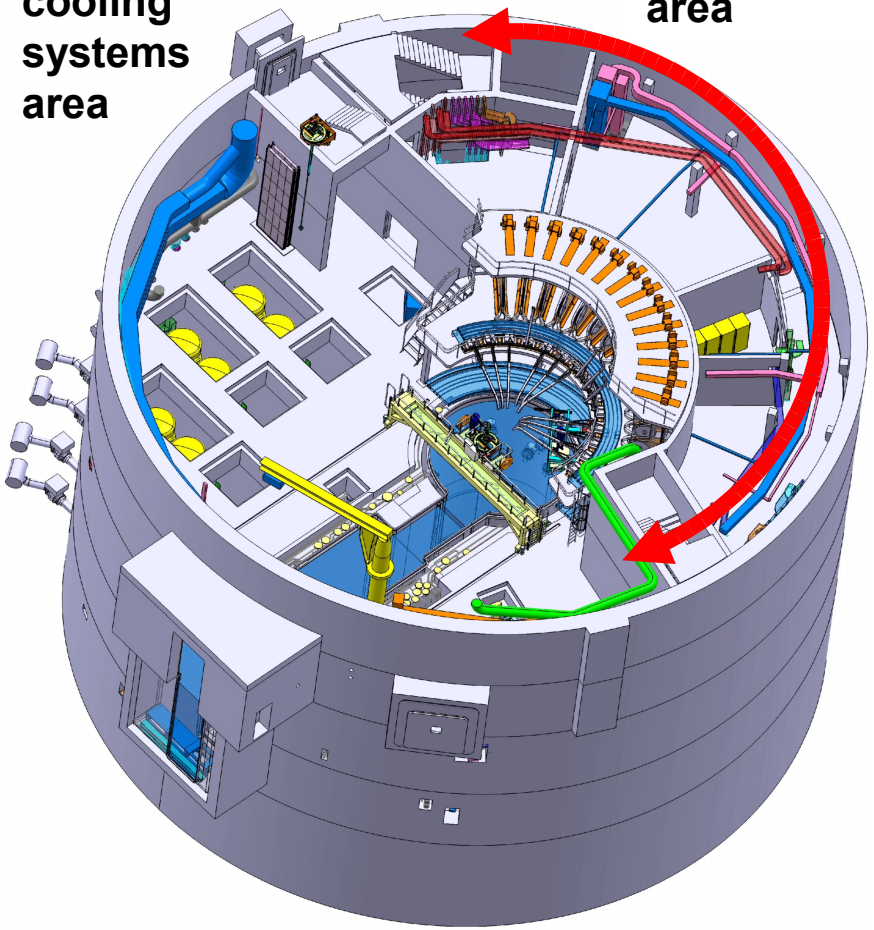
- ✓ Fuel fabrication laboratories
- ✓ Instrumentation of samples
- ✓ Destructive post irradiation exam./tests
- ✓ Management of solid and liquid waste generated by JHR

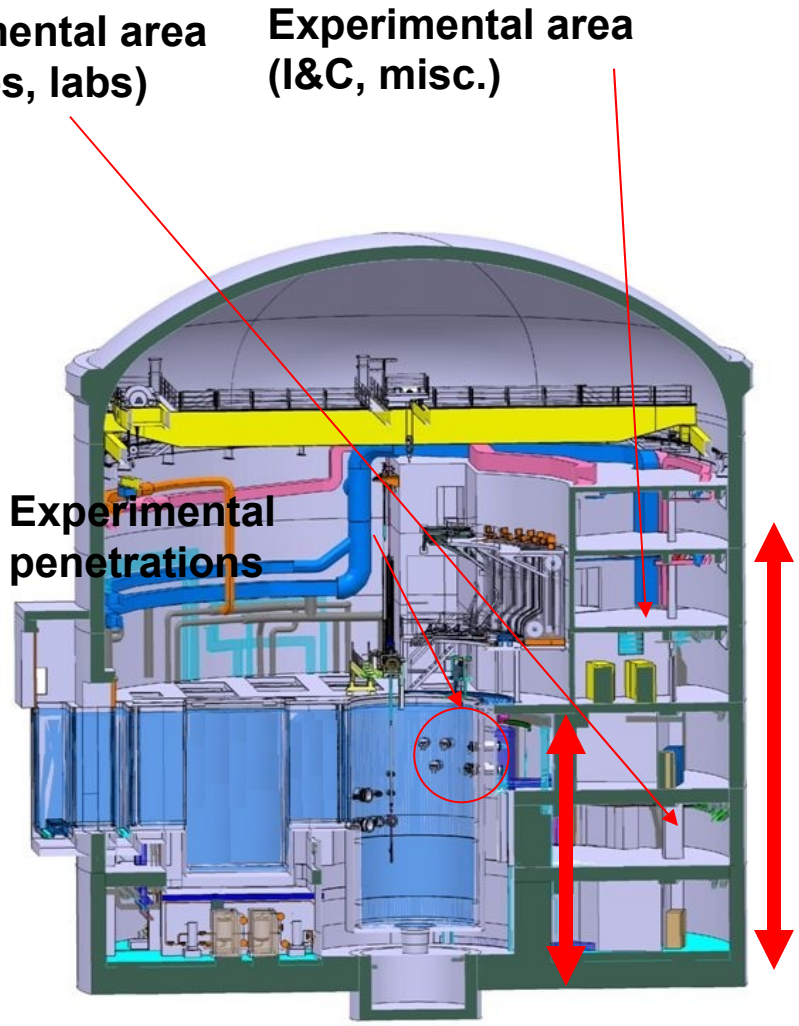
General lay out of JHR nuclear island



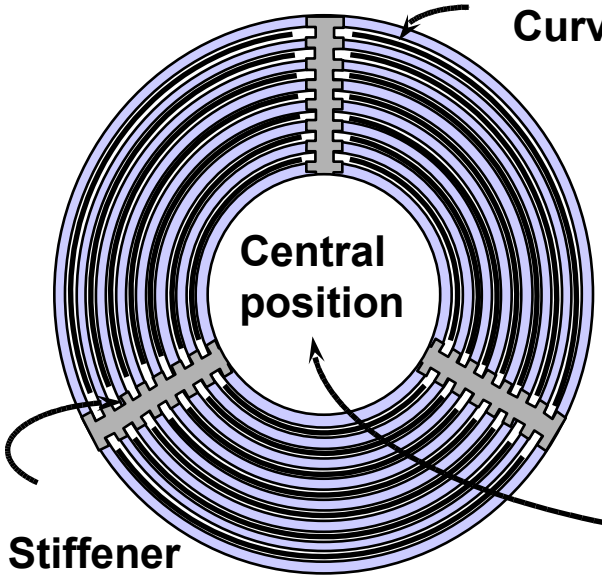
Nuclear island characteristics
51,12m x 46,75m + Φ36.6m
H 34,4m + H44,9 m

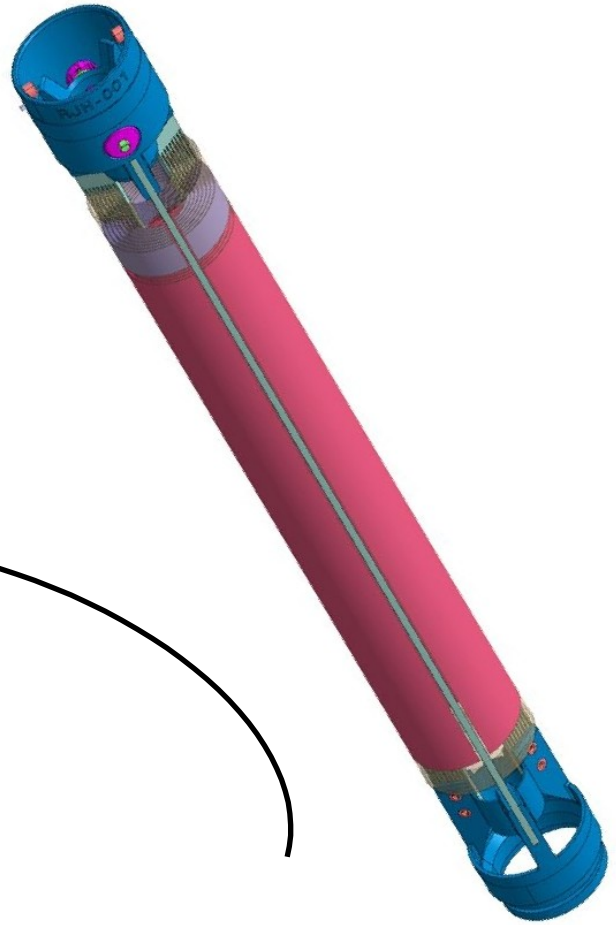
Experimental area in Reactor Building





JHR fuel element data





Fuel meat :	U-8Mo or U_3Si_2, Al
Active height :	600 mm
Fuel meat thickness :	0.61 mm
Water channel :	1.84 mm
Cladding :	Aluminium alloy
Structure :	3x8 plates
Internal diameter :	41 mm
External diameter :	circ. 95 mm

Possibility to host :
- guide tube + neutron control rod or Al rod
- protection tube + experimental device
(int. diameter of protection tube : 37 mm)

Fuel element consists of 8 cylindrical plates separated in 3 sectors
Fuel: UMo (8 g U/cm^3 19.75% U5 enriched)

37 slots in the core
34 are filled with fuel elements

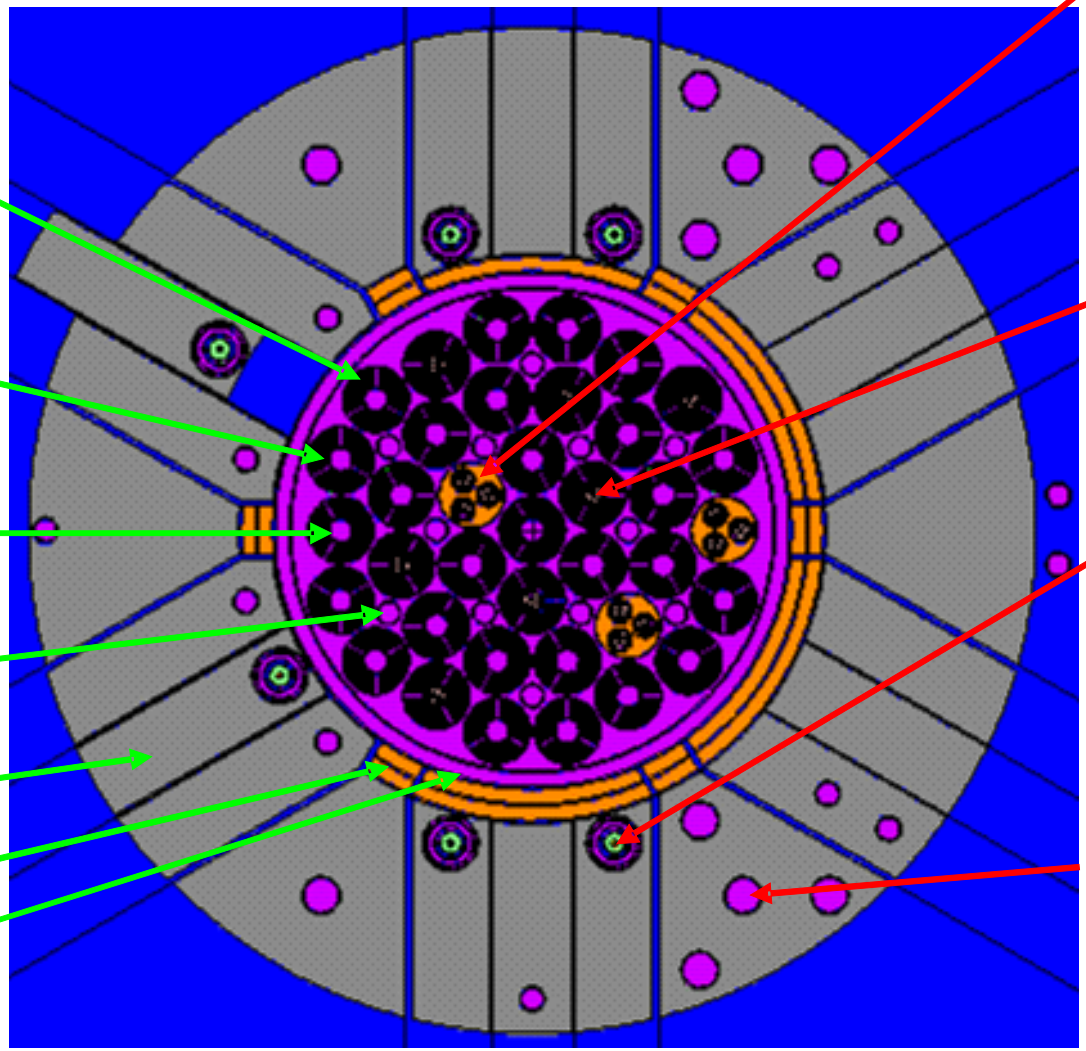
27 center of elements filled with control rods

12 inter-elements positions

30 cm thick Be reflector

2x 2 cm thick zircaloy gamma screen

2 cm thick aluminum core tank



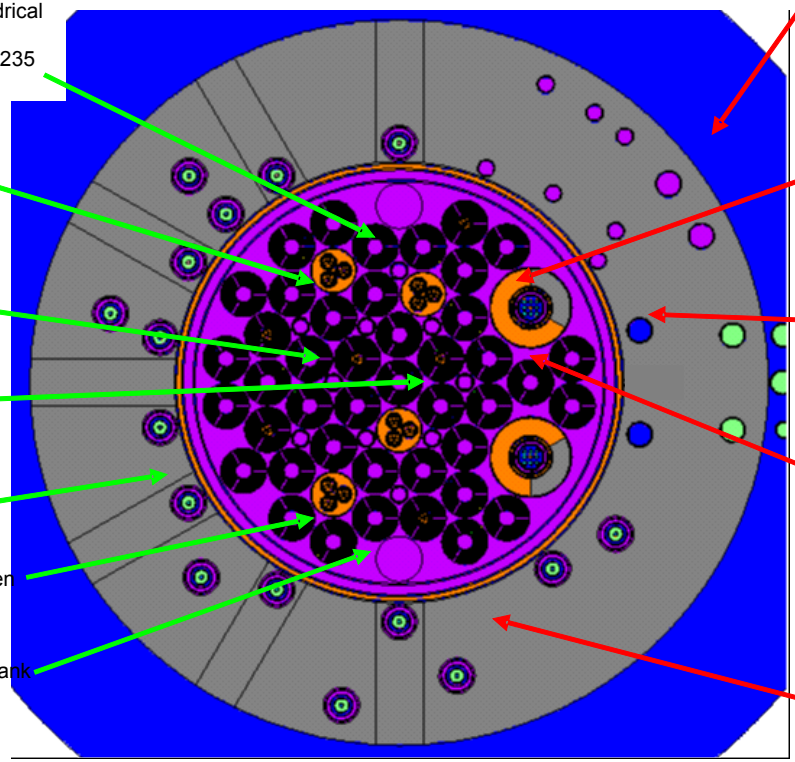
3 threefold irradiation facilities
(in place of a fuel element)
Peak values
(on a standard stainless steel rod)
4,2 E14 n/cm^2/s (fast flux)
2,9 E14 n/cm^2/s (thermal flux)

7 simple irradiation facilities
(in the center of a fuel element)
Peak values
(on a standard stainless steel rod)
5,5 E14 n/cm^2/s (fast flux)
2,9 E14 n/cm^2/s (thermal flux)

6 PWR-condition irradiation positions in the Be reflector (displacement system)
Peak values
(inside a 1% U235 enriched fuel pin)
8,8 E13 n/cm^2/s (fast flux)
4,3 E14 n/cm^2/s (thermal flux)
600 W/cm

9 Artificial Radio Elements devices in the Be reflector
Peak values
(inside a standard aluminium rod)
5,4 E13 n/cm^2/s (fast flux)
6 E14 n/cm^2/s (thermal flux)
1,7 W/cm

Reference configuration core



Fuel element consists of 8 cylindrical plates separated in 3 sectors
Fuel: UMo (8 g U/cm^3 19.75% U235 enriched)

51 slots in the core
43 are filled with fuel elements

37 center of elements filled with control rods

12 inter-elements positions

30 cm thick Be reflector

1 cm thick zircaloy gamma screen

2 cm thick aluminum core tank

9 Artificial Radio Elements devices in the Be reflector
Peak values
(inside a standard aluminium rod)
3,6 E13 n/cm^2/s (fast flux)
3,4 E14 n/cm^2/s (thermal flux)
1,6 W/cm

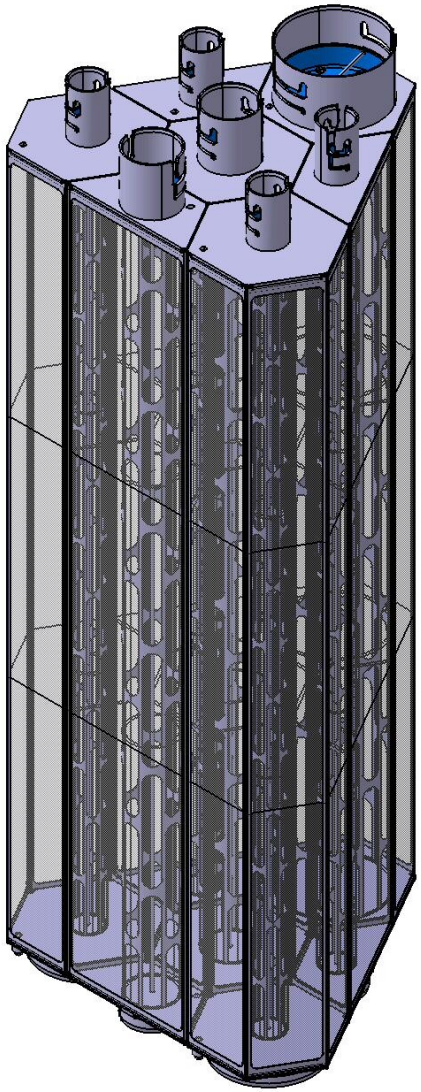
4 threefold irradiation facilities
(in place of a fuel element)
Peak values
(on a standard stainless steel rod)
3,3 E14 n/cm^2/s (fast flux)
2,2 E14 n/cm^2/s (thermal flux)

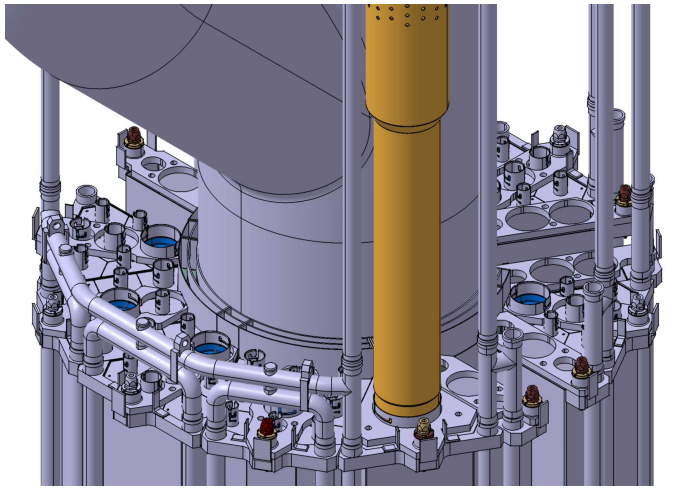
2 large in core irradiation facilities
Peak values
(on a standard stainless steel rod)
1,3 E14 n/cm^2/s (fast flux)
1,5 E14 n/cm^2/s (thermal flux)
500 W/cm

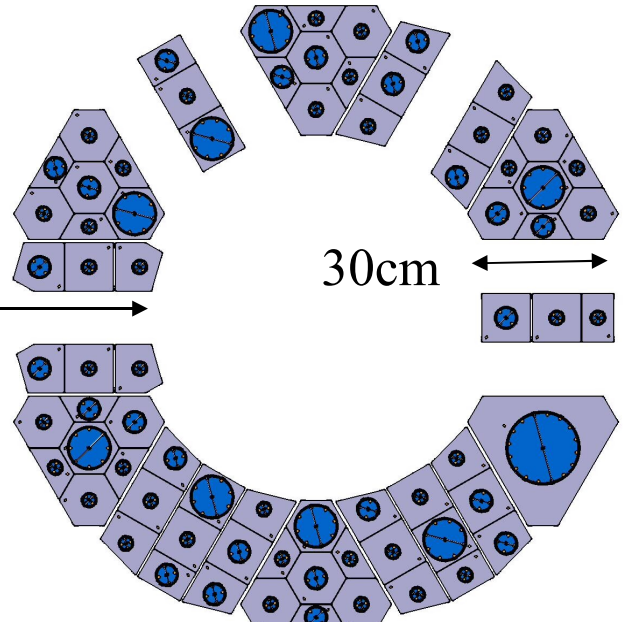
6 simple irradiation facilities
(in the center of a fuel element)
Peak values
(on a standard stainless steel rod)
4,4 E14 n/cm^2/s (fast flux)
2 E14 n/cm^2/s (thermal flux)

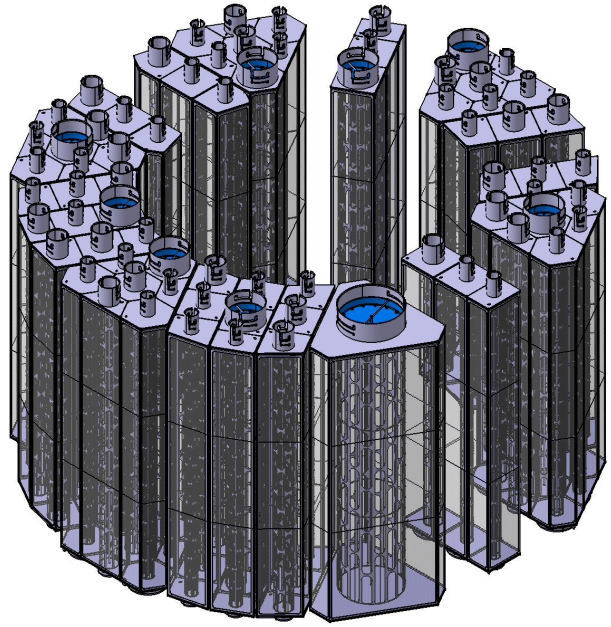
16 PWR-condition irradiation positions in the Be reflector (displacement system)
Peak values
(inside a 2,5% U235 enriched fuel pin)
7,7 E13 n/cm^2/s (fast flux)
3,2 E14 n/cm^2/s (thermal flux)
800 W/cm

Modular Beryllium reflector
Exploratory options

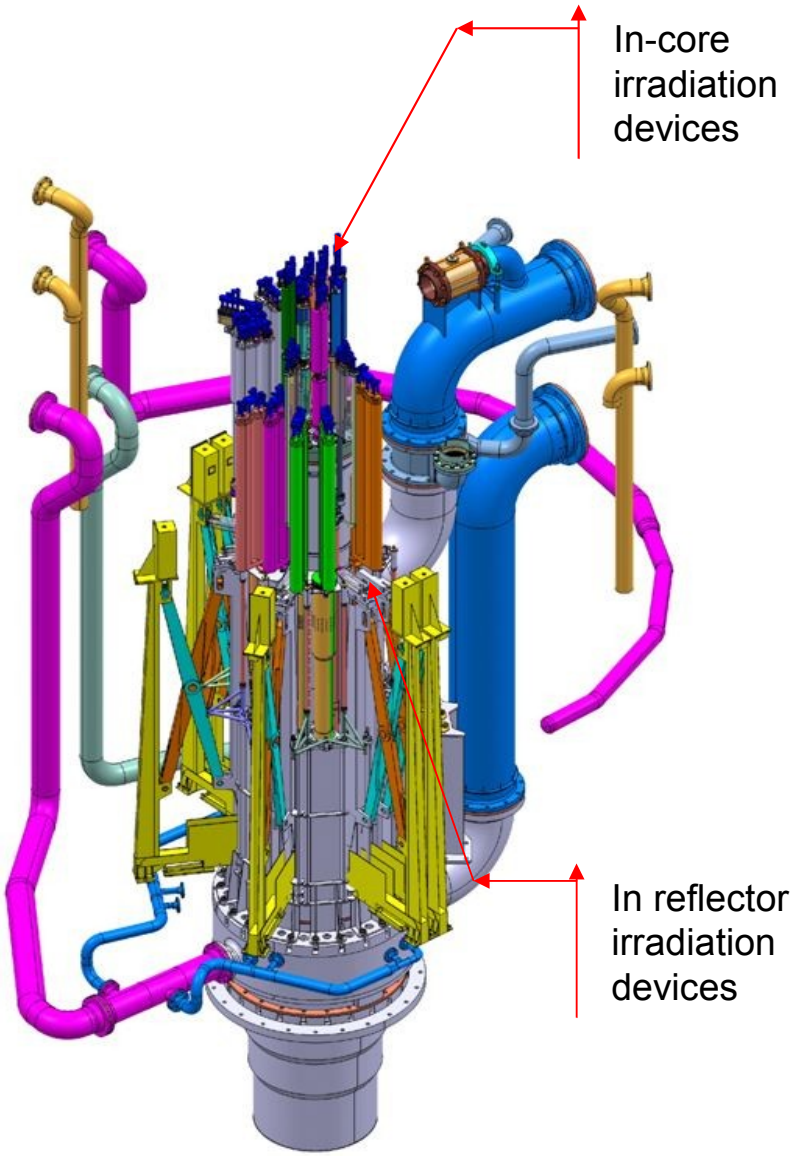


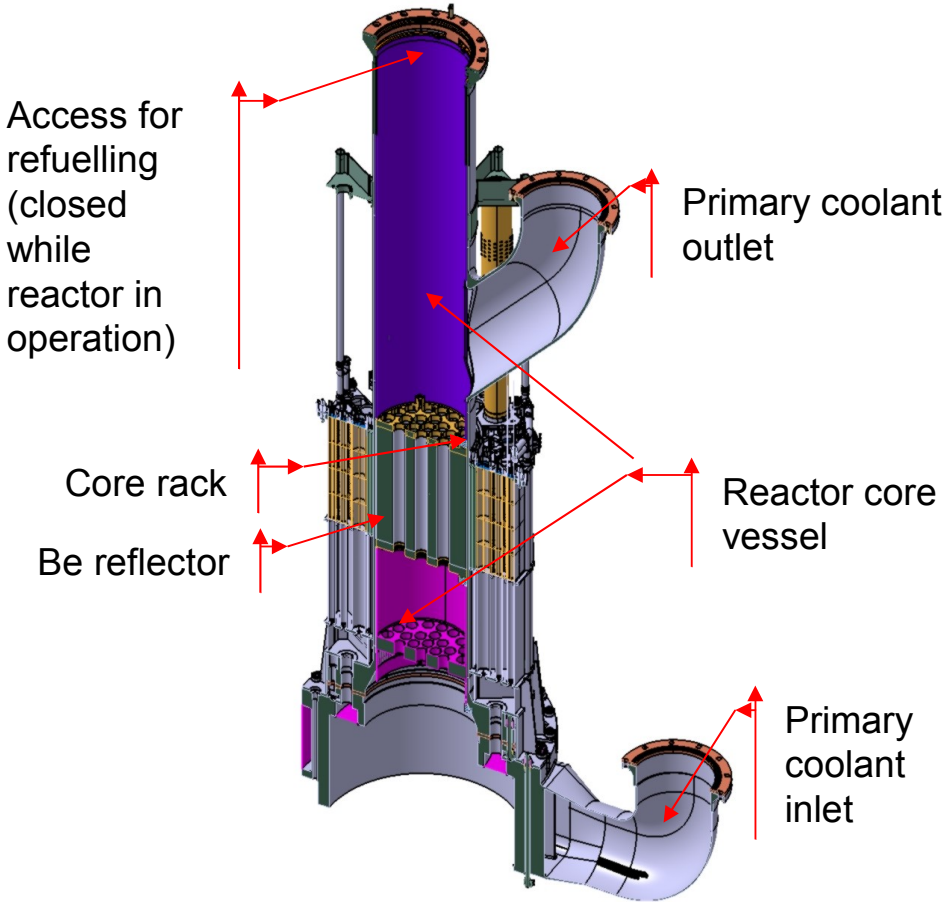


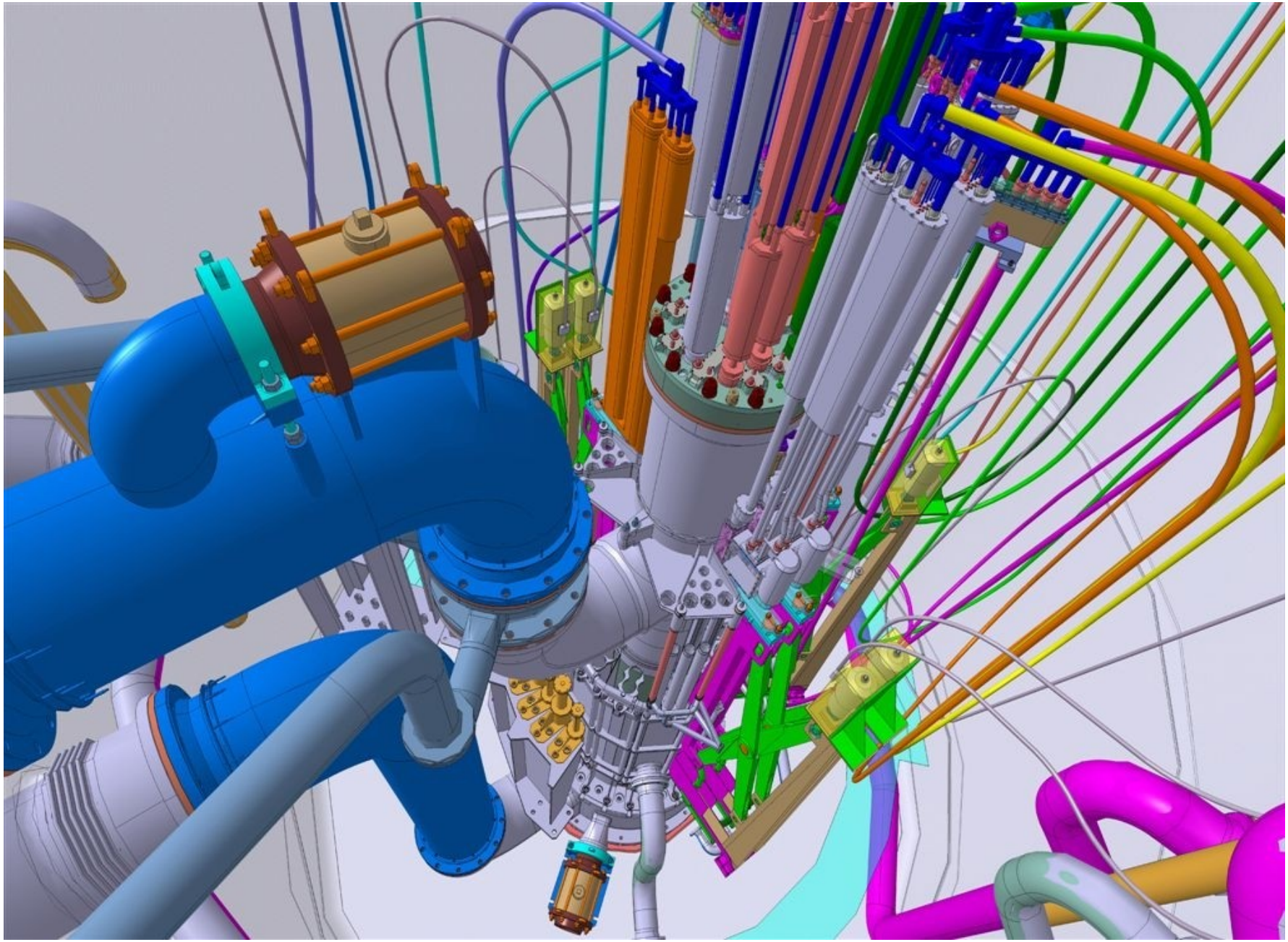


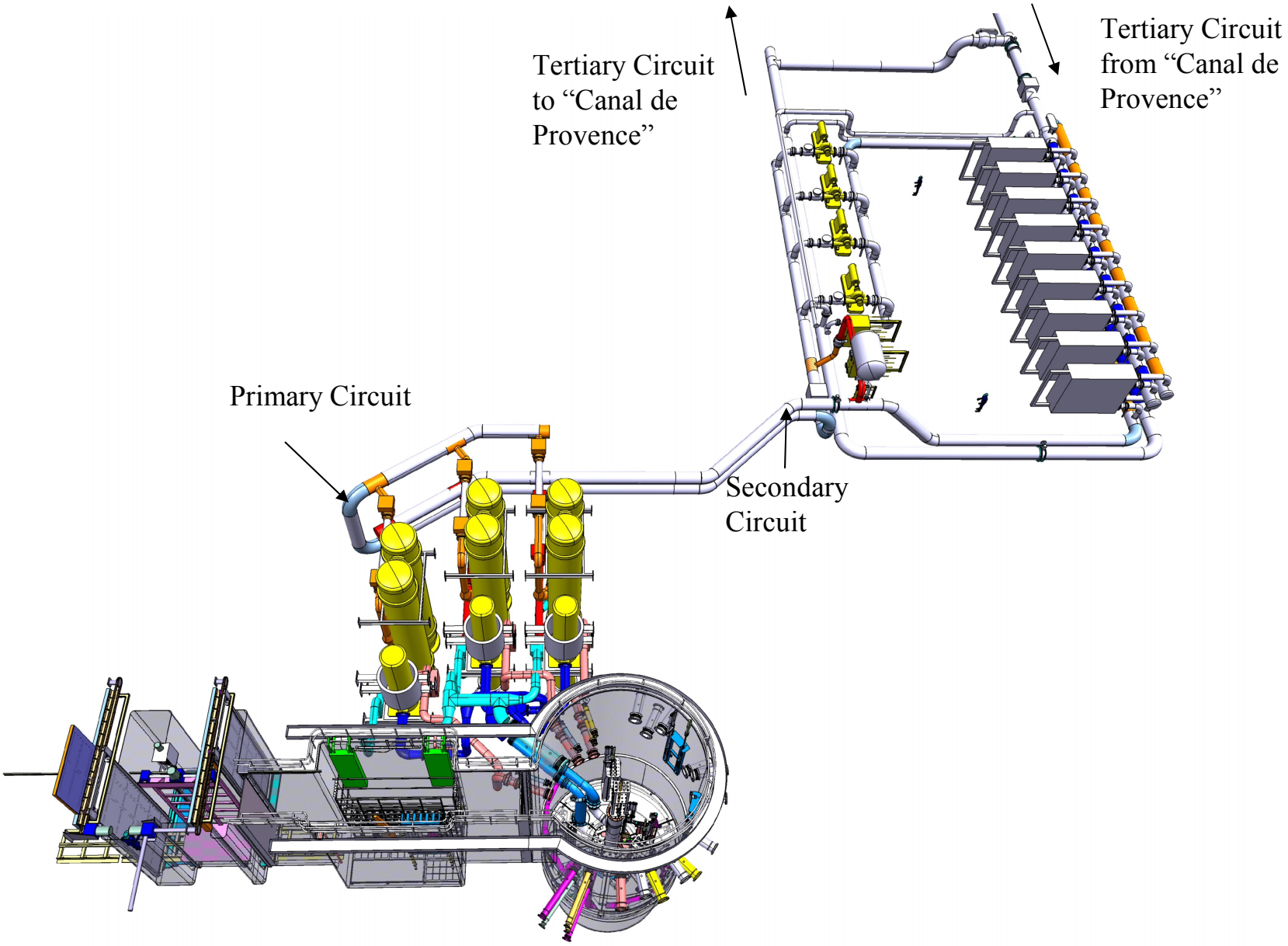


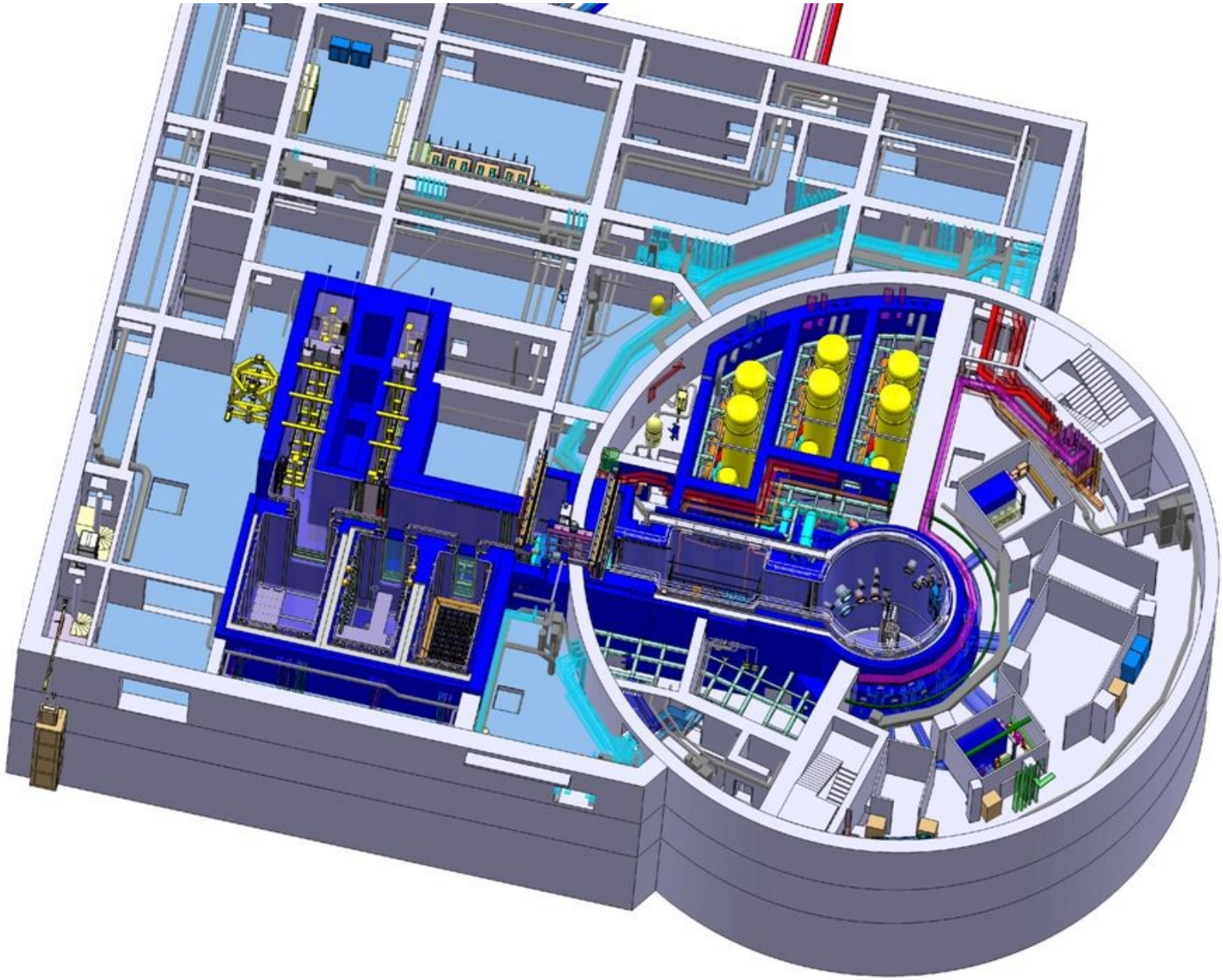
Reactor pile block inside reactor pool

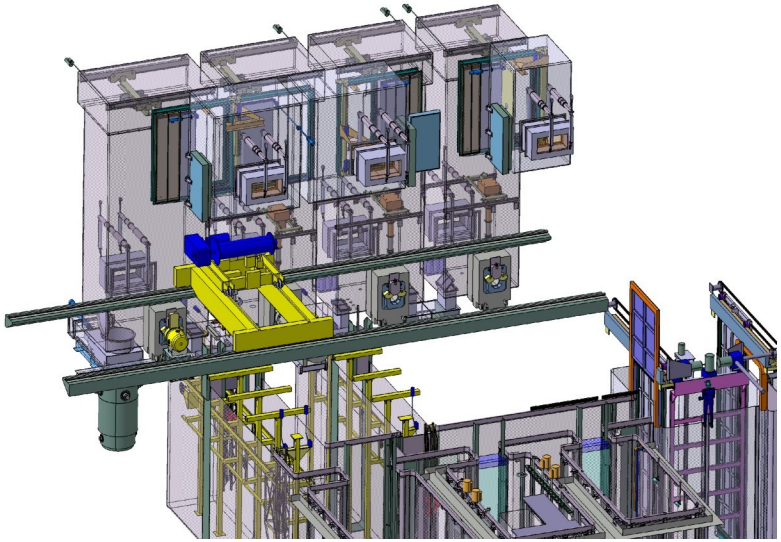


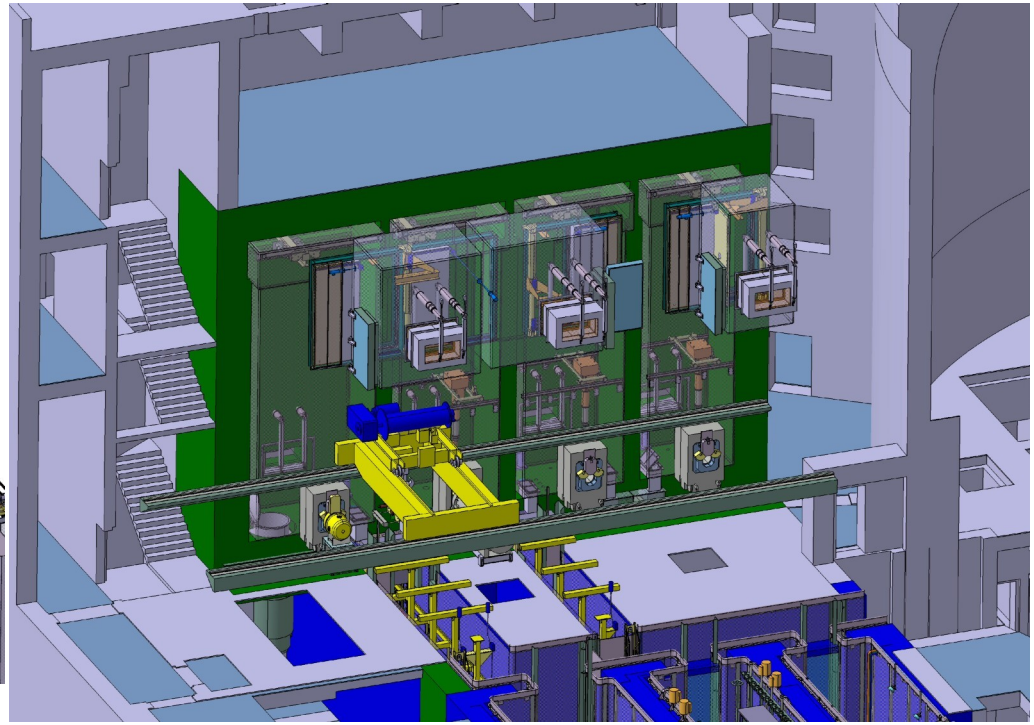





Tertiary Circuit
to “Canal de
Provence”
Tertiary Circuit
from “Canal de
Provence”
Primary Circuit
Secondary
Circuit







↳ Conclusion ?