MYRRHA (SCK•CEN, Belgium)

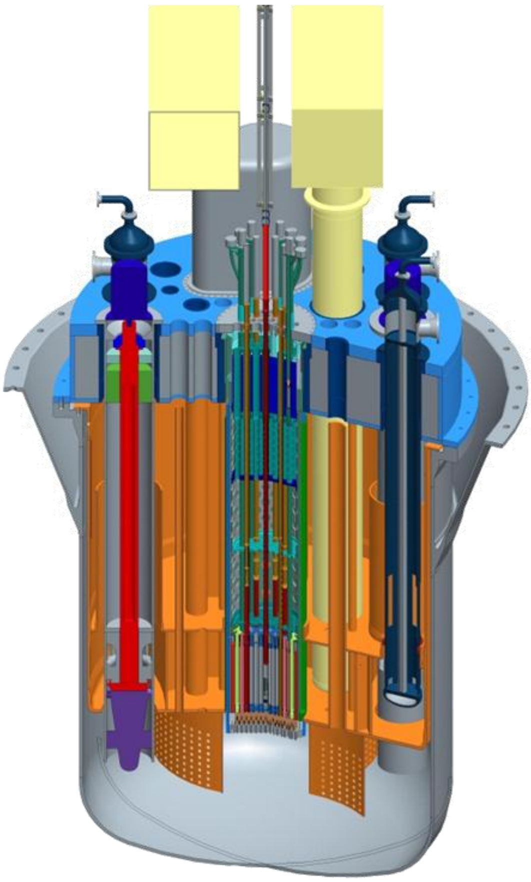

FIG. 14. View of the core of MYRRHA

Full name:	*Multi-purpose hYbrid Research Reactor for High-tech Applications (MYRRHA)*
Designer:	*Belgian Nuclear Research Centre (SCK•CEN)*
Reactor type:	*Heavy liquid metal-cooled Reactor*
Thermal capacity:	*100 MWth*
Coolant	Heavy liquid metal
Primary Circulation	Natural
System Pressure:	*0 MPa*
System Temperature:	*270-410 °C*
Fuel Material:	*MOX*
Fuel Cycle:	*3 Months*
Emergency safety systems:	*Passive*
Residual heat removal systems:	*Passive*
Design Life:	*40 Years*
Design status:	*Concept*
Planned deployment/1st date of completion:	*2023*
New/Distinguishing Features:	*ADS* *LBE*

Introduction

MYRRHA is an innovative multipurpose research reactor currently being developed at SCK•CEN. MYRRHA is conceived as an accelerator driven system but, with the removal of the spallation target and the insertion of control and safety rods, is also able to operate in critical mode.

Description of the Nuclear System

The driver of an ADS like MYRRHA is the accelerator, which provides high energy protons to the spallation target, which in turn creates primary neutrons to feed the subcritical core. The MYRRHA accelerator is a linear accelerator able to provide a beam with capacity of 600 MeV and an average beam current of 3.2 mA.

At the present state of design, the core consists of MOX fuel pins. Thirty seven positions can be occupied by In-Pile Test Sections (IPS) or by the spallation target (the central one of the core in sub-critical configuration) or by control and shutdown rods (in the core critical configuration). This gives a large flexibility in the choice of the more suitable position (neutron flux) for each experiment.

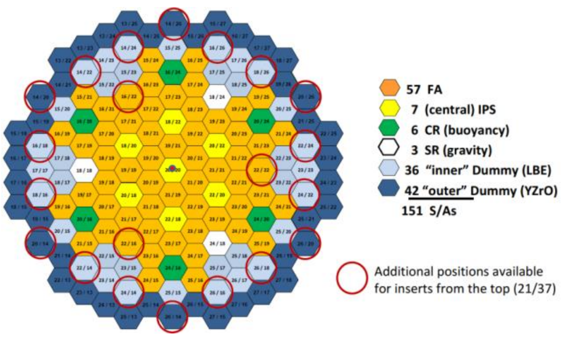

FIG. 15. MYRRHA core

MYRRHA is a pool-type ADS, which means that the reactor vessel houses all the primary systems. The vessel is closed by the reactor cover which supports all the in-vessel components. A diaphragm inside the vessel separates the hot and cold LBE plenums, supports the in-vessel fuel storage and provides a pressure separation. The room directly above the core is occupied by IPS penetrations and the beam tube, thus fuel handling to (un)load the core must be done from underneath. Two in-vessel fuel handling machines are used to fulfil this function.

The primary, secondary and tertiary cooling systems have been designed to evacuate a maximum core power of 110 MW. The primary cooling system consists of two pumps and four primary heat exchangers (PHX). These pumps deliver the LBE to the core. The secondary cooling system is a water cooling system, providing pressurized water to the PHX. The tertiary cooling system is an air cooling system.

Description of the Safety Concept

In case of loss of the primary flow, the beam must be shut off in subcritical case and the shutdown rods inserted in critical mode. The primary, secondary and tertiary cooling system have been designed to remove the decay heat using natural convection. Ultimate decay heat removal is achieved by the reactor vessel cooling system, also by natural convection.

In the unlikely event of a reactor vessel breach, the reactor pit will fulfil the function of secondary containment to keep the LBE in place.

Deployment Status and Planned Schedule

The MYRRHA design has now entered into the Front End Engineering Phase, covering the period 2012-2014. At the end of this phase, the purpose is to have progressed in such a way in the design of the facility that the specifications for the different procurement packages of the facility can be written, to have adequately addressed the remaining outstanding R&D issues, to have obtained a positive licensability statement by the Belgian safety authorities and to have formed the international members' consortium for MYRRHA. MYRRHA will be operational around 2023.