Profile SFR-24

PLATEAU

FRANCE

GENERAL INFORMATION

NAME OF THE FACILITY	Plateforme en eau
ACRONYM	PLATEAU
COOLANT(S) OF THE FACILITY	Water
LOCATION (address):	CEA Cadarache 13108 Saint Paul Lez Durance FRANCE
OPERATOR	CEA
CONTACT PERSON (name, address, institute, function, telephone, email):	D. GUENADOU CEA Cadarache Building 220, 13108 Saint Paul Lez Durance, FRANCE Research engineer +33 4 42 25 47 64 david.guenadou@cea.fr
STATUS OF THE FACILITY	In operation
Start of operation (date):	2014

MAIN RESEARCH FIELD(S)

- ☐ Zero power facility for V&V and licensing purposes
- ☐ Design Basis Accidents (DBA) and Design Extended Conditions (DEC)
- ☒ Thermal-hydraulics
- ☐ Coolant chemistry
- ☐ Materials
- ☒ Systems and components
- ☒ Instrumentation & ISI&R

TECHNICAL DESCRIPTION

Description of the facility

For qualifying the design options, and for validating the computations, experimental tests are needed. For convenience, most experiments are carried out with water instead of sodium. The GISEH platform gathers all the hydraulic loops used for the qualification of the ASTRID components. The PLATEAU (PLATeforme en EAU/water platform in French) facility, belonging to the GISEH platform, is dedicated to large components such as the vessels.

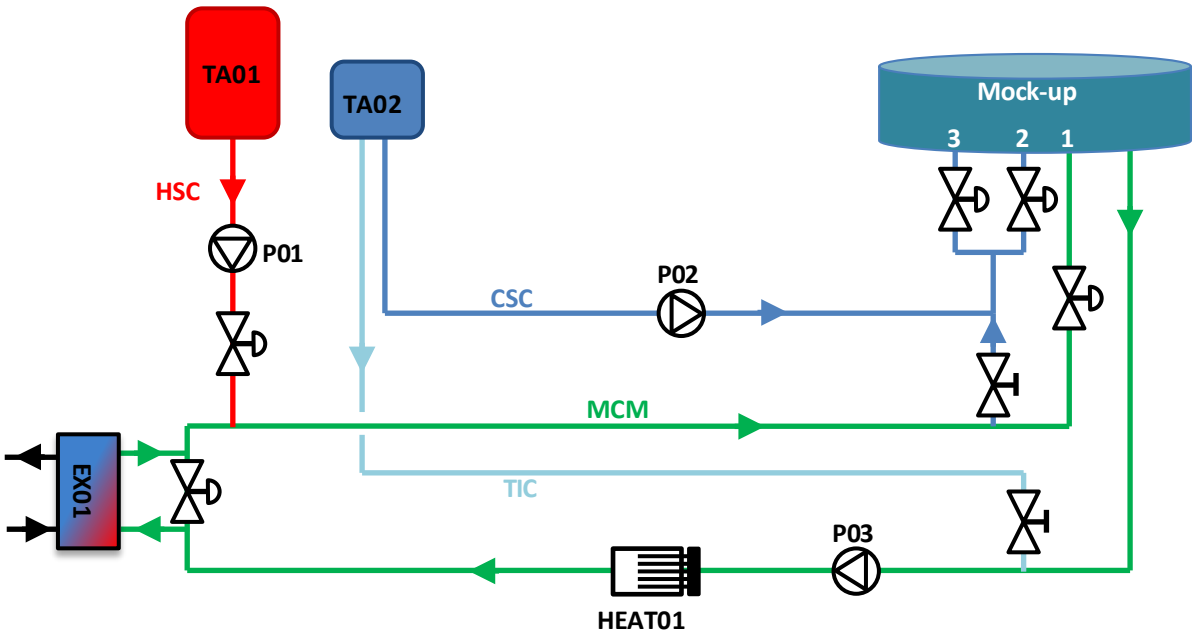
This facility has to accommodate various mock-ups and must be the most versatile as possible. The

entire circuits are shown on the figure below. The loop allows three injection points (named 1, 2 and 3 on figure below) in the mock-up at different temperature and flow-rate. Without the utility networks (not drawn on the figure below), the PLATEAU facility presents four main circuits (cf. the figure below): The main circuit (MCM in green on the figure below); The hot secondary circuit (HSC in red on the figure below); The cold secondary circuit (CSC in blue on the figure below); The transitory injection circuit (TIC in light blue on the figure below).
This network allows three operating methods: Hydraulic mode: only the MCM is used. The temperature is identical in the three injection points, but the flow rate is controlled independently for each one. The temperature is regulated by the mean of the heater HEAT01 and the exchanger EX01 linked to a cooling system. Thermohydraulic mode: the MCM, HSC and CSC are used. As in hydraulic mode, three different flow rates can be imposed on the injection points. But, this time two temperatures can be used; Outlet 1 (cf. the figure below) with hot water and the two others with cold water. The HSC is used to heat by mixing to the set point temperature the water of the MCM; this latter is cooled in the mock-up by injection of cold water from the CSC. The heater HEAT01 cannot be used because the needed power to heat such flow rate is too high. As the level is the mock-up is kept steady, the water overflow is flushed to a tank (not shown on the figure below). Transitory mode: it is begun from the thermohydraulic mode and stabilized conditions. All the circuits are used (CIT, CSC, CHC, MCM). It aims at realizing a temperature step (mainly cold, but also hot) at the injection point 1 (cf. the figure below). Water from TA01 (in case of hot step) or from TA02 (cold step) is injected downstream the pump P03. The temperature change rate is controlled by regulated valves.

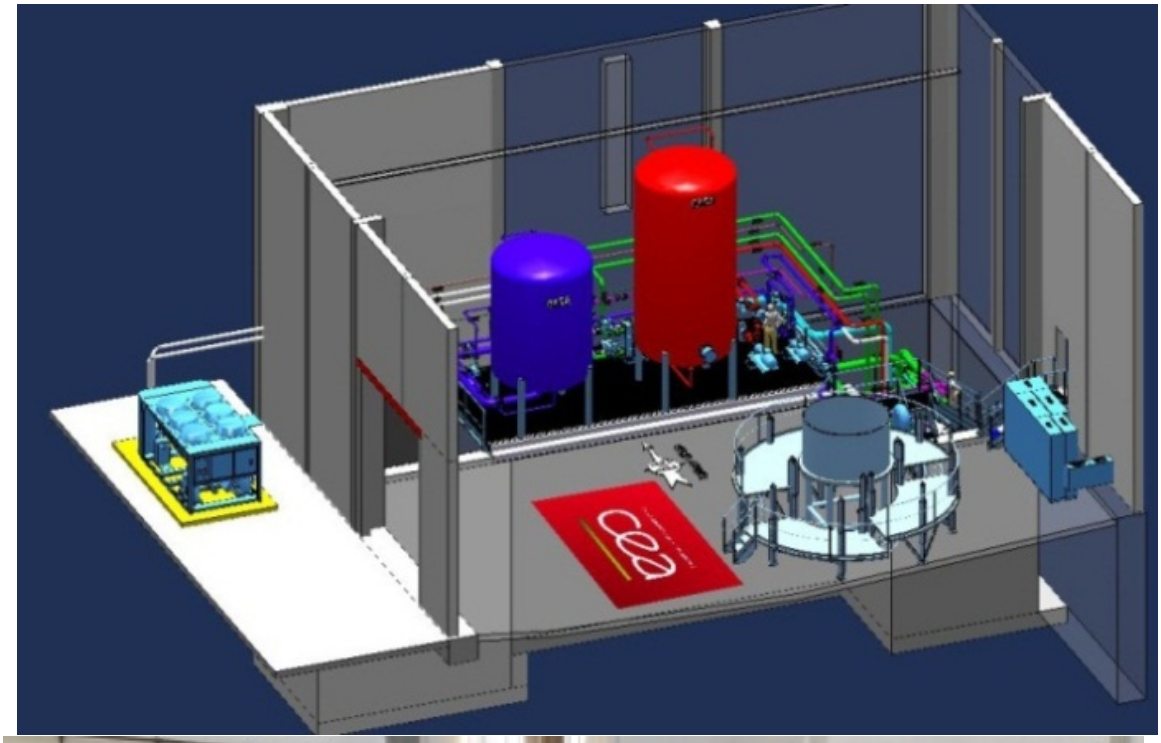
Acceptance of radioactive material

No

Scheme/diagram



3D drawing/photo



Parameters table

Coolant inventory	150 m^3 of water.
Power	60 kW for the heat exchanger, 240 kW for the chiller and 250 kW for the heating rods.
Test sections	
TS #1	*Characteristic dimensions* 5x5x8m (length x width x heigth)
	Static/dynamic experiment Dynamic
	Temperature range in the test section (Delta T) 10 to 60°C
	Operating pressure and design pressure Operating at atmospheric pressure and design pressure 5 bar.

	Flow range (mass, velocity, etc.) <350 m^3/h
Coolant chemistry measurement and control (active or not, measured parameters)	Chlore concentration is controlled.
Instrumentation	Flowmeters Temperatures (thermocouples, PT100, LIF) High speed video Velocimetry (PIV, LDV)

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

Hot plenum hydraulic and thermo-hydraulic tests on the MICAS mock-up: velocity measures around the core, the intermediate heat exchangers, the upper core structures and at the surface. Analyse of the vortex at the free surface and determination of a gas entrainment criterion.

Sodium/gas exchanger tests on the DANAH model: validation of CFD calculation

Liquid jet breakup characterization on the JETSER mock-up: droplet features for combustion models in case of sodium leakage

Link between the pump and the diagrid: analyse of the cavitation regarding the flowrate.

PLANNED EXPERIMENTS (including time schedule)

February 2019 –Dec. 2019: new hydraulic and thermo-hydraulic tests on the enhanced MICAS mock-up

Jan. 2020 – Sept. 2020: diagrid tests (gas accumulation, velocity characterization) on the MILIPOSO mock-up.

Oct. 2020 – Sept. 2021: study of the natural convection (MICONOS model)

TRAINING ACTIVITIES

Possible

REFERENCES (*specification of availability and language*)

D. Guénadou, I. Tkatshenko And P. Aubert, "Plateau Facility in Support to Astrid and the SFR Program: an Overview of the First Mock-Up of the ASTRID Upper Plenum, MICAS", Proceeding of NURETH 16, Chicago, August 30–September 4, 2015

D. Guenadou, P. Aubert, V. Biscay, M. Bottin, J-P. Descamps, "Study of the Free Surface Flow in the MICAS Mock-Up in Support of the ASTRID SFR Program", Proceeding of NUTHOS 11, Gyeongju, Korea, October 9-13, 2016

D. Guenadou, P. Aubert, V. Biscay, J-P. Descamps, “Flow Analysis in the Upper Plenum of the MICAS Model in Support of the ASTRID Reactor Program”, Proceeding of NURTEH 17, Xi’An, China, Sept. 3-8, 2017

U. Bieder, J. Maillard, Y. Gorsse, D. Guenadou “CFD Analysis of the Flow in the MICAS Experimental Facility, a Water Model of the Hot Pool of a Sodium Cooled Fast Reactor”, proceeding of CFD4NRS-7, Shanghai, China, September 4-6, 2018

D. Guenadou, P. Aubert, J-P. Descamps, “MILIPOSO, Mock-up of the Diagrid and the Coupling Pipes in Support of the ASTRID SFR Program”, proceeding of NUTHOS 12, Qingdao, China, October 14-18, 2018

D. Guenadou, P. Aubert, J-P. Descamps, “Analysis of the Gas Entrainment by Vortex in the Upper Plenum of the ASTRID Reactor Mock-up”, proceeding of NUTHOS 12, Qingdao, China, October 14-18, 2018