

Profile SFR-13

NSET

FRANCE

GENERAL INFORMATION

NAME OF THE FACILITY	NSET
ACRONYM	NSET
COOLANT(S) OF THE FACILITY	Sodium and nitrogen
LOCATION (address):	CEA Cadarache, 13108 Saint Paul Lez Durance FRANCE
OPERATOR	CEA
CONTACT PERSON (name, address, institute, function, telephone, email):	O. GASTALDI CEA Cadarache Building 710, 13108 Saint Paul Lez Durance, FRANCE Sodium Technology and Components Project Manager +33 4 42 25 37 87 Olivier.gastaldi@cea.fr
STATUS OF THE FACILITY	Under Design
Start of operation (date):	2018

MAIN RESEARCH FIELD(S)	<input type="checkbox"/>	Zero power facility for V&V and licensing purposes
	<input type="checkbox"/>	Design Basis Accidents (DBA) and Design Extended Conditions (DEC)
	<input checked="" type="checkbox"/>	Thermal-hydraulics
	<input type="checkbox"/>	Coolant chemistry
	<input type="checkbox"/>	Materials
	<input checked="" type="checkbox"/>	Systems and components
	<input checked="" type="checkbox"/>	Instrumentation & ISI&R

TECHNICAL DESCRIPTION

Description of the facility

This test section is one of the three test sections of the CHEOPS facility (NAIMMO, NADYNE, NSET). The CHEOPS facility is under design and will be able to realise experiments from the first half of 2019. CHEOPS is devoted to the development of the

ASTRID innovative components and completes efficiently the PAPIRUS facility, due to the large scale components which could be tested. CHEOPS includes its own cleaning facility which is called STALACMITES.

The NSET test section will permit to realise heat exchange between a sodium loop and a nitrogen loop through a heat exchanger, in order to develop the heat exchanger of the ASTRID energy conversion system. The heat exchanged can reach 10 MW with only 3 MW from electrical heating due to an intermediate heat exchanger which reheats sodium with hot gas after its flowing through the main exchanger.

The development of the heat exchanger will be ensured by tests in similar nominal conditions than those of the ASTRID reactor and in incidental conditions. In effect, some severe transients (representative of ASTRID operations) can be realised to ensure the design and the performance of this component. In nominal conditions, the loop allows to realise some endurance tests and transient tests.

Excepting heat exchangers, all the sodium technology, i.e. storage tank, purification system, pump, heater and cooler is "standard".

So CHEOPS facility includes two sodium loops : the NAIMMO / NADYNE loop and the NSET loop.

Acceptance of radioactive material

No

Scheme/diagram

FUTURE FACILITIES

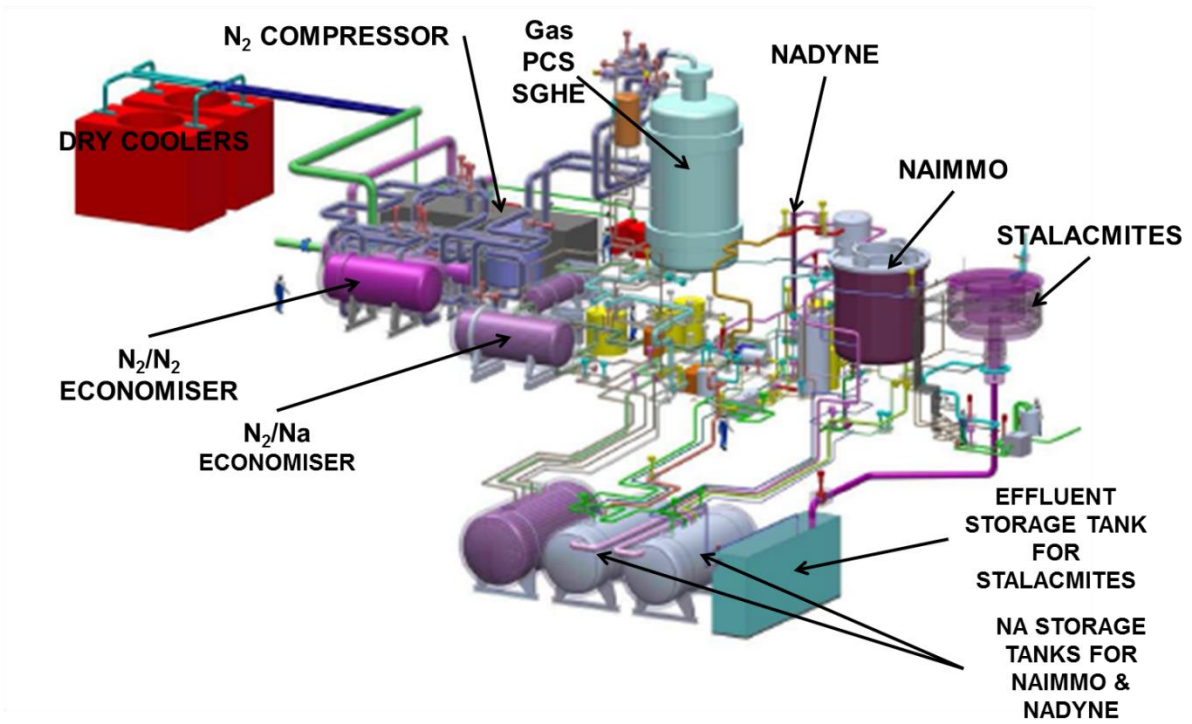


FIG. 1. Overall scheme of CHEOPS processes

3D drawing/photo



FIG. 2. Overall view of CHEOPS Facility

Parameters table

Coolant inventory	Sodium inventory : 7 t.
Power	Heat exchange : 10 MW Heating power – sodium loop : 3 MW Intermediate heat exchanger : 7.8 MW
Test sections	
TS #1	<u>Characteristic dimensions</u> Height of heat exchanger : 11 m
	<u>Static/dynamic experiment</u> Dynamic experiments
	<u>Temperature range in the test section (Delta T)</u> Sodium loop : Inlet – 530°C / Outlet – 345°C Nitrogen loop : Inlet – 310°C / Outlet : 515°C
	<u>Operating pressure and design pressure</u> Sodium loop : atmospheric pressure Nitrogen loop : 180 bar
	<u>Flow range (mass, velocity, etc.)</u> Sodium loop : 45 kg/s Nitrogen loop : 50 kg/s
Coolant chemistry	Active coolant quality measurement and control (purification with a

measurement and control (active or not, measured parameters)	cold trap on a by passed flow: 2 m ³ /h and impurities level < few ppm, and impurities content evaluation by a plugging indicator)
Instrumentation	Thermocouples Argon pressure measurement Inductive level probes Sodium flowmeters Sodium pressure sensor

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

PLANNED EXPERIMENTS (including time schedule)

The time schedule is not yet established, but only the heat exchanger will be tested during some years in this loop. The experimental program will consist in testing the modules used inside the sodium gas heat exchanger (SGHE) (scale 1:2 in power but with full length) and a full component at scale 1:18. The experimental program foresees steady state and transients experiments in order to validate performances, conception and fabrication process. Some long duration endurance tests are also planned. This program will last around several years for the full qualification of the component.

TRAINING ACTIVITIES

REFERENCES (*specification of availability and language*)

1. GASTLADI O. and al. Experimental platforms in support of the ASTRID program: existing and planned facilities at CEA, ICAPP 2015 NICE, FRANCE, MAY, 3-6, 2015 – Paper 15126