DE LA RECHERCHE À L'INDUSTRIE

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ASTRID

Advanced Sodium Technological Reactor for Industrial Demonstration

STATUS OF ASTRID ARCHITECTURE AND PRE-CONCEPTUAL DESIGN

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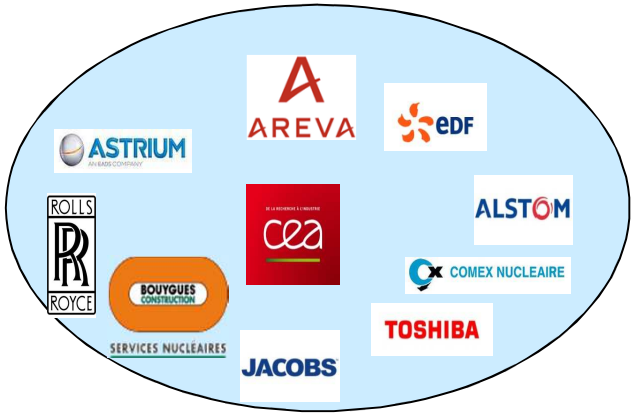
www.cea.fr

Project studies and interface data management



The challenge is to make working and studing in synchronous time , with same basics data, all the 10 engineering teams of the partner companies .

Data workflow and coordination meetings are managed by CEA ASTRID team project to have only one status configuration …. with a lot of technical options.

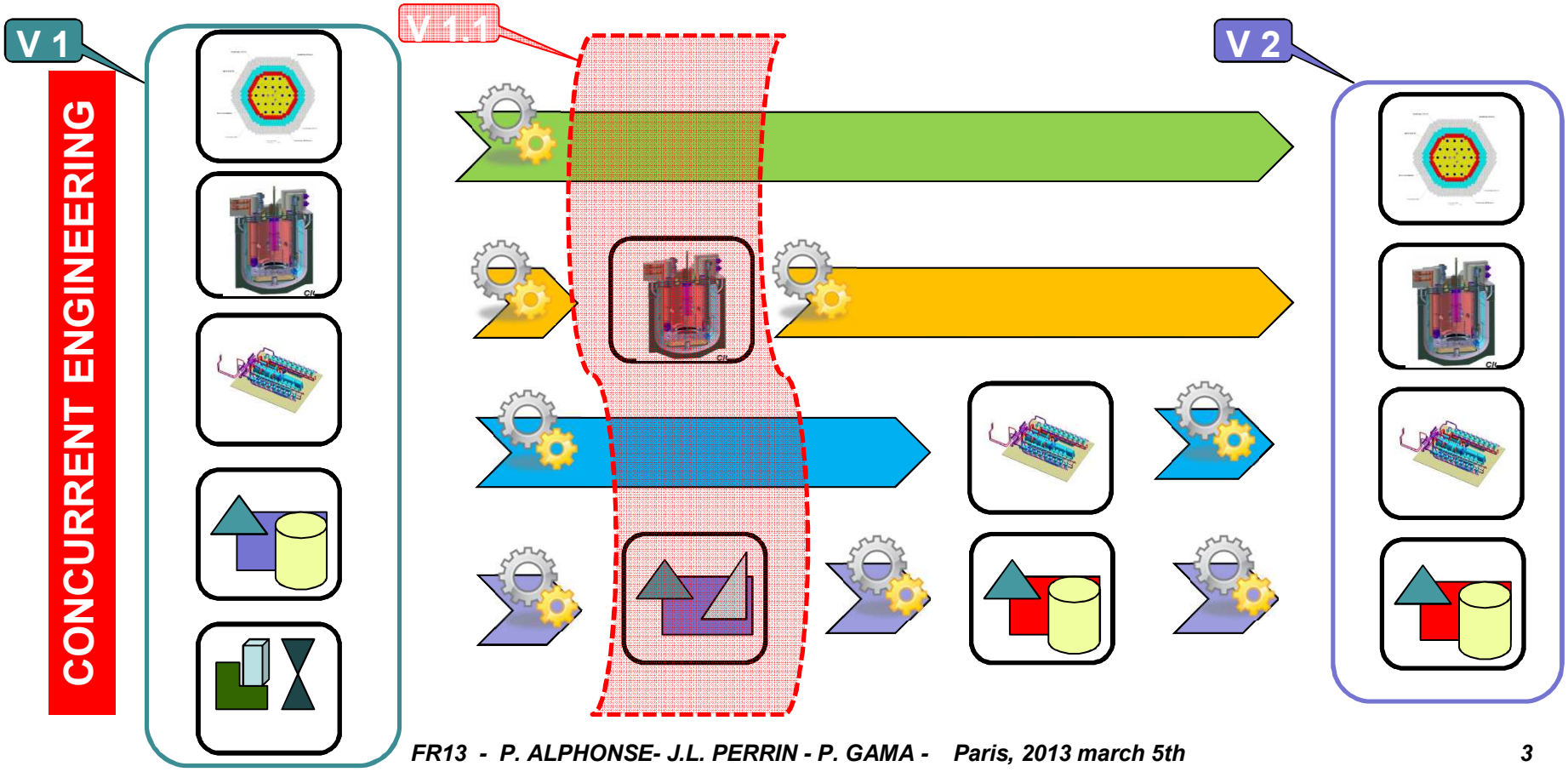
Reviews to estimate performance and choose best options drive the configuration to the final target for pre conceptual design…

Pre-conceptual design management

- **GOAL**

  → Very complex process for pre-conceptual design management of configuration (and all constitutives components), with a lot of movements and selections..

Configuration: «Total functionnal and physical description of a product … with the good answer for needing»



Plan layout and 3D CAD models

After this first third party of pre-conceptual studies, 2 ASTRID models are still in the box :

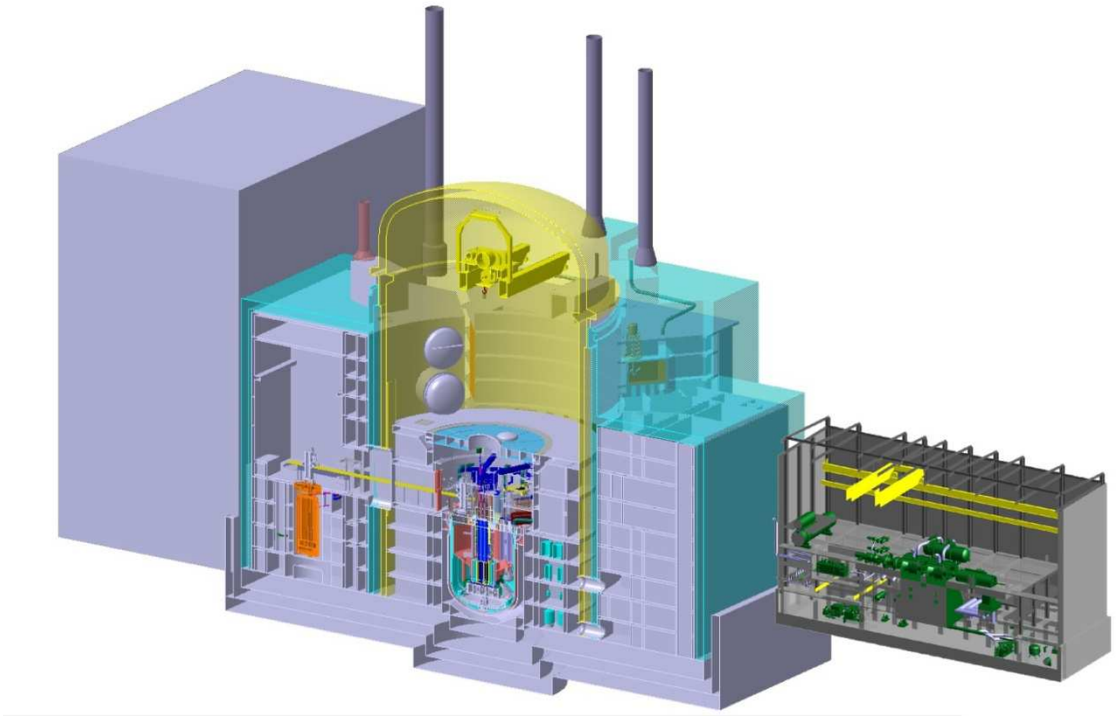
- steam model, with steam genarators (water/sodium exchangers..) and 'classical' steam turbine…

- gas model, with sodium/gas exchangers and pioneering gas turbine / compressor system

For the two models, the reactor would be the same but we select differents options to have one configuration for one model ..and we draw 2 differents layout from reactor to alternator.

- With CAO soft use also for EDF EPR reactor (PDMS)
- In a more simple version to make data and layouts parts exchanges easier in this project's beginning

Plan layout and 3D CAD models – Steam model



→ 1 'BIG COMPONENTS' MAINTENANCE BUILDING

NUCLEAR ISLAND

→ CROSS STRUCTURING

→ 4 STEAM GENERATORS BUILDINGS

→ 3 ELECTRICALS BUILDINGS (6 DIVISIONS)

→ 3 FUEL BUILDINGS

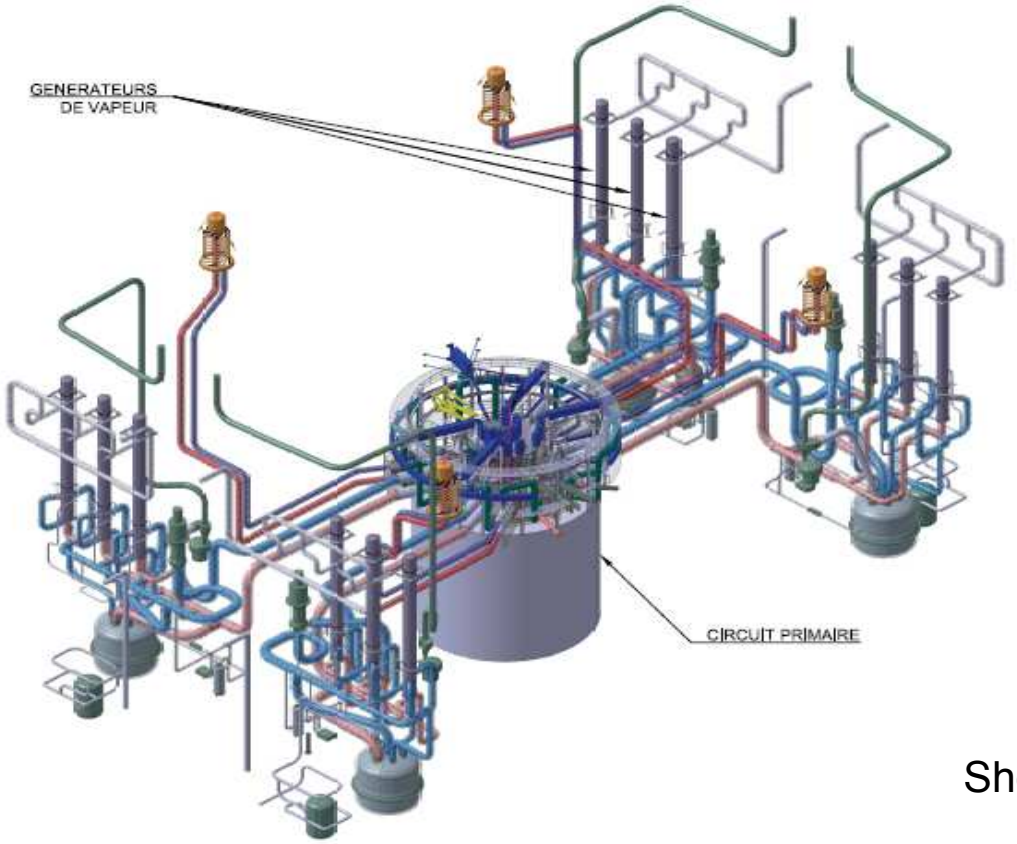
STEAM GENERATORS BUILDINGS

→ SEPARATE BUILDINGS

→ PHYSICAL SEPARATION BETWEEN NA A H20

→ AERATION PLENUM

Plan layout and 3D CAD models – Steam model

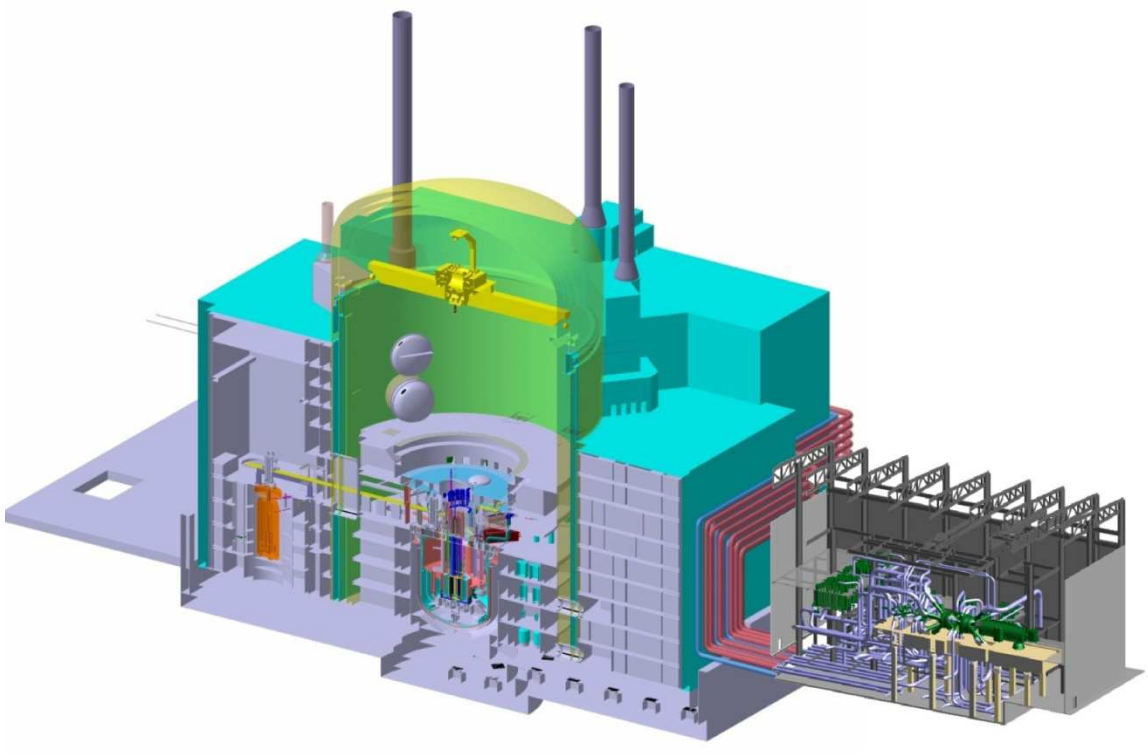


Shortly sodium piping

Layout guided by sodium leak hazards

4 secondary sodium loops located in 4 steam generator buildings .

Plan layout and 3D CAD models – Gas model



Nuclear Island

→ Cross structuring

→ Global Aircraft Shelter

Na/N HX Buildings

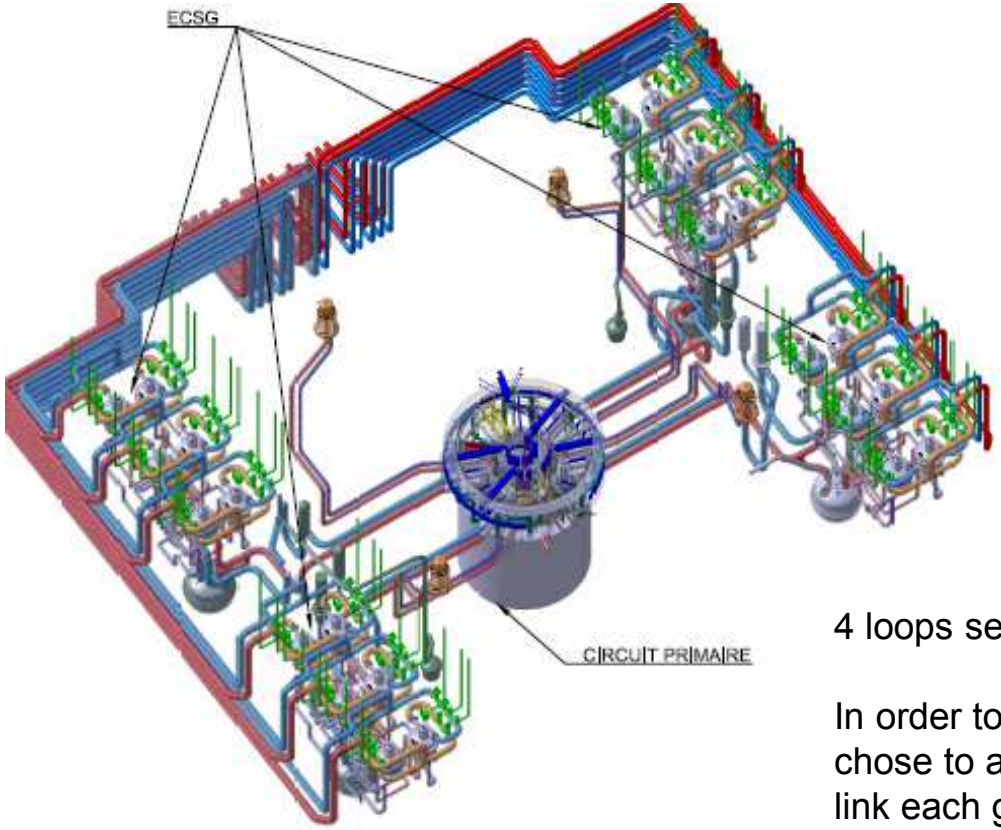
→ Gaz side OPEN

(Easiest to unpack HX modules, low gas pressure on big leaks, …)

CES Building

→ Lot and lengthy big HP gas pipes , ..

Plan layout and 3D CAD models – Gas model



4 loops serving 24 Sodium/Nitrogen Heat exchangers (SNHx)

In order to minimize the losses on the gas side, the designer chose to avoid output collectors upstream the SNHx and to link each gas pipe directly to the turbocharger. The electromagnetic pumps and the 4 segregated trains for the decay heat removal are also kept unchanged.

Site layout

Nuclear Safety

- → NI raft platform under max water level (millenal flood)
- → Various root cooling systems (Air Atmosphere, River, water table, artificial pond,…)

Malevolence Safety

- → Shelter Aircraft
- → Geographical separation for electric generators groups