

## Laser cutting tools

Design and production of laser cutting equipment for nuclear facility dismantling

Multi-kilowatt laser systems offer excellent, easy-to-use, cutting capacities. Framatome has developed know-how enabling to control design and production of laser cutting heads specially adapted for nuclear projects.

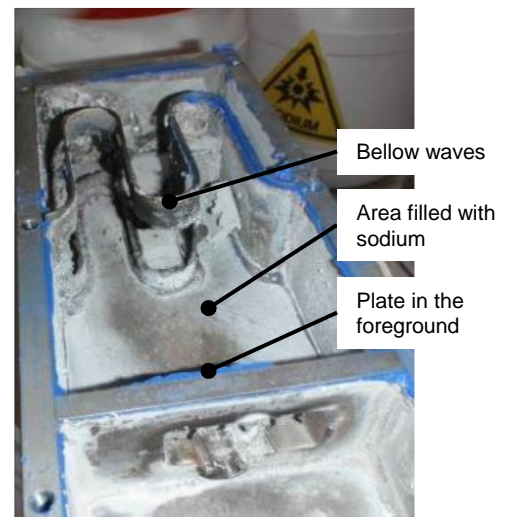
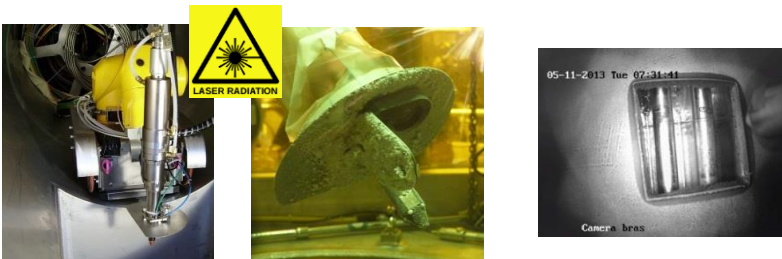
### Challenge

Preliminary testing carried out as part of the dismantling plans for Super-Phenix highlighted the benefits of a laser system compared with other potential processes for certain complex cutting operations, e.g. to release sodium retained by drilling reactor vessel components during dismantling.

In general, complex cutting operations, for which laser cutting techniques would be worthwhile, involve other limitations : multi-layer cutting, use of robots over long access distances, high temperatures and high dose rates.

### Solution

Framatome teams have acquired the skills required to manage laser head design and the integration of the laser process. Laser cutting was necessary in the context of several projects with specific conditions and according to the planned schedule.



View of the inner surface of the SPX primary circuit slab  
After carbonation

Framatome has been able to develop know-how and propose several heads, each corresponding to a context with specific particularities.

Radiological, thermal, chemical and geometric (cut parts and cutting distances) limitations apply during the operations, as well as mass requirements and the need to protect equipment in the background...

The laser heads developed are axial or at 90°. 90° laser heads are suitable for internal orbital cuts, and the rotation of the beam is entirely managed by the head and the umbilical cable can stay secured on the head support side.

Liquid or gas cooling can be used.

Head/part distances range from a few millimeters to several decimeters.

The heads are sealed, easy to decontaminate and maintenance-free.

### Customer benefits

Thanks to feedback acquired while designing and using laser cutting heads in the different contexts, Framatome can propose :

- An optimal design for laser cutting heads with consideration to specific constraints
- The definition of operating parameters
- The integration of the laser system as a whole : from the laser source to the cutting head, head supports, the working cell, and specific laser safety factors.

**Your performance  
is our everyday commitment**

## Technical information

The following examples are actual achievements :

### LIOSO cutting on Super-Phenix mentioned on page 1:

- ❶ Axial cutting head, 6 kW, THERMINOL® cooling, argon flushing gas

### Orbital cutting of FBR bed stands :

- ❷ SPX : 90° orbital cutting head , 6 kW, gas cooling,
- ❸ Phenix : 90° orbital cutting head , 6 kW, gas cooling, built in rotation, head diameter Ø 64 (demonstration tests)

### Orbital cutting of the lower parts of SPX slab penetration :

- ❹ 90° cutting head, gas cooling, head / part distances from 50 to 460 mm

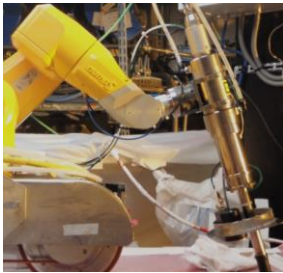
### Cutting of an evaporator / R7 workshop / UP2 factory / La Hague :

- ❺ LALY = axial cutting head, 6 kW, gas cooling, head / part distances from 5 to 60 mm

6 months between the expression of the requirement and the delivery of the 3 qualified laser heads.

The evaporator and its support frame were fully cut with no maintenance operation on the head (more than 1 600 cuts)

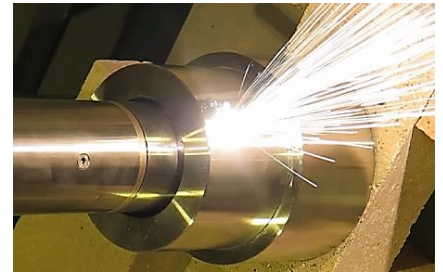
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## Key figures

- Usual laser cutting power : **6 kW**
- Stainless steel cutting speed **60 mm<sup>3</sup>/s**
- Research and development in the field of laser cutting in a nuclear environment for over a decade
- Implementation of laser heads designed and supplied by Framatome in 6 recent projects
- **4** years of operational feedback on the use of laser heads and several hundred meters cut

## References

- EDF Creys-Malville reactor (Super-Phenix)
- CEA PHENIX reactor
- ORANO La Hague Plant

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