FUEL BUNDLE DISMANTLING MACHINE

PLACIDE

F. BERDOULA, J. FURLAN, L. CARAL, C. CHAMBION
Nuclear Reactor Division - DEC/SECI/LIGNE
French Atomic Energy Commission - CEA Cadarache - France
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Motivations and objectives

- The numerically controlled miller **PLACIDE** is designed to disassemble a fuel bundle in **LECA** (Laboratoire d'Examen des Combustibles Actifs, in Cadarache).

- Designed by **LIGNE** (Laboratoire d'ingénierie des expérimentations) of **SECI/DEC** (Departement d'Etudes des Combustibles à l'Energie Atomique).

- Developed, implemented in hot cells in early August 2000.

- **Technical characteristics**: High-precision machining,

- **Specific cutting techniques**: minimum width of cutting and location by Eddy current system,

- **NDE**: Dimensional measurements and gamma-spectrometry,

- Over the year, evolution to other applications.
Placide description (1)

- Numerically controlled miller (and 3-axes machining),
- Creepfeed,
- Remote handling equipment (motors, electric plug) in hot cells
- Removeable cutting head,
- Clamp-holding mandrels,
- Purpose-designed tooling: coated solid carbide tools
- Hard and dry machining,
- Flat or cross drilling operations,
Placide description (2)

- **Complementary apparatus**:
  - Minimum width of cutting and location by Eddy current systems,
  - NDE (dimensional measurements and gamma-spectrometry)
  - Visual monitoring by a pool-side periscope and onboard TV cameras
Main characteristics

- A cooling vacuum cleaner (not represented) onboard

- 3 remote monitored motors and ball screws

- Application is the dismantling of a plate shape fuel bundle Type OSIRIS fuel

- Maximum dimension of fuel bundles 1600 X 400 X 400 mm³
Metrology system

- A computer monitored metrology system able to measure length, diameter, width of any object (rods, plate...)

- Developed with a cold mock-up
Eddy Current validation: test on fuel plate type « caramel » developed by the CEA

- Test on a « caramel » fuel element:
  - location measurement (better than 0,1 mm accuracy)
  - Frequency range (from 7 up to 100 kHz)

![Diagram of Eddy Current Sensor and Fuel Plate Test](image)

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F.BERDOULA, J.FURLAN, L.CARAL, C.CHAMBION DEC/SECI/LIGNE
High-precision machining and Eddy current location

- These technics, although requiring complex operations in a hot cell with specially adapted equipment and a very experienced personnel, enables:

  - (1) high-precision machining (better than 0.1 mm)

  - (2) a good reproducibility of the Eddy current signals was observed (location accuracy better than 0.05 mm)
- Aim:
  - to adapt machining parameters for Zircaloy and increase tool life (minimize tool exchange)
  - to monitor the temperature of the cutting tool during machining operations (minimize metal heating)

- Observations and conclusions:
  - Cooling of chip is extremely fast (1/10 s)
  - Results: Temperature of drills < 100°C
  - Vacuum-cleaner is necessary (cooling and chips and dust recovery)
Conclusion

- Multi-functions milling device,
- Creepfeed,
- High-precision machining and location,
- NDE,
- Upgrade to new cutting devices as Removable Bandsaw machine