DEVELOPMENT OF AN ELECTROMECHANICAL PRESS FOR HOT CELL NUCLEAR FUEL FABRICATION

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5. Virtual reality
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1. INTRODUCTION

Main research studies

- Electromechanical press for hotcell fuel fabrication
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- DEM
- Radiological sizing
- Modelling Optimization FEM
- Materials Ex: microspheres studies
- Methods Laser profilometer for pellet profile
- SEM-Micropress coupled
- 3D
- Virtual reality
- Mock up Remote handling
- Sensors For powder behaviour
- Cycle optimization

CEA/Champollion collaboration
2. OBJECTIVES & APPROACH

OBJECTIVES:
Develop an uniaxial mono-punch press with die displacement piloting:
• For automatic fuel fabrication of annular or full pellet (for transmutation and FBR fuel),
• Operating without oil to reduce the criticality risk,
• Of small height to be implemented in hot cell,
• Able to be easily mounted, dismounted and maintained by remote handling

DESIGN APPROACH:
Simulate to avoid as much as possible experimental trials:
3. ELECTROMECHANICAL PRESS
PRESENTATION AS DESIGNED

3D drawing and press description
4. 3D SIMULATION FOR DESIGN

- Validate the modular decomposition,
- Validate the mounting and dismantling remote handling step,
- Localize gripping tool,
- Size the cell volume and remote handling arm,
- Validate accessibility,
- Validate the maintenance operations,
- Launch the supply and manufacturing.

3DS Max Autocad software simulations

Rotary axe and axe of the press superposition
5. VIRTUAL REALITY FOR DESIGN

- Confirm or modify the conception choices,
- Take into account the remote handling feedback force with song associated, with camera fixed to the gripper,
- Check the mechanism coupling between components,
- Demonstrate feasibility of technology nuclearization,
- Mount or unmount press modules with virtual remote handling arm.

Limited resolution: 2 mm (depends on collision motor)
6. MOUNTING & UNMOUNTING
REMOTE HANDLING PRESS 1/4

Time-lapse

Press in the mock-up cell
6. MOUNTING & UNMOUNTING
REMOTE HANDLING PRESS 2/4

Preliminary step before unmounting
- Drain away the powder
- Withdraw the powder box
- Withdraw filling powder jar

Unmounting tools
- Applied and lower punches
- Applied and lower sensors
- Die, needle

Filling shoe and Displacement sensors withdrawal

Shoe motor and support unmounting
Die motor unmounting

Clamps and upper punch motor unmounting

Upper plate, upper punch plate, die plate, lower plate withdrawal
### 6. MONTING & UNMONTING
REMOTE HANDLING PRESS 4/4

<table>
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<th>Images</th>
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<tr>
<td>![Image](6. MONTING &amp; UNMONTING REMOTE HANDLING PRESS 4/4.png)</td>
<td>Toggle and die motor support unmounting</td>
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<td>![Image](6. MONTING &amp; UNMONTING REMOTE HANDLING PRESS 4/4.png)</td>
<td>Lower plate and rotary plate separation</td>
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7. CONCLUSION & PERSPECTIVES

Press mounting or dismantling feasibility with remote handling in hot cell has been successfully demonstrated,

Qualification: 22 modules, 80 Kg for the heaviest module, with lift unit, MT 120 remote handling arm, duration 2 weeks,

We haven’t transferred all modules throughout the air-lock,

To shunt physical step, virtual reality must be improved, resolution today is 0.5 mm.

Outlook: