

2025 Nuclear Global Internship Job Description

1. Basic Information

- Expected Internship duration: *6 months (or more)*
- Internship Area/Topic: *Thermal-Hydraulics, CFD simulation, applied to steam generator*
- Division/Department Placement: *CEA - IRESNE/DTN/STCP/LTHC at CEA-Cadarache center*
- Supervisor's contact information: *Sébastien FRANCOIS, sebastien.francois@cea.fr*

2. Responsibilities

- 1) Main Purpose: *Characterization of Heat Transfer on the Secondary Side (Two-Phase Flow) using liquid film modeling with Neptune CFD® - Potential benefits for tubes fouling and plates clogging phenomena.*

The CEA/STCP/LTHC operates thermo-hydraulic loops representative of the conditions in nuclear power plants and reactors. The COLENTEC loop focuses on fouling and clogging phenomena in secondary circuit due to the deposition of iron oxides, particularly on the tubes support plates and tubes of the Steam Generators. The study subject concerns the modeling under Neptune CFD® of flows and heat exchanges on the secondary side (a two-phase saturated fluid (277°C at 61 bar abs., with a quality of about 30% and void fractions exceeding 80%)).

A previous study, conducted using a tool from ANSYS® (CFX), allowed for fine modeling of thermo-hydraulics in the test section and highlighted significant fluid vaporization due to "flashing" (i.e., vaporization due to exceeding the saturation temperature resulting from a sudden drop in total pressure) caused by singular pressure losses generated by the tubes support plate. High void fractions led to modeling the flow as follows: a droplet flow (i.e., liquid droplets dispersed in a gas matrix). However, since the calculated power was significantly lower than the measured power, it was decided to continue this study by modeling the liquid film on the tubes and the plate. Additionally, the expected flow topology in the plate is of the "dispersed annular" type (i.e., a liquid film on the wall with a central channel of dispersed liquid droplets in a gas matrix) and can also be modeled.

- 2) Tasks/ Key Results Expected

The internship subject is based on three parts. The first concerns the creation of the mesh from the CAO model (using the SolidWorks software) or the existing CFX mesh. The second part concerns the realization of the model itself under Neptune CFD® until convergence. Finally, the last part consists of performing sensitivity studies (quality, flow rate...) and comparing the results with the experimental results obtained on the COLENTEC.

- 3) Knowledge, Skills and Abilities

- *Thermal-hydraulics*
- *CFD (Ansys Fluent, Neptune...)*

3. Qualifications (Education)

- ☐ (1) Bachelor degree (3rd year ☐, 4th year ☐)
- ☒ (2) Master degree (or candidate)
- ☐ (3) Ph. D. degree (or candidate)
- ☐ (4) Does NOT matter

4. Required documents

- ☒ Resume / Curriculum Vitae
- ☒ Cover letter
- ☒ Academic transcript
- ☒ Recommendation letter written by academic supervisor
- ☒ English Test score (TOEFL, TOEIC, IELTS, etc.)
- ☐ Others ()

5. Is the host organization providing any additional financial support in addition to the funding from KONICOF?

- ☒ Yes
- The amount of stipend: EUR 700 per month ~~/week~~
 - Purpose of the stipend: *assist housing, required minimum wage, etc.*
- ☐ No



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