EPFL

Laboratory for Reactor physics & Systems behavior (LRS)

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© Maxime Filliau

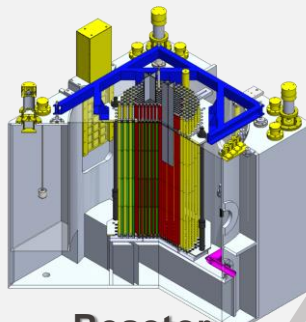# LRS Research in a Nutshell

Code development

Reactor Physics Experiments

GeN-Foam: a multiphysics solver

OFFBEAT: OpenFOAM for fuel behaviour

Reactor Physics

Nuclear Data (PETALE)

Reactor noise (VOID, COLIBRI)

Instrumentation development for high-resolution meas. (min. scintillators, diamond det.)

Uncertainty Quantification

Data assimilation

Verification & Validation

C. Fiorina

Multiphysics modelling of nuclear fuel using the OFFBEAT solver

- OFFBEAT: OpenFOAM Fuel BEhavior Analysis Tool
  - Advanced multi-dimensional tool co-developed by the EPFL and the PSI
  - At the center of an IAEA initiative on open-source code
  - Collaborations with the JRC/Karlsruhe and the CEA

C. Fiorina
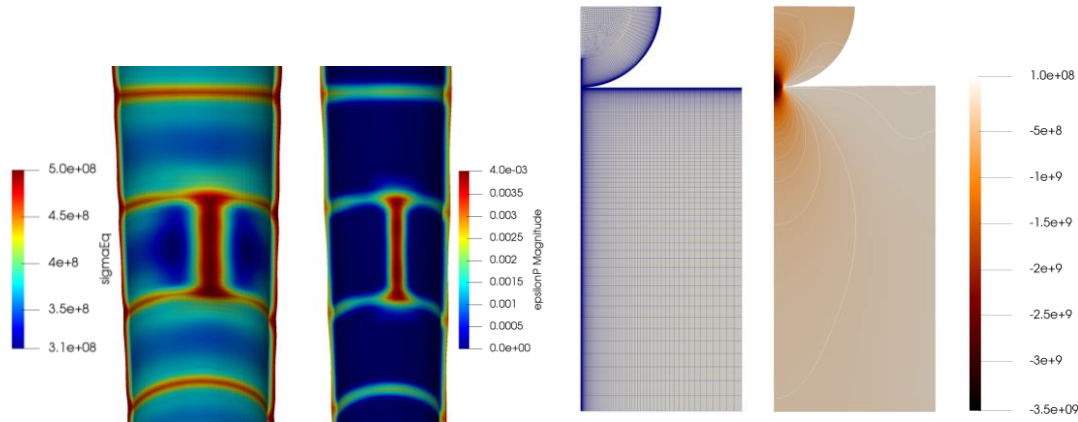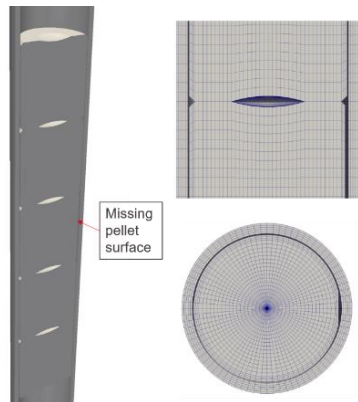
Application and development of the OFFBEAT fuel behavior solver for the analysis of advanced nuclear fuels

- Objectives of the Semester Project
  - Familiarize with OFFBEAT
  - Model advanced high-Pu fuel in the frame of the Euratom PUMMA project
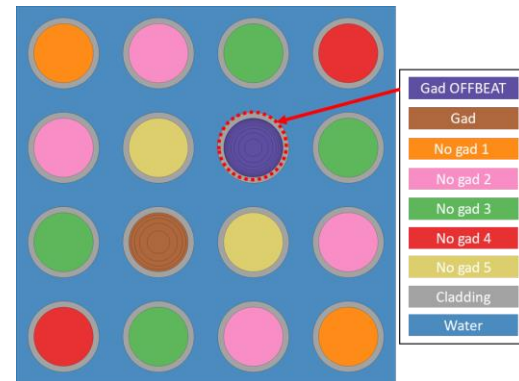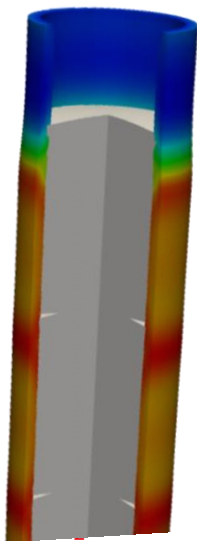- Objectives of the Thesis
  - Familiarize with neutron transport methods and multi-physics modelling
  - Couple OFFBEAT and a neutron transport code (Monte Carlo and/or SN)
  - Apply the new methodology to cases of industrial interest (e.g., advanced fuels)
- The work will take place at the EPFL
- Supervisors:
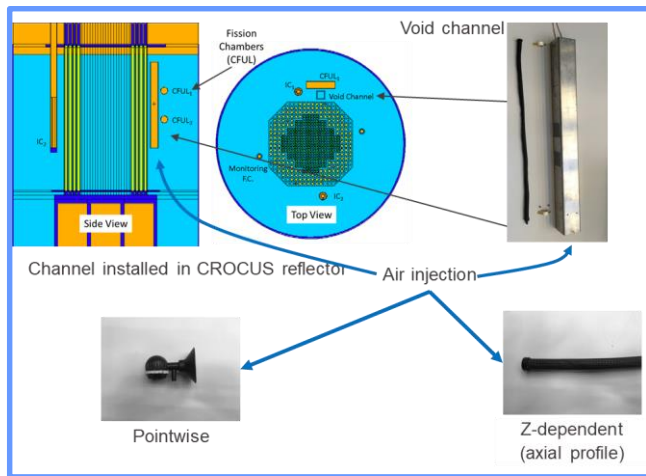 - Dr. C. Fiorina, Scientist
  - Dr. A. Scolaro, Postdoctoral Fellow
  - Mr. E. Bruetto, PhD student
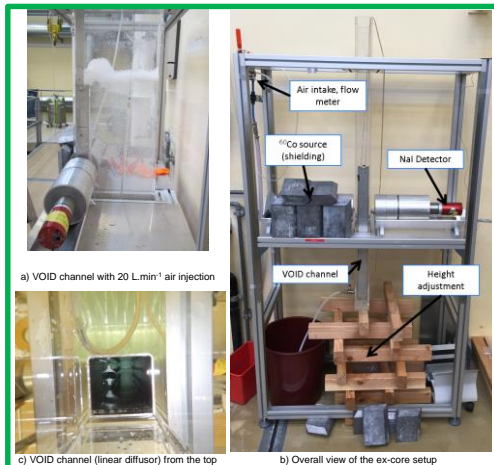- Interested? Contact: carlo.fiorina@epfl.ch

EPFL/ETHZ Nuc. E

Gad OFFBEAT
Gad
No gad 1
No gad 2
No gad 3
No gad 4
No gad 5
Cladding
Water

Void fraction measurements in CROCUS

In-core Setup

Fission Chambers (CFUL)

Void channel

Side View

Top View

Monitoring F.C.

Channel installed in CROCUS reflector

Air injection

Pointwise

Z-dependent (axial profile)

Ex-core Setup

a) VOID channel with 20 L.min⁻¹ air injection

Air intake, flow meter

⁶⁰Co source (shielding)

NaI Detector

VOID channel

Height adjustment

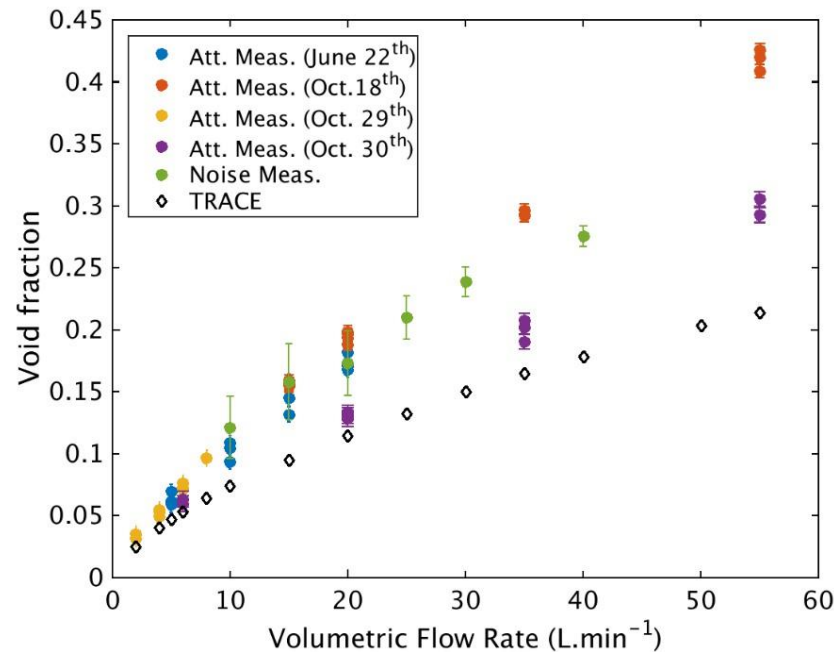c) VOID channel (linear diffusor) from the top
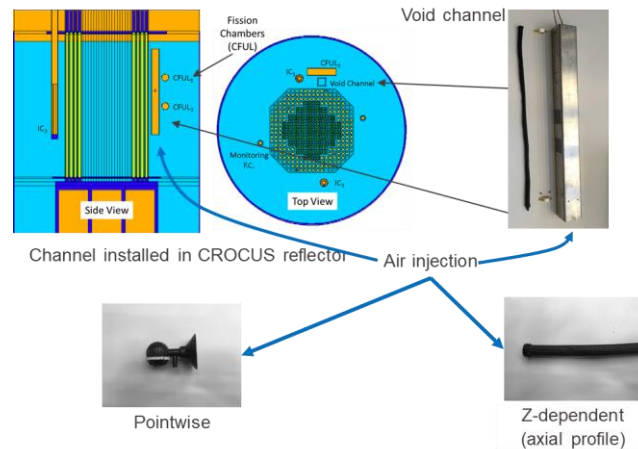
b) Overall view of the ex-core setup

- **Industrial application:** determine the void profile in operating BWRs using existing instrumentation
- Proof of principle measurement in CROCUS (VOID project)

Improvement of the VOID experiment in CROCUS

- Objectives of the Semester Project
  - Familiarize with VOID project as a whole
  - Design and build a prototype detector for void measurement in a channel though water conductivity

- Objectives of the Thesis
  - Instrument the VOID channel for simultaneous determination of void content through neutron noise and conductivity measurements
  - Carry out experiment in CROCUS
  - Comparison with existing model

- The work will take place at the EPFL

- Supervisors:
  - Dr. M. Hursin
  - Pr. M. Prasser

- Interested? Contact: mathieu.hursin@epfl.ch

Fission Chambers (CFUL)

Void channel

Side View

Top View

Channel installed in CROCUS reflector

Air injection

Pointwise

Z-dependent (axial profile)

Practicalities

- Semester project is done remotely

- Master project is carried out at EPFL

- Previous examples
  - Stefan Radman (stefan.radman@epfl.ch), *"Re-analysis of Phase II HCLWR-PROTEUS experiments with modern Monte Carlo codes"*
  - Oskari Pakari (oskari.pakari@epfl.ch), *"Development of Current and Fast Neutron Noise Measurements in CROCUS"*
  - Thomas Ligonnet (thomas.ligonnet@epfl.ch), *" Analysis of the PETALE experiment: stainless steal nuclear data in CROCUS"*

The LRS team is looking forward to working with you !