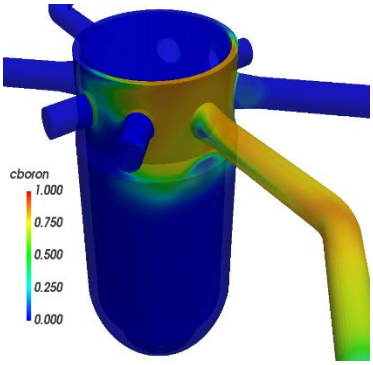
# Workshop

## Practical Application of Multi-scale and Multi-physics Simulation for PWRs using the CUPID code

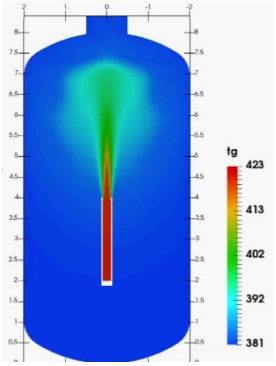
### *Organization: Han Young Yoon (KAERI)*

The multi-scale analysis, where different length scale codes are used together, can improve the accuracy of current PWR thermal hydraulics analysis which are usually based on the one-dimensional model. High fidelity nuclear reactor simulation also involves multi-physics analysis models of the neutron kinetics, fuel performance, structures, etc. With recent advances in large scale computer simulations, this multi-scale/physics simulation is expected to be used as a practical tool for the next generation safety analysis. This will dramatically improve the prediction accuracy of the convectional safety analysis and could contribute to the enhancement of the advanced PWR safety.

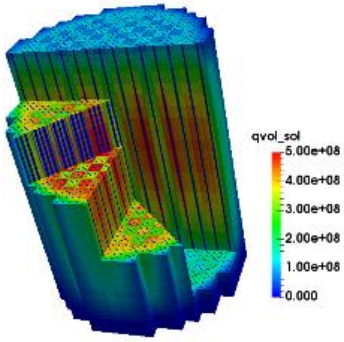
- This workshop will provide the multi-scale and multi-physics simulations of PWRs based on the CUPID code, which is a three-dimensional two-phase flow analysis code developed for a CFD- or component-scale applications.
- In this workshop, the mathematical models of CUPID and multi-scale/physics coupling methods will be presented including their verifications. CUPID standalone applications in CFD- and component-scales will be also presented.
- For a practical use of the multi-scale/physics simulation for PWR safety analysis, full core safety analysis where all the fuel rods are resolved in subchannel-scale is demonstrated using the developed codes for the PWR of steam line break (SLB) accident.



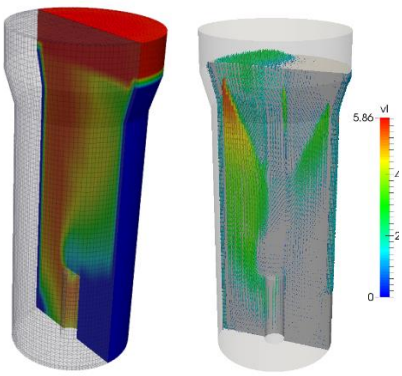

ROCOM flow mixing



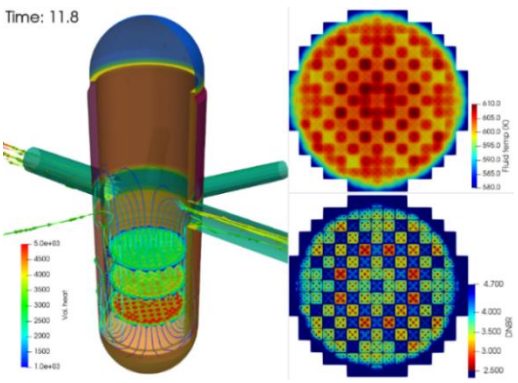

Hydrogen transport




Full core simulation




SG thermal hydraulics




Full core SLB analysis

## Preliminary program

**09:00 Session-1: Introduction of CUPID and multi-scale and multi-physics methods**

09:00 Introduction of CUPID code
09:30 CFD-scale applications
10:00 Component-scale applications
*10:30 Break*
10:50 Multi-scale analysis method
11:10 Multi-physics analysis method

*12:00 Lunch*

**13:30 Session-2: Practical Applications to PWR safety analysis**

13:30 Reactor vessel 3D mesh generation in subchannel-scale
14:00 Implementation of subchannel models and validations
14:30 Multi-scale and multi-physics full core SLB accident analysis of OPR1000
15:00 3D LBLOCA analysis of APR1400

*15:30 Break*

**15:40 17:00 Session-3: Demonstration of a multi-scale and multi-physics analysis**

This workshop is open to all interested parties and requires no prior knowledge of CUPID.