Answers to the Study questions

1. What is the use of adding drag models to the solver?

Considering the geometry of the core of a nuclear reactors, it is computationally expensive to use direct numerical simulation (DNS) or large eddy simulation (LES) approaches, and therefore a Reynolds-averaged Navier-Stokes simulation (RANS) simulation is used. In order to close the momentum equation with respect to forces at the subscale level between solid and liquid interfaces, several drag models can be used. These are based on empirical correlation and using different drag models based on the geometry helps in better prediction of phenomenon. Therefore, in order to increase the accuracy of results, different drag models can be applied and used according to flow conditions and geometry.

2. What is the advantage of using GeN-Foam solver, and which physics is already coupled in it?

GeN-Foam is a multi-physics solver that contains a thermal-hydraulics sub-solver based on the standard $k - \varepsilon$ turbulence model for compressible or incompressible flows but extended to coarse mesh applications through the use of a porous medium approach for user-selected cell zones inside the mesh. It also has sub-solvers for neutronics and thermomechanics. Coupling of these physics is provided by a Multiphysics class withing GeN-Foam.

3. Why is gmsh used in this case for generating mesh, what is the benefit of using such meshing tool?

Gmsh is an open-source 3D finite element mesh generator with a built-in CAD engine and postprocessor. Its design goal is to provide a fast, light and user-friendly meshing tool with parametric input and advanced visualization capabilities. Gmsh also has its own scripting language (.geo files), which was used to create the mesh in this project. The geometry of the problem required a hybrid structured mesh, with different types of cells in different zones. The benefit of gmsh is that it allowed to automate the process by changing just 3 user defined inputs to generate mesh for any type of hexagonal subassembly of a nuclear reactor. Also not many available tools can easily create this kind of hybrid mesh.