

SECTOR:
ENERGY

OFFERINGS:
ENGINEERING DESIGN
SIMULATIONS

TECHNOLOGY:
FLUID DYNAMICS &
THERMAL

THERMAL AND MAGNETO-HYDRODYNAMIC ANALYSIS OF THERMO NUCLEAR REACTOR MODULES

Our customer is a research institute involved mainly in the research of plasma and its uses in the nuclear industry. The customer is involved in the design of Liquid and Solid Test Blanket Module (TBM) for experimental evaluation of Thermonuclear Reactor. The component materials of TBM are exposed to high temperatures that may lead to failure. Zeus Numerix was engaged in thermal hydraulic analysis for these components.

Zeus Numerix performed CFD study to analyze the First Wall, Liquid Breeder (LLCB) and Solid Breeder (HCSB) of a TBM. Effect of magnetic field on the trajectory of plasma was modeled. Safety analysis is performed considering Helium breaks into the vacuum vessel. The effectiveness of cooling is modeled to find out the maximum temperature in the material of the First Wall. Flow analysis is performed that identified the high turbulence regions in a LLCB. The heat loading for different set of conditions in LLCB is estimated using CFD. The temperature profile in HCSB is estimated by using 2D simulation.

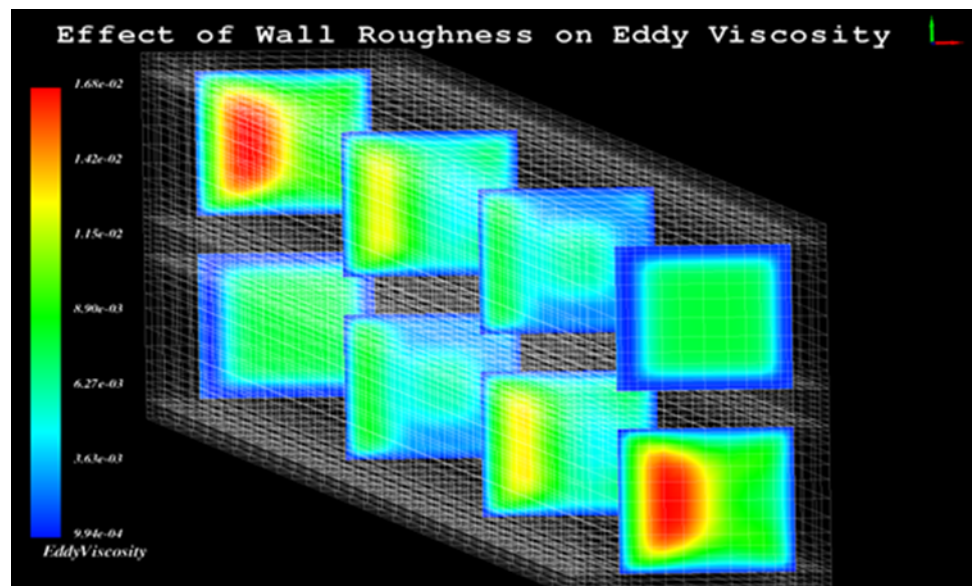
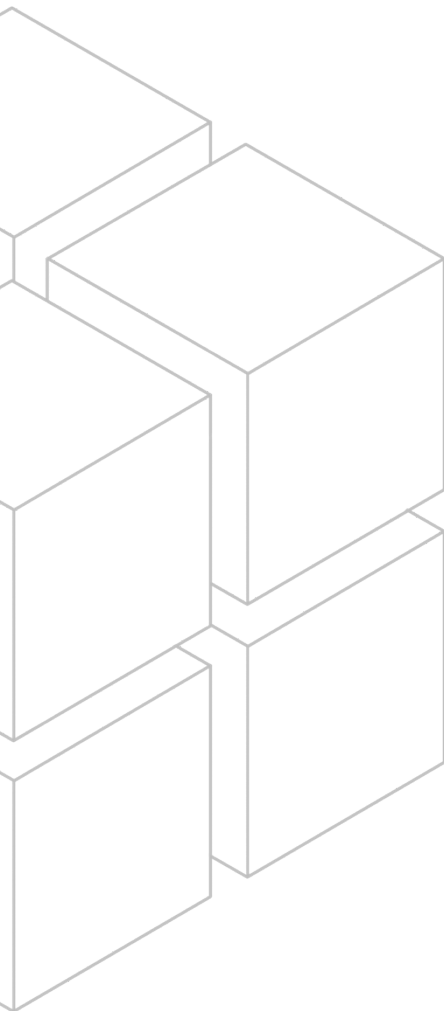


Figure 1: Eddy viscosity plot showing the wall roughness in First Wall Analysis

The customer was provided the consolidated report containing temperature profiles. Plots of temperature profile, eddy viscosity, velocity, pressure and turbulence generated from the thermal and magneto-hydrodynamic analysis were added to the report. The customer used our report to prove the TBM design.