VALIDATION OF A LOSS OF VACUUM ACCIDENT (LOVA) COMPUTATIONAL FLUID DYNAMICS (CFD) MODEL

C.Bellecci[1], P.Gaudio[1], I.Lupelli[1], A.Malizia[1], M.T.Porfiri[2],R.Quaranta[1], M.Richetta[1]

[1]EURATOM-Faculty of Engineering, University of Rome "Tor Vergata" Via del Politecnico 1, 00133 Rome, Italy;
[2]ENEA Nuclear Fusion Tecnologies, Via Enrico Fermi , 45 I-00044 Frascati, Italy

Corresponding author: ivan.lupelli@uniroma2.it

Intense thermal loads in fusion devices occur during plasma disruptions, Edge Localized Modes (ELM) and Vertical Displacement Events (VDE). They will result in macroscopic erosion of the plasma facing materials and consequent accumulation of activated dust into the ITER Vacuum Vessel (VV). A recognized safety issue for future fusion reactors fueled with deuterium and tritium is the generation of sizeable quantities of dust. In case of LOVA, air inlet occurs due to the pressure difference between the atmospheric condition and the internal condition. It causes mobilization of the dust that can exit the VV threatening public safety because it may contain tritium, may be radioactive from activation products, and may be chemically reactive and/or toxic [1]. Several experiments have been conducted with STARDUST facility in order to reproduce a low pressurization rate (300 Pa/s) LOVA event in ITER due to a small air leakage for two different positions of the leak, at the equatorial port level and at the divertor port level, in order to evaluate the velocity magnitude in case of a LOVA that is strictly connected with dust mobilization phenomena. A two-dimensional (2D) modelling of STARDUST, made with the CFD commercial code FLUENT, has been carried out. The results of these simulations were compared against the experimental data for CFD code validation. For validation purposes, the CFD simulation data were extracted at the same locations as the experimental data were collected. In this paper, the authors present and discuss the computer-simulation data and compare them with data collected during the laboratory studies at the University of Rome "Tor Vergata" Quantum Electronics and Plasmas lab