The dust erosion due to the plasma disruption inside the vacuum vessel, mainly in the divertor zone, is one of the main safety concern for the ITER experimental machine. In case of loss of vacuum accident (LOVA) the dust mobilizes and can exit outside the VV, if the internal pressure equalizes the atmospheric pressure, inducing a radiological release. The aim of work is to quantify the fraction of the dust resuspended inside the VV, describing the experimental results got through the facility STARDUST (Small Tank for Aerosol Removal and Dust showed in fig.1). 2D simulations , made by the software CM depict the thermal field and the velocity inside the VV during the accidental transient.

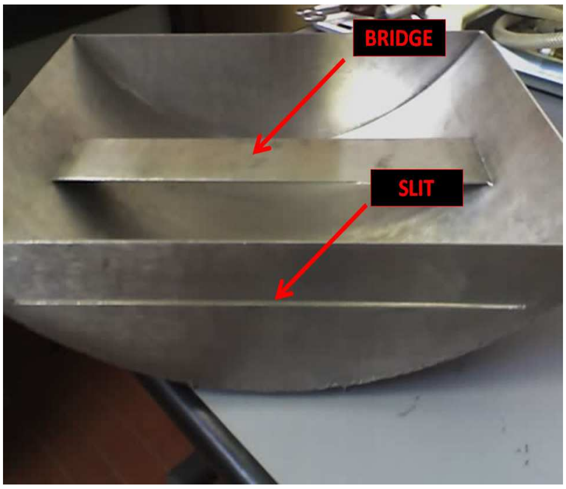

Figure 1: STARDUST Tank (Left) and Obstacle (Right)

STARDUST is a small facility set up in the ENEA Frascati laboratories to perform experiments on dust mobilization in a volume having initial conditions similar to the ITER vacuum vessel. Inside the facility a semi-cylindrical obstacle has been set to simulate effects like those caused by the divertor in ITER. The bridge inside the obstacle (fig. 1) represents the dome of the ITER divertor. The LOVA experiments were done by an air in-leak entering at two different positions, at the equatorial port level (from valve A in fig. 2) and at the divertor port level (from valve B in fig. 2), respectively. The pressurization rate of 300 Pa/s is typical of a small LOVA. The dust used (tungsten, carbon, stainless steel) is similar to what is foreseen inside the ITER VV when, the plasma facing materials vaporize for the high energy deposition due to the disruptions. In the experiments it was layered in a little tray placed in different positions inside the tank: tray under obstacle; tray inside obstacle under the bridge; tray inside obstacle over the bridge. The experiments were repeated in three different conditions: high temperature of the STARDUST's walls (110°C); low temperature of the STARDUST's walls (25 °C); high temperature of the STARDUST's walls (110°C) when the obstacle has a slit in a wall (fig.1), representing the opening between divertor and limiter in ITER. All the experiments have been repeated for two air inlets: A and B (fig.2) representing, respectively, the ITER equatorial port level and at the divertor port level.

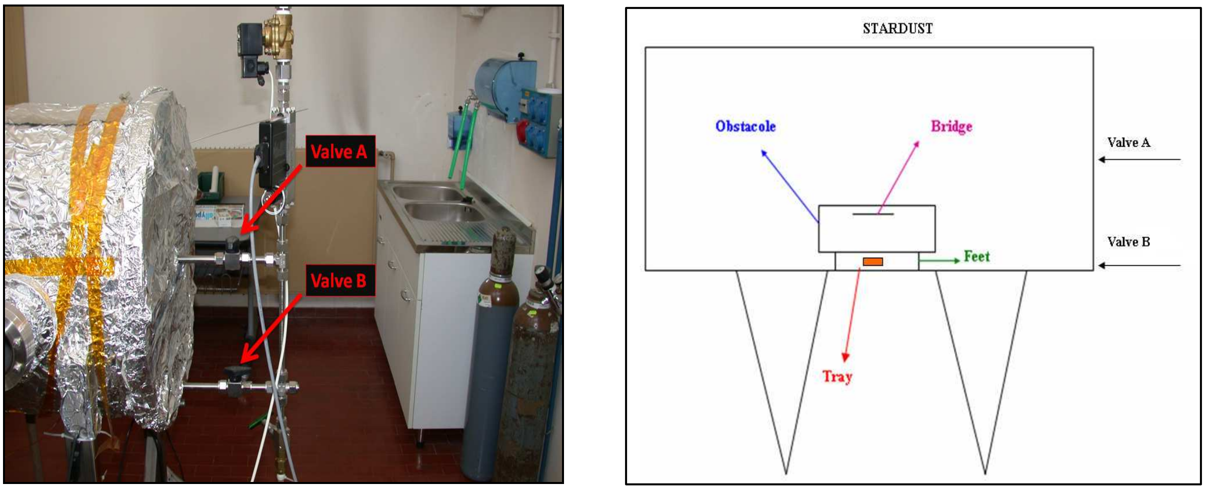

Figure 2: Position of inlet A and inlet B

The results have been compared to those obtained in previous experimental campaigns [2003] made without obstacle in VV. In all the experiments with tray under obstacle and air in-leak from the divertor port level, the values of the dust mobilized were lower than the values obtained without obstacle. In all the experiments done in condition of high internal temperature the values of the dust mobilized were higher than the values of the dust mobilized in condition of low internal temperature. In all the experiments done in condition of high internal temperature plus a slit in the obstacle's wall the values of the dust mobilized were lower than the values of the dust mobilized in condition of high internal temperature when the slit in the obstacle is absent (fig.3). Therefore we can conclude that the presence of the obstacle reduces the mobilization fraction. The obstacle influences the velocity field reducing the module of velocity on the tray; the colder temperature seems to have a positive effect in the reduction of the mobilization fraction the slit presence probably reduce the air velocity, introducing a discontinuity in the flow streaming. The second item must deeply investigated because it is in contradiction with results obtained in previous experiments [7] and the third one must be verified by means of CFD simulations, mapping the air velocity behavior in presence of an opening in the obstacle. A time-dependent CFD model of the STARDUST tests, with both inlet configurations, has been performed in order to support the experimental results.

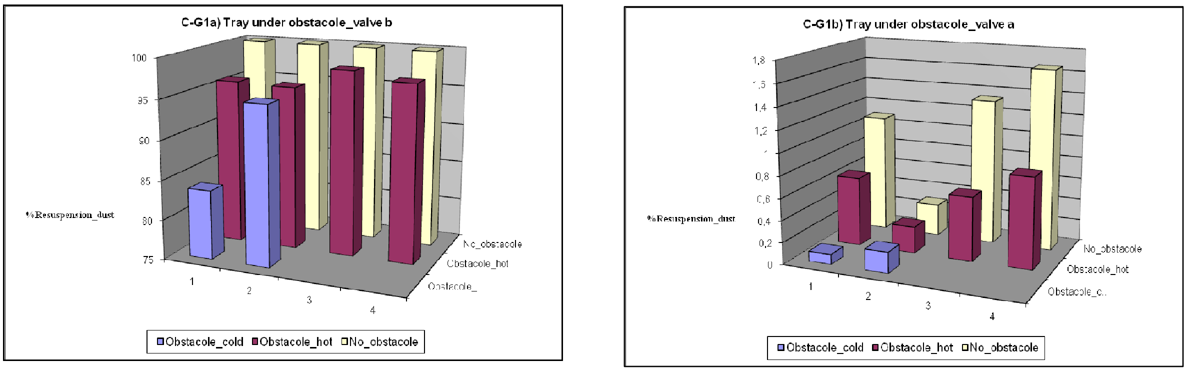

Figura 3 : Experimental results

Simulation of the thermal and flow fields into STARDUST® has been carried on, with CM. The implemented model is based on the fully compressible formulation of the continuity equation and momentum equations and the conduction/convention heat transfer equation. The sub domain and boundary conditions reply the operational conditions of the facility. For the inlet A and B the results of the simulation have made to record maximum inlet velocity 629 m/s and of the order of 30 m/s in the low part of the facility (point X in figure 4) for the inlet A and of the order of 190 m/s for inlet B.

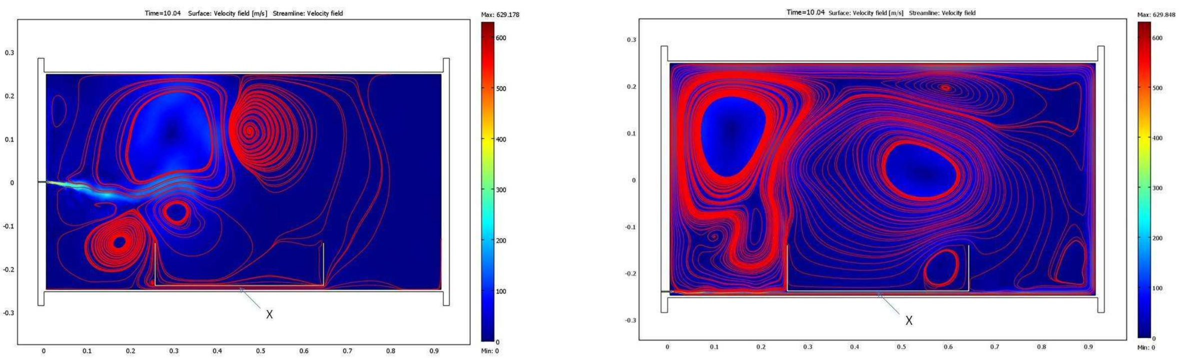

Figure 4:Velocity field for inlet A and B

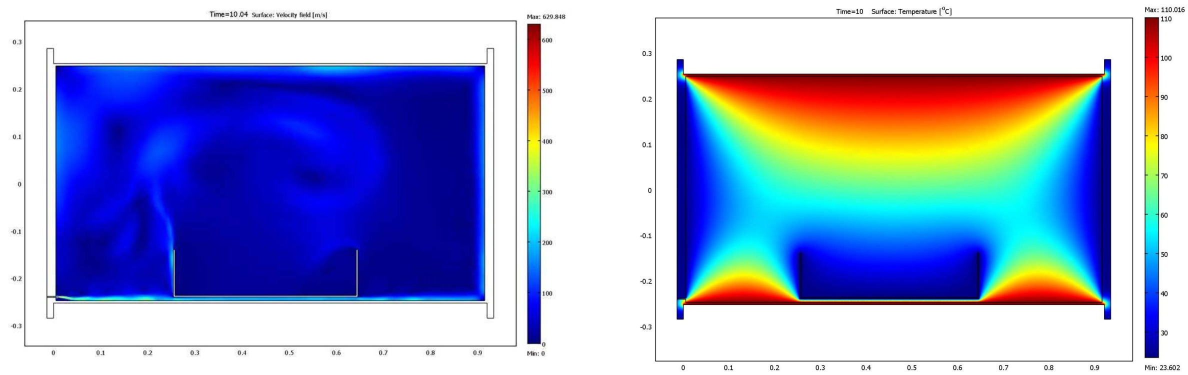

Figure 5: Velocity and Thermal field for inlet B

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