EFFECT OF DROPLETS ON THE FLOW OVER A CAVITY

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This experimental study is a part of a long term project between the VKI and the European Space Agency (ESA). The long term goal of the project is to understand the physical parameters governing the Al_2O_3 entrapment in solid rocket motors.

The principal aim of this work is to perform an assessment of the measurement techniques and a preliminary experimental simulation concerning the entrapment and the accumulation of droplets in stagnant areas.

Two-phase and single-phase flow measurements are performed over a rectangular cavity in the VKI L-6 wind tunnel facility at $Re_h \tilde{}$ 4000 and $Re_h \tilde{}$ 9000.

The water droplets for the 2-phase flow experiments are introduced in the flow field using an atomizer put in the stagnation chamber of the wind tunnel.

The interaction between the flow field over the cavity and droplets is investigated by means of Particle Image Velocimetry technique. Also Particle Tracking Velocimetry technique and Wavelet analysis have been used to determine the velocity lag between the droplets and the surrounding air and the characteristics of the coherent structures in the flow field respectively.

A method is developed for the PIV measurements to determine simultaneously the velocity field of the two phases.

In this method fluorescent water droplets are used. The images of the flow field are acquired simultaneously with 2 CCD cameras. One of the cameras is filtered in order to view only the fluorescent liquid phase. This information about the instantaneous position of the liquid droplets is used in order to mask their position in the images acquired with the second camera and then obtain images (containing only seeding particles) that can be processed with the correlation code (Wi.D.I.M.).

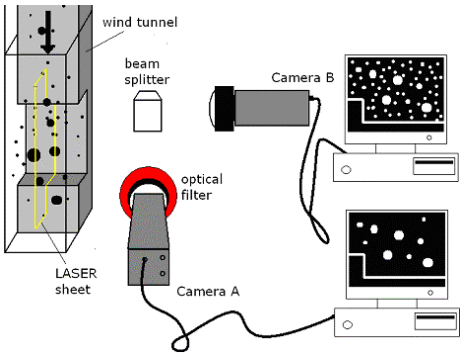

Figure 1: Schematics of the acquisition system

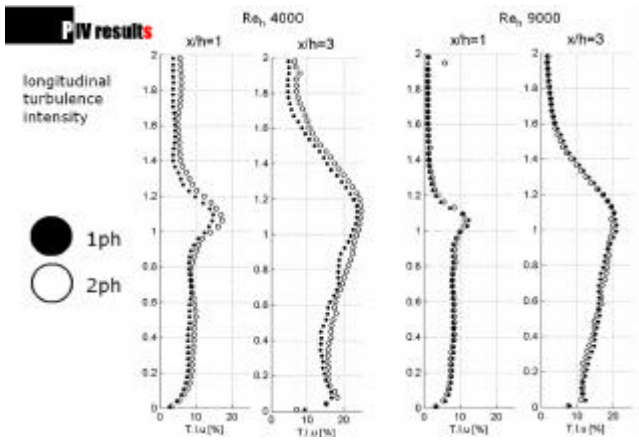

Figure 2: Turbulence intensity profiles at different longitudinal positions