IMPROVEMENT OF DOPPLER GLOBAL VELOCIMETRY AT VON KARMAN INSTITUTE

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Since the beginning of turbomachinery research, in order to validate models and develop new theories, it has been necessary to measure the thermodynamical fluid properties. The flow in turbomachines is quite complex, usually turbulent with complex three-dimensional structures. What is needed is to measure this fluid properties and this can be done in two ways: intrusive and non-intrusive. Laser techniques are particular ways to investigate flow fields with the big advantage of being non-intrusive. The basic principle is to travel the information of the flow speed with light. This work is related to a laser technique and in particular to a new technique called

Doppler Global Velocimetry. Doppler Global Velocimetry (DGV) is a laser technique that allows measuring the velocity of particles seeded in a flow by the Doppler shift of scattered light. In order to discriminate the weak frequency shift molecular iodine vapor is used. The amount of light transmitted through the iodine cell varies as the frequency of the scattered light changes and this information could be used as a measure of velocity. Here at von Karman Institute there is an ongoing and continuous research to develop a reliable point-wise approach and to extend the limits of this technique.

The aim of this project is to extend the capability of the VKI DGV system from a point-wise configuration to analyze a planar investigation area. To reach this target an optical bench was designed and built together with the software for processing the acquired images and a dedicated calibration procedure. Through various tests the system was demonstrated to work properly and to be able to discriminate planar velocity fields. A procedure for the iodine cell calibration was proposed by means of a constant flow field retrieved from the velocity core of a jet flow. Recommendations were proposed for future investigations.

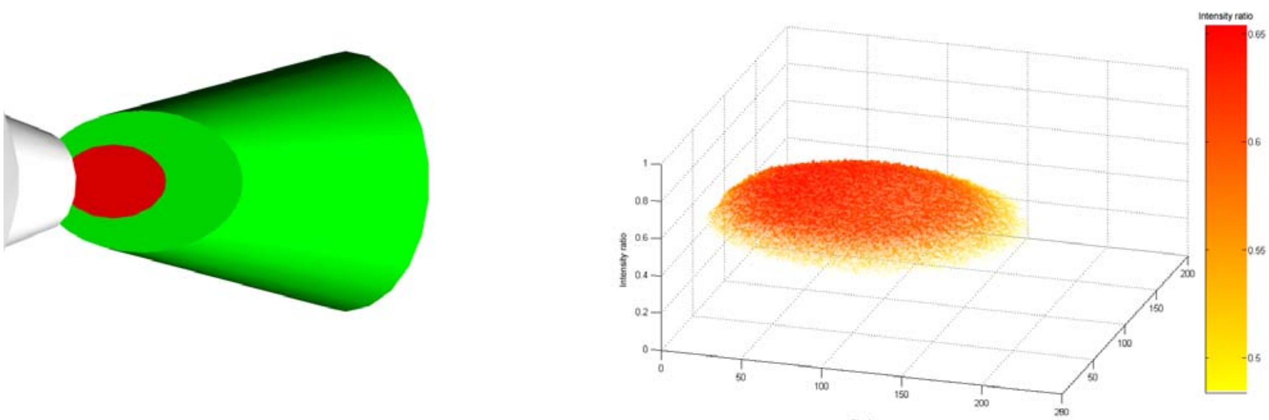

Figure 1: nozzle flow analyzed through DGV, left configuration, right aquisition