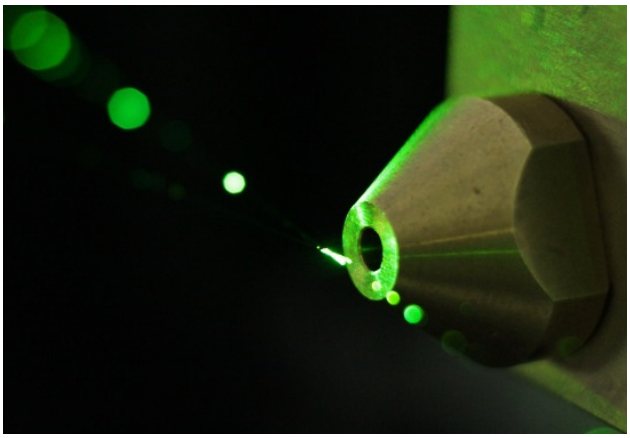
LDV-Profile Sensor



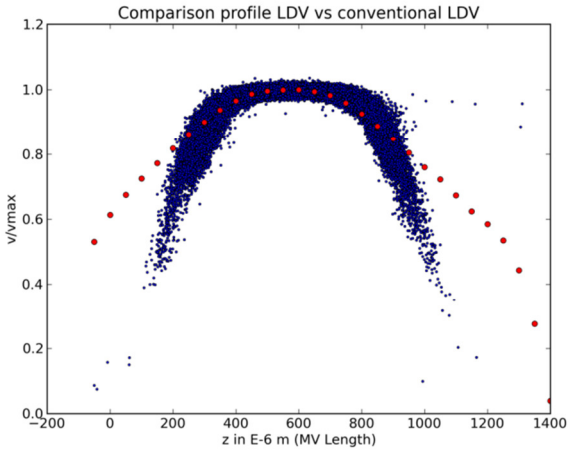


Fig.1: velocity distribution in a free jet

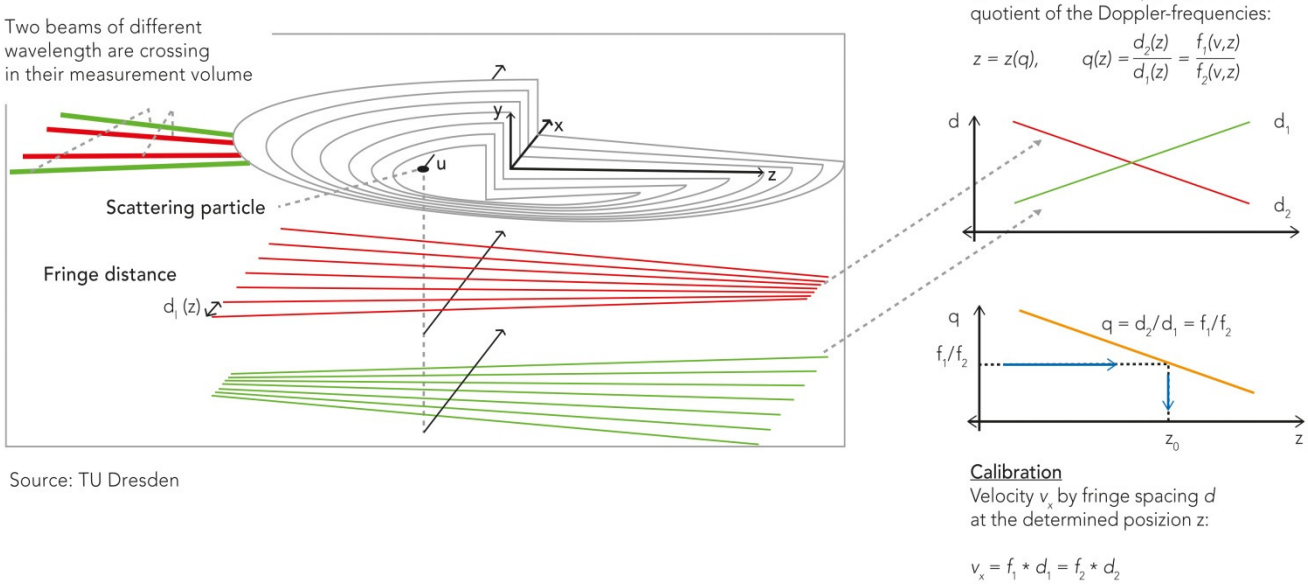
Overview

Using conventional LDV systems in strong velocity gradients is difficult, because the measured velocity is an average over the length of the measuring volume. Even the use of front lenses with short focal length and measuring volumes of less than 1mm is not a solution because the spatial resolution required for measurements in boundary layers is about 1-10 µm. ILA GmbH developed in cooperation with the Technical University of Dresden a new LDV-profile sensor that offers a spatial resolution of 1% of the length of the measurement volume.
The LDV-profile sensor probe contains two Nd:Yag-Laser (532nm and 561nm), works with the normal 2D-LDV controller and with an extension of the proven LDV software Qt-LDA.

Fig. 1 shows the comparison of the measurement results inside a free jet of a conventional LDV (red dots) and a LDV-profile sensor (small blue dots). The free jet has a diameter of 1mm. The length of the measurement volume of the conventional LDV (f=160mm) is about 500µm. The LDV profile sensor offers a length of the measuring volume of 1mm with a spatial resolution of 1% (10µm). It is obvious that the conventional LDV is not able to resolve the high velocity gradient in the shear stress region of the free jet.

The basic idea of the developed LDV-profile sensor is to detect the position of the particle inside the measuring volume. This is realized by the overlap of two measuring volumes with different wavelength, one with a divergent fringe system the other with a convergent one. The ratio of the detected Doppler frequency of both fringe systems f_{D1}/f_{D2} is used to calculate the particle position z inside the measuring volume. The particle position and velocity can be calculated with the known fringe distance under consideration of the deviation of the fringe distances.

Physical Principles



Source: TU Dresden

Specifications

Weight: 5,5 kg
Focal length: 160mm, 250mm
Length of measuring volume: 0,5mm, 1mm
Dimensions: 80 x 115 x 420 mm

Laser Power: 75, 100, 200mW
Wavelength: 532nm, 561nm
Spatial resolution: 1% of MV length
Controller: 2D-LDV standard controller

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