LDV-Profile Sensor

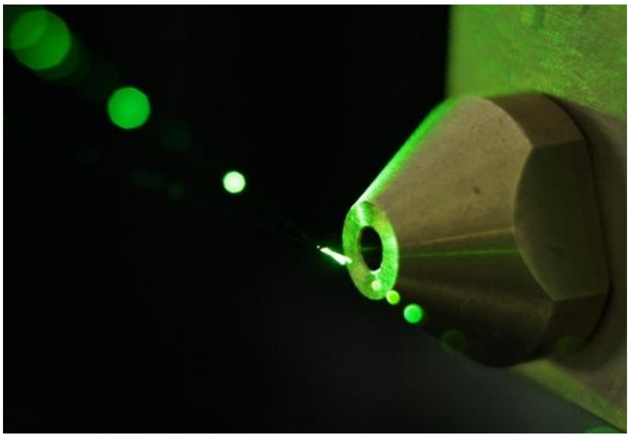


Fig.1: Velocity distribution in a free jet

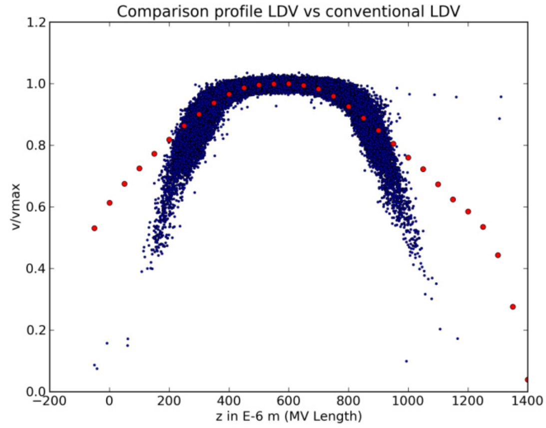


Fig.2: Comparison profile LDV vs conventional LDV

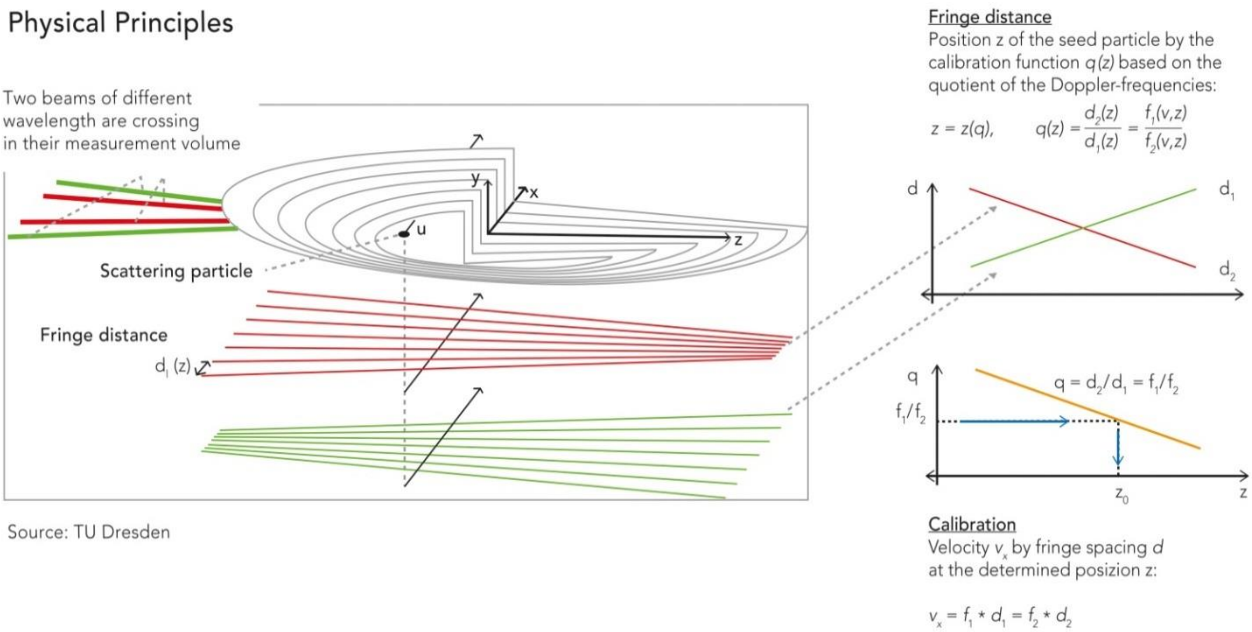
Overview

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 lengths and measuring volumes of less than 1 mm is not a solution, because the spatial resolution required for measurements in boundary layers is about 1-10 µm. ILA R&D developed in cooperation with OPTOLUTION and the Technical University of Dresden (Prof. Jürgen Czarske*, Dr. Lars Büttner*) a new LDV-Profile Sensor that offers a spatial resolution of 1% of the length of the measurement volume.

The LDV-Profile Sensor contains two Nd:Yag-Laser (532 nm and 561 nm), works with the normal 2D LDV Controller and with an extension of the proven LDV software *LDA Control Qt*.

Fig. 2 shows the comparison of 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 1 mm. The length of the measurement volume of the conventional LDV
(f=160 mm) is about 500 µm. The LDV Profile sensor offers a length of the measuring volume of 1 mm with a spatial resolution
of 1 % (10 µm). 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.



(*) „Czarske, J., Büttner, L., Razik, T., & Müller, H. (2002). Boundary layer velocity measurements by a laser Doppler profile sensor with micrometre spatial resolution. Measurement Science and Technology, 13(12), 1979-1989."

Specifications

Dimensions	420 x 115 x 80 mm (L x W x H)
Weight	5.5 kg
Laser Power	75, 100, 150, 200, 300, 500 mW
Power Adjustment	30-100 %, optional
Wavelengths	532 and 561 nm
Coherence Length	≥ 100 m
Focal Length	160, 250, 400 (*)
Beam Distance	45 mm
Length of measuring volume	0.5 mm-1 mm
Accuracy	0.2 %
Spatial resolution	1 % of MV length
Controller	Standard 2D LDV Controller

(*) Other focal lengths are available on request

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