R&D GmbH
Research and
Development

Combined 2D shifted Profile Sensor

The new Combined 2D shifted Profile Sensor consists of a 2D fp50-shift LDV System extended with the capability of measuring one velocity component with the high spatial resolution of a shifted ILA R&D Profile Sensor. This makes it suitable for measurements in strong velocity gradients and for the investigation of boundary layers. A modular design of the probe allows using the combined probe for measurements as well as using just the detachable 2D fp50-shift probe. The combined 2D shifted Profile Sensor contains three Nd:Yag-Laser (532 nm, 553 nm and 561 nm), works with an ILA R&D LDV Controller and with an adapted version of the proven LDV software *LDA Control Qt*.

Main Features:

- 2D-LDV-Measurement with high spatial resolution
- Simple setup and alignment
- High long term stability
- High laser power transferred to the measurement volume
- Low measurement uncertainty
- No optical transmission fibers
- Backward scattering arrangement
- Automatic traversing,(optional)
- Robust transportation suitcases
- Little dispersion effect
- Good visibility

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Specifications

Combined 2D shifted Profile Sensor

Dimensions	112 x 125 x 512mm
Weight	9,5 kg
Laser Power	75 , 100 , 150 , 200 , 300 , 500 mW
Coherence Length	>50 m
Focal Length	160, 250, 400 mm
Beam distance	45 mm and 70 mm
Wavelengths	532, 553 and 561 nm
Accuracy	0,2 %
Length of measuring volume	0,5 mm- 3mm
Spatial resolution	1% of MV length
Power Adjustment	30 % up to 100 % (optional)
Calibration	ILA factory calibration (PTB Calibration certificate on request)

LDV Controller (2D, Profile Sensor and photomultiplier)

Dimensions	330 x 370 x 150 mm* 330 x 370 x 78 mm **
Weight	8,7 kg and 5,9 kg**
Signal Detector	Photomultipliers, separation module
Communication	Ethernet Connection

(*) LDV controller also available for 19'' rack

(**) External PM-Controller Unit

Spectral Analysis Module

Sample rates	50 MHz, 250 MHz-, 1 GHz
Resolution	(8 Bit/ 12 bit/ 14 bit)
Input range	+/- 100 mV, +/- 200 mV, +/- 500 mV, +/- 1 V
Interface	PCI/PCI-ex

Accessories

- Traversing units, up to 4 axes with displacement from 200 up to 2000 mm
- Traversing software for different suppliers integrated in LDV software *LDA Control Qt*
- Raytracing Software
- Receiving optical fibers
- Integrated IF Converter with 6 analog channels
- ILA LDV workstation Seeder, particles

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LDV-Profile Sensor

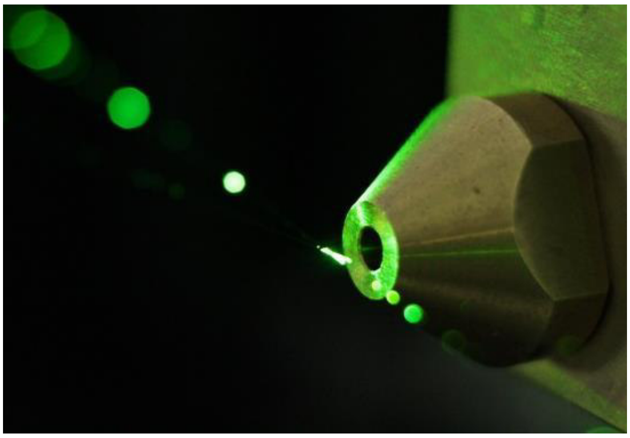
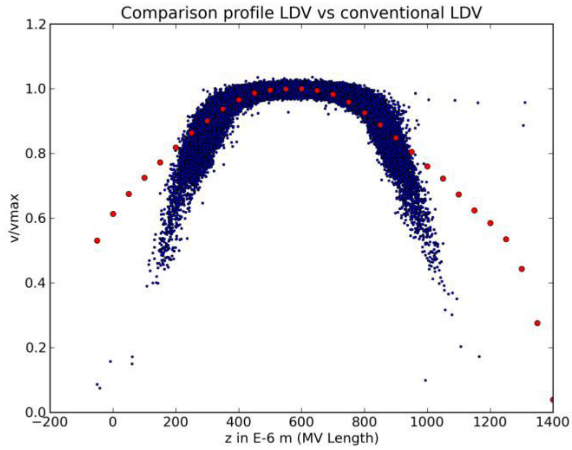


Fig.1: velocity distribution in a free jet



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 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.

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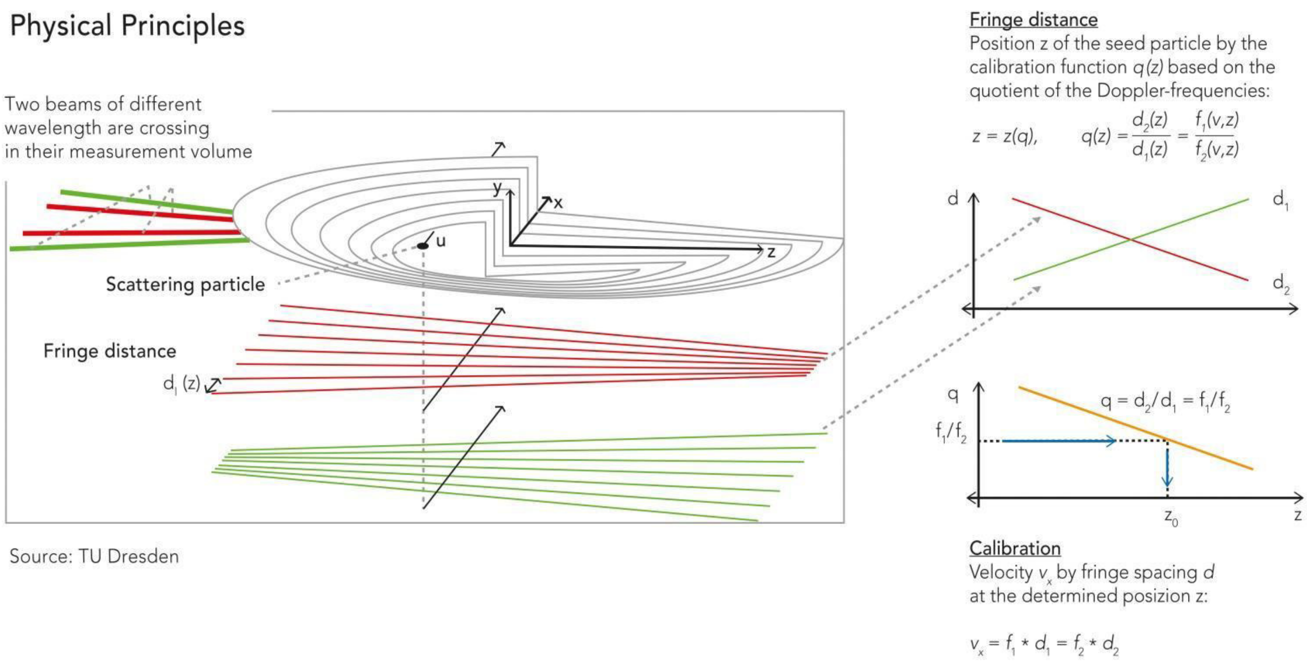
The basic idea of the (developed) LDV-Profile Sensor is to detect the position of the particle inside the measuring volume. This is realized by the overlap of two measuring volumes with different wavelength, one with a divergent fringe system the other with a convergent one. The ratio of the detected 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.



Specifications

Dimensions	80 x 115 x 420
Weight	5,5kg
Laser Power	75, 100, 200 mW
Focal length	160 mm, 250 mm, 400mm
Coherent length	
Wavelength	532, 561nm
Length of measuring volume	0,5 mm, 1 mm
Spatial resolution	1% of MV length
Controller	2D LDV standard controller

*„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."

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