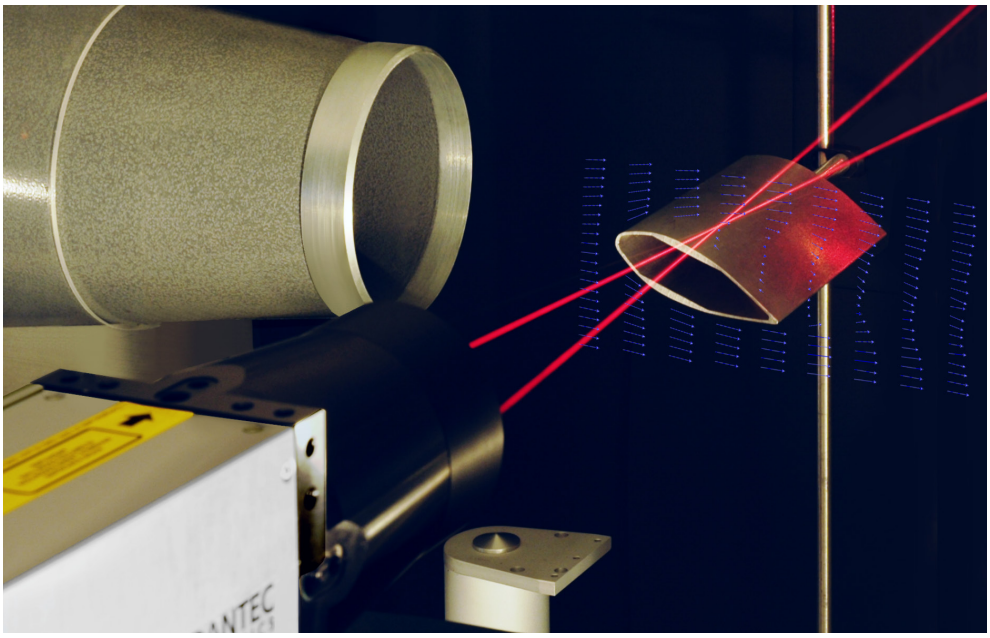
SOLUTION SHEET

DANTEC DYNAMICS

FlexLDA systems

Factory aligned and calibrated



FlexLDA system measuring the air flow around a wing profile

Pre-aligned and calibrated LDA solution for flow velocity measurements

Laser Doppler Anemometry (LDA) is an optical technique ideal for non-intrusive point measurement of velocity and turbulence in a wide range of fluid dynamics applications.

The FlexLDA system is a full featured turn-key solution for working distances up to 500 mm and velocities up to 68 m/s. It uses compact lasers and Bragg cells integrated into the stable and robust design. The system is very easy to set up due to the factory aligned and calibrated optics. Signal processing is done by the well proven BSA (Burst Spectrum Analyzer) using robust real time FFT (Fast Fourier Transform) processing. The calibration data are loaded into the BSA Flow software package providing the most accurate results directly in velocity units (m/s or ft/s).

Key benefits

- Factory aligned and turn-key operation for fast setup
- Calibrated to 0.11% uncertainty
- 1 and 2 velocity component configurations
- Measurement distances from 300 mm to 500 mm
- Robust real-time FFT signal processing
- On-line end-results thanks to real-time processing
- Extensive graphics and data exchange features
- Real-time display of signals, validation and data rate
- Wi-Fi, LAN or USB connection to PC

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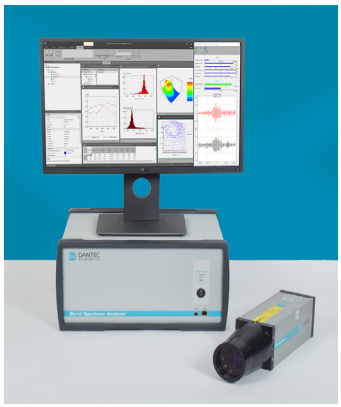
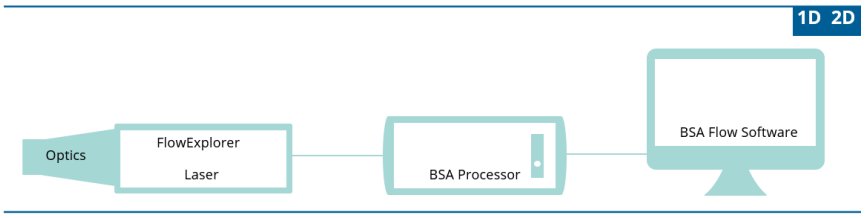
The FlexLDA solution

The LDA method uses the Doppler effect which occurs when laser light is scattered from seed particles in a gas or liquid flow. Inside the FlowExplorer, a laser beam is split in two and then focused to a point to form a measurement volume. The Doppler-shifted scattered light of each particle passing the measurement volume is collected and then sent to the signal processor to determine their velocity. The main benefits of LDA over other flow velocity measurement methods include: the optical technique does not disturb the flow, the transfer function is linear and can be determined to high accuracy, small measurement volumes are possible, high frequency response is possible in well-seeded flows, and the absolute accuracy of the measurement results are unmatched due to calibrated optics and signal processor performance. The solution is based on three core components: optics, signal processor, and software.

Configurations for one or two component measurements are available.



FlexLDA system including FlowExplorer optics, BSA processor and BSA Flow software.



1D and 2D FlexLDA configurations

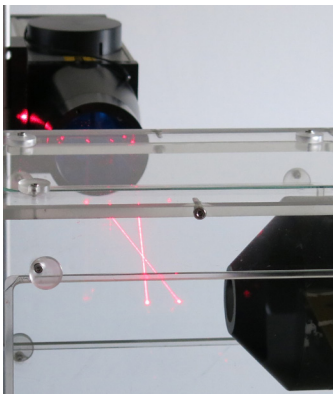
Optics

Calibrated LDA solution

Since the optical transceiver is factory aligned and calibrated, the FlexLDA system is the ideal solution for applications requiring documentation of the measurement uncertainty.

The velocity calibration uncertainty is 0.11% (coverage factor 2). The velocity resolution is better than 0.002% of the chosen velocity range.

The systems have a single optical head with one or two lasers, connected to a BSA processor with one or two channels.



Air jet experiment with FlexLDA

Processor

Fast & powerful all-in-one processor

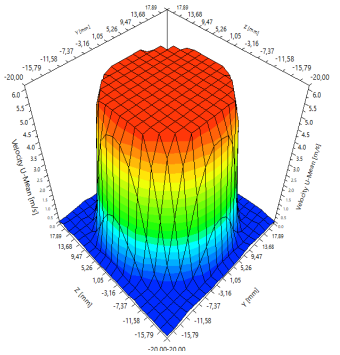
The BSA F100 processor is a fast and powerful all-in-one processor. With Ethernet, Wi-Fi and USB interfaces included, the processor can be connected to a PC via a local area network or a wireless or cabled connection. In large facilities or in situations where remote access is required, these features make it easy to have the processor near the experiment while keeping the PC at a greater distance away for safety and/or convenience.

The processor covers a velocity range up to more than 68 m/s depending on the optical configuration. Robust FFT (Fast Fourier Transform) processing is used.

System setup is very easy and user friendly: the setup is done directly in velocity units, based on a center velocity and a velocity span value.

The processor software includes an on-line signal monitor which provides the user with real-time information about signal quality, data rate, validation, coincidence between channels, PM sensitivity, and anode current. This results in a powerful tool for optimizing the user adjustable parameters during set-up and monitoring of measurement results.

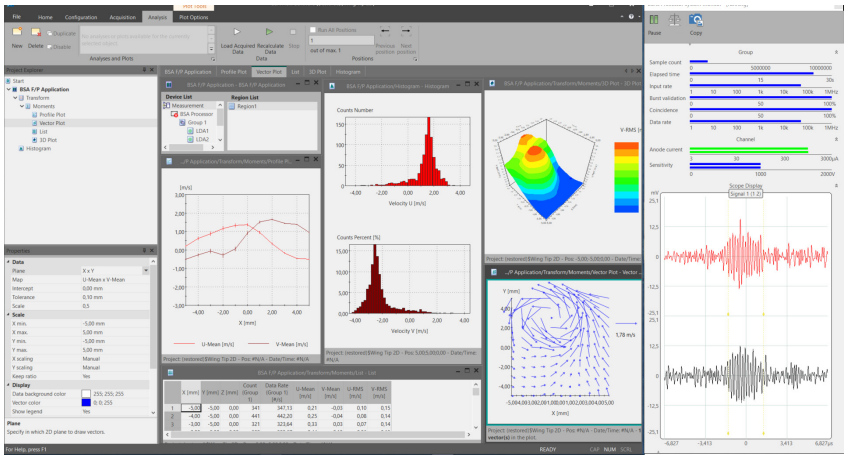
For more details on the signal processor, please refer to the data sheet on “Burst Spectrum Analyzer (BSA)” available at our website.



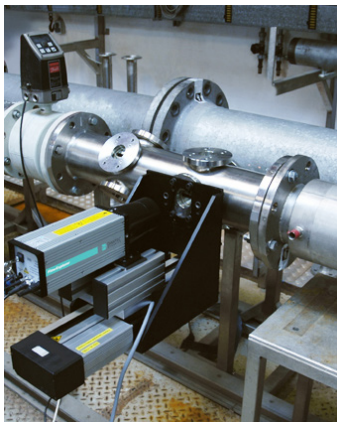
Plot of velocity profile in an air jet

Data Analysis

The most flexible and comprehensive software for LDA measurements



BSA Flow with Advanced Graphics add-on, included in the FlexLDA solution.

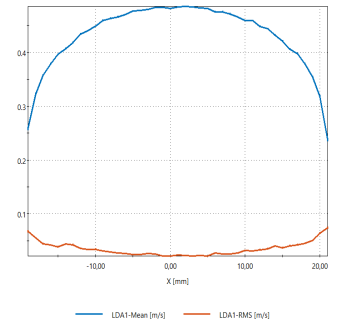


Calibration of a water flowmeter

The BSA Flow software is easy to use thanks to its workflow-based user interface and includes extensive graphics and data exchange features. The system setup, including the optical configuration as well as processor settings, is controlled via the software. Tools are provided which enable user-defined data analysis and display, dynamically updated during measurements.

Data analysis can be customized with a built-in Calculation module, with Python or via a MatLab link for ultimate flexibility. Graphical output includes vector plots, 2D line and scatter plots, and 3D plots. Both plots and numerical results can be transferred to a measurement report in PDF or HTML format. Numerical output includes binary, ASCII, MS Excel, and TecPlot formats.

For further details on the software's performance and capabilities, please see the data sheet on "BSA Flow Software" available on our website.

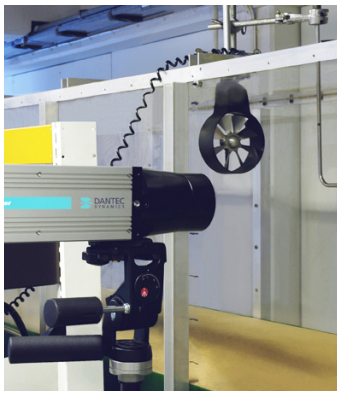


Plot of velocity profile in a turbulent pipe flow in water

FlexLDA configurations

The FlexLDA solution is being offered in the following 1D and 2D configurations.

Item no	Item name	Description
9061N0011	FlexLDA 1D	FlowExplorer 1D 90mW (660nm) BSA F100 1D 660nm BSA Flow Software Advanced Graphics Add-on Laser Alignment Eyewear Laser Protective Eyewear Front Lens for FlowExplorer (300 mm or 500 mm)
9061N0021	FlexLDA 2D	FlowExplorer 2D 90/70mW (660/785nm) BSA F100 2D 660/785nm BSA Flow Software Advanced Graphics Add-on Laser Protective Eyewear Front Lens for FlowExplorer (300 mm or 500 mm)



Calibration of a pitot tube and a flywheel anemometer

Options

The FlexLDA system offers several options to meet the requirements of the application. The options include:

Optics mounts: adjustable supports for rotating a FlowExplorer head around an axis

perpendicular to its optical axis (panning) as well as for fine-adjustable pan, tilt and translation are available.

Processor upgrade: The BSA F100 processor can be upgrade to BSA F600 which offers 120 MHz max. frequency, allowing for measurements of higher velocities.

Software add-ons: Spectrum/Correlation Add-on, Cyclic Phenomena Add-on, Scripting and MATLAB link Add-on, LIF and Parametric Analysis Add-on. Please see separate data sheet on our website.

Traverse: A software-controlled automatic traversing mechanism with 1D, 2D or 3D capability for flow mapping can be added to the system. Several standard traverse controllers are supported in the software. Please see separate data sheet on our website.

Seeding: For air flows, a range of liquid droplet and solid particle seeders are available. For liquid flows, we offer a variety of seeding particles. Please see the separate data sheets on our website.

Technical specifications

Optics	FlowExplorer
Laser	Diode
Laser power	90/70 mW (1D/2D)
Laser wavelength	660/785 nm (1D/2D)
Focal length	300, 500 mm
Measurement volume dimensions	0.09 x 0.09 x 0.92 mm^3 (300 mm focal length) 0.15 x 0.15 x 2.55 mm^3 (500 mm focal length)
Optics weight (excl. laser controller)	5 kg

Processor	BSA F100
Max. Velocity	>40 m/s (300 mm focal length) >68 m/s (500 mm focal length)
Data rate	>100,000 bursts/sec
Resolution	>16 bits

Software	Features
BSA Flow	Workflow-based user interface Real-time oscilloscope display of signals On-line display of data validation, data rate, coincidence rate, photomultiplier anode current Real-time end results thanks to multi-threading and decimation of displayed data Set up of BSA processor Acquisition of data from BSA, Control of traversing system Statistics of results (mean, RMS, Skewness and Flatness) Listing of results Export of data
Advanced Graphics Add-on	X-Y plots, vector plots, 3D plots, profile plots

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