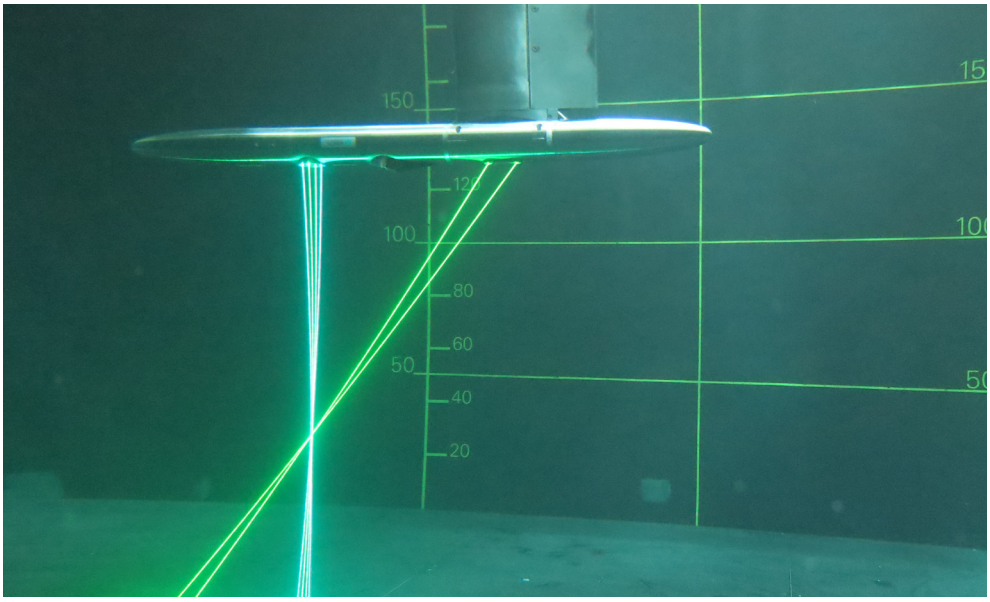
SOLUTION SHEET

DANTEC DYNAMICS

Integrated 3D LDA System

Flow velocity measurements with minimum disturbance



Streamlined 3D LDA optics for water channels

Laser Doppler Anemometry (LDA) is an optical technique ideal for non-intrusive point measurement of velocity and turbulence in flows. It is based on the Doppler effect of laser light scattered from seed particles that follow the flow.
Simultaneous measurement of 3 velocity components in a water flow is often a complicated task using standard optical probes. Keeping individual probes aligned in a flow with strong flow forces is difficult and often results in mounting structures disturbing the flow and misalignment due to the flow forces on the probes or thermal effects.
With the integrated streamlined probe, these problems are minimized. The integration of all transmitting and receiving optics in one probe ensures stable alignment and a simpler mounting structure. The streamlined probe design ensures minimum flow disturbance.

Key benefits

- Minimum flow disturbance due to streamlined submerged optics.
- High resolution of all three-velocity components due to large angle between measured components
- Adjustable orientation of measurement plane
- Simple to align and mechanically stable
- High laser power for high data quality
- Alignment and calibration tools included

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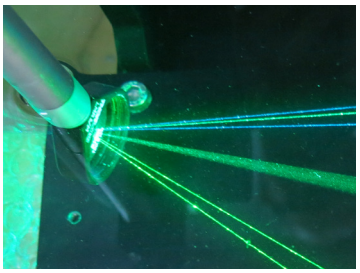
Integrated solution with simple cabling and few adjustments

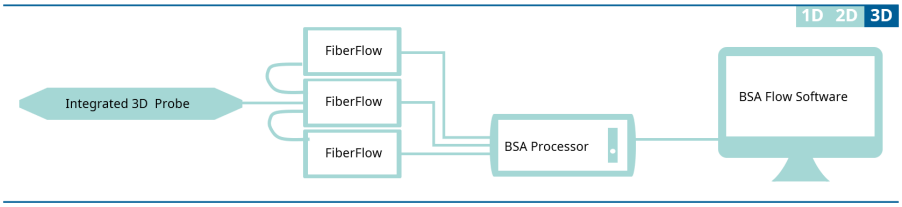
The Integrated 3D LDA System is based on four core components: Probe, transmitter/laser, signal processor, and software. Tools for alignment of the laser beams to the receiver optics are included.

The probe is usually connected to a traverse mechanism above the water via a streamlined strut. We can offer a traverse mechanism adapted to the experimental rig, as well as a strut with length and stiffness adapted to your requirements.



Tools for alignment of the laser beams and the receiver optics are included.

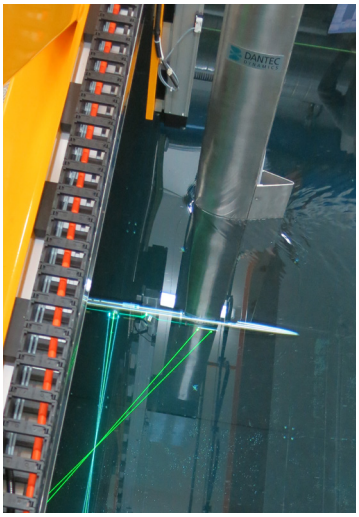
The integrated 3D LDA system in brief



Overview of the system components

Integrated 3D probe

The streamlined submersible probe emits 6 laser beams, which interfere in pairs. The beams all intersect in a common measurement volume. One receiving optic detects light scattered from particles passing through the measurement volume. Optical fibers guide the laser light to the probe and the optical signal back to the detectors in the BSA Processor.
The geometry ensures high accuracy of all 3 velocity components. The off-axis receiver ensures high spatial resolution and the ability to measure close to surfaces.
A calibration basin and calibration tools are included. The calibration factors (fringe spacings) of the three beam pairs, and the coordinate transformation matrix for conversion from the measured to ortogonal velocity components are defined in a single process.



The probe is attached to a streamlined strut (optional) connected to a traverse (optional).

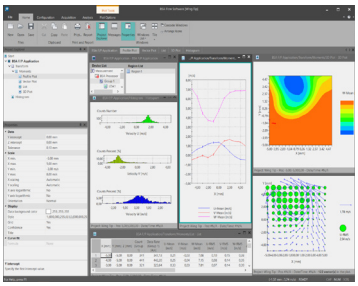
Transmitter/laser

Fiber lasers offer high laser power in compact packages, without need for water cooling or three-phase power. Equal laser power in the three wavelengths used in 3D optics ensure similar signal quality and data rates for all three measured velocity components.
The units are designed with focus on user safety and ease-of-use with a minimum of adjustments.
The laser light is blocked automatically by shutters when the optical fiber connectors are detached.
A built-in attenuator reduces the laser power 99% to protect the user during alignment.

BSA Processor

The new third generation Burst Spectrum Analyzer (BSA) from Dantec Dynamics is the fastest and most powerful signal processor for LDA systems ever. Using the latest developments in signal processing technology, we offer a robust and accurate processor for LDA.
For further details on the BSA Processor, please consult separate data sheet on our website.

BSA Flow software



The BSA Flow Software is Windows-based, easy to use, and features the most complete and comprehensive interface for Laser Doppler Anemometry measurement systems. The software is an integral part of our LDA and PDA systems using BSA F/P signal processors. The modular design of the software provides the user with many add-ons so that the system functionality can be enhanced to meet your measurement needs now and in the future.
For further details on BSA Flow software, please consult separate data sheet on our website.

Options

Streamlined Strut

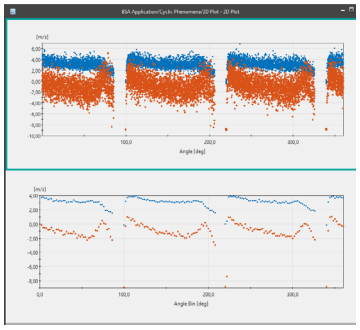
A streamlined strut for stable connection of the probe to a traverse mechanism can be offered on request. The strut must be designed for the max. depth and max. flow velocity that the probe will be exposed to. Please contact you Dantec Dynamics prepresentative for further details.

Traverse Mechanism

The measurement position is controlled by a traverse mechanism. We can offer a traverse mechanism on request, or an existing traverse mechanism may be used. In the latter case, we can offer adaptation of our software to the protocol of the traverse mechanism so that measurement campaigns with predefined measurement position grids can be done automatically.

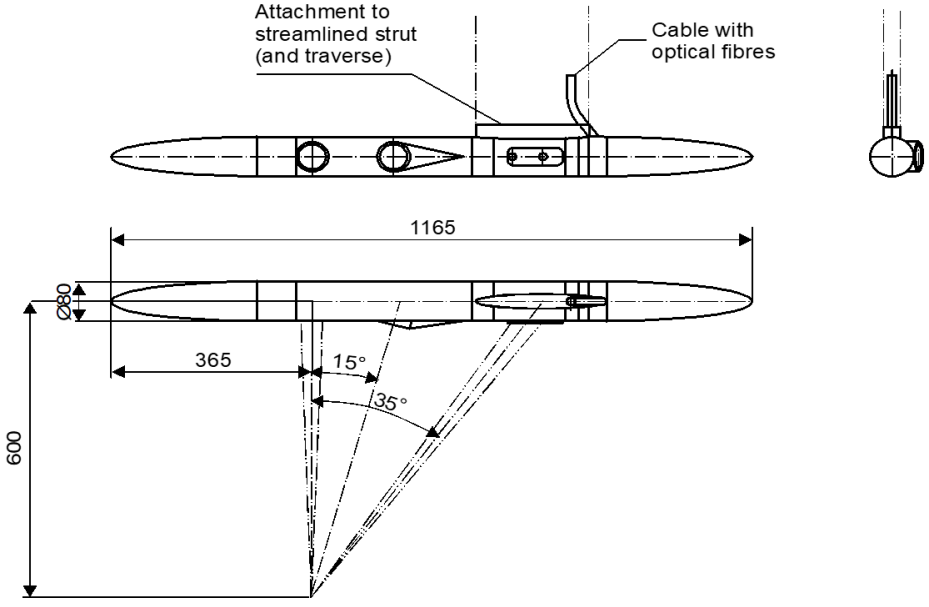
Phase locked measurements

Phase locking measurements to eg. a rotating propeller or a wavemaker can be done by adding the Synchronization Option to the BSA processor and the Cyclic Phenomena add-on to the BSA Flow software. For further details on this, please consult separate data sheets about the BSA Processor and about BSA Flow software on our website.



Phase sorted and phase averaged velocity data from a 3 blade impeller.

Technical specifications



Dimensions of the LDA probe

3D submersible probe	
Probe length	1165 mm
Probe diameter	80 mm
Weight (excl. strut)	20 kg
Material	Stainless steel
Measurement distance from axis (in water)	600 mm
Probe volume	Ø 0.3 mm x 2 mm
Manual probe rotation (around longitudinal axis)	270°
Optical fiber length	15 m

Laser/transmitter	
Laser power	1W per wavelength
Laser wavelengths	520/532/546 nm
Laser safety classification	Class 4
Safety shutter	Laser light automatically blocked when fiber connector is removed
Attenuator	Open, attenuated (to 1%), closed
Software control	Laser on/off, laser power

Processor	BSA F100
Velocity span	30 m/s
Min. velocity	-60 m/s
Max. velocity	60 m/s
Data rate	>100,000 bursts/sec
Resolution	>16 bits

Software	BSA Flow
Features	Online oscilloscope display of signals Online display of data validation, data rate, coincidence rate Photomultiplier anode current 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 Set up of analysis sequences Export of data
Advanced Graphics Add-on	X-Y plots, vector plots, 3D plots, velocity profile plots

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