

LASER DOPPLER VELOCIMETRY (LDV)

PROVEN PERFORMANCE FOR CHALLENGING FLOW MEASUREMENTS

Laser Doppler Velocimetry (LDV) is a laser diagnostic technique for measuring the flow velocity at a point.

ILLUMINATION

- A continuous wave (CW) laser and beam generator emit up to three beam pairs, one for each velocity component being measured.
- Each beam is split into a pair of beams, where a phase shift applied to one of the beams.
- The beam pairs pass through a fiberoptic cable, and exit the transceiver probe.
- At a distance D from the probe, the beams intersect.
- The geometry and orientation of the individual beam pairs are chosen to allow up to all 3 orthogonal components of velocity to be measured simultaneously.

MEASUREMENT REGION

- Each intersecting laser beam pair forms an interference fringe pattern at the crossing location, creating the measurement region.
- The spacing of interference fringes is a known function of the laser wavelength and the separation angle between the two laser beams.
- Small tracer particles are used to follow the fluid flow through the measurement region.
- As they pass through the beam intersection, the particles reflect and refract the laser light from the fringe pattern.

SIGNAL COLLECTION

- Each color of light scattered from the particles is collected on a dedicated photodetector.
- The scattered light signal, or burst, features a waveform of increasing and decreasing intensity, corresponding to the particle passing through the bright and dark fringes at the beam intersection.
- The signal is collected at multiple sampling rates, allowing dynamic selection of the optimal sampling rate to accurately measure the burst frequency.

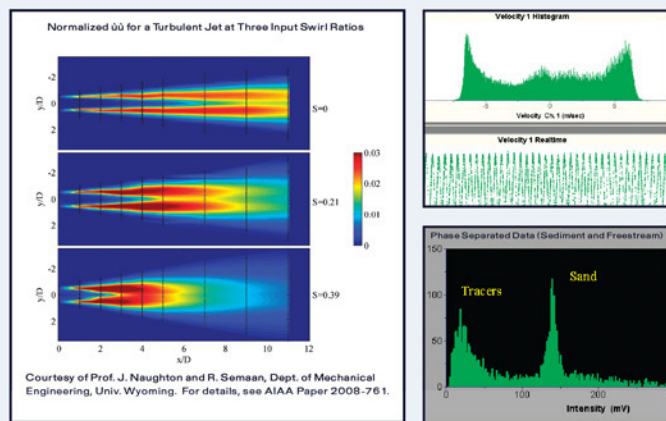
SIGNAL PROCESSING

- Both the Fast Fourier Transform (FFT) and autocorrelation techniques are used to obtain the burst frequency (velocity) with the best possible resolution and accuracy.
- A high pass filter removes the intensity 'pedestal' from the middle of the burst, and a low pass filter then removes high frequency noise from the signal.
- Once the Doppler burst is isolated, the dominant frequency can be measured and related to the velocity of the particle passing through the fringes.



LDV RESULTS

- 1, 2, or 3 orthogonal velocity components along with turbulence and Reynolds Stresses
- Time resolved or crank-angle resolved measurements
- Energy and spectrum analysis
- Phase-separated measurements



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