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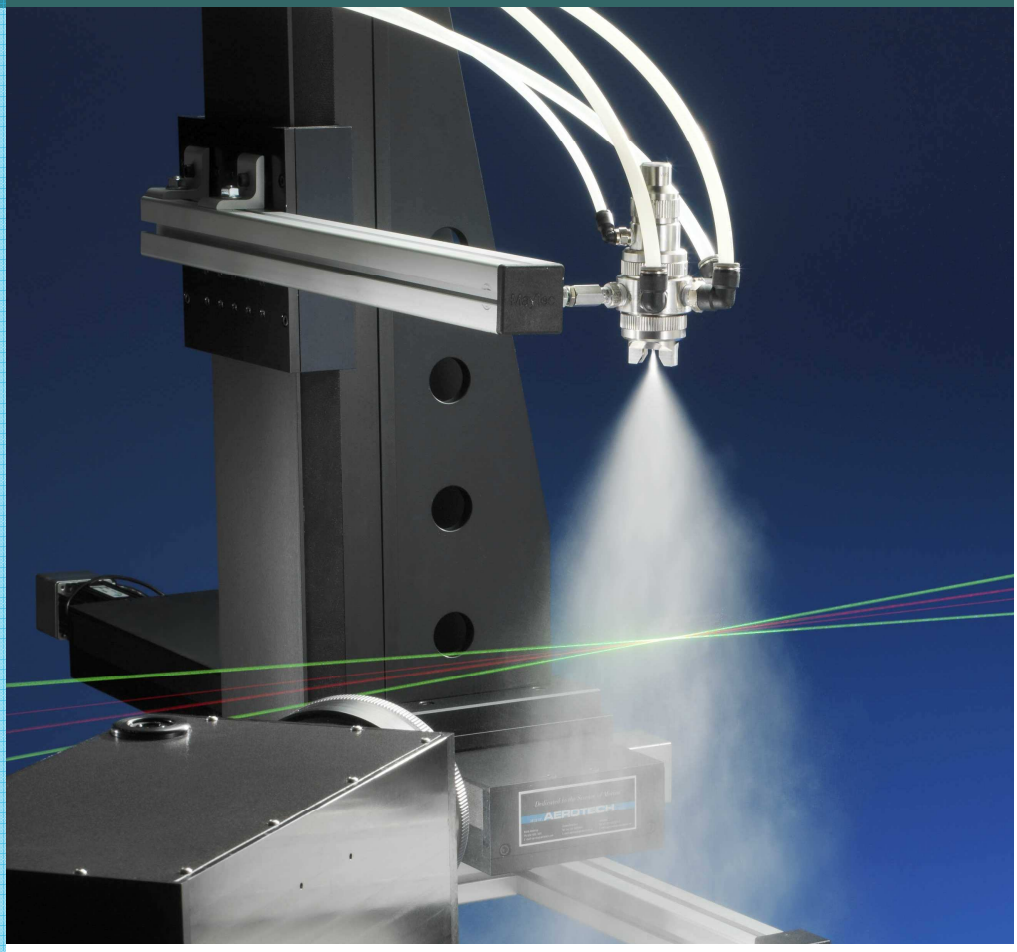
ARTIUM TECHNOLOGIES, INC.

PHASE DOPPLER INTERFEROMETER



Accurate droplet size and velocity measurements in spray environments

Artium Technologies is introducing the next generation of phase Doppler interferometers — the modular PDI-X00MD series, the self-contained PDI-X00SC series, and the flight probe PDI-FP. These are the most advanced, turnkey, PDI instruments available in the market today.

Artium Technologies Inc.

Phase Doppler Interferometry - *Key Advantages of the method*

- Measures drop size distribution and mean values without the requirement of assuming a distribution function
- Measurements are based on the laser light wavelength which is known to high accuracy
- Does not require field calibration
- Particle sizing is independent of light intensity, so attenuation and window contamination have a minimal effect on drop sizing performance
- Sample volume size can be easily adjusted to accommodate wide range of drop number density
- Measures particle velocity simultaneously for drop dynamics studies, volume flux, and number density determinations
- Computes size-velocity correlations; useful in drop impact and deposition studies, turbulence interactions, etc.
- Large size dynamic range with excellent resolution

PDI-200MD

Product Development Philosophy

- *Emphasis on accuracy and reliability*
- *Very high dynamic range: up to 1:1000 μm*
- *Ease-of-use, turnkey operation with automated setup and measurements*
- *Incorporate advanced solid state laser to eliminate troublesome fiber optics*
- *Expand range of instrument applications and capabilities*
- *Incorporate multiple levels of signal validation to ensure reliable measurements*

Available Systems

- **PDI-X00MD: Modular Systems** for flexibility in research applications; 1-, 2-, or 3- velocity component systems
- **PDI-X00SC: Self-Contained Systems** for fixed alignment, easy to use development and testing applications; 1-, 2-, or 3– velocity component systems
- **PDI-Comp SC: Compact Self-Contained Systems** for characterizing nebulizers, inhalers and other small spray applications
- **PDI-FP: Rugged and Compact Flight Probes** for operation in large wind tunnels and on aircrafts
- **Custom Optical Systems** to accommodate special applications

The **Automated Instrument Management System (AIMS)** controls all aspects of the instrument setup and operation. It can run either on Windows (2000/XP) or LINUX (2.4 kernel) operating systems. The system software is designed around a client/server model that allows remote operation via the intranet or the Internet and is multi-user accessible. Dedicated algorithms are included for automated setup of the instrument functions and online adjustment to the prevailing measurement conditions. An external input feature allows tagging of the PDI signals with external events such as engine RPM or throttle. The software has the capability of accepting, processing, displaying, and storing data for extended periods of time without interruption. During long acquisition periods, the data can be broken into multiple files for greater manageability. The data analysis and display are easily extensible and may be modified as needed. The data can be easily exported to Microsoft Excel and MATLAB™ for analysis and plotting.

Artium PDI System

- *Fully automated setup and operation at every measurement location*
- *Rugged, compact optical systems*
- *No troublesome fiber optics*
- *Automated sample volume selection based on spray conditions*
- *Automated traverse control for easy spray mapping*
- *Advanced signal validation and analyses systems (patent pending)*
- *Remote multi-user data access and control*
- *Built in MATLAB™ data exchange*

PDI-200SC

PDI-FP

Advanced Signal Analyzer (ASA) - The ASA is the most advanced signal processor available for PDI applications. It is a Fourier transform based signal processor with several innovations to ensure optimum performance. The optical signal collected by the PDI optics is converted to a voltage using a PMT/pre-amplification system. The signal is then high-pass filtered and amplified before being fed to the ASA analog section. Within the analog section, the signal is mixed with a software selectable variable quadrature mixer. The quadrature mixer outputs are low-pass filtered to improve signal SNR. The quadrature outputs of the analog section are sampled and digitized at a software selectable sampling rate. The digitized signal is then applied to the phase domain burst detector. The Phase Burst Detector (PBD) output is combined with the analog burst detector output and then used as an input to the adaptive sampling circuitry. The sampled data for each Doppler burst is then packed into a single data packet. The data packets are stamped with other relevant information (time of arrival, transit time and external input data) and transferred to the computer via a high-speed PCI interface card.

Key PDI Specifications

- *Drop Size Range: 0.5 to 2000 μm*
- *Size Accuracy: 0.5 μm*
- *Size Resolution: 0.5 μm*
- *Velocity Range: - 100 to 300 m/s*
- *Velocity Accuracy: 1%*
- *Volume Flux Accuracy: 15%*
- *Processor Bandwidth: 5-150 MHz*
- *Minimum Transit Time: 100 ns*
- *Maximum Sampling Frequency: Quadrature, 320 MHz*
- *Minimum SNR: - 6 dB*
- *Maximum Date Rate: 100,000 per second*

Company Description and History

- **Founded in 1998** by former Aerometrics, Inc. key personnel
- **Experts in laser-based instrumentation**, fluid mechanics, and spray characterization
- **Developed Laser-Induced Incandescence (LII)** instrument for soot emissions characterization under NASA Glenn Research Center (GRC) and EPA support
- **Developed advanced Phase Doppler Interferometer** instruments under US Navy ONR and NASA GRC support
- **Developed and commercialized instruments** for cloud and aircraft icing research
- **Developing advanced instrumentation** under NASA SBIR funding
- **Collaborating with Spraying Systems** on development and marketing
- **Collaborating with University of California**, Santa Cruz on meteorology studies
- **Conducting research on islet encapsulation** and transplantation to cure Type 1 diabetes under NIH NIDDK support