Spray Characterization: Laser Diffraction

Henrik Krarup
Product Manager, Lab. Diffraction Products, Malvern Instruments INC.
Historically, the laser diffraction technique started by taking only scattering at small angles into consideration and thus, has been known by the following names:

- Fraunhofer diffraction
- (near-) forward light scattering
- low-angle laser light scattering (LALLS)

INTERNATIONAL STANDARD: ISO13320-1
Particle Size Analysis – Laser Diffraction Methods
Part 1: General Principles

www.Ansi.org ($100)
Laser Diffraction Instrument

From: ISO13320-1
Laser Diffraction
What does it measure?
Deriving Droplet Sizes from Light Scattering

Comparison

Guess

Mie

Scattering

Size Distribution

Scattering

Comparison

Size distribution
Data display – time history
Data display - time average

Transmission = 61.26%  
Cv = 348.5 (PPM)  
SSA = 0.224 (m^2/cc)  

Dv(10) = 22.39 (µm)  
Dv(50) = 37.84 (µm)  
Dv(90) = 61.05 (µm)  

Span = 1.02  
D[3][2] = 26.81 (µm)  
D[4][3] = 41.73 (µm)
Instrument accuracy example
Comparison: MMAD vs VMD

$$\text{MMAD} = \text{Density}^{0.5} \times \text{VMD}$$
Comparison: PDI - LD

$D[3,2]$ appears to be a good comparison parameter.
LD measures “finer” than PDI.

Information on laser diffraction

• Identifying Areas of Concern When Using Laser Diffraction to Study Droplet Size Distributions
  H. G. Krarup, Malvern Instruments, Inc., Southborough, MA
  ILASS Proceedings, Monterey 2003: P07B3 (Proceedings CD)

• Exploring the Limits of Laser Diffraction
  H. G. Krarup, Malvern Instruments, Inc., Southborough, MA

• INTERNATIONAL STANDARD: ISO13320-1
  Particle Size Analysis – Laser Diffraction Methods
  Part 1: General Principles
  www.Ansi.org ($100)