Some fundamentals of liquid spray formation - implications for the Phase Doppler measurement technique in dense transient fuel sprays

Dr Graham Wigley
Visiting Fellow
Aeronautical and Automotive Engineering
Loughborough University, UK

Nozzle flow fundamentals and spray formation and the terminology of liquid, primary, secondary breakup and atomisation are introduced. This is aided by the use of spray imaging of liquid sheets, jets and hollow cone sprays.

The major problem associated with the application of optical techniques to study spray development is in the optically dense region of the spray in the near nozzle region.

As with imaging methods the application of the Phase Doppler technique to dense sprays may also suffer from multiple scattering, high light absorption and low transmission levels.

However, the technique is not based on the signal intensity since the measurements of droplet velocity and size are based on the frequency of the scattered light from a measurement volume generated at a fixed point in space by two coherent laser beams of a specific polarization.

The technique can be successful as long as the measurement volume is formed and the scattered light exits the spray to be collected with the probability of droplet detection maximised and optical noise minimised. The spray must also be in the form of discrete droplets.

This is discussed in relationship to a pressure swirl hollow cone spray where the PDA data have allowed a physical concept for the near nozzle spray formation to be developed.

Loughborough University