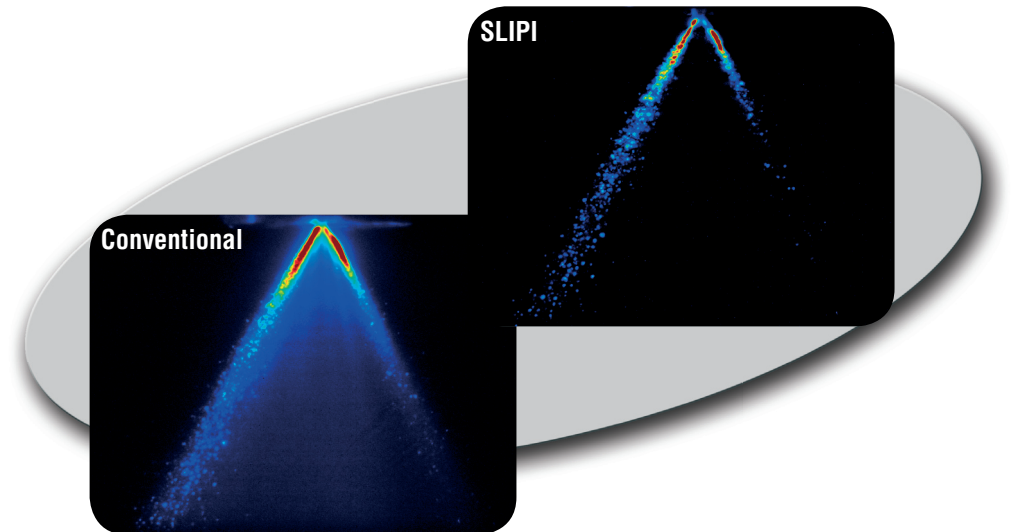


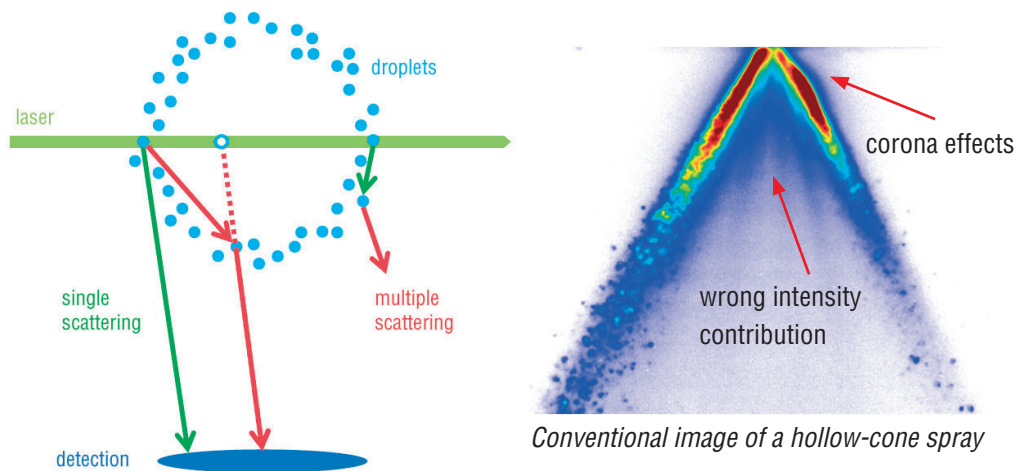
# Structured Laser Illumination Planar Imaging (SLIPI)

a novel technique for laser imaging in dense sprays

Planar laser imaging is widely employed in the field of optical spray diagnostics in order to provide qualitative and quantitative two-dimensional scalar information. The techniques incorporate the detection of elastic light scattering (Mie scattering) or approaches based on Laser Induced Fluorescence (LIF) to extract the desired physical quantities.



An essential approximation is to assume that the detected light has only experienced one scattering event prior to detection. However, in many spraying applications or two-phase flows a large amount of light is multiply scattered and the single scattering approximation is no longer valid. This may introduce substantial errors and reduces the number of applications for standard laser imaging techniques.



## Principle

Main images:  
courtesy of E. Berrocal, E. Kristensson,  
M. Richter, M. Linne and M. Aldén,  
Opt. Express 16, 17870-17881 (2008)

SLIPI is based on a spatial intensity modulation of the excitation light, which can be created by projecting a grating onto the sample of interest. The idea is that multiply scattered light within the sample loses the modulation information while it is maintained for singly scattered light. Processing images for at least three different spatial phases suppresses blurring effects from multiple scattering.

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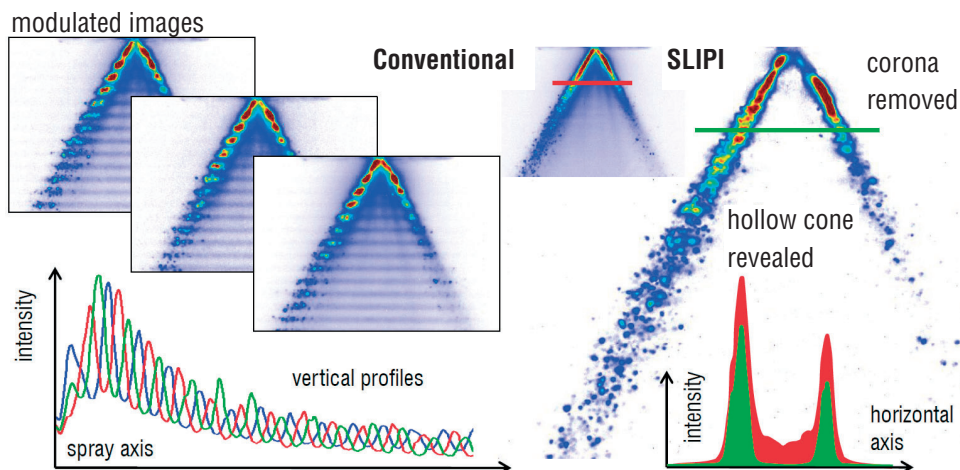
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## Advantages

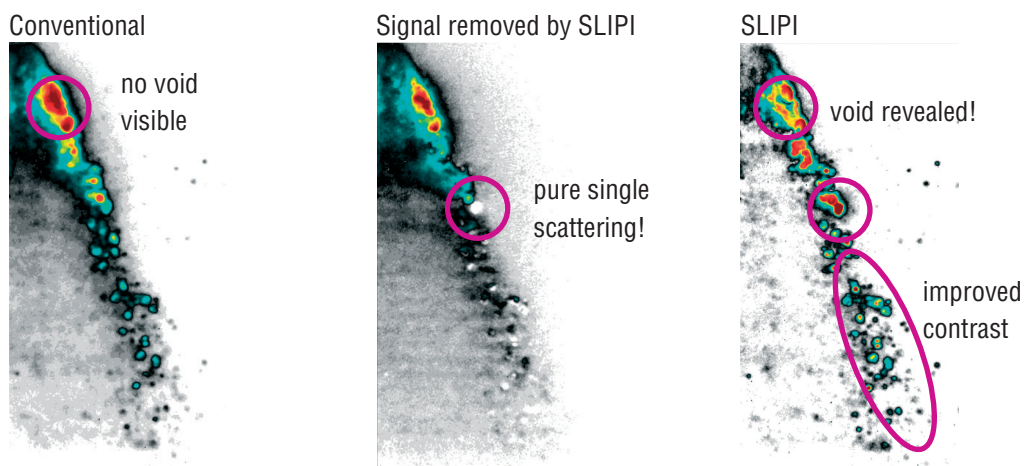
- ▶ Effective suppression of multiple scattering and indirect reflections
- ▶ Image contrast enhancement improving visualization of break-up and atomization processes in dense sprays
- ▶ Feasible for single-shot and averaged imaging using standard laser systems
- ▶ From the modulated images SLIPI and conventional results can be extracted and compared



*Principle of SLIPI: Averaged images at three different spatial phases are processed to reveal SLIPI and conventional images*

## Application

It is demonstrated by E. Berrocal and E. Kristensson that the true geometry and structure of a hollow-cone water spray - running at 50 bar injection pressure - can be obtained from averaged SLIPI images. Furthermore, the capability of the system for single-shot imaging is demonstrated for detailed studies of liquid break-up and atomization processes. Suppression of multiple light scattering by means of SLIPI results in higher image contrast and reveals structures, such as voids and break-ups, which are concealed when using conventional planar laser imaging.



*Single shot image of a hollow-cone water spray;  
courtesy of E. Berrocal and E. Kristensson (Combustion Physics, Lund Institute of Technology)*

Data provided by LaVision are believed to be true. However, no responsibility is assumed for possible inaccuracies or omissions. All data are subject to change without notice.

Jun-10

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