TECHNOLOGY OFFER

Features & Benefits

- Synchronous flow and concentration monitoring
- Simultaneous measurement at the same spot or fluid element of a flow
- Calibration free velocity measurement
- Adaptable for any type/combination of fluids
- Allows for fluid finger-printing
- Only one optical access to the flow is needed
- No disturbances from probe insertion, no cleaning/hygienic issues
- Multiple points of the flow field can be accessed via a traversing system which moves/shifts the optical probe
- Suitable for liquid mixing in laminar, transitional and turbulent flow regime
- Proven with water and miscible/immiscible organic fluids
- Basic concept can also be used in gas flow
- High data rates allow for determination of flow and concentration fluctuations, from this data turbulence intensities and flow regime information can be derived (essential for pressure drop calculations)
- ATEX variant of device can be constructed

Users & Application

- Chemical, petrochemical, pharmaceutical, or food industry & research
- Any application needing combined flow and concentration/component monitoring
- Sensor can detect flow rate and identify the stream (e. g. for GMP environment in pharma, or filling/dosing machines, blending stations at refineries)
- Comprehensive detection of multiphase flow with different phase velocities (e. g. from drift flux or slip velocities) as the phase identification for each velocity measurement point can be collected
- Measurement of flow, and concentration fluctuations for mixing devices

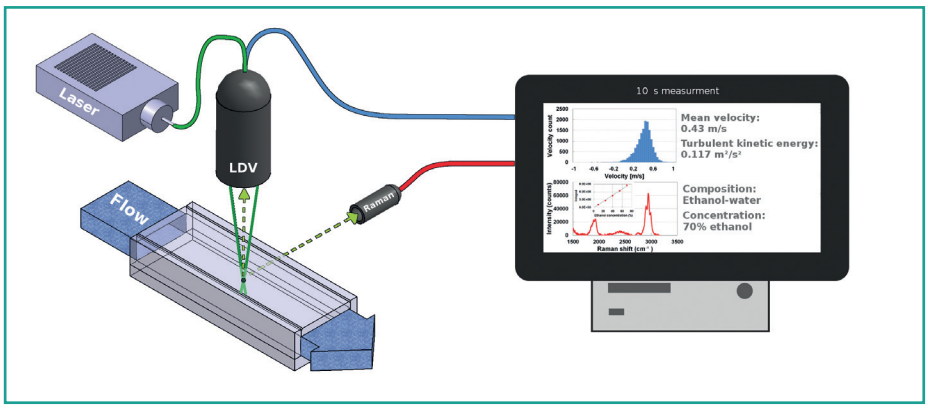
imPACts
Industrial Methods for Process Analytical Chemistry

Fluid-Dynamics and Chemistry in One Shot

Simultaneous Laser Doppler Velocimetry and stand-off Raman spectroscopy as a novel tool to assess flow characteristics of process streams

We offer a new method for simultaneous measurement of velocity, velocity fluctuations, composition and concentration in process streams. It uses two well-known measurement techniques, Raman spectroscopy and Laser Doppler Velocimetry (LDV), where the LDV laser source was used as the unique light source for LDV and Raman for simultaneous measurements from the same point. This is essential e. g. for multiphase flows or for blending/mixing applications.

Our new method can deliver combined information on the flow velocity (Laser Doppler Velocimetry, LDV) and on the chemical composition (component concentrations, stand-off Raman spectroscopy) from selected positions in a flowing fluid with time resolution. This overcomes the limitation of other methods, which deliver flow velocity and concentration information from different, independent devices.
Only a single laser source is required for both, LDV and Raman. The scattered light is collected and analyzed – the characteristic LDV bursts are analyzed for the velocity information, the frequency shift of the light is investigated for Raman shifts, which identify the chemical components in the fluid mixture and can be calibrated for concentration detection.
One key benefit of the method is that it needs only one or two optical windows admitting the laser beams to the flowing fluid and allowing for collection of the scattered photons. No physical interference of the probe will disturb the flow field. Spatial synchronization is achieved by rigid mounting of the LDV and Raman probes in defined geometrical arrangement, temporal synchronization is taken care of by using trigger signals for starting the data acquisition. Using moving sender and receiver probes it is possible to traverse through the flow field.



imPACts – CONSORTIUM MANAGEMENT:
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OFFICE@RECENDT.AT, WWW.RECENDT.AT

Status – our offer

- Patent pending – application number A161/2017
- Experimental unit for demonstration of principle available
- Prototype for industrial application needs to be designed (cooperation or license possible)
- Contact with leading instrumentation company established

Contact data

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References, Publications

B. Haddadi, C. Gasser, C. Jordan, M. Harasek, B. Lendl; Simultaneous Laser Doppler Velocimetry and stand-off Raman spectroscopy as a novel tool to assess flow characteristics of process streams; Chemical Engineering Journal 334 (2018) 123–133; dx.doi.org/10.1016/j.cej.2017.10.027

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Federal Ministry
Transport, Innovation and Technology

Federal Ministry
Digital and Economic Affairs

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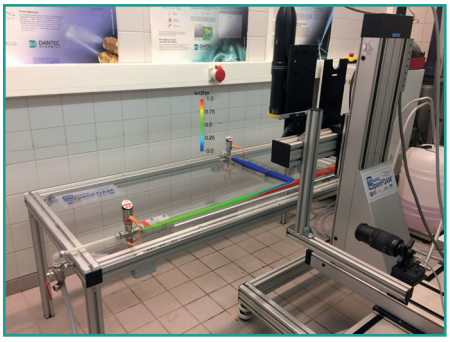
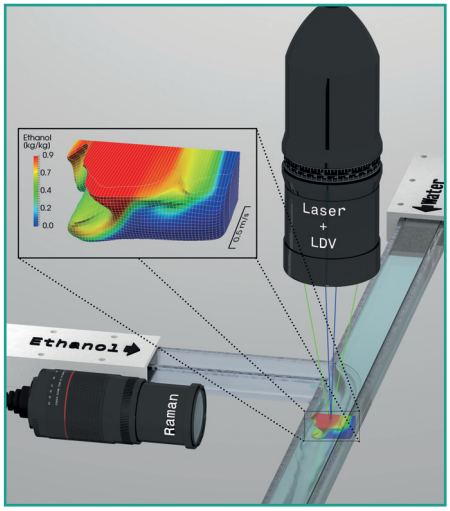
Industrial Methods for Process Analytical Chemistry



Lab scale implementation of the new method using commercial LDV and Raman probes. Two mixing streams are observed in a glass T-mixer channel for combined concentration and flow velocity measurements (2 velocity components).



Schematic view of the setup: Laser probe (LDV) and Raman detection lens are aligned in 90° setup on a T-mixer channel with two inlets.

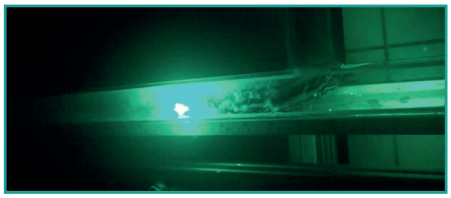
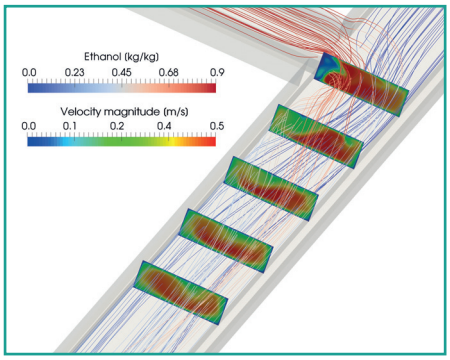


Photo of the scattered laser light from the measurement point, the „Schlieren" pattern illustrates the mixing zone of the two fluids.



CFD simulation illustrating the mixing behavior in the flow channel which can be observed using the new combined LDV/Raman method.

Competence Centers for Excellent Technologies

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