Stereoscopic Micro Particle Image Velocimetry

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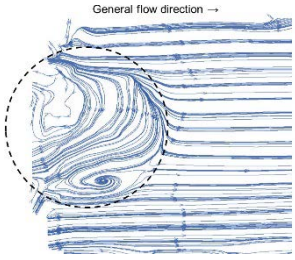
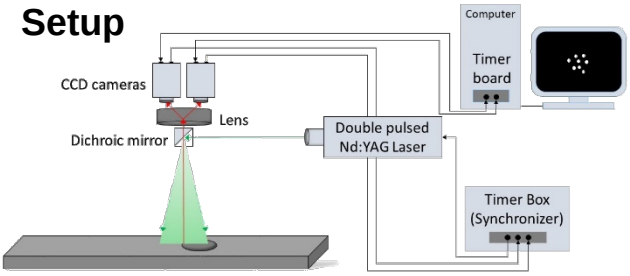
Objectives

- Three-dimensional visualization of streamlines (2D3C).
- Quantification of flow vectors within the velocity fields.
- Determination of local turbulence intensities.
- Calculation of wall shear stress.



Setup



Principle of Measuring

- The laser (Nd:YAG) fires a laser pulse for a few nanoseconds with a defined wavelength of 532 nm, adapted to the excitation of fluorescence of the tracers.
- A dichroic mirror reflects the laser beam into the flow channel in which the tracers are excited to glow.
- The light emitted by the tracers has a different wavelength (584 nm) than the laser and can transmit through the dichroic mirror.
- The emitted light it is detected by the image sensors of the cameras and appears as bright dots on the images.
- The relevant parameters, i.e., the time between two laser pulses, the trigger rate and the number of images must be defined.
- With the divergent position of the particles on each image of the image pair and the time between the images the velocity vectors are calculated.

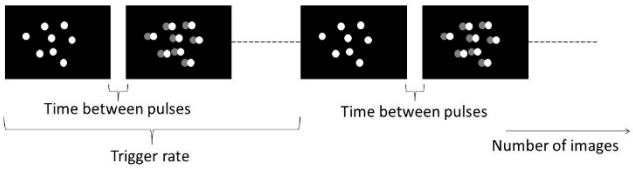
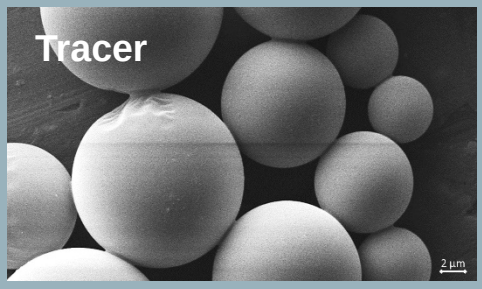


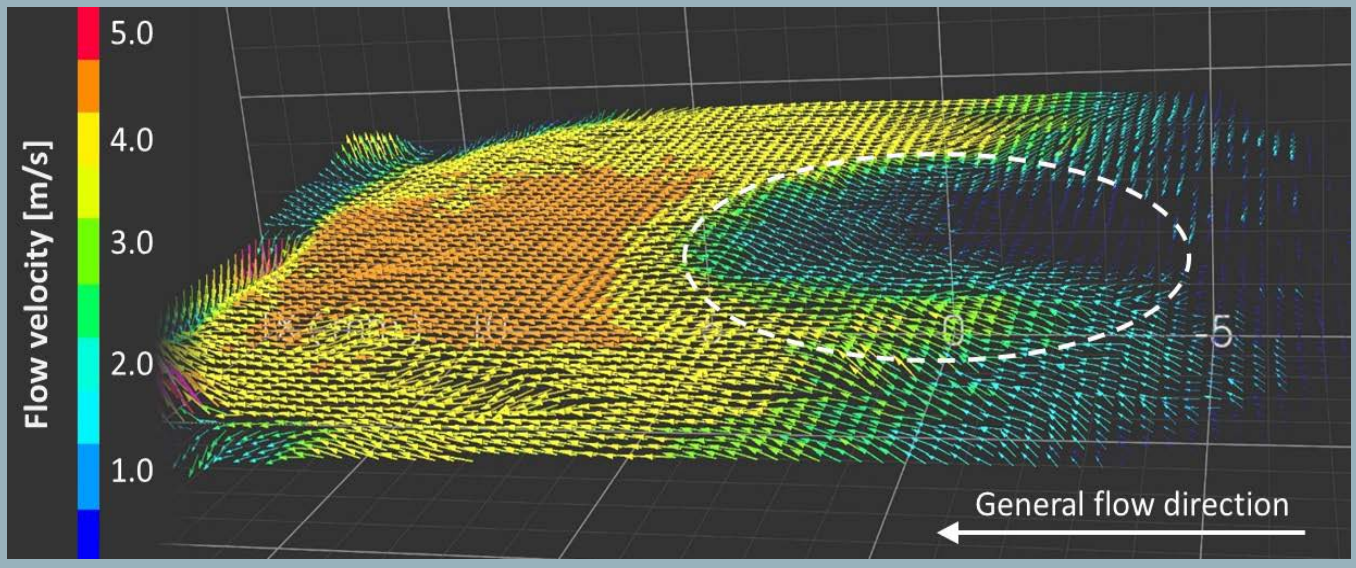
Image Processing

- Background subtraction to reduce wall reflection is applied (mean value filter).
- Analysis with adaptive correlation, which iteratively adjusts the shape and size of interrogation areas.
- Merged image are created from the calculated vectors of the single images.

Requirements

- Field of view: 50 × 50 µm² to 18 × 18 mm²
- Depth of field: up to 1 µm
- Duration: ~ 60 ms to a few minutes
- Optical accessibility is required
- Tracers must be dispersed in the fluid (d_p = 1 - 20 µm, $\Psi \approx 1$)





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