

MiniShaker

3D camera for volumetric
flow field measurements



MiniShaker Underwater

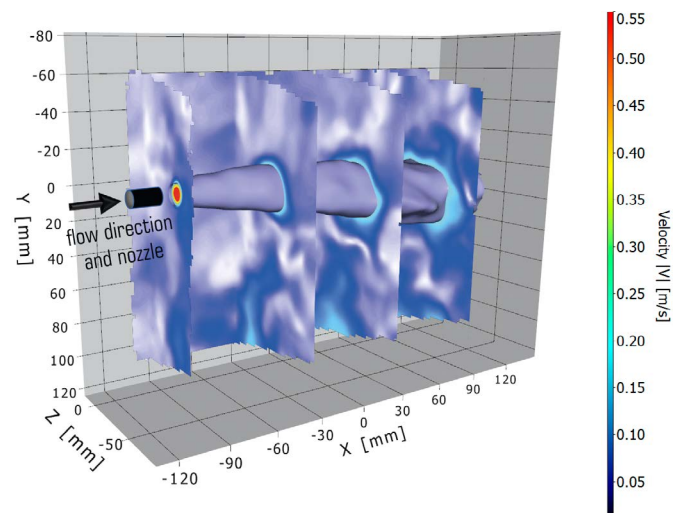
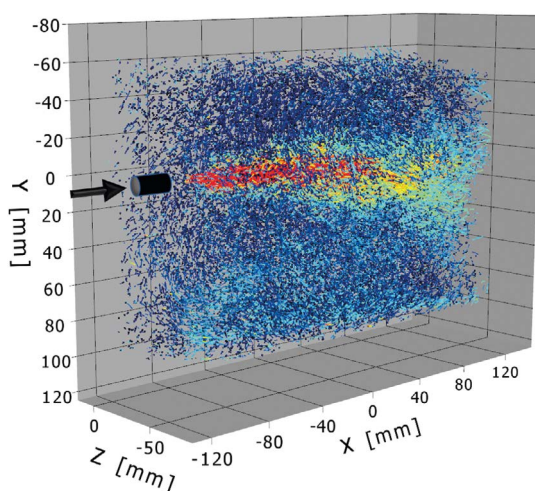
Quick installation and
easy operation

Nowadays, 3D particle image velocimetry is the state-of-the-art measurement technique for understanding complicated flow phenomena. This is especially true for transient flows and turbulent coherent structures, where instantaneous 3D measurements are essential. Consequently, **Tomographic PIV** and the **Shake-the-Box** (high-density PTV), the most advanced Lagrangian particle tracking algorithm, have become the techniques of choice for 3D flow field analysis. Furthermore, with LaVision's software package **Pressure from PIV**, even pressure fields can be obtained from Shake-the-Box and PIV data with only a few clicks.



The **MiniShaker** paves the way to 3D measurements without the hassles of complicated experimental setups. Four cameras are aligned in a compact housing and fully integrated into LaVision's **DaVis** software. With a common cable duct for all cameras, connecting the **MiniShaker** is fast and handy.

The **MiniShaker** can be used in combination with LaVision's cost-effective **LED-Flashlight 300** for fluid and air flow measurement. In air, this is made possible by LaVision's **Helium-filled soap bubbles**, a neutrally buoyant seeding with up to 10000 times higher light scattering intensity compared to common $1\mu\text{m}$ aerosol droplets.



*A water jet measured with MiniShaker TR and LED-Flashlight 300.
Instantaneous particle tracks (left) and average velocity field (right) (both color coded by velocity magnitude)*

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Four sensors for
best performance

Available models



Flexible measurement volumes

Time-efficient measurements

Four pre-aligned sensors provide superior suppression of undesired ghost particles for both **Tomographic PIV** and **Shake-the-Box** when compared to three sensors or fewer.

Different **MiniShaker** models meet measurement demands from time-resolved recordings of Lagrangian particle tracks to double-frame measurements at high velocities in liquids, gases, or even submerged in water:

- ▶ **MiniShaker 5M** combines high spatial resolution with double-frame recording at min. interframe times down to 500 ns suitable for high-speed flows.
- ▶ **MiniShaker TR** and **MiniShaker 2M** models are cost-effective solutions for mid-speed flows up to 40 m/s.
- ▶ **MiniShaker Aero TR** and **MiniShaker Aero MP** with an aerodynamically optimized housing are ideal for wind tunnel applications with robotic support.
- ▶ **MiniShaker Underwater** is the watertight option for measurements, e.g. in towing tanks or cavitation tunnels.

The **MiniShaker Underwater** is combined with a watertight laser illumination unit.

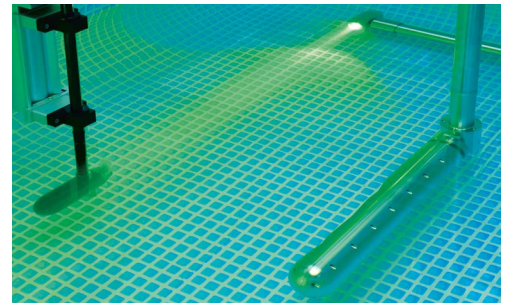
All other **MiniShaker** models can be equipped with coaxial laser illumination delivered through an optical fiber. This facilitates air flow measurements even in regions with a single optical access.

Depending on the **MiniShaker** model, different choices of lenses are available allowing the user to select from a wide range of possible measurement volumes.

In wind tunnels or towing tanks, measurement time is an important factor. The **MiniShaker** is designed for measuring flows in multiple positions without the need for recalibration. The basis is a single initial calibration refined by LaVision's Volume Self-Calibration. Underwater, the increased robustness of the calibration is an indispensable feature. In air, a large-scale flow field is quickly retrieved from multiple sub-volumes measured with a **MiniShaker** mounted to a robotic arm.



At TU Delft the flow field surrounding the complex shape of a human-sized mannequin and a racing bike was obtained with the MiniShaker TR-S mounted to a robotic arm and with co-axial laser illumination, courtesy TU Delft.



The propeller wake in a pool was studied with MiniShaker Underwater and LaVision's underwater illumination unit. Time-resolved Shake-the-Box retrieved particle tracks, instantaneous velocity fields and 3D pressure data.

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.

June-24

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