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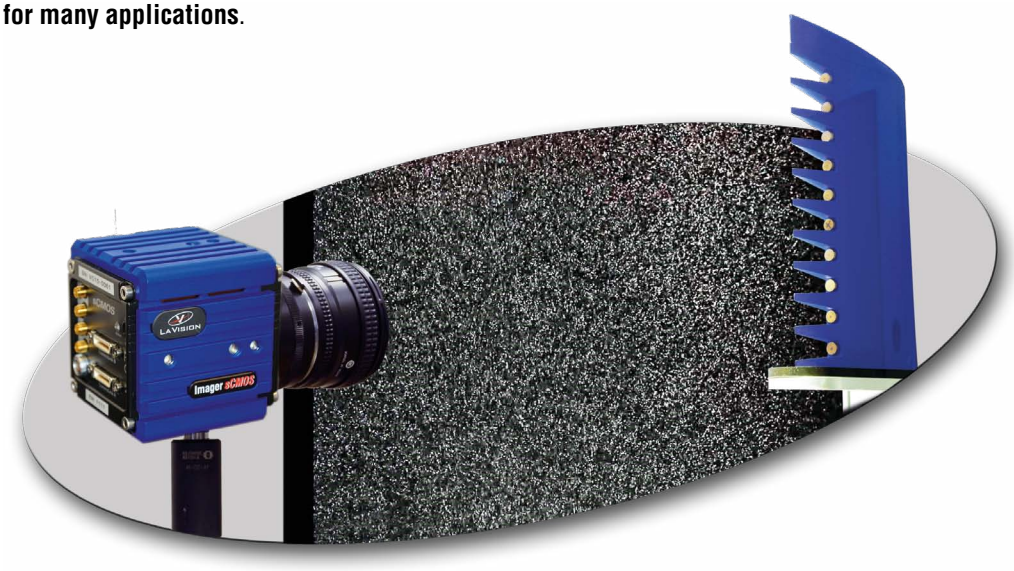
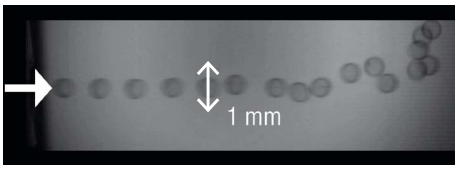
Helium-filled Soap Bubble Generator

for large volume PIV & Particle Tracking

Helium-filled Soap Bubbles (HFSB) were successfully used in the past for flow visualization and large scale PIV & PTV applications in air [1]. The mm-sized bubbles are neutrally buoyant and extremely bright. The main limitation was the low production rate, e.g. <1000 per sec., not sufficient **for many applications**.





Bubbles leaving nozzle at a rate of 40000/sec.

LaVision now developed in cooperation with DLR Göttingen and TU-Delft a new seeding generator and nozzle design for 100 or more nozzles in parallel. The bubbles have a highly constant size of down to 300 µm and are 10000 times brighter than standard oil aerosol seeding particles. With a relaxation time of 11 µs they follow the flow perfectly, even at high velocities and flow gradients [2]. Large measurement volumes can be filled with a high seeding concentration, recorded and processed with LaVision's time-resolved **Tomographic PIV** or **Shake-the-Box** particle tracking systems.

Micro-processor controlled operation

The micro-processor inside the controller device automatically manages the air, helium and soap flow rates with start, stop and pause modes. All maintenance procedures such as cleaning and filling are carried out at a push button. A large soap reservoir enables continuous operation of up to 20 h. Remote control is possible with LAN connection to any remote device with standard internet browser.

Multi-nozzle arrays

The nozzles are separated from the controller at a distance of up to 20 m. An aerodynamically shaped Linear Nozzle Array (LNA) with up to 20 nozzles has been designed for e.g. wind-tunnel operation, typically placed inside the settling chamber. Several LNAs can be connected to a single controller for flexible configurations and seeding large measurement volumes of more than 1 m³.

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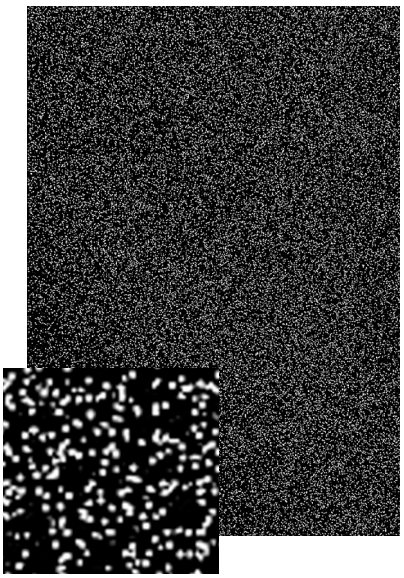
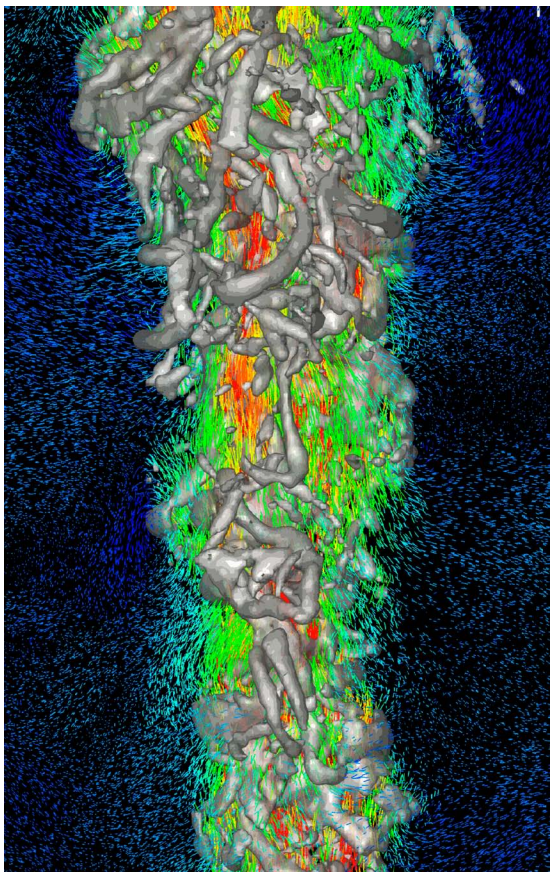
Example



Volume: 800 x 800 x 1200 mm³, illuminated with LED spots

Thermal air convection in 1 cubic meter



movie and more

Particle tracks and vorticity contours calculated with Shake-the-Box (STB), courtesy D. Schanz, A. Schröder, F. Huhn DLR Göttingen

Specifications

- bubble size: down to 300 µm
- 10000 brighter compared to usual oil aerosol seeding
- LED illumination possible in many applications
- neutrally buoyant, relaxation time τ=11 µs
- bubble lifetime of several minutes
- aerodynamically shaped Linear Nozzle Array (LNA) with up to 20 nozzles
- large measurement volume > 1 m³
- high seeding concentration: 1300 bubbles per cm³ at nozzle exit
- remote control via LAN: start, stop, pause, etc.

References:

[1] Bosbach J, Kühn M, Wagner C (2009) Large scale particle image velocimetry with helium-filled soap bubbles. Exp Fluids 46:539–547

[2] Scarano F, Sina Ghaemi S, Carlo Alp Caridi G, Bosbach J, Dierksheide U, Sciacchitano A (2015), On the use of helium-filled soap bubbles for large-scale tomographic PIV in wind tunnel experiments, Exp Fluids 56:42

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