Introduction

Wind tunnels are widely used in various research areas involving fluid mechanics. They provide the ability to adjust and regulate certain flow properties (e.g. velocity, turbulence).
Their application area ranges from small scale tunnels with flow velocities ~ 0.1 m/s up to hypersonic channels.
The wind tunnel existing at the LSS is a two-phase wind tunnel. Contrary to common wind tunnels, which are designed only for gas flows, it opens the possibility of considering multiphase flow conditions in particular for gas-spray applications.
This opens new options to analyze various multiphase configurations under well defined conditions for the atomizer system as well as for the gas flow.

Open test-section with mounted spray head

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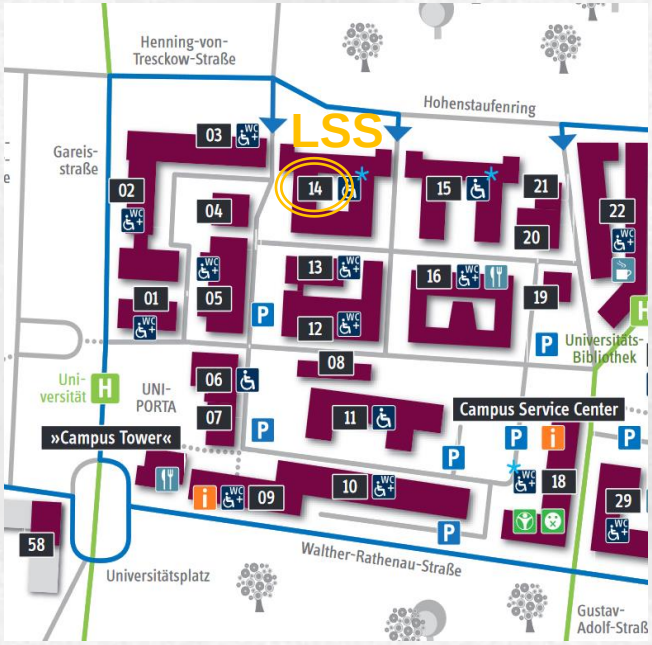

Two-Phase Wind Tunnel at LSS

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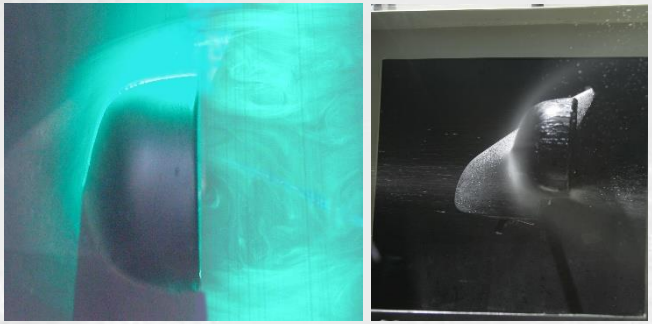
Technical details:

- Wind tunnel “Göttingen-Type” (with closed recirculation)
- Size: 12m x 7m x 3 m
- Working mode with opened as well as closed test-section possible
- Test-section: 500x600 mm²
- Length: 1100/1500 mm (opened/closed status)
- Power: 18,5 kW
- Optical access to closed test-section through 3 transparent windows (400/450 mm², l=500 mm)
- Flow velocities: ~ 0.3 m/s up to more than 50 m/s
- Turbulence intensity: below 0,5% (for single-phase flow conditions)
- Unsteady mode programmable for low velocity fluctuation frequencies

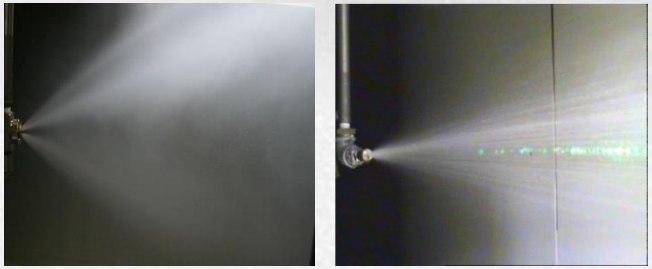
Closed test-section with mounted spray head



Analysis of rear view mirror of a car: aerodynamics (PIV) and spray impact

Spray applications:

- Spray generation with twin-fluid atomizer and spiral pump; very fine droplets (droplet diameter ~10 µm, high droplet density) associated with low volume flow rate, max. 50 l/h
  (e.g., investigation of meteorological flows)
- Spray generation with pressure atomizer to produce coarse sprays (droplet diameter ~700 µm, low droplet concentration) at volume flow rates around 6 l/min
  (e.g., study of vehicle soiling)
- Variation of spray generation system and nozzle heads according to the main research objectives.



Experimental methods & know-how:

- Particle Image Velocimetry (PIV) and Particle Tracking Velocimetry (PTV) for 2D to 4D velocity field measurements
- Laser-Doppler Velocimetry (LDV) and Constant-Temperature-Anemometry (CTA) for local velocity and fluctuation measurements

Investigation of wing and vehicle model, as well as flow around a shuttlecock

- Phase-Doppler-Anemometry (PDA) and Shadow Imaging for characterization of disperse systems/Sprays
- Laser-induced Fluorescence (LIF) for simultaneous liquid and gas velocity measurements and film characterisation