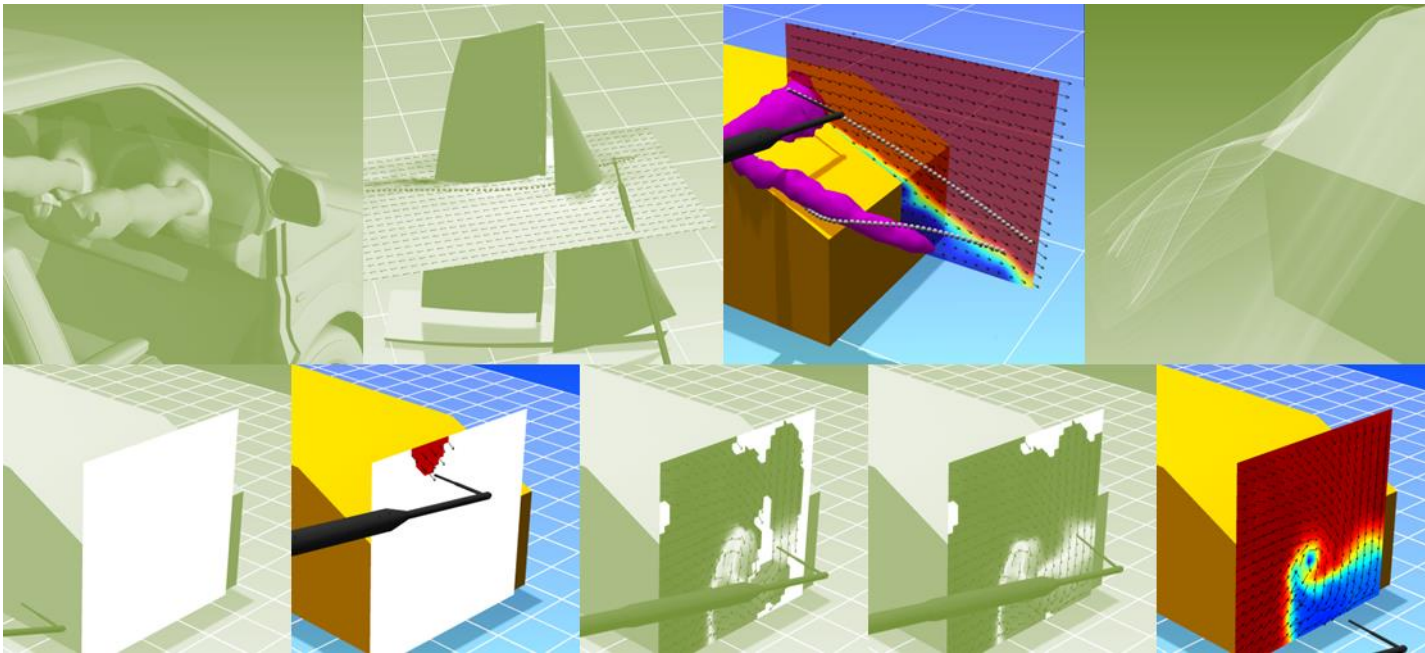


STREAMWISE

ProCap quantitative flow visualization system

Data sheet



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Content

1. ProCap	3
2. Working principle	3
3. Applications	3
4. Versions of ProCap	3
5. Features	5
6. System specifications	6
6.1 Compact package components	6
6.2 Professional options	8
6.3 Additional items	9

1. ProCap

ProCap (Probe Capture) is a new and unique tool for flow visualization and measurement that combines the intuitive and simple handling of a smoke probe with the data content and quality of a 3D-point measurement scan. In the compact version ProCap offers very flexible measurement possibilities for smaller wind-tunnel applications.

2. Working principle

The region of interest is manually scanned by the operator using a hand-held probe while the system records the measurement data, optically tracks the probe's instantaneous position and processes and visualizes the flow field in real-time. This human-based scanning approach is very efficient as in regions of large gradients the scanning is refined and no machine-teaching even for complex geometries is necessary. The measured 3D data is accessible in real-time, typically on a large screen or projected to a wall with good visibility during testing. For later analysis, the data is also available offline using either the ProCap software or standard CFD visualization and analysis tools.

3. Applications

Motorsport

- Reduce wind tunnel setup and turnaround times
- Obtain precision 3D velocity and pressure data in areas that are optically-inaccessible
- Provide a powerful, quantitative alternative to classical smoke-wand visualization

Wind tunnel

- Get real-time, independent feedback from your traverse system
- Digital visualization of both your model and the probe, reducing the risk of probe crashes
- True three-component, three-dimensional velocity fields without the need for flow seeding, and reduce aerodynamic testing time

HVAC and clean-room

- Very low speed ultrasonic flow probe available
- Scanning of problematic areas to visualize real flow situation
- Flow probe movement compensated

Education

- Provide students with a real-time, quantitative visual representation of complex, three-dimensional flow fields
- For internal or external flows
- Robust, hands-on measurement system ideally-suited for laboratory demonstrations

4. Versions of ProCap

Customers can choose out of two software versions:

▪ ProCap Compact

A one-stop flow measurement solution, easy to use and quick to setup.

▪ ProCap Professional

Offering full features and flexibility for adaptation to customer specifications and facility. We offer a basic upgrade package as described below that can further be adapted to the application specific requirements.

Table 1 shows the capabilities of these two versions.

		ProCap version	
		Compact	Professional
Software features	Real-time data visualization	✓	✓
	GPU 3D processing	✓	✓
	Raw data export	✓	✓
	Interpolated data export	✓	✓
Data acquisition	Working distance	0.5-3m	1-10m
	Number of cameras	1 (3 sensors)	unlimited
	Acquisition rate	120 Hz	variable
Supported probes	Digital iProbe	✓	✓
	Digital 7-hole probe	✓	✓
	TriSonica Mini & Sphere	✓	✓
	Analog 5-hole probe	-	✓
	Analog 14-hole probe	-	✓
	Integration of custom probes	-	✓
Measured quantities (probe dependent)	Flow direction & velocity	✓	✓
	Static and total pressure	✓	✓
	Fluid temperature and density	✓	✓
	Mach number	✓	✓
Derived quantities (probe dependent)	xyz components of velocity	✓	✓
	RMS of velocity	✓	✓
	User defined functions	-	✓
	Interpolation kernel size	✓	✓
Standard visualization	Current state of the probe	✓	✓
	Actual measured velocity	✓	✓
	Measurement domain	✓	✓
	No. of scalar & vector planes	(5)	(10)
Advanced visualization	Streamlines	-	✓
	Iso-surfaces	-	✓
	Probe-fixed planes	-	✓
	Voxel eraser	-	✓
Model geometry	CAD file import (.stl)	✓	✓
	Number of displayed models	(1)	(10)
	Model geometry trackable	(no)	✓
Tracking systems	Optitrack	✓	✓
	Qualisys	-	✓
	Vicon	-	✓

Table 1: Comparison ProCap Professional and ProCap Compact

5. Features

Plug-and-play

- Easy and intuitive to set up and use
- Digital probes with USB connector

Digital flow probes

- Velocity, pressure and temperature from a multi-hole and ultrasonic flow probes

Fully quantitative dataset

- Direct analysis and post-processing or export capabilities to 3rd party software

Optical motion tracking

- Three-dimensional motion capture for precision, independent relative position tracking

Easy visualization

- Clear, simple, and powerful real-time graphics and post-processing tools for volumetric flow visualization
- Immediate visualization during measurement

Application specific probes (Pro)

- Wide range of flow probes with up to 320° of acceptance angle and low-speed capabilities

Wide operating range

- Pressure sensitivities available down to 250 Pa full-scale, and temperature-rated between 5° and 60° C

Fast response

- RMS bandwidth up to 200 Hz

Complete package

- Carefully selected hardware components for seamless operation
- Rugged transport casing holds all components

Versatile application

- Wide range of possible application including teaching experiments for seamless operation

Modular system (Pro)

- Flexible and scalable system for a wide range of applications and facilities

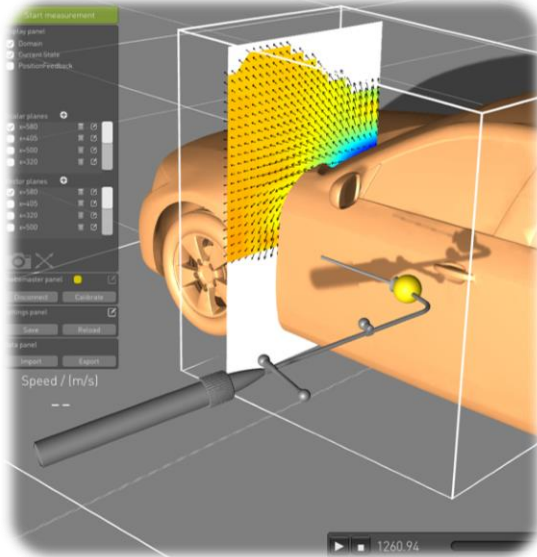
Customizable components (Pro)

- Non-standard components can be integrated according to the customer's specifications

6. System specifications

6.1 Compact package components

1 ProCap Compact software suite preinstalled on a powerful laptop



Software

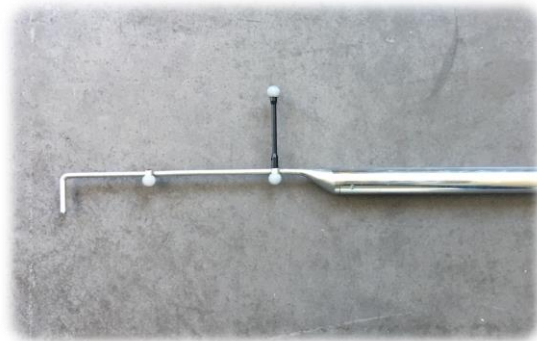
- Real-time data interpolation with adaptive spatial resolution
- Visual probe position and measurement point density feedback
- Real-time adjustment of viewing angle and zoom, positioning
- Visualization features: vectors, contour planes
- Selectable quantities, colormaps and scaling
- Probe velocity correction
- CAD model import (stl file format, e.g. available from 3D scanners)
- Fusion of different measurements to one dataset (offline)
- Data-export to Paraview (vts file-format)

Laptop

- Powerful mobile workstation with pre-installed ProCap software (currently based on Lenovo)

2 The following digital probes can be used:

5-hole digital probe, fully integrated with USB connector from Vectroflow



iProbe

- Digital 5-hole flow probe
- USB data and power connector
- Flow direction, velocity, static and dynamic pressure output
- Passive optical markers
- Left- or righthanded operation
- stl file for position feedback included
- Multiple pressure range options
- Metal housing
- Individually calibrated

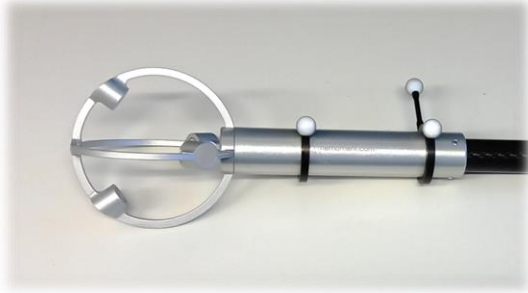
14-hole digital omni-probe, fully integrated with USB connector from Vectroflow



Omni-iProbe

- Digital 14-hole flow probe
- USB data and power connector
- Flow direction, velocity, static and dynamic pressure output
- Passive optical markers
- Left- or righthanded operation
- stl file for position feedback included
- Multiple pressure range options
- Metal housing
- Individually calibrated

Three Component Ultrasonic Probe TriSonica™ from Anemoment



TriSonica™ Sphere

- Digital 3D ultrasound probe
- Aluminum housing
- USB data and power connector
- Flow range (0-30 m/s): ± 0.1 m/s
- $\pm 60^\circ$ out-of-plane flow acceptance angle
- Temperature
 - Range: -40°C to 85°C
 - Resolution: 0.01°C
 - Accuracy: $\pm 2.0^\circ\text{C}$



TriSonica™ Mini

- Digital 3D ultrasound probe
- USB data and power connector
- Flow range (0-10 m/s): ± 0.1 m/s
- $\pm 15^\circ$ out-of-plane flow acceptance angle
- Temperature
 - Range: -40°C to 85°C
 - Resolution: 0.01°C
 - Accuracy: $\pm 2.0^\circ\text{C}$
- Humidity, static pressure, dew point, magnetometer, and air density sensors

3 3D camera system Optitrack V120 trio, incl. dongle license for tracking software



Optitrack Camera

- V120 Trio Camera bar incl. dongle license of the tracking software and cabling
- USB data connection
- Frame Rate: 120 FPS
- Latency: 8.333 ms
- Accuracy: Sub-millimeter
- Working distance: 0.6 to 5 m

(Please visit the OptiTrack website for the details regarding hardware specification and software license and updates)

4 Custom transport casing

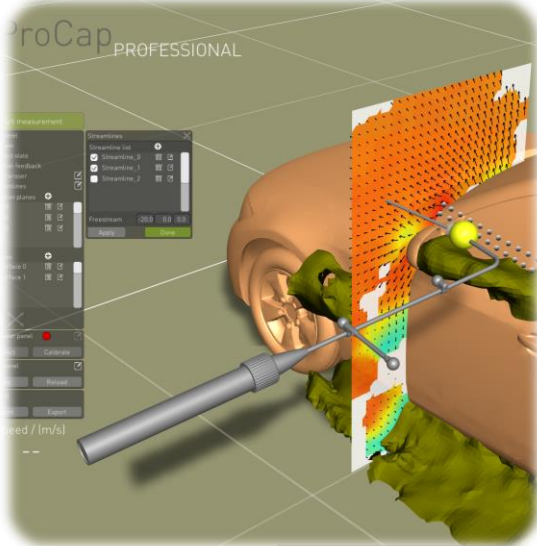


Industrial casing

- Custom made casing
- Fit to customer specific probe shape
- Holds all components but laptop

6.2 Professional options

1 ProCap Professional software suite preinstalled on powerful laptop



Professional software features

- Increased number of visualization planes
- Visualization plane can move with probe
- Iso-surfaces of selectable quantities
- Streamline visualization
- Enhanced spatial reference with Voxel eraser
- Display and tracking of multiple model geometries
- Support of customized and analogue probes up to 14 holes
- Acquisition of user-defined analogue channels
- Support of customizable Optitrack, Qualisys and Vicon tracking systems

2 Custom optical tracking system



- Optitrack or Qualisys tracking systems
- Tracking for large volumes with sub-millimetre accuracy
- Up to 1 kHz tracking rate
- Wide range camera options
- Permanently installed systems
- Working distance up to 8 m
- Outdoor (daylight) and underwater capability
- Model position and deformation measurement
- High-speed video output

6.3 Additional items

Description	Applies to	
	Compact	Professional
1 Software maintenance contracts for one or three years	x	x
2 On-site installation and training	x	x
3 Light-weight telescopic probe stick with articulated joint	x	x
4 Rugged telescopic pole for probe with different lengths	x	x
5 Tripods and magic arms	x	x
6 Custom tracking setup		x
7 Camera mounting hardware for fixed installations		x
8 Customized transport casing	x	x
9 Camera calibration hardware		x
10 Extra marker kits	x	x
11 Customized probe types and shapes		
12 Customized probe and mounting hardware (e.g. mechanical support for high velocities)	x	x

(All content subject to change without prior notice).

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