LINEARIS3D
INDUSTRIELLE PHOTOGRAMMETRIE

# Photogrammetry-System [Portable 3D-Coordinate measuring system]

## Linearis3D Photogrammetry System

The portable 3D coordinate measuring system computes precise 3D positions for an arbitrary number of markerd points using digital photographs. The underlying measurement principle is triangulation.

## Typical Tasks

+ Deformation measurement for automotive climate tests, for the validation of finite element analyses and for welding deformations
+ Quality assurance for large objects in ship and plant building and steel construction
+ Reverse Engineering of large surfaces like propellers of ships and sheet metal parts
+ Referencing of all laser and white light scanning systems
+ Measurement of stairs and installation spaces
+ Measurement of calibration objects for other optical systems

## Advantages of photogrammetry

+ High precision for objects up to 20m and more
+ Insensitive against shocks and vibrations
+ Robust for a large range of temperatures
+ Easy to carry (system weight ca. 10kg)
+ Usable in constrained spaces (e.g. car interiors)
+ Usable in bright daylight as well as in near darkness

## Measuring procedure

### Marking

The points to be measured on the object are marked with self-adhesive or magnetic circular markers. The centers of the markers will be measured by the photogrammetry system with very high precision. Only marked points can be evaluated.

### Taking photographs

Depending on the size and the complexity of the object twenty to several hundred photos are taken from different perspectives. A measurement point should be visible on as many photos as possible.

### Evaluation

Using sophisticated image processing algorithms the marked measuring points are identified in the images. The least squares bundle adjustment used for the evaluation is the "gold standard" for high precision applications.

## Features*

### Usability

+ Fully automatic evaluation of measurement results
+ Comprehensive analysis and assistance features for the interpretation of the measurement results
+ Export of measurement results as text file or as reference files for leading scanner models

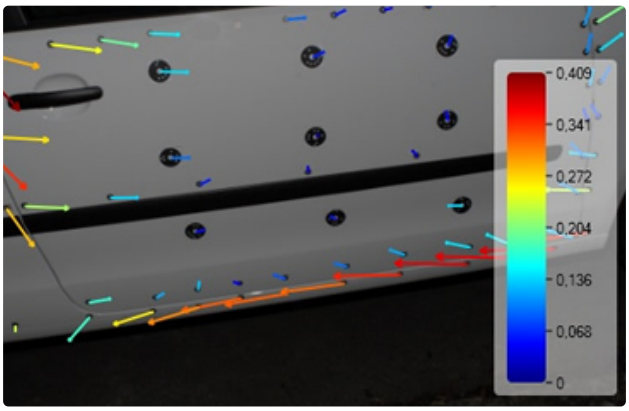


Figure 1: Deformation of a car.

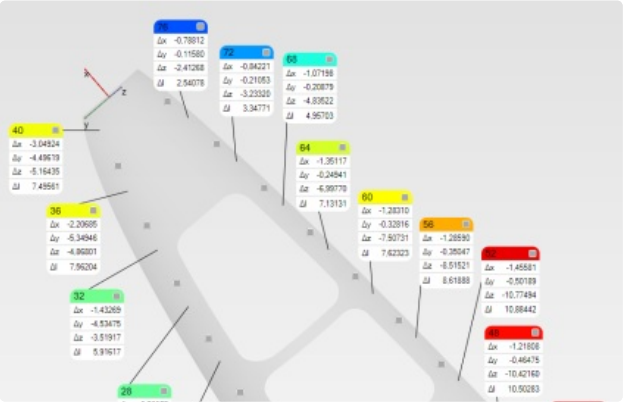

Figure 3: Comparison of a ship hull element with its CAD model.

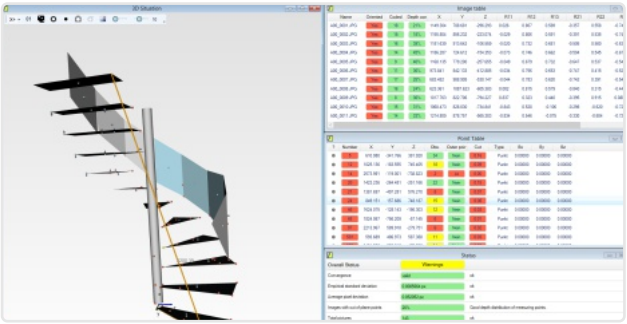

Figure 4: 3D-caputre of stairs and the graphical user interface of the software.

Technology

+ Size of projects only limited by memory
+ Standard and extended calibration models
+ Computation of standard deviation and quality heuristics
+ Simultaneous calibration
+ System compliance according to VDI 2634

Geometry functions

+ Flexible definition of the coordinate system
+ Parametric creation of adjusted planes, flanges and cylinders as well as distances and angles
+ Automatic detection of adapters for holes, edges, corners and customer specific features
+ Flange measurent functions

Deformation analysis

+ Transformation of multiple deformation states in a common coordinate system
+ Flexible definition of reference points
+ Visualization of deformations as vector field

CAD comparison

+ Import of CAD data
+ Computation and visualization of deviations


Figure 5: Elements of the photogrammetry system including camera, flash, scale, targets and starting cross.

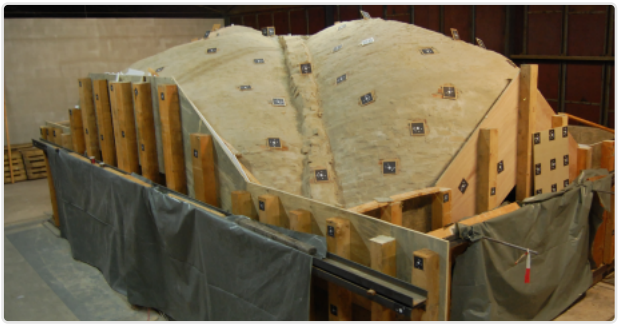

Figure 6: Photogrammetric acquistion of deformations for an experimental vault load test.

## Versions

| | Standard | Professional |
|---|---|---|
| Precision (1m³) | 100µm** | 30µm** |
| Camera | Basic DSLR with 24mm lens | Professional DSLR with 24mm lens |
| Adapters | no | yes |
| Deformations | no | optional |
| CAD comparison | no | optional |
| Geometry | yes | yes |
| Ext. Geometries | no | yes |
| Scale | carbon | carbon or invar |
| Support | web/e-mail | on site/phone |
| Geometries | no | optional |
| Quality check | basic | extended |
| Price (without VAT) | € 4950,- | please call |

The Standard system is designed for scanner referencing and simpler mesurement tasks while the Professional version is aimed at high end industrial applications.

## Contact

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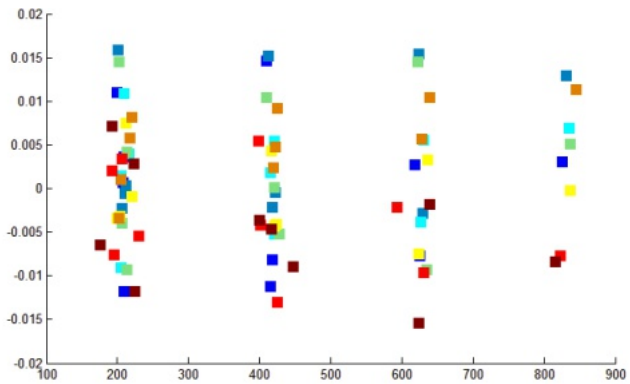


Figure 7: Example of length deviations [mm] according to VDI 2634 for a measuring volume of 1m³ (Prof. system).**

Version: 1 June 2016. Subject to change without notice.
* Features vary depending on version and configuration.
** Precision is influenced among others by object size, object visibility, camera, camera positions, number of photos, user and length and number of scales. Precision for other measurement configurations can be worse.