Specifications

Establishing the reference

The required target quantities of rail inspection are obtained in a stop and go mode in a local coordinate system not tied to the plumb line. At each stop the local gear system is transformed to a superordinate coordinate system by means of free stationing. This coordinate frame is given by survey points along the track with well-known coordinates.

The calculation of the track gauge is carried out initially in the coordinate system of the measuring gear, whereby the relation to the rail is given contactless via laser profile sensors.

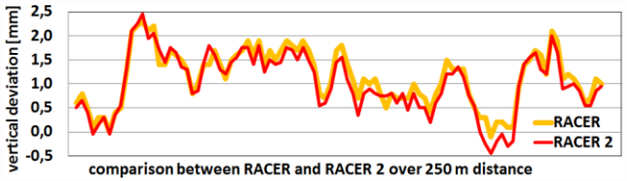
Performance data

With an interval of the cross-sections of 2.5 m, a progress of about 1 km is achieved in an operation time of 5.5 hours. Continuous operation around the clock is possible by exchanging the batteries while the system is running.

Measurement uncertainties

Typical accuracies (1 sigma) derived from validation measurements:

- 3D-position < 0.2 mm
- gauge < 0.3 mm
- gradient < 0.2 ‰
- cross slope < 0.2 mm/1.5m



comparison between RACER and RACER 2 over 250 m distance

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Measuring gear RACER 2

Rapid
Automatic
Control
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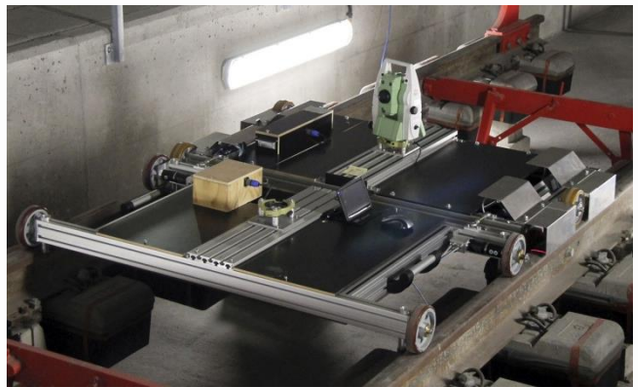

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Task

High-precision and economical control of rail track geometry

- for new and existing tracks
- for inspection and proof of damage

Target quantities of survey

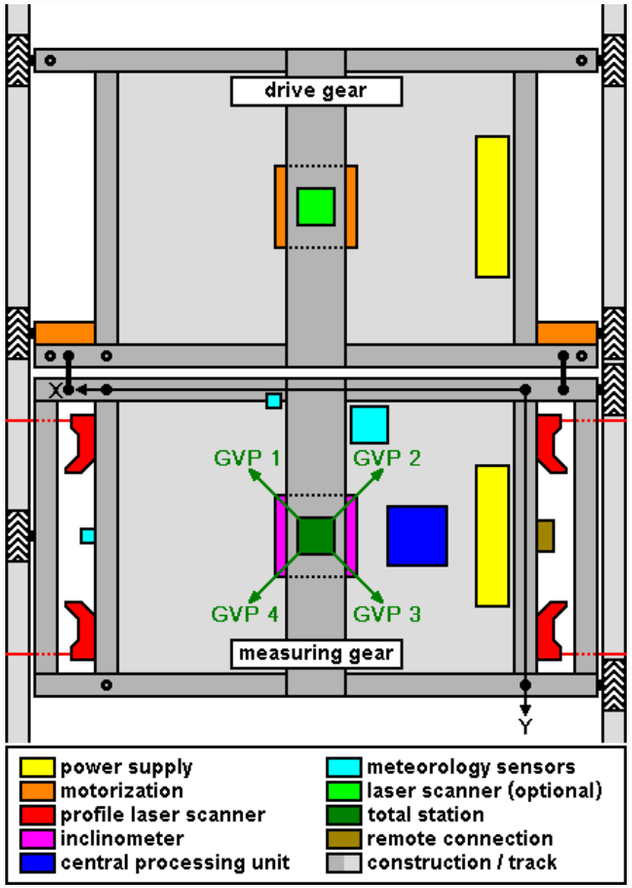
- absolute 3D position of track axis
- gauge
- gradient and cross slope

Characteristics of RACER 2

- fully automated measuring process using a motorized drive gear and a motorized total station
- immediate comparison with reference values if alignment data are available
- contactless measurements via profile laser scanners which enables:
  - rapid measuring cycles
  - low wear operation
  - profile measurements of each track
- reduced weight due to light construction
- long autarkic operating due to the battery concept
- comprehensive quality assessment due to redundant sensors
- remote control operation via WLAN with graphical interface to monitor the process
- free definition of measuring intervals
- easy transport of equipment with two gears solution to be separated
- best operation with a staff of two persons

Development

The measurement concept as well as hard- and software are developed at the Institute of Geodesy. Intensive system calibration is performed and the operating procedure was optimized in extensive tests.



The operators monitor the complete automated process. Only the survey points along the track (called GVP) are to be equipped and aligned with precision prisms manually during the measurements.

Reference projects of RACER 2

The measuring system was used to control the rail track geometry at the Gotthard base tunnel, Switzerland, between 2012 and 2014 and as well at the Ceneri base tunnel, Switzerland, in 2018.

Validation of the measuring system

Extensive validation measurements were carried out to check the performance and accuracy, whereby the rail geometry was measured parallel using the high-precision T-scan system of the Leica AT901-LR laser tracker.