

Modern Geodetic Systems have internal ranging accuracy better than 1 mm

Calibration/Excentricity has to be done with 100 μm accuracy

- distance to calibration target
- excentricity vector to geodetic markers
- monitoring of collocation vectors
- 1. Principle of Operation
- 2. Ranging Results
- 3. Perspectives/Modifications

Fachhochschule
Deggendorf



Intention of Project: High Accuracy Laser Meter for Industrial / Geodetic Application

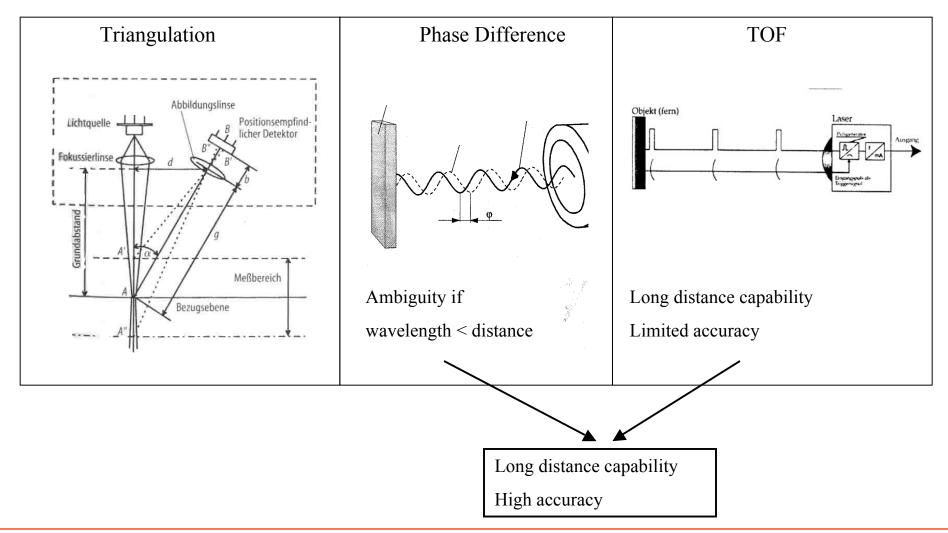
Short Range: 5 m (100 m)
eyesafe, visible Diode, non cooperative target

- Accuracy and Reproducibility: 0.1 mm new operational principle
- High Aquisition Rate: 1 Hz 1 kHz simple measurement
- Long Term Stability / Low Cost absolute calibration

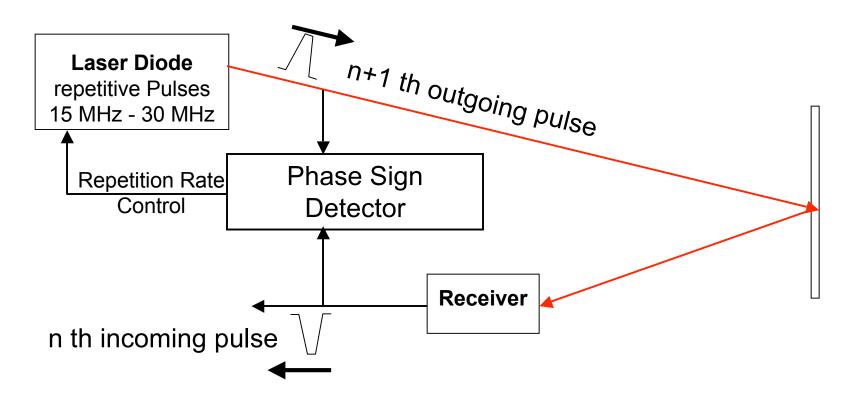


High accuracy laser meter for system calibration

Possible Operational Principles







- Fast signal rise time: High sensitivity of phase sign detection
- Measurement cycle: few 10 ns: Many averages per measurement cycle
- Frequent fibre calibration / Calibration to known target
- Simple range measurement by frequency count

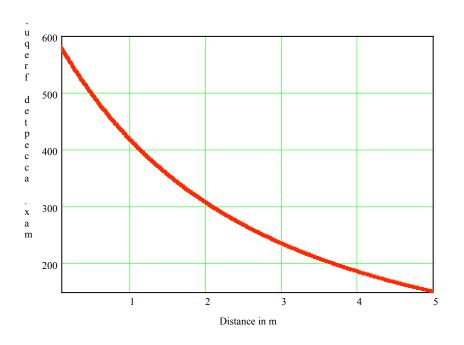


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Laser Diode Repetition Rate versus Distance to Target

Max. acceptable frequency error for 0.1 mm ranging accuracy versus Distance to Target



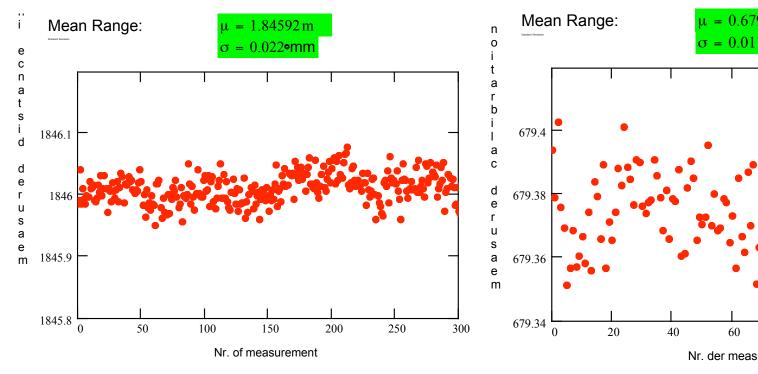


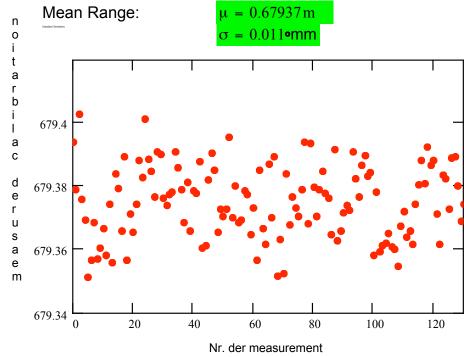


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Ranging Results Non cooperative target 10 ms measurement time

Calibration Results Stable return level 10 ms measurement time



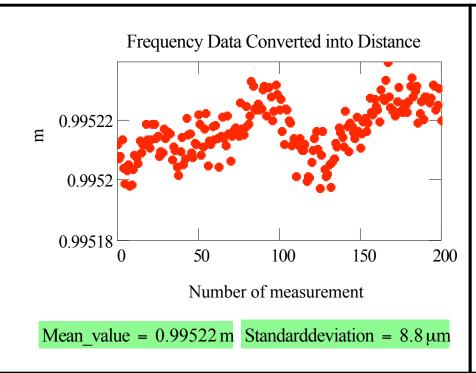


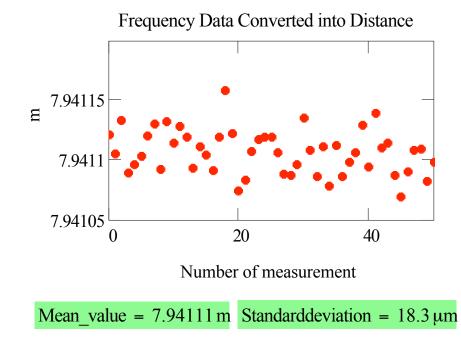


High accuracy laser meter for system calibration

Ranging Results
1s measurement time
5 m max. range
1 m target distance

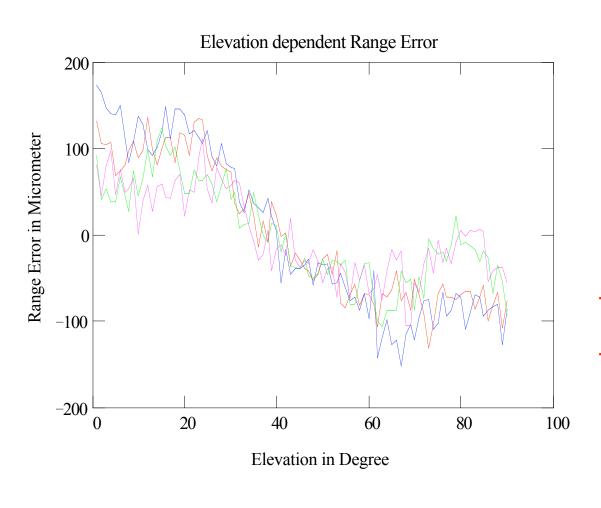
Ranging Results
1s measurement time
20 m max. range
8 m target distance





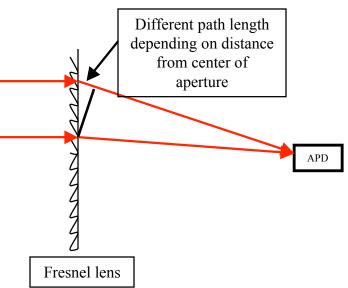


Ranging through Graz SLR Telescope with moving Elevation Axis



Four consecutive measurements

Drift just due to moving return spot on fresnel lens → changing path length



Prof. Dr. Peter Sperber



High accuracy laser meter for system calibration

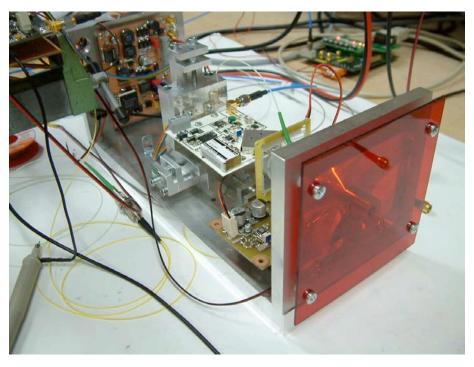
Status	Geodetic Application
Large diameter Fresnel Lens for noncooperative target → variable pathlength through different areas of lens no problem for diffuse reflection	Reflector → Directional reflection Small glas lens for ranging to reflector → fixed path length through aperture
Integrated fibre switch for calibration → additional noise compromises accuracy	Calibration to external target
Designed for fast (1 ms) steps in distance and return level → high speed, high bandwidth control circuit compromises accuracy	Limiting bandwidth of control circuit will increase accuracy and stability
Fast (1 ms, 10 ms) measurement gate limits accuracy	1 Hz measurement rate gives best accuracy
Frequency measurement through internal counter	External atomic frequency stabilized counter is used to measure frequency

Prof. Dr. Peter Sperber

E.F.

High accuracy laser meter for system calibration





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High accuracy laser meter for system calibration

Advantage for collocated instruments

Routine fully automatic site survey up to 100 m distance

- Small, leightweight package for continuous installation
- Remote control, fast aquisition time
- Sub mm ranging accuracy to noncooperative targets (5 m) and reflectors (100 m)

frequent realtime test of excentricity vector with 0.1 mm accuracy