塑造智慧变革

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2018.hexagonchina.com.cn

Leica GS18 T
World's Fastest GNSS RTK Rover

Dr. Xiaoguang Luo, GNSS Product Engineer

10−12, September, 2018

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Agenda

1. Customer’s pain points in GNSS RTK surveying
2. Tilt compensation solution of the Leica GS18 T
   a) Key technologies and advantages
   b) World’s fastest GNSS RTK rover – Why?
3. Technological innovations
   a) Advanced GNSS signal tracking
   b) IMU-based tilt compensation
4. User benefits
   a) Increased productivity
   b) Superior RTK performance
   c) Enhanced user experience
5. Conclusions

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You are not solving customer's problems until you understand his pain points"

… Bernhard Richter (GNSS Business Director at Leica Geosystems)

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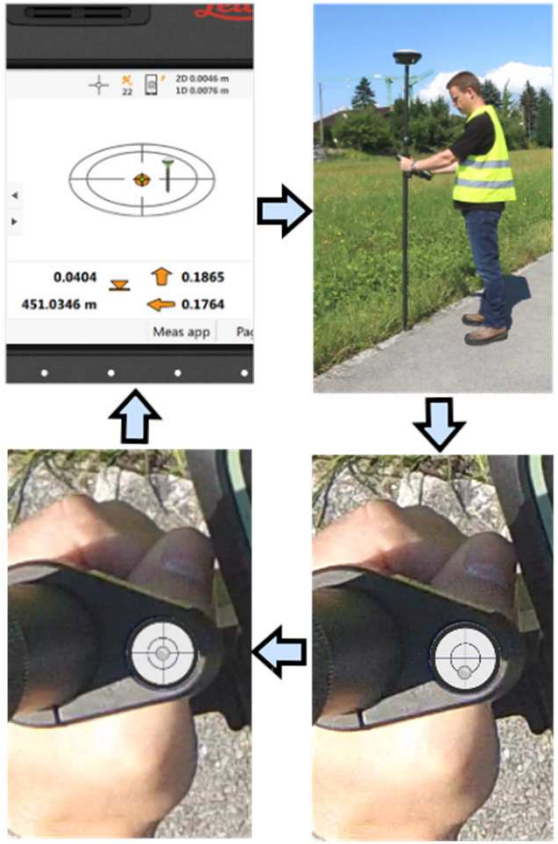
Customer’s pain points in GNSS RTK surveying

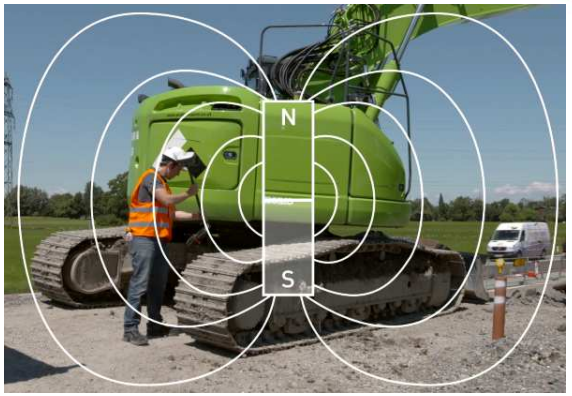
1. Levelling the pole



2. Measuring obstructed points

3. Time-consuming calibrations

4. Magnetic disturbances



5. Limited tilt compensation range

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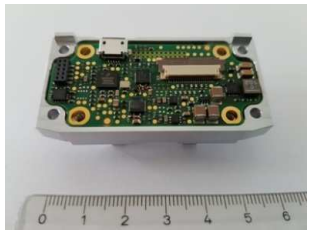
Tilt compensation solution of the Leica GS18 T

- Key technologies
  - Using precise IMU measurements (instead of magnetometer)
  - Sophisticated GNSS/INS integration with quality control mechanisms
- Main advantages
  - Completely free from on-site calibrations
  - Immune to magnetic disturbances
  - Applicable at large tilt angles (> 30 degrees)

IMU



GS18 T

IMU: inertial measurement unit
INS: inertial navigation system

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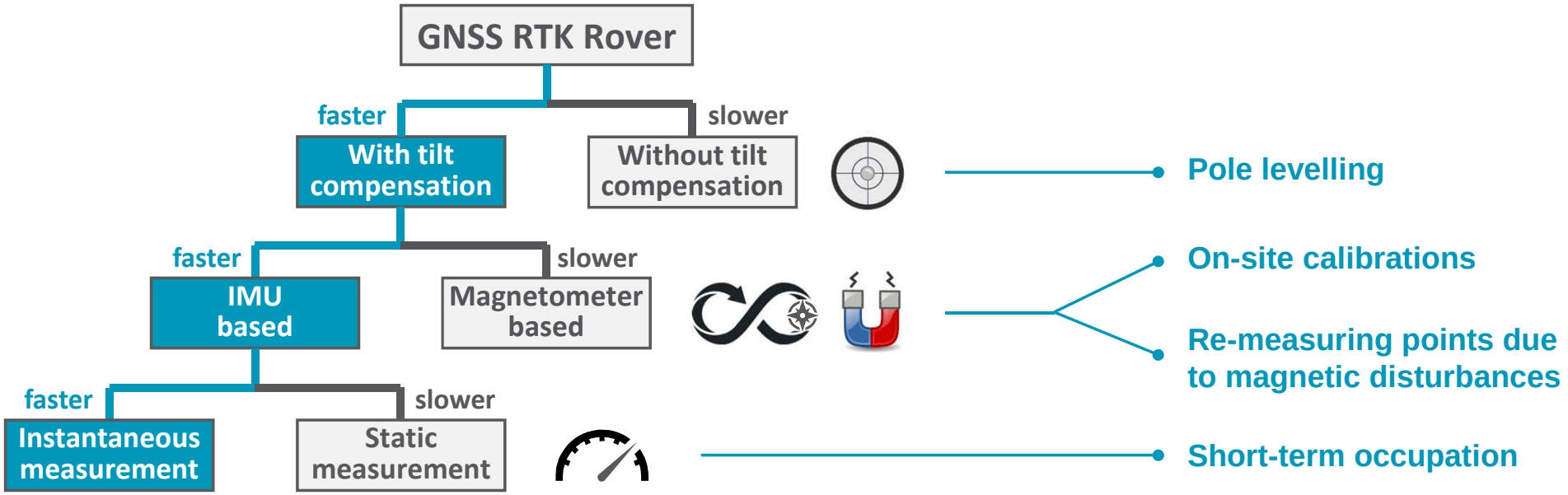
Why is the Leica GS18 T world's fastest GNSS RTK rover?



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Technological innovations

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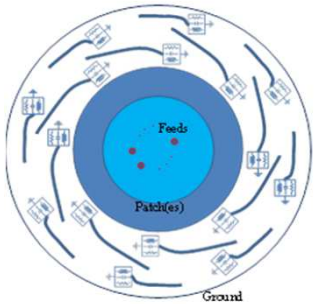
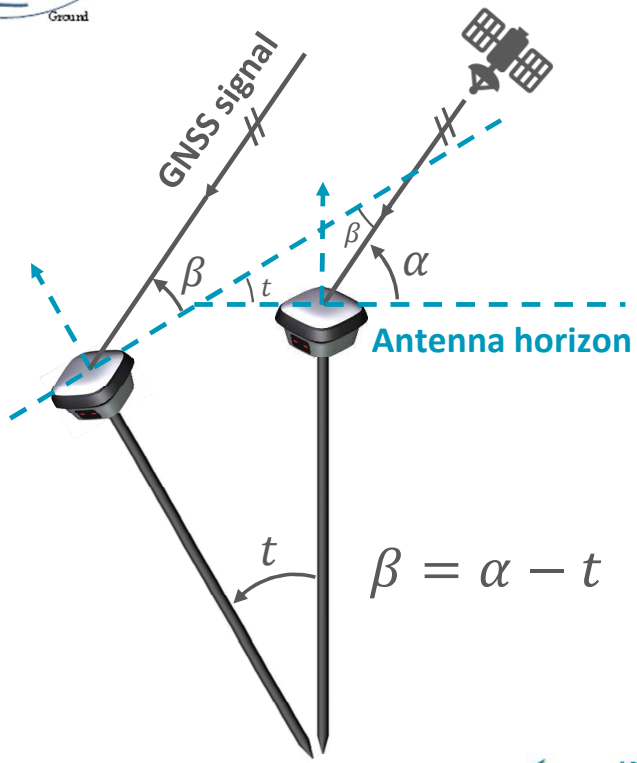
Advanced GNSS signal tracking

- Key components
  - High-performance patch antenna with **multiple design patents**
  - 555-channel ME7 with faster signal acquisition and higher sensitivity
- Main advantages
  - **Superior low-elevation tracking capabilities**
  - Sub-millimetre phase centre stability
  - Multi-constellation and multi-frequency GNSS

ME7: measurement engine 7



GS18 T patch antenna with parasitic circular array loading technology



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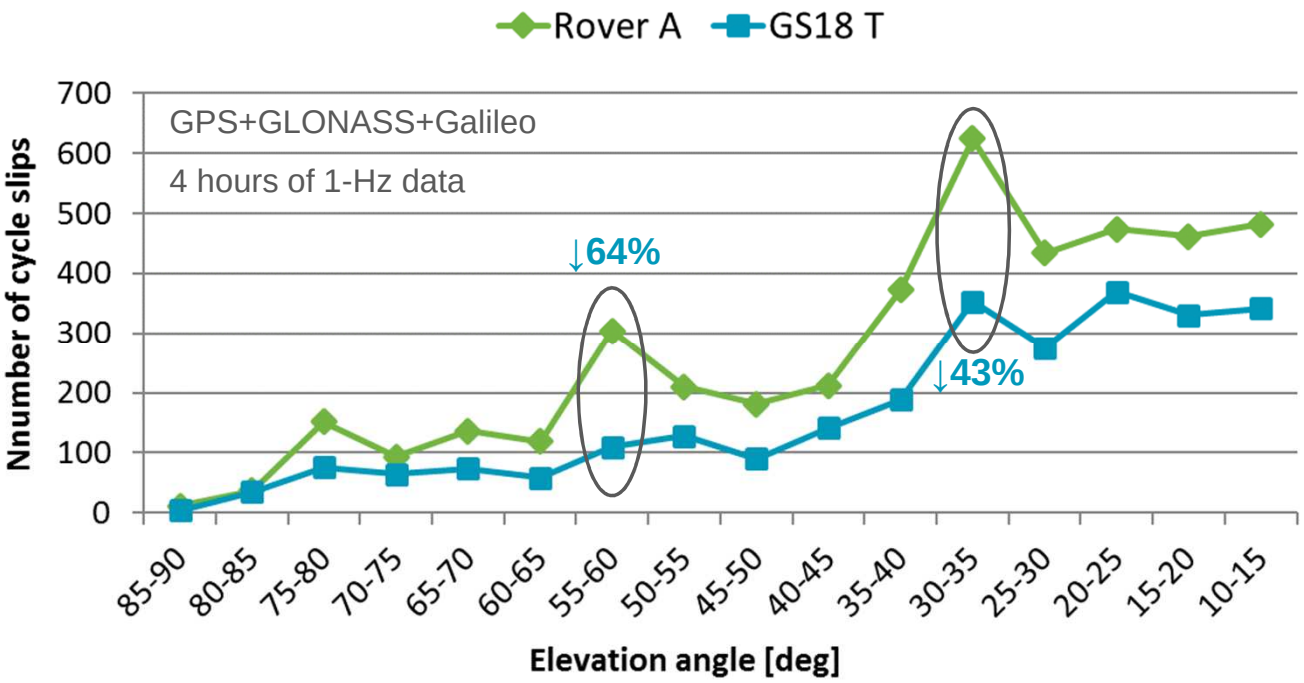
Advanced GNSS signal tracking



When compared to Rover A (a survey-grade GNSS smart antenna), GS18 T reduces the total number of cycle slips by 40% under heavy canopy.

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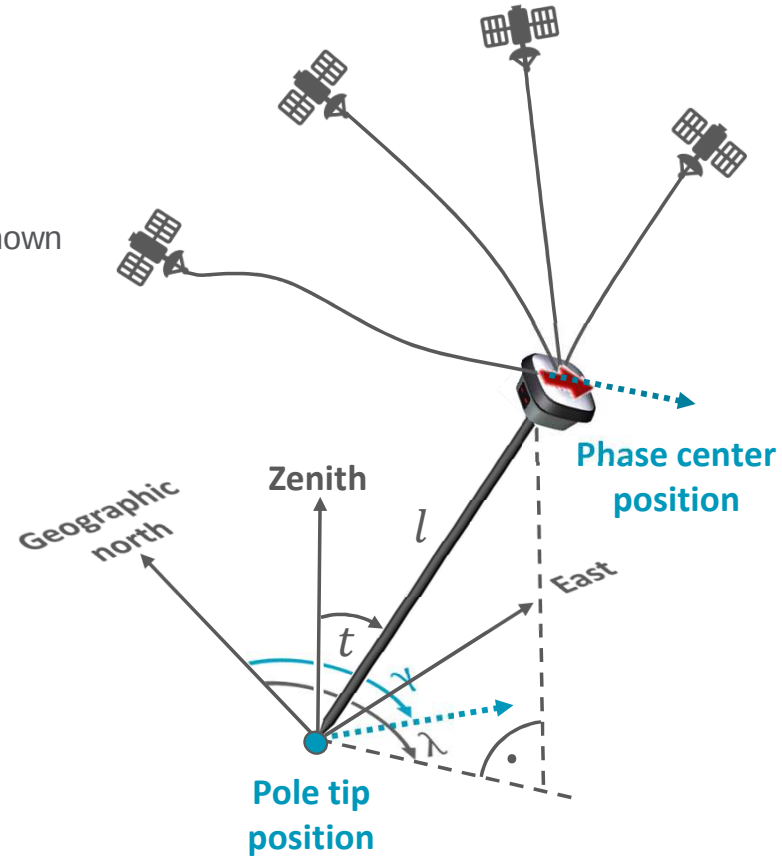
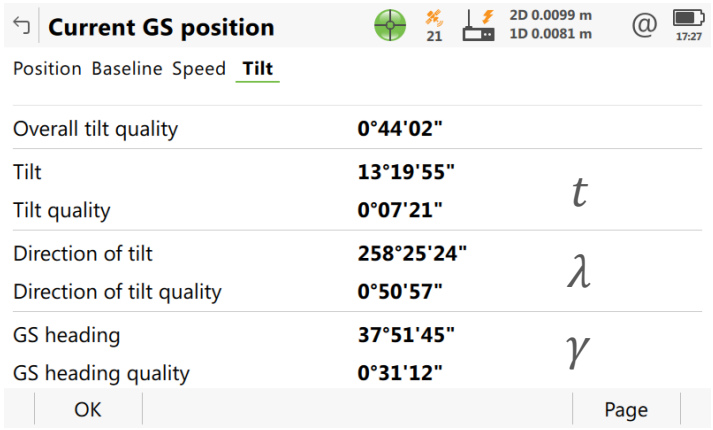
IMU-based tilt compensation

- Assumptions
  - Surveying pole is a rigid body
  - Length of the pole is precisely known
- Pole tip position derived using
  - GNSS phase centre position
  - Length of the pole (l)
  - Attitude of the pole
- Interpretation of pole attitude
  - Tilt (t) and direction of tilt (λ)
  - GS heading (γ)



GS18 T tilt information panel



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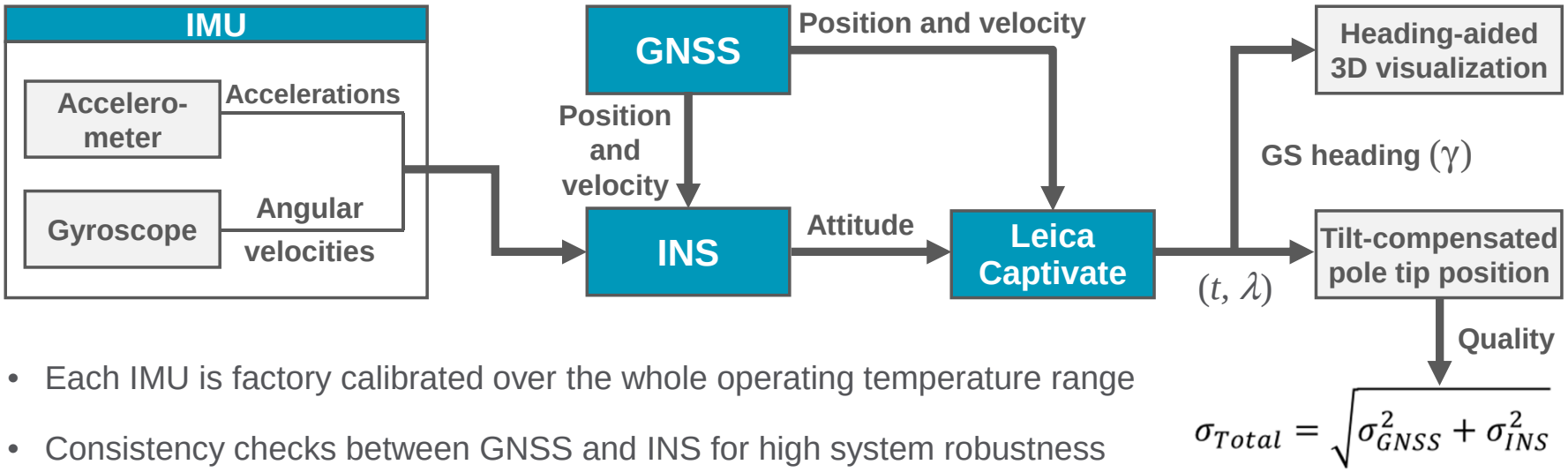
GNSS/INS integration



- Each IMU is factory calibrated over the whole operating temperature range
- Consistency checks between GNSS and INS for high system robustness
- Automatic start of tilt compensation through metre-level movements
- Total error budget behaves according to the error propagation law

IMU: inertial measurement unit
INS: inertial navigation system

User benefits

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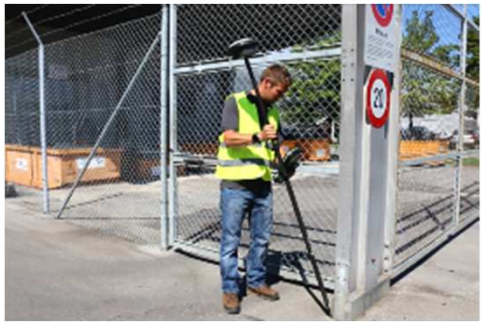
Increased productivity

With the Leica GS18 T, high-precision RTK becomes **more applicable**…





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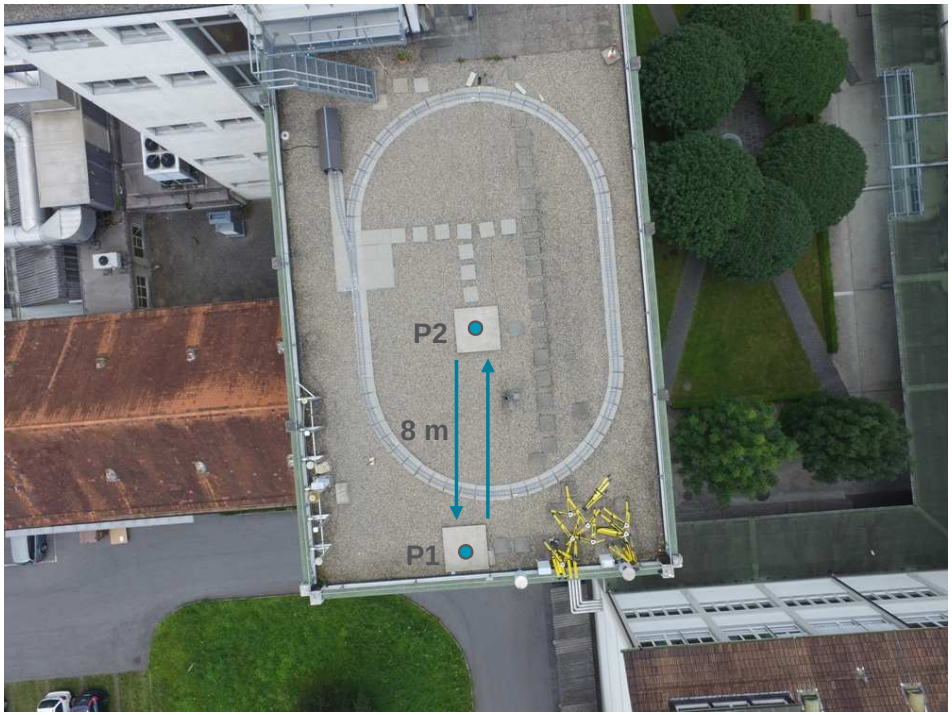
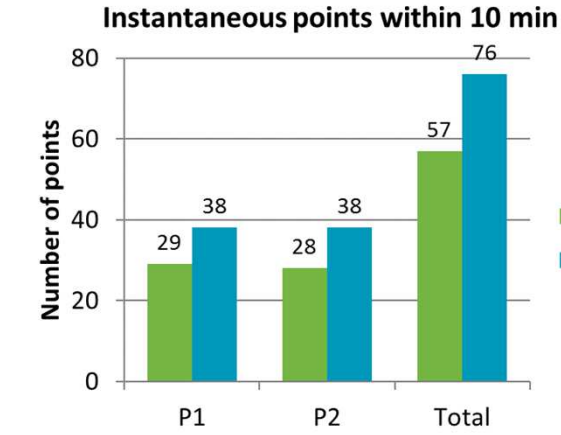
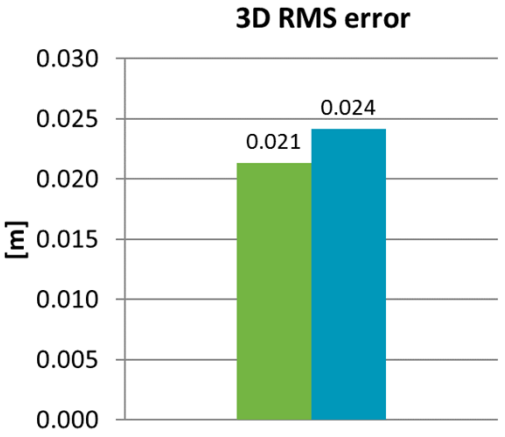
Increased productivity

Without the need to level the pole, points can be measured **faster**…





Productivity increases significantly by 33%



3D accuracy decreases slightly by 3 mm
(RMS: root mean square)

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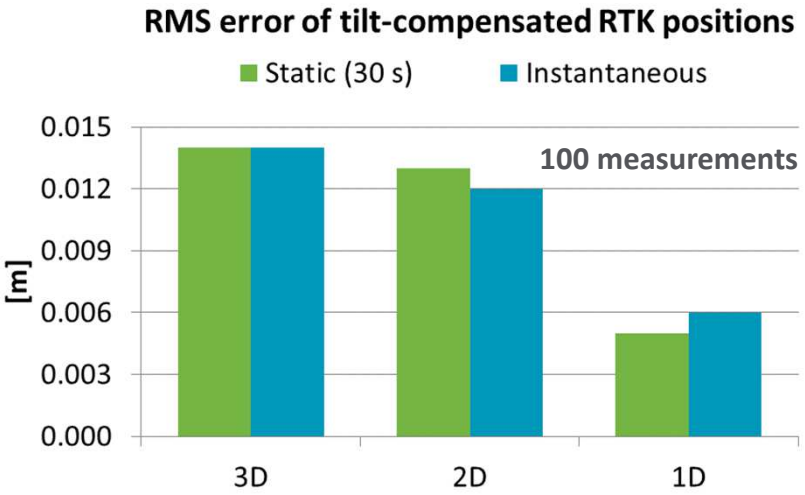
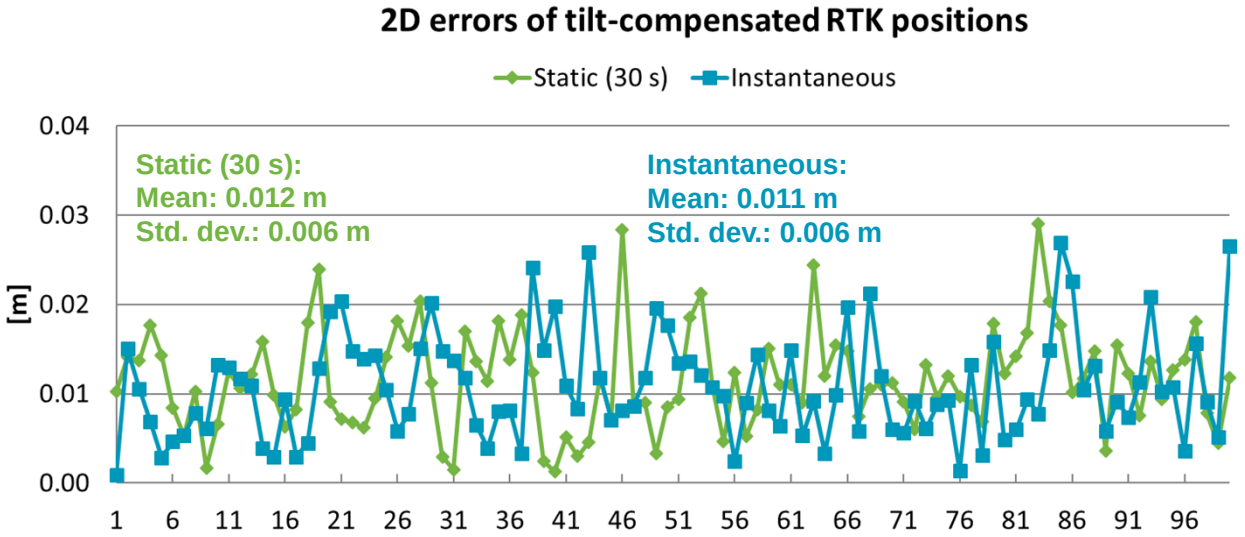
Increased productivity

Using tilt compensation, the instantaneous method enables **the fastest RTK measurement with high accuracy**…

Similar accuracy between 30-static and instantaneous measurements





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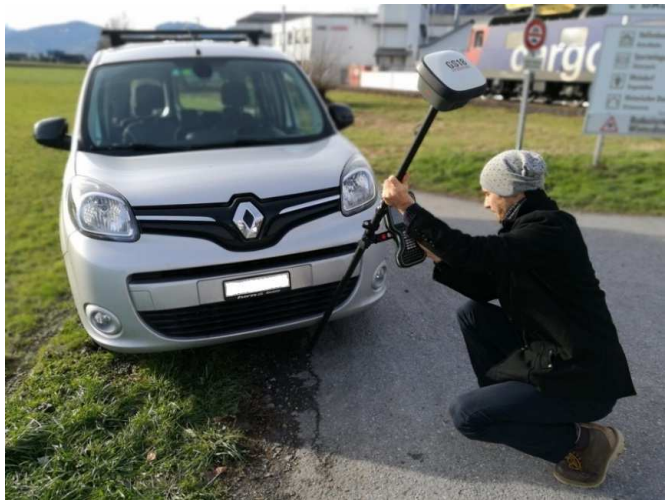
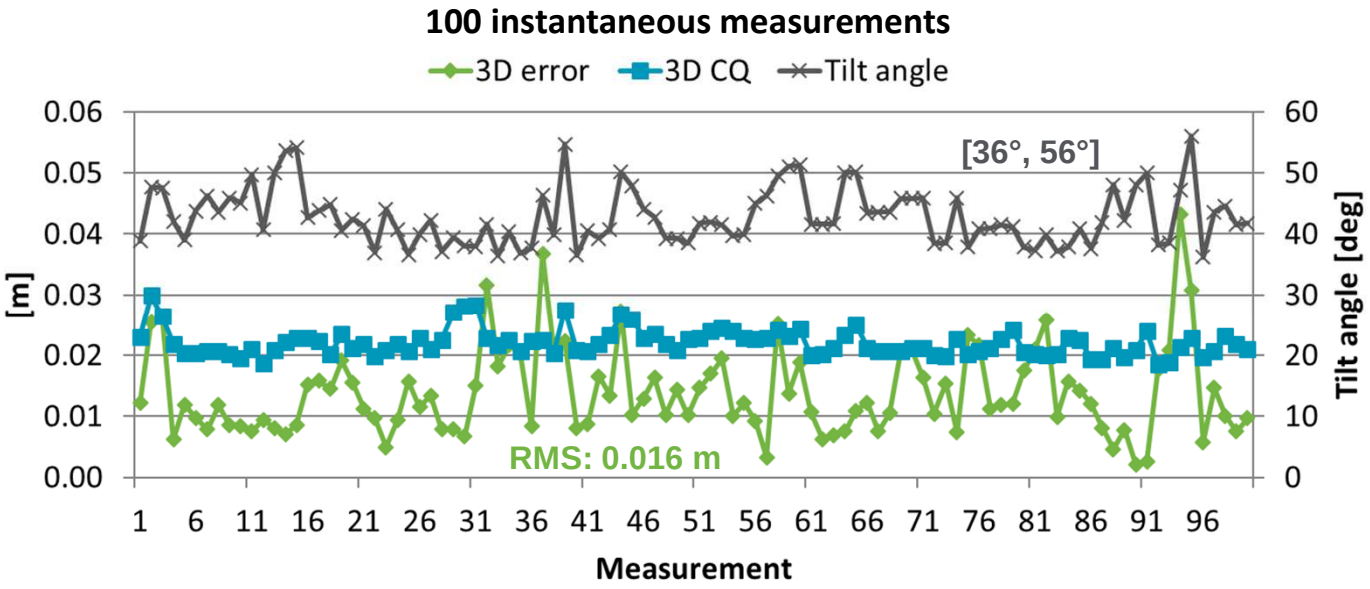
Increased productivity

3D accuracy below 2 cm with a realistic uncertainty level

The Leica GS18 T is **applicable at large tilt angles**…





CQ: coordinate quality

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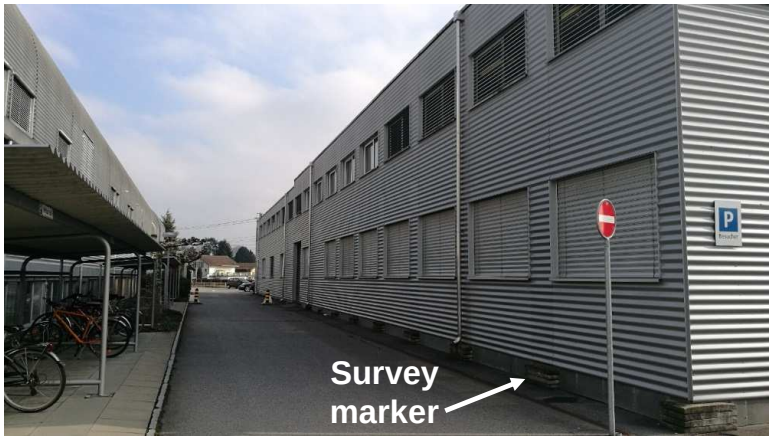
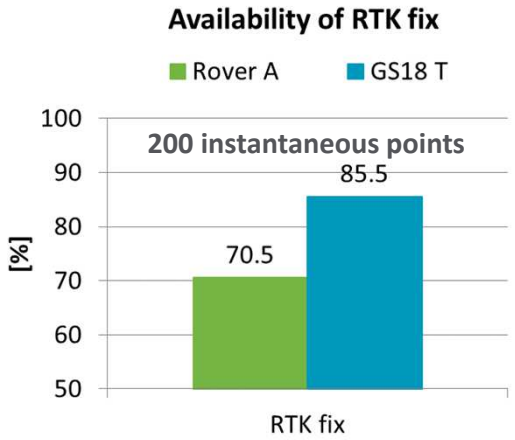
Superior RTK performance

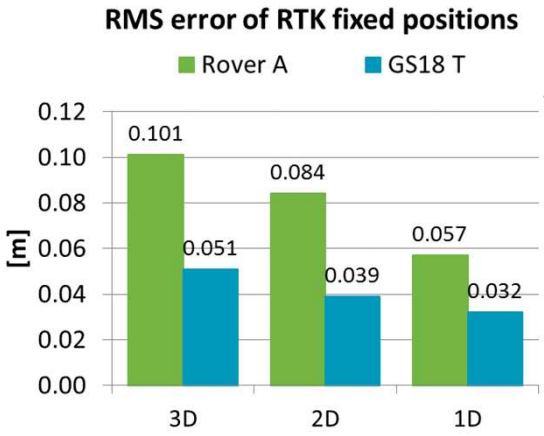
With the Leica GS18 T, RTK-fixed positions are **more available and more accurate**…



Test environment with strong multipath and magnetic disturbances



Availability increases significantly by 15%



3D accuracy is largely improved by 50%

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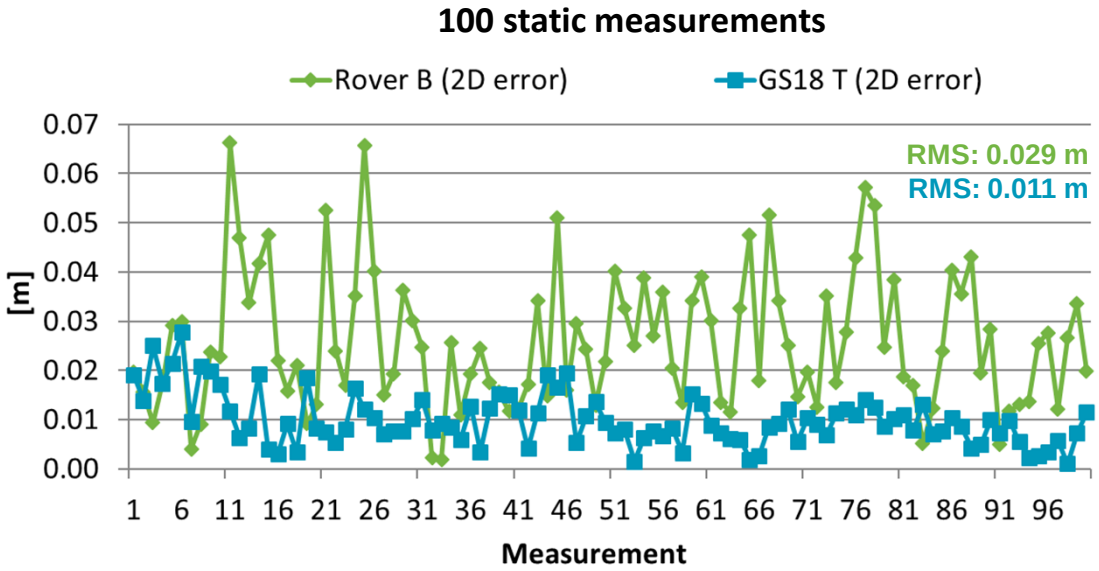
Superior RTK performance

The IMU-based tilt compensation provides **more accurate** RTK positions than magnetometer-based approaches…

Test environment with magnetic disturbances

Rover B with magnetometer-based tilt compensation



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Enhanced user experience

The Leica GS18 T is the **easiest-to-use** GNSS RTK rover with tilt compensation…

- Free from on-site calibrations
- No need to level the pole
- Automatic start/stop of tilt compensation
- No limitation on tilt compensation range
- **Heading-aided 3D visualisation**

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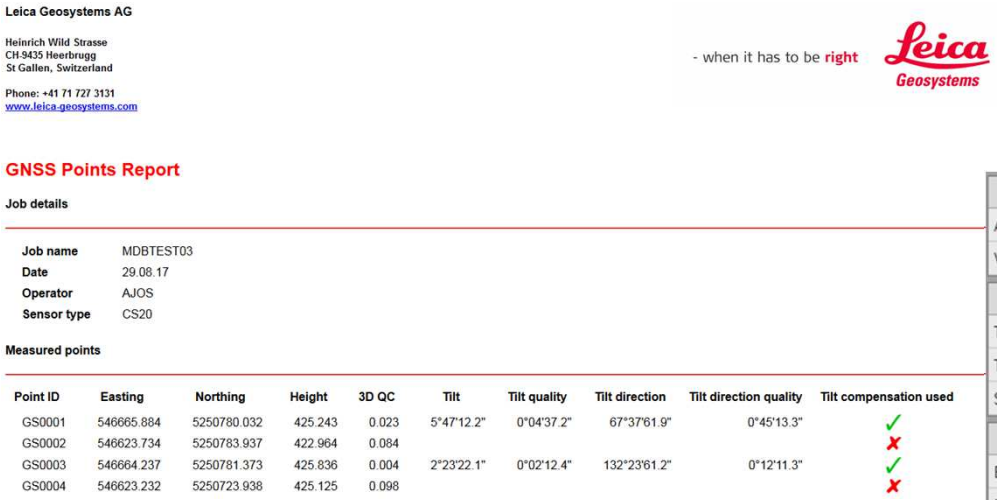
Enhanced user experience

By storing attitude information with point records, the Leica GS18 T enables **full traceability and complete quality reporting**…

Quality report from the Leica Captivate field software



Leica Geosystems AG

Heinrich Wild Strasse
CH-9435 Heerbrugg
St Gallen, Switzerland

Phone: +41 71 727 3131
www.leica-geosystems.com

- when it has to be **right**

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GNSS Points Report

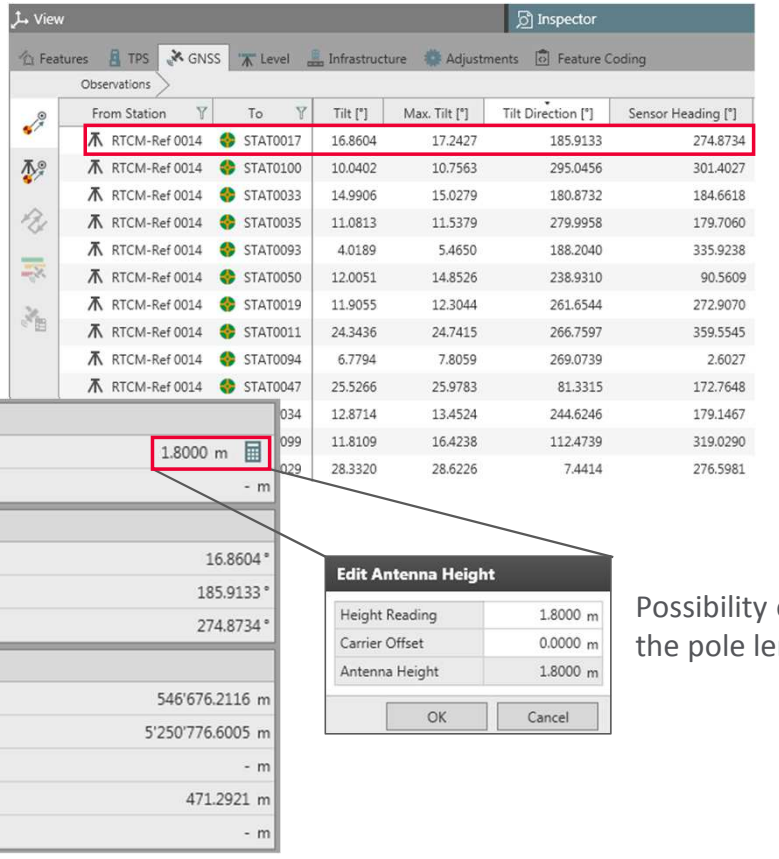
Job details

Job name	MDBTEST03
Date	29.08.17
Operator	AJOS
Sensor type	CS20

Measured points

Point ID	Easting	Northing	Height	3D QC	Tilt	Tilt quality	Tilt direction	Tilt direction quality	Tilt compensation used
GS0001	546665.884	5250780.032	425.243	0.023	5°47'12.2"	0°04'37.2"	67°37'61.9"	0°45'13.3"	✓
GS0002	546623.734	5250783.937	422.964	0.084					✗
GS0003	546664.237	5250781.373	425.836	0.004	2°23'22.1"	0°02'12.4"	132°23'61.2"	0°12'11.3"	✓
GS0004	546623.232	5250723.938	425.125	0.098					✗

Attitude shown in the Leica Infinity office software



View | Inspector

Features | TPS | GNSS | Level | Infrastructure | Adjustments | Feature Coding

Observations

From Station	To	Tilt [°]	Max. Tilt [°]	Tilt Direction [°]	Sensor Heading [°]
RTCM-Ref 0014	STAT0017	16.8604	17.2427	185.9133	274.8734
RTCM-Ref 0014	STAT0100	10.0402	10.7563	295.0456	301.4027
RTCM-Ref 0014	STAT0033	14.9906	15.0279	180.8732	184.6618
RTCM-Ref 0014	STAT0035	11.0813	11.5379	279.9958	179.7060
RTCM-Ref 0014	STAT0093	4.0189	5.4650	188.2040	335.9238
RTCM-Ref 0014	STAT0050	12.0051	14.8526	238.9310	90.5609
RTCM-Ref 0014	STAT0019	11.9055	12.3044	261.6544	272.9070
RTCM-Ref 0014	STAT0011	24.3436	24.7415	266.7597	359.5545
RTCM-Ref 0014	STAT0094	6.7794	7.8059	269.0739	2.6027
RTCM-Ref 0014	STAT0047	25.5266	25.9783	81.3315	172.7648
		034	12.8714	13.4524	244.6246	179.1467
		099	11.8109	16.4238	112.4739	319.0290
		029	28.3320	28.6226	7.4414	276.5981

Antenna	
Antenna Height	1.8000 m
Vertical Moving Offset	- m
Tilt	
Tilt	16.8604 °
Tilt Direction	185.9133 °
Sensor Heading	274.8734 °
Local Position	
Easting	546'676.2116 m
Northing	5'250'776.6005 m
Ortho. Height	- m
Ellip. Height	471.2921 m
Geoid Separation	- m

Edit Antenna Height

Height Reading	1.8000 m
Carrier Offset	0.0000 m
Antenna Height	1.8000 m

OK | Cancel

Possibility of editing the pole length

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Conclusions

- Leica GS18 T is designed to solve customer's pain points in GNSS RTK surveying
- Innovative technologies
  - Advanced GNSS signal tracking
  - IMU-based tilt compensation
- Main advantages
  - On-site calibration free
  - Immune to magnetic disturbances
  - Applicable at large tilt angles
  - Heading-aided 3D visualisation

Fast
Accurate
Easy-to-use

- User benefits
  - Improved productivity and user experience
  - Superior RTK performance

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“With the Leica GS18 T, Leica Geosystems sets new standards for high-precision RTK through easy-to-use sensor-fusion techniques.”

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谢 谢