Improvements of OTG handling for Leica Absolute Tracker

IWAA2024 @ SLAC

Matthias Saure, 26.09.2024

Improvements of OTG handling for Leica Absolute Tracker

Content

- Motivation
- Technical Differences between Tracker Platforms
- Why is OTG handled differently?
- Spatial Analyzer new OTG feature
- Levelling performance AT500 vs. AT40x
- Accessories for Levelling

Improvements of OTG handling for Leica Absolute Tracker

Motivation

“Why do you do OTG differently on the AT9x0/AT500? We want it like the AT40x!”

IWAA 2022 @ CERN

“Bring back the 403, or marker an instrument with the same level compensator.”

Customer Satisfaction Survey 2024

“It is a big effort to fabricate measurements in SA for AT960, so instrument frame and inclination frame are the same.”

Tomasz Zawierucha, ESS

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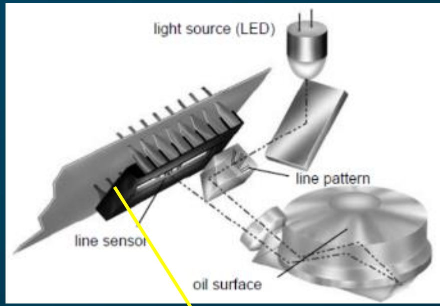
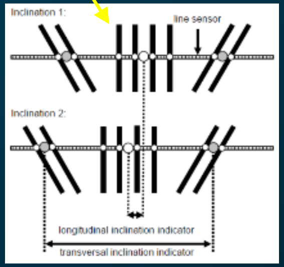
Technical Differences & Commonalities between Tracker Platforms

Axis System

Inclination Sensor *

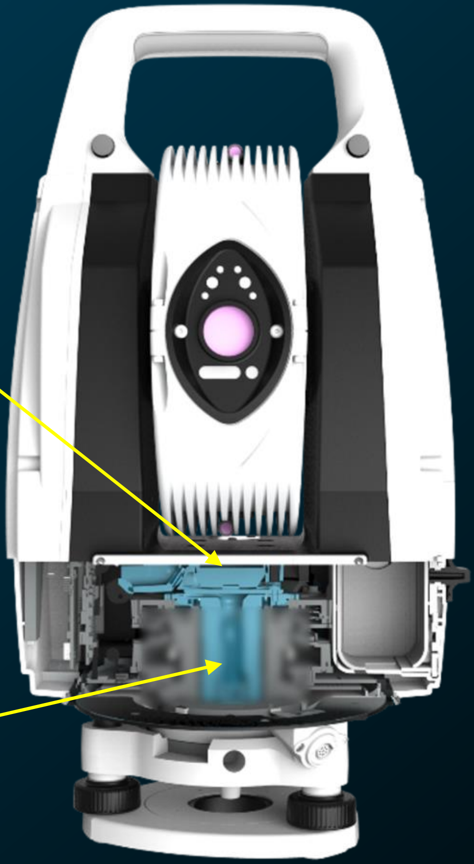




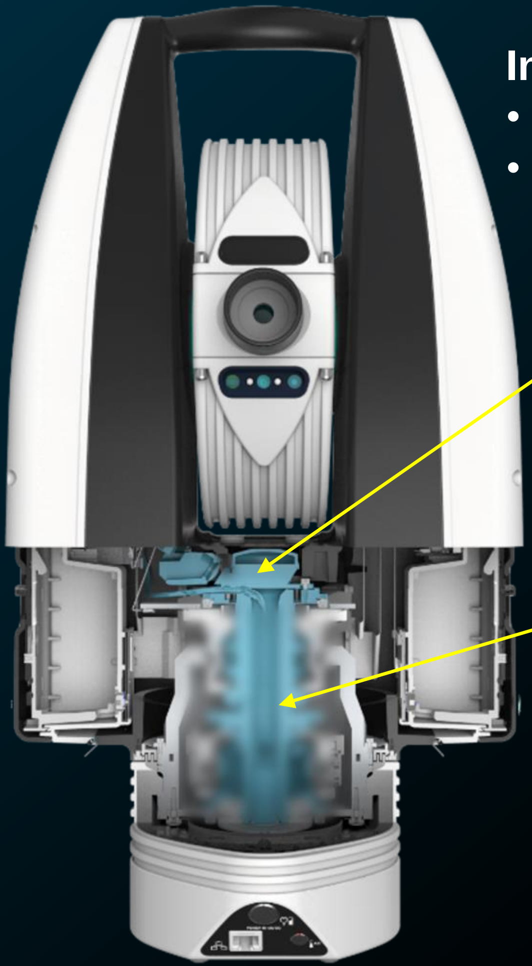
Standing Axis

- Aluminium Axis with brass ball cage
- Very light weight, but has a staggering error

AT403



AT500



Inclination Sensor

- Identical to AT403
- Used in all current Leica Trackers

Standing Axis

- Large steel axis with pre-loaded ball bearings
- No significant staggering error

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* For further details refer to «Leica Absolute Tracker AT401 White Paper»

Technical Differences & Commonalities between Tracker Platforms

OTG Handling

AT403

AT500

AT403 OTG:

- OTG always on, like surveying total stations
- Each measurement is inclination corrected
- Compensation of staggering error
- Instrument frame = Levelling frame
- Monitoring recommended

AT9x0/AT500/ATS600 OTG:

- OTG on request, like LTD/AT901 Trackers
- Static OTG angles provided to application SW
- Dynamic measuring system, no loss of performance due to repeated inclination readings
- No compensation of staggering error needed
- Instrument frame ≠ Levelling frame
- Monitoring recommended

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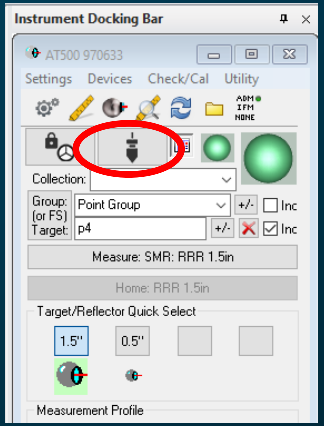
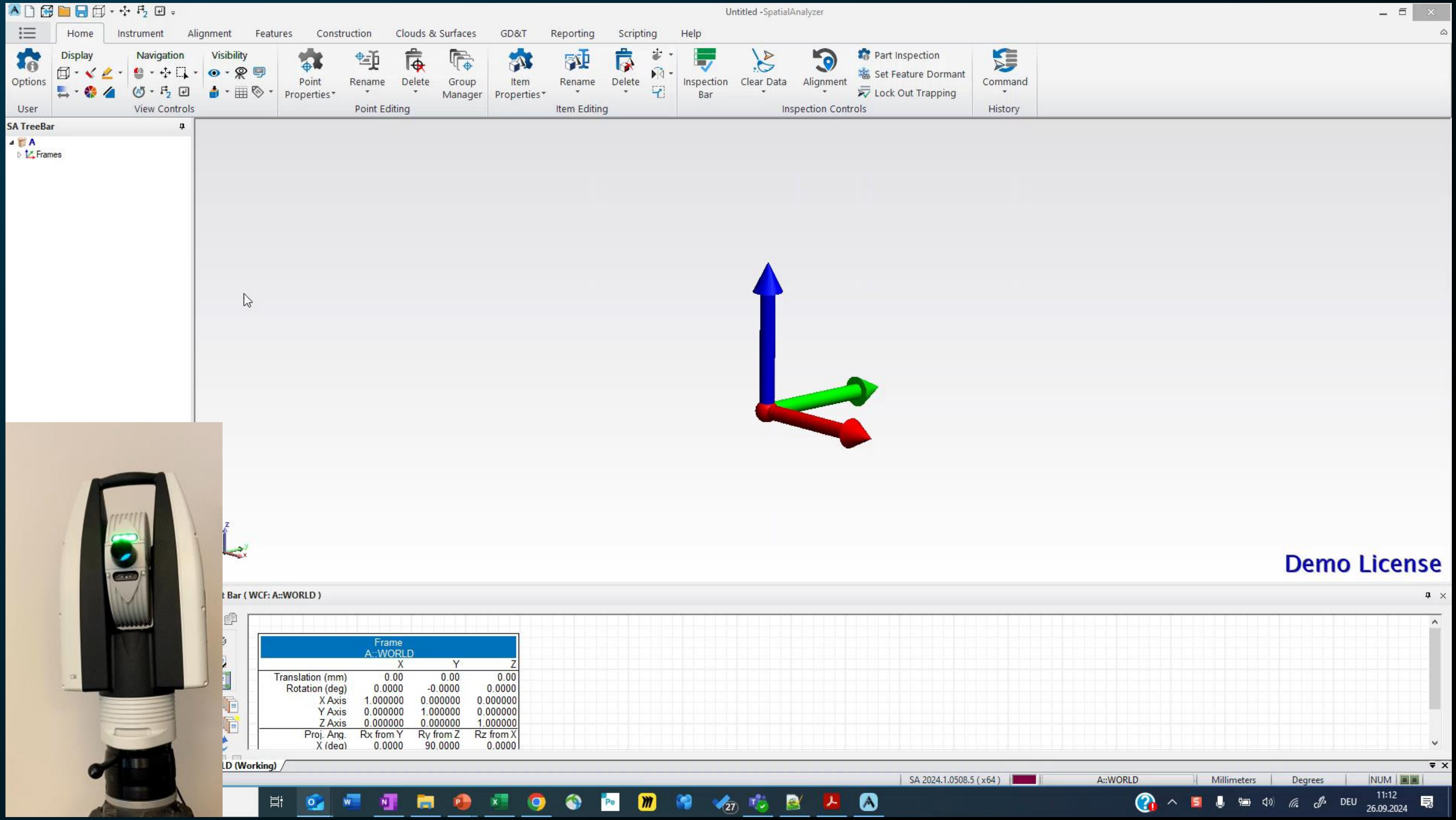
Changes in OTG Handling implemented in Spatial Analyzer

SA Version 2024.1

- New function introduced in Spatial Analyzer v2024.1 to apply OTG on instrument





- Continue working in instrument frame
- Levelling frame is still added in tree, but can be ignored

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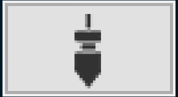
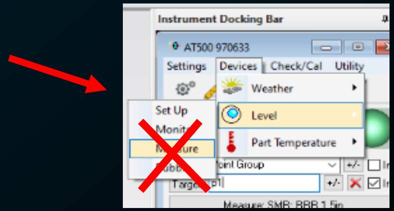
Changes in OTG Handling

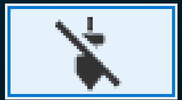
Best Practice, Known Issues

- First version of OTG handling has been implemented in SA v2024.1
  - Process still needs some improvements, for the time being the following best practice is recommended:
  - Don’t repeat the OTG process (*Device, Level, Measure*) while the OTG is on

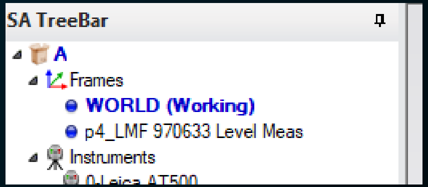




  - Turn the OTG off before moving to the next instrument station



  - Don’t activate the levelling frame -> double correction



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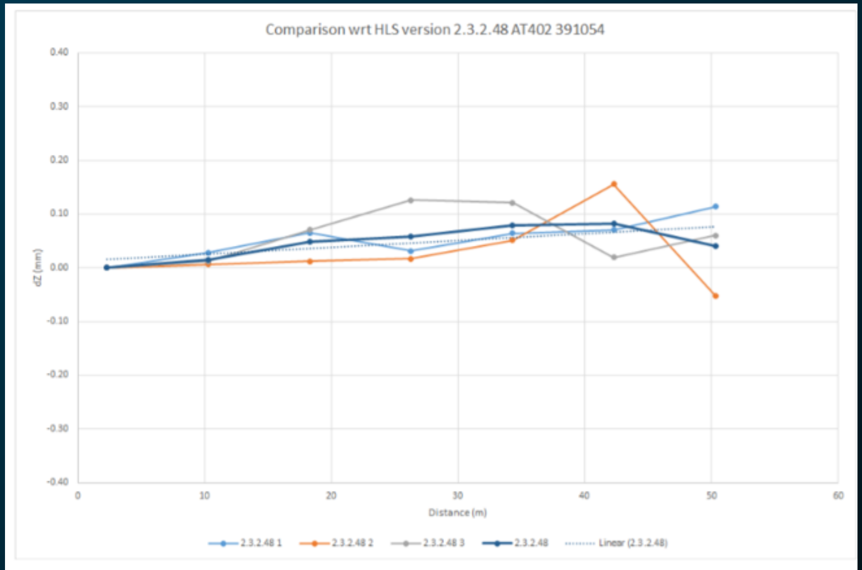
Is the Levelling of AT9x0/AT500 as good as AT403?

ESRF campaign

- Measurement campaign in March 2023 at ESRF in Grenoble to test performance of AT500 compared to AT403
- Levelling on 50 meter HLS bench
- Result: AT500 achieved equivalent performance to AT403 *(note: graphs below don’t have the same scale)*
- Please reach out to David Martin for further details of this measurement campaign

AT403, Measurement Campaign 2016



The average linear trendline has a slope of 1.3 µm/mm.

Source: M. Saure, Presentation IWAA2018 Fermilab

AT500, Measurement Campaign 2023

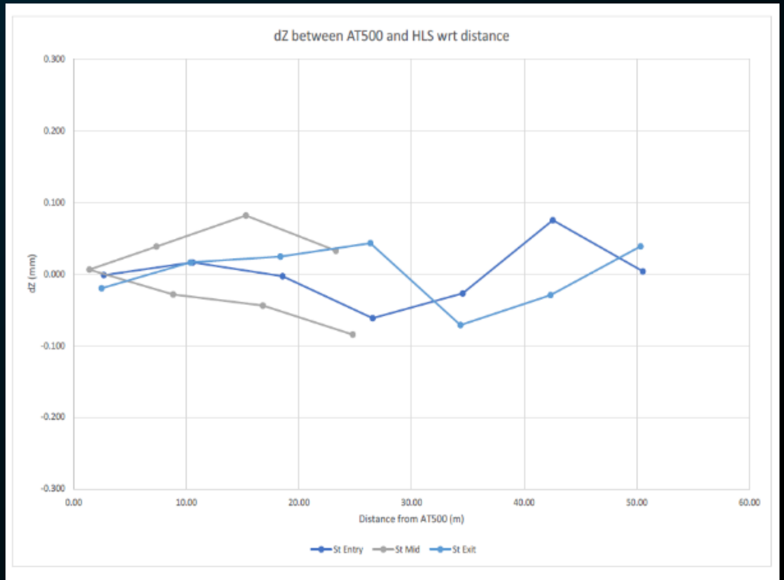


Figure 2 Height difference between HLS and AT500 wrt distance

Source: G. Gatta, Report ESRF-TS-ALGE/2310GG

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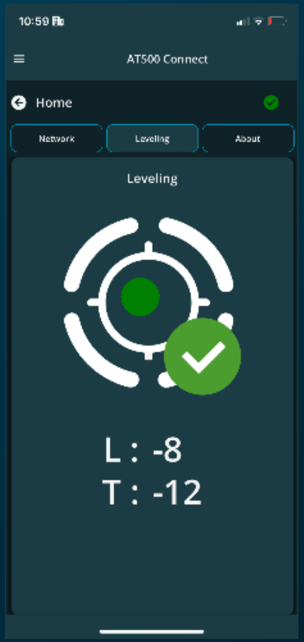
Accessories for Levelling

MAL177

- New adapter MAL177 Levelling Unit introduced in April 2024
- Facilitates levelling instrument into working range for OTG
- Compatible with 3 1/2’’ x 8 UNC thread



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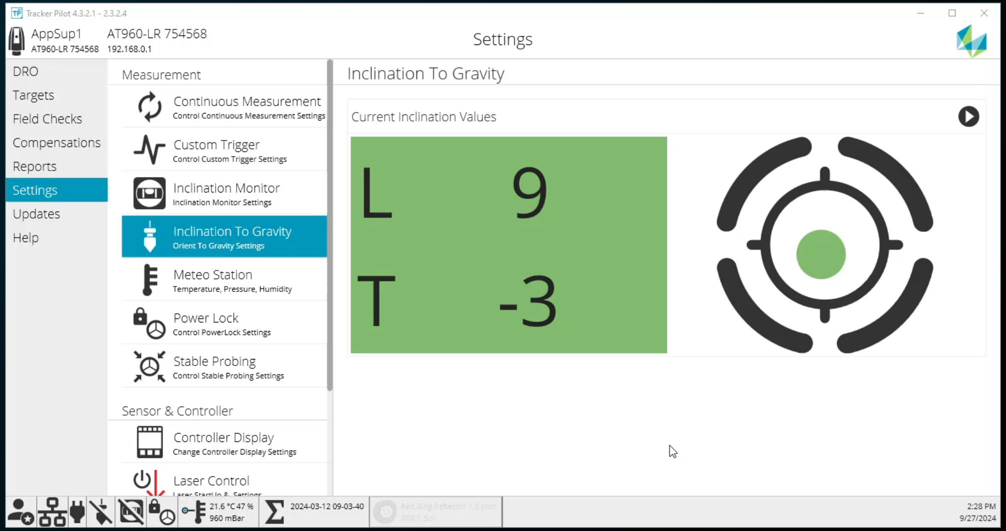
Accessories for Levelling

Automatic Tribrach AD14T

- Sold as special product
- Working range +/- 2.85°
- Automatic levelling of instrument into the working range of the inclination sensor



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Improvements of OTG handling for Leica Absolute Tracker

Conclusions

- There are differences in the handling of OTG data between AT40x and AT9x0/AT500/ATS600 Trackers
- A new function in SA to overcome the differences for certain workflows
- The levelling performance of the AT500 is equivalent to the well-known performance of the AT40x series
- Accessories are available to facilitate the set-up of the instrument for OTG

THANK YOU

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