



# The Leica Absolute Tracker ATS600

CERN, October 2019

# INTRODUCING THE LEICA ABSOLUTE TRACKER

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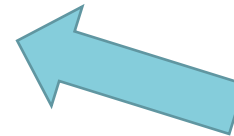
# ATS600 – technology Background



**MS50**  
Next Generation WaveFormDigitizer (WFD) as Absolute Distance Meter  
Measures Uncooperative Targets



**AT960/930**  
Iconic Design  
Responsive Axes



**AT403**  
Faster Automated  
Target Recognition (ATR) for Retro-Reflectors

# ATS600 – Tracker or Scanner? Both! Two modes of operation!

## Reflector Targets

- Tracking
- Powerlock

### Reflectors



RRR 0.5in



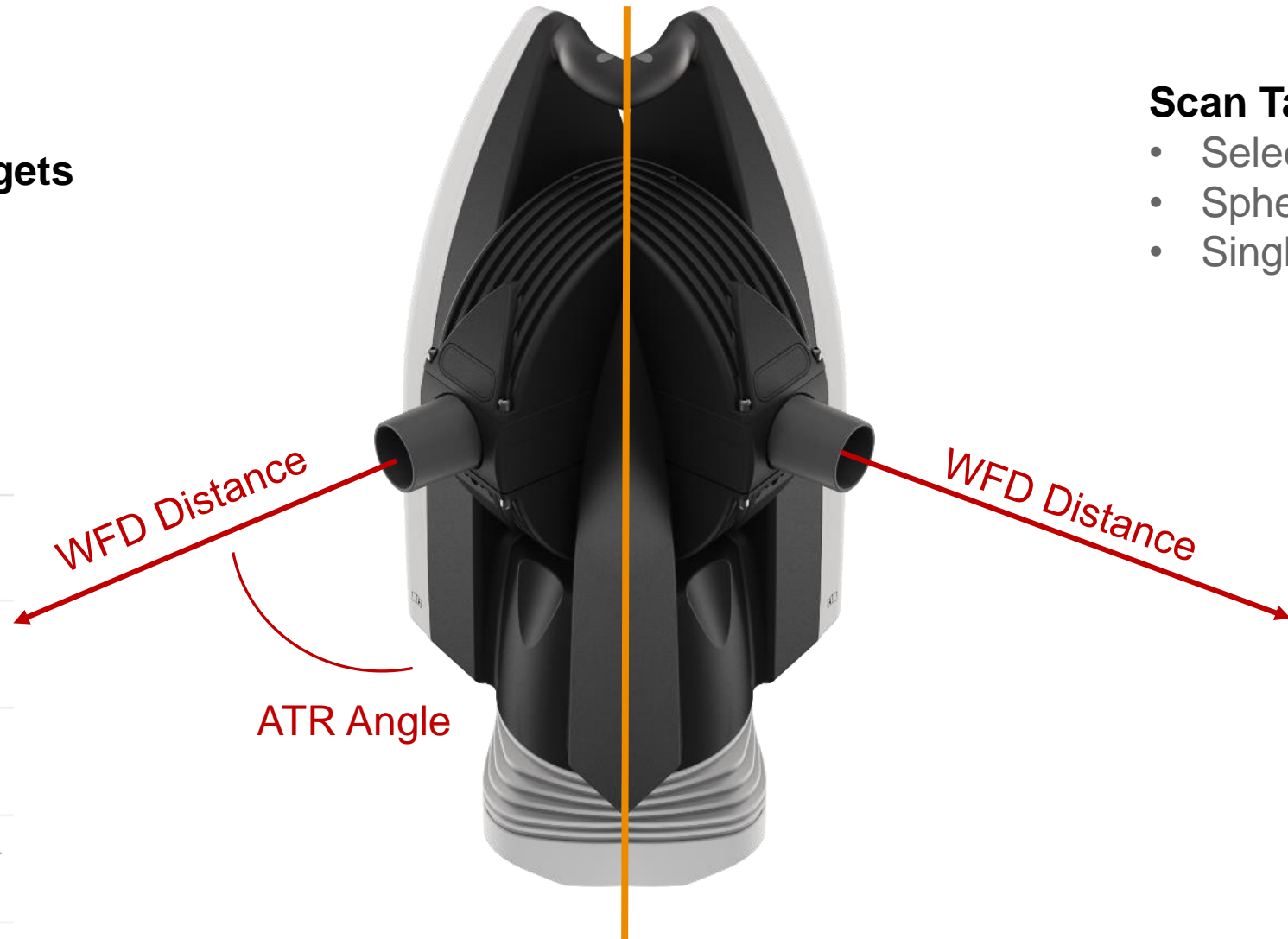
RRR 1.5in



RRR 0.875in



Custom Reflector



## Scan Targets

- Selective Scanning
- Spheres
- Single Surface Points

### Scan Targets



Custom Sphere



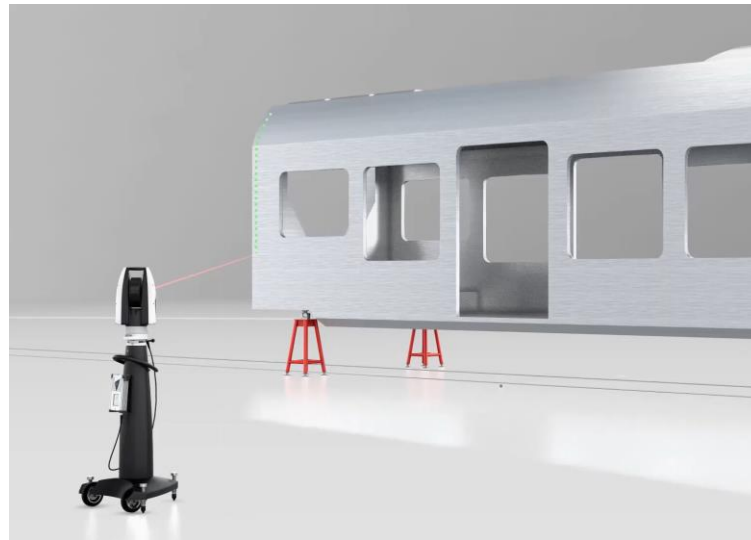
Reference Sphere



Surface

# Worlds First Scanning Laser Tracker

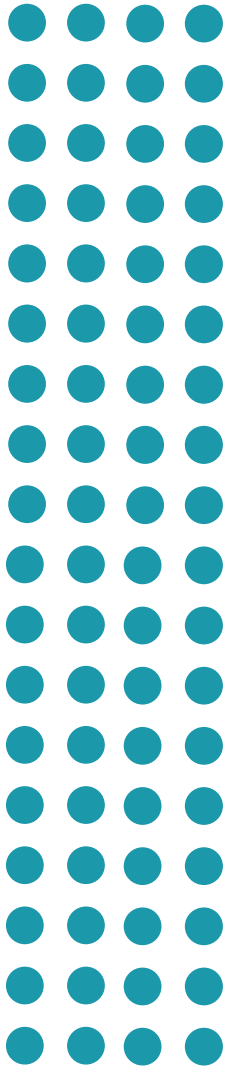
Leica Absolute Tracker ATS600 is a Metrology grade large volume scanner, combining scanning with tactile measurements seamlessly



Scanning Range  
1 to 60 meter



Reflector Range  
1 to 80 meter



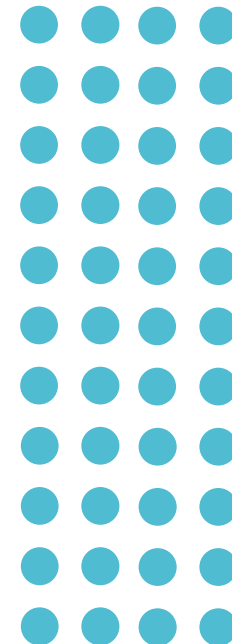
# Selective Scanning



**Leica Absolute Tracker AT600** offers selective scanning capabilities, «only scan data that you really need»

Scanning rate up to 1 kHz

Scanning speed up to 10 sec/m<sup>2</sup> in Fast mode @ 5 m with 50 mm point-to-point and line-to-line spacing



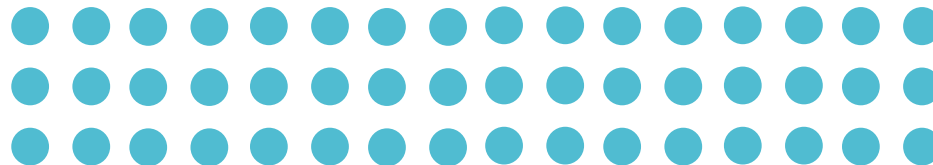
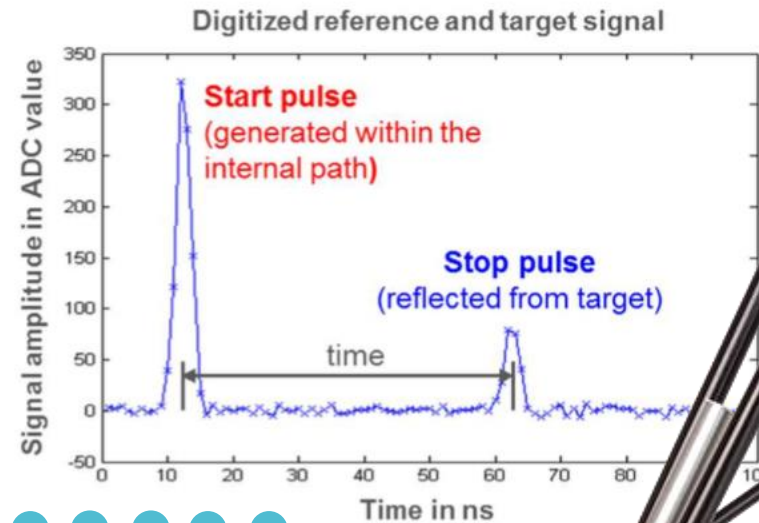
# Scanning Absolute Distance Meter (ADM)

Our new Scanning ADM is based on the well established «Wave Form Digitizing» technology, which is used in many other Leica Geosystems instruments

The WFD combines the principles of time-of-flight and phase-shift measurement technologies, where the distance is calculated based on the time between a start and stop pulse, that is digitized out of the the received signal

The WFD system constantly evaluates, digitizes and accumulates the waveform of all reflected signals to precisely recognize and extract the start and stop pulses

The Scanning ADM is a class 2 laser (eye-safe)



# ATS600 Tracking Accuracy

According to ISO10360-10:2016

Absolute Angular Performance<sup>1</sup>

eT

±15 µm + 6 µm/m

(Same accuracy as the AT403 and AT960)

Length Measurement<sup>2</sup>

E<sub>uni:0:LT,MPE</sub>

±100 µm

<sup>1</sup>Angular Performance Transverse eT according to ISO10360-10:2016, this respects to a MPE for the Location Error (Dia.2x1:P&R:LT,MPE) in accordance with chapter 6.3 of ISO 10360-10:2016 of ±30 µm + 12 µm/m

<sup>2</sup>In accordance to ISO10360-10:2016 chapter 6.4, table 4 positions 1-35

### SPECIFICATIONS

**Accuracy**

- Reflector Measurement

Absolute Angular Performance <sup>1</sup>	± 15 µm + 6 µm/m
Length Measurement (E <sub>uni:0:LT,MPE</sub> ) <sup>2</sup>	± 100 µm

All accuracies specified as Maximum Permissible Error (MPE). Typical values are half of MPE.

- Non-Contact Measurement

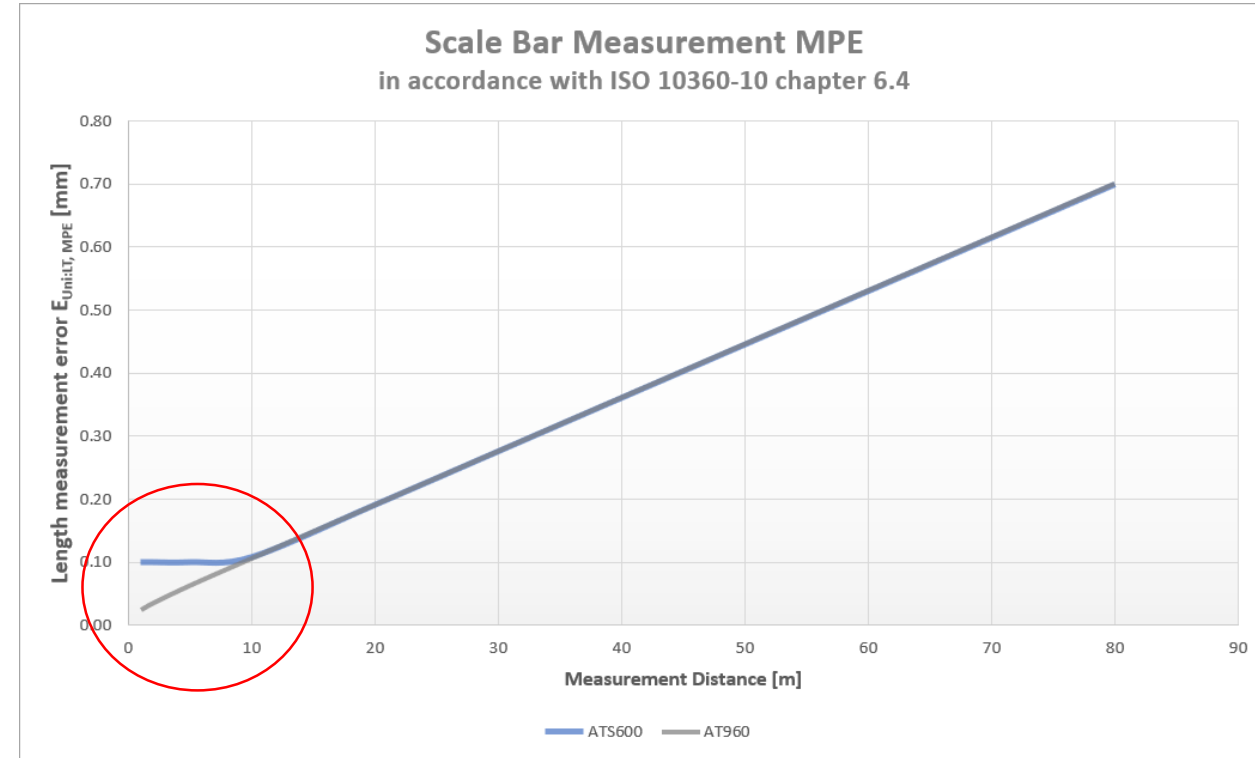
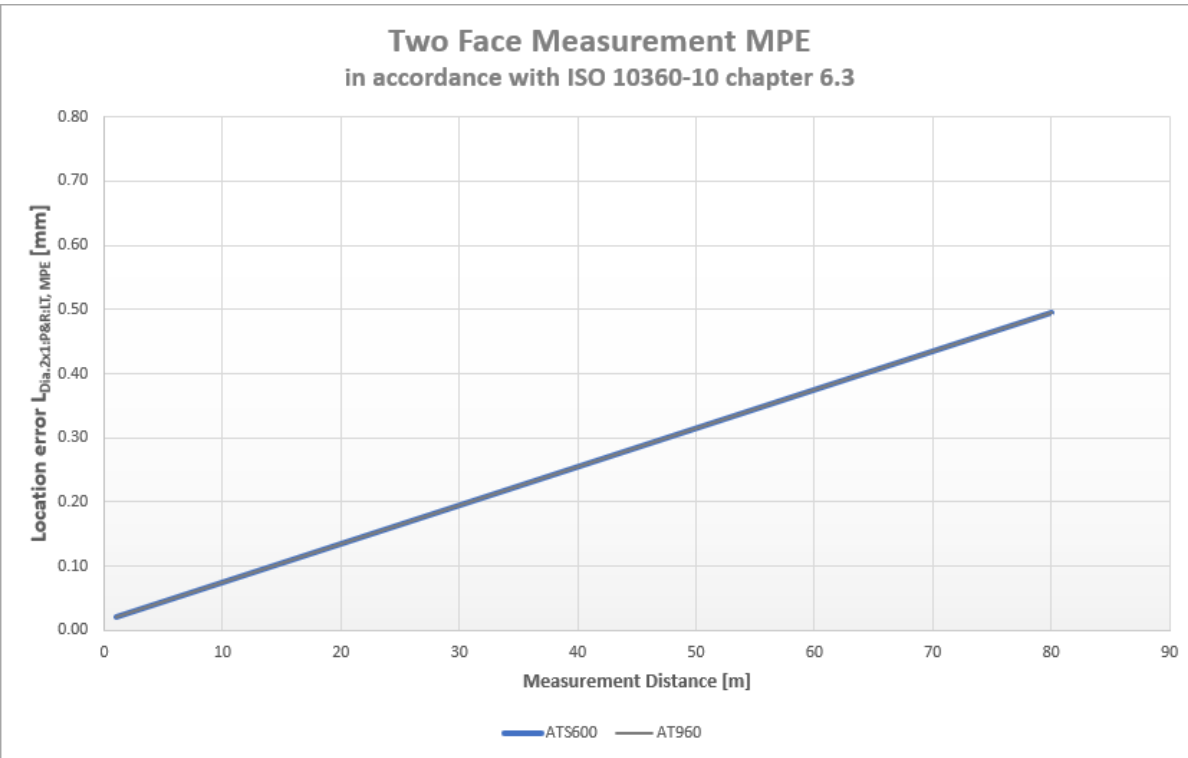
Range Noise <sup>3</sup>	< 80 µm
Absolute Accuracy <sup>4</sup>	< ± 300 µm

<sup>1</sup>Angular Performance Transverse e, according to ISO 10360-10:2016, this respects to a MPE for the Location Error (Dia.2x1:P&R:LT,MPE) in accordance with chapter 6.3 of ISO 10360-10:2016 of ± 30 µm + 12 µm/m.  
<sup>2</sup>In accordance with ISO 10360-10:2016 chapter 6.4, table 4, positions 1 - 35.  
<sup>3</sup>Standard deviation (1σ) of a best-fit plane (78% albedo), distance 1 - 30 meter, standard measurement mode, target aligned  
<sup>4</sup>Maximum Deviation (MPE) of the absolute position of a plane (78% Albedo), 1 to 30 meter, 0 to ± 45° incidence angle





# ATS600 Laser Tracker Accuracy ctd.

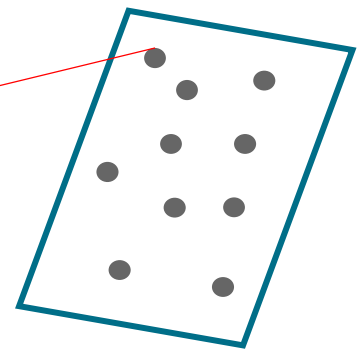


Model	Two Face Measurement $L_{\text{Dia.2x1:P\&R:LT,MPE}}$	Scale Bar Measurement $E_{\text{Uni:LT,MPE}}$
ATS600	$\pm 15 \mu\text{m} + 6 \mu\text{m/m}$	$\pm 100 \mu\text{m} (< 10 \text{ m})$ $\pm 18 \mu\text{m} + 8.5 \mu\text{m/m} (> 10 \text{ m})$
AT930/AT960 AT403	$\pm 15 \mu\text{m} + 6 \mu\text{m/m}$	$\pm 18 \mu\text{m} + 8.5 \mu\text{m/m}$

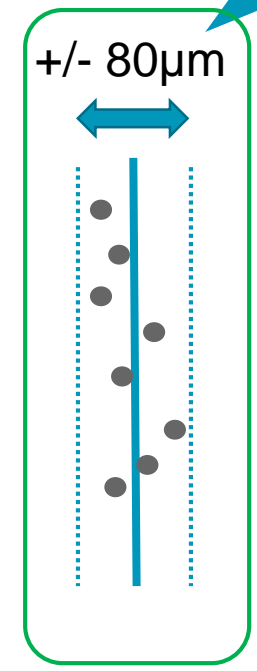
# Accuracy - Reflectorless



30 meters



Reference plane



This is the NOISE

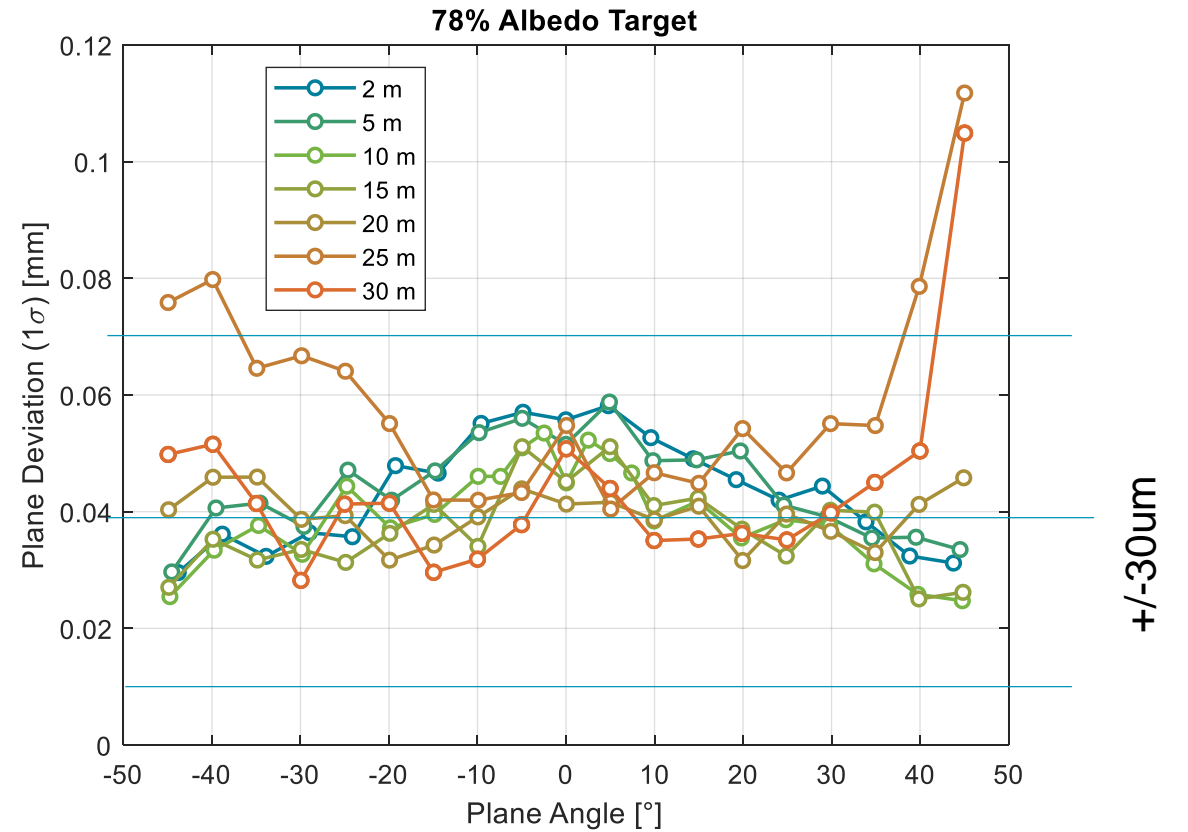
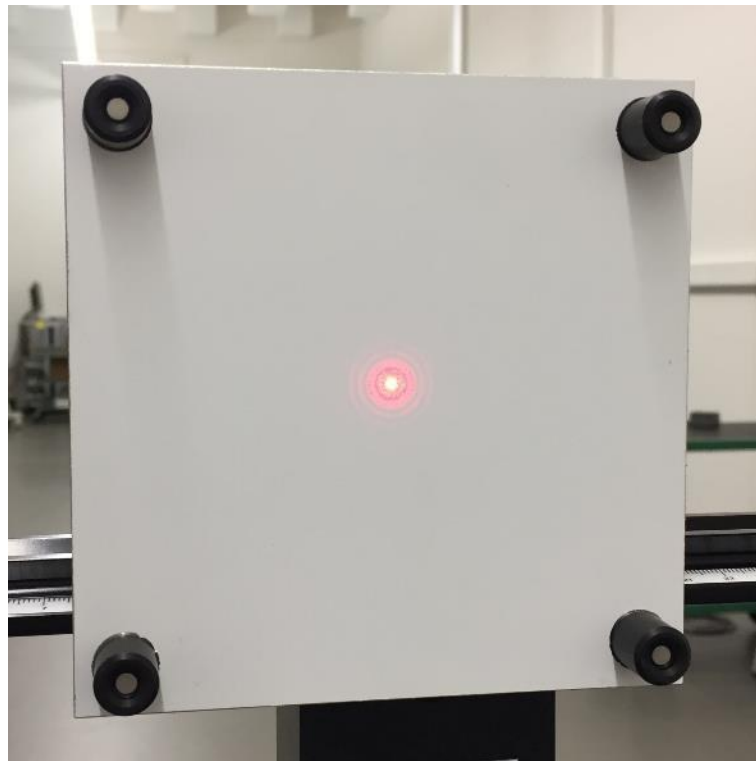
This is the LOCATION

Range Noise<sup>1</sup> < +/- 80µm  
Absolute Accuracy<sup>2</sup> < ± 300µm

±0.3mm  
True position

# Range Noise – Reference Plane

(specs +/-80 um)



<sup>3</sup> Standard deviation ( $1\sigma$ ) of a best-fit plane (78% albedo), distance 1.5 to 30 metres, standard measurement mode, target aligned.

<sup>4</sup> Maximum Deviation (MPE) of the absolute position of a plane (78% Albedo), 1.5 to 30 metres, 0 to  $\pm 45^\circ$  incidence angle.

Typical performance. Hexagon does not guarantee values beyond specifications.

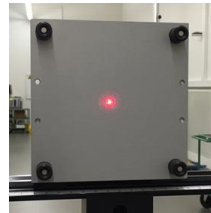
# ATS600 A Benchmark in Scanning Accuracy

ATS600 Range Noise ( $1\sigma$ ) significantly less than Terrestrial Laser Scanners (TLS),  $< 0.1$  mm

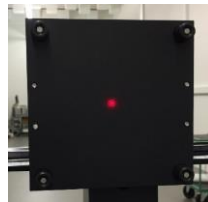
Absolute scanning accuracy of ATS600 to a variety of common materials better than  $\pm 0.3$  mm (best-fit plane 95%)

Very large incidence angle ( $> 45^\circ$ ) on many materials with almost no decrease in accuracy

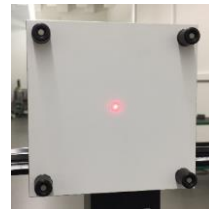
## Tested Material Samples



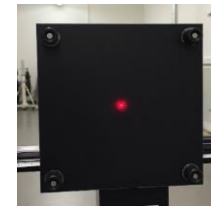
MELOX FBL



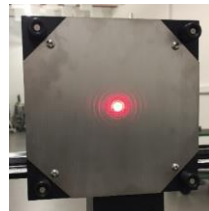
MELOX SW



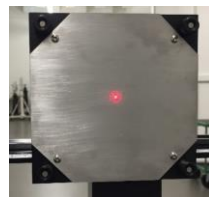
A1



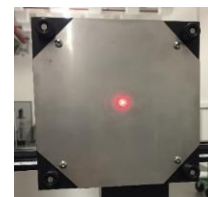
A4



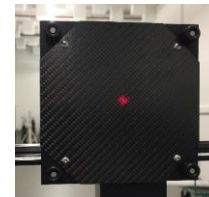
Steel brushed vertical



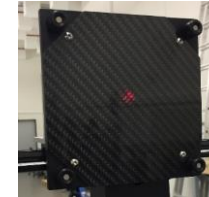
Steel brushed horizontal



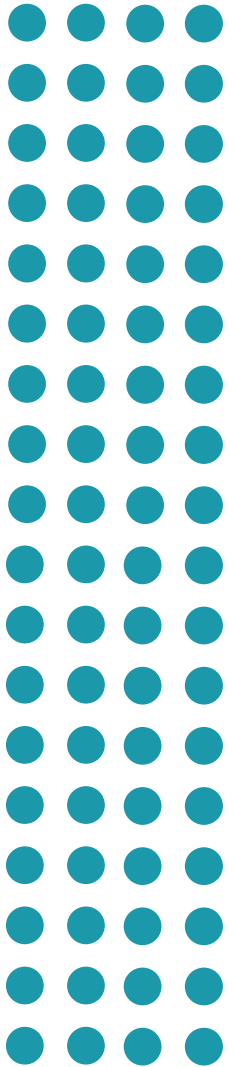
Steel bright (polished)



Carbon rough (texture)



Carbon smooth (polished)

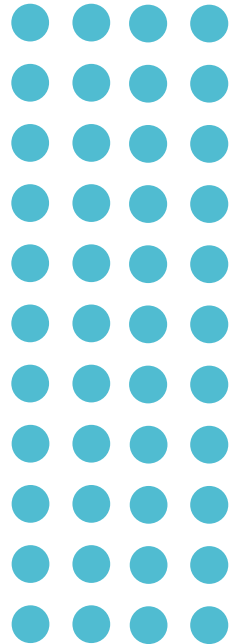


# Application Software Workflow

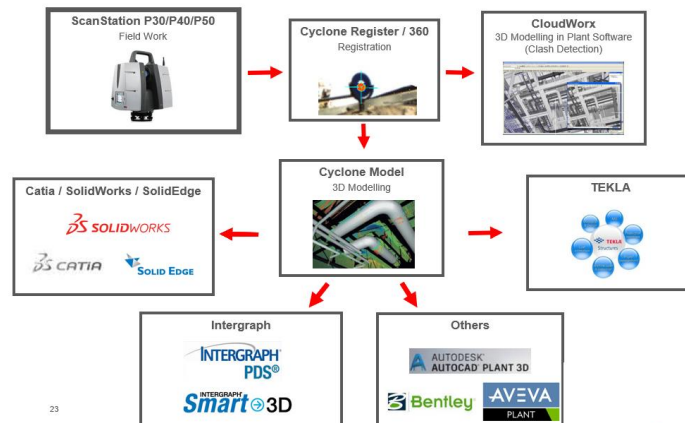
The **ATS600** offers true Metrology workflows of integration of large scale scan data in metrology software

Point cloud data from ATS600 is directly available within the application software for immediate feedback, i.e. Build & Inspect

Terrestrial Laser Scanners are quite fast to take a full dome scan, but it takes a significant amount of time to import the point cloud into an application software package



Workflow TLS Scanners



Workflow ATS600



# Application Software

- New interface (LMF v1.6) implemented,



<http://discoverinspire.com>



- Informed, working on interface

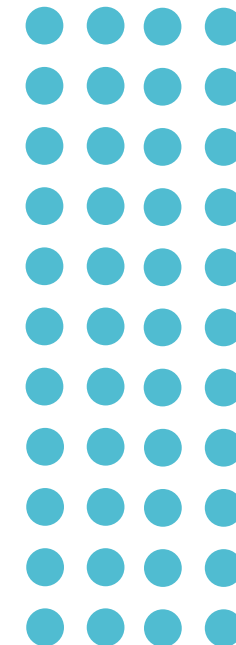
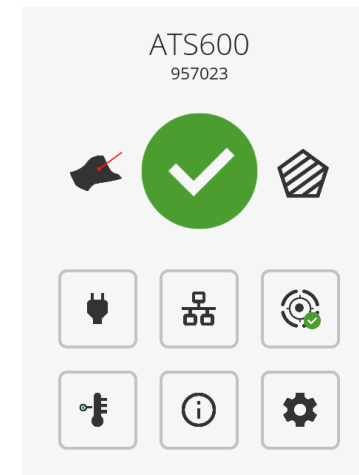
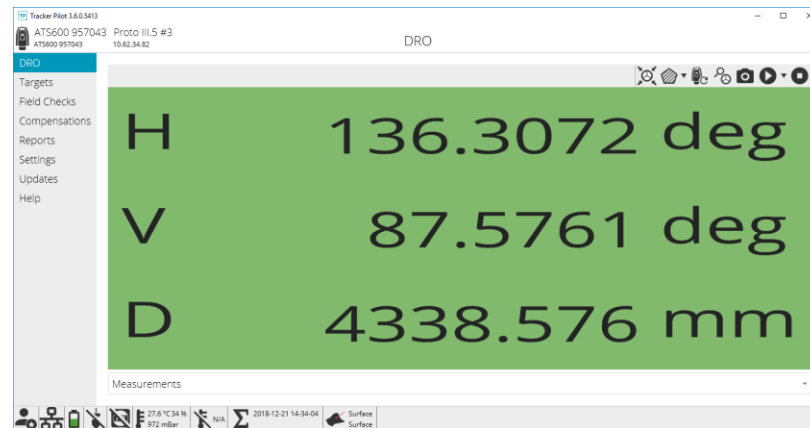


# Application Integration



**Leica Absolute Tracker ATS600** is compatible with LMF software development kit (SDK), it is easy to integrate into Metrology software packages

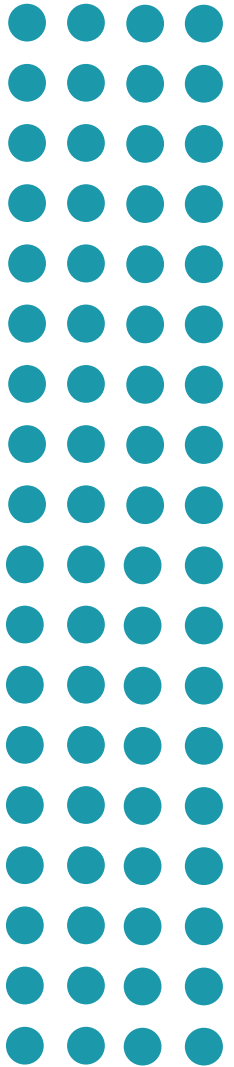
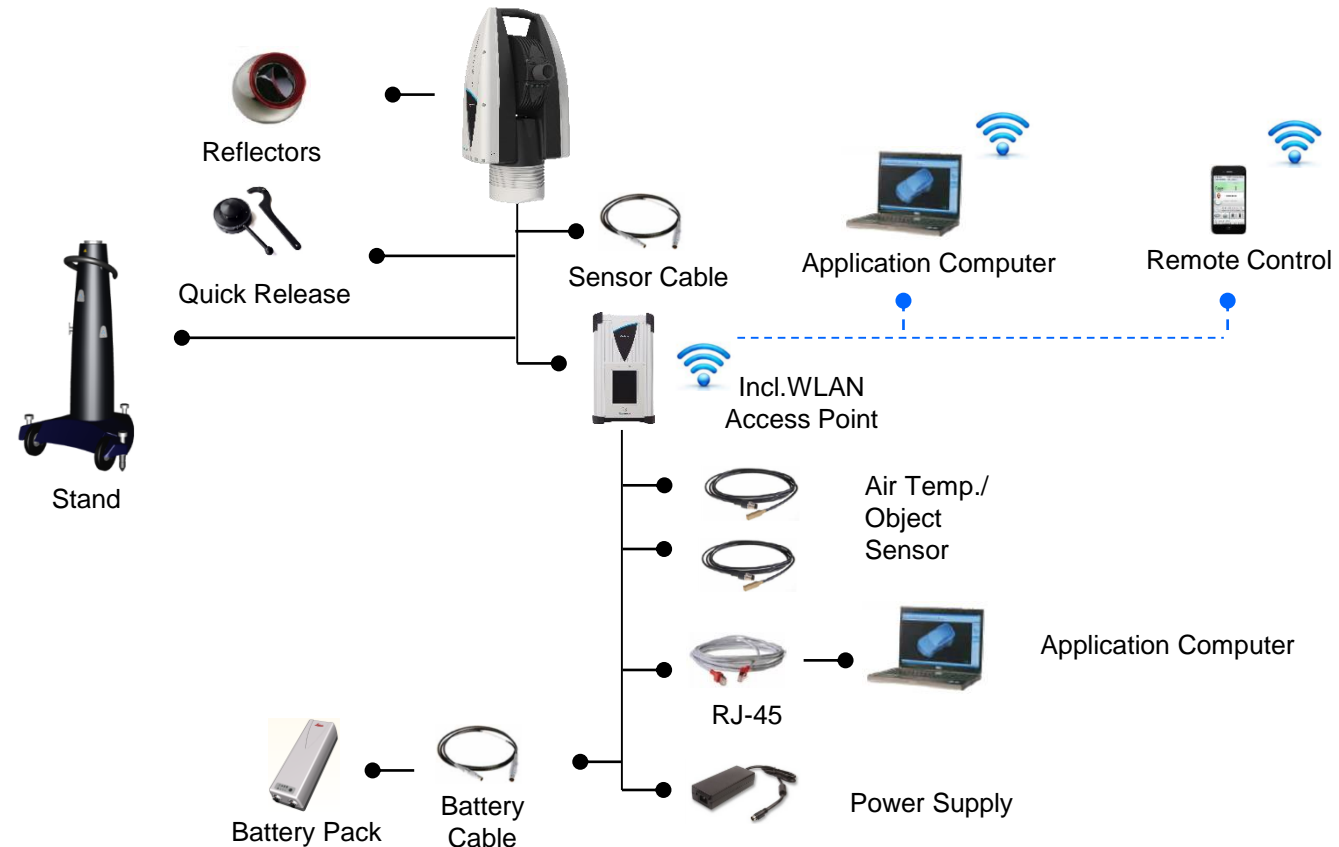
New design of Tracker Pilot and Controller screens, adapting Hexagon style guides



# System Components

The **ATS600** has been developed on the basis of the successful AT9x0 platform

Many accessories are compatible between ATS600 and AT930/AT960





# ATS600 – Key Features



All-in-one system design



Power Lock

1KHz >

1 kHz Data Output



Orient to Gravity



Overview Camera



Smart Connectivity



IP54

IP54 Certification



Battery Power



Built-in Meteo Station



Measurement Volume



24 month warranty





# Good reasons to look closer to the ATS600

1. It is a laser tracker- can measure with reflectors in large volume @ Laser tracker accuracy
2. The workflow allows immediate results
3. It enables to measure reflectorless
4. It allows fast and precise selective scanning



THANK YOU!