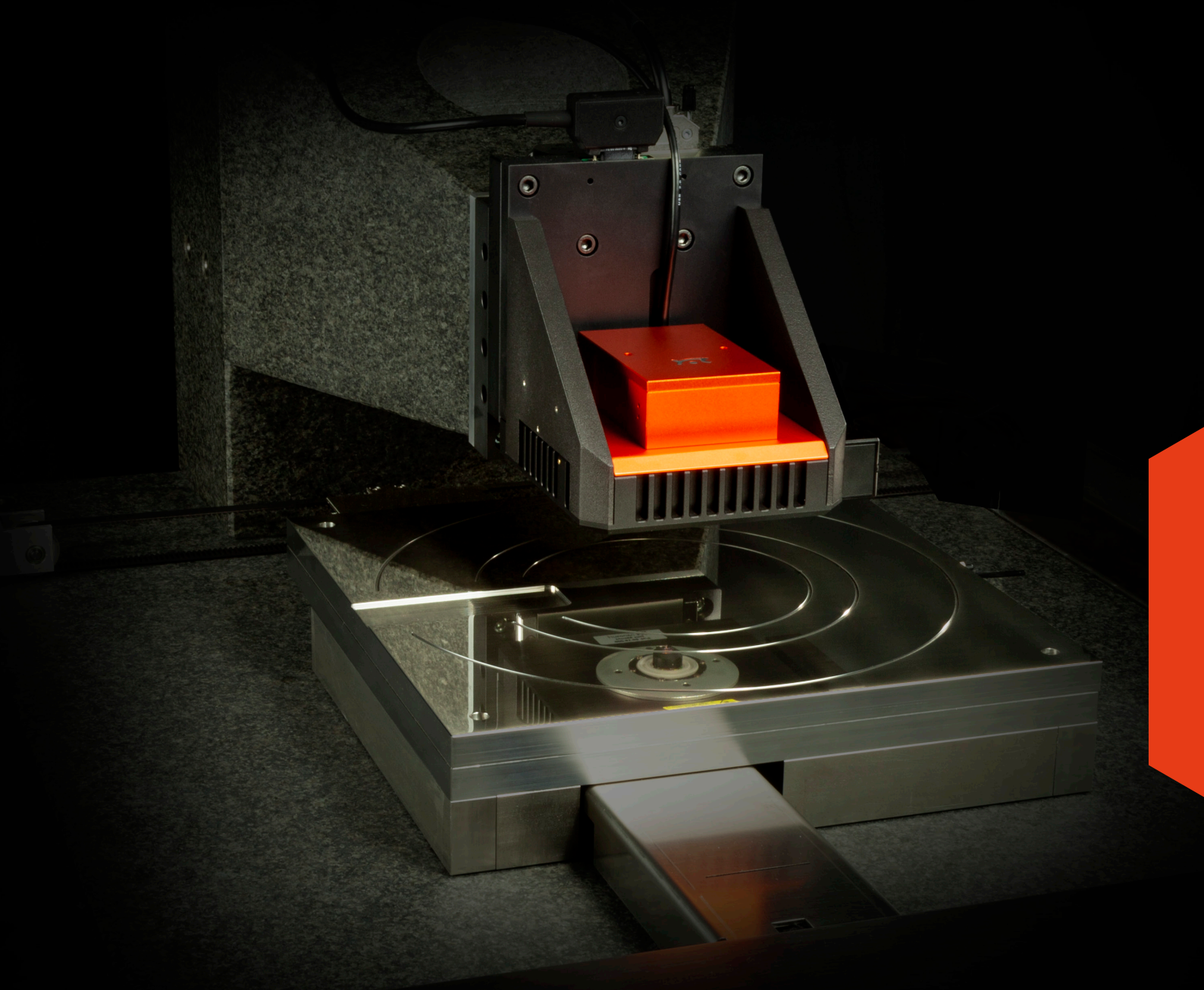
Next-Level Nanotechnology Tools swiss quality

Alphacen 300

The tip-scanning AFM for heavy & large samples up to 300 mm



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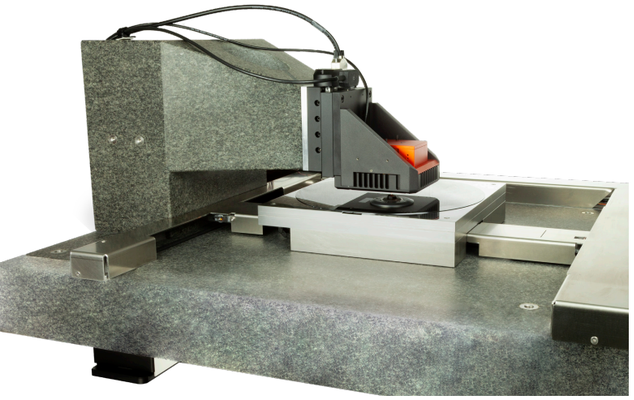


Alphacen 300 mm: The tip-scanning AFM for large and heavy samples

Nanosurf is the market leader for custom developed systems for large and heavy samples. Over the past years our team has built a substantial knowledge base developing these custom stages for various customers.

Utilizing this vast body of knowledge, we have now developed a standard product for large samples up to 300 mm or heavy samples up to 45 kg. The Alphacen 300 reduces the price and the delivery time compared to a custom system.

Handle heavy samples with ease thanks to tip scanning and air bearings

Heavy samples demand special handling: the Alphacen 300 can move samples up to 45 kg virtually frictionless with a repositioning accuracy of 2 µm thanks to the employed air bearings. The sample stage is lifted up using pressurized air or nitrogen, and high-precision belts move it as required. Once the area of interest on the sample is reached, the air pressure is released, putting the sample in position for measurement without stage drift. For scanning Alphacen 300 uses tip-scanning technology, keeping the size and weight of the moving parts at a minimum.

Run automated measurement series

The Alphacen 300 includes powerful automation software that allows the user to preselect the locations of interest, either on an optical image or a stage map, and let the system collect the images with no user intervention. Set up a measurement series on your sample (or multiple samples) and safely let the system do the rest.

Large samples

The Alphacen 300 AFM system has a sample stage that can move 300 mm x 300 mm in XY and can measure every point on a 300 mm sample. On request, the stage can be modified to handle a larger range in X (up to 500 mm).

The XY stage has a resolution of 1 µm and a positioning accuracy of 2 µm which allows for precise positioning of the sample under the imaging tip.

The software's integrated automation feature enables time saving pre-programming of measurement series.

Heavy glass samples

Most large sample AFMs are capable of handling planar samples up to 200 mm, typically geared toward analysis of semiconductor wafers. However, one of the limitations of these systems is the sample weight that they can handle.

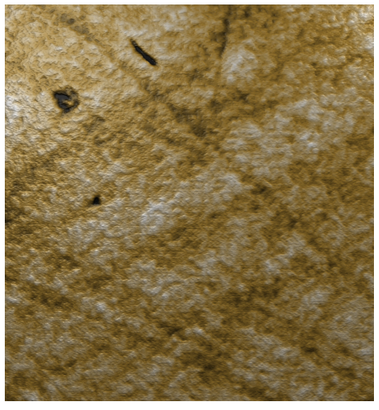
Alphacen 300 addresses the need for a standard AFM capable of imaging large and heavy samples with a weight limit of up to 45 kg. The Z-stage travel of 50 mm also allows for imaging of samples that are not thin silicon wafers.

Large, heavy samples are quite commonplace in the optical industry, e.g. in the production of large lenses and semiconductor industry, e.g. assembled cassettes or completed products.

SiC steps

Scan size:
1.5 µm x 1.5 µm

The scan shows the step heights of 0.75 nm between each terrace.



Glass

Scan size:
5 µm x 5 µm

Surface roughness:
0.112nm RMS
(0.087nm Ra)

System functionality

Standard imaging modes	Static force, dynamic force, phase contrast, MFM, friction force, force modulation, spreading resistance, EFM
Imaging functions	Up to 8000×8000 data points X/Y sample slope correction
Standard spectroscopy modes	Force–distance, amplitude–distance, phase–distance, tip current–tip voltage
Spectroscopy functions	Setup wizard for each spectroscopy mode XY-position table: point, line, and grid
Standard lithography modes	Free vector objects drawing or real-time drawing by mouse Tip lift or force control during movement from point to point
Sample approach	Fast home, retract, and advance movement Automatic step-by-step approach

CX Controller specifications

High resolution outputs (DAC)	12x 28 bit, 1 MHz/sampling; thereof 4x user DAC, ±10V/3dB@200kHz
Fast outputs (DAC)	4x 16 bit, 100 MHz/sampling; thereof 1x user DAC, ±1V/3dB@10MHz
High resolution inputs (ADC)	10x 20 bit, 1 MHz/sampling; thereof 4x user ADC, ±10V/3dB@200kHz
Fast inputs (ADC)	3x 16 bit, 100 MHz/sampling; thereof 1x user ADC, ±1V/3dB@10MHz
Signal analyzers	2 signal analyzer function blocks that can be configured as dual channel lock-in
FPGA module and embedded processor	System-on-chip module with low-latency FPGA signal processing at 100MHz and dual-core ARM processor, 2GB RAM, 1.5GHz clock
Scan control	28Bit X/Y/Z-DAC with ±10V/3dB@200kHz
Detector inputs	Deflection/lateral signals each 16 bit/3dB@10MHz and 28 bit/3dB@200kHz
Digital sync, Spike-Guard	2-bit line/frame sync out 5 V/TTL galvanically isolated, Spike-Guard input
Clock sync	10MHz/3V clock input to synchronize data acquisition and processing
Communication to PC	Gigabit Ethernet, galvanically isolated

Scanner specifications

Scan head type	Tip scanner
Maximum XY scan range	100 µm(1)
Maximum Z-range	10 µm(1)
XY linearity mean error	< 0.1%
XY flatness at max. scan range	typ. < 5 nm
Z-sensor noise level (RMS)	typ. 150 pm / max. 200 pm
Z-measurement noise level (RMS, static mode in air)	typ. 100 pm / max. 200 pm
Z-measurement noise level (RMS, dynamic mode in air)	typ. 25 pm / max. 35 pm
Optical detection light source	850 nm low coherence SLD
DC detector noise	<10 pm RMS (0.1Hz to 1kHz)
AC detector noise	<60 fm $Hz^{-1/2}$ above 100 kHz
Detector bandwidth	DC to 4 MHz

(1) Manufacturing tolerances ±10%

Stage specifications

Top view field of view	5 MP, 1.5 mm x 1.1 mm
Side view field of view	5 MP, 3.2 mm x 3.2 mm
Max. sample size	300 mm x 300 mm x 45 mm
Max. sample weight	40 kg
Vacuum chuck for	4" / 6"/ 8" / 12" wafers
Motorized XY travel range	300 mm x 300 mm
Motorized approach range	50 mm
System dimensions	1008 mm x 1887 mm x 1208 mm (fits through 800 mm door prior to assembling the acoustic enclosure)
System weight	833 kg
Stage XY resolution	< 1 µm
Unilateral repositioning accuracy	2 µm
Acoustic isolation	~30 dB above 250 Hz
Vibration isolation	Active vibration isolation

Full Alphacen 300 system in acoustic enclosure. The system features two orthogonal side view cameras to allow easy sample navigation in its closed state.

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