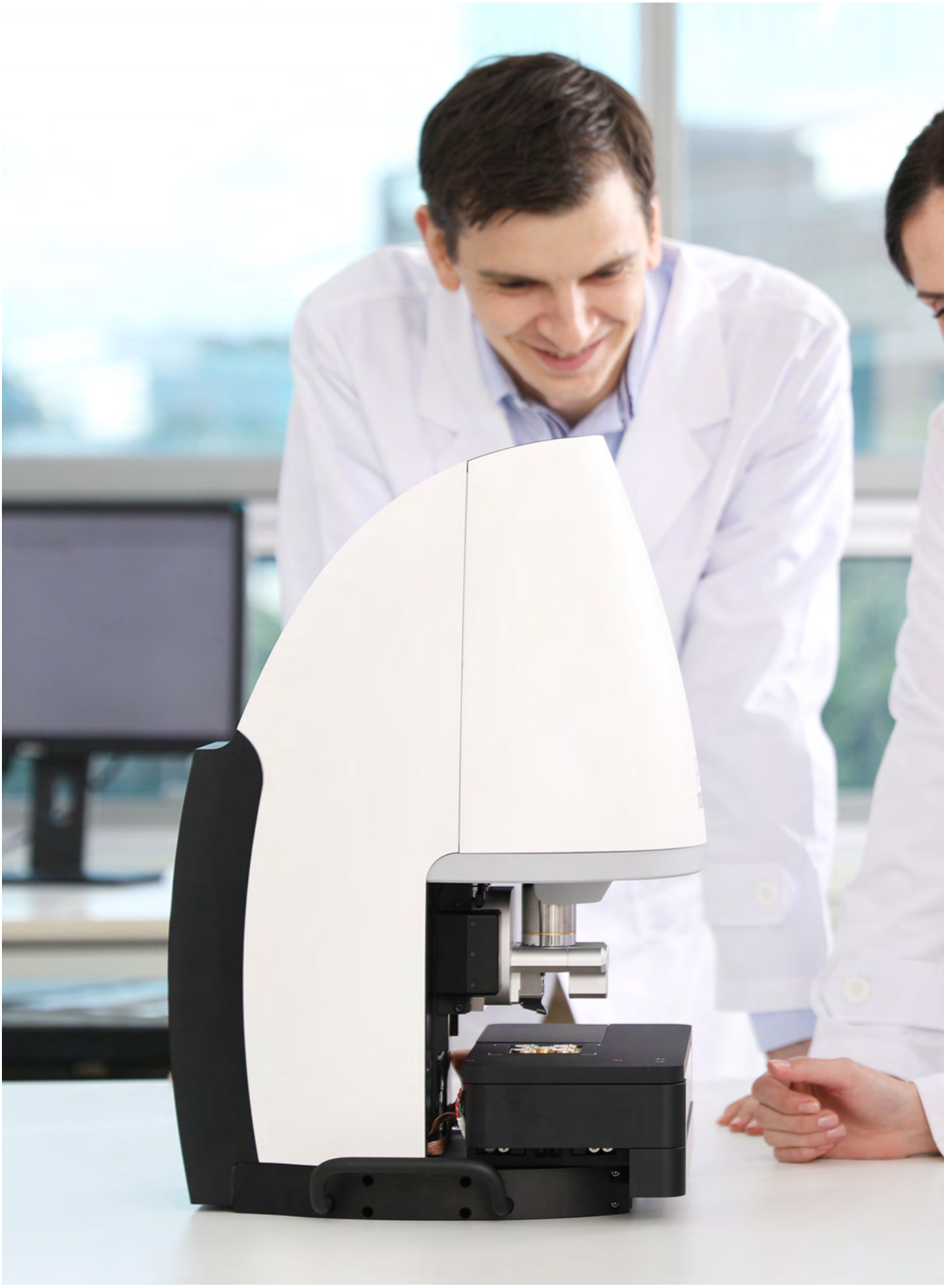
ATOMIC FORCE MICROSCOPE

Park FX40

A Groundbreaking New Class of Atomic Force Microscope for Nanoscientific Research: The Autonomous AFM



Park FX40

A Groundbreaking New Class of Atomic Force Microscope for Nanoscientific Research: The Autonomous AFM

Effortlessly, get the sharpest, clearest, highest resolution images one sample after another on multiple applications. Boost your progress and scientific discoveries through unprecedented speed and accuracy - as the Park FX40 infuses artificial intelligence with robotics, enabling automated processes and machine learning for your nanoscale microscopy needs. Additional axis cameras automatically align in synch with laser beams and photodetectors. Early warning systems and fail-safes, in addition to information extraction and storage at every step of the way allows scientists and researchers like you to push past human limits - all without specialized microscopy training.

Park FX40

The Automatic AFM

Turbo charge your Research and Development with next level tech:

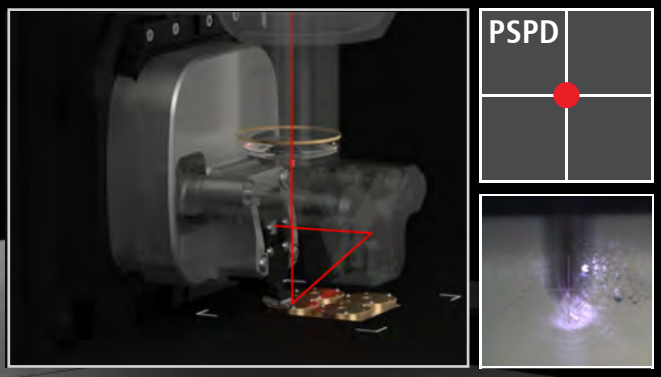
- The first dual-camera system ever adopted in research AFM
- Machine learning automation with updatable data

Auto Probe Identification

The Probe Recognition Camera reads the QR code imprinted on the chip carrier of a newly loaded probe and extracts and displays all pertinent information on each of the tips available, including the type, model, application, and usage. This enables you to select the best probe tip for each job.

Auto Probe Exchange

With automated probe exchange, users can now replace old probes easily and safely in full automation. Harnessing the convenience of an 8-probe cassette, along a magnetic controlled mechanism, probes can be mounted without the user handling them.



Auto Beam Alignment

Automatic Beam Alignment positions the SLD beam onto the proper location of a cantilever and further optimizes the PSPD position both vertically and laterally.
One simple click shifts the X,Y and Z axis for clearer images, with no distortion.

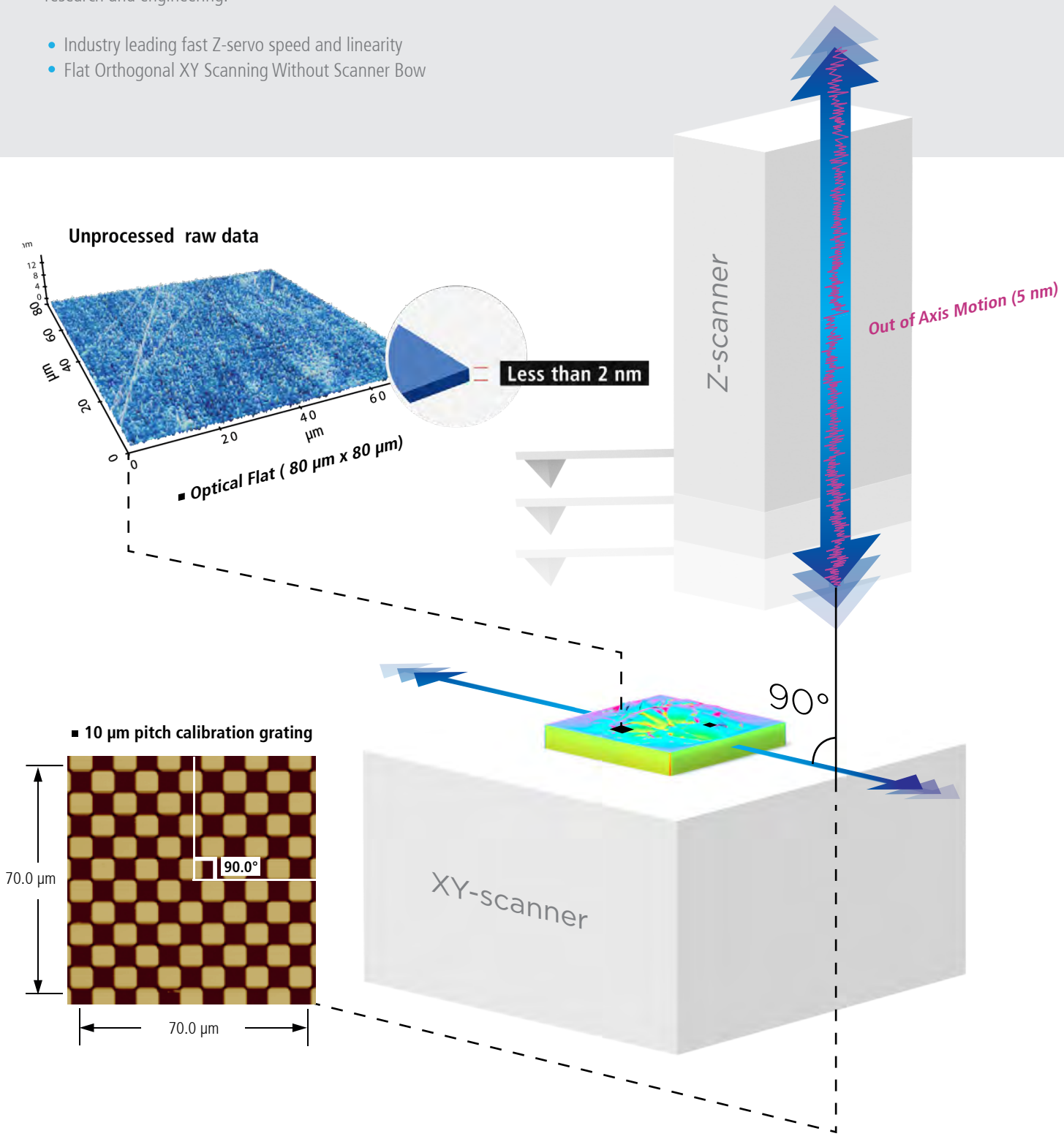
Park FX40

AFM Technology

Most Accurate Scan System by Crosstalk Elimination

Park's Crosstalk Elimination removes scanner bow, allowing flat orthogonal XY scanning regardless of scan location, scan rate, and scan size. It shows no background curvature even on flattest samples, such as an optical flat, and with various scan offsets. This provides a very accurate height measurement and precision nanometrology for the most challenging problems in research and engineering.

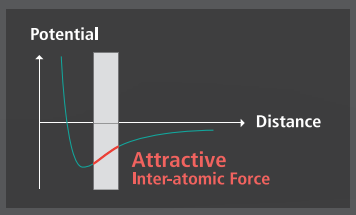
- Industry leading fast Z-servo speed and linearity
- Flat Orthogonal XY Scanning Without Scanner Bow



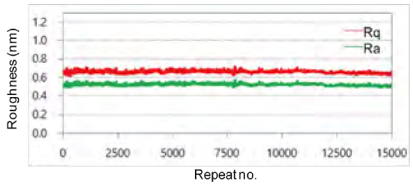
The Fastest, Most Accurate, True Non-contact™ Mode Ever in an AFM

True Non-Contact™ Mode is a scan mode unique to Park AFMs that produces high resolution and accurate data. It achieves unprecedented control over tip-sample distance at the sub-nanometer scale. The Park FX40 has a faster and more accurate True Non-contact mode than any other AFM on the market.

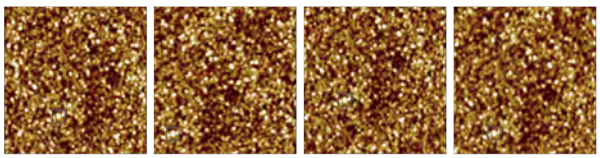
- Less tip wear → Prolonged high-resolution scan
- Non-destructive tip-sample interaction → Minimized sample modification
- Immunity from parameter dependent results



Unlike in contact mode, where the tip contacts the sample continuously during a scan, or in tapping mode, where the tip touches the sample periodically, a tip used in non-contact mode does not touch the sample. Because of this, use of non-contact mode has several key advantages. Scanning at the highest resolution throughout imaging is now possible as the tip's sharpness is maintained. Non-contact mode avoids damaging soft samples as the tip and sample surface avoid direct contact.



Repeat	1st	...5 000th	...1 0000th	...1 5000th	Total Avg.	1σ (%)
Rq(nm)	0.669	0.6740	.665	0.642	0.662	0.011 (1.720%)
Ra(nm)	0.527	0.5350	.525	0.5080	.524	0.010 (1.835%)

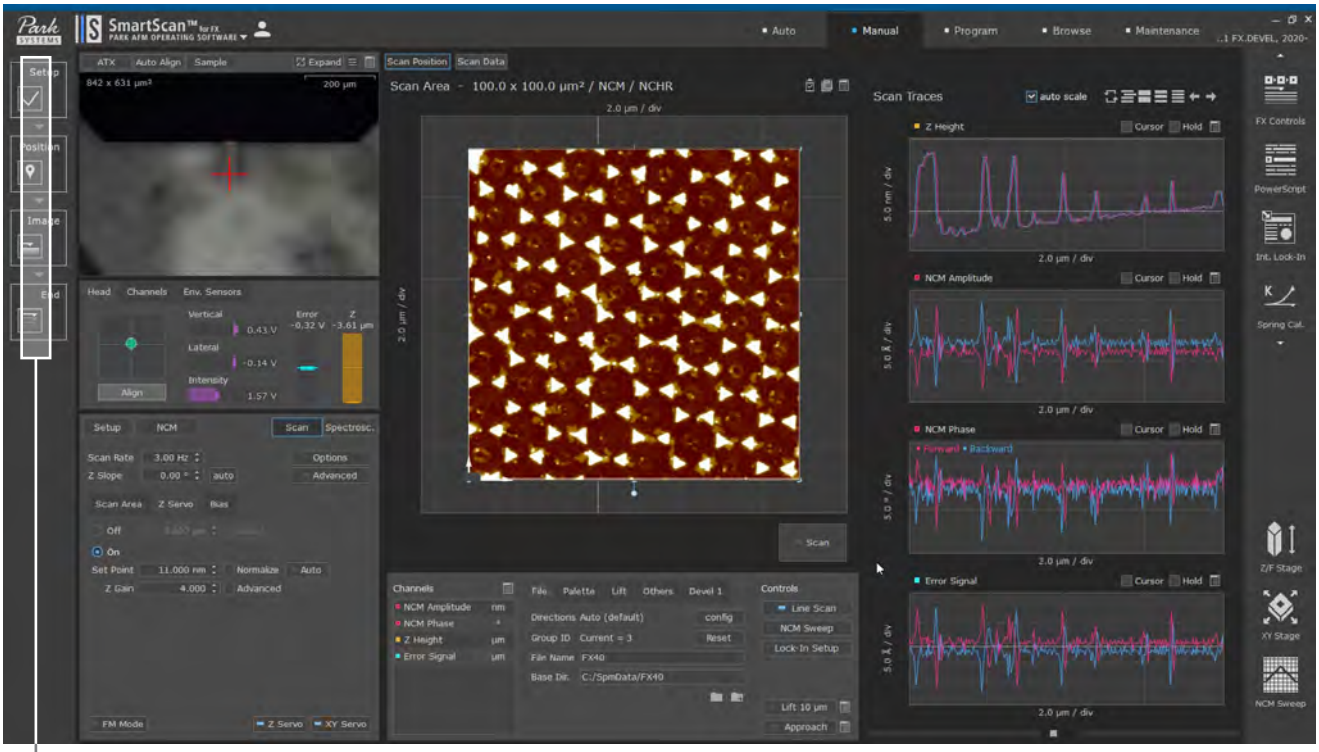


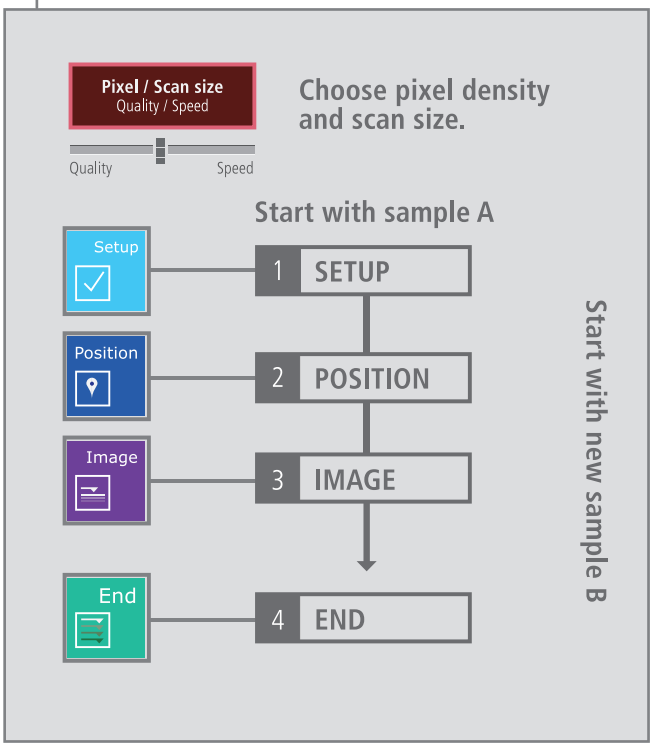
1st image | 5,000th | 10,000th | 15,000th

Furthermore, non-contact mode senses tip-sample interactions occurring all around the tip. Forces occurring laterally to tip approach to the sample are detected. Therefore, tips used in non-contact mode can avoid crashing into tall structures that may suddenly appear on a sample surface. Contact and tapping modes only detect the force coming from below the tip and are vulnerable to such crashes.

SmartScan™ for FX
PARK AFM OPERATING SOFTWARE

The Best AFM Experience
Park SmartScan OS for FX





Simplicity from start to scan with 3 simple clicks of Park SmartScan™

SETUP

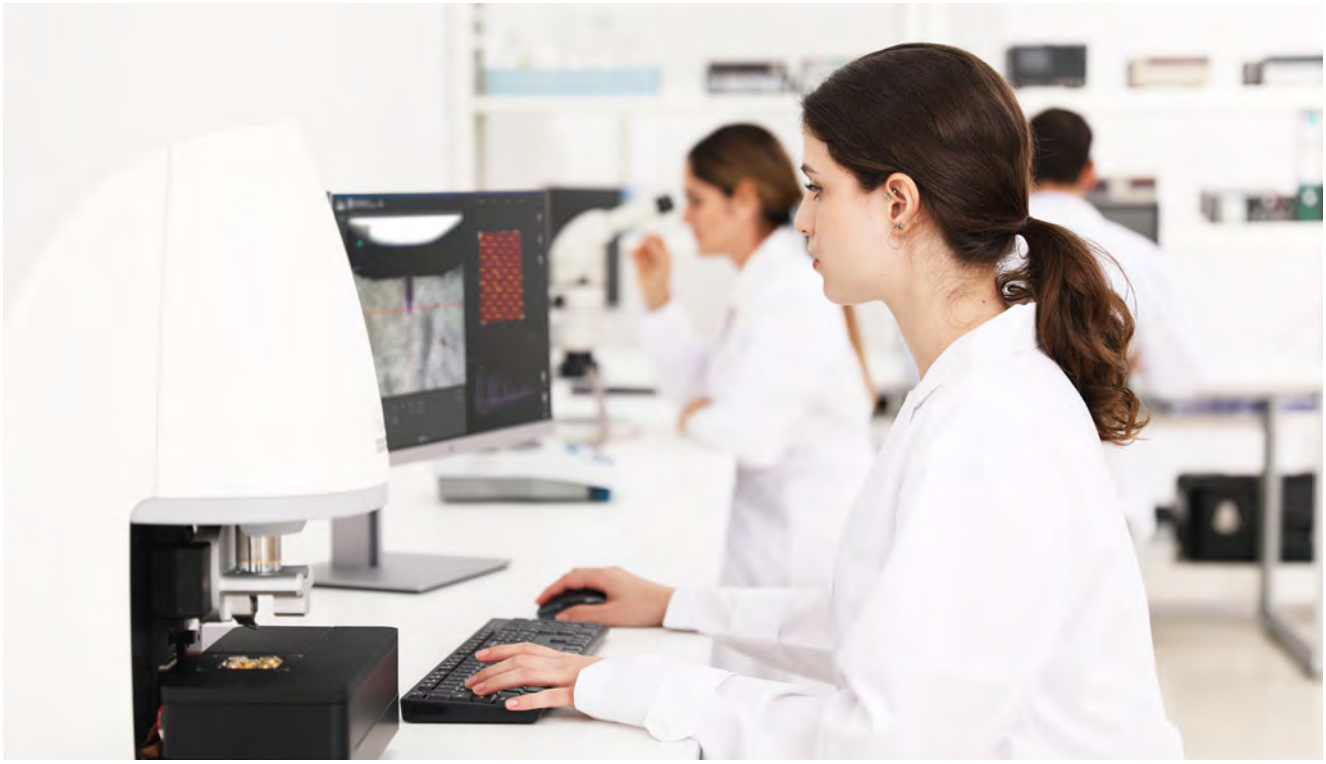
It does all your setup such as automatically probe change, laser alignment for imaging with animated instructions for setup anyone can understand.

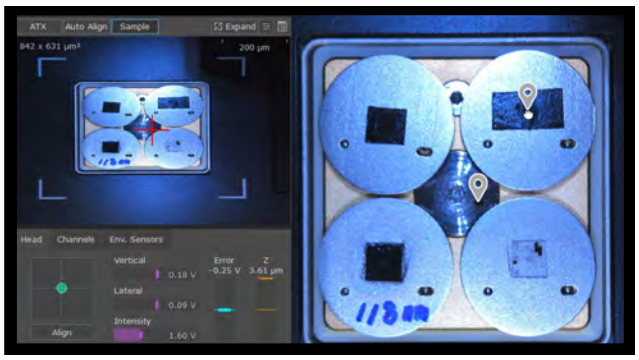
POSITION

Your new AFM automatically performs a frequency a sweep for the cantilever, approaches the Z-stage to the sample, and with the newly added sample camera, allows you more freedom to navigate your area of interest for imaging.

IMAGE

The system sets all the necessary parameters for optimum setting, then engages the cantilever and starts scanning the sample.
It continues to scan until the image is acquired and completed.





Easy Sample Navigation

With the newly added sample camera, a user can automatically pair probes to sample locations. The sample camera effortlessly locates the most relevant spot for scanning. The UX of SmartScan™ easily enables intuitive navigation of the sample by controlling the motorized stages in the sample navigation window.

Environmental Sensors for Self-diagnostics

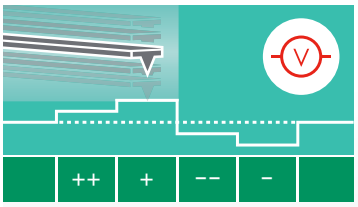
SmartScan displays and stores data from sensors, which measures essential environmental conditions such as temperature, humidity, leveling and vibration. This allows you to compare your scanned images with different environmental channels, providing further environmental indicators for system diagnosis.

Auto Set-up for Imaging

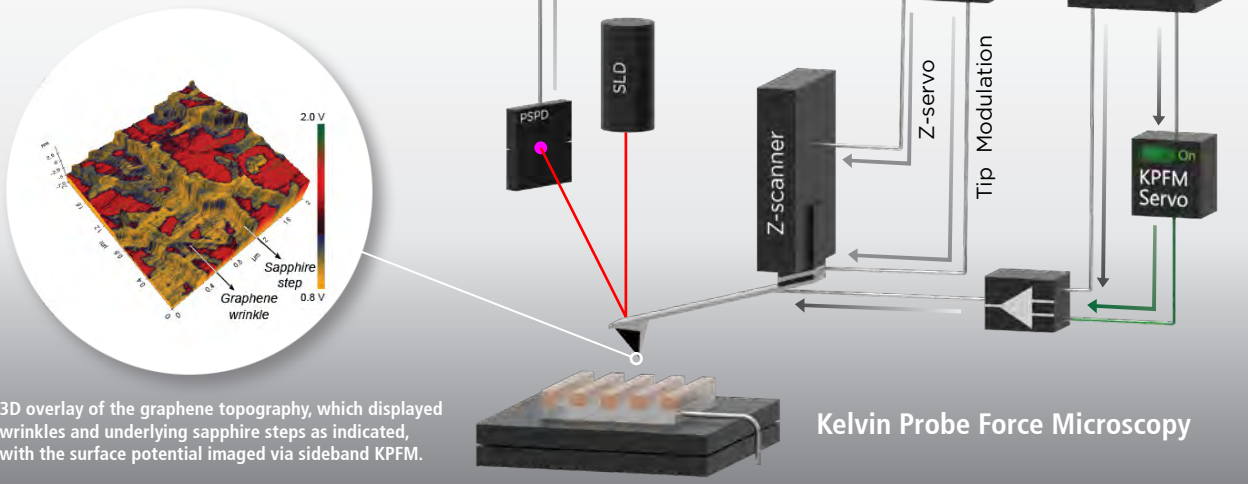
Park FX does all your set up with the simple click of a button, automatically changing and replacing its own tips, to avoid any contamination or user-related errors. Operators are offered tip choices including the type, model, application, and usage.

High capability advanced modes as standard and option features

Many advanced modes come as standard in Park FX AFM. Sideband KPFM and high-speed force spectroscopy are included in the basic system platform with the latest and state-of-the-art high-performance electronics controller. Latest advanced modes like heterodyne KPFM and Dual Frequency Resonance Tracking (DFRT) PFM are available as options.

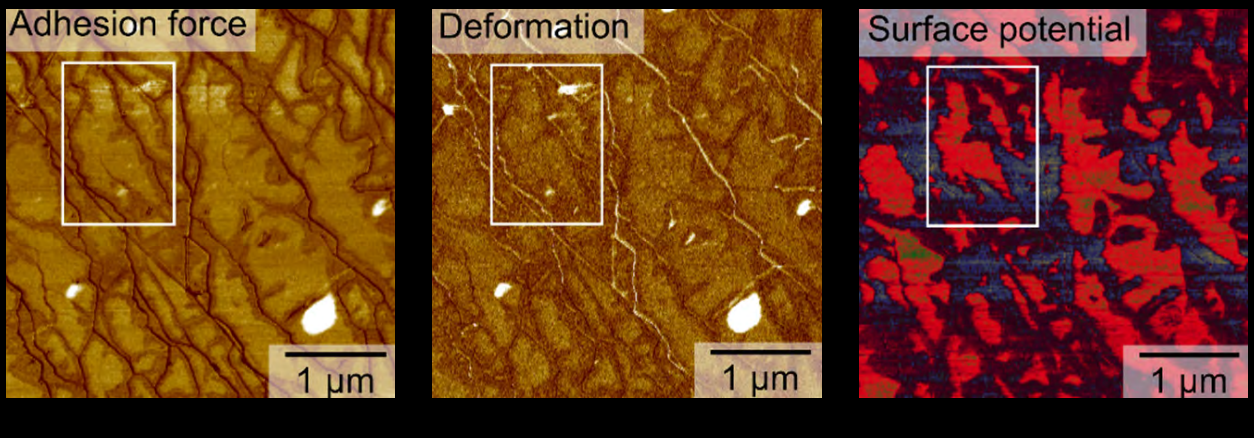


Atomic force microscopy correlates Graphene's functional properties on the nanoscale

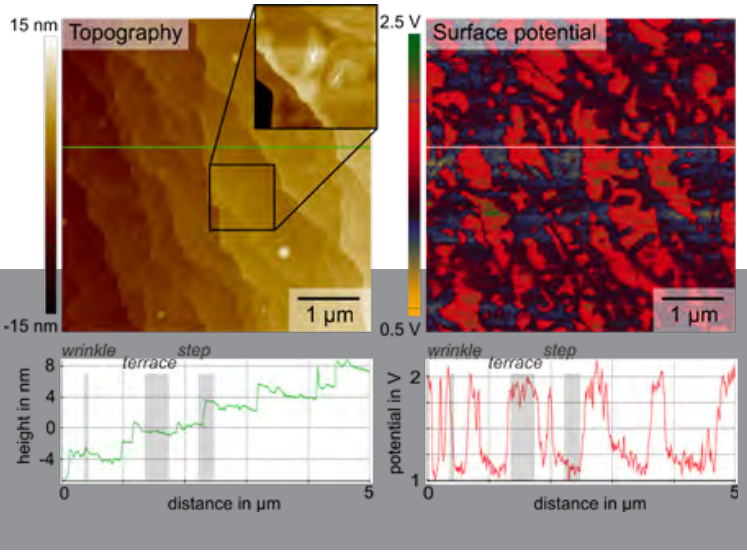


3D overlay of the graphene topography, which displayed wrinkles and underlying sapphire steps as indicated, with the surface potential imaged via sideband KPFM.

Kelvin Probe Force Microscopy

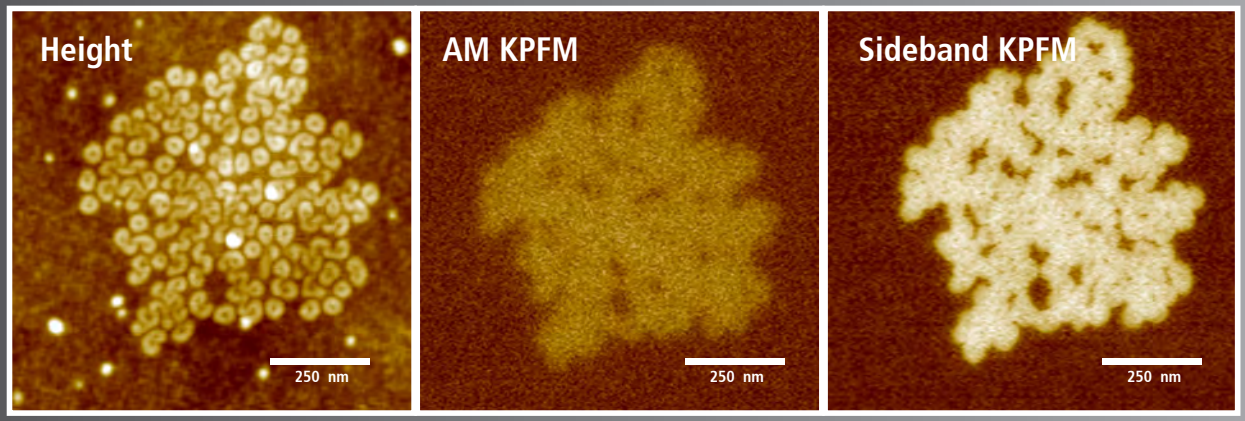


Adhesion force and deformation acquired on graphene on a sapphire substrate via Park Systems' PinPoint nanomechanical imaging and the corresponding surface potential imaged via sideband KPFM at the same measurement area. The white box highlights the same sapphire terrace featuring a higher adhesion force, deformation and surface potential with than surrounding sapphire steps.



Topography and surface potential captured via sideband KPFM on CVD-grown graphene on a sapphire substrate. The line profiles of the topography in green and the surface potential in red show a correlation of the two signals with a distinct potential contrast between underlying sapphire steps and terraces as well as graphene wrinkles.

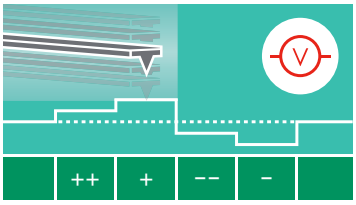
$F_{14}H_{20}$ on Si; Work Function



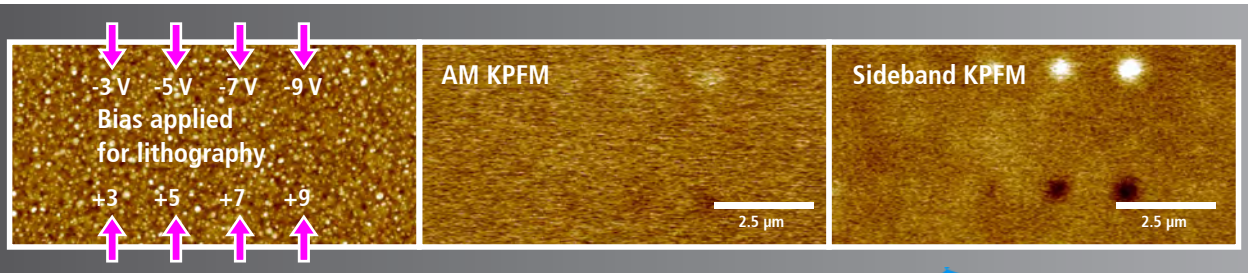
The same image color scale was used for work function image comparison.
Sideband KPFM shows the better image quality and quantitative results compared to AM KPFM.

Scanning conditions

Scan Mode: Kelvin Probe Force Microscopy
Cantilever: PPP-EFM (k=2.8 N/m, f=75 kHz)

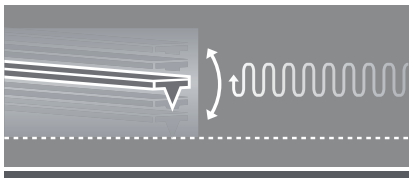


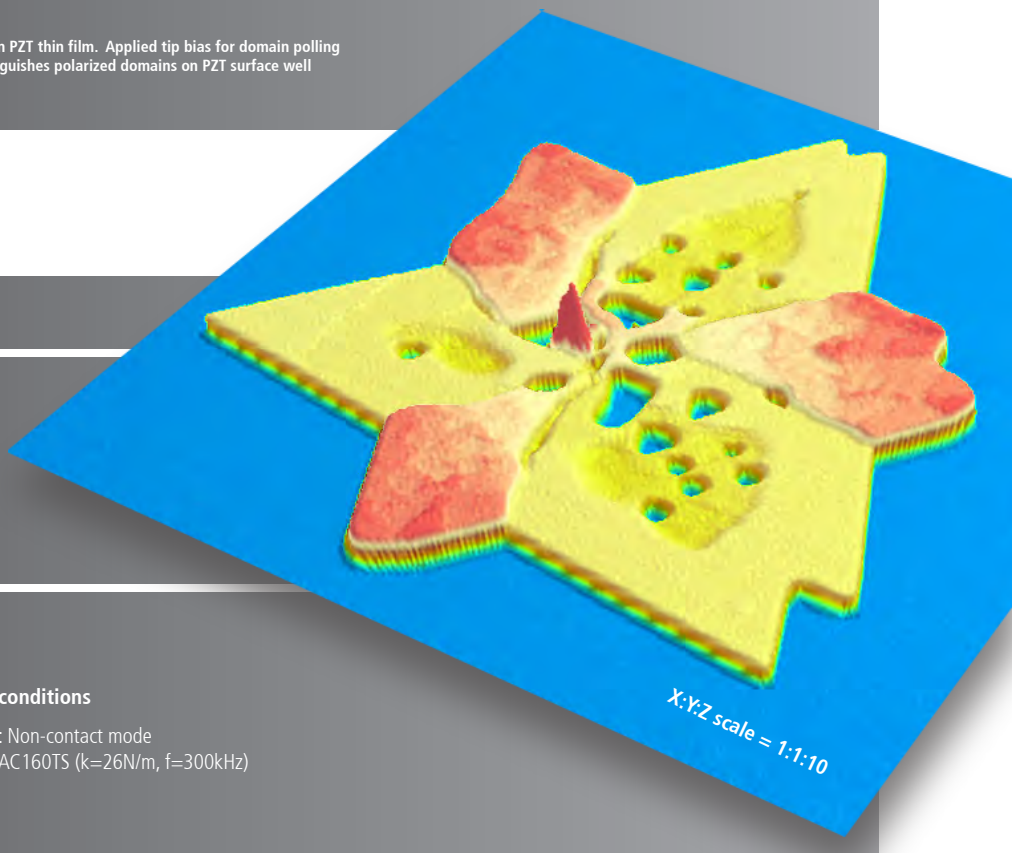
Dot lithography on PZT; Potential



Surface potential was measured after "dots lithography" on PZT thin film. Applied tip bias for domain polling were 3V, 5V, 7V and 9V for both sign. Sideband KPFM distinguishes polarized domains on PZT surface well but the AM KPFM shows weak surface potential signal.

Mica composite flake





Scanning conditions

Scan Mode: Non-contact mode
Cantilever: AC160TS (k=26N/m, f=300kHz)

Park FX40 Specification

XY-scanner

Structure	Position detector noise level
- Single-module, parallel-kinematic 2D flexure scanner - Better symmetry than serial-kinematic flexure scanner	- < 0.4 nm (@ 1 kHz bandwidth, rms) - Resolution: 0.1 nm
XY scan range	
- 100 µm x 100 µm	

Z-scanner

Structure	Height noise
- Flexure-guided high-force scanner	- < 0.03 nm (@ 0.5 kHz bandwidth, rms) - Resolution: 0.015 nm
Z scan range	
- 15 µm x 15 µm	

Sample mount

Sample size	Mounting
- 20 mm x 20 mm (w x d) recommended, thickness up to 20 mm	- Magnetic holder (Max. 4 sample disc) - FX Snap-in Sample Disk for Multi Snap-in Sample Chuck

Stage

XY stage travel range	Z stage travel range
- 105 mm x 40 mm (Motorized)	- 22 mm (Motorized)

Visions and optics

Vision path	Objective lens	CCD	Field-of-view
- On-axis sample view from top - The same view as an optical microscope	- 10x (N.A. 0.21) - Resolution: 1 µm	- 5.1 M Pixel - Pixel size: 3.45 µm x 3.45 µm	- 840 µm x 630 µm View with 10x lens

AFM controller

Lock-in amp
- 4 channel integrated 16 Hz ~ 5 MHz

Dimensions

AFM body dimension
- 450 mm x 350 mm x 300 mm (W x D x H) Max. dimension of system use inside the acoustic enclosure

Accessories

Cantilever exchange	Cantilever mount
- Cantilever exchange in less than 1 minutes using Automated Probe Exchange (ATX) (No need to remove head to exchange cantilevers)	- Pre-aligned mount using chip carrier

Modes and options

Topography imagingM	agnetic properties	Mechanical properties		
- True Non-Contact™ Mode - Contact Mode - Tapping Mode	- Magnetic Force Microscopy (MFM)	- PinPoint™ Nanomechanical Mode - Force Modulation Microscopy (FMM) - Nanoindentation	- Nanolithography - Nanolithography with High Voltage* - Nanomanipulation	- Lateral Force Microscopy (LFM) - Force Distance (F/d) Spectroscopy - Force Volume Imaging

Electrical properties		Dielectric/piezoelectric properties	Thermal properties
- Conductive AFM (C-AFM) - I/V Spectroscopy - Kelvin Probe Force Microscopy (KPFM) - KPFM with High Voltage*	- Scanning Capacitance Microscopy (SCM)* - Scanning Spreading-Resistance Microscopy (SSRM) - Photo Current Mapping (PCM)* - Electrostatic Force Microscopy (EFM)	- Piezoresponse Force Microscopy (PFM) - PFM with High voltage* - Piezoresponse Spectroscopy	- Scanning Thermal Microscopy (SThM)*

* soon be available

Committed to Contribute to Impactful Science and Technological Development

More than 25 years ago, the foundations of Park Systems were laid at Stanford University, where Park Systems' founder, Dr. Sang-il Park, worked in Prof. Calvin Quate's group; the group that invented the world's first AFM. After years of development, Dr. Park introduced the first commercial AFM to the world, thus starting the successful path of Park Systems. With good foresight, a superior product and keen business acumen, Park has positioned themselves as the dominant industry leader in AFM Nanoscale Metrology and in 2020, Park Systems will roll out their most exciting line of AFM products in their history.

Park Systems continuously strives to live up to the innovative spirit of its origin. Throughout its long journey, the company has been committed to provide advanced, accurate, and reliable AFM instrumentation, with revolutionary features such as True Non-Contact™ mode and PinPoint™ Nanomechanical AFM. Cutting-edge AFM automation features, like SmartScan™, make Park Systems AFMs not only extremely easy to use, but they also enable users to obtain outstanding results faster, more efficiently, and more accurately.

Note: All specifications are subject to change without notice.
Please visit our website for the most up-to-date specifications.

Park Systems

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