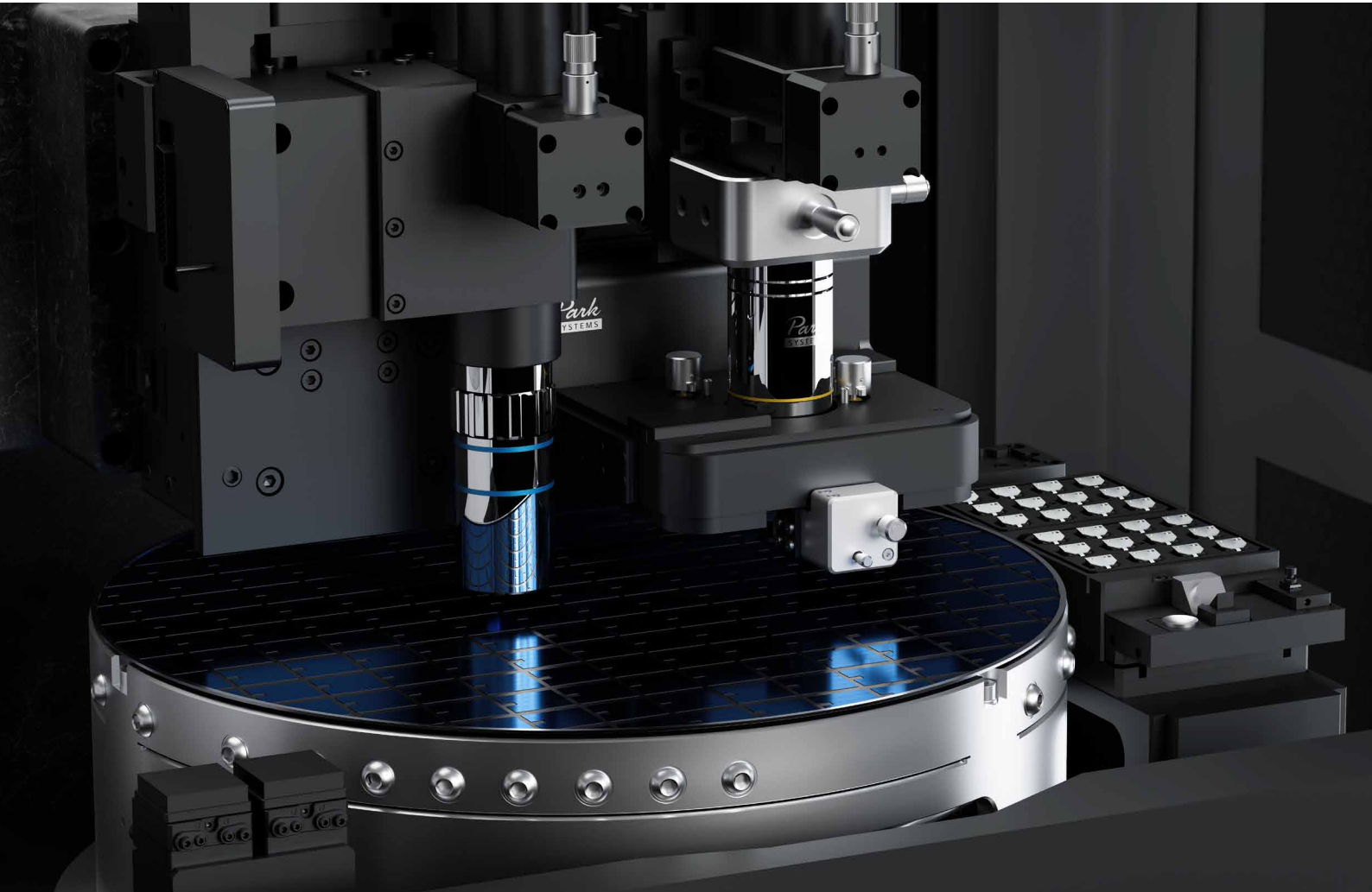


Park NX-TSH300 Overlay

Synergy of AFM and Optical Overlay
for Advanced Packaging



Park
SYSTEMS

Park NX-TSH300 Overlay overcomes the limitations of traditional sample-scanning AFM systems. Designed specifically for measuring heavy, large, and high-bow 300 mm wafers, it employs a revolutionary Tip Scanning Head (TSH) technology combined with an anti-warping sample chuck. By moving the scanner instead of the sample, it ensures high-speed, high-precision metrology regardless of wafer weight or warpage. Integrated with high-resolution vision and optional optical modules, it maximizes overlay alignment accuracy and yield for advanced semiconductor packaging.

Park NX-TSH300 Overlay

Key Features

Semiconductor Fab Integrability

- Fully automated operation through XEA software with an intuitive UI
- SECS/GEM communication for fab host integration
- Automated wafer handling and probe exchange
- Full compatibility according to SEMI standards

Engineered for Advanced Packaging Applications

- Combined AFM and Optical Overlay metrology in a single tool
- Pad-type sample chuck designed for high-warpage substrates

High-Precision AFM Technology

- Minimized out-of-plane motion through a decoupled XY and Z scanner architecture
- True Non-contact™ mode preserves tip shape and extends tip lifetime

High Accuracy & Reliability

- High-accuracy optical overlay enabled by an AFM Z scanner
- Damage-free measurement with non-destructive AFM technology

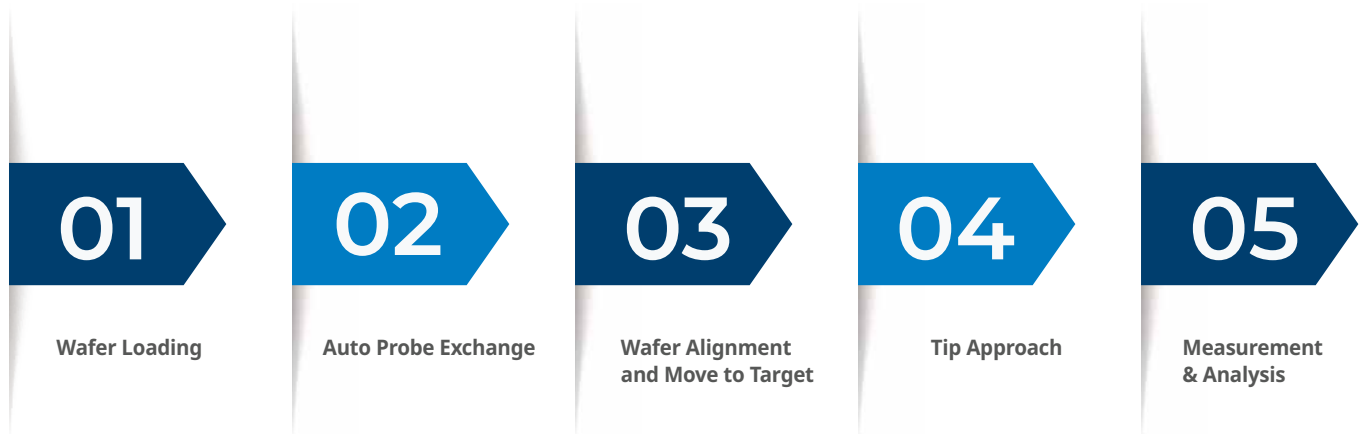


Park NX-TSH300 Overlay

Fully Automated Operation for In-line Process Control

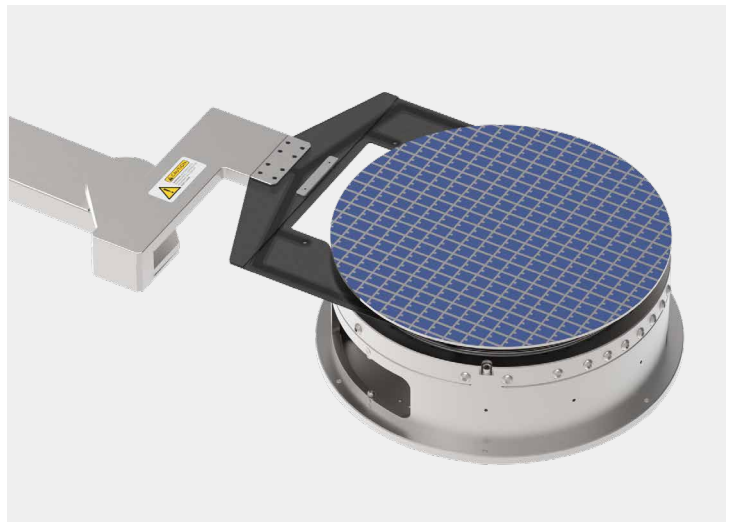
Fully Automated Operation

NX-TSH300 Overlay enables fully automated operation for high-volume manufacturing (HVM) environments, covering the entire workflow from wafer handling to measurement and analysis. It automatically receives a recipe from a host and executes the full sequence—selecting the appropriate tip, scanning multiple target areas, analyzing data, and generating reports.



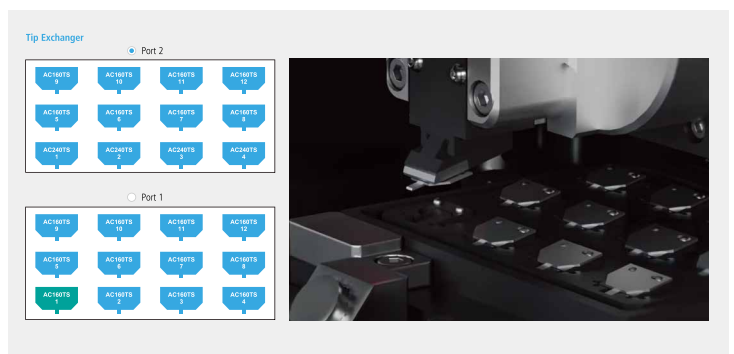
Automated Wafer Handling Capability

Wafer transfer is performed automatically by an equipment front end module (EFEM). It uses robotic mechanisms, sensors, and algorithms to ensure precise alignment and reliable handling of various materials, including warped wafers.



Automatic Probe Exchange

The automatic tip exchanger seamlessly replaces the probe when a threshold is exceeded. It can store up to 24 pre-mounted probes (12 probes per cassette).



Park NX-TSH300 Overlay

Semiconductor Fab Integrability

Single Recipe for Both Overlay and RDL

XEA offers practical features such as easy copy/paste of recipes, specialized editing modes, and real-time recipe updates. Additionally, a single recipe supports both overlay and RDL measurement methods. With built-in functions providing comprehensive system operation—including parameter adjustment, database management, and maintenance—the interface remains straightforward and user-friendly.

The screenshot displays the Park NX-TSH300 Overlay software interface. The top bar shows system status: User: Vendor, Equip. State: NORMAL, Proc. State: MANUAL, A+B (V): 0.035, DISTANCED, A-B (V): 10.000. The main window is titled 'Recipe - S3_270_5RDL - OVL_RDL-PM_minAvg'. The left sidebar contains a 'Manage' menu with options: Tip, Wafer Info, Wafer Align, Dies & Points, and Options. Below this is a 'Methods' section with a list: Overlay, Overlay_2, RDL_1, and RDL_2. The central area shows a 'Select dies & points to measure' grid with a 3x3 grid of points. A table on the right lists 'Dies and Points' with columns: No, Die X, Die Y, X (um), Y (um), and Method. The table contains 25 entries, with the first 13 entries marked as 'RDL_1' and the last 12 entries marked as 'Overlay'. A legend at the bottom right indicates 'Overlay' with a blue box and 'RDL' with a red box. The bottom of the interface features a 'Navigator' bar with icons for Jobs, Recipes, Methods, System, Logs, SECS, Setup, Measure, and Result.

The navigator provides an intuitive user interface that integrates system adjustment and operation.

Fab Host

Wafer ID
Recipe ID



Data
Event



Fab Host Communication via SECS/GEM Protocol

The system enables Fab host communication via the SECS/GEM protocol, ensuring full compliance with SEMI standards, including E30, E40, E87, E90, E94, and E84 PI/O for AMHS integration.

Fab Compatibility According to SEMI Standards

NX-TSH300 Overlay ensures optimal compatibility with cleanroom environments in semiconductor fabs. The system achieves ISO Cleanliness Class 1 (≤ 10 particles/ $m^3 \geq 0.1 \mu m$ and ≤ 2 particles/ $m^3 \geq 0.2 \mu m$) and minimizes particle contamination along the tape frame movement path through its engineered fan filter unit and ventilation system, while maintaining efficient noise shielding. Furthermore, the system is equipped with advanced monitoring capabilities that can detect and alert users to potential fire hazards or voltage sags.

Park NX-TSH300 Overlay

Park High-Precision AFM Technology

Tip Scanning Head (TSH) System

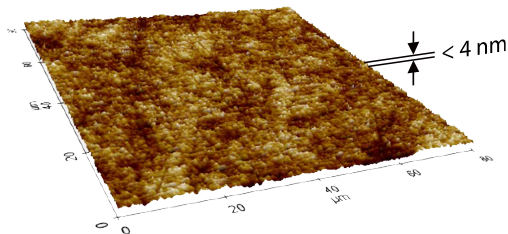
The sample is secured on the chuck while the gantry-mounted tip scanning head moves to desired measurement positions on the sample surface. This tip scanning approach eliminates sample size and weight limitations. The tip scanning head features fully decoupled XY and Z scanners, enabling precise control in each direction.



Optical Flat (80 × 80 μm)

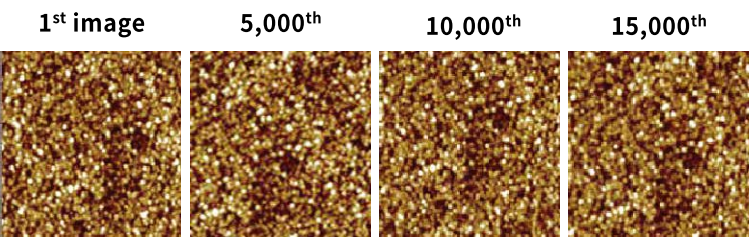
Decoupled XY and Z Scanner System

The separate flexure-guided 2D XY scanner and 1D Z scanner system minimizes out-of-plane motion by eliminating crosstalk between horizontal and vertical motion. The independent Z scanner enables precise, linear, and fast dynamic performance.

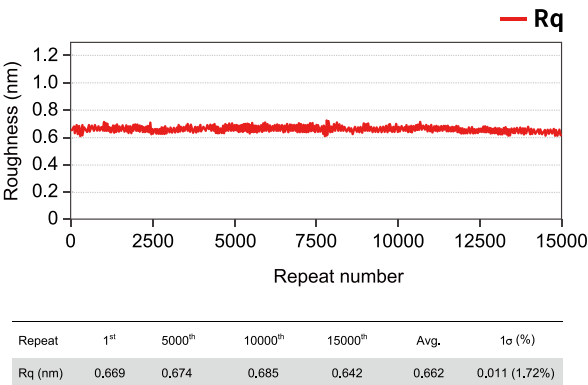


True Non-Contact™ Mode

True Non-contact™ mode, a proprietary technology offered by Park Systems, obtains topography by detecting the attractive van der Waals force between the tip and sample surface. The key advantage of True Non-contact mode is the prevention of tip wear and sample damage, ensuring consistent results with superior data reliability. This also reduces the total cost of ownership by extending tip life. The system also supports contact mode and tapping mode when required.



(500 nm × 500 nm)

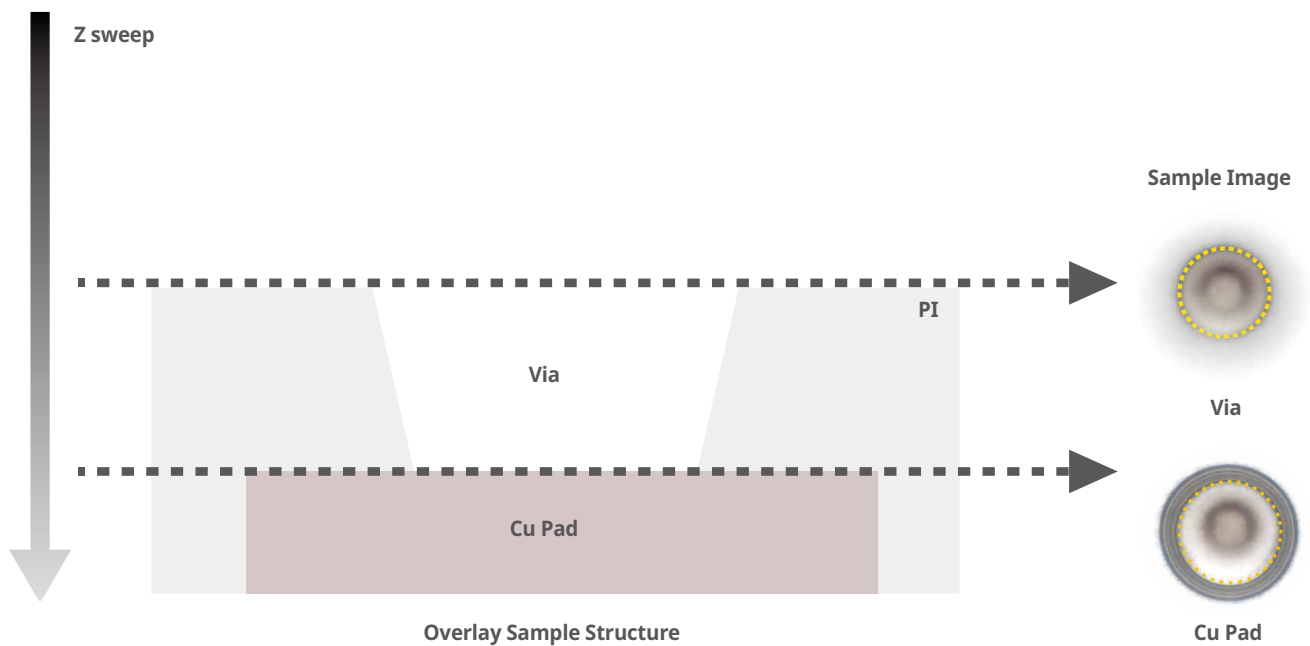


Park NX-TSH300 Overlay

Versatile Applications

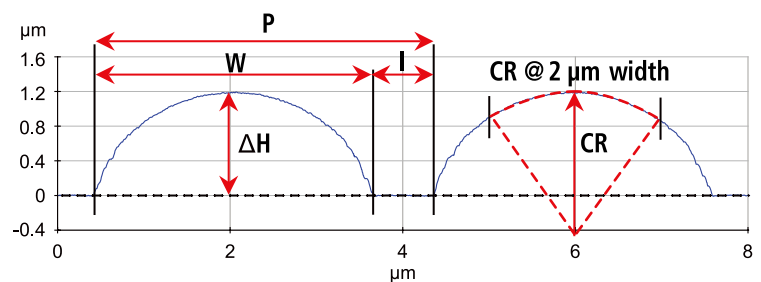
Semiconductor Overlay Measurement

Park Systems' well-established AFM Z scanner technology forms the foundation for an independent Z scanner, offering a 30 μm sweeping range with AFM-level precision to find the optimal focal plane. A high-resolution (HR) and shallow Depth of Focus (DOF) objective lens enhances image contrast and facilitates profile edge detection. By comparing the concentric circles of each layer obtained in this way, the offset value can be automatically measured.



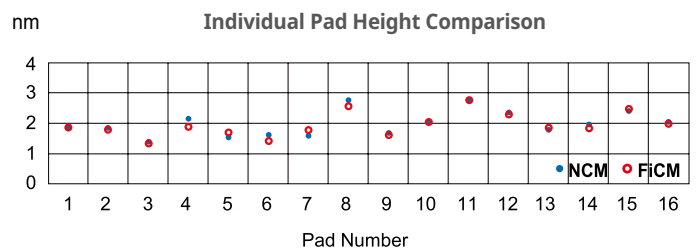
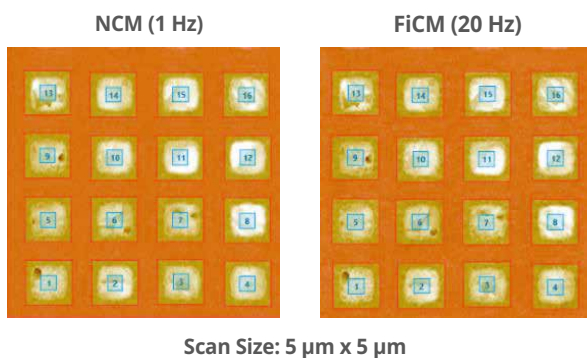
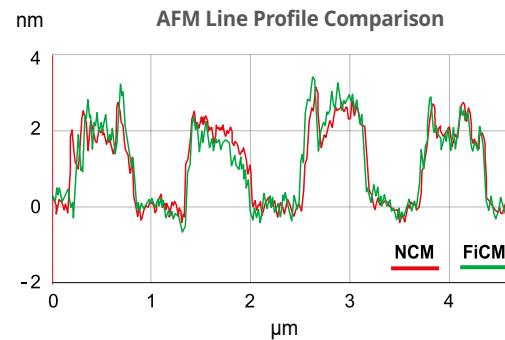
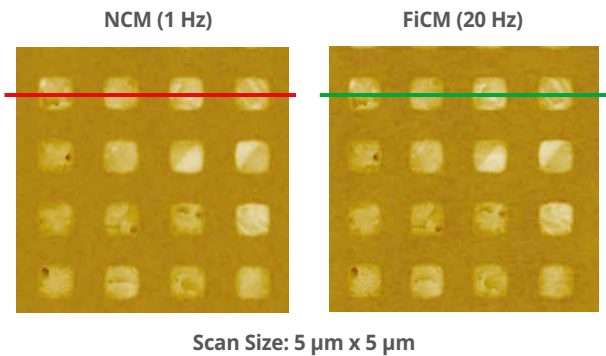
Comprehensive 3D Nano-Metrology

Park AFM accurately measures challenging patterns such as micro-lenses that are difficult to characterize with optical metrology tools, while providing comprehensive analytical capabilities including measurements of width, interval, pitch, height, and radius of curvature.



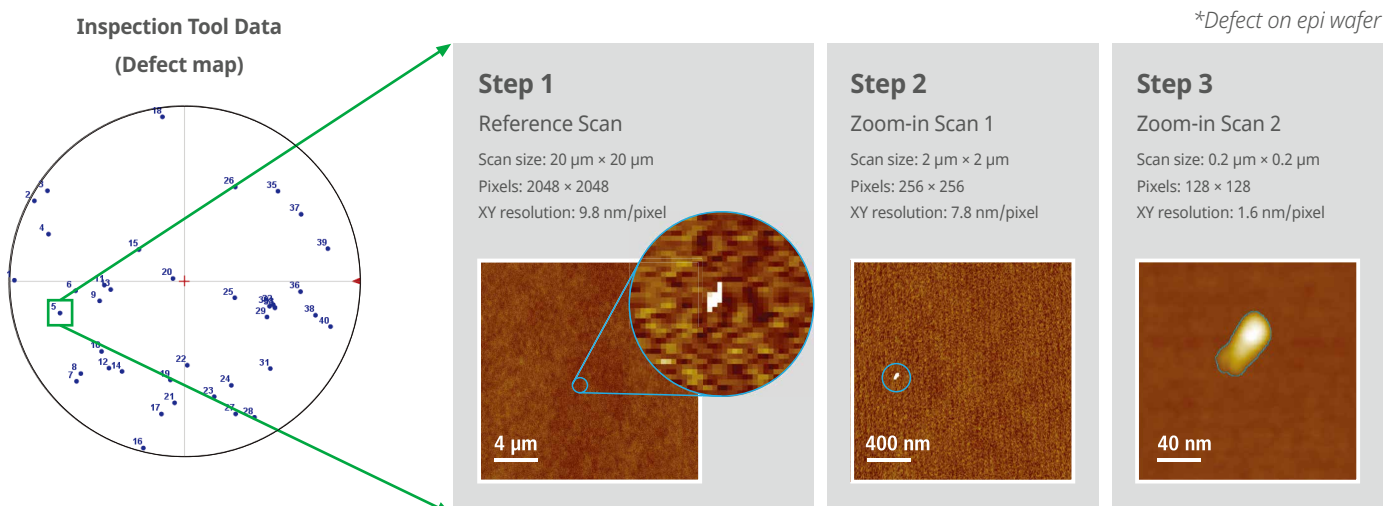
High-Throughput Measurement for Cu Pad

Park's fast imaging contact mode (FiCM) provides reliable data for Cu pad measurements with high throughput. The Cu pad data from the fast imaging mode delivers line profiles and height values equivalent to those obtained in True Non-contact™ mode. The proprietary analysis algorithm can analyze each Cu pad regardless of pad shape or array arrangement.



Automatic Defect Review (ADR)

The ADR function provides further analysis of defects detected by conventional defect inspection tools. The defects are automatically scanned by AFM once inspection tool data with defect coordinates is uploaded. Defect types and profiles are automatically analyzed in detail using zoom-in scan data.



Park NX-TSH300 Overlay

Technical Specifications

AFM Modes

- True Non-contact™ Mode
- Tapping Mode
- Contact Mode
- Fast-imaging Mode (FiM)

Tip Scanning Head

- XY scan range (90 μm $\times$ 90 μm)
- Z scan range (15 μm)

On-Axis Optics

- Direct on-axis vision of sample surface and cantilever
- Field of view: 840 μm $\times$ 630 μm (w/ 10 $\times$ objective lens)
- CMOS: 5 M pixels

Off-Axis Optics

- Magnification: 50 $\times$
- Pixel Size: 0.069 μm
- Resolution: 0.37 μm

Automatic Tip Exchanger

- 24 pre-mounted probes (12 probes per cassette)

Sample Handling Capability

- 300 mm wafer

Warpage Handling Capability

- ± 2 mm

Dimension and Weight (Approx.)

- 3,852 mm $\times$ 2,408 mm $\times$ 2,035 mm (4,070 kg)

Required Environment

- Room temperature (stand by): 10 $^{\circ}\text{C}$ $\sim$ 40 $^{\circ}\text{C}$
- Room temperature (operating): 18 $^{\circ}\text{C}$ $\sim$ 24 $^{\circ}\text{C}$
- Humidity: 30% $\sim$ 60% (not condensing)
- Floor vibration level: VC-D (6.25 $\mu\text{m}/\text{sec}$)
- Acoustic noise: Below 65 dB
- Pneumatics: CDA 0.7 Mpa, Vacuum -80 kPa
- Power supply rating: 208 $\sim$ 240 V, single phase, 50/60 Hz
- Ground resistance: Below 1 Ω

* Requires additional options

** Consult with Park Systems

