

WHITE LIGHT INTERFEROMETRY **InSight WLI**

Automated, Non-Contact Metrology for Semiconductor,
MEMS, and Optoelectronics Manufacturing



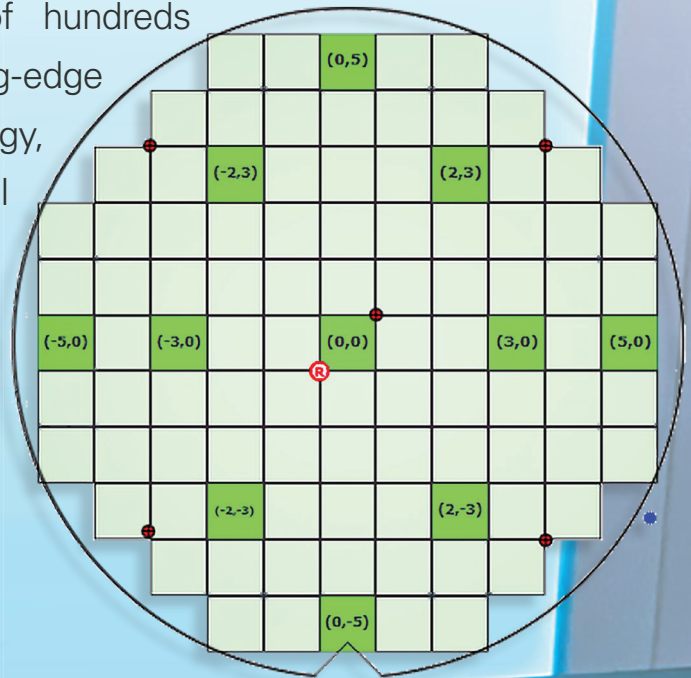
InSight WLI

Comprehensive Measurement Solution for High-Throughput Semiconductor Manufacturing

InSight WLI is an inline, high-precision 3D optical profilometer specifically designed for semiconductor applications, where accuracy, productivity, and process insights are paramount. This system utilizes white light interferometry (WLI) for rapid, non-contact lateral critical dimension (CD) and topography depth measurements. Capable of sub-angstrom precision and measuring step heights of hundreds of micrometers, it incorporates cutting-edge technologies for 3D topography, CD metrology, and overlay measurements. InSight WLI also provides full industrial automation with SECS/GEM compatibility for 200 mm and 300 mm wafers, Cognex pattern recognition, and over 35 built-in analyses.

Only InSight WLI delivers:

- Seamless automation for high-volume production
- An integrated platform with complete metrology coverage
- Versatile precision from nano- to millimeter scale



Proven Performance for Inline Production

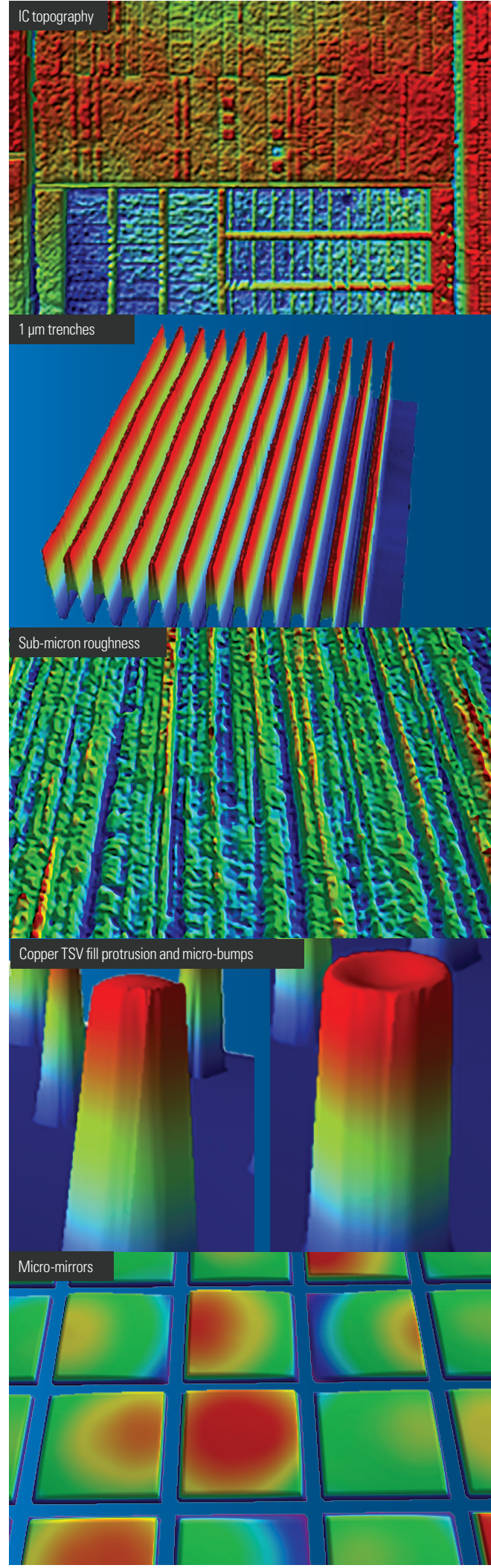
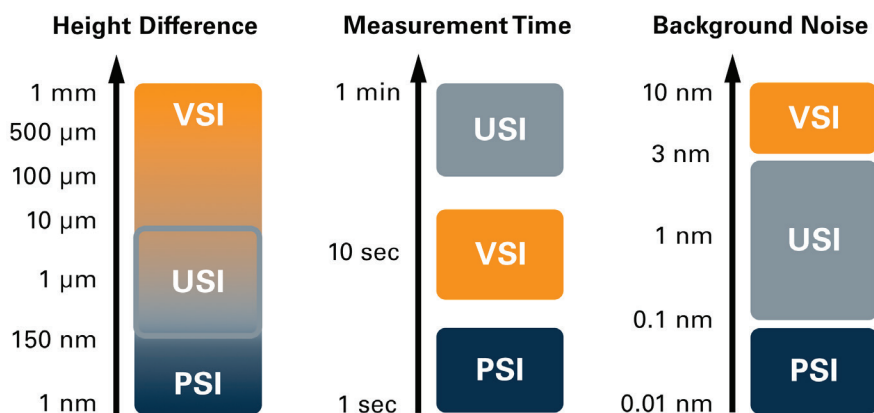
Bruker has a long history of providing the most advanced optical profiling solutions for semiconductor fabs around the world. We have a reputation for developing robust tools with local support to maximize uptime. We diligently keep our technology in pace with the semiconductor roadmap and next-generation nodes. InSight WLI builds upon this vast experience, incorporating the latest advanced technologies to streamline processes and deliver the most reliable data.

Specialized and Proprietary Technology

InSight WLI integrates industry-leading technology to support a wide variety of front-end-of-line (FEOL), back-end-of-line (BEOL), advanced packaging, and microelectromechanical (MEMS) applications. A laser reference for self-calibration during operation ensures accurate metrology while maximizing uptime. Specialized piezo scanners and Bruker's patented automated tip/tilt head ensures top-notch metrology performance on sub-nanometer roughness or nanometer critical dimensions. Large-area scanning with stitching capabilities accommodates up to full-die imaging. SECS/GEM compatibility guarantees seamless integration with host systems. These and other features make InSight WLI an industry-leading metrology tool for semiconductor high-volume manufacturing and leading-edge R&D activities.

A Mode for Every Surface

InSight WLI's primary measurement modes are PSI, VSI, and USI. These modes cover wide ranges of height difference, measurement time, and background noise. There are also specialized modes for specific applications, such as intensity-based CD and overlay or film measurement modes for either thin or thick films.



Unmatched Application Versatility

InSight WLI incorporates superior features and capabilities to provide precise, repeatable measurements and analyses for many FEOL, BEOL, advanced packaging, and MEMS applications. It uses fast and non-destructive methods for surface measurements of warped wafers, high aspect ratio (HAR) trenches, ultraflat surfaces, and more.

Through-Silicon Via and Through-Glass Via Monitoring

- Generate 3D profiles of HAR TSVs up to 1:20 AR
- Ensure TSV quality with reliable metrology for 3D advanced packaging and CMOS image sensors (CIS)

Critical Dimension Monitoring

- Measure CD, profile, and line edge roughness
- Maintain tight CD control for advanced packaging

Overlay Monitoring

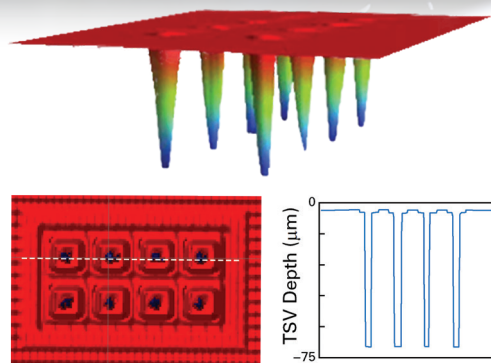
- Assess alignment between fan-out layers at the critical nanometer scale
- Obtain accurate overlay as required to improve lithography process windows

CMP Process Monitoring

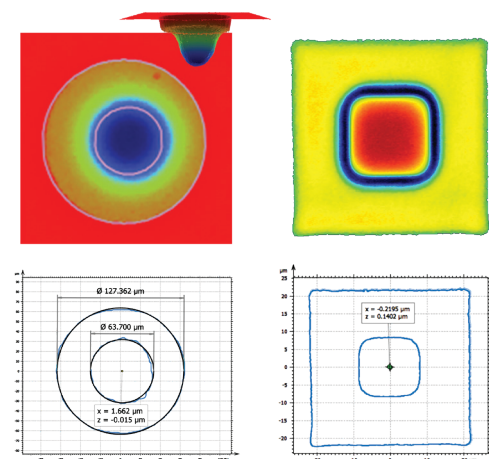
- Measure post-CMP flatness, erosion, and defects at high throughput
- Monitor and improve CMP uniformity with rapid, precise metrology

Die Flatness Qualification

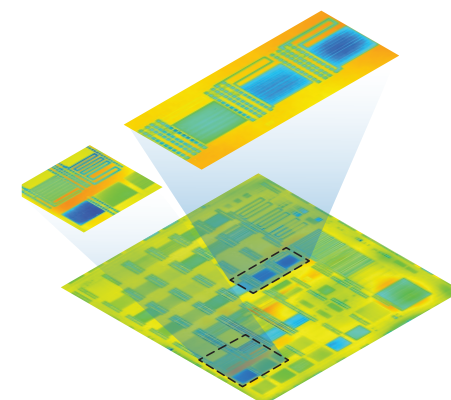
- Stitch and analyze full dies for defects
- Ensure flatness specifications for multi-chip modules in wafer or die-to-wafer bonding



Effortlessly measure and analyze HAR TSVs on InSight WLI, such as the challenging 1:15 AR TSVs shown to the left.

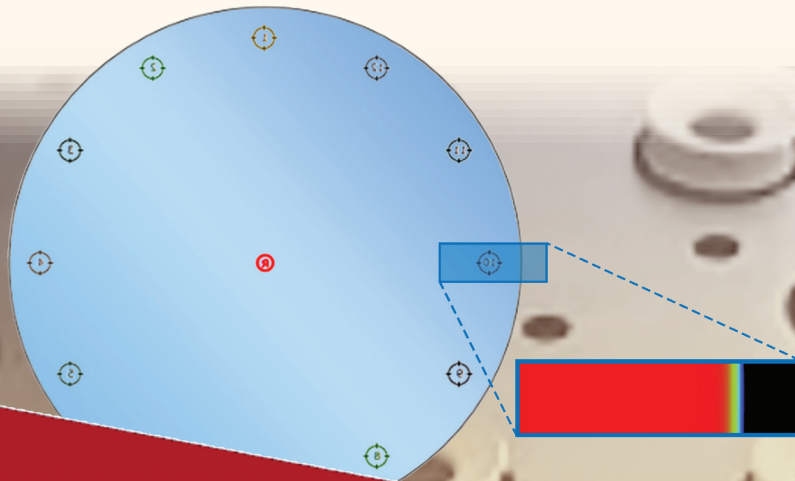


Achieve nanoscale accuracy in top and bottom CD measurements with overlay monitoring using intensity data frames, ensuring unmatched precision and reliability.



Seamlessly stitch large fields of view for critical hotspot detection, delivering unparalleled accuracy and performance.

With Automated Metrology Capabilities



Etch Depth and Deposition Height Monitoring

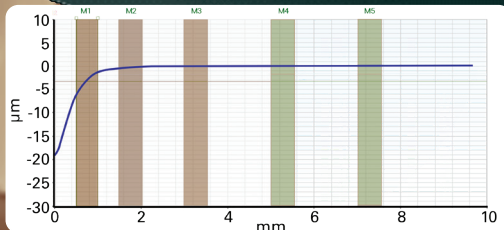
- Measure depth and step height on a wide range of substrate/metals
- Monitor process for MEMS devices and sensors in legacy automotive and high-power IC applications

Edge Inspection

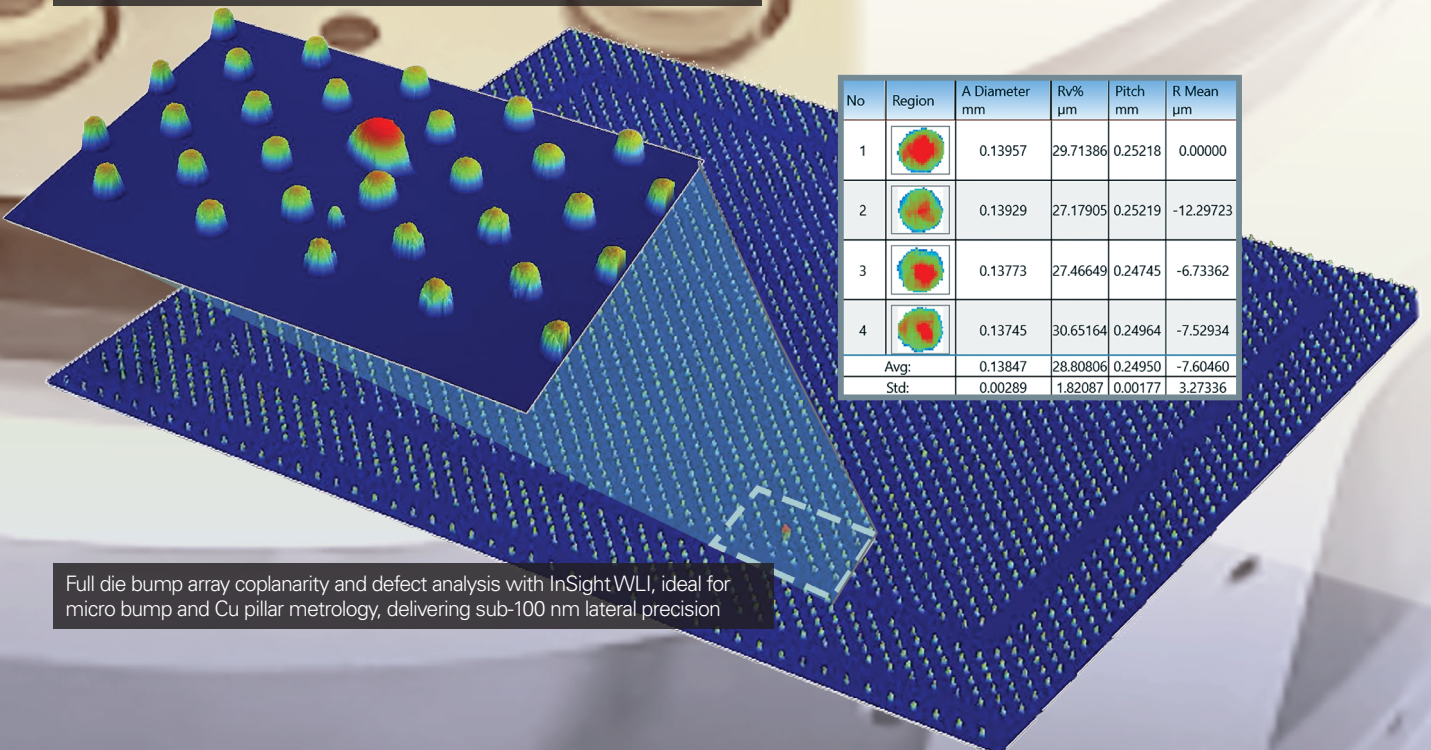
- Measure wafer edge roll-off (ERO) characteristics automatically at radial positions along wafer circumference for bare and patterned wafers
- Monitor multiple edge parameters including slope, step height, and roughness

Bump Analysis

- Measure bump height, diameter, and pitch, plus assess full-array coplanarity and defects
- Monitor processes in packaging fabs and electroplating equipment foundries



Experience high speed, fully automated edge roll-off measurement with built-in analysis, extracting slope, Z-step height, and other key parameters, enhanced with edge detection.



No	Region	A Diameter mm	Rv% μm	Pitch mm	R Mean μm
1		0.13957	29.71386	0.25218	0.00000
2		0.13929	27.17905	0.25219	-12.29723
3		0.13773	27.46649	0.24745	-6.73362
4		0.13745	30.65164	0.24964	-7.52934
Avg:		0.13847	28.80806	0.24950	-7.60460
Std:		0.00289	1.82087	0.00177	3.27336

Full die bump array coplanarity and defect analysis with InSight WLI, ideal for micro bump and Cu pillar metrology, delivering sub-100 nm lateral precision

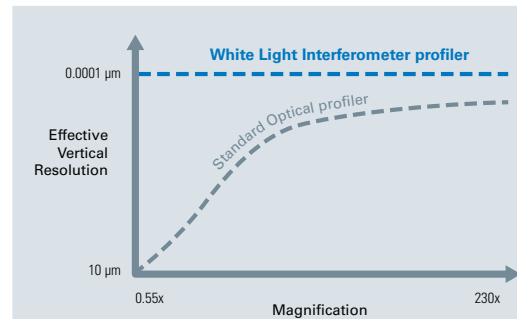
Superior Resolution, Accuracy, and Robustness

InSight WLI has a higher, more consistent vertical resolution than a standard non-interferometry-based optical profiler. It captures topography within the full field of view, with independent calculation of height for each pixel, leading to fastest time to results versus other scanned optical beam technologies. Compared to other optical technologies, InSight WLI properly segregates interfaces on transparent layers up to 100 nm. It also covers a wide range of applications with a single optical head, enabling comprehensive process monitoring and seamless transition from one measurement mode to another.

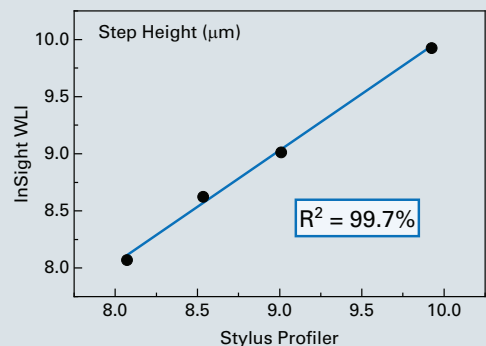
White light interferometry as a technique has several inherent benefits:

- Vertical resolution is independent from field of view and working distance. InSight WLI has an unmatched vertical resolution limit of 0.01 nm.
- Lateral resolution can reach down to 0.38 μm with Sparrow criterion, and optimal resolution is preserved for each objective lens.
- Universal applicability and robustness leads to consistently accurate results for measurements on surfaces with any combination of translucent, reflective, and high-roughness features.

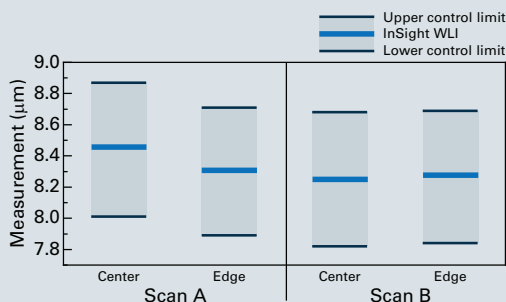
InSight WLI delivers sub-nanometer vertical resolution and picometer accuracy across measurement ranges from nanometers to millimeters. This enables precision analysis of a wide variety of semiconductor structures and surfaces with lateral resolution down to 200 nm. Robust repeatability across different measurement modes guarantees a high confidence in measurement results.



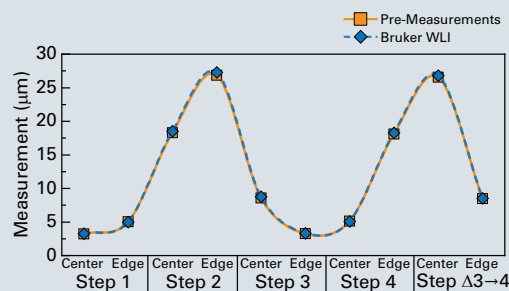
Effective vertical resolution is constant for WLI regardless of FOV, while it is variable for standard optical profilers.



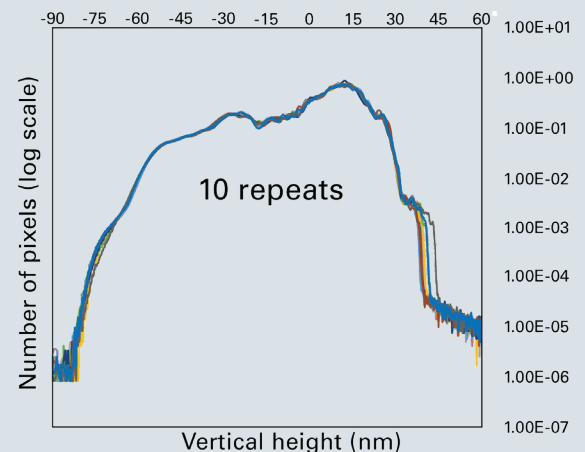
Regression/bivariate chart showing close agreement between InSight WLI and stylus profiler step height data.



Accuracy chart confirming that InSight WLI measurements fall within the upper and lower control limits.

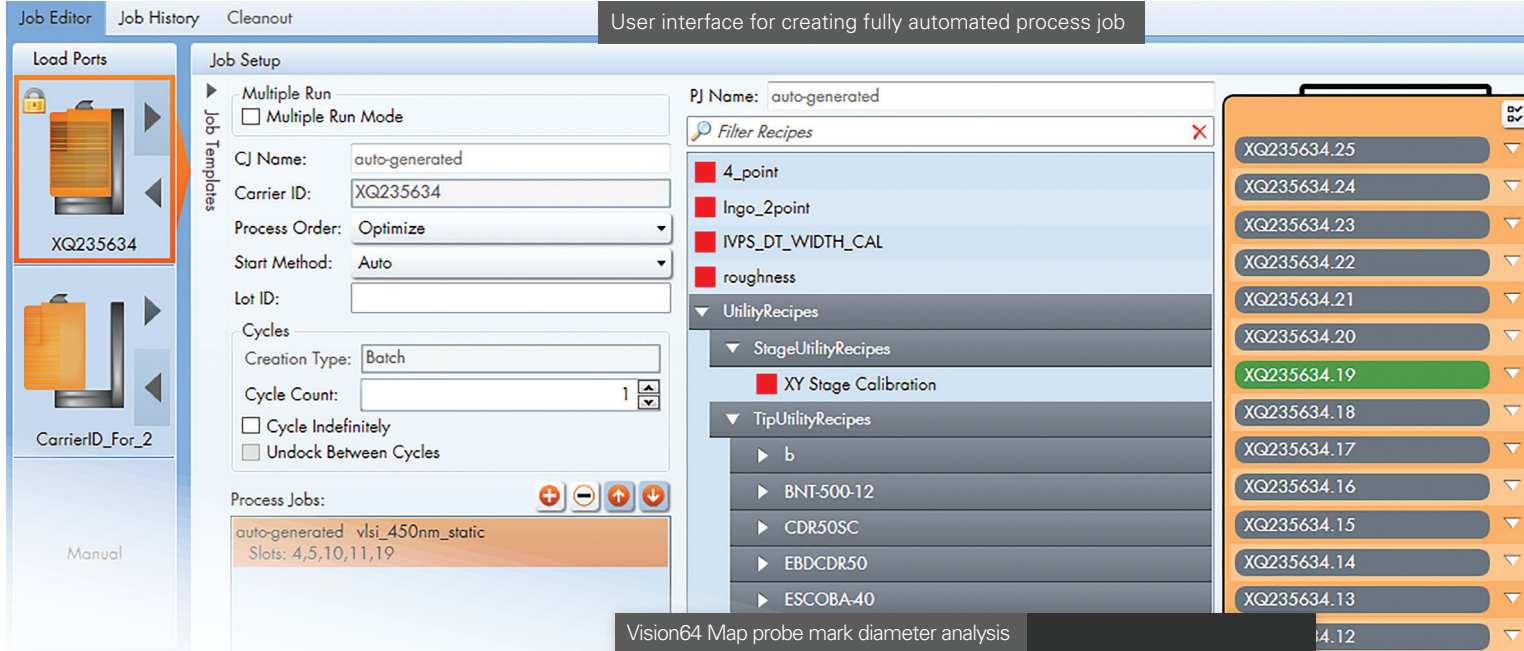


Measurement trend chart, tracking the excellent agreement between pre-measurements and WLI measurements.



Height distribution from a full die. Ten repeats overlap very well, showing die flatness measurement down to 1 nm repeatability across the full distribution.

Advanced Automation and Analytics for HVM

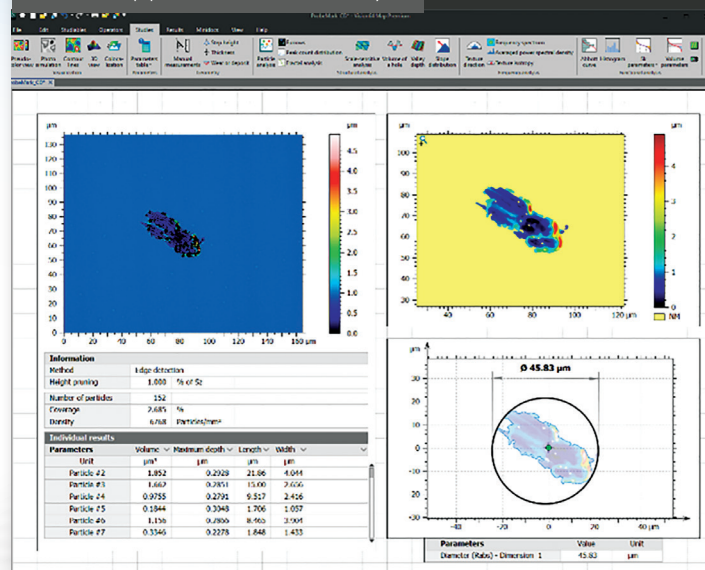


InSight WLI makes high-volume manufacturing easier from the first step through the last. It provides fast, consistent measurements and minimal operator intervention. Setting up measurements is easy with recipe creation and a full suite of automation features, including autofocus, automatic tip/tilt, and optional Cognex pattern recognition.

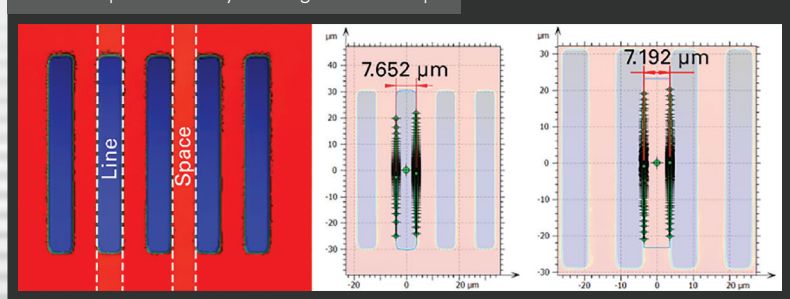
An EFEM shuttles wafers into the tool, where their wafer ID is read and they undergo a pre-alignment process. The wafers are placed on a fully automated stage that can accommodate inline auto-loading of 200 or 300 mm wafers. Numerous wafer chucks are offered, some tailored to application-specific needs.

Data processing is streamlined with fast shape removal, auto hotspot detection, database reporting with pass/fail criteria, and over 35 types of built-in analyses. Furthermore, optional Vision64 Map™ software provides a suite of advanced analyses and powerful visualization capabilities and fully integrates with the tool's data for enhanced defect detection, correlation, and characterization beyond common metrology needs.

Vision64 Map probe mark diameter analysis

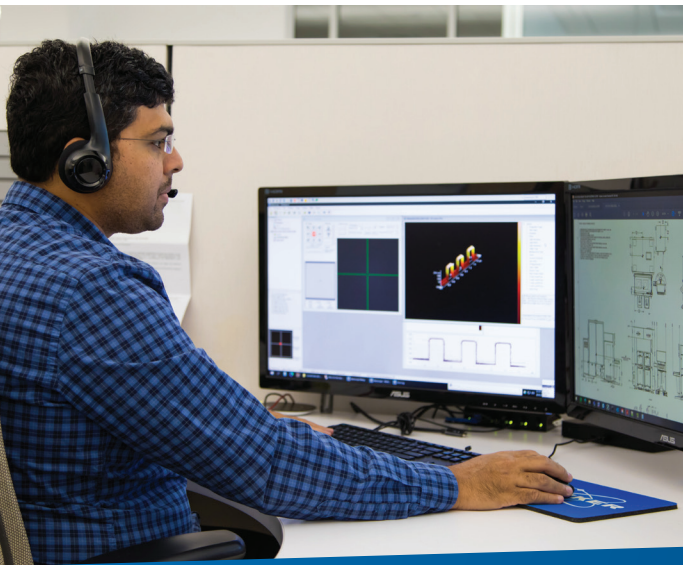


Line and space CD analysis using Vision64 Map.



InSight WLI Select Specifications

Performance	Vertical resolution	Down to 0.01 nm
	Lateral resolution	Down to 0.38 μm (Sparrow criterion)
	Vertical repeatability	Down to 0.125% (1σ)
System Hardware	Wafer size	200 or 300 mm, compatible with 300 mm fab automation
	Wafer warpage handling	Up to 4 mm
	Chuck flatness	Down to 1 μm flatness for 300 mm wafer size
	Light source	Patented dual-LED illumination (white, green)
	Magnification	Interferometric and Brightfield: 1.4x to 200x
	Turret	Encoded motorized 5-position turret
	Camera resolution	1200x1000 pixels
	Optical path tip/tilt	Patented automated goniometric correction up to $\pm 2^\circ$
	Vertical scan range	Up to 1.5 mm
	Measurement modes available	Topography, film thickness, intensity-based lateral dimension



Service and Support

Bruker's combination of global service infrastructure, local applications expertise, and proactive support aims to maximize customer uptime and success over the tool's lifespan. Before installation, applications engineers conduct demonstrations and feasibility studies. During installation, there is a dedicated field service engineering team on-site to oversee installation and testing. Once the tool is installed, operator and maintenance training covers recipe creation, automation, data analyses, and tool maintenance procedures. Regular software and firmware updates ensure access to the latest performance enhancements. Remote support, service contracts and periodic preventative maintenance by field service engineers ensure high tool uptime and utilization. Onsite process development and optimization support is also available.

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