

3D Optical Profilers

ROBUST, NON-CONTACT METROLOGY
SOLUTIONS FOR EXACTING APPLICATIONS

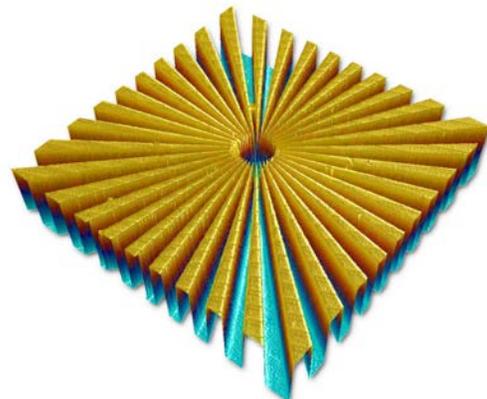
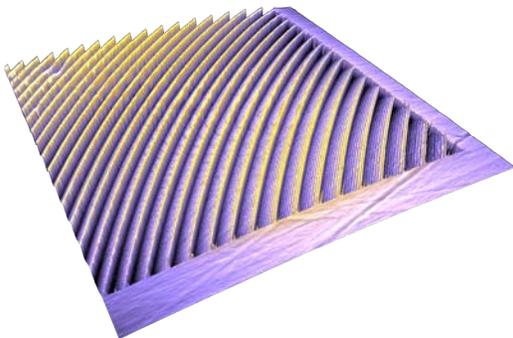
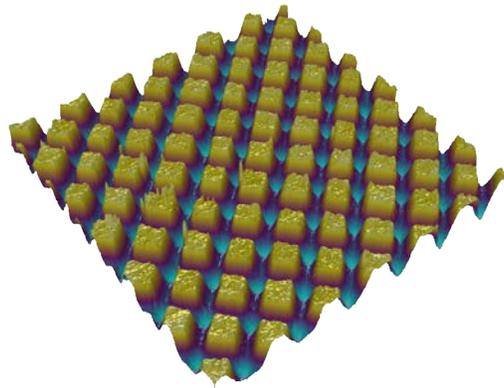


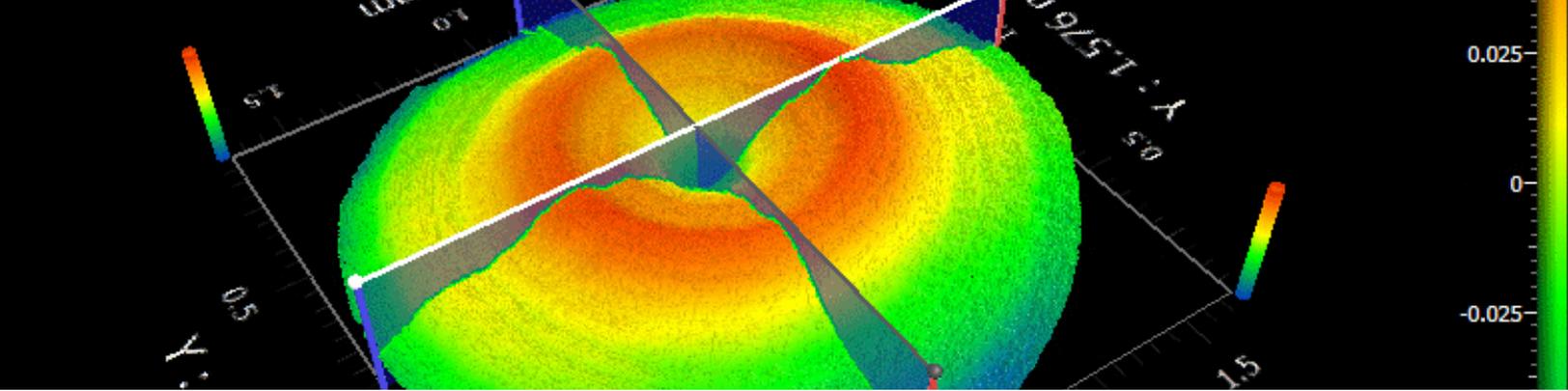
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zygo[®]
AMETEK[®]

Zygo® is respected globally as an innovator and for providing best-in-class technologies, services, and solutions with a focus on surface metrology, position sensing, and optical components and assemblies. In a world where meeting and achieving precise tolerances are critical to the success of advanced applications, Zygo is your dedicated strategic partner.

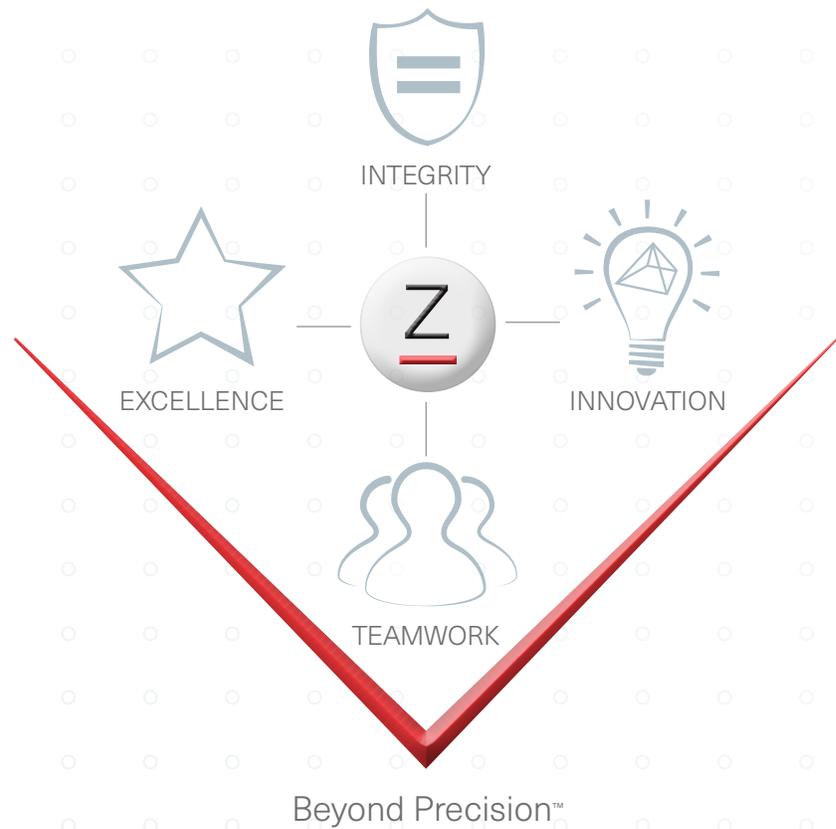




Zygo has been at the cutting edge of ultra-precision manufacturing for 50 years.

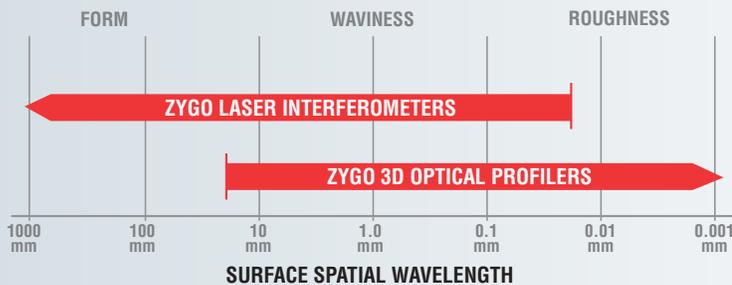
Zygo's global, industry-wide reputation for excellence is a result of a dedicated team, and an unwavering focus on timely, cost-effective, and exceptional high-quality outcomes for the most critical specification.

We continuously innovate, achieving cutting-edge solutions through a combination of passion, experience, tenacity, and the desire to succeed. Zygo's four core values sit at the heart of all we do. In every way Zygo goes Beyond Precision™.



Zygo has elevated the status of optical metrology to a disruptive, enabling technology.

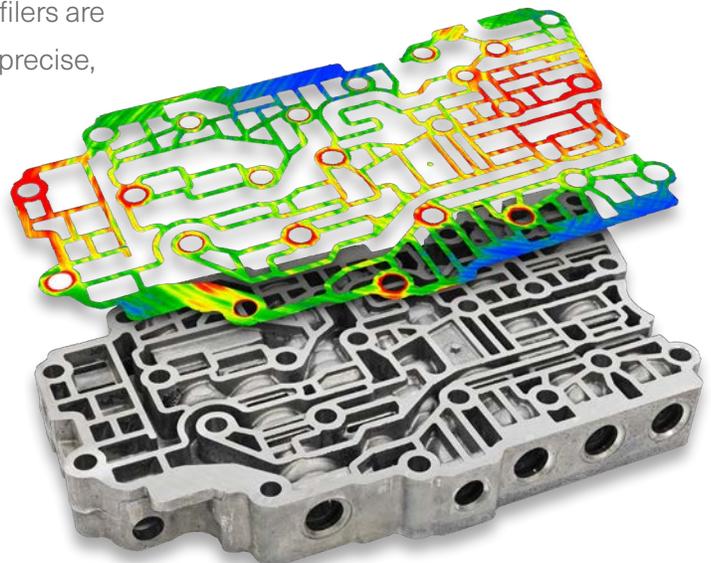
Optical metrology is an extremely versatile surface measurement tool for laboratory inspection and process control. It is non-destructive, non-contact, highly sensitive, and exhibits exceptional resolution and accuracy — all required in modern industrial and R&D applications.



Zygo's optical metrology tools including our laser interferometers and 3D optical profilers measure the broadest range of surface spatial wavelengths in the industry today.

Why 3D optical profiling?

Modern-day product development is being driven by the innovative use of surfaces to manipulate functional performance. 3D optical profiling is used to measure surface finish, roughness, and topography on numerous surfaces. Zygo 3D optical profilers are the measurement tools of choice because they enable precise, quantitative, ISO-compliant, non-contact surface measurement and characterization of micro- and nano-scale surface features, capturing up to 1.9 million data points in seconds.



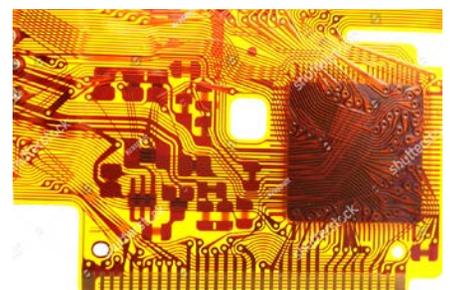


Zygo optical profilers drive process control and optimization as they move beyond the quality lab and into production.

Zygo 3D optical profilers are designed for ease-of-use and achieve best-in-class performance through advanced, patented, and innovative technology solutions. They are highly automated, versatile and packed with features for superior speed and precision; have wider magnification; measure super smooth to rough surfaces and very high slopes.

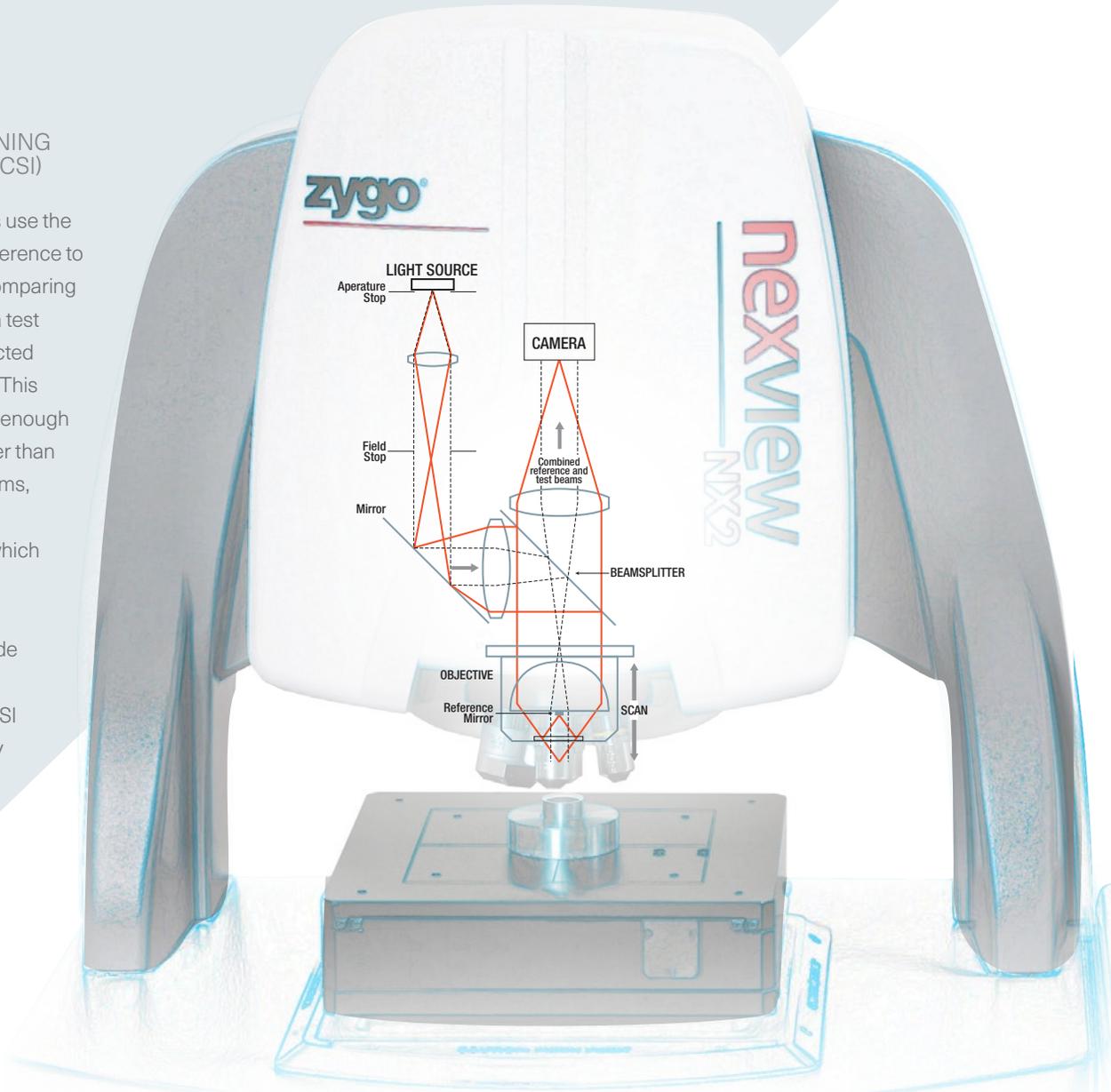
Customers benefit from hundreds of reportable parameters when measuring surface structure and texture across varying surface scales, including aeral surface roughness to ISO 25178 standards, and 2D profile parameter compliant to ISO 4287/4288.

Zygo's 3D optical profilers are not just faster than traditional stylus profiling in measuring surface areas. With large fields of view and more pixels per measurement than less sophisticated solutions on the market, they rival stylus profiling solutions for precision and accuracy.



COHERENCE SCANNING INTERFEROMETRY (CSI)

Zygo 3D optical profilers use the principle of optical interference to measure a sample by comparing the light reflected from a test surface to the light reflected from a reference mirror. This interference is sensitive enough to detect features smaller than 1 nm tall. In Zygo's systems, the interferometer is the microscope objective, which provides magnification as well as the integrated reference. We offer a wide range of lenses which provides our powerful CSI technology across many applications.

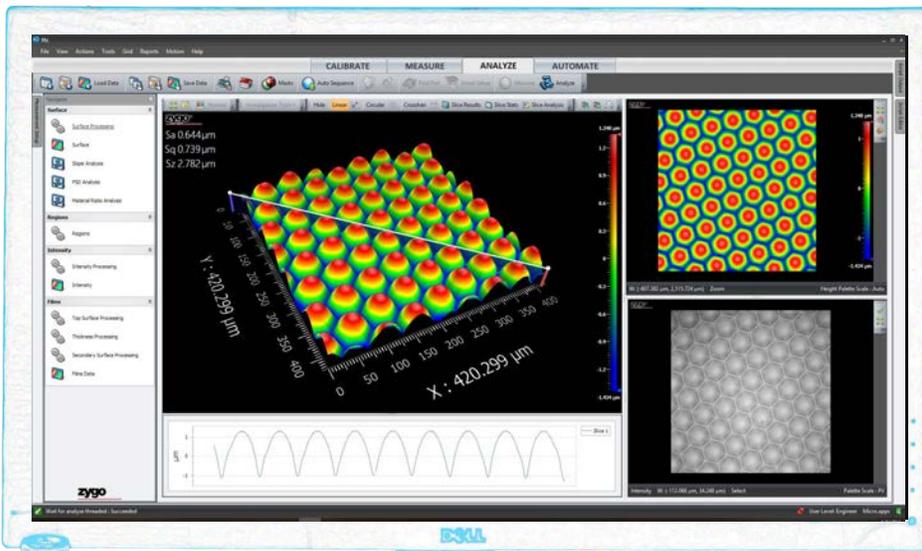


CSI technology is at the heart of Zygo's 3D optical profilers.

CSI technology delivers sub-nanometer measurement precision at all magnifications, and facilitates the measurement of a wider range of surfaces quickly and more precisely than other commercially available technologies. CSI uses a filtered white light source, and because of this, the focus depth over which interference occurs is quite

shallow — a key to its flexibility. However, if the interference signal and optical focus are not coincident, the measurement data appears smoothed, so Zygo optimizes each objective to bring these two points together and ensure the highest fidelity height information from every measurement.

Zygo Mx™ software provides a powerful set of tools that sets it apart from standard data analysis and system control software.



- Robust measurements
- Interactive 3D plots
- Flexible analysis
- Intuitive user interface
- Built-in SPC analysis

Zygo's Mx software powers complete system control and data analysis, including interactive 3D maps, quantitative topography data, intuitive navigation, and built-in statistical process control (SPC) with statistics, control charting, and pass/fail limits. Using a simple workflow-based concept, users can easily navigate the metrology experience from setup through analysis and reporting.



Part Finder & SmartSetUp™
No guesswork or expert-level training required. Automatically optimizes data in >1 minute.



SureScan™
Precision metrology in vibration-prone environments.



SmartPSI™
Precision and speed, with the lowest possible noise. Results of 0.06 nm sq with 0.005 nm repeatability – in just seconds.



Regions Analysis
The power of area measurements. Compare regions separated laterally and/or vertically.



Custom Workspace
Create customized interfaces and dashboards for control, analysis, and reporting.



Stitching & Patterned Sampling
Examine surfaces at a higher magnification with higher data density, and measure different locations on the stage.



PYTHON™ Scripting
Built-in PYTHON programming environment to automate recipes and/or customize analysis.

— Zygo 3D optical profilers provide metrology solutions for every industrial sector where there is a demand for cost-effective, reliable, repeatable, and accurate ultra-precision measurement.

- Non-contact metrology
- No consumables
- Vibration resistant
- For both the lab and process optimization
- Sub-nanometer precision at all magnifications
- ISO 25178 compliant results
- Automated configuration for ease-of-use
- Full 3D visualization of virtually any surface
- Vertical precision and high speeds are independent of magnification
- Up to 1.9 million data points in every measurement field
- Data integrity and reliability in all environments

Zygo has engineered a full line of non-contact 3D optical profilers designed for an extensive range of applications.

ZEGAGE™ PRO

The ZeGage Pro and Pro HR robust bench-top class profilers provide measurement and characterization of micro-scale features on virtually any 3D surface, setting new standards for performance, ease-of-use, flexibility, and precision. Both

systems use Zygo's interactive and intuitive Mx control and analysis software for easy and detailed visualization to help in process control. SureScan technology, for vibration robust metrology, is now paired with Part Finder and SmartSetup tools to make sample changes fast and easy. The ZeGage Pro delivers quantitative surface metrology

with nanometer-level precision, ideal for most industrial surfaces. For smoother optical surfaces, super-finished surfaces, and polished metallic components — the ZeGage Pro HR offers more than 20X better precision with sub-nanometer performance.



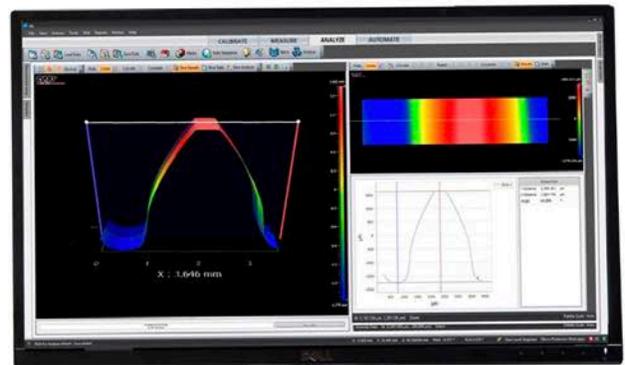
SureScan

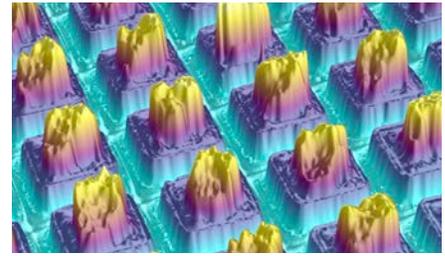
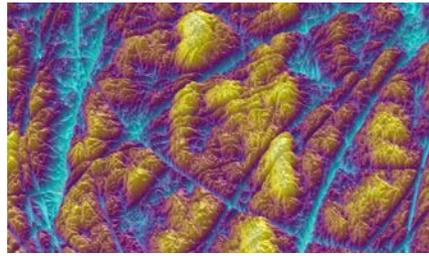
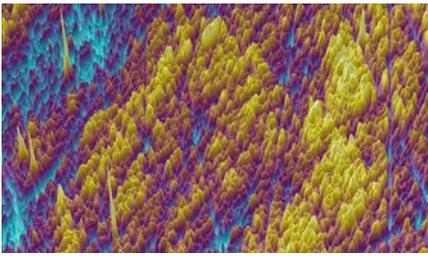


Part Finder & SmartSetup



Stitching & Patterned Sampling



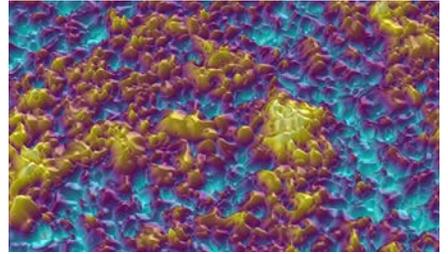
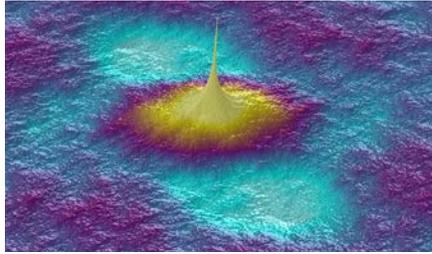
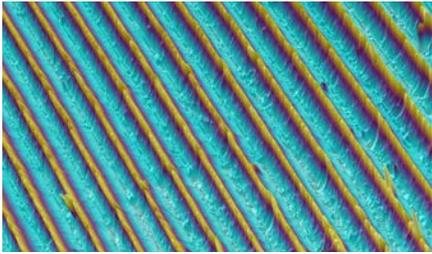


Confidence in Metrology

“On Zygo tools, instrument reliability is outstanding, which results in consistent long-term results.”

– Jack Clark, Principal Scientist, WOODWARD, INC.





Each Zygo optical profiling system is characterized by superior performance, accuracy, speed, and precision.



Part Finder & SmartSetup



SureScan



SmartPSI



Stitching & Patterned Sampling



Multiple Sample Stage Options

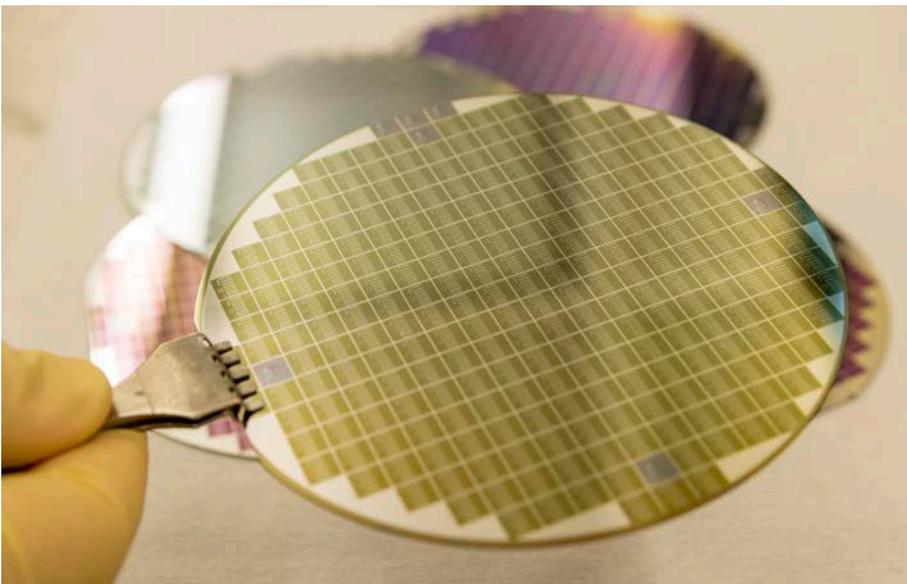


Film Thickness Capability

NEWVIEW™

Zygo's NewView 9000 profiler provides powerful versatility in non-contact optical surface measurement, making it easy and fast to measure a wide range of surface types, including smooth, rough, flat, sloped, and stepped. All measurements are non-destructive and require no sample preparation. At the core of the NewView 9000 is Zygo's Coherence Scanning Interferometry (CSI) technology, delivering sub-nanometer precision at all magnifications, and measuring a wider range of

surfaces faster and more precisely than other commercially available technologies. All NewView 9000 systems are configured with advanced SureScan vibration reduction technology and SmartSetup automated configuration tools for quick and confident setup, while optional motorized sample staging enables programmed sequences to measure multiple part segments, recipe-based in-tray part measurements, or wide-area part stitching of larger surfaces into a single measurement.





Sub-nanometer precision at all magnifications.

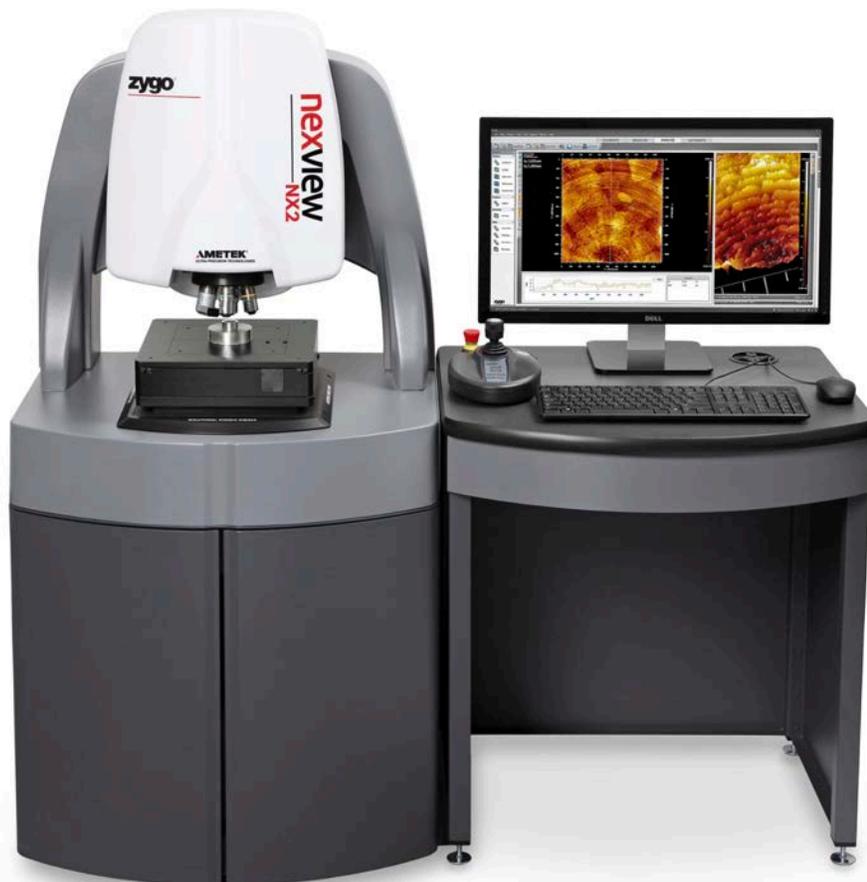
NEXVIEW™ NX2

The Nexview NX2 is Zygo's most advanced profiler, a fly-by-wire tool with no manual controls designed for the most exacting of applications, and combining exceptional precision, advanced algorithms, application flexibility, and automation into a single package. The Nexview NX2 delivers sub-nanometer precision at all magnifications and measures a wider range of surfaces faster

and more precisely than any other commercially available system.

With applications as varied as flatness, roughness and waviness, thin films, step heights, and more on virtually any surface and material, the Nexview NX2 exhibits gage capable performance through exceptional precision for the most demanding production applications with 2D and 3D

results that comply to ISO 25178 and ISO 4287 standards. SureScan and SmartSetup technologies deliver robust and precise measurements with minimal effort. Additionally, SmartPSI™ technology ensures extremely fast profiling of ultra-smooth surfaces. And the Nexview NX2 exclusive Model Based Films analysis option measures transparent films as thin as 50 nm.



Part Finder & SmartSetup



SureScan



SmartPSI



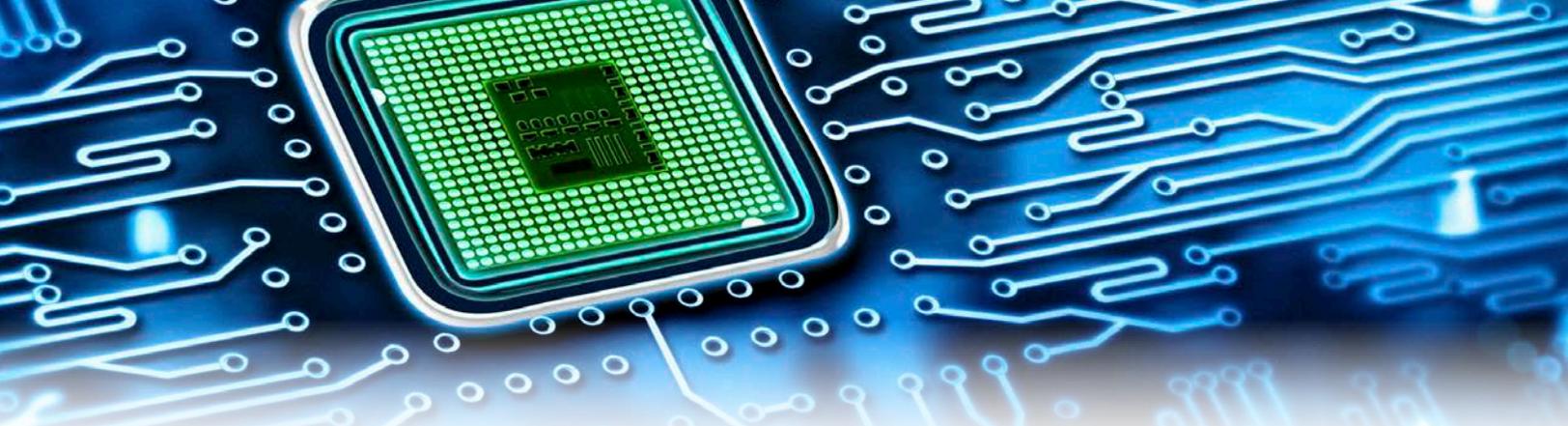
Stitching & Patterned Sampling



200 mm Staging



Fully Automated Controls



NEXVIEW™ 650

The Nexview 650 is a large format inspection tool optimized for automated measurement of injection molding tooling, PCBs, glass panels, and other samples requiring an extended work volume. It provides 2D & 3D measurements of a variety of surface features on virtually all types of surfaces (from rough to super smooth, including thin films, steep slopes, and large steps); provides sub-nanometer measurement precision independent of field magnification; and offers gage capable performance meaning exceptional precision and repeatability for the most demanding production applications.

With lateral dimensions up to 650 x 650 mm, and a split axis high load stage, the Nexview 650 accommodates the largest and heaviest of today's substrates and tooling — providing value for years to come.



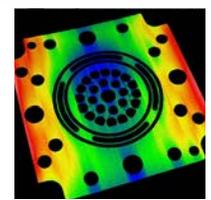
Part Finder & SmartSetup



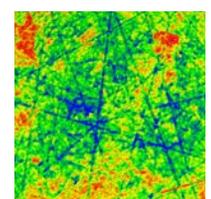
SureScan



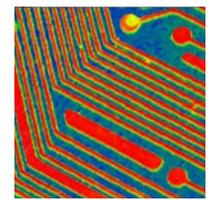
Large Work Volume



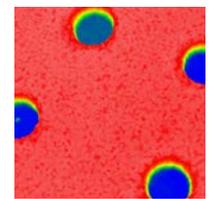
Large area flatness and topography



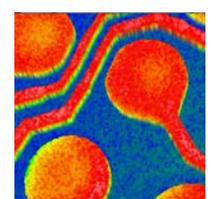
Surface texture and roughness



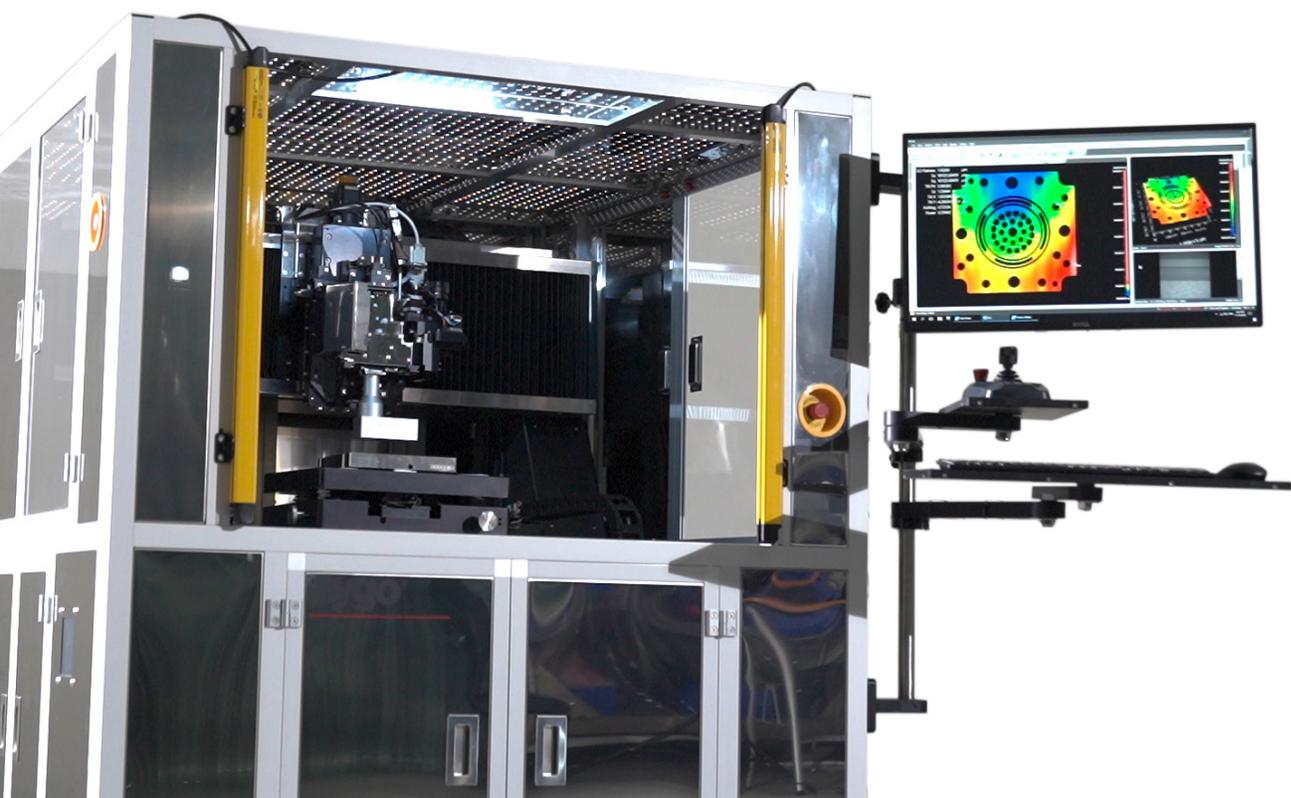
Line and space depth and width



Hole depths and size



Surface features size and topography



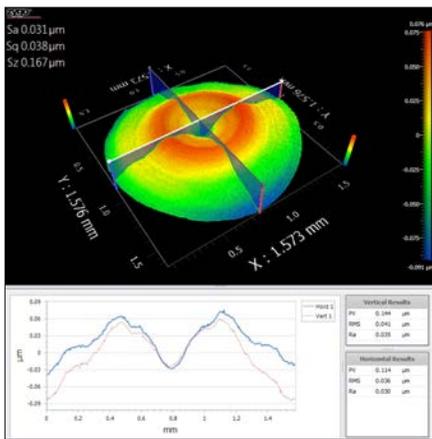


The benchmark for automated, non-contact 3D surface metrology and process control for discrete micro lenses and molds critical to compact imaging systems.

COMPASS™

As our most advanced system, Compass sets the bar for precision metrology of spherical, aspherical, and freeform micro lenses and their injection molds typically employed in smartphone cameras and automotive vision systems. Compass utilizes CSI technology and advanced software algorithms, together with an automated multi-axis staging

system to deliver surface form and deviation, texture, and relational (dimensional) parameters. It is ideal for applications requiring complete characterization of the optical surface and mechanical datums. The Compass RT system packages the same relational metrology into a workstation platform for when full surface characterization is not required.



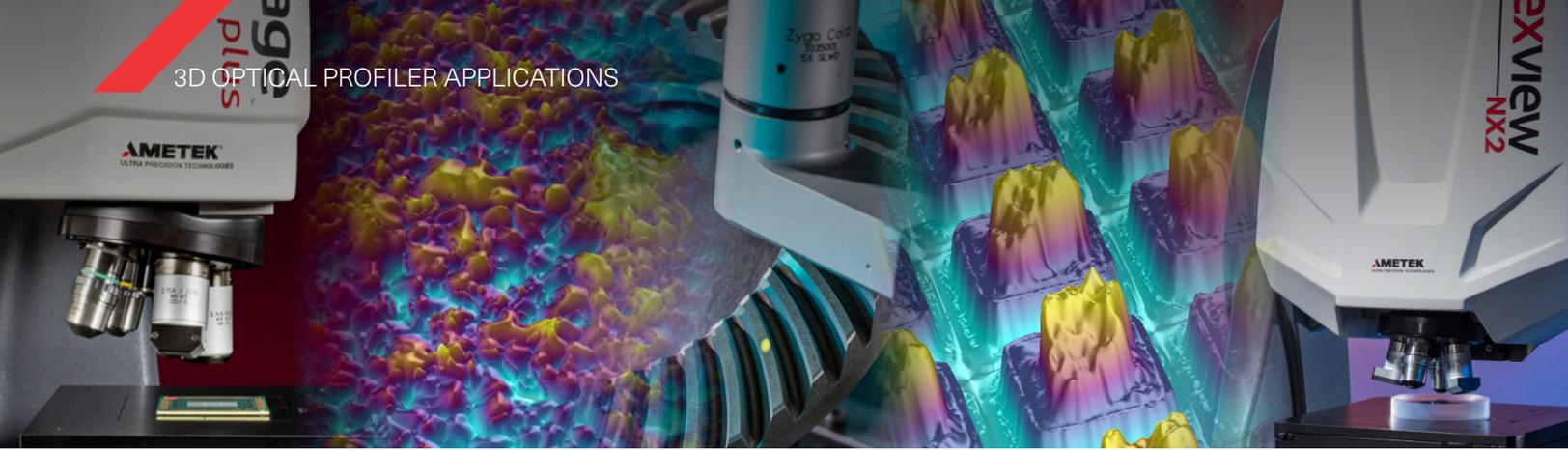


Production-ready metrology solutions for your specific applications.

Durable, ergonomic and compact, Zygo's Guardian industrial enclosure provides protection from harsh environments while maintaining optimal performance and functionality — enabling precision metrology directly on the manufacturing floor.

ZYGO GUARDIAN™

- Isolated metrology core
- Compact footprint
- Acoustical dampening side panels are removable for serviceability
- Ergonomic controls with workspace lighting and large access window
- Compatible with NewView and Nexview class 3D optical profilers



As 3D optical metrology specialists, Zygo engineers and scientists design, manufacture and provide solutions for a vast array of applications.

FORM, WAVINESS, AND ROUGHNESS

Zygo's full offering of non-contact optical metrology systems cover a wide range of spatial frequencies. This enables surface characterization from high frequency features such as roughness and texture to low frequency form and topography. Both qualitative visual images as well as quantitative 3D surface measurements are produced, with surface data compliant to the latest ISO 25178 standards. These capabilities enable process insight across industries and applications:

- Precision machining users can control manufacturing processes while gaining the insight necessary to address manufacturing challenges as they arise.
- Optics manufacturers can examine characteristics of texture using simple and robust PSD analysis to fingerprint their manufacturing process.
- Microelectronics manufacturers can quickly and easily examine steps, depths, texture, and critical dimensions at a single instrument, saving valuable process time.

The areal nature of these measurements provides a faster and more robust solution that delivers a comprehensive assessment of the manufacturing process.

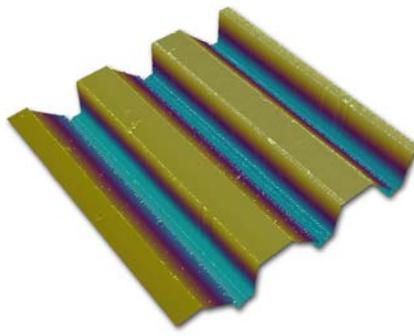
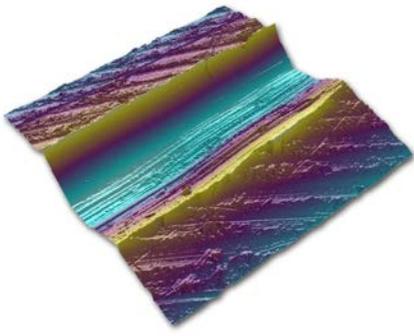
STEP HEIGHT AND REGIONS

Zygo's Mx software performs complete system control and data analysis in a single package and is standard with all of its 3D optical profilers. One key capability is the ability for customers to focus in on specific surface features with the embedded "Regions Analysis Tool". This software tool performs isolation of features of interest for individual scrutiny or group analysis. While applications of the Regions Analysis Tool are countless, the measurement of step heights is particularly common.

Zygo's optical profilers can measure step heights up to 20,000 μm with exceptional precision and repeatability. The height and relative angle difference between two discontinuous planes is handled easily using Zygo's CSI technology at the heart of all its 3D optical metrology solutions.

Regions analysis does more than just simple steps. Other application examples include:

- Quantify feature heights and sizes
- Characterize trench widths and depths compared to the surface
- Individually measure micro lenses separately from their substrate



TRIBOLOGY

Zygo's 3D optical profilers are frequently selected for precision tribology applications in material research, refinement of surface finishing techniques, and lubrication engineering. They can examine surface features with nanometer-scale precision and provide reliable quantitative 3D measurement data quickly and reliably. Zygo's profilers are valuable tools for wear analysis, and virtually all types of surfaces (over a wide range of reflectivities), can be measured, including microbial biofilms, PTFE nanocomposite films, diamond-like films, silver tantalate coatings, as well as more conventional materials like metals, ceramics, and glass.

AUTOMATED IMAGE INSPECTION

Using Zygo's Mx software, users can leverage optional 2D analysis tools to augment the precise 3D topography with robust and precise lateral metrology and pattern recognition. The software can process either the high-fidelity intensity images or the precise topography maps for lateral metrology including linewidth and spacing, feature sizes, counts, and distances. 2D analysis is done simultaneously with topography measurements, using the same magnification, field of view, and measurement location, saving time and reducing uncertainty that comes from using multiple tools for multiple measurements. The analysis tools are built into the standard Mx analysis sequences and are completely configurable by end users to solve specific application needs.

TRANSPARENT FILM INSPECTION

Zygo 3D optical profilers with Mx software have two optional films inspection options available, depending on the profiler platform and required metrology. All systems are able to measure the topography of films >400 nm thick. Additionally, films from 1-150 μm thick can be inspected for surface and substrate topography and thickness on NewView, Nexview, and Compass platforms, while ZeGage platforms can inspect surface and substrate topography only.

On the Nexview, Zygo's most advanced CSI-based films measurement technology — the patented model based films analysis (MBA) — is also available to inspect surface and substrate topography and thickness of films as thin as 50 nm in just seconds. MBA can also be used to accurately profile the heights of dissimilar materials by correcting for the phase change on reflection (PCOR) that occurs in these situations.

Both are optionally available either at the time of system manufacture, or as add-on options for when application requirements evolve.



System control,
data analysis,
and production
quality analysis
made simple.

Zygo's 3D optical profilers are extremely versatile, and customers use our metrology solutions in every industrial sector where there is a demand for cost-effective, reliable, repeatable, accurate, and precise nanometer-level measurement. Key among these are the consumer electronics, automotive and precision machining, optics manufacturing, medical, and advanced R&D. Our systems have helped solve challenges manufacturing cell phone cameras and vehicle transmissions, and been instrumental in advancing innovation in human joint implants and augmented and virtual reality displays. In this we always strive to provide the highest quality data in the easiest and most robust way to ensure confidence.



CONSUMER ELECTRONICS (CE)

Zygo's metrology systems enable CE manufacturers to improve quality and yield of their processes, while lowering metrology costs. Our flexible platforms and interchangeable applications allow manufacturers to develop applications on one system and deploy them on another in order to maximize metrology investments — for example, developing at a central facility with an instrument such as Nexview NX2, and then deploying to factories at scale on a NewView or ZeGage platform. Specialized application platforms such as Compass and Nexview 650 enable critical metrology for small lenses and large panels respectively with the unique constraints of the customer's sample considered first and foremost. The processes and volumes in consumer electronics run the full range from simple to complex and small batch to mass production — and Zygo supports this with the full range of 3D optical profilers for this sector.



PRECISION MACHINING

In the area of precision machining, the full array of Zygo profilers are used. SureScan technology enables the cost effective deployment of 3D optical profiling right to the manufacturing floor. No longer are instruments like the ZeGage, NewView, and Nexview reserved only for the metrology room. Accessories like Long (LWD) and Super Long (SLWD) working distance objectives and the Guardian enclosure facilitate accurate and precise metrology with maximum flexibility.

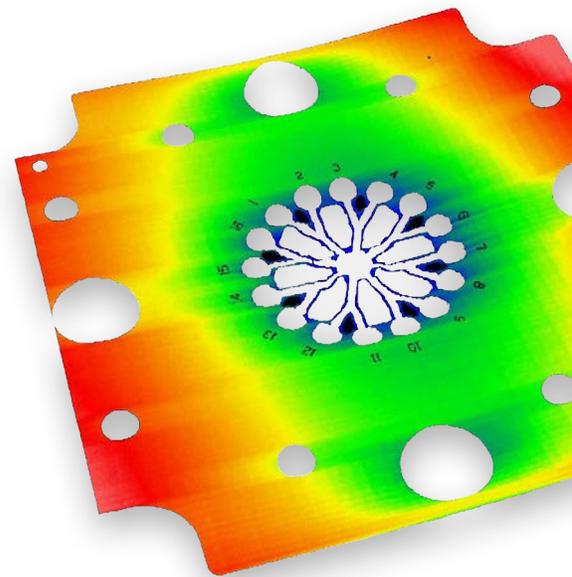
ADVANCED R&D

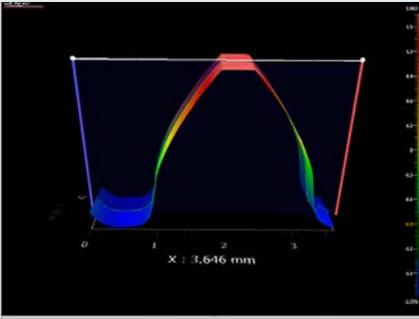
Zygo optical profilers provide researchers the advanced data collection and analysis techniques to enable scientific exploration of new materials, processes, and surface effects by providing confidence in highly repeatable, quantifiable results.



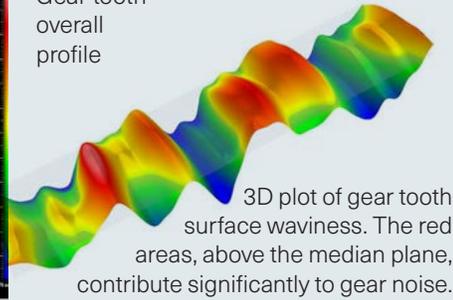
OPTICS MANUFACTURING

Optics require exceptional control over roughness and mid-spatial frequency waviness. Zygo's wide range of objective magnifications enable a single tool to characterize the full spectrum of surface structure on an optic. And unique technology such as SmartPSI on the NewView and Nexview profilers enable precise roughness measurement of extreme polished sub-angstrom surfaces in seconds instead of minutes.





Gear tooth overall profile



3D plot of gear tooth surface waviness. The red areas, above the median plane, contribute significantly to gear noise.



“Zygo’s precision metrology instruments help manufacturers identify problems quickly, thus reducing scrap and downtime.”

Today’s cars and trucks require an unequalled level of comfort, convenience and quietness — with emphasis on reduced cabin noise. The last thing that an automaker wants to hear when testing its new vehicles is a pervasive humming sound that seems to emanate from nowhere, but this is exactly what one major automaker discovered while testing the vehicles coming off its assembly line — a mysterious humming sound that had their engineers stumped.

They turned to Zygo’s industry experience and reputation for help. Using state-of-the-art, optical non-contact surface metrology instrumentation, the humming sound was identified as microscopic waviness on the gear teeth in the rear differential unit — one of the vehicle’s major drive components. The waviness resulted from the machining process, and had gone undetected by traditional inspection technologies. Once identified by Zygo, the gear manufacturer was able to refine their production process to eliminate the noise, but still needed a fast, quantitative and reliable way to continually monitor the process to ensure the problem did not recur. Zygo collaborated with the manufacturer to embed the precision metrology instrument directly into the production line of this critical component, which avoided sending gears to a metrology lab and waiting for the test results. Zygo’s precision metrology instruments are vibration resistant, enabling them to deliver reliable, precise measurements in a production environment. Their speed and advanced capabilities enable manufacturers to quickly identify problems, thus reducing scrap and downtime.

As the automaker quickly discovered, controlling the process with Zygo’s advanced 3D technology not only helped improve the quality of their gears, but also increased production yield and efficiency, thereby saving them money and resulting in rapid payback and ROI.



Zygo, the go-to metrology expert when there is no room for error.

Whether in the QC lab or in-process and in-line, virtually anything is possible through the use of our unique and patented data acquisition technologies. Quality and process control are at the heart of our customers’ requirements, and today thousands of companies around the world use our reliable metrology tools backed by innovative algorithms to guarantee excellence in production measurements of surface form of components and assemblies. Zygo’s team of experts can design a system to your most critical specifications.



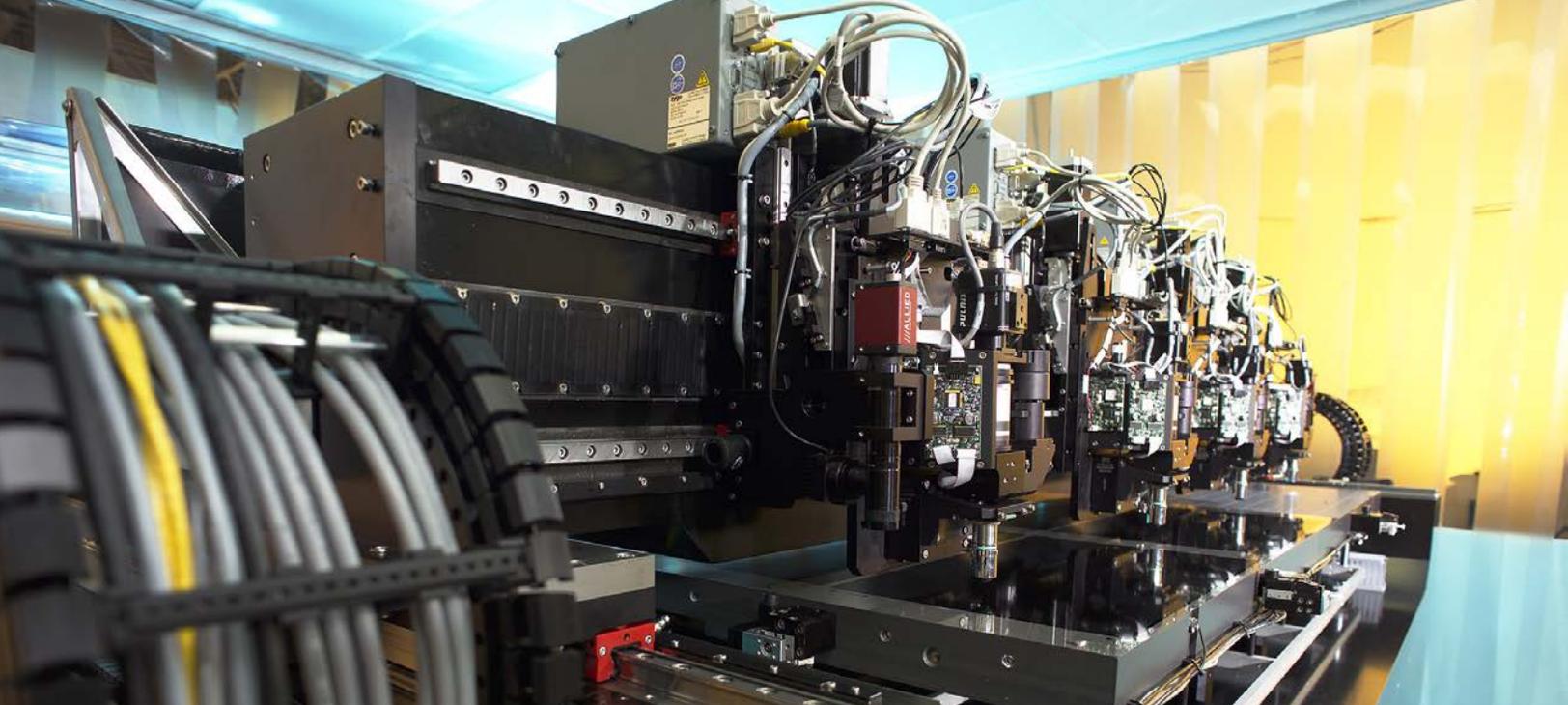
Key to making the investment in an optical profiler cost effective and relevant for the long haul is making sure that it will be flexible and adaptable as metrology needs evolve. For that reason, Zygo has worked to have an extensive collection of instrument accessories that can be added over time. Interferometric objectives are the heart of the

system — ZYGO's selection ranges from 1X to 100X with unique long and super-long working distance options, special glass compensated models for looking through a window, and application specific models. As an optics company, Zygo designs and manufactures several of its lenses from scratch, including the patented Zygo Wide Field

(ZWF) lenses which combine large field of view and a compact package. Beyond just objectives, accessories for image zoom lenses, sample stage options, part holding fixtures, calibration artefacts, and software licenses round out the collection, ensuring you have confidence in and flexibility with your metrology investment.

PROFILER COMPARISON MATRIX

	ZEGAGE PRO	ZEGAGE PRO HR	NEWVIEW 9000	NEXVIEW NX2	NEXVIEW 650	COMPASS
Surface Topography Repeatability (STR)	3.5	0.15	0.08	0.06	0.12	0.12
Repeatability of RMS	0.1	0.01	0.008	0.006	0.01	0.01
Image Zoom	1X fixed	1X fixed	3 pos automated 1X included	3 pos automated 0.5X, 1X, 2X included	3 pos automated .05X, 1X, 2X included	3 pos automated 0.75X, 1X, 1.5X included
Camera Array (max)	1600 x 1200	1600 x 1200	1600 x 1200	1600 x 1200	1600 x 1200	2560 x 2560
Illumination	Fixed	Fixed	Manual filter and apertures	Software controlled filter and apertures	Software controlled filter and apertures	Software controlled filter and apertures
Riser Kits	75 mm head only	75 mm head only	75 mm head, 35 mm, 176 mm gantry	75 mm head, 35 mm, 150 mm gantry	75 mm head	Fixed
Sample Tilt Staging	Manual	Manual	Manual or motorized	Motorized	Fixed	Motorized
Sample Staging	Manual 100 x 50 Motorized 100 x 100	Manual 100 x 50 Motorized 100 x 100	Manual 100 x 100 Motorized 150 x 150	Motorized 200 x 200 Motorized 325 x 200	Motorized 650 x 650	Motorized 6 axis positioner
Focus Stage	100	100	100 standard 200 optional	100	150	100
Color Imaging	No	No	No	Included	No	No
Films	Thick film topography and substrate	Thick film topography and substrate	Thick film topography, thickness and substrate	Thick and thin film topography, thickness and substrate	Thick film topography, thickness and substrate	Thick film topography and substrate



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