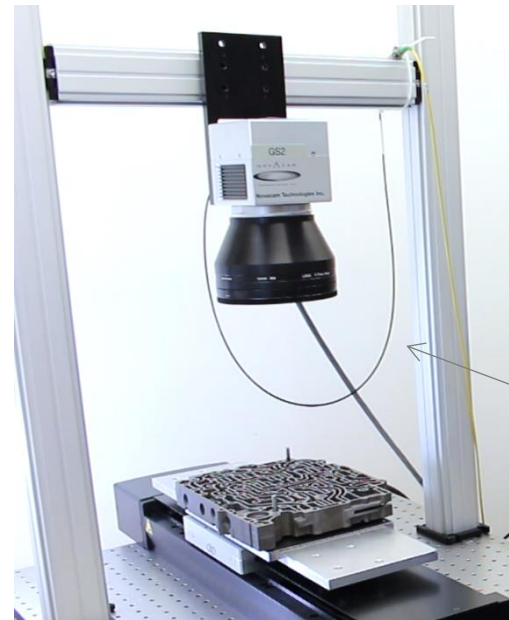NOVΛCAM

SURFACEINSPECT^{TM} system

For non-contact high-precision 3D metrology
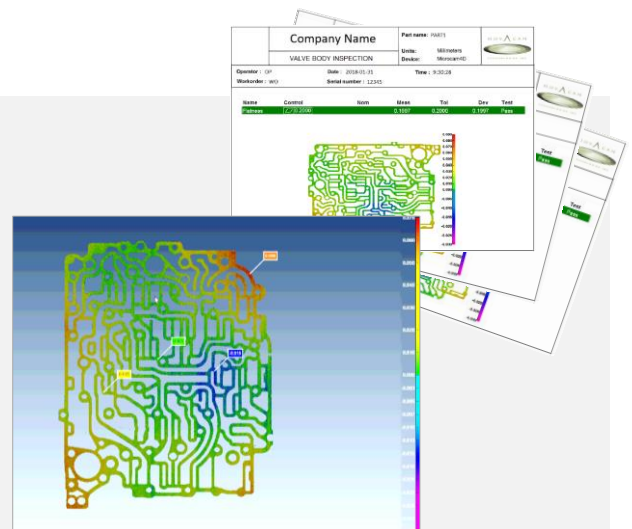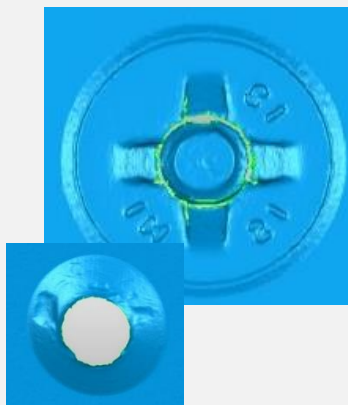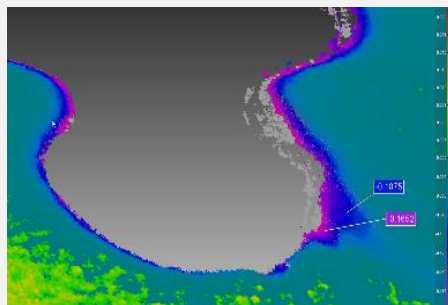

Measurement with
galvo (raster) scanner

Optical fiber
to system
interferometer

✓ Wide range of micron-precision 3D measurements

- **3-dimensional geometry (GD&T) measurements** – position, profile, flatness, straightness, and more
- **Roughness measurement**
- **Defect detection** – porosities, burrs, cracks, and scratches
- **Thickness measurement** of single or multi-layer films (semi-transparent materials)

✓ Fully configurable automated inspection
✓ Easily integrated in fully automated production lines

System Benefits

- ✓ **Micron-precision measurements of 3D geometry, roughness, defects, or thickness**
- ✓ **Measures high-aspect-ratio features such as grooves, blind holes and slots**
- ✓ **Reduced inspection cycle time:** up to 100,000 measurements per second, each representing a 3D topographic point
- ✓ **Flexible options for evaluating inspected parts with third party software:** measured features can be compared to CAD or to user-defined set of locations, nominals, and tolerances
- ✓ **Simple scan definition and execution:** The scanning sequence defined once by teaching the system with a joystick
- ✓ **Time-saving automated reporting:** Following a scan, go-no-go reports can be produced, and results logged in a manner compatible with industry-standard mechanisms
- ✓ **Adaptable to hostile environments:** radioactive, very hot, cryogenic, vacuum, etc.
- ✓ **No need for expensive consumables:** Optical probes do not wear out like contact probes.

System components

NOVACAM™ SURFACEINSPECT™ system is a fiber-based modular system that comprises:
(1) Galvo (raster) scanner
(2) Microcam interferometer
(3) Inspection station
(4) PC
(5) Galvo controller and motion controller(s) (not shown)
(6) Multiplexing hardware (optional, not shown).
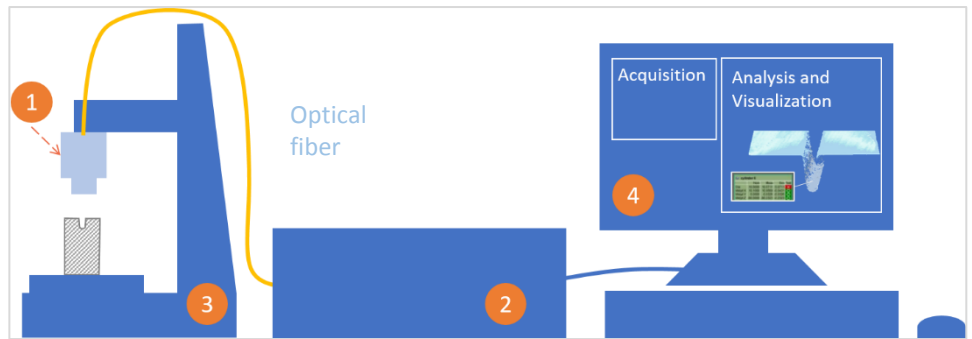
① Galvo scanner (GS)

The galvo scanner consists of a galvo head and a lens selected for the application. It acquires 3D surfaces or material thickness in an efficient raster pattern. The GS housing is robust and shop-floor ready.

Surface scanning setup
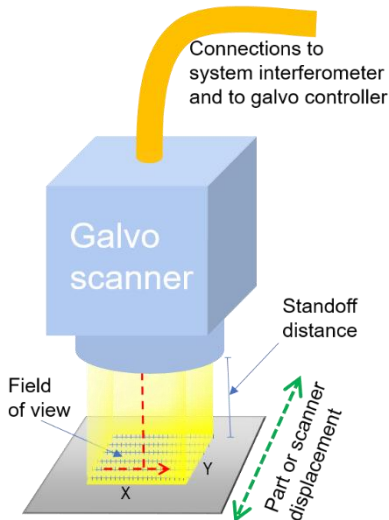
Standard GS lens characteristics*

Field of view (FOV) (mm)	Standoff distance (mm)
4.7 x 4.7	7.5
9.4 x 9.4	25.1
14.1 x 14.1	42.3
18.8 x 18.8	64
28.9 x 28.9	93.8
30 x 30	87.5
43 x 43	137
54 x 54	126
84 x 84	215.4

* Only standard galvo lens characteristics are listed in this table. Galvo scanners with non-standard characteristics are custom-built upon request.

2 MICROCAM™ interferometer

The interferometer provides the light source to the optical probe and processes the optical signal received from the GS. The GS and the interferometer are connected with an optical fiber.

MICROCAM interferometer models

	MICROCAM-3D		MICROCAM-4D
General characteristics			
Technology	low-coherence interferometry		
Light wavelength	1310 nm, infrared		
Size of interferometer enclosure box (depth x width x height)	4U rackable enclosure 445 x 445 x 178 mm		
Non-contact measurements			
Scanning depth range options*	3.5 mm	7 mm	5 mm
Acquisition (A-scan) rate	2.10 kHz	1.05 kHz	100 kHz
Axial (Z-axis) resolution	< 0.5 µm		
Light spot size (Lateral [XY-axis] resolution)	4.1 - 146 µm, typically 15 - 35 µm		
Standoff distance	0.5 - 100 mm for standard probes, up to 1 m for non-standard probes		
Repeatability**	< 1 µm		
Thickness measurements			
Thickness measurement range (optical in air)	10 µm - 3.5 mm	10 µm - 7 mm	20 µm - 5 mm
Typical materials for thickness measurements	glass, polymers, multi-layer films, coatings, plastics, silicone, liquids, specular or non-specular		
Sample reflectivity	0.1 - 100%		

* *To further increase maximum scanning depth, a mechanical displacement axis is available.*

***The stated repeatability pertains to a system where the optical sensor is not moving with respect to the measured surface. The repeatability of the motion mechanism is usually bigger; this can be effectively addressed by the use of a glass reference plate.*

3 Inspection station

Inspection station configurations are application-dependent and can be supplied by Novacam. Fixturing for the part is not included.

Measurement may be carried out in 2 modes:
- **Scanning in X direction only,** where the scanned surface is moving relative to the lens in the Y direction
- **Scanning in both X and Y direction** to obtain an area at a time, with multiple scans stitched together if required.

For automated inline industrial inspection, NOVACAM SURFACEINSPECT system galvo scanners may be integrated with precision stages or robots to support high-volume continuous flow manufacturing. They can also be integrated with third-party CMMs (coordinate-measuring machines) and CNC (computer numerical control) machines.
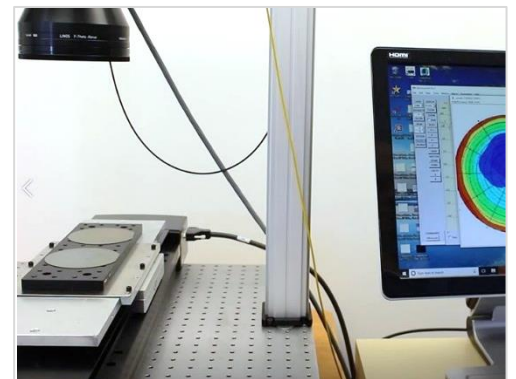
The GS is mountable on a variety of precision stages and robot arms. Here it is measuring the thickness of coating on electronic wafers.

4 PC, monitor and joystick

The SURFACEINSPECT system comes with a PC, monitor, mouse, and joystick.

5 Galvo and motion controller(s)

The galvo controller and motion controller(s) are included. The galvo controller controls the motion of the light beam within the raster pattern. Depending on the number of additional motion axis required, the motion controllers are housed in a 2U, 3U, or 4U rackable enclosure.

With optional optical switches, more than one galvo scanner (possibly in combination with one or more optical probes) may be multiplexed to a single MICROCAM interferometer. Multiplexed galvo scanners and probes may be used one at a time. This option brings additional return on investment (ROI) to many installations.

System software

The SURFACEINSPECT system comes with NOVACAM high-performance data acquisition software, which is PC, Windows®-based, and user-friendly for scan programming. The system simultaneously generates 3 data sets from the same scan: 3D point cloud, light intensity image, and height image. The height and light intensity images facilitate defect detection. STL file format is also available.

An application programming interface (API) is available for system integrators and OEMs to accommodate a wide variety of online and offline applications. Exported results may be integrated with data loggers and SPC software.

A turnkey solution for full GD&T analysis of measured parts is available with InnovMetric PolyWorks Inspector metrology software that may be purchased with the system. Go-no-go reporting is easily programmed and automated. Operators benefit from capabilities such as a quick visual comparison (deviation map) of the acquired part measurements to pre-specified tolerances or to the CAD of the part.

Measurement analysis of a blind EDM slot on an aerospace stator blade using PolyWorks® Inspector

Visualizing the scan data may be accomplished by importing the data into third party visualization and numerical analysis software such as PolyWorks Inspector, Geomagic, ImageJ, SolidWorks, Octave, MatLab, Mathematica, IDL, or IGOR Pro.

Deriving application-specific measurements from the 3D point cloud is available through a selection of in-house and third party software. Novacam supports the following options:

Data processing options

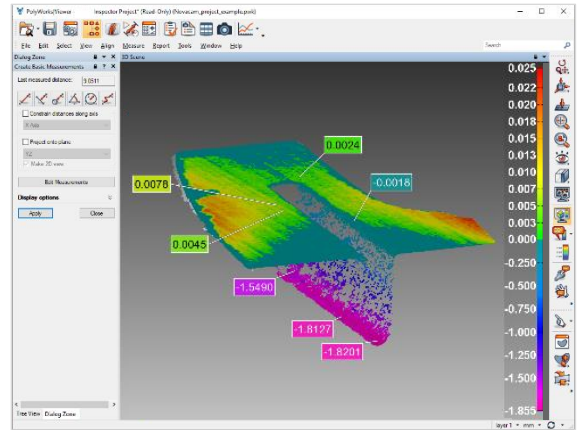|	Novacam in-house software	3rd party software, such as
Dimensional measurements (GD&T parameters)		PolyWorks Inspector (turnkey solution), Geomagic
Roughness and surface analysis	✓	TrueSurf, MountainsMap
Thickness	✓	
Chatter (vibration)	✓	
Volume loss	✓	
Defects	Custom-developed*	

Novacam offers the option of custom data processing, reporting, and defect detection programs that can be written based on client requirements.

Standard system configuration

- Galvo scanner with a 30×30 mm field of view
- MICROCAM-4D interferometer
- PC with NOVACAM acquisition software
- 1-year warranty

Instrument safety

NOVACAM SURFACEINSPECT systems feature an in-probe red laser pointer (650 nm wavelength) for alignment purposes. They are Class 1M Laser products, with < 20 mW of infrared and < 5 mW of in-probe laser pointer.

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visit www.novacam.com