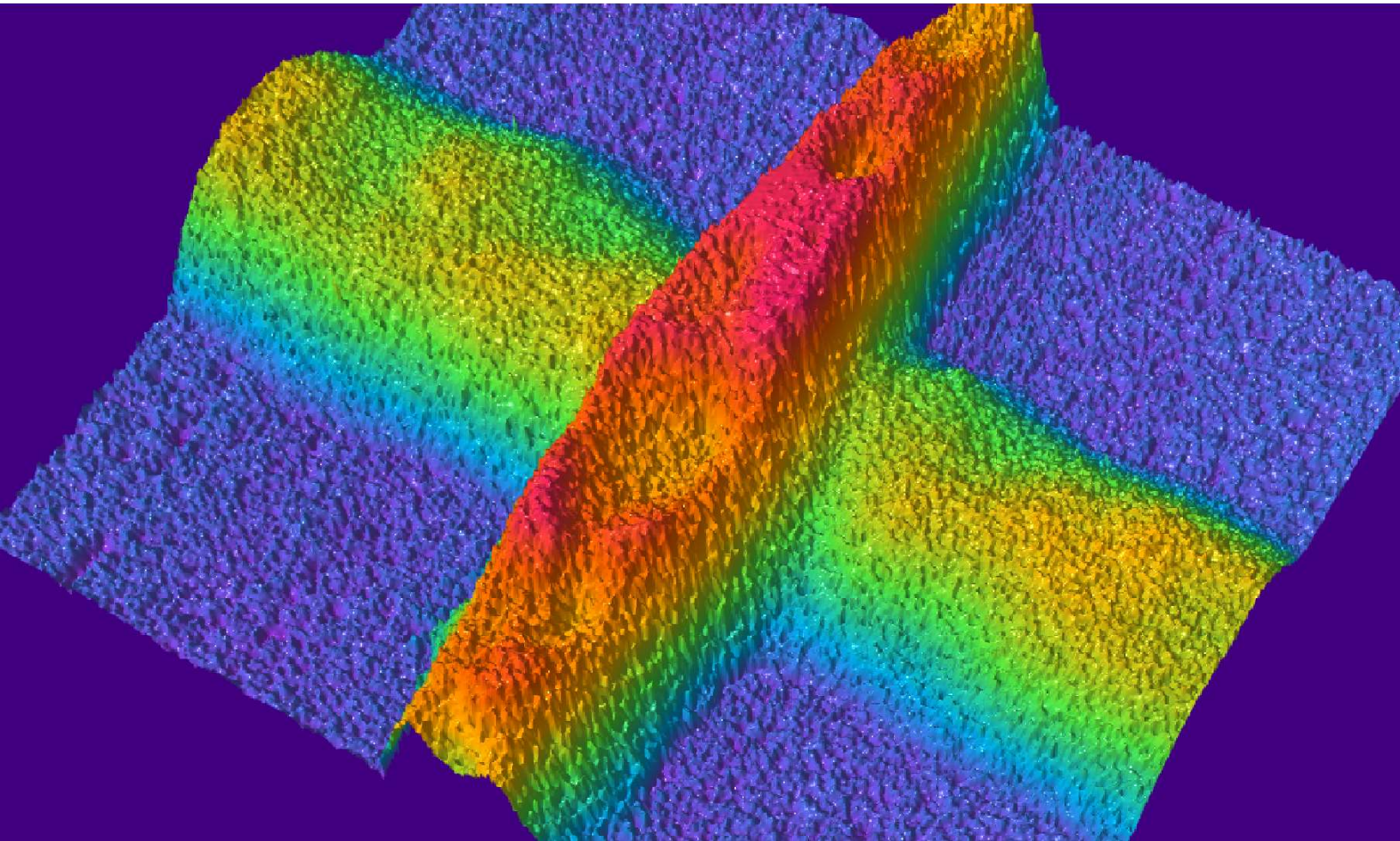
KLA INSTRUMENTS

Filmetrics® Profilm3D®

Optical Profiler



Features

- Automated XY stage with:
  100mm x 100mm travel (Profilm3D)
  200mm x 200mm travel (Profilm3D-200)
- Automated Focus with 100mm travel
- Four-position turret
- Tip-tilt stage with ± 5° travel
- Industry-leading 500µm piezo travel
- Industry-leading 2mm-wide field of view with 10X objective
- Low cost of ownership
- Easy to use, intuitive software interface

Measurements

- Step height
- Surface roughness
- Etch depth of trenches and vias
- Dimensions
- Particles and grains
- Volume
- Bearing Ratio
- Flatness

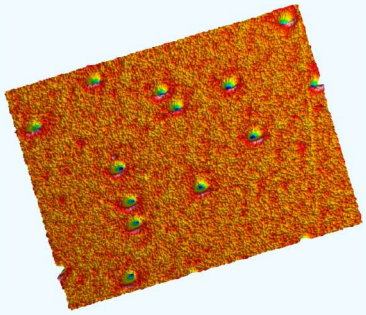
Profilm3D® Optical Profilers

Quality | Ease | Affordability

The Profilm3D and Profilm3D-200 are affordable, state-of-the-art optical profilers. The Profilm3D family of profilers uses white light interferometry (WLI), phase shifting interferometry (PSI) and Enhanced Roughness Mode to produce high quality 3D surface measurements, profiles, and True-Color images.

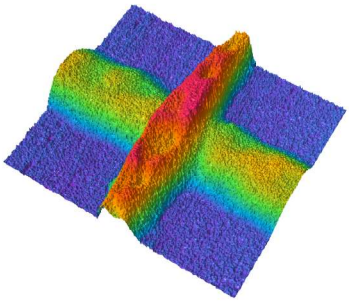
The latest Profilm3D platform is designed to measure from the smoothest of surfaces to highly rough and steeply-sloped samples. The tool's flexibility enables measurements from polished optics to microfluidics channels, circuit boards, biological samples, biomedical devices, solar cells, and micromachining.

Profilm3D Optional Features



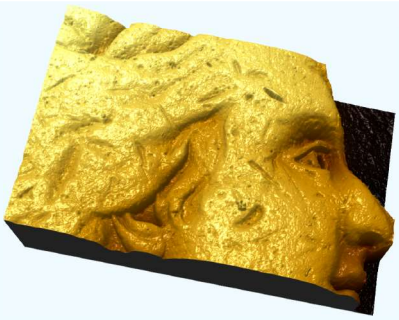
Phase Shift Imaging (PSI)

Phase Shift Imaging is used when accurate measurement of nanometer-scale surface features is required. A post-wet polish of SiC resulted in surface defects that are 2-3µm in diameter but only a few nm deep, as shown in this 50µm x 50µm image. The Profilm3D software easily measures defect depth, density, diameter, etc. PSI can also be combined with WLI to enable
PSI sensitivity over larger surface Z variation.



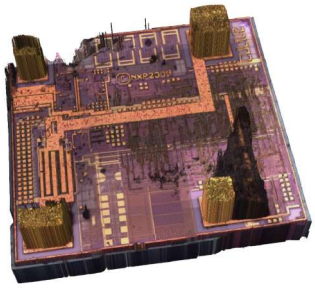
Enhanced Roughness Mode

For rough surfaces, WLI mode and PSI mode may be insufficient. Enhanced Roughness mode increases fringe contrast, providing significantly improved fidelity on sloped surfaces and rough surfaces, and especially when the surface includes both rough topography and low reflectivity, such as this solar cell.



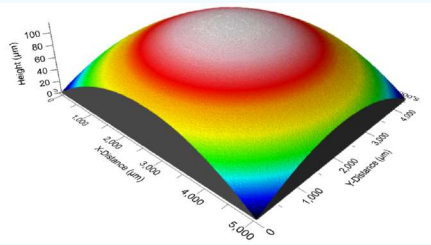
TotalFocus™ Infinite Depth-of-Field Imaging

With a traditional microscope, it is impossible to simultaneously focus each pixel across the entire field of view without changing the setup. Profilm3D's TotalFocus™ mode utilizes the 3D measurement data to produce images where every pixel is in focus. Topographic details of this coin, from the very top of the image to the smooth background surface, are clearly resolved using TotalFocus.



True-Color Imaging

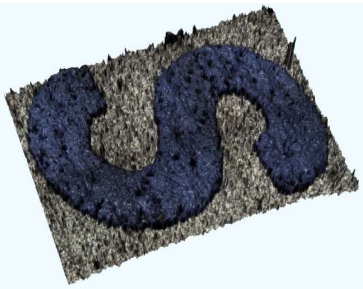
True-Color imaging is typically used to enhance image presentation but is highly important in distinguishing underlying or buried details that may influence color variation from otherwise similar surface topography. This circuit board shows significant color and height variation, and True-Color imaging can also be critical for biomedical applications.



Stitching

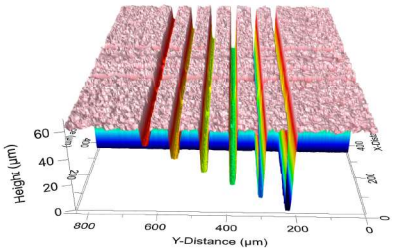
Stitching combines multiple individual images to create a larger measured field of view. An intuitive software interface requires basic input, after which the software completes the image combination. This feature is most commonly used for applications where a large area measurement is required, such as MEMS, biomedical devices, and this optical lens, for which the radius of curvature was measured.

Profilm3D Applications



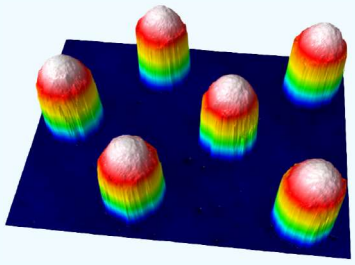
3D and Flash Printing

The Profilm3D easily measures this silkscreen print on machined stainless steel. Measure thickness and uniformity of the printing layer and characterize delamination, coverage uniformity and surface roughness. The Profilm3D design offers easy sample setup and software interface to streamline manufacturing and QC process monitoring.



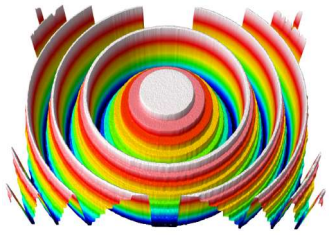
Metal Finishing / Micromachining / Tooling

The Profilm3D can be used in metal finishing and tooling, such as for the critical calibration of a dicing saw where cut depths into a piezoelectric material are quantified. The system also simultaneously measures surface roughness and critical dimensions of machined components.



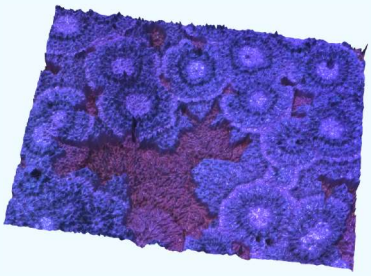
Semiconductors

Backend packaging bump coplanarity is critical to ensure optimized bonding, and the Profilm3D quickly generates measurements of coplanarity, pitch uniformity, size, and more. Other applications include mask manufacturing, laser marking, photoresist patterning, and other R&D and process qualification.



Optics

This scan shows a miniaturized Fresnel lens that was created by electron beam lithography. For steep surfaces such as lenses, the Profilm3D in Enhanced Roughness mode can now measure up to 60°of slope.



Biology

The Profilm3D is well suited to measurement of biological samples, such as this Tetraphenylprophyrin (TPP) thin film on glass. The TPP was imaged with the 50X Mirau objective at 2x zoom, and the film displays growth of crystalline structures. This image was generated with TotalFocus™ color technology, showing the actual colors of the sample.

Profilm3D Software Features

Profilm Desktop Analysis Software

The Profilm software platform is full-featured, intuitive and fast, with a low ownership cost. Most features are already included in the base configuration, and premium features such as Stitching are inexpensive as compared to the competition.

Partial List of Image Operators
Leveling, Standard/FFT filtering, outlier removal, particle removal, cropping, rotation

Partial List of Analysis Functions
Step Height: Line, rectangle and histogram methods,; dissimilar materials correction supported
Roughness: By line and area, with all 47 standard ASME/EUR/ISO roughness parameters supported
Others: Dimensions, feature spacings, volume, bearing ratio, particles and grains, and much more

Graphics Interface
Color scale (standard/custom gradients), 3D lighting options, 3D vertical scale control, etc.

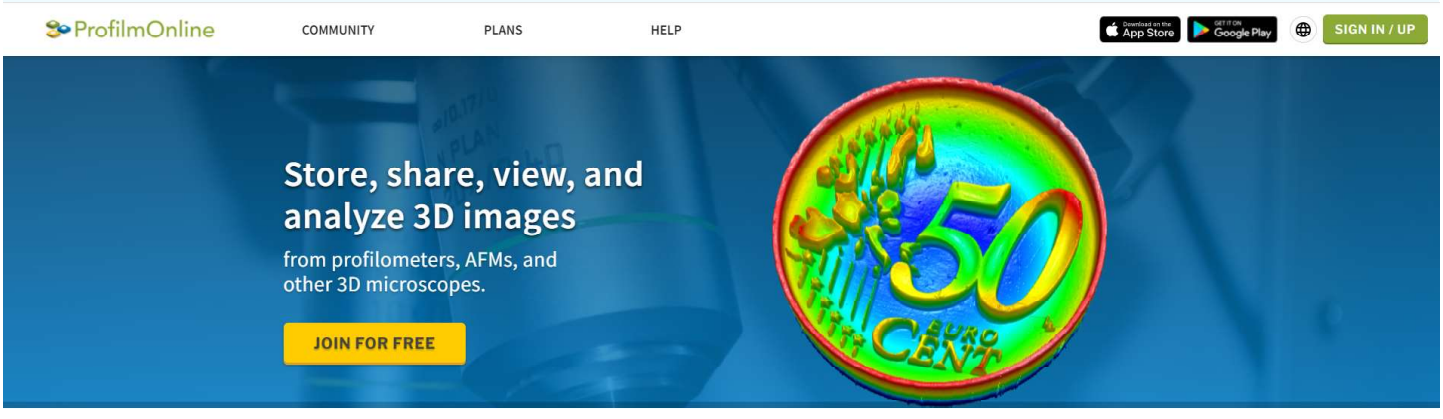
Image Processing – Manual
Never lose the breadcrumb trail back to your original image

Image Processing – Automatic
User recipes perform multi-step analyses with single click for customized measurements

Profilm Online: Free 3D Image Web/Mobile App

View and analyze your 3D images wherever you are! Virtually all of Profilm's desktop image-viewing and analysis functions – including Stitching – are available at low- or no cost at profilmonline.com. ProfilmOnline is the place to share, store, view and analyze 3D images, whether you're on your computer or mobile device (free Android and iOS apps are available). A wide variety of file formats, including AFM, are supported (there are even SPM-specific image correction and analysis functions). You can upload your images from Profilm to ProfilmOnline with a single click.

Image-encryption capability is provided, so your images are secure and confidential. If you have images you'd like to share, you can post them in our Public Gallery. You can also interact with the 3D imaging community in our online Forum.



Profilm3D Specifications

General	
Z Range	100mm
Piezo Range	500µm
Scan Speed, Vertical	12µm/s
XY Stage Type	Automated
Sample Max Weight	2.5kg
Tip-Tilt Stage	± 5°, Manual
Camera	2592 x 1944 (5MP)
Camera Zoom[4]	1X, 2X, 4X

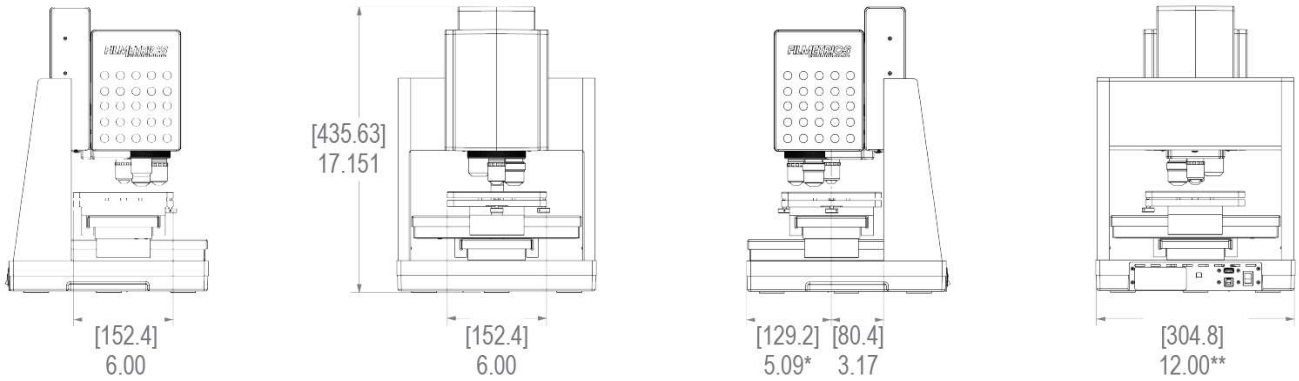
Performance	
Thickness Range, WLI	50nm – 10mm
Thickness Range, PSI	0 - 3µm
RMS Repeatability, WLI[1]	1.0nm
RMS Repeatability, PSI[1]	0.1nm
Step Height Accuracy[2]	0.7%
Step Height Precision[3]	0.1%
Step Height Stability[3]	0.15%
Sample Reflectance Range	0.05% - 100%
ISO 25178 Compliant	Yes

Mechanical – Profilm3D	
XY Stage Range	100mm x 100mm
Sample Max Width	265mm
System Size	305mm W x 305mm D x 550mm H
System Weight	15kg

Mechanical – Profilm3D-200	
XY Stage Range	200mm x 200mm
Sample Max Width	365mm
System Size	406mm W x 406mm D x 550mm H
System Weight	22kg

Objectives[5] (Nikon CF IC Epi Plan)					
Magnification	5X	10X	20X	50X	100X
Field of View at 1X Zoom	4.0mm x 3.4mm	2.0mm x 1.7mm	1.0mm x 0.85mm	0.4mm x 0.34mm	0.2mm x 0.17mm
Numeric Aperture	0.13	0.3	0.4	0.55	0.7
Working Distance	9.3mm	7.4mm	4.7mm	3.4mm	2.2mm
Spatial Sampling at 4X Zoom[6]	1.76µm	0.88µm	0.44µm	0.176µm	0.088µm
Resolving Power of Lens	2.1µm	0.92µm	0.69µm	0.5µm	0.4µm
Maximum Sample Slope[7]	8.5°	14°	21°	25°	42°

[1]Typical value.
[2]8µm step.
[3]Precision is 1σ of 30 measurements of a 10µm Step Height Standard, average of 1σ over 20 successive days. Ambient stable to within 1°C. Stability is 2σ of daily average of 30 measurements of a 10µm Step Height Standard, average of 1σ over 20 successive days. Ambient stable to within 1°C.
[4]Digitally realized. Number of effective pixels after binning is 648 x 484 for all zooms.
[5]Sold separately.
[6]Pixel size projected on sample.
[7]Measures ≥ 60° slope on rough surfaces with ≥ 50% filled camera pixels.



*179.2mm/7.06” for Profilm3D-200
**404.8mm/15.94” for Profilm3D-200

The KLA Instruments™ Family

The KLA Instruments™ group within the KLA Corporation includes our Fabs and Labs defect inspection and metrology suite. Fab tools are designed for automation and production environments, and include the Candela® defect inspection tools, the automated HRP®-260 and Tencor™ P-170 stylus profilers, and the Zeta™-388 automated optical profiler. Lab tools are primarily benchtop metrology systems and include the Alpha-Step® D-Series and Tencor P-Series stylus profilers, the Zeta-20 and Zeta-300 optical profilers, the Nano Indenter® product group, and the Filmetrics® suite of measurement equipment, which includes the thin film measurement systems, the R-50 Series sheet resistance mappers, and the Profilm3D® optical profiler.

Fabs

Candela®

Wafer Inspection

Disk Inspection

Defect Inspection Systems

HRP®

Optical-based

Stylus-based

Automated High Resolution Profilers

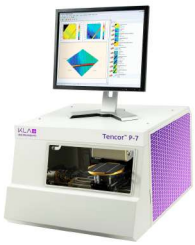
Labs

Optical Profiler

Profilm3D®

Zeta™

Stylus Profiler



Tencor™

Alpha-Step®

Thin Film

Filmetrics® F-Series

Nano Indenter®

G200X, iNano®, iMicro

Resistivity

R50-Series

KLA SUPPORT
Maintaining system productivity is an integral part of KLA's yield optimization solution. Efforts in this area include system maintenance, global supply chain management, cost reduction and obsolescence mitigation, system relocation, performance and productivity enhancements, and certified tool resale.

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