Lyncée Reflection Series

Time-Resolved Advanced Topography Solutions

Park SYSTEMS

Lyncée Reflection series are optical interferometers powered by digital holographic microscopy (DHM). Measurements are acquired in real time, with a single acquisition without mechanical scanning.

This quasi-instantaneous measurement specificity enables DHM to measure not only the 3D topography of samples, but also to monitor the time response of samples to external stimuli, characterize samples and optimize processes during manufacturing, characterize very large surfaces and screen them for small defects, and operate in situ at high or low temperatures, in liquid, under vacuum, or in a gas-controlled environment.

DHM are used in research labs and production facilities for semiconductor, MEMS, medtech, watch industry, industrial metrology, polymer, micro-nano technology, micro-optics, and photonics applications.

Key Features

Advanced Performance

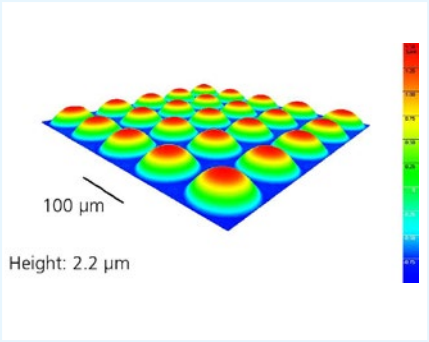
- Interferometric resolution
- High-speed acquisition and real-time data display
- Digital refocusing for high resolution imaging at high speed and in challenging environments

Address All Experimental Needs

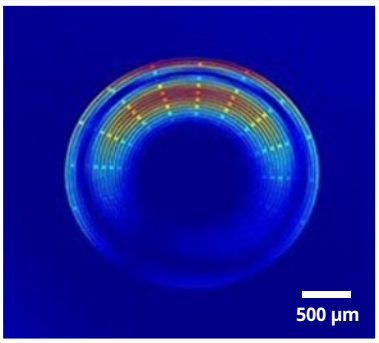
- Multi-wavelengths: for extended vertical range
- Stage: up to 300 mm travel range and 6-axis
- Wide range of options dedicated to specific applications
- Fully upgradeable

Discover Our Standard Configuration for:

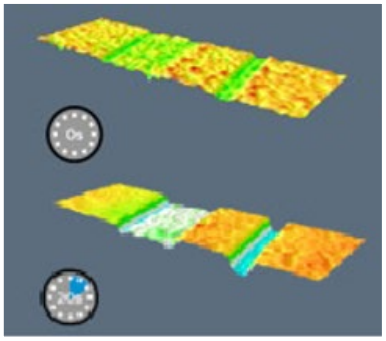
3D Interferometry



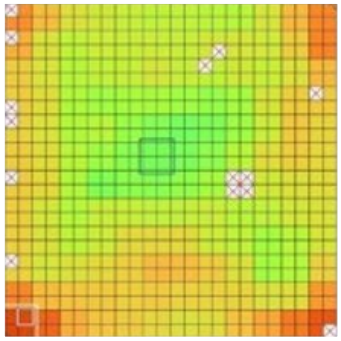
MEMS Analysis

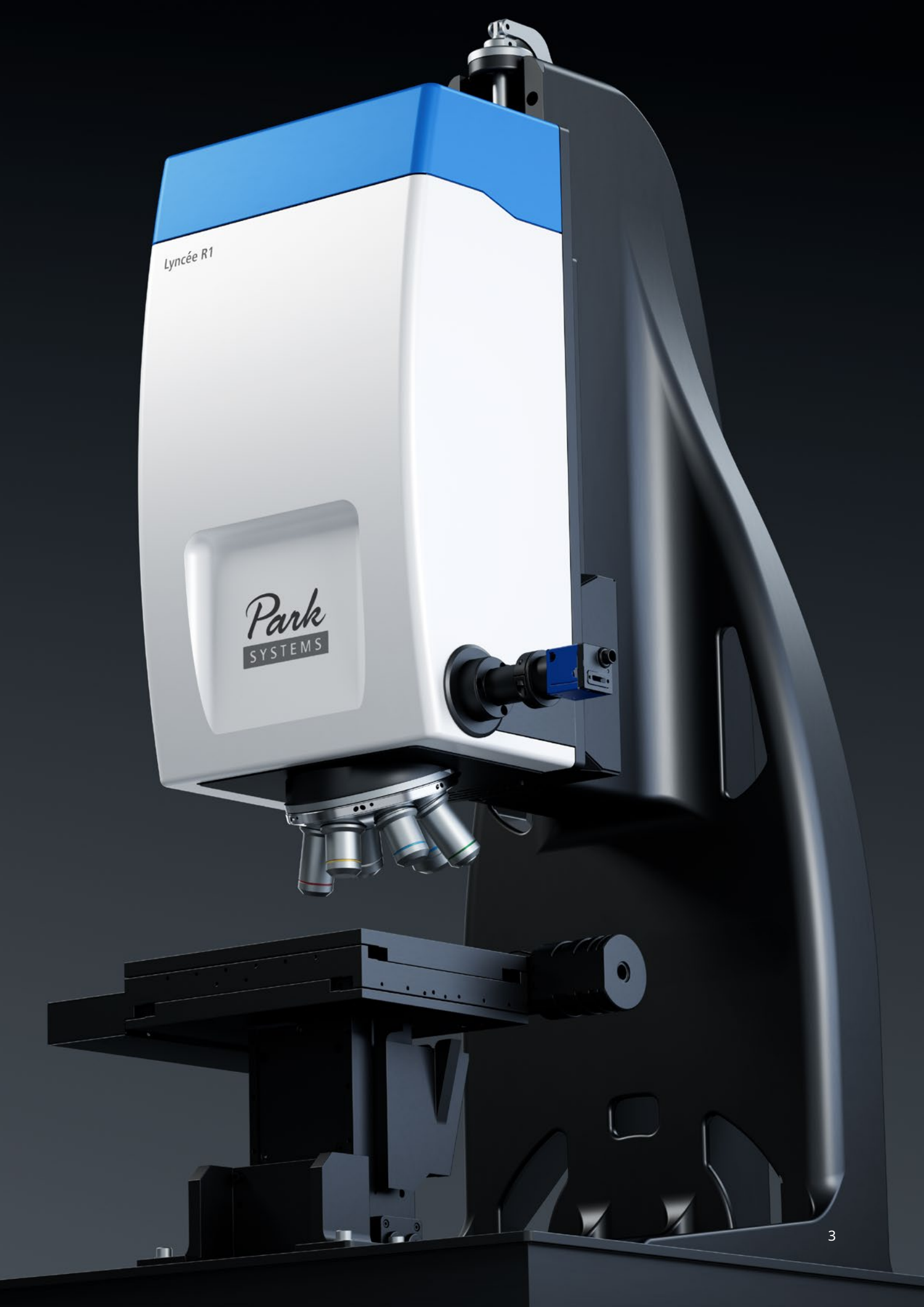


4D Interferometry



Industrial Applications




Lyncée R1
Park
SYSTEMS

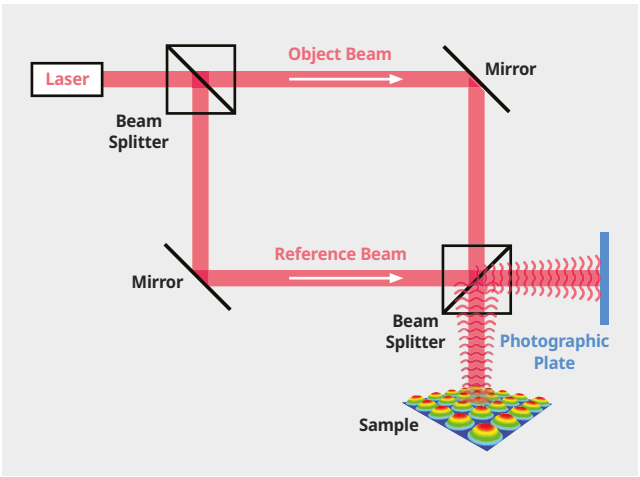
Lyncée Reflection Series

DHM Technology

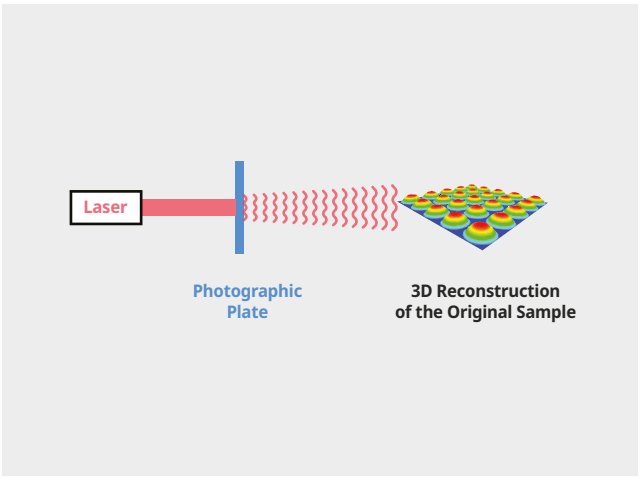
Principles of Classical Holography

A coherent light beam is split by a beamsplitter between a reference and an object beam. The object beam is shined onto a sample. The interference between the light reflected by the sample and the reference beam, i.e. the hologram, is recorded on a photosensitive support: the photographic plate. It contains information on the wavefront phase and intensity changes induced by the sample. Shining coherent light onto the holographic plate recreates a 3D image of the original sample.

Hologram Recording on Holographic Plate

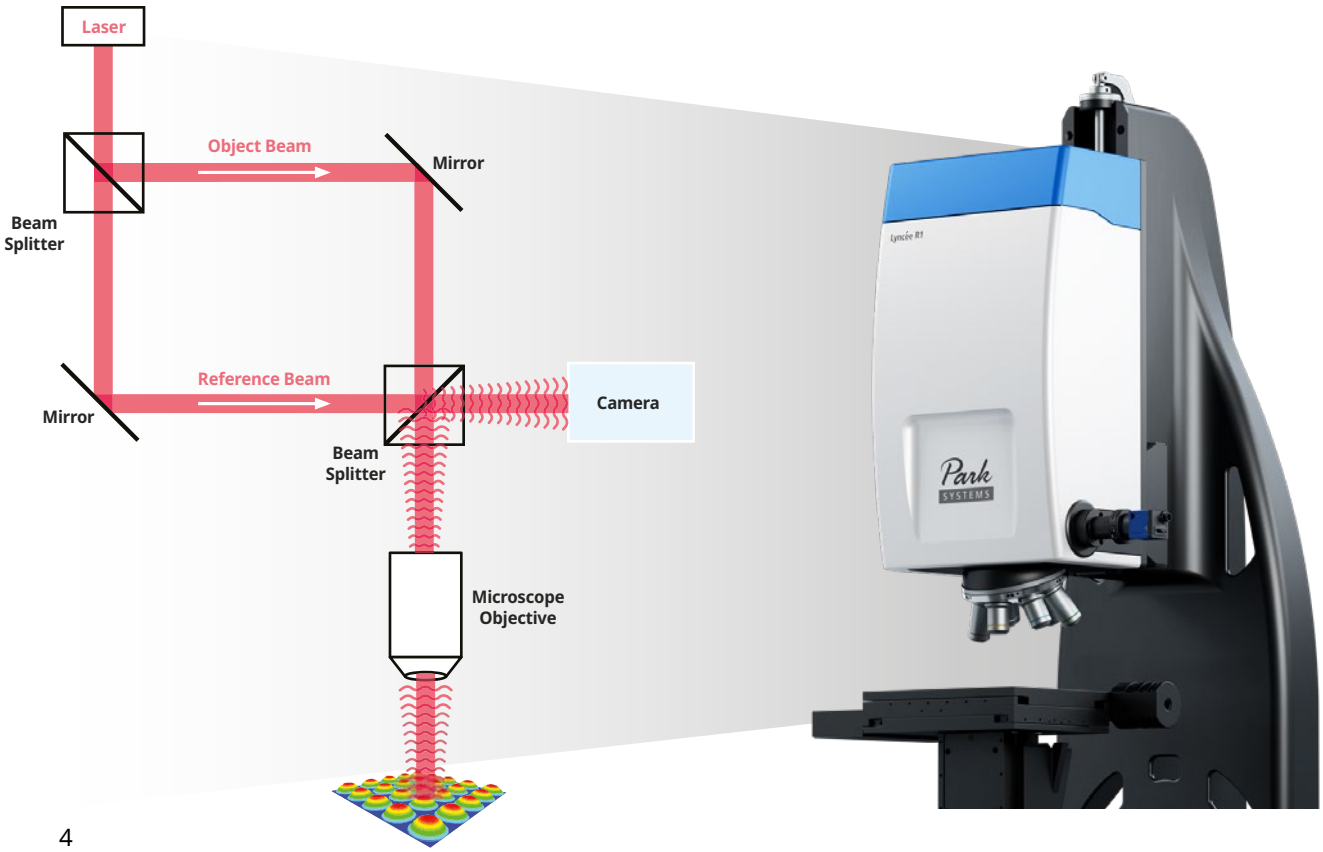


Hologram Reconstruction



Principle of Digital Holographic Microscopy (DHM)

DHM is the digital extension of classical holography. It is a patented technology that records holograms with a digital camera rather than on a photographic plate. A numerical processing replaces the classical re-illumination process to retrieve, in real time, the phase and intensity changes induced by the imaged sample. This information is then interpreted to retrieve the sample topography.

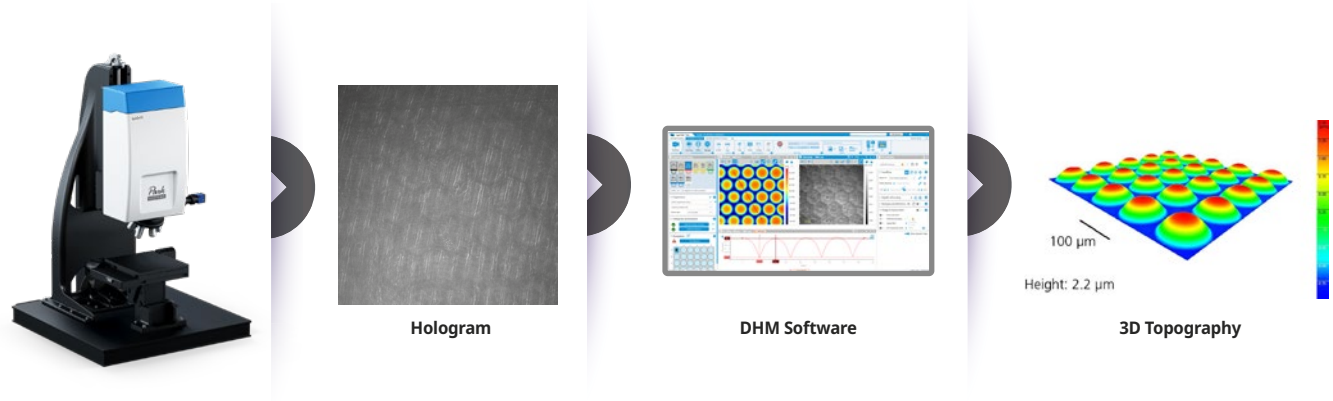


A Workflow Shaped for Fast and Time-Resolved Applications

3D data acquisition is performed in a single image capture and is repeated at the camera frequency. All the pixels in the field of view are acquired simultaneously, without any lateral, vertical, or phase mechanical scanning enabling full-field fast-acquisition of dynamics samples.

The acquisition time, which effectively defines the temporal resolution, is equal to the camera's shutter open time or, in the case of a pulsed source, the duration of the laser pulse. For standard systems, it is typically a few hundreds of microseconds, a few tens of microseconds when using high-speed cameras, and can be as small as five nanoseconds for MEMS analysis.

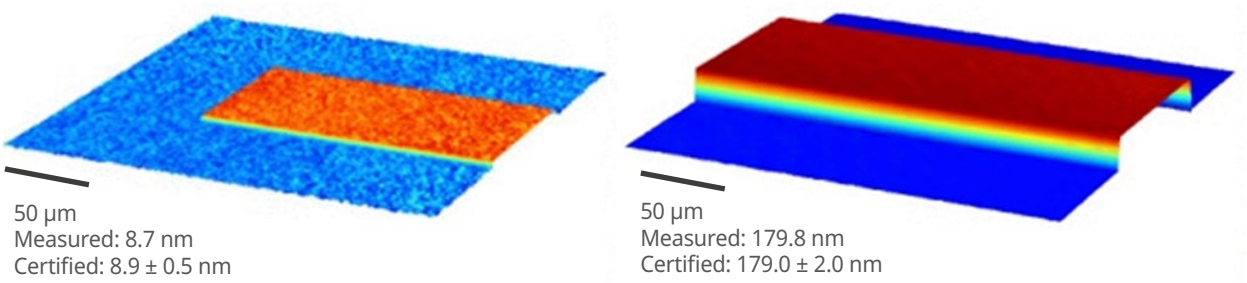
This exceptional acquisition speed is ideal for the dynamic measurement of sample deformation and for characterizing large-area samples. It ensures excellent repeatability and high robustness against environmental disturbances, which is particularly relevant for industrial applications.



3D Data Acquisition – Camera Rate | **Digital Reconstruction – Live**

High-Resolution, Repeatability, and Linearity for Advanced Topography Applications

The phase changes measured by Lyncée Reflection series are precisely related to the laser source wavelength. Consequently, the surface topography is measured with interferometric resolution. By using ultra-stable interferometric filters for selecting a precise wavelength band, the operating wavelengths are precisely controlled and perfectly stable. The height values do not depend on any vertical calibration, precise positioning, or repeatability of an interferometric piezo-controller, nor on any motorized displacement or confocal detection system. This thus provides precise measurements with high repeatability.



50 µm
Measured: 8.7 nm
Certified: 8.9 ± 0.5 nm

50 µm
Measured: 179.8 nm
Certified: 179.0 ± 2.0 nm

VLSI Certified Steps - Subnanometric Vertical Resolution

Lyncée Reflection Series

Adaptable to Your Experimental Needs

Lyncée Reflection Head Models

Lyncée R1

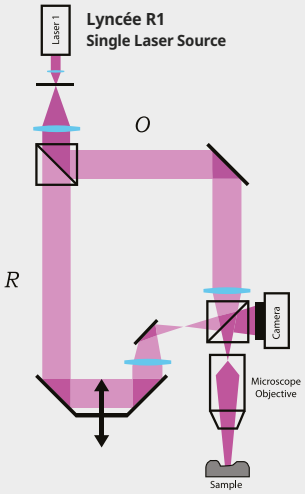
Operating at a **single wavelength,** Lyncée R1 is an ideal solution for most applications in MEMS vibration analysis and 3D topography measurement of surfaces with small step heights below **333 nm.**

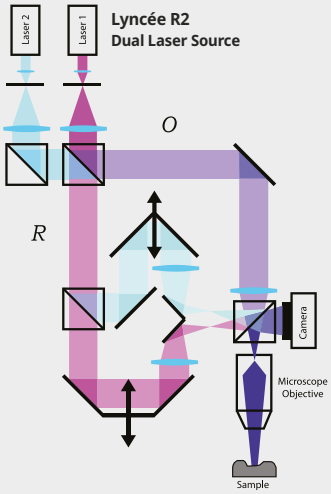
Lyncée R2

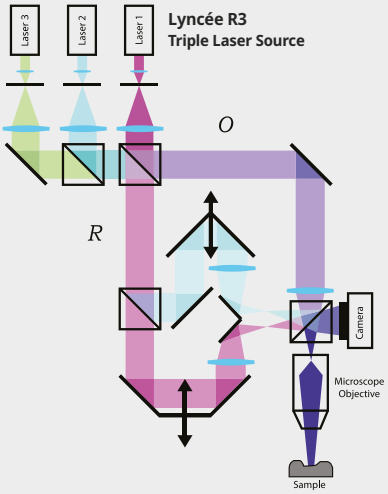
Equipped with **two wavelengths,** Lyncée R2 extends the step-height measurement range up to **2.1 µm** while maintaining the vertical resolution.

Lyncée R3

Equipped with **three wavelengths,** Lyncée R3 further extends the step-height measurement range up to **24 µm,** making it ideal for studying large discontinuous structures.







Flexible Upgrade and Options

Lyncée Reflection is designed with modularity in mind. Adding wavelength in the DHM head, or objective, motorized stage, environmental chamber, options to control samples can be upgraded to suit applications and budgets at any time.

Objectives Lens Sets

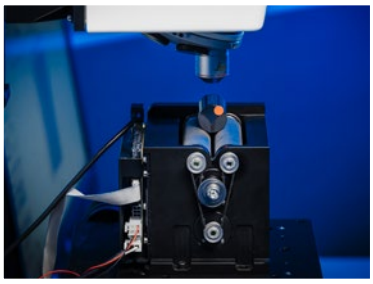
Objective turret supports up to six objectives from 1.25 × to 100 × magnification, which allows easy switching between wide-field overview and high-magnification inspection. The choice of objectives encompasses ultra-high working distances, ultra-high NA, glass corrected as well as oil, and water models.

Motorized Sample Stage

Motorized stages are available for enhancing measurement capabilities. They can be manually controlled by a joystick and are fully automated by the Koala software, enabling users to automate displacements for multisite measurements or to enlarge the measurement field of view by automatically acquiring and stitching multiple images together. A large selection of stages is available to fulfill application and sample requirements. These includes linear stages with 100 mm to 300 mm XY travel-range and 38 mm travel-range along the Z direction (optical axis, focus).

6-Axis Control

Solutions with up to 6-axis control enable precise measurement of spherical and cylindrical samples, as well as structures such as micromirrors that deflect light at large angles.



Rotating Stage

For measuring the entire surface of cylindrical components such as cylinders, shafts, metal rolls, and glass tubes, Lyncée Reflection offers a motorized rotating stage that is compatible with the motorized or manual XYZ linear stage.

The separation between the two driving rollers can be adjusted to accommodate samples of various diameters. A dedicated interface allows users to control the displacement both along the axis of symmetry of the sample and to rotate it in order.

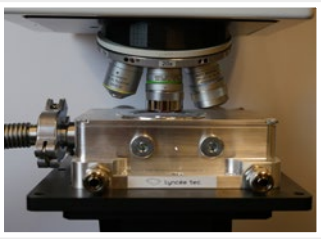
Stroboscopic Unit

Specialized for MEMS analysis, the stroboscopic unit works with Koala MEMS Analyzer Suite to synchronize MEMS excitation driving signal and hologram acquisition. It enables precise topography measurements of the MEMS along its excitation period for frequencies up to 25 MHz with a bandwidth of 200 MHz.

Vacuum and Thermal Chambers

The unique optical setup of Lyncée Reflection series enables measurement through optical windows. The optical thickness of the window is automatically accounted for, without the need to manually add perfectly calibrated glass compensation slides in the reference beam.

Two optional vacuum/thermal chambers modules optimized for Lyncée Reflection series are available for measuring samples under various gas, thermal and pressure conditions. The chambers are equipped with ports to purge the chamber of a desired gas.



Stage Top Vacuum Chamber

Stage-top vacuum chamber is compatible with the manual or motorized stage, accepts samples up to Ø40 mm, supports temperatures ranging from -196 to 350 °C.

Large Vacuum Chamber V400

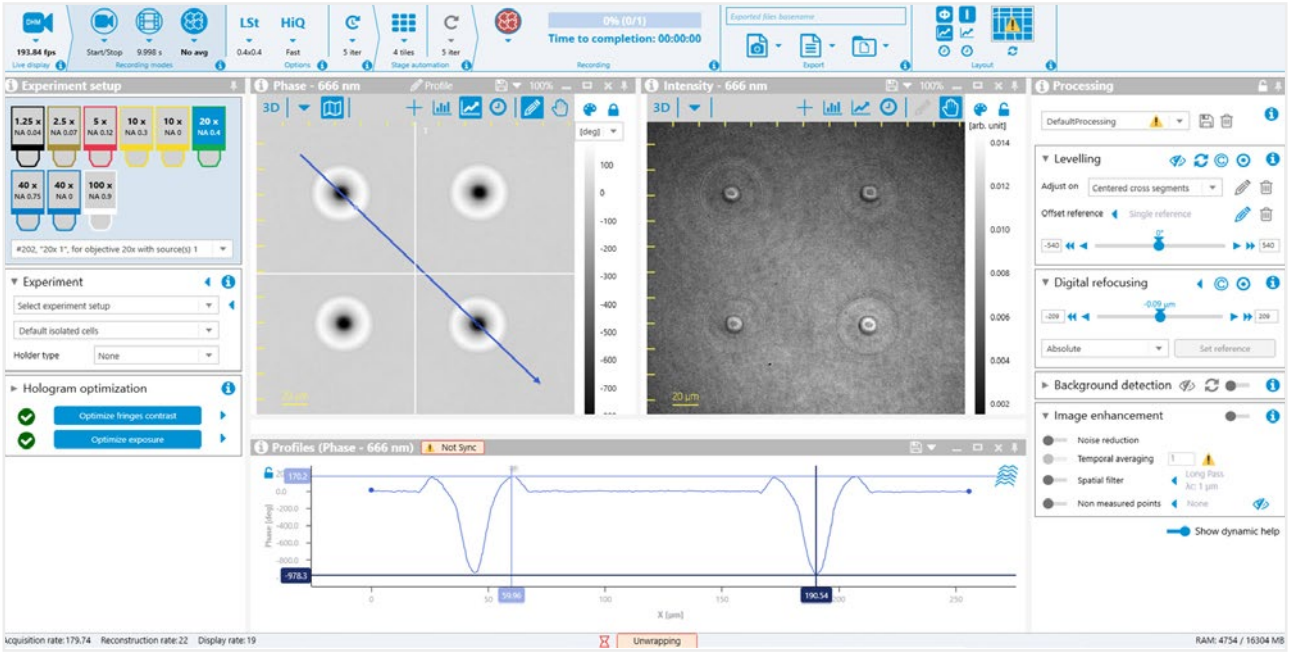
The V400 vacuum chamber includes a motorized stage, a large viewing window and accommodates samples up to 100 × 100 mm. It is compatible with manual or motorized stages, supports temperatures ranging from -40 to 120 °C.

Lyncée Reflection Series

For a Complete Solution from Sample Handling to Data Analysis

Koala Acquisition & Analysis Software

Koala serves as the central platform for DHM hardware control, image acquisition, processing, and data visualization, providing a real-time, user-friendly interface with GPU-accelerated performance and flexible export of images and analytical data.



Koala offers flexible operating modes tailored for real-time observation, dynamic analysis, and automated workflows. Each mode is optimized to streamline acquisition, visualization, and large-area measurements within a single interface.

- Sequence Mode – Records and replays hologram data to study temporal changes.
- Stitching Mode – Merges multiple fields of view into a seamless large-area image.
- Automated Multisite Mode – Performs automated measurements across multiple sites.
- Stroboscopic Mode – Synchronizes acquisition with periodic motion for vibration or MEMS analysis.
- TCP-IP Mode– Enables automation and external software integration for repeatable workflows.
- Replay and Reprocessing Mode – Replays and reprocesses previously acquired data.

Koala also offers advanced analysis modes for accurate quantitative evaluation of holographic data. Processing and digital reconstruction enable precise surface measurement, dynamic monitoring, and efficient post-processing within a unified environment.

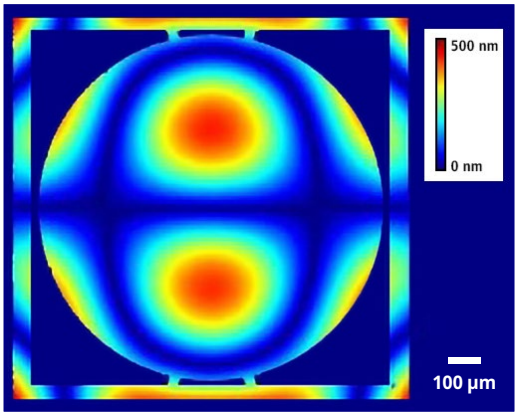
- Digital Focusing – Refocuses digitally to extend depth of field without mechanical adjustment.
- Tilt Compensation & Surface Leveling – Removes tilt and form to improve topography representation and analysis.
- Phase Monitoring – Tracks temporal phase changes for dynamic or live-sample analysis.
- Roughness & Surface Texture Analysis – Calculates standardized roughness, waviness, and shape parameters.
- Profile Extraction & Measurement Tools – Extracts cross-sections and performs dimensional measurements from 3D data.
- Advanced Visualization & Data Display – Displays interactive 2D, and 3D views with enhanced visualization tools.

MEMS Analysis Tool Software

The MEMS Analysis Tool is a post-analysis software that provides quantitative and precise space, time, and frequency analysis of the 3D time sequence of topographies (4D) for both periodical and non-periodical phenomena.

Measure Any MEMS Characteristics

- Mode shapes
- Vibration maps: amplitude & phase
- Displacements, velocities and accelerations
  - along any direction
  - at any place in the field of view
  - for any structure
- Frequency response
- Electrical response



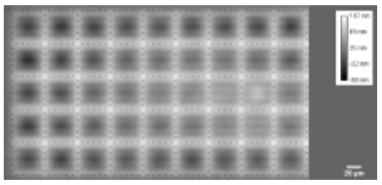
Vibration Map @ 773 kHz.
Courtesy of Lemoptix, Lausanne, Switzerland.

Compare Simulation with Measurements

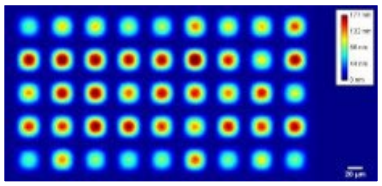
- Post-analyze your data anywhere at anytime
- Export data in open formats for advanced analysis
- Define your own analysis templates to compare efficiently batches of samples

Disseminate Your Work Efficiently

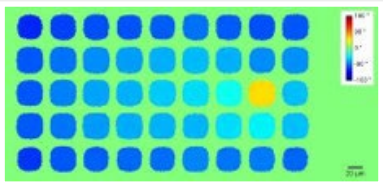
- Open format: access raw data and analysis
- Illustrate publication and conference presentations with videos



cMUT @ 8 MHz : Time-sequence of topographies.
Courtesy of Fraunhofer IPMS, Dresden, Germany.



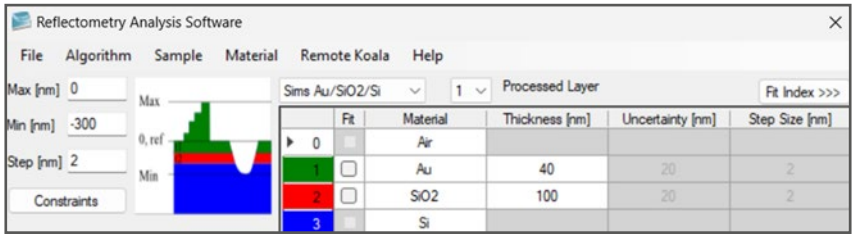
cMUT @ 8 MHz : Amplitude vibration map.



cMUT @ 8 MHz : Phase vibration map.

Reflectometry Analysis Software

Reflectometry Analysis software is a dedicated post-analysis tool designed to retrieve the topography of transparent or semi-transparent structures on reflective substrates. The dedicated suite has been developed to interpret the reflected signals by computing the wavefront using the physical laws of reflection. Through this computation, the 3D topography, refractive indices, and thicknesses of transparent and translucent layers can be calculated and visualized. Measurement accuracy is improved by minimizing unknown parameters and by increasing the number of acquisition wavelengths.



Reflectometry Analysis Software can construct the strata of different transparent and translucent layers.

Reflectometry Analysis software comes pre-loaded with a database containing many materials refractive indices and sample structures for convenient and fast reflectometry analysis of common materials. For more specialized cases, users can directly upload and update custom values into the data for future use.

Lyncée Reflection Series

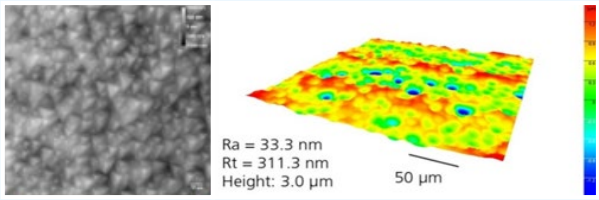
Designed for Your Applications

3D Topography

Thermal Deformation

Measurements with Lyncée Reflection series are as simple as those performed with a bright-field optical microscope, while real-time topographic images are displayed directly on the screen. No precise adjustment of the sample tilt/tip is required, enabling quick setup and rapid identification of areas of interest on the sample surface. It is especially useful for in-situ measurements.

Thermal deformation of a Micro Hot Plate @ 800°C
5× objective (NA 0.12). FOV 1.2 mm × 1.2 mm.



Quartz wafer (left) and aluminum (right) surfaces topography,
40× objective (NA 0.75). FOV 160 µm × 160 µm.

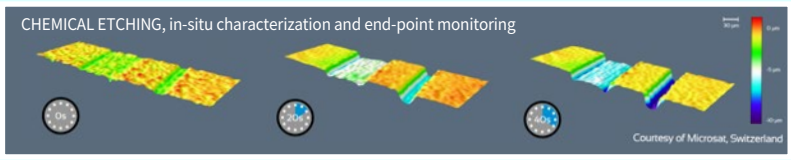
Surface Texture Analysis

Using Koala software, the topographic data acquired with Lyncée Reflection series can be analyzed according to international standards to extract key surface texture parameters, including roughness (e.g., Sa, St, Sz, Sp), waviness, and primary profiles, enabling standardized and reliable surface characterization.

4D Topography

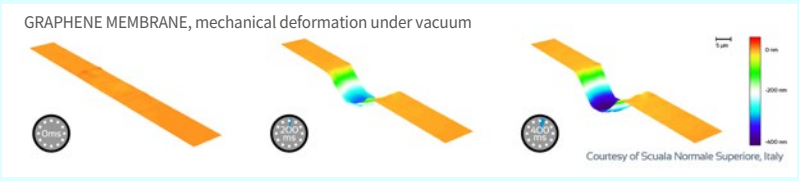
Electrochemistry

Research projects involving electro-chemical processes, etching or deposition, require measurements in various media, enclosed setups, or operation under extreme thermodynamical conditions. Therefore, Lyncée Reflection series provides a range of objectives optimized for measuring in liquid or through optical viewports, while digital refocusing enables compensation of thermal expansion and focus drift during post-processing.



In situ monitoring of electrochemical etching of 20 µm and 100 µm trenches using a glass corrected 20x objective.

When standard acquisition speeds are not sufficient, Lyncée Reflection series can be equipped with an ultra-fast camera. High-speed hologram acquisition reaches up to 16,000 fps (1024×1024), 60,000 fps (512×512), and 116,000 fps (256×256) for real-time analysis of fast dynamics.

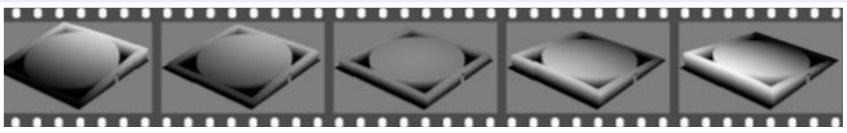


Graphene membrane (diameter 10 µm) deformation under vacuum using a 100x (NA 0.9) objective.

MEMS Analysis

4D (3D + Time) Microsystem Characterization: Unrivaled Wealth of Data

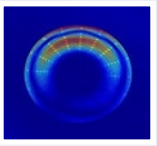
Successive topographies measured with Lyncée Reflection series enable detailed analysis of MEMS behavior along its excitation waveform. The acquired dataset can be directly used or further processed with DHM analysis tools to extract in- and out-of-plane displacements and vibrations, instantaneous velocities and accelerations at any pixel, as well as amplitude and phase vibration maps.



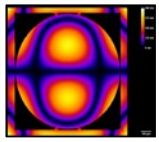
Micro-mirror response to a 20 kHz sinusoidal waveform at phases 0°, 45°, 90°, 135°, and 180°.

Out-of-plane Amplitude and Phase Vibration Maps

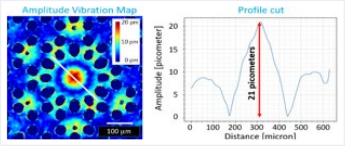
Using Lyncée Reflection series, out-of-plane amplitude and phase vibration maps enable fast and direct comparison between experimental data and simulations, helping to reduce microsystem development time. High-resolution maps can be acquired within seconds at megapixel scale, with sub-picometer out-of-plane sensitivity for precise vibration analysis.



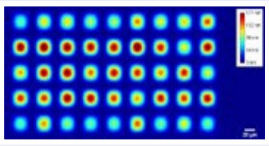
Gyroscope at 80 kHz
Fine Structures Resolved.



Micromirror @ 491 kHz
4th picometer Vertical Resolution.



Phononic Crystal @ 1.37 MHz, High-Q Mode
Sub-picometer Vertical Resolution Achieved.

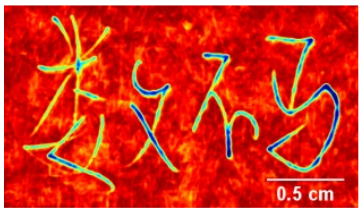


CMUT Array at 8 MHz
Cross-Talk Analysis.

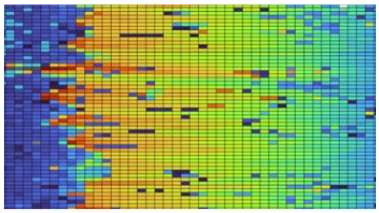
Industrial Applications

Characterization of Large-Surface-Area Samples

Signature 3D topography is a powerful tool for forensic document examination, revealing writing pressure, stroke sequence, and writer handedness. In this example, Lyncée Reflection series combines high lateral resolution with large-area analysis through automated image stitching, enabling precise characterization of entire specimens while preserving fine surface details. The scanning time for full signature (20 mm x 30 mm) is <60 s.



Lyncée R3, stitching 20mm x 30mm,
10× objective, 200 × 200 × 38 mm motorized stage.



Unfolded representation of the thickness of the silicone coating on the inner surface of a syringe with an 8 mm diameter.
Lyncée R1, 20× objective, 200 × 200 × 100 mm motorized stage.

Syringes Inner Surface Siliconization

In close cooperation with the EMEA Technology Excellence Center laboratory in Italy, an automated system was developed to measure the amount and spatial distribution of silicone deposited on the inner surfaces of pharmaceutical glass containers, such as syringes. Accurate control of silicone thickness and uniformity is essential to ensure both the functional and cosmetic performance of glass containers.

Lyncée Reflection Series

Technical Specifications

Lyncée R1

- Number of laser sources: 1
- Operating wavelength (±1.0 nm): 675 nm
- Laser stability: 0.01 nm/°C at 675 nm
- Operation modes: single wavelength
- Objective & condenser turret: up to 6 lenses
- Vertical resolution: 0.3 nm
- Vertical measuring range
  - Continuous structure: up to 200 µm
  - Discrete structure: up to 333 nm
- Accuracy: 0.15 nm
- Repeatability: 0.01 nm

Lyncée R2

- Number of laser sources: 2
- Operating wavelength (±1.0 nm)
  - 675 nm
  - 794 nm
- Laser stability: 0.01 nm/°C at 675 nm
- Operation modes
  - Single wavelength
  - Synthetic 4.4 µm wavelength
- Objective & condenser turret: up to 6 lenses
- Vertical resolution:
  - 0.3 nm (single wavelength)
  - 6.0 nm (synthetic wavelength)
- Vertical measuring range
  - Continuous structure: up to 200 µm
  - Discrete structure: up to 2.1 µm
- Accuracy
  - 0.15 nm (single wavelength)
  - 3.0 nm (synthetic wavelength)
- Repeatability
  - 0.01 nm (single wavelength)
  - 0.1 nm (synthetic wavelength)

Lyncée R3

- Number of laser sources: 3
- Operating wavelength (±1.0 nm)
  - 666 nm
  - 675 nm
  - 794 nm
- Laser stability: 0.01 nm/°C at 675 nm
- Operation modes
  - Single wavelength
  - Synthetic 50 µm wavelength
- Objective & condenser turret: up to 6 lenses
- Vertical resolution: 40 nm (single and synthetic wavelength)
- Vertical measuring range
  - Continuous structure: up to 200 µm
  - Discrete structure: up to 24 µm
- Accuracy
  - 0.15 nm (single wavelength)
  - 3.0 nm (synthetic wavelength
- Repeatability
  - 0.5 nm (single and synthetic wavelength)

Optional Motorized Sample Stage

- Travel range (X × Y × Z): up to 300 × 300 × 38 mm

Standard Camera

- Acquisition time (standard): 500 µs
- Acquisition rate (standard): 190 fps @ 1024 × 1024 pixels
- Reconstruction rate: up to 200 fps @ 1024 × 1024 pixels

Dimensions and Weight

- Dimensions (L × W × H): 600 × 600 × 800 mm
- Weight: 48 kg

Power Requirements

- Input voltage: 85-260 VAC, 50/60 Hz
- Power: 250 W (maximum)

Optional High-Speed Camera

- Acquisition time (standard): 10 µs @ 256 × 256 pixels
- Acquisition rate (standard)
  - 16,500 fps @ 1024 × 1024 pixels
  - up to 100,000 fps @ 256 × 256 pixels

Vacuum and Thermal Chambers

- Stage-top vacuum chamber
  - Vacuum: minimum pressure (pump-limited, typical 10^{-6} mbar)
  - Thermal range
    - standard: −40 °C to 120 °C,
    - optional: −196 °C (requires liquid nitrogen) to 350 °C
  - Optical port 46 mm diameter
  - Sample size: max 40 mm diameter
  - Adaptation plate for manual stage and 100 × 100 motorized stage
  - Minimum objective working distance: 4.5 mm
  - Internal dimensions: 130 × 80 × 29 mm
- V400 environmental chamber
  - Vacuum: minimum pressure (pump-limited, typical 10^{-6} mbar)
  - Thermal range: -20 °C to 120 °C
  - Sample size: max 100 × 100 mm
  - Minimum objective working distance : 3 mm
  - Chamber size: 400 × 400 × 400 mm
  - Top-flange with 2 mm-thick window and 40 mm clear aperture
  - Transparent Plexiglas front door for convenient sample visualization

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