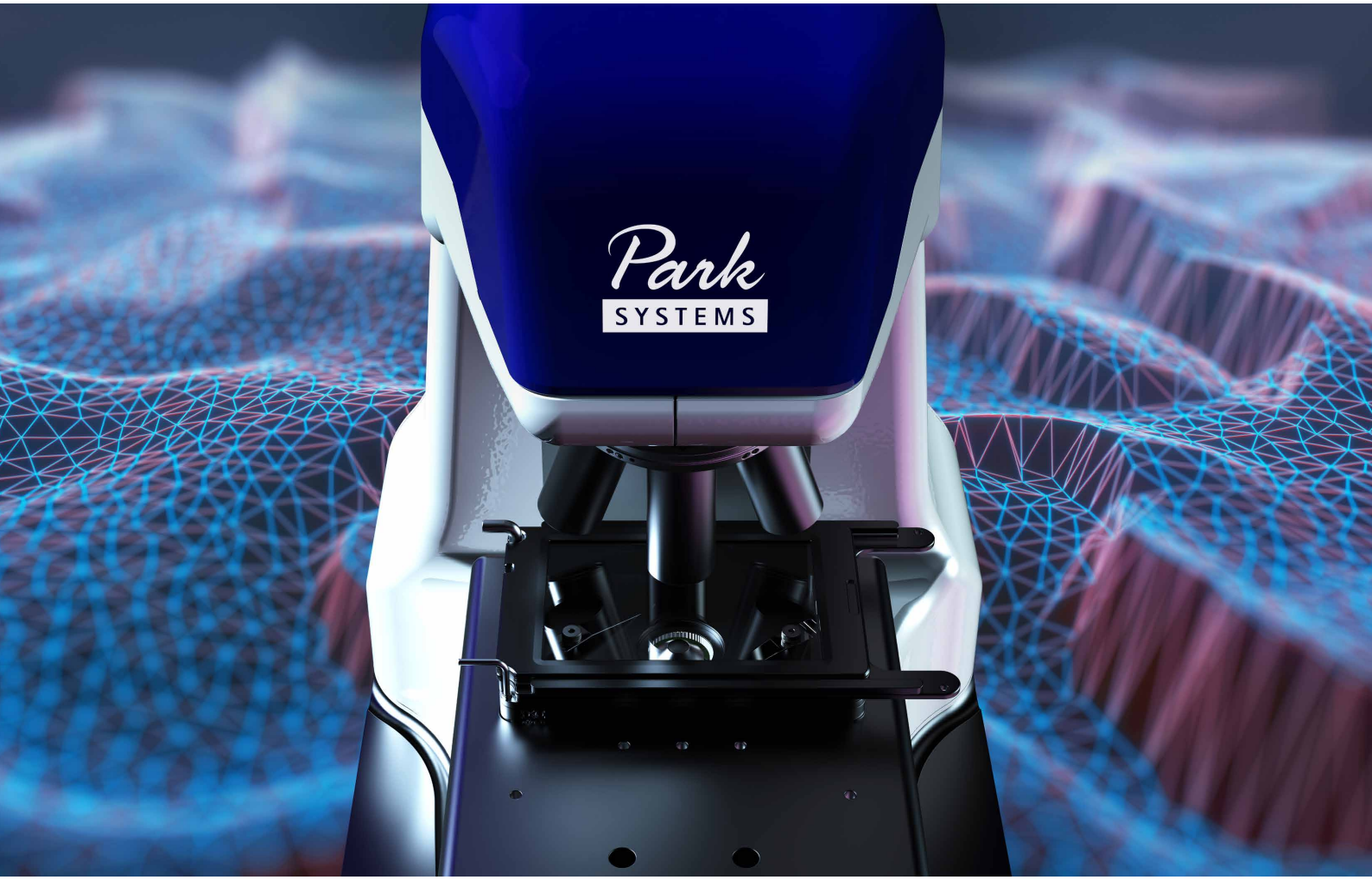
Lyncée Transmission Series

Real-Time Quantitative Imaging for Life and Materials Science



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Lyncée Transmission series is powered by Digital Holographic Microscopy (DHM) for quantitative imaging and measurement of transparent and semi-transparent samples with interferometric resolution. Holograms are captured and then digitally reconstructed to extract 3D information, which is subsequently interpreted by dedicated software to provide unique and meaningful insights for applications in both life sciences and materials science.

For life sciences, DHM enables label-free imaging and provides measurements of morphology and intracellular content (dry mass). These parameters are endogenous markers of cell health status and biological processes, opening applications in cell viability, dynamics monitoring, and 4D cell tracking.

For materials science, DHM provides information on surface topography, measures thickness variation and intra-sample properties such as defect and refractive indices changes. It also tracks dynamic changes and 3D position over time. It is compatible with our stroboscopic module, enabling measurement of optical MEMS, displays, and acoustofluidic devices.

Key Features

Superior DHM Performance

- Single shot full-field imaging
- Up to 100 kfps acquisition rate
- Millisecond time resolution

Address All Experimental Needs

- Multi-objective, multi-wavelength
- Wide range of options dedicated to specific applications
- Fully upgradeable

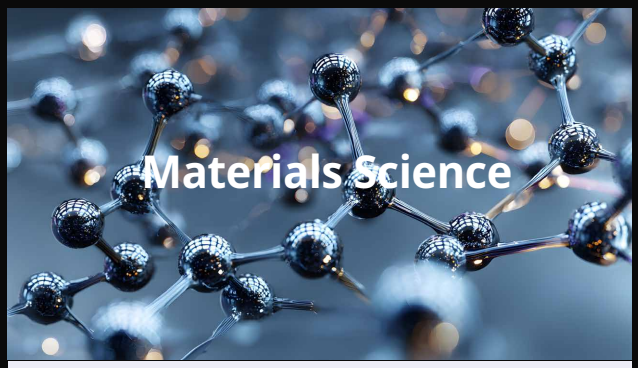
- **Non-invasive live-cell phenotyping**
- **Time-lapse imaging (ms to days)**
- **Cell health and functional diagnostics**

Cell Culture Monitoring
Cell Health Status, Cytotoxicity, Migration and Proliferation

Cell Dynamics
Cardiomyocytes Beating and Cell Motion

Optical Electrophysiology
Neuronal, Channel, and CFTR Activity

4D Tracking
Bacteria, Sperm Cells, and Flagella



- **Surface and in-sample characterization**
- **Measurement in air, liquid, or gas**
- **Time-resolved response to external stimuli**

Micro-Optics
Topography, Freeform and High NA components, Optical Fibers

Micro-Fluidics
Micropumps, Wetting, and Fluid Dynamics

Display
3D Screens, LCD, and Holographic Devices

4D Tracking
Particle Image Velocimetry (PIV)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Lyncée T1

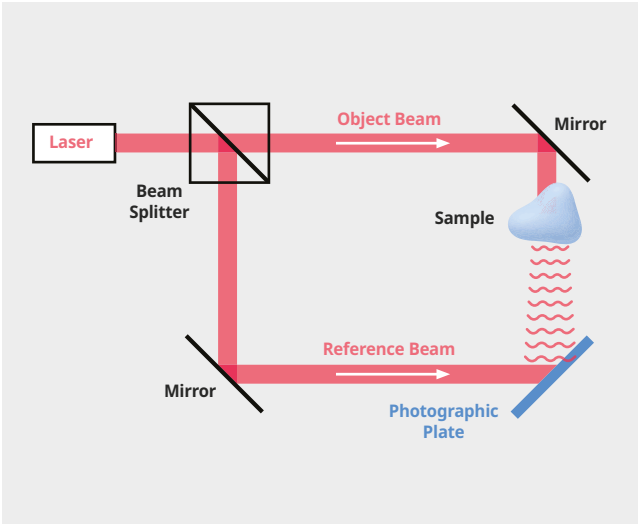
Lyncée Transmission Series

DHM Technology

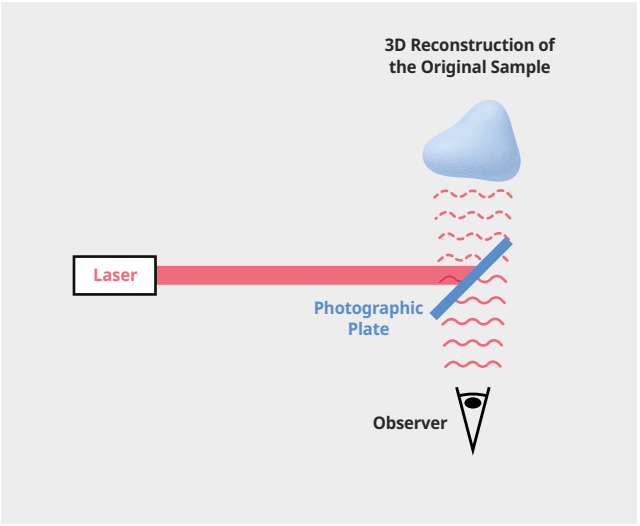
Principles of Classical Holography

A sample is illuminated by coherent light that is transmitted through it and then interferes with a reference beam to generate the hologram, containing information about both the phase and the intensity changes induced by the sample. These changes are recorded onto a specialized holographic plate through a single acquisition. By shining the same coherent light onto the holographic plate, a 3D image representation of the original sample is reconstructed.

Hologram Recording on Holographic Plate

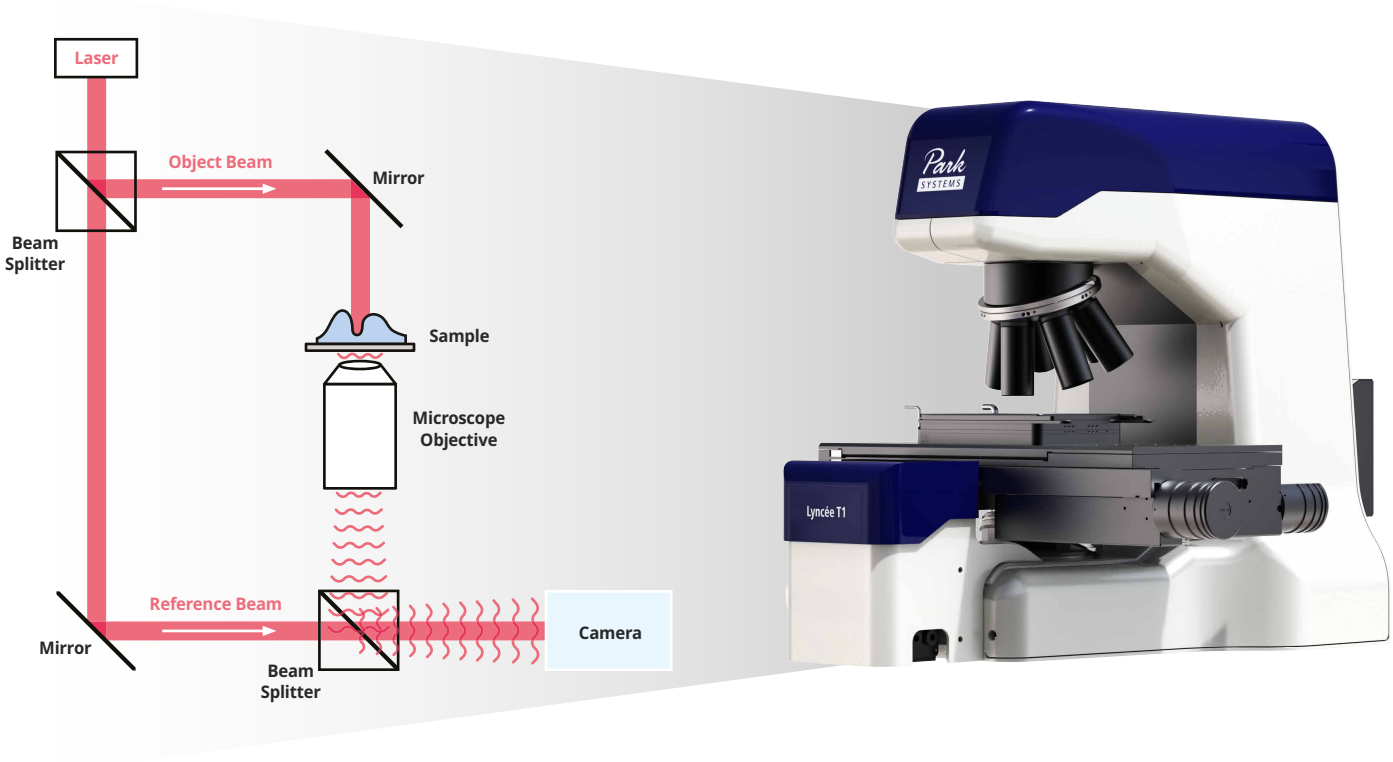


Hologram Reconstruction



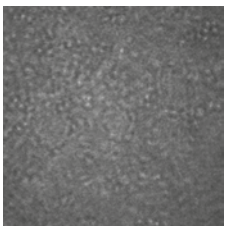
Lyncée Transmission Series: Data interpretation

For life sciences applications, Lyncée Transmission series provides real-time Quantitative Phase Imaging (QPI) of living cells. Segmentation then provides biological parameters on individual cells such as viability, confluency and cell dynamics.

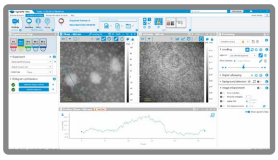


Lyncée Transmission Series: Workflow

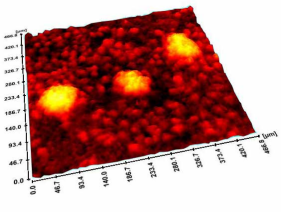
Data acquisition encodes the whole information about the sample in the recorded hologram in a single shot at camera rate speed. The recorded hologram is then numerically reconstructed in real time. Numerical reconstruction allows to refocus the phase image after the acquisition and to get quantitative information providing insights about the monitored sample.



Hologram



DHM Software



3D Phase Image

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

Lyncée Transmission Series: Data interpretation

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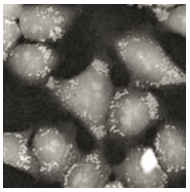
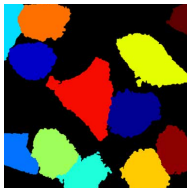
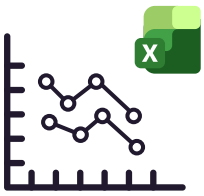


Quantitative Phase Image

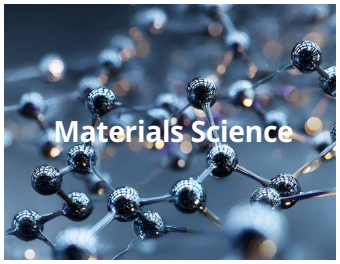


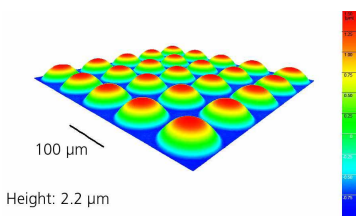
Cell Segmentation, Analysis and Data Export



Biological Parameters Quantification

For materials science applications, Lyncée Transmission series provides 3D topographic and material properties information and their time evolution. This information is then processed to obtain relevant metrics for research and quality control.





3D Topography

Sag: 8.9 µm
ROC: 160 µm
K: -1.15

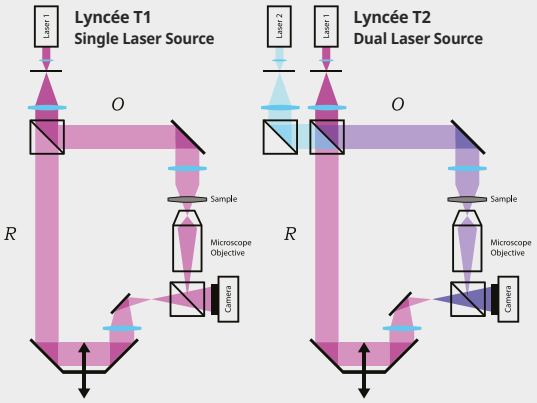
Sample Characterization

Lyncée Transmission Series

Adaptable to Your Experimental Needs

Transmission DHM Models

Lyncée Transmission series (Lyncée T1, T2) offers single- and dual-laser source configurations optimized for precise optical topography. Each model is an ideal tool for its application: Lyncée T1 for most applications, and Lyncée T2 for large step height samples.



Objectives Lens Sets

Objective turret supports up to six objectives from 1.25 × to 100 × magnification (air and oil immersion), which allows easy switching between wide-field overview and high-magnification inspection.

Motorized Stage

The optional motorized stage enables automated acquisitions at predefined XYZ locations to record multiple sites without user intervention. The motorized stage also allows stitching multiple acquisitions to obtain a larger field of view to investigate large samples. In life sciences it is compatible with standard multi-well microplates (up to 384 wells) for high-content and high-throughput screening assays.

Fluorescence Module

When combined with Lyncée Transmission series, the optional fluorescence module enables simultaneous quantitative phase imaging and epifluorescence observation through the same objective lens. This allows direct correlation between label-free DHM measurements and fluorescence reference assays for applications such as cardiotoxicity screening and single-cell analysis. The plug-and-play module supports multiple light sources and cameras, with dedicated filters ensuring crosstalk-free operation.

Environmental Chamber

The perfect addition for non-perturbing multi-day time-lapse experiments. It allows full control of temperature, O_2, CO_2 and humidity with the same precision as a full incubator. O_2 control (for hypoxia and hyperoxia experiments) can be added with an optional gas mixer.

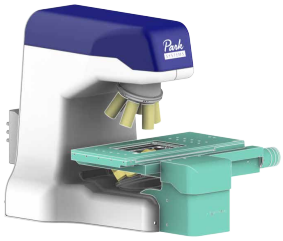
Flexible Upgrade Options

Lyncée Transmission series is designed with modularity in mind, and its hardware can be upgraded to suit customers' applications and budgets at any time.

T1, the Standard DHM	T2, the Dual-wavelength DHM	Upgrade Parts
Single objective	Multiple objectives	Turrets of condensers and objectives
Single laser source	Dual laser sources	A motorized stage for multisite experiments
Multiple objectives		A fluorescence module for correlative microscopy
		An environmental chamber for long time lapse

Lyncée T1, Standard DHM

Lyncée T1, Standard DHM



Lyncée T1, Standard DHM

Lyncée T1, Standard DHM

Lyncée T1, Standard DHM

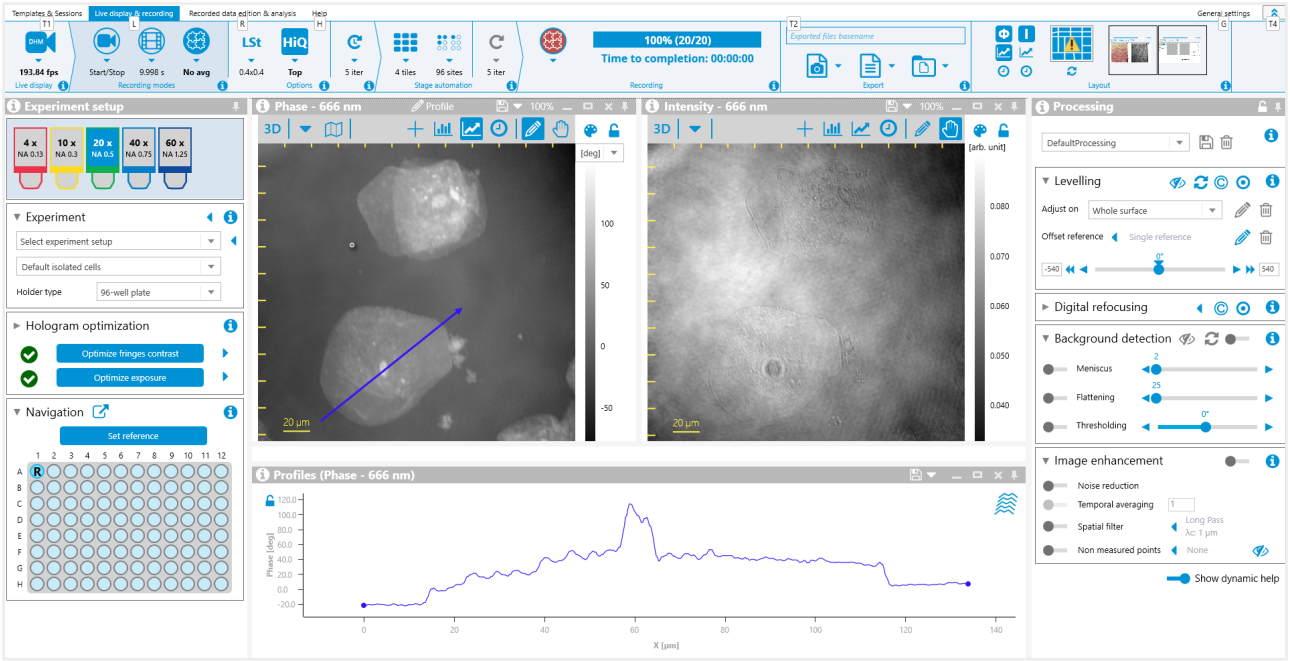
Lyncée T2, Dual-wavelength DHM

Lyncée Transmission Series

For a Complete Solution from Sample Handling to Data Analysis

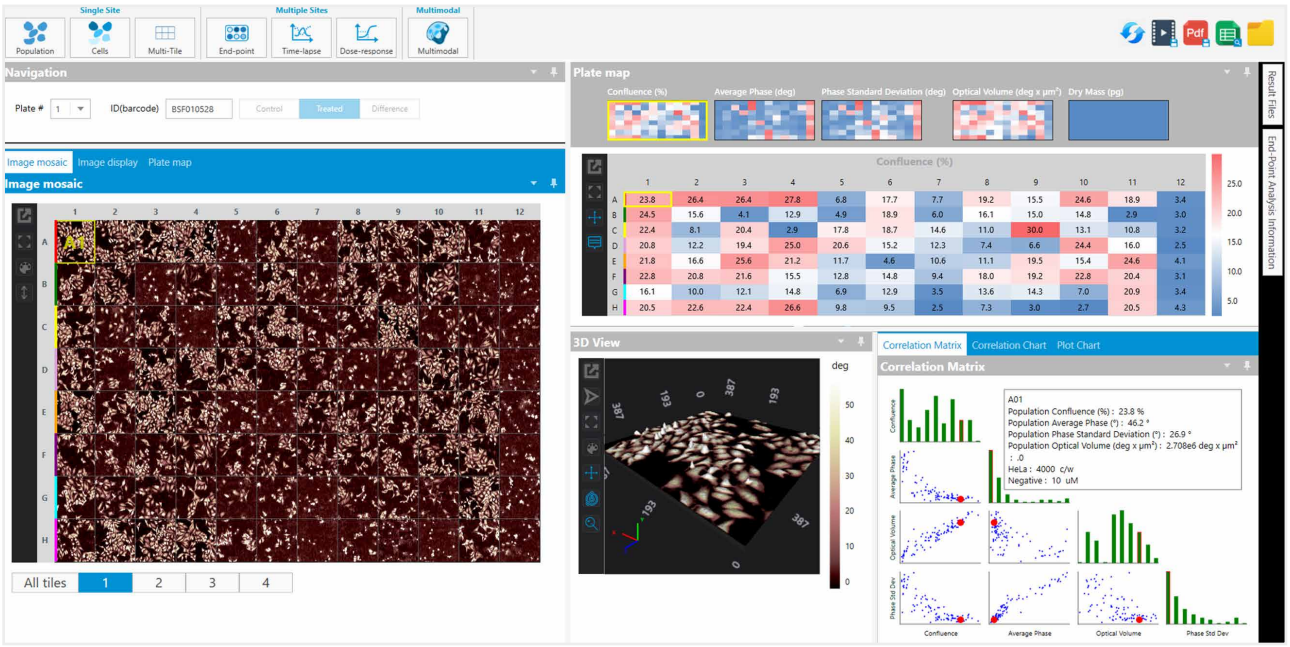
Koala Acquisition & Analysis Software

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.



Cell Analysis Tool (CAT) Software for Bioanalysis

CAT is an analysis software designed specifically for life sciences experiments, working seamlessly with our proprietary acquisition software Koala to provide a complete workflow from image acquisition to data visualization and report generation. It automatically refocuses and tracks cells during holographic time-lapse experiments, processes multi-well plate experiments for High-Content Screening experiments while also supporting combined phase and fluorescence analysis in dual-modality workflows.



Lyncée Transmission Series

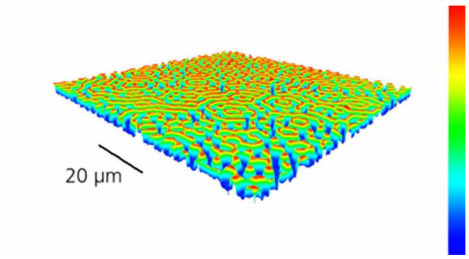
Designed for Your Applications

Materials Science

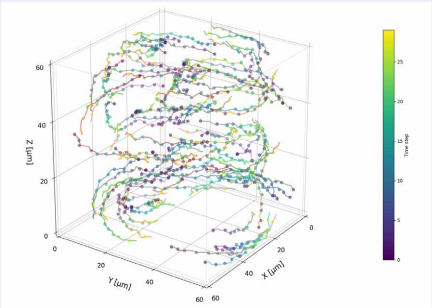
Micro-Optics

Characterization of the optical transfer function of freeform optics, gratings, conventional lenses, or Fresnel lenses. It provides measurements of geometry, radius of curvature, conical constant, or root mean square deviation from an ideal shape. The use of immersion liquids allows information to be obtained on components with very high NA, such as retro-reflectors.

A unique transmission interferometer



Diffraction Grating



3D Tracking of Beads in a Fluidic Chamber

Micro-Fluidics and PIV

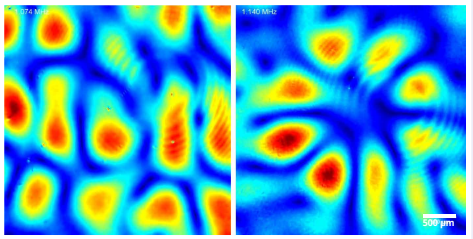
Static and dynamic characterization of liquid spread on functionalized surfaces, of microbubbles and particle trajectories inside microfluidic devices, of interfaces between liquids, of water surface deformation by micro-rafts, or of the effects of thermodynamic parameters on systems.

3D localization from a single hologram acquisition

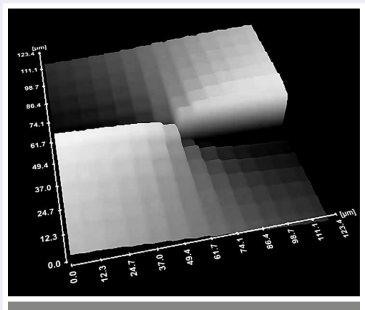
Acoustofluidics

Measure the force fields created by piezo actuation by synchronizing transmission DHM using our stroboscopic module for frequencies up to 25 MHz. Use DHM equipped with a high-speed camera providing up to 100,000 frames per second to analyze the non-reversible effects of the acoustic field on samples.

Observe simultaneously µseconds and seconds timescales phenomena



Force Heat Map of the Acoustic Field Induced in a Square (left, 1.074 MHz) and Circular (right, 1.140 MHz) Resonator Fluidic Chamber



Phase Delay by Liquid Crystal Display

Displays

The evolution of display components is shifting toward panels of dynamic micro-nano, bio-inspired adaptive optics, metalenses, diffractive waveguides, birefringent components, or liquid crystal devices, among others. Transmission DHM is a primary tool for development and quality control of all these systems.

Characterize intensity, phase, polarization, and optical transfer function

Lyncée Transmission Series

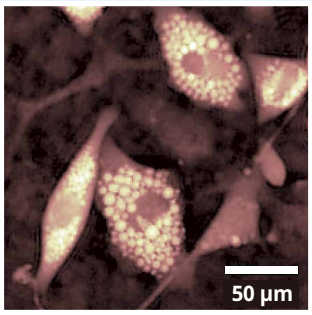
Designed for Your Applications

Life Sciences

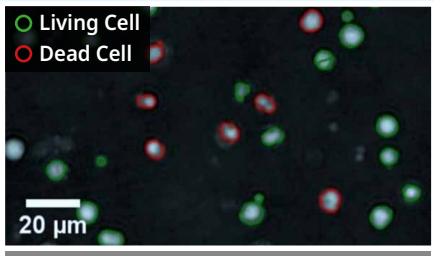
Lipid Droplet Quantification

DHM enables continuous, label-free measurement of the shape, morphology, and intracellular contents of living cells in 2D and 3D. In this example, Lyncée Transmission series was used to quantify lipid droplet production in adipocytes over 6 days without cell staining or washing.

Identify and quantify intracellular organelles



Adipocyte Differentiation



Human T-cell Viability Assay

Label-Free Cell Viability Assessment

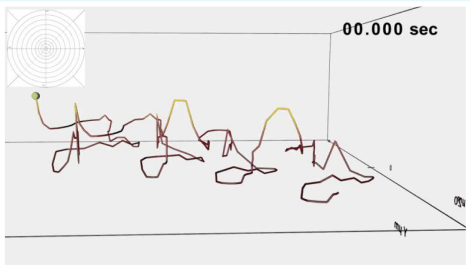
DHM combined with machine learning accurately classifies living (green) and dead (red) cells based on morphological traits, achieving over 84% correlation with fluorescence validation standards. Lyncée Transmission series enables non-invasive cell analysis, potentially revolutionizing cell health monitoring in the field of cell and gene therapy.

Unique method to assess viability without-label

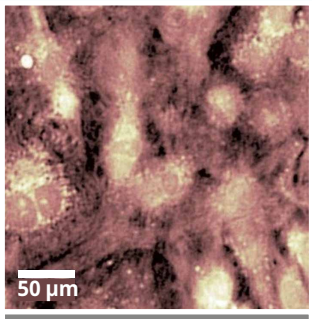
Live Cell Tracking

The high-acquisition speed of DHM enables isolation and tracking of specific cell movements in 3D space. In this example, Lyncée Transmission series was used to track the animated trajectory of free-swimming bull sperm cells over 2.5 seconds. A green marker indicates the head, and the color-coded path represents the z-position and its clockwise helical motion.

Fastest technology to track 4D motion



3D Tracking of Bull Sperm Cell Head Movement



Beating Cardiomyocytes

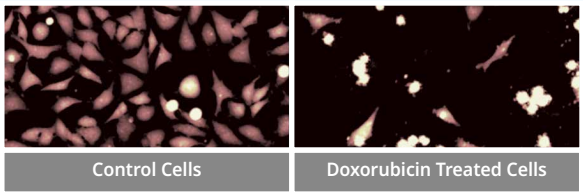
Cell Dynamics

The combination of DHM's high-acquisition speed and label-free capability enables visualization and quantification of fast cellular dynamics in vitro. Lyncée Transmission series can be used to investigate morphological changes in myocytes. In this example, mechanical changes and intracellular calcium release in cardiomyocytes were investigated using Lyncée Transmission.

Non-perturbing monitoring of high-speed cell dynamics

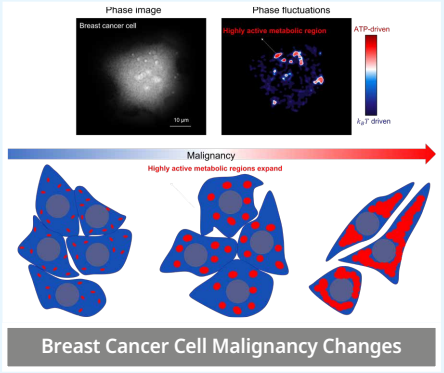
Label-Free Cytotoxicity Screening

Validated against standard fluorescence methods, label-free DHM proves to be a faster and more effective high-content screening (HCS) method for cytotoxicity assays. Lyncée Transmission series provides an ideal solution for early drug discovery and toxicological profiling.



Control Cells | Doxorubicin Treated Cells

High-content screening for drug discovery



Breast Cancer Cell Malignancy Changes

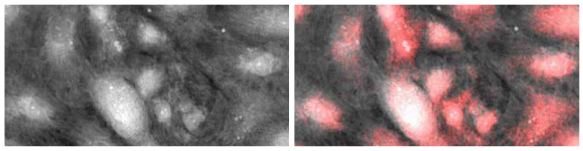
Early Cancer Detection

Single-acquisition enables DHM to image as fast as camera speed allows. In this example, intracellular ATP-driven phase fluctuations were recorded at intervals of 0.05 seconds over 100 seconds. The results of DHM analysis show that intracellular fluctuations are good indicators of malignancy and metabolic condition without the need for sample preparation.

Combined metabolic and oncologic insights

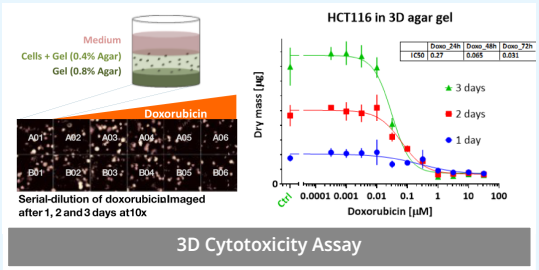
Correlation between DHM and Fluorescence

Simultaneous dual recording using DHM and fluorescence allows for the precise quantification of cardiomyocyte contraction dynamics through 14 distinct parameters. This multimodal approach offers critical physiological insights for assessing cardiotoxicity in novel therapeutic drug development.



DHM | DHM + Fluorescence

Multimodal capabilities to correlate complementary inputs



3D Cytotoxicity Assay

Drug Testing in 3D

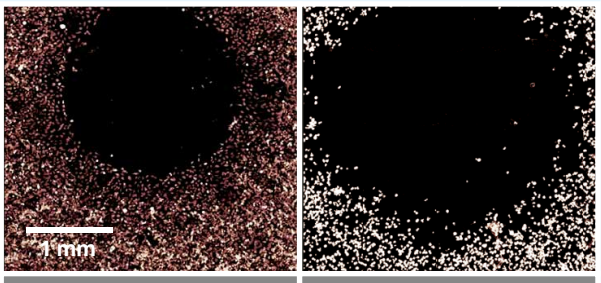
Lyncée Transmission enables monitoring of spheroid growth under drug treatment in physiologically relevant 3D agar models. Quantitative phase imaging allows label-free measurement of dry mass production and growth dynamics, providing a robust platform for evaluating drug response and efficacy over time.

3D information with a single acquired image per well

Cell Migration Screening

Label-free DHM imaging offers a fast and cost-effective approach for screening cell migration and proliferation inhibitors, enabling the simultaneous categorization of compounds based on potency, phenotype, and cytotoxicity via direct QPI image analysis.

Large field of view quantification of migration/proliferation



Control Cells | Cytochalasin D Treated Cells

Lyncée Transmission Series

Technical Specifications

Lyncée T1

- Number of laser sources: 1
- Operating wavelength (±1.0 nm): 666 nm
- Sample illumination: down to 1 μW/cm²
- Operation modes: single wavelength
- Objective & condenser turret: up to 6
- Vertical resolution: 2.0 nm
- Vertical measuring range:
  - Continuous structure: up to 500 μm
  - Discrete structure:
    - up to 1.0 μm (air)
    - up to 3.5 μm (water)
- Accuracy: 1.0 nm
- Repeatability: 0.02 nm

Lyncée T2

- Number of laser sources: 2
- Operating wavelengths (±1.0 nm)
  - 666 nm
  - 794 nm
- Sample illumination: down to 1 μW/cm²
- Operation modes
  - Single wavelength
  - Long synthetic 8 μm wavelength
- Objective & condenser turret: up to 6
- Vertical resolution
  - 1.0 nm (single wavelength)
  - 10.0 nm (synthetic wavelength)
- Vertical measuring range:
  - Continuous structure: up to 500 μm
  - Discrete structure:
    - up to 7.0 μm (air)
    - up to 22 μm (water)
- Accuracy:
  - 1.0 nm (single wavelength)
  - 5.0 nm (synthetic wavelength)
- Repeatability:
  - 0.02 nm (single wavelength)
  - 0.05 nm (synthetic wavelength)

Standard Camera

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

Optional High-Speed Camera

- Acquisition time standard: 10 μs @ 256 × 256 pixels
- Acquisition rate standard: up to 100,000 fps @ 256 × 256 pixels

Motorized Stage

- Travel range (X × Y × Z): 114 × 76 × 38 mm
- X, Y min step size: 0.01 μm
- X, Y max speed: 60 mm/s
- Maximum load: 10 kg

Dimensions and Weight

- Dimensions (L x W x H): 600 x 350 x 500 mm
- Weight: 30 kg

Power Requirements

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

Environmental Control Chamber

- Temperature range: ambient temperature +3 °C to 45 °C
- 0_2 and $C0_2$ control
- Humidity: up to 95%

Objective Lenses (Life Sciences)

Mag.	Numerical Aperture	Working Distance (mm)	Field of View (μm) (square)	Lateral Resolution (μm)
1.25	0.04	3.7	4,200	19
2.5	0.07	11.2	2,100	11
5	0.15	13.7	1,050	5.3
10	0.32	11.1	525	2.7
20	0.55	1.20	260	1.4
40	0.80	0.40	130	0.78
63*	1.30	0.16	83	0.53
100*	1.32	0.18	52	0.47

** Requires oil immersion*

Objective Lenses (Materials Science)

Mag.	Numerical Aperture	Working Distance (mm)	Field of View (μm) (square)	Lateral Resolution (μm)
1.25	0.04	3.7	5,280	8.50
2.5	0.07	11.2	2,640	4.90
5	0.12	14.0	1,320	2.85
10	0.30	11.0	660	1.15
20	0.40	1.15	330	0.85
40	0.75	0.37	165	0.45
63	0.75	0.50	132	0.43
100	0.9	1.0	66	0.38

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