Holotomographic Microscopy

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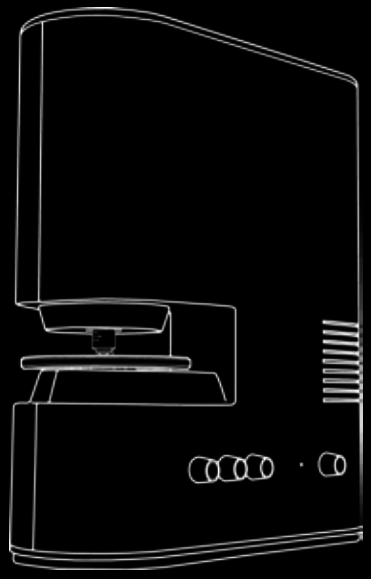


Tomocube

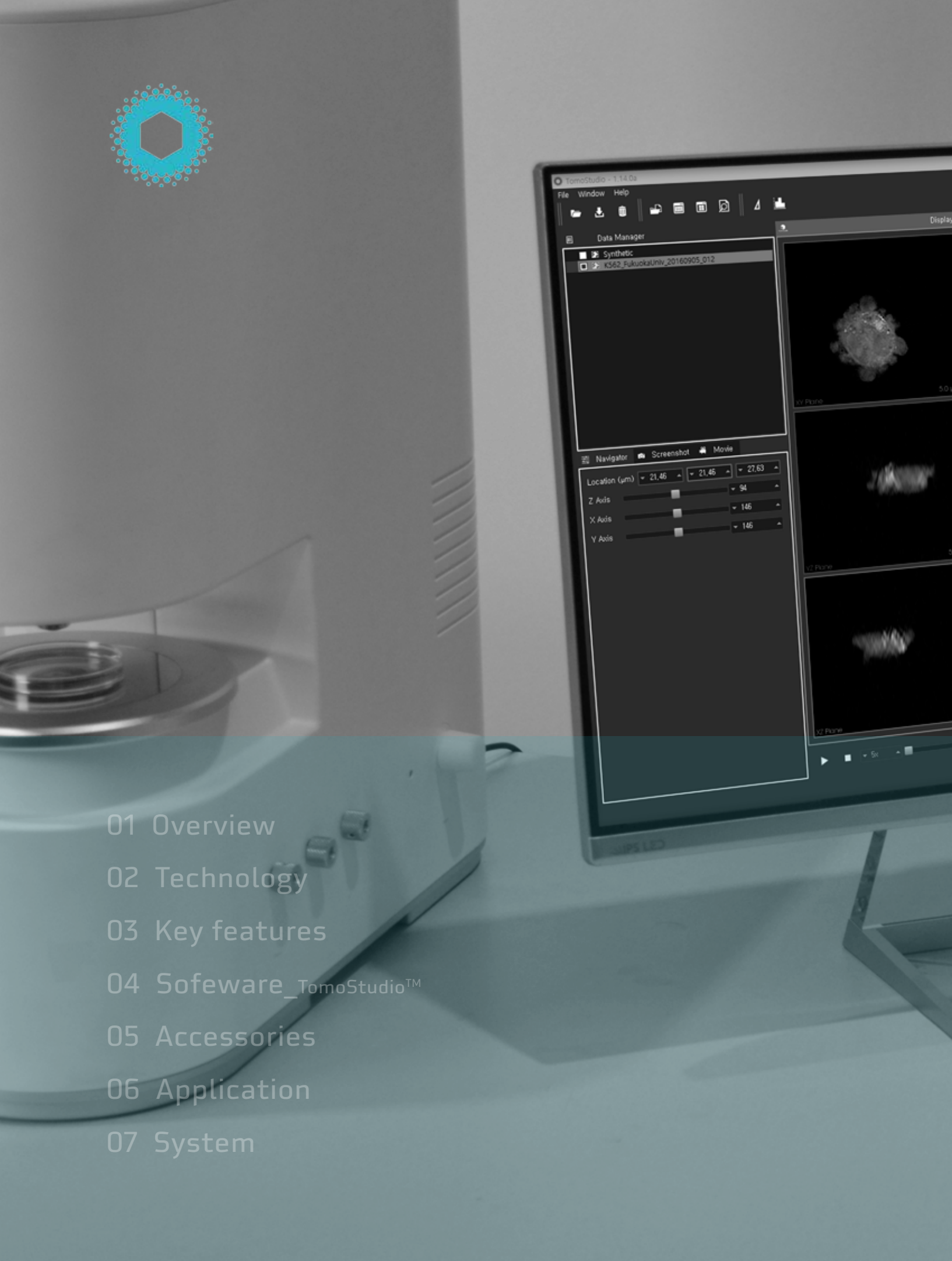


IMAGE DIFFERENT

2D/3D/4D Holographic Microscopy

Overview

Revolutionary Holotomographic (3D holographic) microscopy opens new era for Label-Free Live Cell Imaging

Cellular analysis plays a crucial role in a wide variety of research and diagnostic activities in the life science. However, the information available to researchers and clinicians is limited by current microscopy techniques. An innovative new tool – Holotomographic microscopy – can overcome many of these limitations and open new vistas for researchers and clinicians to understand, diagnose and treat human diseases.

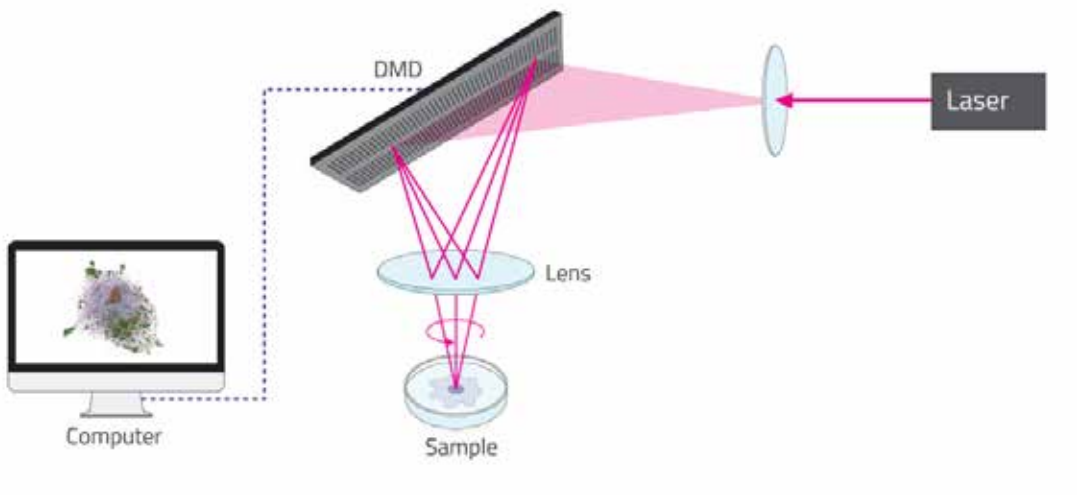
Holotomographic Microscopy - New era of microscopy

Tomocube's holotomography series utilize optical diffraction tomography (ODT), which enables users to quantitatively and noninvasively investigate biological cells and thin tissues. ODT reconstructs the 3D refractive index (RI) distributions of live cells and by doing so, provides structural and chemical information about the cell including dry mass, morphology, and dynamics of the cellular membrane.

Technology

Optical Diffraction Tomography(ODT) using Digital Micromirror Device(DMD)

RI is an intrinsic optical parameter describes the speed of light passing a specific material. Light passing through a cell is slower than light passing a surrounding medium. Analogous to X-ray CT (computed tomography), holotomography uses a laser beam to measure 3D RI distributions of cells. The system measures multiple 2D holograms of a sample with various illumination angles, from which a 3D RI tomogram is reconstructed via an inverse scattering algorithm.



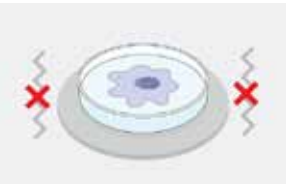
Key features

Label-free

No labeling, fixation or staining process is required for cellular imaging.

Fast imaging

High speed, real-time imaging up to 2.5 3D images per second.



Stable mechanism

No moving parts while imaging enables precise, high resolution images.

High resolution

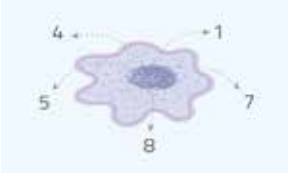
Holotomography technique secures high resolution beyond the diffraction limit.

Long term live cell imaging

Time-lapse video imaging over time with a top-stage incubation chamber and accessories.

Small power laser

HT-1 uses a low power laser (532 nm, 0.05 mW, laser safety class I) as a light source with a negligible photo damage.



Quantitative

HT series provides morphological (volume, surface area, projection area, sphericity and ellipticity), chemical (dry mass, concentration) and mechanical (cell deformability, fluctuation) properties of biological cell.

TomoStudio™

2D/3D/4D holographic images

01

Tomostudio™, HT-1 operating SW, controls the system and visualizes the captured image in various ways. This flexible user interface provides fast imaging capability and 2D/3D/4D visualization of cellular image based on 3D RI distributions of cells and tissues.

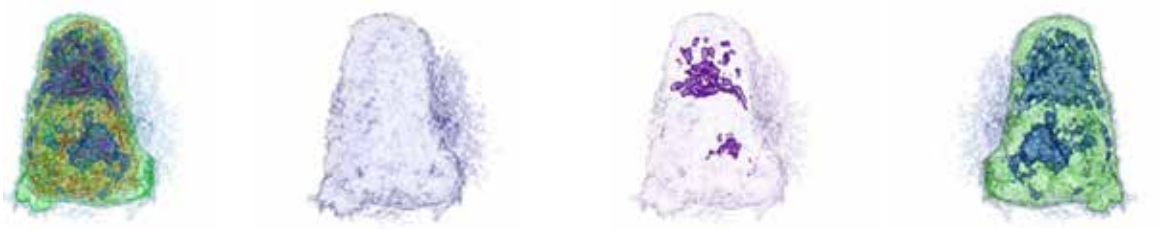
02

Tomostudio™ provides quantitative bioimaging information about morphological, chemical and mechanical properties. Quantitatative and label-free bioimaging capability will open a new avenue for the study of pathophysiology of cells and tissues.

03

Output parameters:

Morphological parameter	Chemical parameter	Mechanical parameter
Volume (μm^3)	Dry mass (pg)	Cell stiffness
Surface Area (μm^2)	Concentration (pg/μm^3)	Dynamic membrane fluctuation
Projection Area (μm^2)	*RBC: Hb contents and concentration	
Sphericity	* Red Blood Cell	



Tomostudio™ provides

01

Work flow interface

User can control the microscope easily following the workflow.

02

Data backup

Raw data can be stored in the computer for further analysis.

03

Fast image acquisition

HT-1 captures Holotomographic images in every 0.4second (2.5 f/s) and 2D holographic images in 0.007second (150 f/s).

04

Holographic staining

Digital color coding controller (Transfer function) is a graphical user interface to stain the sample digitally based on refractive index information.

05

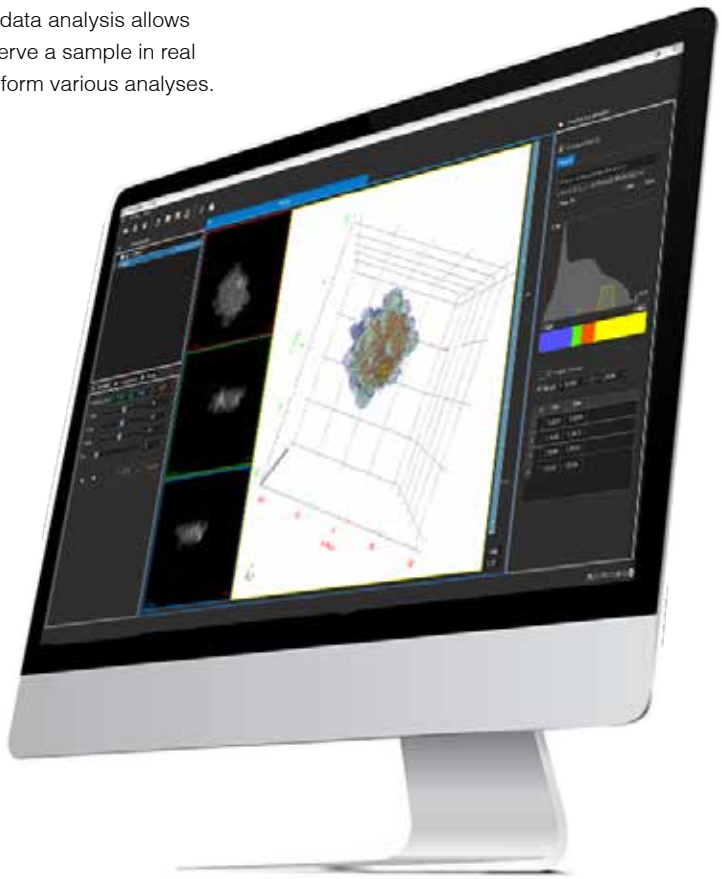
Data analysis

Quantitative data analysis allows users to observe a sample in real time and perform various analyses.

06

Dynamic image processing

Data processing does not affect on image acquisition with the dynamics image processing feature. Processing a batch of user data enables smooth long-term imaging of a sample.



Accessories

01

TomoChamber

For long-term live cell imaging, it is necessary to secure an environment to keep the cells alive. Tomochamber is an incubation chamber designed to perform time lapse imaging with HT-1. It is installed in the sample stage, maintains the temperature and supplies CO_2 properly for environmental condition.

02

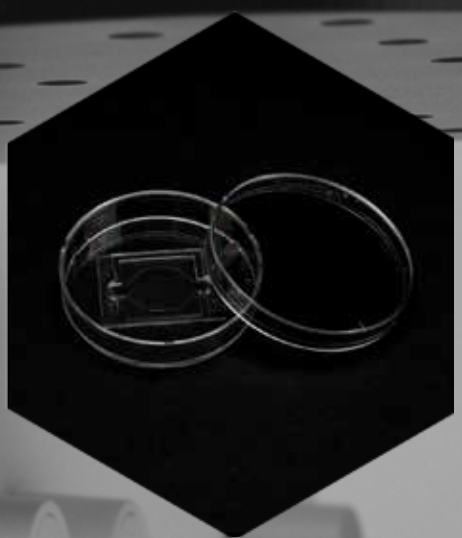
TomoPlate

The laboratory is exposed to a vibrating environment. Tomoplate is a magnetic type compact anti-vibration table specially designed for higher resolution imaging, minimizing the effects of vibration.

03

TomoDish

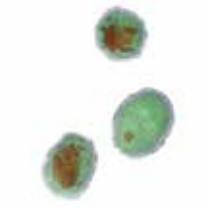
Specially designed dish for live cell imaging, allowing easy sample preparation and high-resolution sample imaging. Both adherent and floating cells can be cultured and ready for imaging very easily.



Application

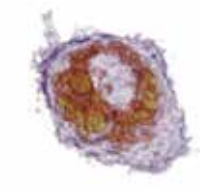
Hematology

- Malaria infection
- Sickle cell identification
- Blood analysis



Microbiology

- Bacteria classification
- Microorganism imaging
- Lipid content test of microorganism

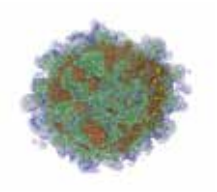


Immunology

- White blood cell classifcation
- Immune response

Nanotechnology

- Nanoparticle imaging
- Cell organelle tagging with nanoparticle



Cell biology

- Intracellular trafficking
- Cell division
- Live cell imaging
- Quantification
- Cellular structure analysis

Capabilities

01 Observe the cellular changes without any labeling or staining.

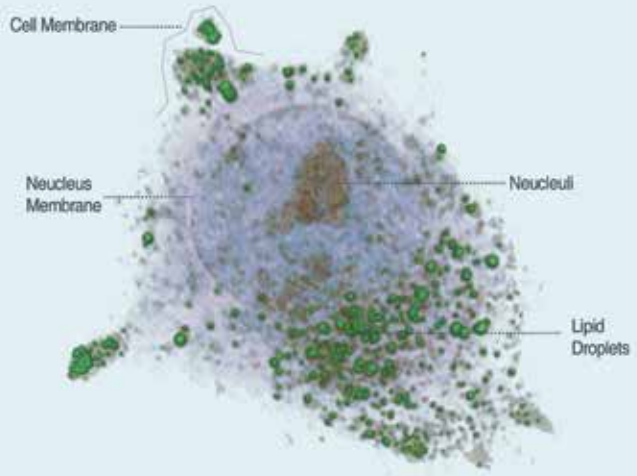
02 Multidimensional acquistion : 2D time (150 fps) / 3D time (2.5 fps).

03 Visualize the cellular organelles with 3D RI distribution.

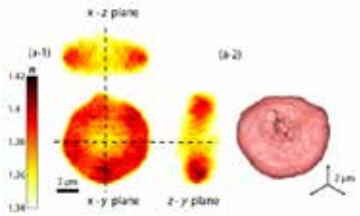
04 Identify the changes of the quantitative properties of cells.

05 Detect the cellular organelles tagged by nanoparticles.

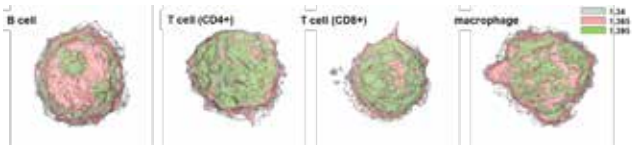
06 Observe the vesicle movement in time lapse.



3D properties of red blood cell

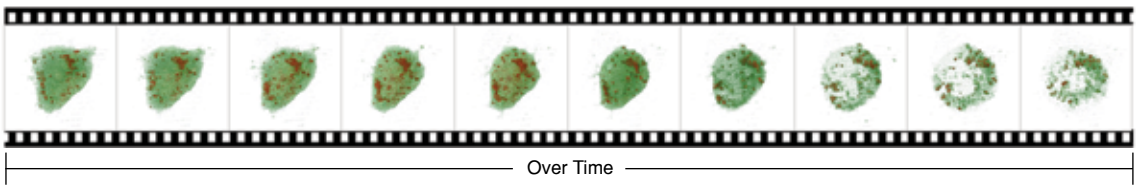


Various types of white blood cell

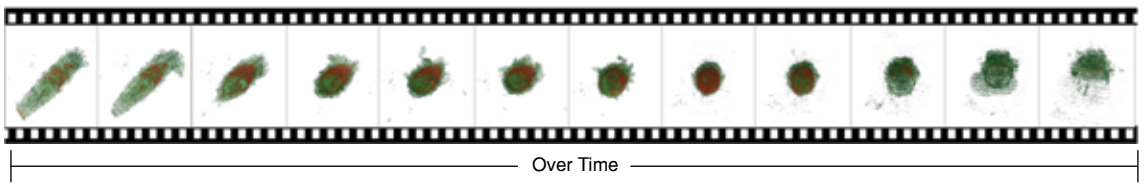


4D timelapse – Apoptosis & Necrosis

Necrosis of Hepatocyte

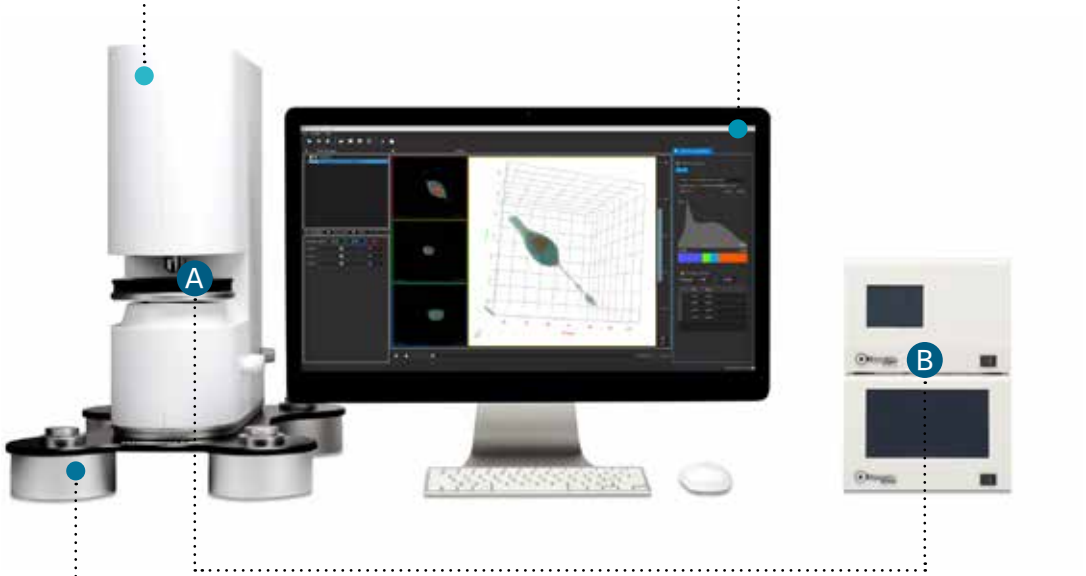


Apoptosis of Hela Cell



Holotomographic image of cells

System



01 HT-1
Microscope Body

02 TomoStudio™
Software for HT-1

03 TomoPlate
Anti-vibration plate for HT-1

04 TomoChamber
TomoChamber, the incubator for HT-1, consists of **A**. stage top incubator and **B**. controller.

Technical Specification

Technical specification			
Model		HT-1S	HT-1H
Objective Lens		60x NA 0.8	60x NA 1.2 (water immersion)
Optical Resolution	Lateral Resolution	166 nm	110 nm
	Axial Resolution	1 ㎛	356 nm
Reconstructed voxel Resolution	Lateral Resolution	166 nm	110 nm
	Axial Resolution	332 nm	220 nm
Field of View		max. 80 ㎛	
Depth of Field		max. 40 ㎛	
Imaging Speed		150 fps (2D holography)	
		2.5 fps (3D holography)	
Light Source (Laser)		532 nm, 0.05 mW, laser class 1	
Max. illumination angle in the sample plane		53˚	63˚
Microscope body		Fully motorized	
Size (W x D x H, mm)		445 x 180 x 500	
Weight		23 kg. / 51 lbs.	
Power requirement		100~240 V, 50 / 60 Hz, 1.5 A, 100 W	

Environmental requirement	
Temperature	22℃ ± 3℃, It has to be ensured that the airflow of the air-conditioning is not directed toward the system.
Humidity	< 65%

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