

Cell Voyager CQ1

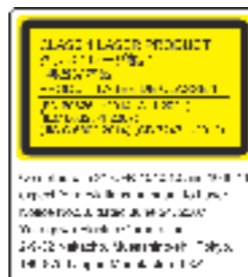
Confocal Quantitative Image Cytometer

Optics	Microlens enhanced dual wide Nipkow disk confocal
Fluorescence	Laser : Choose Max.4 lasers from 405 / 488 / 561 / 640 nm EM Filter : Max. 10 filters (Included 1 filter for transmitted illumination)
Transmitted illumination	Phase contrast*1, Bright field Light source : LED
Camera	Number of effective pixels : sCMOS 2000 × 2000pixels, FOV: 13.0 × 13.0mm
Objective lens	Max.6 lenses Dry : 2x, 4x, 10x, 20x, 40x Long working distance : 20x, 40x For thick bottom vessel : 20x Phase contrast*1 : 10x, 20x
Attachment	All wells imaging type, Chambered type*2
Sample vessel	Microplate (6, 12, 24, 48*3, 96*3, 384*3, 1536*3 well), Slideglass*4*5, Cover glass chamber*4, Dish*4 (35, 60 mm)
XY stage	High-precision XY stage, designated resolution: 0.1 μm
Stage heater (Option)	Stage heater with chamber Controllable temperature range : Room temperature +5 - +17°C, Max.40°C Settable temperature resolution: 0.1°C Humidity holding*6
Z focus	Electric Z motor, designated resolution: 0.1 μm
Autofocus	Laser autofocus, Software autofocus
Feature data	Number of cells / cellular granules, Intensity, Volume, Surface area, Area, Perimeter, Diameter, Sphericity, Circularity, Length, etc.
Data format	Captured image : 16 bit TIFF (OME-TIFF) Output movie format : WMV, MP4 Output image format : TIFF (16 bit, 8 bit), PNG, JPEG Output numerical data format : FCS, CSV, ICE
Fast time lapse (Option)	Selectable from Max.100fps or Max.20fps
Workstation	Measurement and analysis workstation
Gas Mixer (Option)	Long-time model : CO ₂ concentration 5 - 18 % Hypoxia model : CO ₂ concentration 5 - 20 %, O ₂ concentration 0.1 - 18 %
Size / Weight	Main unit : 600 × 400 × 437 mm, 44 kg Utility box : 275 × 432 × 298 mm, 18 kg Gas Mixer (Option) Long-time model : 275 x 432 x 298mm, 9.3kg Gas Mixer (Option) Hypoxia model : 160 x 260 x 187mm, 5.2kg
Environment	Main unit and Utility box : 15 - 35 °C, 20 - 70 % RH No condensation Gas Mixer (Option) Long-time model : 15 - 30°C, 20 - 70%RH No condensation Gas Mixer (Option) Hypoxia model : 20 - 30°C, 10 - 85%RH No condensation
Power consumption	Main unit and Utility box : 100-240 VAC, 800 VAmx Workstation : 100-240 VAC, 950 VAmx Gas Mixer (Option) Long-time model : 100 - 240 VAC, 60 VAmx Gas Mixer (Option) Hypoxia model : 100 - 240 VAC, 50 VAmx

*1 Phase contrast option is required
*2 Stage heater option is required to use environment keeping function
*3 Phase contrast observation is unavailable
*4 Option
*5 Environment keeping function is unavailable
*6 Humidity holding time is changed by condition

Reliable after-service / Powerful technical support

We offer the best after-service program to meet your requirement and budget.
Our HCA experts will support you to obtain the best results easily.



Safety Precautions
 * Read the user's manual carefully in order to use the instrument correctly and safely.
 * This product falls under the category of class 1 laser products.

CQ1 is sold under license from ThermoFisher Scientific patent portfolio related to High Content Screening and Analysis.

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<https://www.yokogawa.com/solutions/products-platforms/life-science/>



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Confocal Quantitative Image Cytometer

Cell Voyager CQ1

Confocal Quantitative Image Cytometer

Cell measurement by high-throughput 3D imaging

Confocal Quantitative Image Cytometer

Cell Voyager CQ1 offers a new approach to cell measurement

Summary

Clear 3D images obtained from confocal microscopes have been enabling advancements in cell biology research for many years.

This imaging technology combined with population analysis now provides a significant advancement for cytometry.

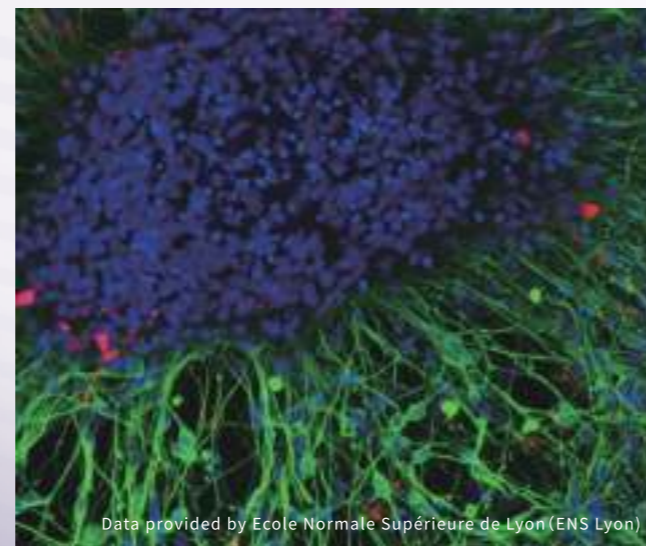
The CQ1 enables clear 3D imaging, object recognition, and rapid quantification of live cells and cell clusters.

The data from the images help in the understanding, and enhance the reliability of data.

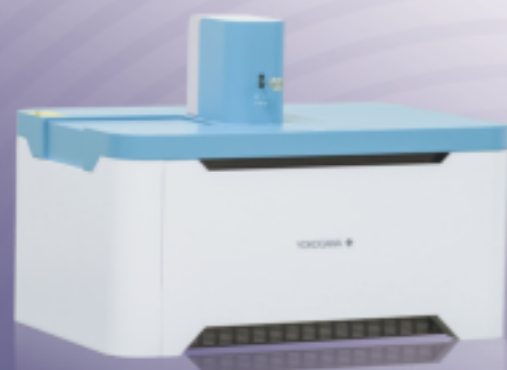
CQ1 is equipped with a high-performance stage incubator which enables long term live imaging in combination with Yokogawa's unique cell-friendly imaging technology.

The Yokogawa CQ1 is an easy to use all-in-one confocal microscope for an affordable price.

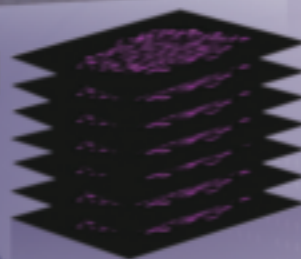
The CQ1 comes with a number of configurable options and can be integrated into a fully automated screening system.



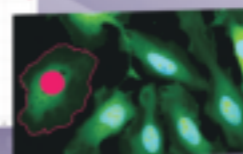
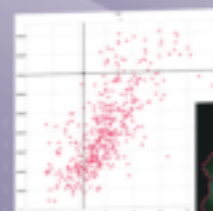
Data provided by Ecole Normale Supérieure de Lyon (ENS Lyon)



Imaging



Analysis



Graph



Raise your high-content analytics to the next level!

Enables measurement of spheroids, colonies and tissue sections.

- Possible to measure cells in culture dish without preprocessing such as cell peeling, unlike a flow cytometer
- Thanks to Yokogawa add comma after technology the confocal disk confocal, 3D images are acquired rapidly and gently
- Max.10 colors emission with 4 colors excitation and transmission illumination imaging
- Live cell chamber and time-lapse measurements
- Accurate feature extraction to facilitate sophisticated cell analysis
- Wide FOV with tiling function ensures effortless imaging of large samples

Offers the similar capabilities as flow cytometry

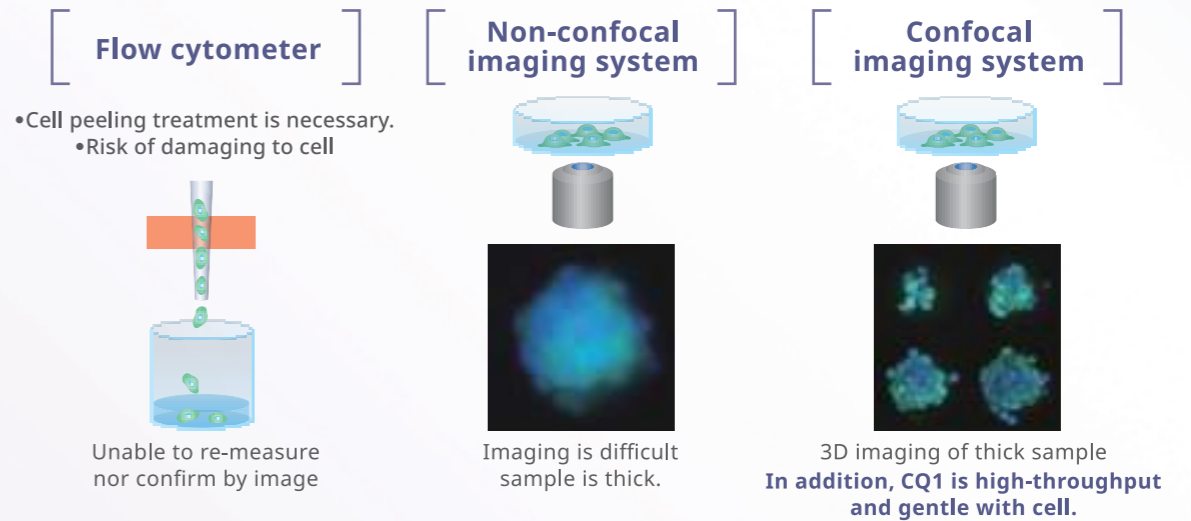
- Analyzed data displayed in real-time with image acquisition (On the fly analysis)
- Application protocols guided by templates
- Ability to trace back to the original image from a data point in a graph and to remeasure
- All-in-one system with easy operation

Open platform

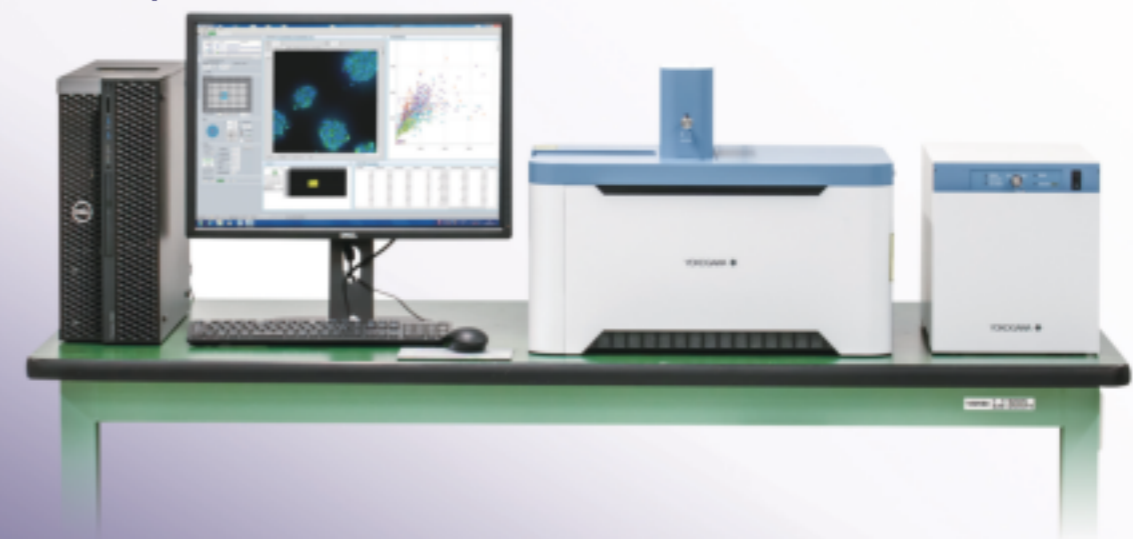
- Output FCS/CSV/ICE data format readable by third-party data analysis software
- Connectable with external systems via plate handling robot
- A variety of cell culture and sample vessels are applicable

Compact footprint, light weight bench-top system; no need for darkroom

Contrast of measurement methods



Example of setup



About the CQ1

Multiple Functions Fully Integrated in a Compact Box

Microscope Unit

Maximal performance objective lens (super apochromat) and the widest field/ highest-resolution sCMOS camera achieve high-throughput measurements of submicron sample.

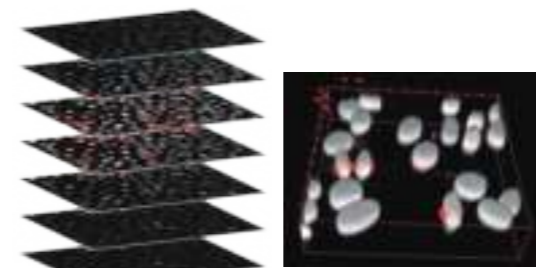
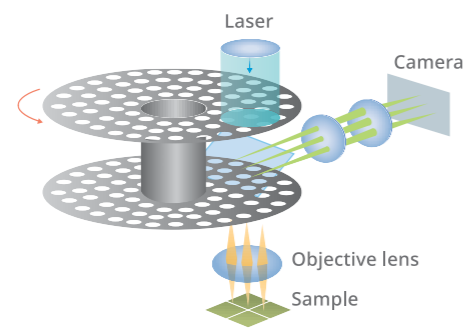
Emission Filter

Up to 10 Emission filters can be mounted. Measurement of multiple markers can be achieved in just one experiment.



Confocal Scanner Unit

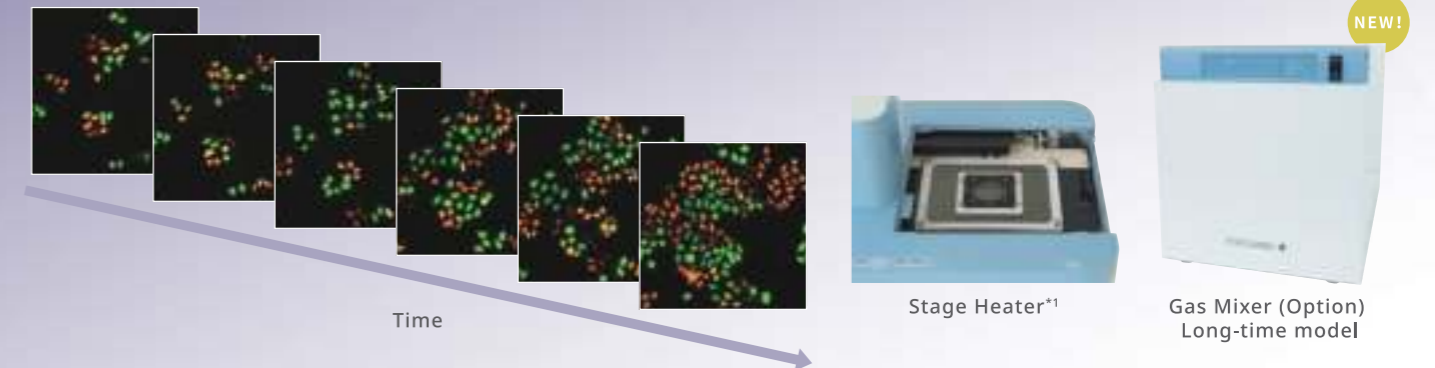
Multi-beam scan by "Microlens enhanced dual Nipkow disk confocal" achieve high-throughput 2D/ 3D imaging with minimum damage to samples.



Example: Cellcycle measurement of cancer cells

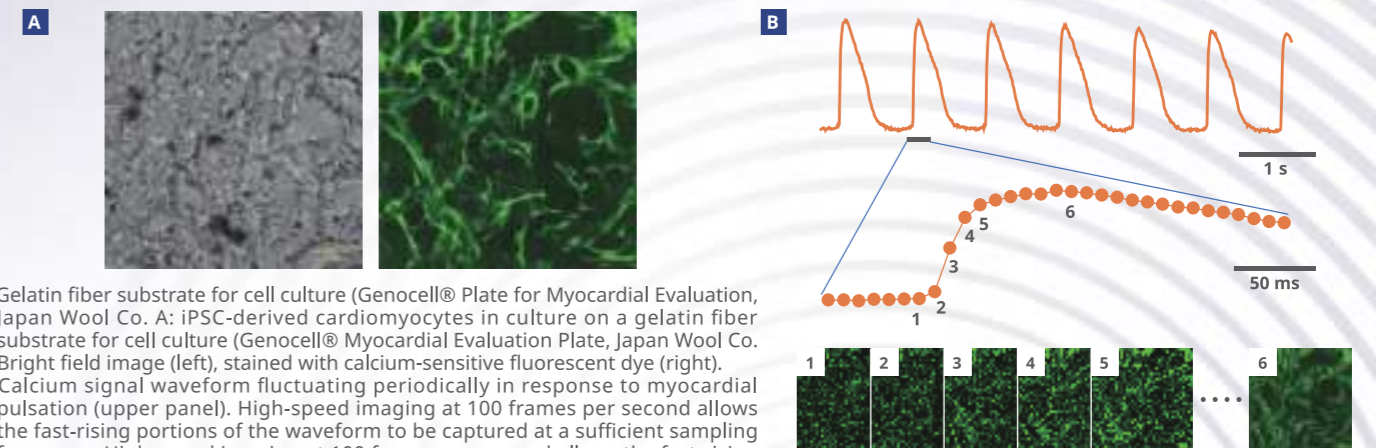
Stage Incubator

The stage heater controls the temperature, humidity, and CO₂ / O₂ concentration of the sample environment to maintain the incubation environment and makes possible time-lapse imaging. Time-lapse imaging for up to 72 hours in combination with the dedicated gas mixer (Long-time model). By using 3D time-lapse imaging, detailed reactions of intracellular organelles and dynamic movements such as cell migration can be captured and analyzed without missing anything.



Fast Time Lapse Function

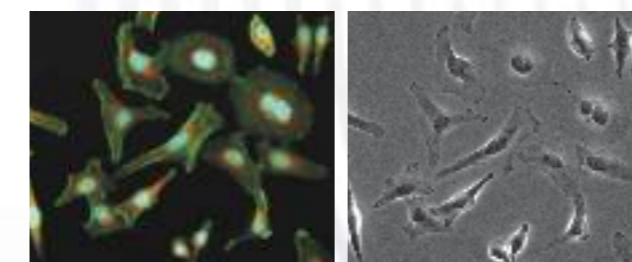
Capable of capturing up to 100 images per second (100 fps). It makes possible to capture high-speed phenomena that were previously difficult to capture.



A: Gelatin fiber substrate for cell culture (Genocell® Plate for Myocardial Evaluation, Japan Wool Co. A: iPSC-derived cardiomyocytes in culture on a gelatin fiber substrate for cell culture (Genocell® Myocardial Evaluation Plate, Japan Wool Co. Bright field image (left), stained with calcium-sensitive fluorescent dye (right).
B: Calcium signal waveform fluctuating periodically in response to myocardial pulsation (upper panel). High-speed imaging at 100 frames per second allows the fast-rising portions of the waveform to be captured at a sufficient sampling frequency. High-speed imaging at 100 frames per second allows the fast-rising portions of the waveform to be captured at a sufficient sampling frequency.

Light Sources

Up to 4 laser sources for confocal imaging can be installed. Also, light source for phase contrast and bright field imaging is installed as a standard function, which is extremely useful when confirming sample shapes.



Sample vessels

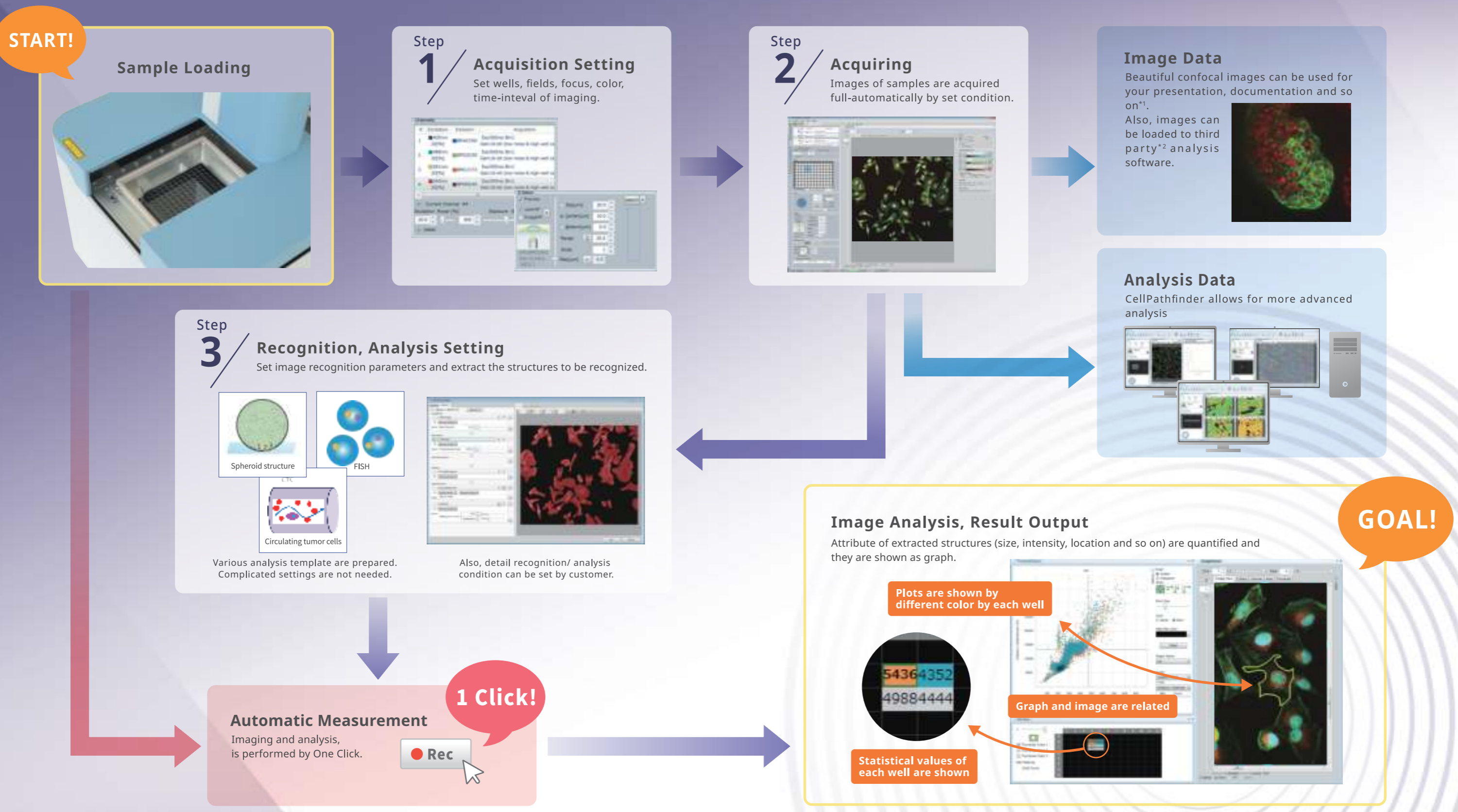
Imaging with a variety of containers is possible.



*1 Option

About CQ1

Set the protocol and One Click! -Easy & Universal Software-

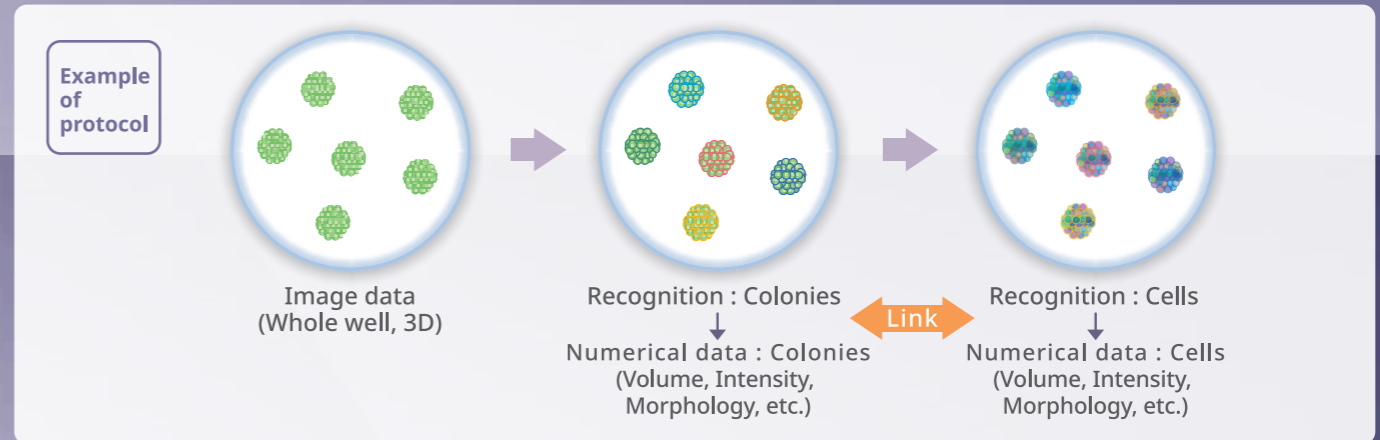


*1: Output by PNG, JPG or 8bit-TIFF format *2: Output by OME-TIFF format

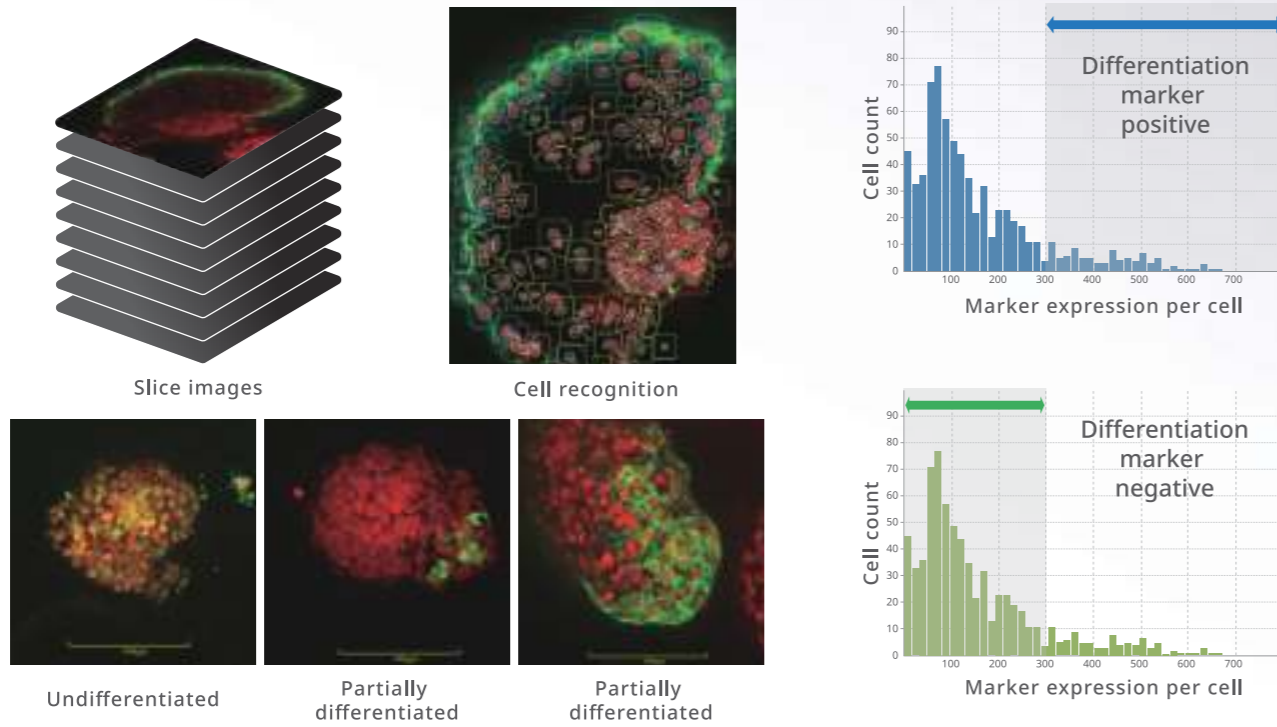
Measurement example

Let's start the easiest 3D Measurement!

The CQ1 stands as the premier solution for 3D measurement systems. It offers straightforward cell identification, precise colony counting, and intricate colony property analysis. Moreover, it provides comprehensive well imaging and analysis capabilities.



Quality control



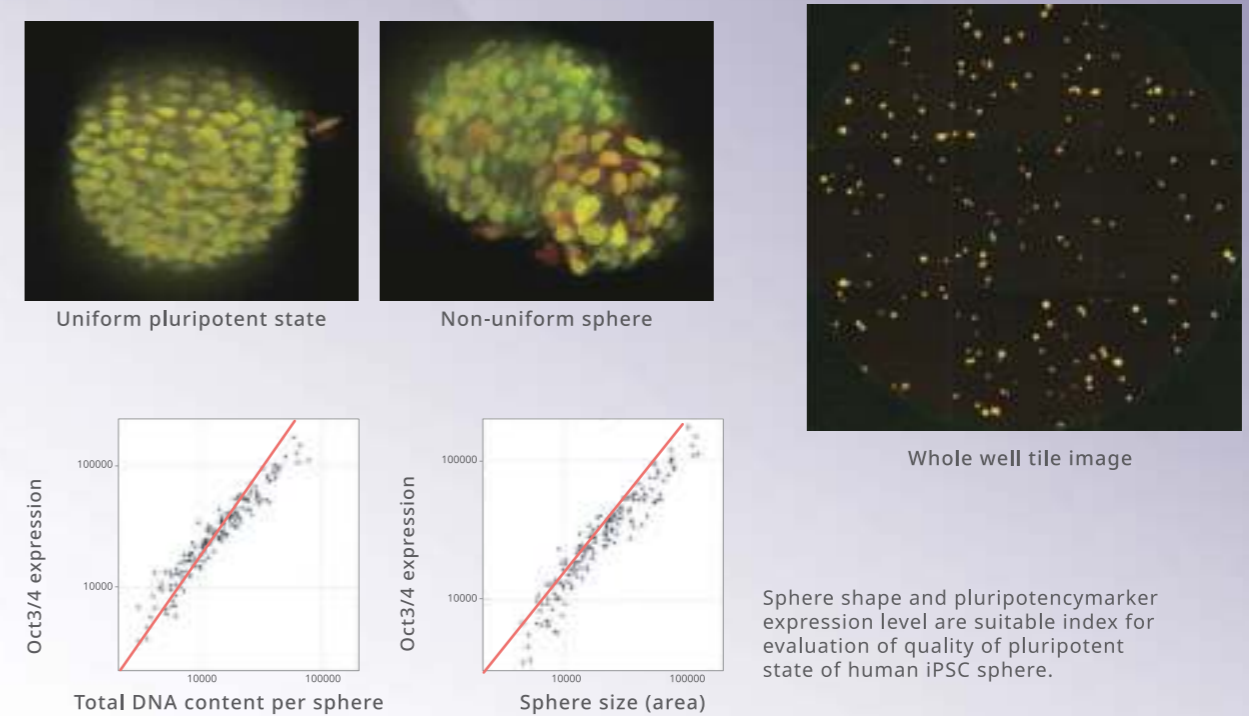
Aggregated cell images were taken in slices and presented as 3D. Marker expression level as well as spatial information of individual cells were quantified via image analysis.



Template

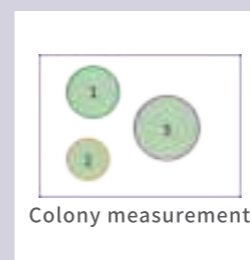
- Spheroid structure**
Cell-by-cell measurement of aggregated cells like spheroids.
- Applications**
 - should be spheroids
 - Differentiation

Quality control



Sphere shape and pluripotency marker expression level are suitable index for evaluation of quality of pluripotent state of human iPSC sphere.

Data provided by ReproCell



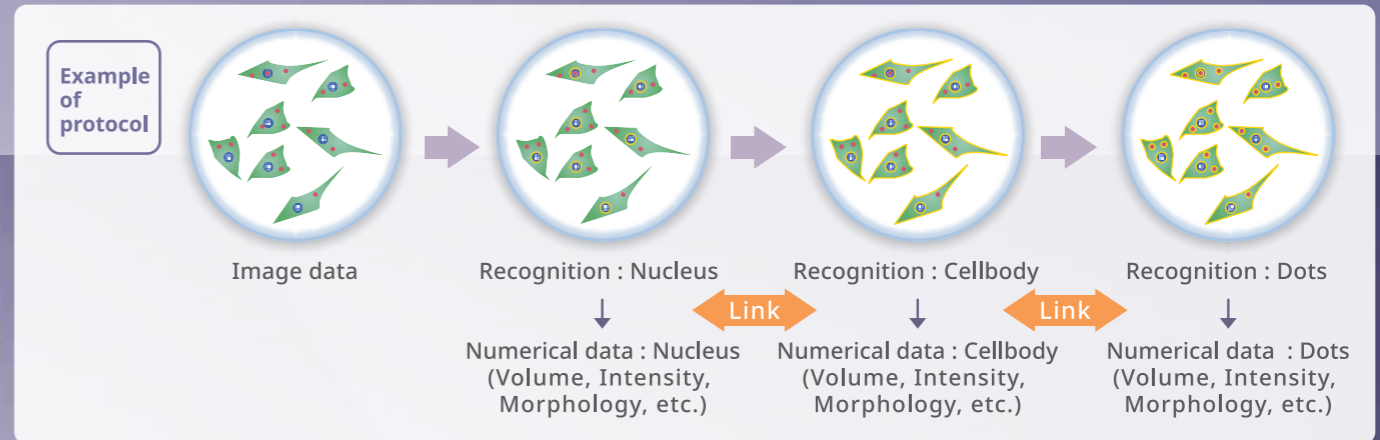
Template

- Colony measurement**
Cell-by-cell measurement of aggregated cells like spheroids
- Applications**
 - Colony growth evaluation
 - Differentiation

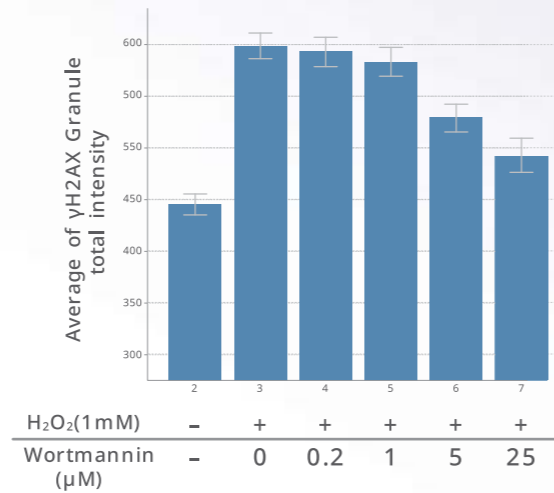
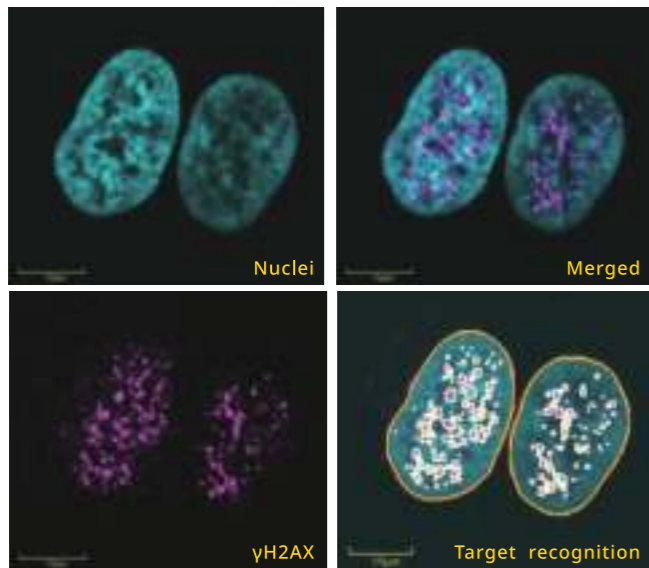
Measurement example

Dive Deeper into Analysis!

High quality confocal images from the CQ1 can be used for more detailed image analysis. Morphology change, particle analysis and other High Content Analysis that require high resolution images. Of course the CQ1 can work like simple Confocal Microscopy to space problem between get analyzed data and images.

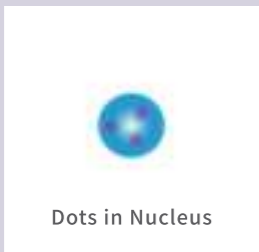


Analysis: gamma-H2AX focus formation



The phosphorylation of histone H2AX Ser139 (gamma-H2AX) is one of the significant events upon the breakage of double strand DNA. Quantitative measurement of gamma-H2AX focus formation can be easily performed by using the high-speed confocal image acquisition in combination with the Granule Analysis Template.

Template



Dots in Nucleus

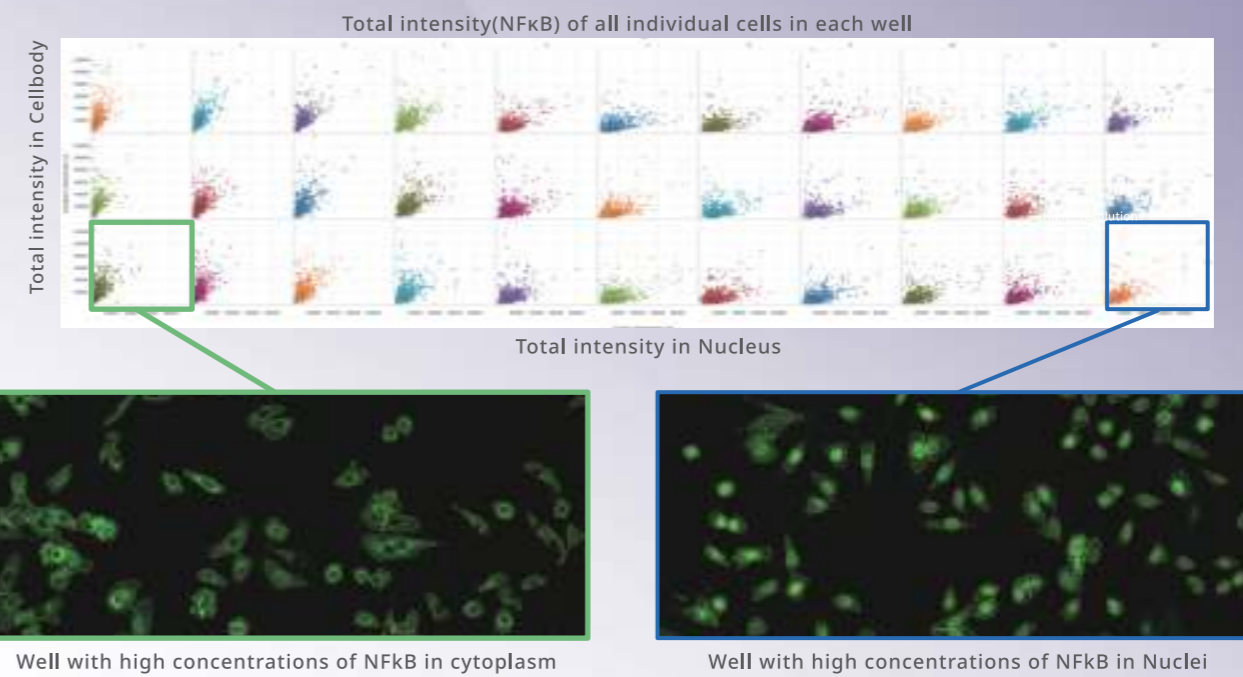
Applications

- FISH
- GPCR

Applications

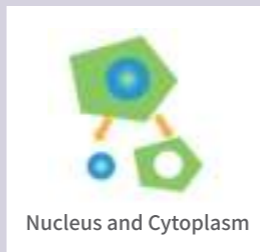
- Measurements of dots in cytoplasm and nuclei
- Precise separation of individual dots by the confocal unit

Nuclear translocation



NFkB is one of the famous transcription factor of DNA. NFkB plays a key role in regulating the immune response and inflammation and is attracting attention as a tumor therapy and anti-inflammatory drug target. NFkB is located in the cytoplasm with IκB which is inhibitory protein. Once the signaling pathway is activated by cytokine stimulation via cell membrane receptors, NFkB is activated as a consequence of the dissociation of IκB. Then NFkB translocate into the nucleus to bind specific sequence of DNA, which induce inflammation. Nucleus and intracellular NFkB level indicates protein level between cytoplasm and nucleus.

Template



Nucleus and Cytoplasm

Applications

- Nuclear translocation
- Membrane translocation

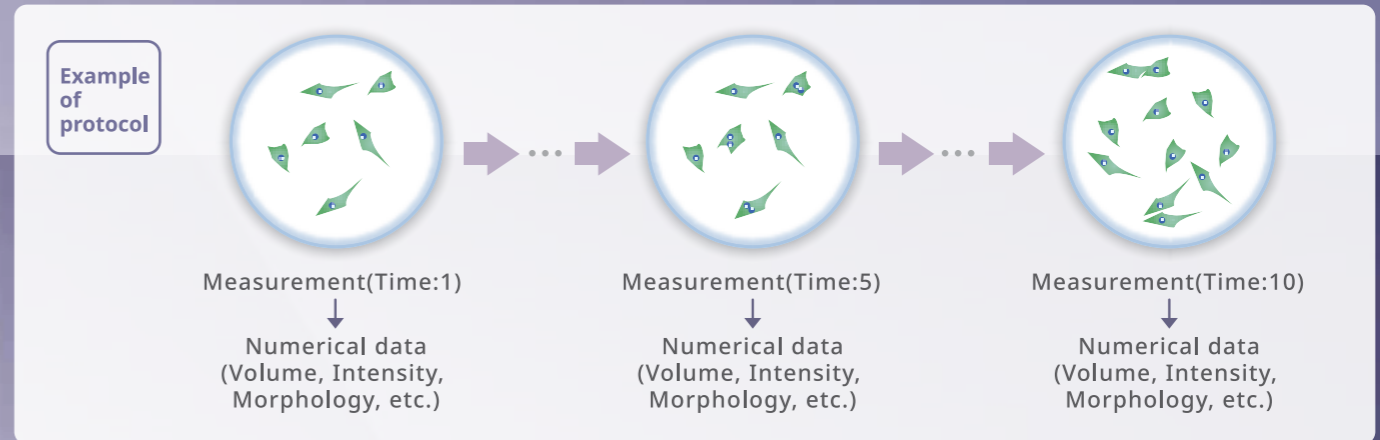
Applications

- Measurements of nuclei and cytoplasm
- Precise separation of localization by the confocal unit

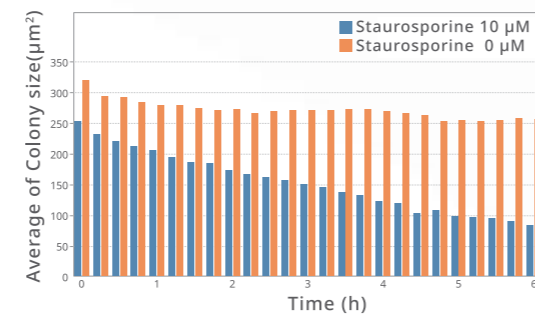
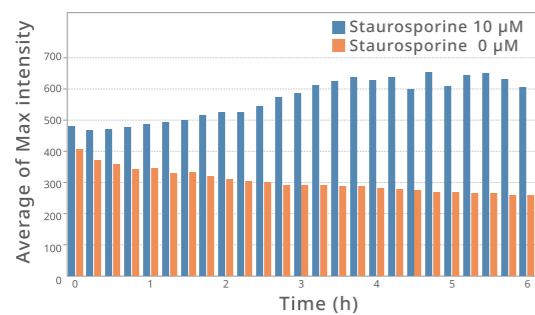
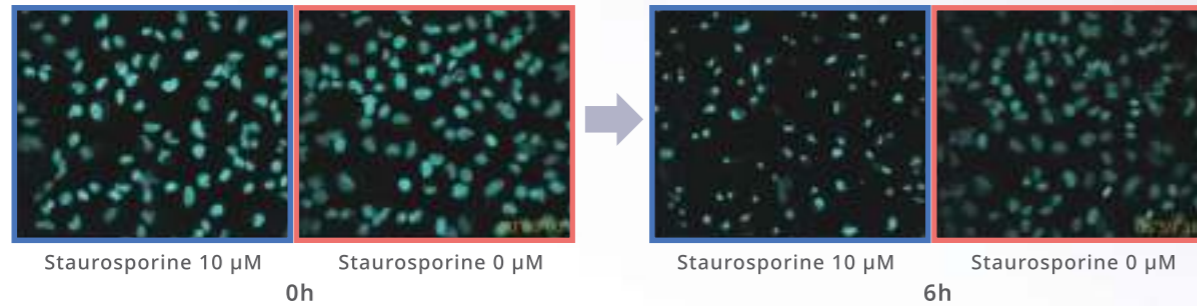
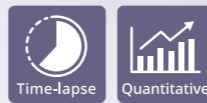
Measurement example

Try time lapse imaging!

Keep cells happier in incubator to see how they react on live.
The CQ1 is installed with Yokogawa's proprietary technology CSU, which is which is very gentle to cells and causes only low-level of photobleaching and phototoxicity. low photobleaching and low phototoxicity.
Long-term time lapse are possible while minimizing the effects of multiple measurements.

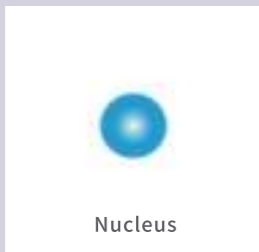


Time lapse analysis: Apoptosis



Spread HeLa cells to 96well microplate with 10,000 cells/well.
Stain with Hoechst 33342 (1 μg/ml, 30 min, 37 °C) and treat with Staurosporine (0 - 10μM) and capture image every 15 min. Recognize DNA fragmentation area of nuclei at Staurosporine 10 μM treatment.

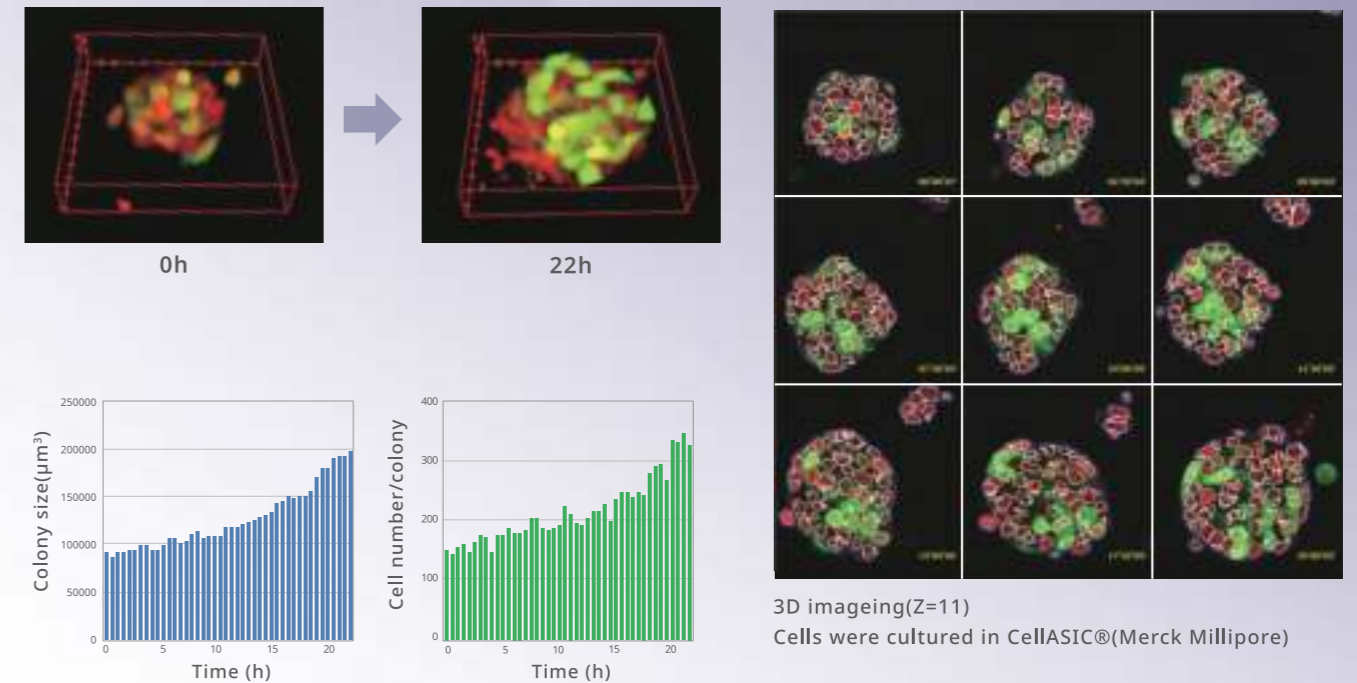
Template



Nucleus

- **Nucleus**
Measurements of Volume, Intensity and Morphology
- **Applications**
• Cellcycle
• Apoptosis

Time lapse analysis: ESC colony

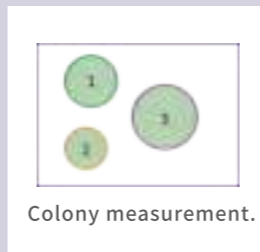


3D imaging(Z=11)
Cells were cultured in CellASIC®(Merck Millipore)

Time lapse analysis of colony size and individual cells allow to monitor colony formation state. CQ1's image can perform image acquisition with low photo-toxicity.

Data provided by Kyoji Horie,ph.D, Physiology II, Nara Medical University

Template



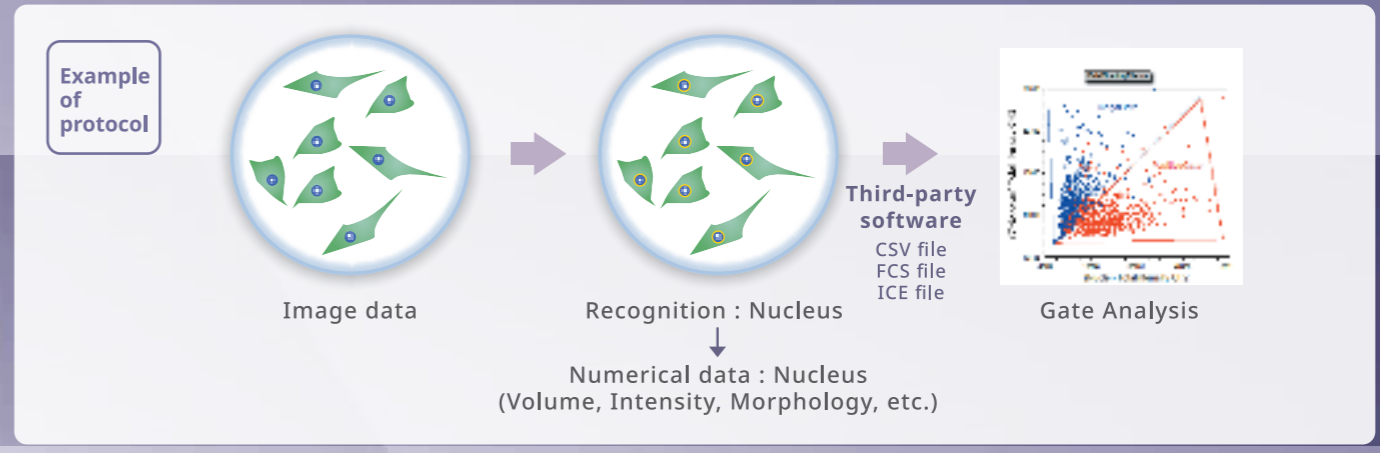
Colony measurement.

- **Colony measurement**
Time course measurement allows to monitor cell colony growth
- **Applications**
• Cell colony growth
• Differentiation

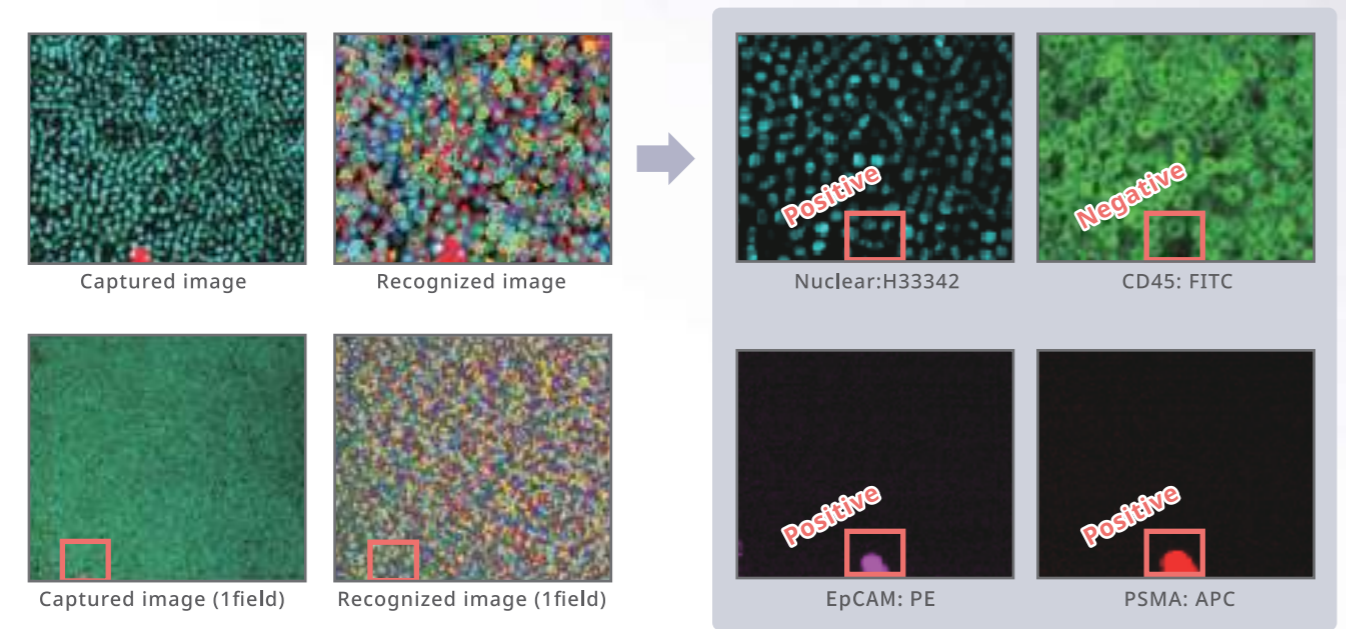
Measurement example

Want to try the measurement again...

Capture cell images directly in the culture plate, eliminating the need for single-cell suspension preparations. Seamlessly transition between diverse measurements using the same sample. With integrated image and analysis data, even the most subtle differences become discernible.



CTC (Circulating tumor cells)



Total cells (count)	113443
CTCs (count)	2 (0.001%)

Example of CTC quantitate (spiking experiment). CTC : CD45 is only Negative.
Data provided by Yusuke Tomita, Min-Jung Lee, Jane B Trepel, Developmental Therapeutics Branch, National Cancer Institute, National Institutes of Health, Bethesda, MD 20892 USA

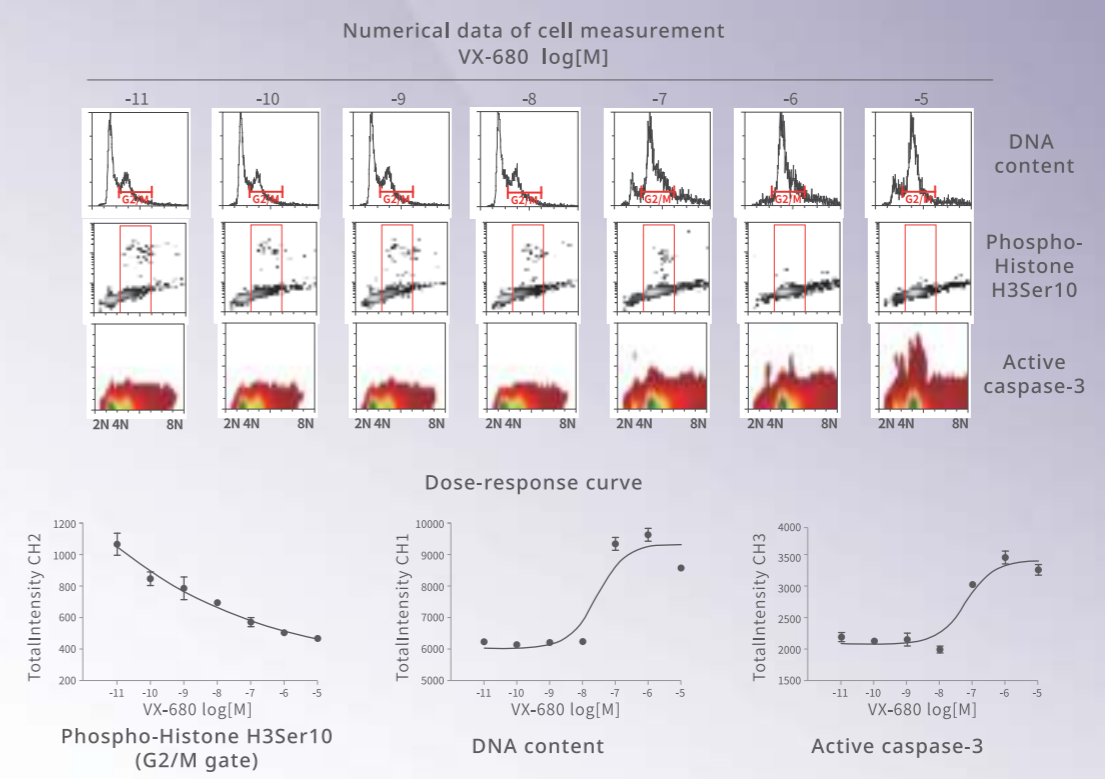
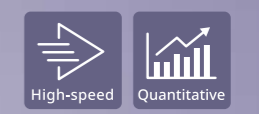
CTCs are tumor cells which circulate in peripheral blood. Developed tumors metastasize through the bloodstream and lymph fluid. Therefore, tumor cells exist in the bloodstream when metastasis occurs. The detection of CTCs makes it possible to diagnose recurrence and metastasis at an early tumor stage. CTCs numbers are very small as only less than 100 CTCs are contained in more than 1×10^6 of blood cells in 10 ml of cancer patient's blood. Therefore it is difficult to detect CTCs with a flow cytometer because they detect CTCs as noise. However, it is very easy to detect rare CTCs with an Image cytometer.

Template

CTC

You can detect multiple marker expression of the cell. Not only for circulating tumor cells, but also for the other specific marker can be detected.

Cell cycle analysis: M-phase inhibitor



Cell cycle analysis in relation to H3Ser10P immunofluorescence by utilizing the CQ1's multi-color channel capabilities. Histone molecules are phosphorylated during cell cycle progression with phosphorylation of the 10th serine of histone H3 being one of the well characterized events of late-G2 to M progression.

Template

CellCycle

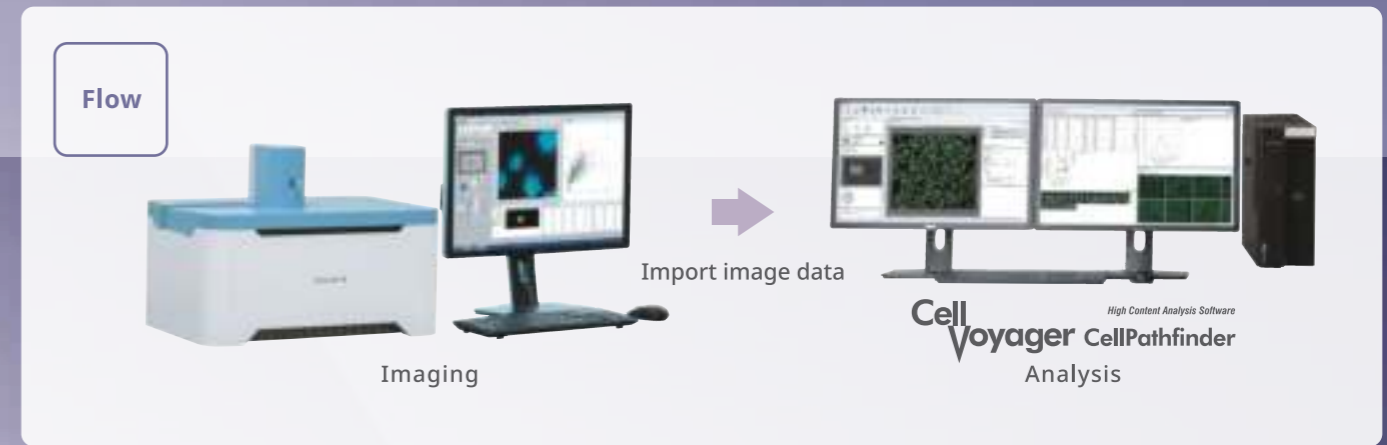
You can detect cell cycle to verify drug treatment efficiency. This is available by the flow cytometer, but CQ1 can analyze more items which typical at the image cytometer.

Analysis example

Make analysis easier!

NEW!

Introducing CellPathfinder our cutting-edge analysis software crafted to effortlessly process vast amounts of image data from varied perspectives, culminating in a visually captivating graphical display. Enhanced by machine learning capabilities, the novel Deep Learning feature profoundly elevates target recognition. This makes it an indispensable tool not just for bright field image analysis, but also for intricate tasks like 3D culture systems and live cell imaging.



Fast results for immediate verification and study

Computed numeric data can be displayed in a variety of ways. Graph plots and cell images are linked, making for easy result verification and inquiry

Unbiased phenotype evaluation via AI

Machine-learning also provides bias-free digitization of visually-evaluated experiments. Automatic recognition is made possible simply by clicking the shape you want the software to learn.

Deep Learning



No expertise in image analysis required. Save time for creating analysis protocols

Cell Recognition : Deep Area Finder

You can recognize targeted objects, such as cells and intracellular organelles by painting them using not only fluorescence images but also bright field images. This function is useful when the analysis accuracy with conventional analysis methods are not enough.



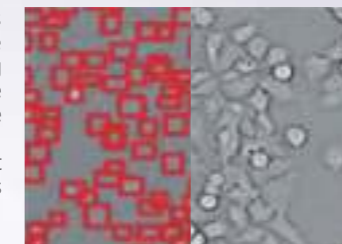
Cell Classification : Deep Image Gate

You can classify phenotypes that are difficult to quantify but appear to be "something different". Simple operation of selecting the cell groups to be classified. No need to select effective features or set thresholds.



Cell Counts : Deep Detection

This function detects cells with simple operation of enclosing cells. No expertise are required. It is possible to count cells in high-density on bright field images as well as fluorescence images.



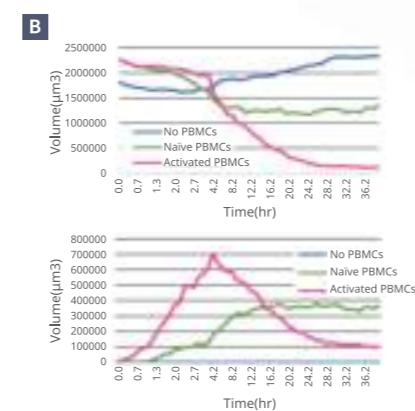
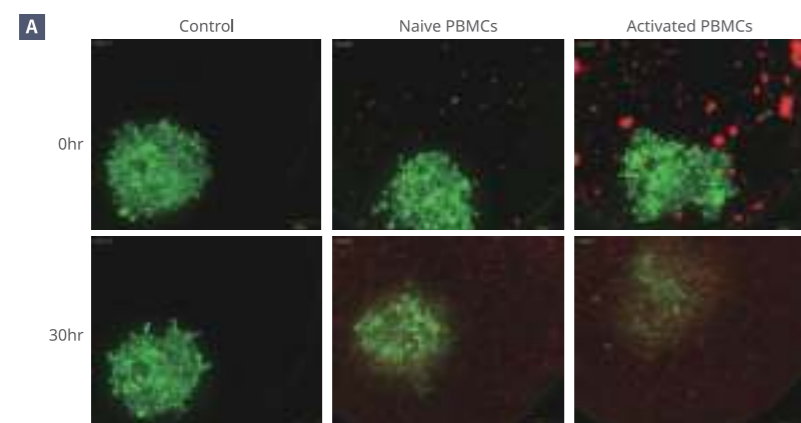
EC50/IC50 Calculation : Deep Image Response

This function enables comprehensive quantification of complex phenotypes using whole images. Simple operation of selecting negative and positive wells and entering compound concentration information. Any protocol to segment cells is not necessary.



Immuno Oncology

- Immune-cell infiltration into Tumor Microtissue -

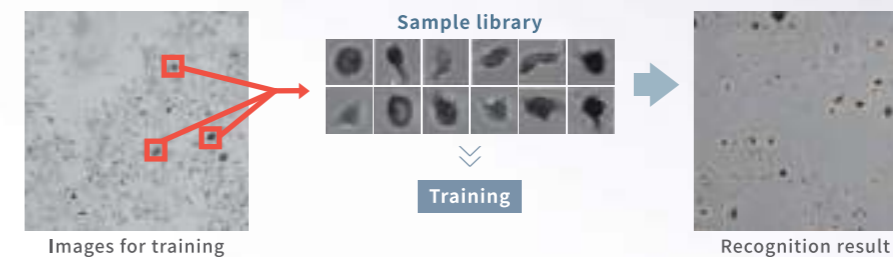


A. Merged images of 488 nm and 640 nm of each condition after 0 and 30 hrs.
A 3D tumor microtissue treated with the activated PBMCs was destructed 30hrs later.
B. Top: The volume of 3D tumor microtissue.
Bottom: The total volume of immune cells touching to the 3D tumor microtissue.
Objective lens: 20x / Ex: 488 nm (A549-GFP), 640 nm (CellMask™)
Time lapse: 39 hrs at 10 min interval (timepoint 1-20) and 60 min interval (timepoint 20-56)
Wardwell-Swanson, J., Suzuki, M., et al., A Framework for Optimizing High Content Imaging of 3D Models for Drug Discovery. SL AS Discovery. 2020, Aug;25(7): 709-722



3D tumor microtissues comprised of A549-GFP (human lung cancer) cells were exposed to either naive or CD3/CD28-activated immune cells labeled with CellMask™ Deep Red. Time-lapse imaging was performed for 39 hours.

Application: Measurement of inhibition of osteoclast differentiation



RANKL was added to RAW 264.7 cells to promote their differentiation into osteoclasts, and differentiated cells were detected by TRAP staining. Using CellVoyager (CQ1, CV 8000), we acquired the stained cells, and after learning the osteoclast images differentiated by the deep learning function, we analyzed them quantitatively. We can search for foods, cosmetics, medicines, etc.

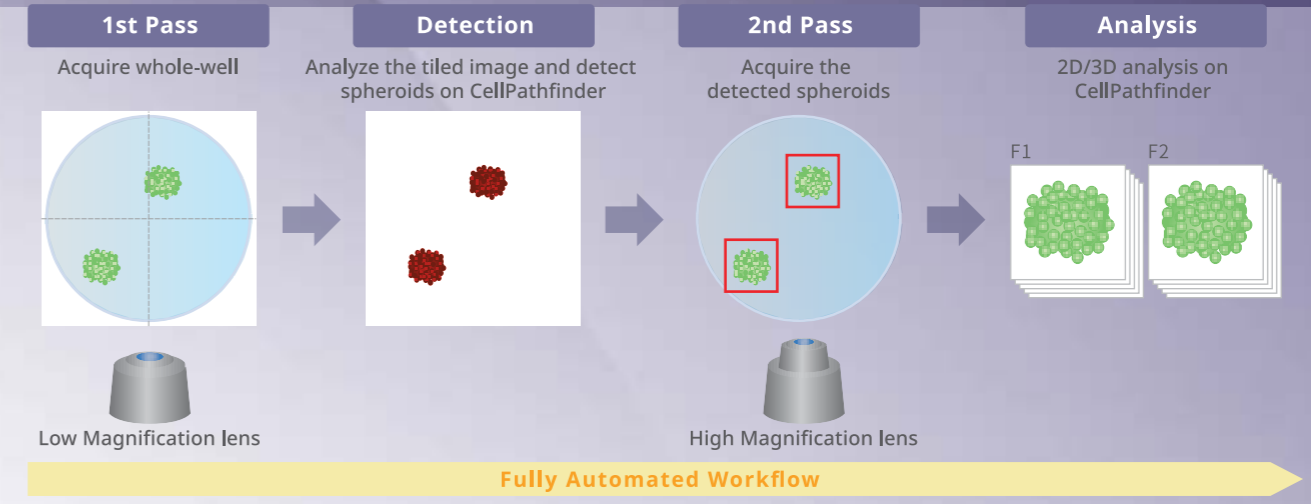
System integration CQ1 in Integrated Automation

Embrace the transformative power of the automated CQ1 system. It's a game-changer for your research. Beyond merely enhancing throughput, it substantially minimizes human error by diminishing the need for manual intervention. Most notably, it ensures a consistent experimental environment, providing stability even in live screenings where results have historically been unpredictable.

CellVoyager ACE Software for CellVoyager CQ1*1*2

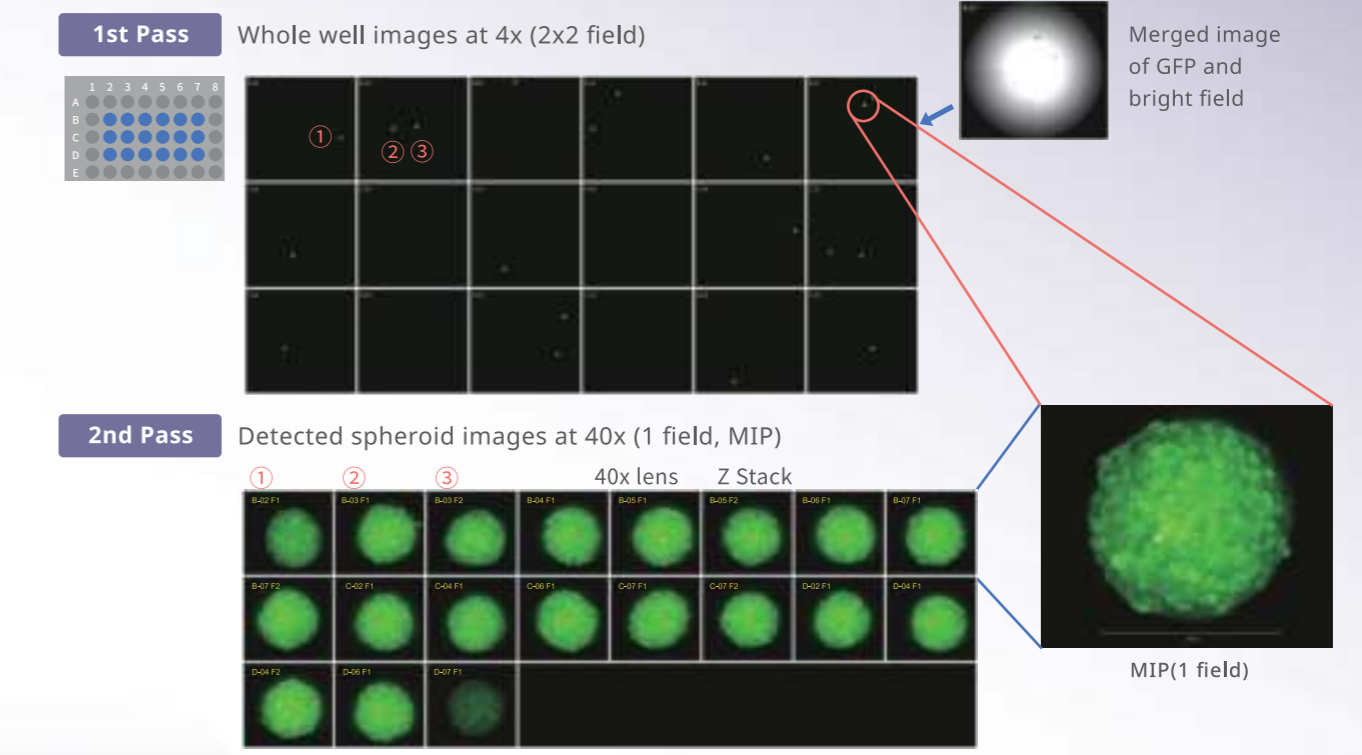
It can scan the entire well at low magnification, detect the position of the object based on the analysis results, and acquire images at high magnification. This makes it possible to image samples where it is not possible to know where the object is located in the well, or to image and analyze only the cells that match the conditions from among a large number of cells.

Targeted Imaging Overview



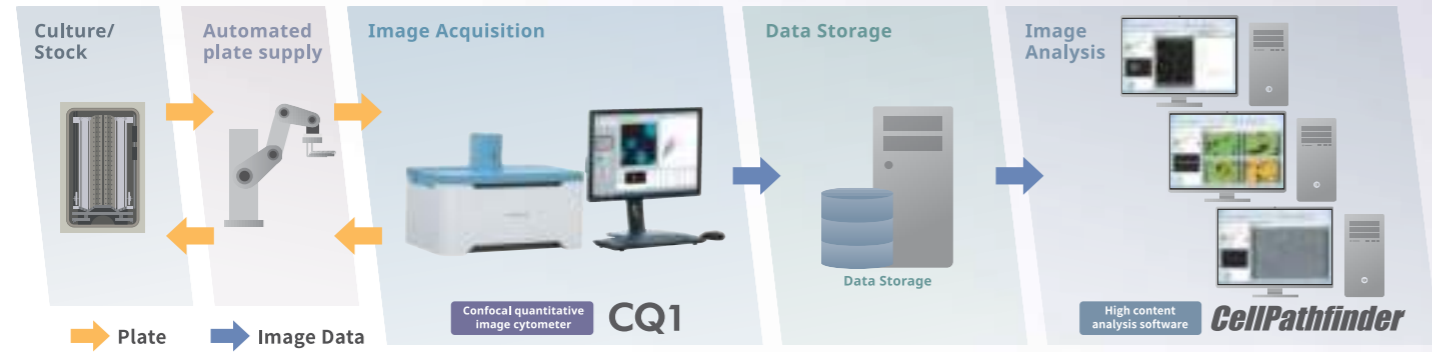
- Advantage**
- High magnification imaging only in the field where the target is detected, greatly reducing the amount of data and throughput.
 - Reduce unnecessary images and tiling by imaging at the center of the target.
 - Automation of the two imaging processes reduces human intervention time and human error.

Example: Detect Spheroids of GFP-expressing HeLa

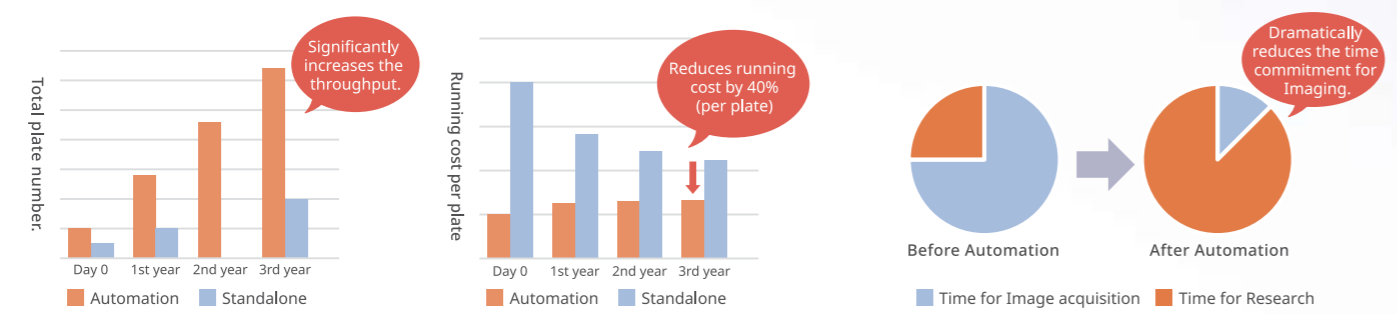


*1 This software is provided as free of charge only for our customers. We cannot guarantee performance of operations, in case of unexpected circumstances.
 *2 To be able to use this software, the corresponding analysis software CellPathfinder is necessary.

System Integration



Benefits of Robotic automation



Robot automation not only reduces the running cost, it also saves time and significantly reduces the time required to complete a project. This not only shortens the imaging and screening cycle, but also allows researchers to focus on their own research.



Automation companies which have installed CQ1



We can also support manufacturers not on the list. Please feel free to contact us.