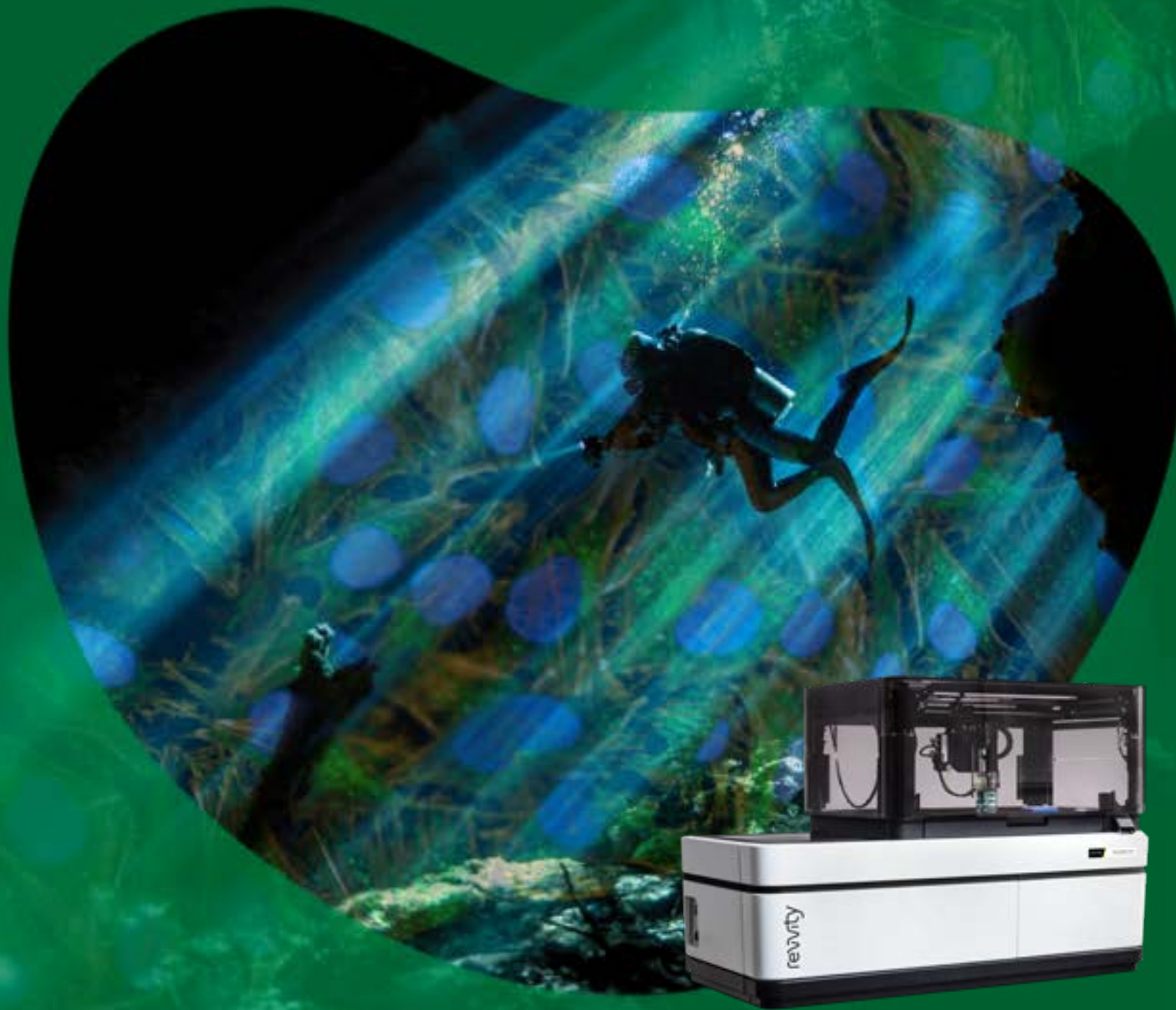


Faster  
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Deeper  
insights.  
More  
discoveries.

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Opera Phenix™ Plus high-content screening system  
with liquid handling option



- Applications

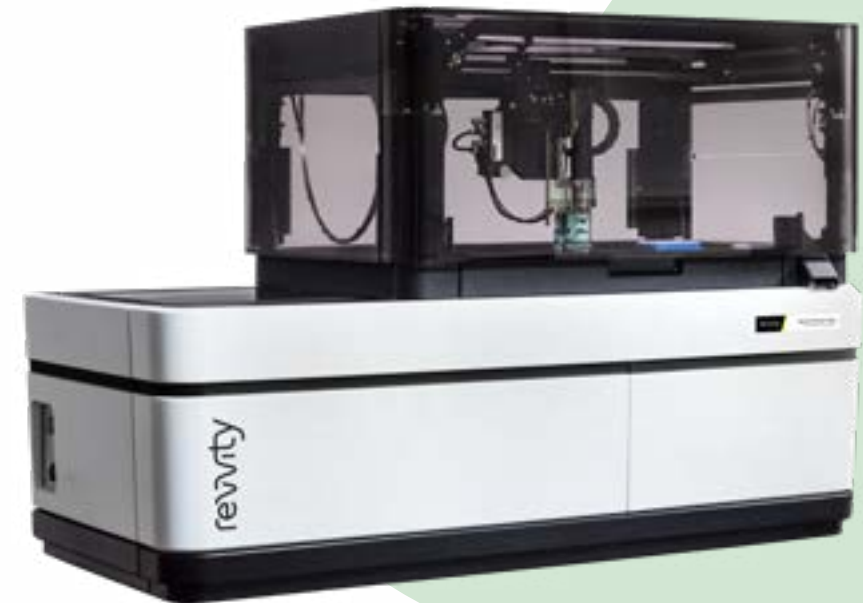
# Deeper insights from your most demanding assays

Today's labs are moving beyond classical, target-based high-content screening and embracing phenotypic screening approaches with increasingly complex cellular models that yield unbiased, predictive results. But to really benefit from these advancements, you need a system with the sensitivity to see more clearly, the resolution to capture both temporal and spatial detail, and the ability to generate robust, comprehensive results.

## The Opera Phenix Plus high-content screening system

The Opera Phenix Plus system provides simultaneous multicolor confocal image acquisition. Because spectral crosstalk is reduced to a minimum, it delivers speed without compromising sensitivity. Together with proven automated water immersion lenses, you'll achieve higher throughput and richer content, making it the ideal high-content screening system for discriminating phenotypes and studying complex disease models.

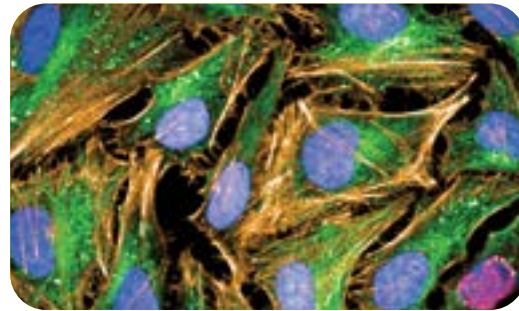
And with its liquid handling option and fast imaging frame rate, you can tackle fast-response assays such as calcium flux or measure cardiomyocyte beating.



# From the everyday to the extraordinary

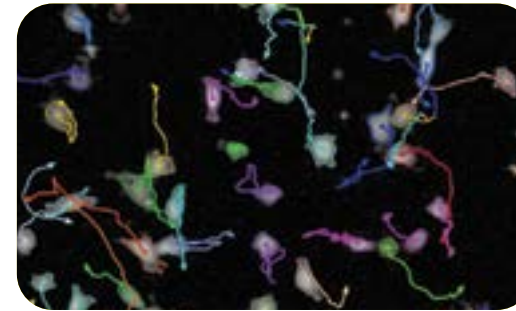
## ▪ Applications

From basic assays to the most demanding applications, the Opera Phenix Plus system delivers the right combination of advanced optics, liquid handling, and software features to help you glean more physiologically relevant information from your assays.



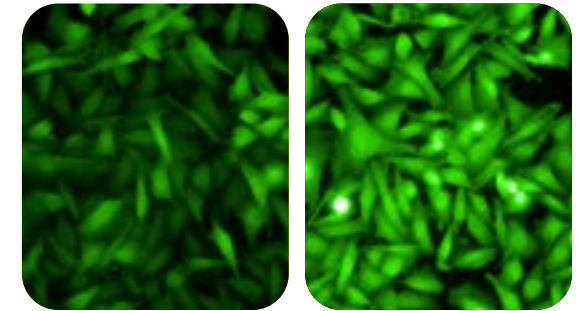
### Fixed-cell assays

For assay development and common applications such as translocation assays, the Opera Phenix Plus system has a choice of brightfield, digital-phase contrast, widefield, and spinning-disk confocal fluorescent imaging. Intuitive software with ready-to-go protocols means greater productivity.



### Live-cell assays

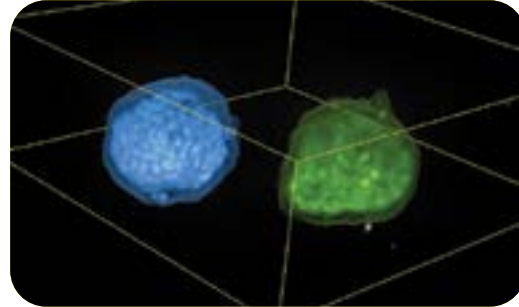
Meaningful live-cell assays require minimal photodamage. Spinning-disk confocal optics and synchronized illumination minimize phototoxicity and bleaching when measuring fluorescent dyes. To analyze live cells without any fluorescent dye labels, you can choose the digital-phase contrast imaging mode.



### Fast-response assays

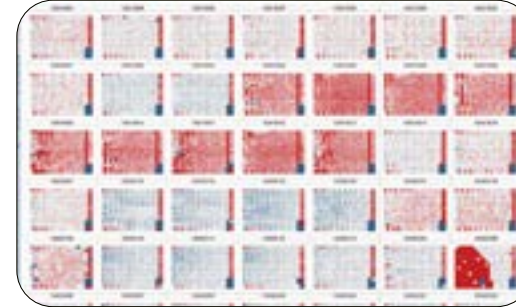
For assays to measure fast responses, the Opera Phenix Plus can be equipped with a liquid handling module that measures cellular responses immediately after compound addition. Also, fast frame-rate imaging enables you to measure rapid cellular changes such as cardiomyocyte beating frequency.

- Applications



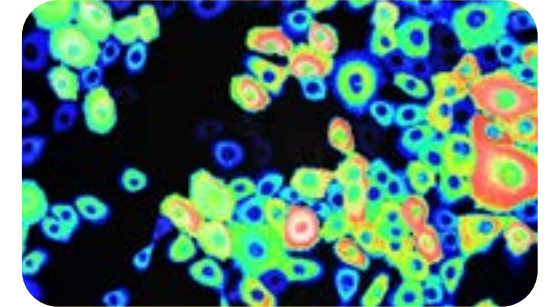
### Complex cellular models

3D cell culture models hold the promise of greater physiological relevance but pose unique challenges for imaging. That's why the Opera Phenix Plus system's spinning disk has an increased pinhole-to-pinhole distance that reduces out-of-focus noise in thick samples such as microtissues, while water immersion objectives provide high resolution deep into the sample.



### High-throughput phenotyping

When screening large libraries with 100,000 compounds or more, speed and sensitivity are crucial. Combine advanced optics with up to four large-format cameras and lasers that deliver up to three times more excitation power than standard lasers for sensitive high-throughput imaging.



### Protein-protein interactions

These types of interactions are pivotal for cellular function and are a major target for drug discovery. CFP-YFP fluorescence resonance energy transfer (FRET) is a powerful tool for investigating protein-protein interactions in living cells. With dedicated image analysis tools for ratiometric imaging, it's easy to turn images into statistically significant results.

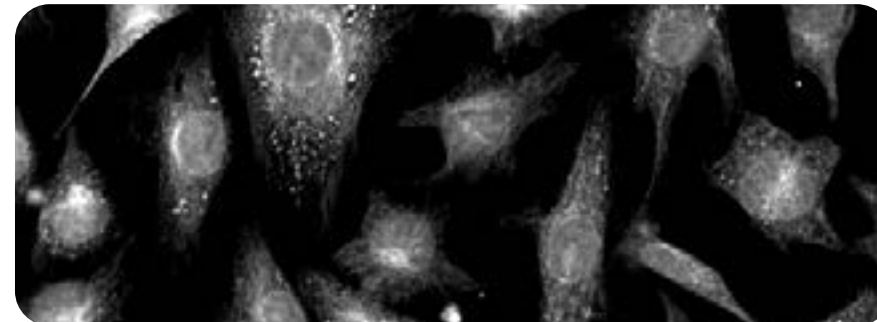


▪ Applications

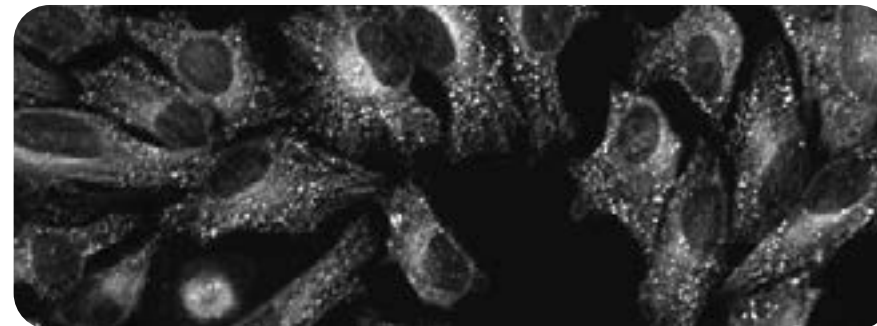
# You don't have to choose between speed or sensitivity

The Opera Phenix Plus high-content screening system is our premier imaging instrument. Drawing on more than a decade of experience in HCS applications, its unique lightpath and advanced optics enable you to get the most out of your high-content imaging applications.

With other HCS systems, you have to sacrifice either speed (as a single camera can acquire only one color at a time) or sensitivity, (as spectral crosstalk artifacts limit sensitivity when imaging multiple fluorophores simultaneously). When using fluorophores with broad blue emission bands, such as DAPI and Hoechst DNA stains, the overlap with the green fluorescein protein-emission band can be pronounced, limiting the sensitivity for assays such as nuclear translocation. You can capture the blue and green channels sequentially, but that defeats the primary purpose of parallel detection - speed.



*HeLa cells stained with Hoechst (DNA) and Alexa488 labeled anti-tubulin antibodies and imaged with traditional simultaneous acquisition. The Alexa488 channel shows pronounced crosstalk from the Hoechst stain in the nuclear region.*



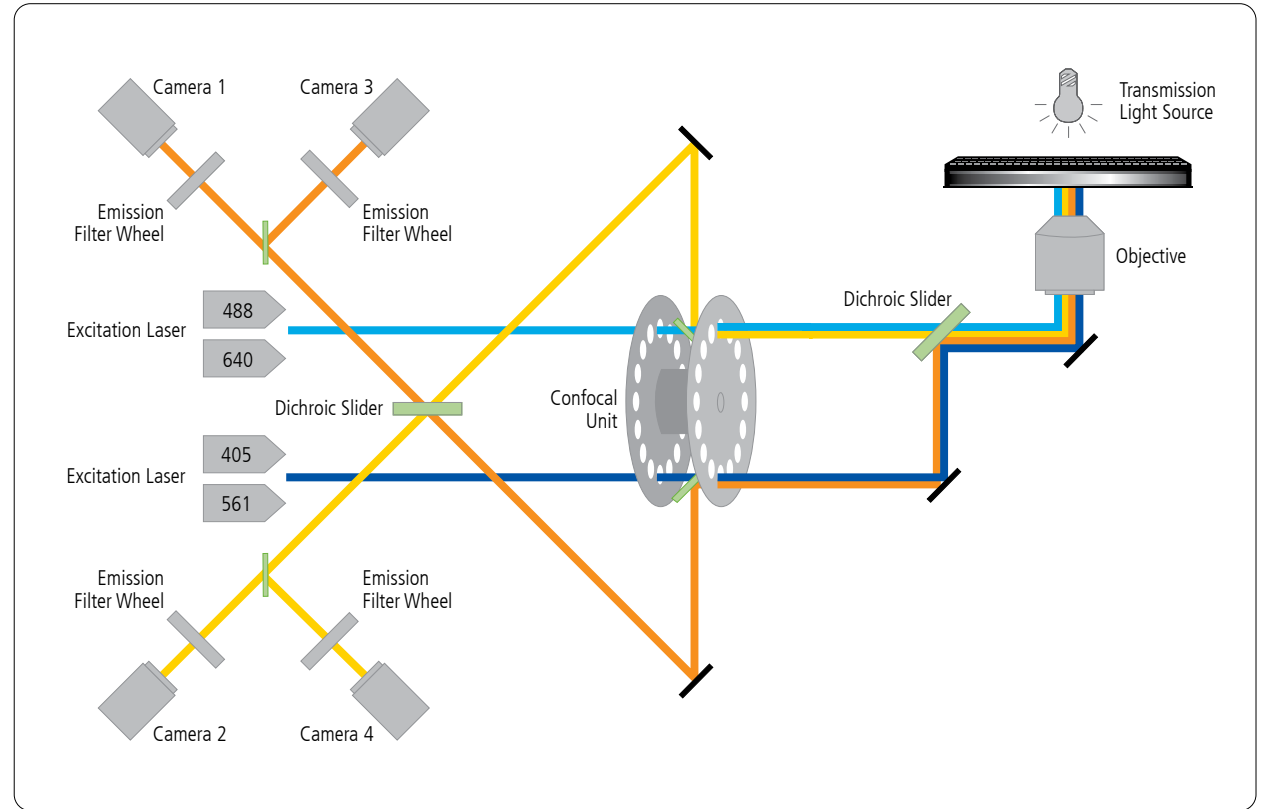
*The same staining imaged simultaneously on the Opera Phenix Plus system with Synchrony Optics shows only minimal crosstalk in the nucleus.*

**See our solution**



▪ Applications

At the heart of the Opera Phenix Plus, patented Synchrony™ Optics make the trade-off between speed and sensitivity unnecessary, delivering more light to the sample and capturing more light from it. A microlens-enhanced Nipkow disk with high transmission rates enables fast, sensitive true-multipoint confocal imaging. The dual-view design creates nonoverlapping pinhole patterns in the sample to minimize crosstalk between adjacent channels by 98% when performing simultaneous multicolor measurements with up to four cameras. You can simultaneously acquire images of the nuclei (labeled with Hoechst) and of the cytoplasm (labeled with GFP) and up to two more markers - with minimal crosstalk.



Synchrony Optics separate the lightpaths for adjacent excitation lines to minimize crosstalk during simultaneous imaging and maximize speed and sensitivity.

- Applications

# Make every photon count

From effectively controlling excitation and collecting fluorescence emission to detecting photons with the highest levels of sensitivity, the Opera Phenix Plus system is designed to maximize performance.

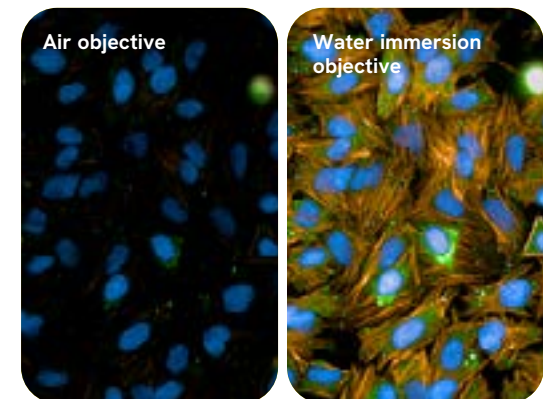
The Opera Phenix Plus system's suite of features makes the system the ideal choice to meet the challenges of your most demanding assays using today's complex models, including fast-response assays, live-cell assays, primary cells, spheroids, microtissues, and organoids.

## The system is equipped with:

- Spinning-disk optics and synchronization of laser excitation and camera exposure to minimize bleaching and phototoxicity
- Improved, proprietary automated water-immersion objectives with high numerical aperture that deliver and capture more photons and provide higher resolution than conventional air objectives
- Up to four large-format sCMOS cameras that deliver low noise, wide dynamic range, and high resolution - perfect for sensitive and quantitative measurements at short exposure times



Proven automated water-immersion objectives deliver and capture more photons and provide higher resolution in XYZ than conventional air objectives



Comparison of images acquired with air and water immersion objective lenses. HeLa cells labeled with Hoechst (nuclei, blue), anti- $\alpha$ -tubulin-AlexaFluor<sup>®</sup> 488 (tubulin, green) and TRITC-Phalloidin (actin, orange). Images were acquired using the same exposure settings and are displayed with the same contrast settings. Left: Air objective. Right: Water immersion objective.



▪ Applications

# Capture fast cellular responses

With its fast frame rate imaging capability and on-board liquid-handling option, the Opera Phenix Plus system enables assays that measure very fast cellular responses.

The system's imaging frame rate of faster than 95 fps is well-suited to assays that measure fast cellular movements such as the beat-rate of cardiomyocytes, as often used in cardiotoxicity studies. And the fast frame rate, together with the dispense and read capabilities of the optional pipettor module, enables fast response assays in which cell responses occur within milliseconds to seconds - notably calcium flux assays.



### On-board liquid handling option at a glance

Tip-based pipettor	Compatible with Revvity 20 $\mu$ L and 200 $\mu$ L tips, 1-200 $\mu$ L in 1 $\mu$ L increments
Compound addition	One compound plate and one reservoir, up to 2 additions per well
Sample plates	96- and 384-well microplates
Environmental control	Temperature, CO <sub>2</sub> , and humidity
Automation compatibility	Compatible with automated exchange of sample plate, tip racks and compound plate
Imaging compatibility	Liquid handling module is compatible with brightfield imaging





## ▪ Applications

# Everything you need, from acquisition to analysis

With Harmony™ high-content imaging and analysis software, you can easily quantify more of what you see in your images. Harmony software includes everything you need to analyze the most complex cellular models in 3D, discriminate phenotypes reliably, and turn your biological data into discovery.

Harmony software enables you to control every aspect of an Opera Phenix Plus experiment through a single workflow-based user interface. From setting up an acquisition protocol to analyzing images and evaluating results, Harmony software guides you through the entire process and provides instant feedback.

- Analyze common assays with more than 30 ready-made solutions, or create your own with simple image-analysis building blocks
- Easily quantify complex cellular phenotypes based on changes in morphology, fluorescence intensity, intensity distribution, and texture parameters
- Follow phenotypic changes over time and accurately quantify label-free live cell images
- Visualize and analyze your samples in 3D for greater depth of information and insights in a more physiologically relevant context
- Find images, metadata, and results quickly via the integrated sortable database



- A.** Workflow-based interface with easy-to-read icons
- B.** Analysis building blocks for easy protocol design
- C.** Clear plate navigation and wizard for easy setup of new plate types
- D.** Results summary with immediate numerical output for faster insights

# Science and software in perfect harmony

Easily quantify complex cellular phenotypes with Harmony high-content analysis software. Designed for biologists, Harmony's workflow-based interface makes the whole process of high-content analysis straightforward, even for novice users.

## Easily quantify cellular phenotypes – even in complex 3d models

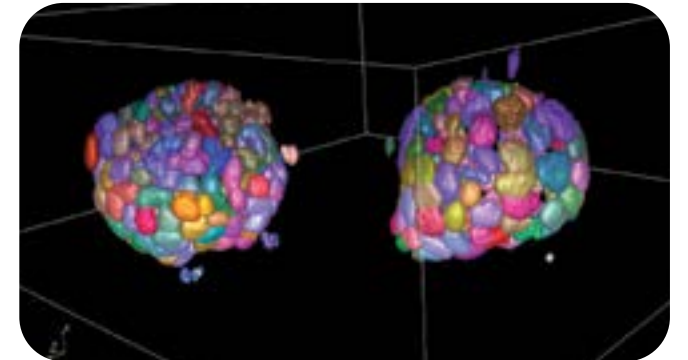
Speed up 3D image acquisition through targeted imaging – independent of the culture method – and better understand your cell models by exploring them in a 3D viewer and an XYZ viewer. Measure morphology, volume, and texture in 3D; count nuclei within spheroids; and calculate XYZ positional properties. Plus, quickly analyze your z-stack as maximum intensity projection, with 3D information preserved, using PlaneMap technology.

## Accurately target your objects of interest for greater efficiency

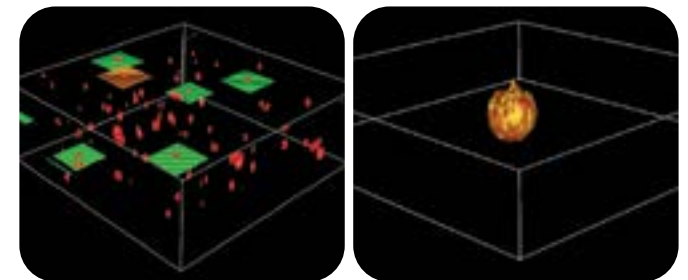
The PreciScan plug-in for Harmony software enables intelligent image acquisition to let you accurately target your objects of interest in x, y, and z dimensions such as spheroids, stem cell colonies, or rare cell phenotypes. The software delivers a fully automated, integrated workflow of low-magnification prescans, image analysis, and higher magnification rescans to reduce acquisition times and data volume and ultimately speed up analysis significantly.

## Become an image analysis expert with machine learning

With the PhenoLOGIC™ software plug-in, you can recognize different cell populations and regions by example – making it easy to create optimized algorithms. Just click on a few cells of each type to show the software what you're looking for. PhenoLOGIC software then selects the most meaningful combination of parameters to robustly discriminate phenotypes or to segment images based on texture features.



3D view of MDCK cysts with 3D segmentation of nuclei.



10x pre-scan in x, y, and z dimensions.

63x magnification re-scan.



## ▪ Applications

# A solution configured to suit every need

Whatever your application, there's an Opera Phenix Plus system configured to meet your requirements. And it's modular, so it can change with your research demands.

### Standard

With a single camera and four lasers, this model delivers outstanding sensitivity and resolution, and can accommodate more cameras if needed.

### Professional

Two cameras and four lasers make this model perfect for simultaneous acquisition, with extraordinary sensitivity and resolution and fast multiplexing.

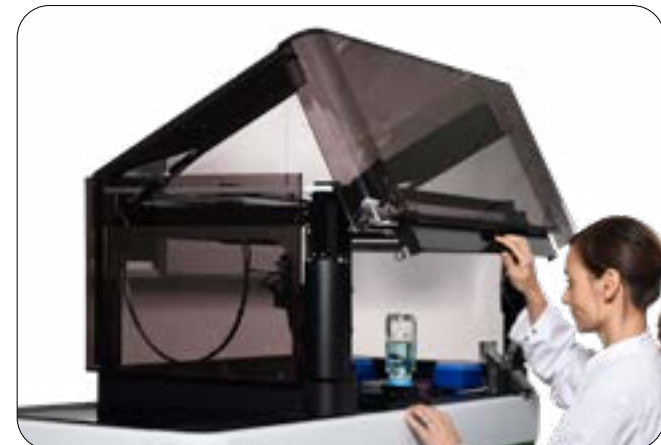
### FRET

With its five lasers and four-camera setup, it's designed for CFP/ YFP FRET applications to map protein-protein interactions.

### Screeener

The ultimate in throughput and performance, it delivers four cameras and four higher powered lasers – perfect for screening large libraries.

Other configurations available on request.





# Accessories and support

From accessories to software to service and support, the Opera Phenix Plus offers a complete solution for all your high-content screening needs.

## ▪ Applications

### Liquid handling option

Compatible with all configurations. Requires environmental control option.

### It pays to automate

Higher throughput, improved productivity, reduced variability, savings on reagent costs - these benefits and more come from automating your Opera Phenix Plus system. Integrate with the plate::handler™ Flex system for automated plate loading to enable overnight runs, or automate your entire high-content screening workflows with explorer™ G3 automated workstations.

### Understand your data

Export your results automatically into the Signals Image Artist™ image analysis and management platform, so you can access, reanalyze, store, and share image data from Opera Phenix Plus and other HCS systems across your organization. You can also use Signals VitroVivo™, powered by TIBCO Spotfire® software, which provides lab management and analysis for all modalities in one platform. It unites assay development, low throughput to ultra-high throughput production assays, HCS, and *in vivo* studies so you can search across all assay and screening data in a single platform.

### The perfect plate

For best results, choose the microplates designed specifically for high-end imaging systems. We've developed and validated a range of microplates for HCS applications, including PhenoPlate™ (formerly CellCarrier™ Ultra) microplates with a unique patented design for high-content imaging readers.

### Count on our support

We take a team-based, consultative approach to every engagement with you - one that addresses your unique set of requirements. Our expert, global service and support team members are dedicated lab- and field-based applications specialists. They can work with you in partnership to overcome the unique challenges your application brings.



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