

YOKOGAWA 



## FlowCam<sup>®</sup> 8000 Series

FLOW IMAGING MICROSCOPY

Highest versatility in particle imaging

## Particle Analysis with Vision™

Flow Imaging Microscopy (FIM) combines the benefits of digital imaging, flow cytometry, and microscopy into a single solution. Beyond traditional particle sizing and counting, image-based analysis allows for comprehensive characterization of subvisible API aggregates and contaminants in biopharmaceuticals, mammalian cells, microplankton, emulsions, and advanced materials.

Through its exceptional image quality and the widest size range available, FlowCam 8000 represents state-of-the-art particle imaging technology. Analyze thousands of particles in less than a minute and comprehensively characterize the size, count, morphology, and identity of subvisible and visible particulates in their native solvent.

With applications in biopharmaceutical formulations, cell and gene therapy, oceanographic research, municipal water quality monitoring, materials science, and many other markets, FlowCam continues to re-imagine particle analysis.



**OBTAIN  
MEANINGFUL RESULTS**

Obtain statistically significant results in less than a minute, with as little as 100  $\mu$ L of sample. With advanced hardware and processing capabilities, FlowCam is streamlined for rapid data acquisition and analysis.

**SORT, FILTER, QUANTIFY**

Acquire data and classify images based on 40+ morphological parameters with the powerful, yet flexible VisualSpreadsheet<sup>®</sup> software

**AUTOMATICALLY  
IDENTIFY WITH AI**

Add out-of-the-box machine learning to automatically differentiate protein aggregates in formulations with the optional VisualAI<sup>™</sup> software module – no user setup required.

**MAINTAIN  
SAMPLE INTEGRITY**

Analyze samples in their native environment. FlowCam accommodates a wide range of aqueous and organic fluids, including high-viscosity solvents and buffers.



FlowCam

**DIFFERENTIATE  
WITH FLUORESCENCE**

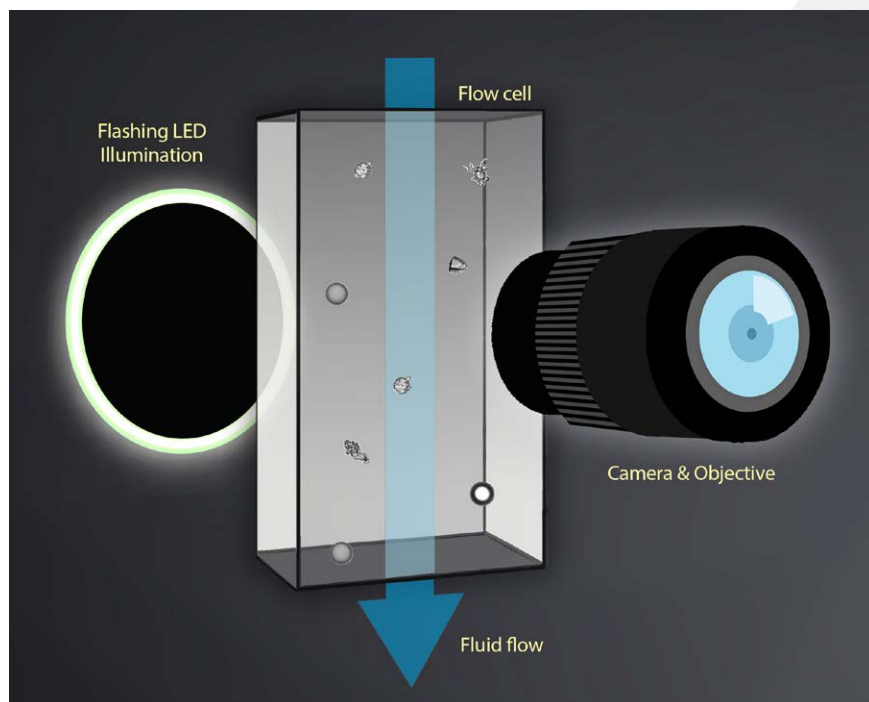
Enhance analysis of fluorescent samples with FlowCam 8400. Excitation options of 488 nm, 532 nm, or 633 nm assist in identifying aquatic organisms.

**BE FLEXIBLE**

Use FlowCam in both research and routine operations and work with any sample type over a wide range of concentrations. ALH for FlowCam<sup>™</sup> enables unattended operations for up to 384 samples.

## How it Works

Flow imaging microscopy, sometimes referred to as dynamic image analysis, is a solution-based technique to capture subvisible and visible images in a microfluidic channel under flow.



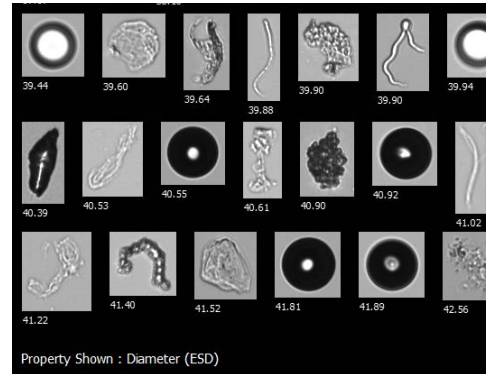
1. A sample is manually or automatically loaded into the injection port
2. A high-precision syringe draws the sample into an optical flow cell and a fluidics sensor initiates data acquisition
3. A high-speed camera records images of the full width and depth of the flow cell as the sample flows through the optical field of view
4. Particle images are segmented from the camera images and captured in real-time as they flow through the flow cell
5. Data may be further analyzed, grouped, and filtered post-acquisition

In FlowCam 8400 and FlowCam Cyano, fluorescence excitation allows FlowCam to capture particle images whenever a fluorescing object is detected in the flow cell.

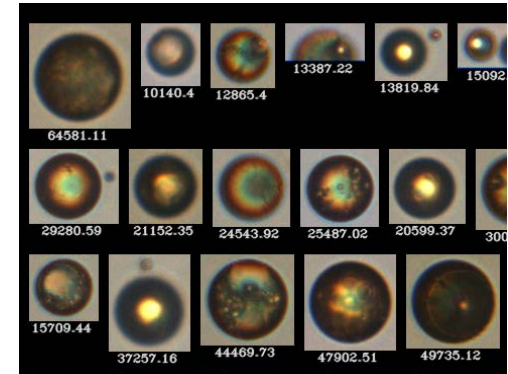
# FlowCam 8000 Series Models

## FlowCam 8100

- Highest versatility in flow imaging microscopy
- Widest range of applications in biopharma formulations, cell and gene therapy, materials characterization, and aquatic research
- Available with color or black-and-white camera



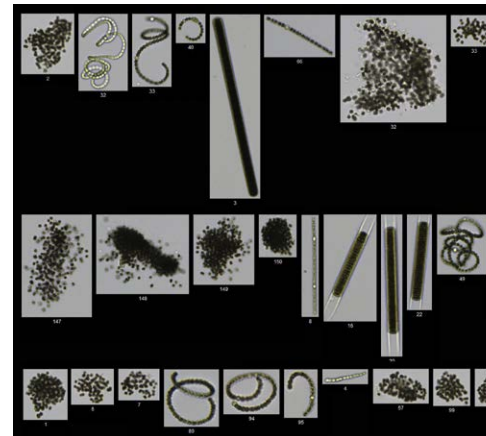
Analyze biotherapeutics with FlowCam 8100 with a black and white camera



Characterize colored particles with FlowCam 8100 (pictured here: oil droplets in water)

## FlowCam Cyano

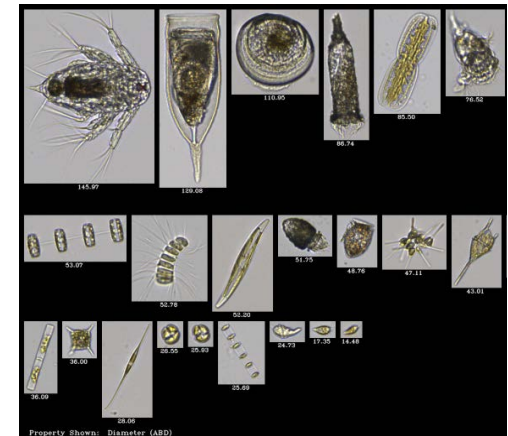
- Optimized for freshwater quality monitoring
- Integrated fluorescence triggering option to detect and differentiate between images of cyanobacteria and other algae types
- Color camera, 633 nm laser excitation



Separate cyanobacteria from diatoms and other algae with FlowCam Cyano

## FlowCam 8400

- Differentiate specific analytes through fluorescence triggering
- Applications include marine and freshwater research as well as water quality monitoring
- Color camera, 488 nm or 532 nm laser excitation



Perform viability studies with FlowCam 8400

# VisualSpreadsheet Software



## Turning Data into Insight

VisualSpreadsheet is a powerful, all-in-one software program capable of setting up methods, acquiring data, and processing images captured with FlowCam.

Analyze, sort, filter, group, and classify images based on 40+ morphology parameters and their combinations, or use the “Find Similar” function in the software to identify what is in your sample. Group data from multiple runs or samples for easy comparison.

VisualSpreadsheet offers an optional 21 CFR Part 11 compliance package.

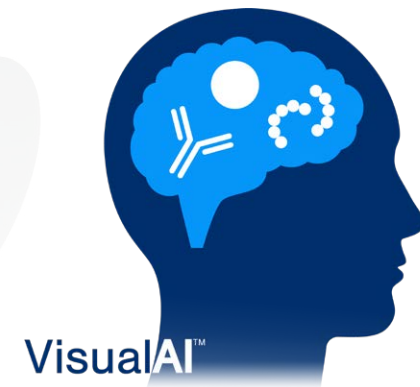
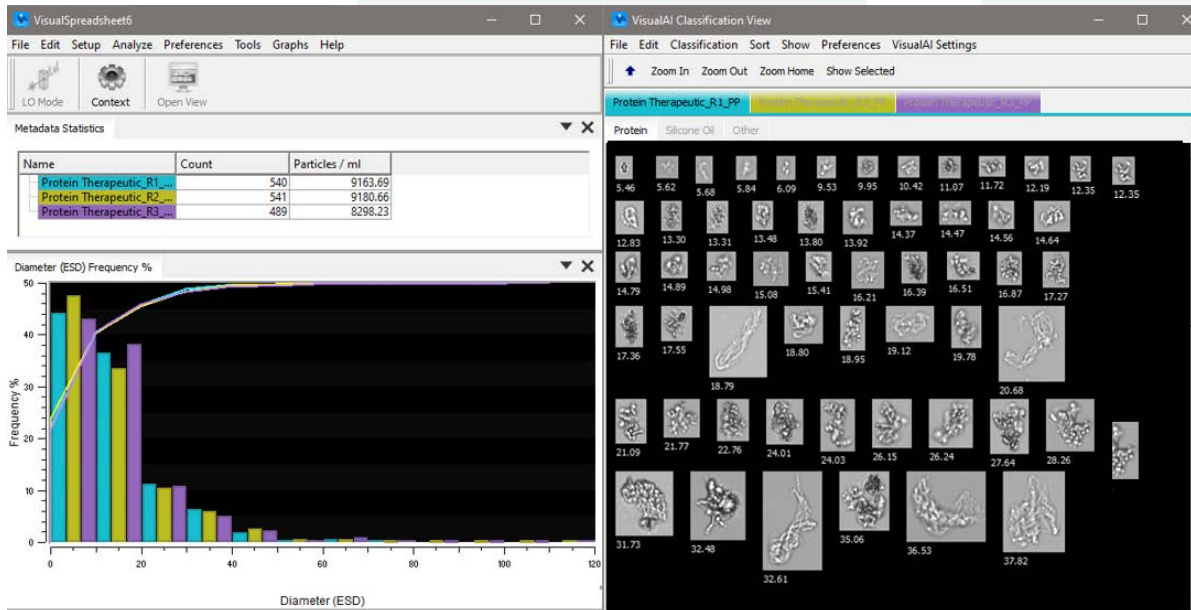
# VisualAI™



## Beyond Morphological Parameters

VisualAI, an optional Artificial Intelligence module, is an instrument- and sample-agnostic tool to automatically classify particles in a biotherapeutic formulation.

Identify protein aggregates and silicone oil droplets and differentiate them from other contaminants directly within VisualSpreadsheet 6 – using out-of-the-box VisualAI software.



## Automated Liquid Handling

ALH for FlowCam™ seamlessly integrates with FlowCam 8000 Series instruments, FlowCam LO, and FlowCam Cyano to enable automated sample preparation and analysis. Improve lab productivity, analysis repeatability, and data quality of flow imaging microscopy with state-of-the-art robotic handling.

### ALH for FlowCam benefits:

- Unattended flow imaging microscopy for up to 384 samples
- Higher productivity and improved data reproducibility
- A configurable sample deck for flexible sample queuing and preparation
- Powerful, easy-to-use software with integrated data acquisition in VisualSpreadsheet
- HEPA-filtered sample enclosure for cleaner sample handling
- All-inclusive system installation and support



## World-Class Customer Service

Our customer support team is available to help with all things FlowCam, including:



- Technical Support
- Remote and on-site training
- Application Support
- IQ/OQ Services
- Preventative Maintenance
- Repairs and Upgrades

Maximize your FlowCam utilization with a full training package led by our experts – customized for your application. This hands-on, in-depth training provides a thorough understanding of flow imaging microscopy. Learn from our scientists how to run and analyze samples; and get a wealth of tips and tricks to get the most out of your instrument.

Every new instrument includes a one-year warranty, unlimited email and phone support, and one year of free access to FlowCam University training.

For continuous support we offer Gold or Silver service plans that include annual preventative maintenance services, software upgrades, access to virtual training, personalized remote support, and other benefits.



## Biopharmaceutical Development

Flow Imaging Microscopy is a recommended orthogonal method to Light Obscuration for determining subvisible particulate content per USP <1788>. FlowCam is widely used in biotherapeutics research, formulation, and development for proteins, nano-drug delivery systems, and cell and gene therapy products.



## Materials Characterization

FlowCam is employed in a wide variety of materials and chemicals-focused applications: from the characterization of food and beverage ingredients to printer toner and superabrasives, ion exchange resins, column packing material, fibers, additive manufacturing, polymer composition analysis, chemicals, cosmetics formulations, and microencapsulation processes.



## Marine and Freshwater Research

For more than 20 years, scientists have been using FlowCam as an automated, fast and accurate, easy-to-use alternative to manual microscopy to monitor plankton community composition. FlowCam has become a valued instrument worldwide for studying marine and freshwater microorganisms.



## Water Quality Monitoring and Environmental

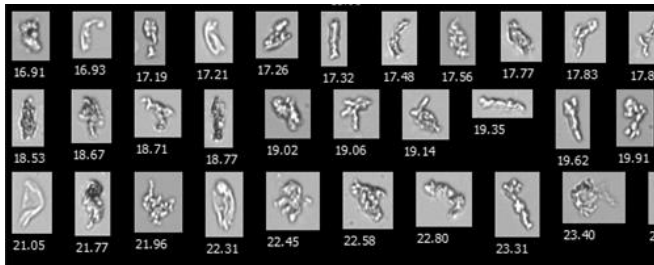
FlowCam provides a proactive, cost-effective, and scalable solution to monitor raw and treated water. Water utilities around the world use FlowCam to detect and quantify populations of taste and odor producers, filter-fouling diatoms, and potentially toxic cyanobacteria. Environmental applications include monitoring soil microorganisms, pollen, seeds, and pollutants.



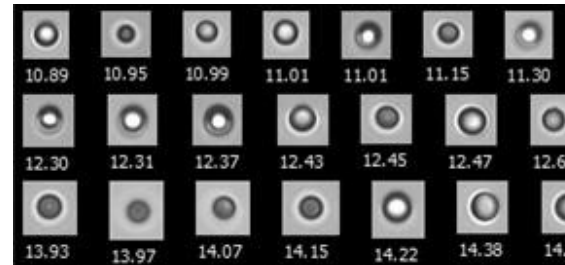


## Biopharmaceutical Development

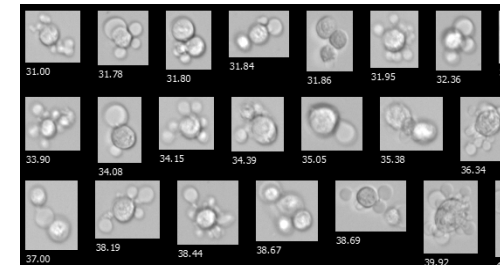
- Detection and measurement of cells, API aggregates, and other particles
- Formulation research and development
- QC diagnostics and lot release testing
- Stability studies and shelf life estimation
- Purification process development
- Excipient and API characterization



*Protein aggregates*



*Silicone oil droplets*

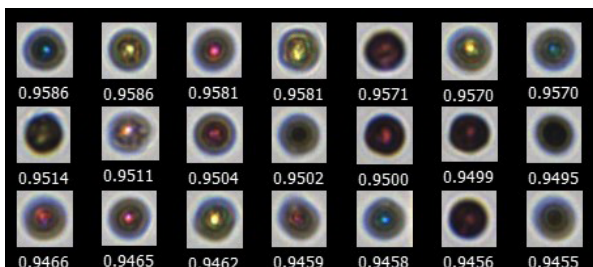


*Cell aggregates*

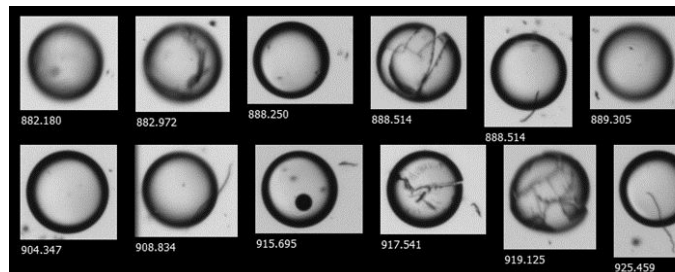


## Materials Characterization

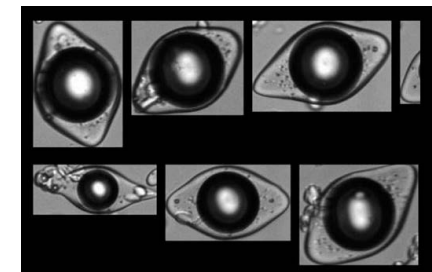
- Abrasives
- Wood and pulp fibers
- Cosmetics and fragrances
- Food and beverage
- Microencapsulation
- Oil and gas
- Paints and polymers
- Printer toner
- Washwater



*Color printer toner particles*



*Polystyrene spheres*

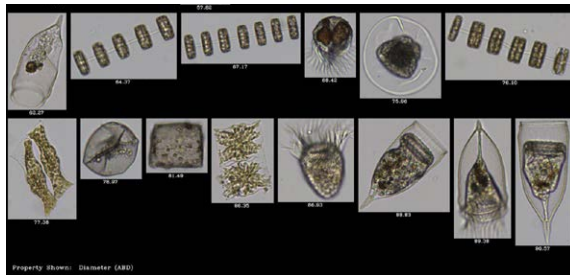


*Microencapsulated flavor particles*

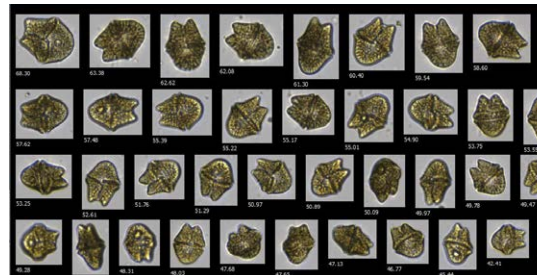


## Marine and Freshwater Research

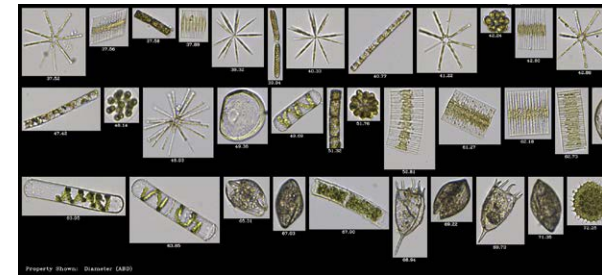
- Identify and enumerate phytoplankton and zooplankton
- Investigate harmful algal blooms (HABs)
- Support health of aquaculture systems
- Observe microalgae cultures
- Analyze sediment particles



Marine plankton



*Akashiwo sanguinea* (harmful algal bloom)

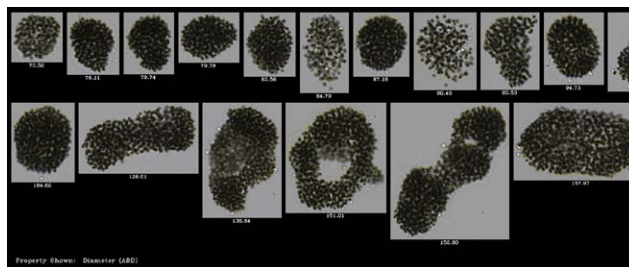


Freshwater plankton

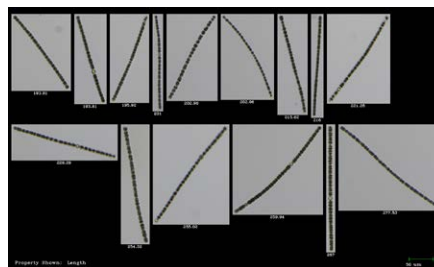


## Water Quality Monitoring and Environmental

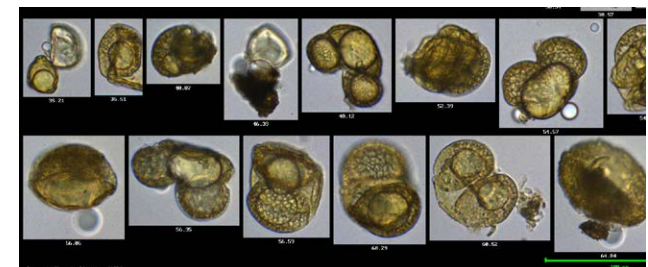
- Identify cyanobacteria, taste and odor, and other nuisance algae in drinking source water
- Use data to inform water treatment decisions
- Monitor filter performance
- Detect and monitor soil microbes, mites, forest litter invertebrates, and nematodes
- Determine seed viability
- Analyze pollen particles



*Microcystis* (cyanobacteria)



*Dolichospermum* (cyanobacteria)

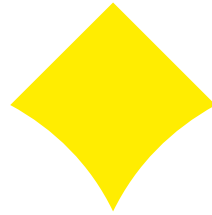


Pollen grains

# Specifications

<b>PARTICLE SIZE RANGE</b>	2 µm to 1 mm
<b>MAGNIFICATION &amp; FLOW CELLS</b>	20X (~200X magnification), flow cell: 50 µm FOV 10X (~100X magnification), flow cell: 80 µm FOV or 100 µm FOV 4X (~40X magnification), flow cell: 300 µm FOV or 600 µm FOV 2X (~20X magnification), flow cell: 1 mm FOV
<b>MINIMUM SAMPLE VOLUME</b>	100 µL
<b>SAMPLE PROCESSING CAPABILITY</b>	0.05 mL/minute at 20X and up to 10 mL/minute at 2X
<b>FLUIDICS</b>	Micro-syringe pump with multiple sizes to optimize flow rates: 0.5 mL, 1 mL, 2.5 mL, 5 mL, 12.5 mL
<b>MAXIMUM PARTICLE CONCENTRATION</b>	5 million particles/mL at 2.5 µm particle size
<b>DATA ACQUISITION METHOD</b>	FlowCam 8100: auto-imaging, FlowCam Cyano and FlowCam 8400: fluorescence-based laser triggering and auto-imaging
<b>CAMERA</b>	High resolution (1920 x 1200 pixels) CMOS. Monochrome and color available.
<b>FRAME RATE</b>	Shutter speed up to 100 frames per second
<b>FOCUS METHOD</b>	Automatic
<b>MEASURED PARAMETERS</b>	<p><b>Basic Shape Parameters:</b> Area, Aspect Ratio (width/length), Diameter (Spherical and Area-Based), Length, Volume (ABD-based), Volume (ESD-based), Width, 3 Biovolume Measurements</p> <p><b>Advanced Morphology Parameters:</b> Area (Filled), Circle Fit, Circularity, Circularity (Hu), Compactness, Convex Perimeter, Convexity, Elongation, Fiber Curl, Fiber Straightness, Geodesic Aspect Ratio, Geodesic Length, Geodesic Thickness, Perimeter, Roughness, Symmetry</p> <p><b>Gray Scale and Color Measurements:</b> Average Blue, Average Green, Average Red, Blue/Green Ratio, Red/Blue Ratio, Red/Green Ratio, Edge Gradient, Intensity, Sigma Intensity, Sum Intensity, Transparency</p>
<b>AUTOMATION</b>	Compatible with ALH for FlowCam automated liquid handler
<b>SOFTWARE OPTIONS</b>	21 CFR Part 11 compliance module, VisualAI tool to automatically ID protein aggregates and silicone oil droplets
<b>DIMENSIONS &amp; WEIGHT</b>	36 cm wide x 43 cm deep x 38 cm tall, 27 kg (43 kg shipping weight)
<b>POWER REQUIREMENTS</b>	FlowCam 8100: 92 watt maximum, FlowCam Cyano and FlowCam 8400: 115 watt maximum

Specifications are subject to change without notice



**YOKOGAWA**

### Yokogawa Fluid Imaging Technologies

Yokogawa Fluid Imaging Technologies manufactures industry-leading particle analysis instrumentation based on digital imaging technology. Our flagship product, FlowCam, is the first automated particle analysis instrument to use digital imaging for measuring size and shape of microscopic particles in a fluid medium. FlowCam has been deployed in over 50 countries, supporting research, development, and environmental monitoring in the life sciences, materials research, and industrial applications.



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