
Agilent Microscopy Solutions

Agilent iMIC 2000
Intelligent Digital Microscope

Agilent Technologies

# Agilent iMIC 2000: The Intelligent Digital Microscope

Following fast processes in cells requires fast technology and an intelligent microscope to keep track of what is happening. The Agilent iMIC 2000 is the fastest, most precisely controlled scientific imaging platform on the market. An innovative, modular architecture provides a unique combination of advanced fluorescence measurement capabilities for quantitative microscopy.

Publish faster! The iMIC 2000 has been engineered specifically to keep up with the ever-increasing pace at which scientific discoveries are made. Fully automated and digitally driven, the user-programmable iMIC performs tasks quickly, efficiently, and reliably. Its high-speed focus easily follows fast processes, not only saving time but safeguarding sensitive biological specimens from phototoxicity and bleaching.

For live-cell imaging, the iMIC's flexible hardware and software architecture provides:

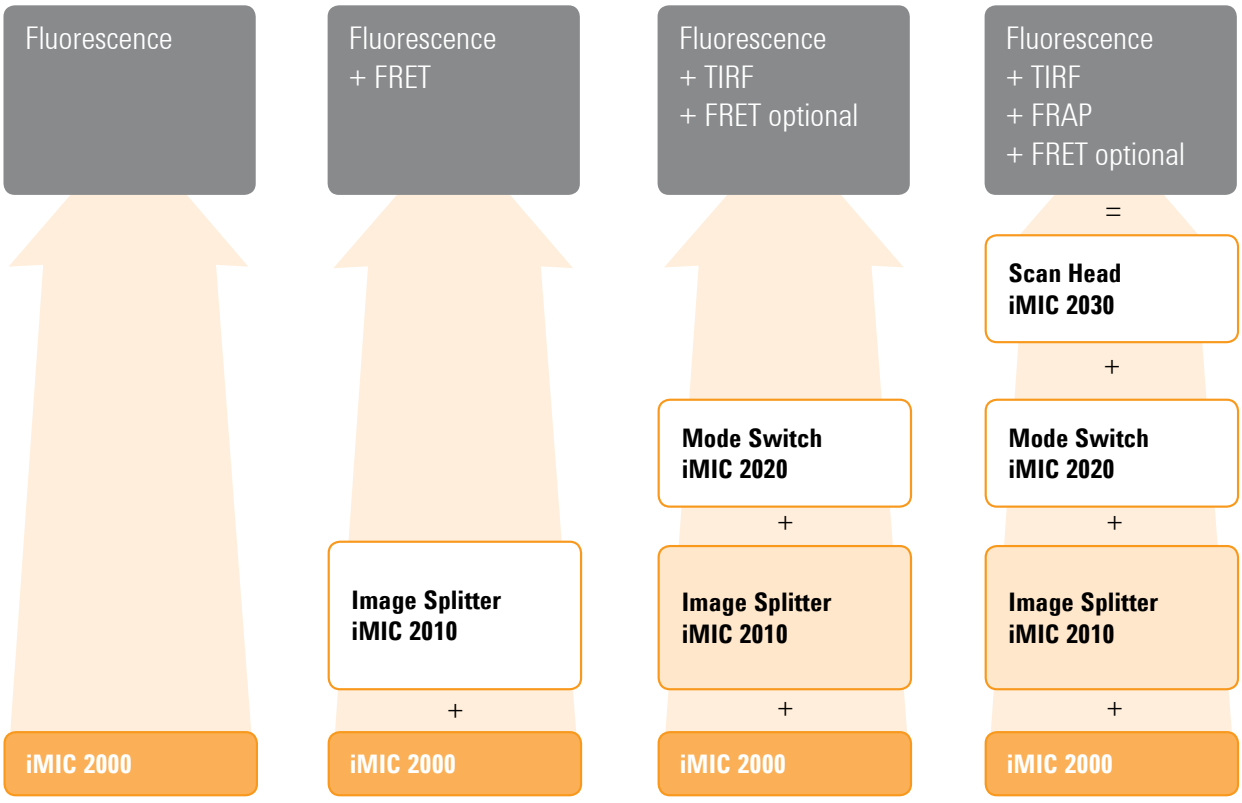
- **Automation to control complex experiments**
- **Rapid, reliable operation for high throughput**
- **Controlled environmental conditions**

## Modular Concept

Invest time in research, not in setting up a microscope! The iMIC's integrated, modular platform makes it simpler than ever to select, purchase, and use a multipurpose scientific imaging solution. All iMIC components and functions are optimized to work together as a unified system, delivering increased performance and speed in a small footprint.

The modular concept underlying the iMIC platform has numerous benefits, including:

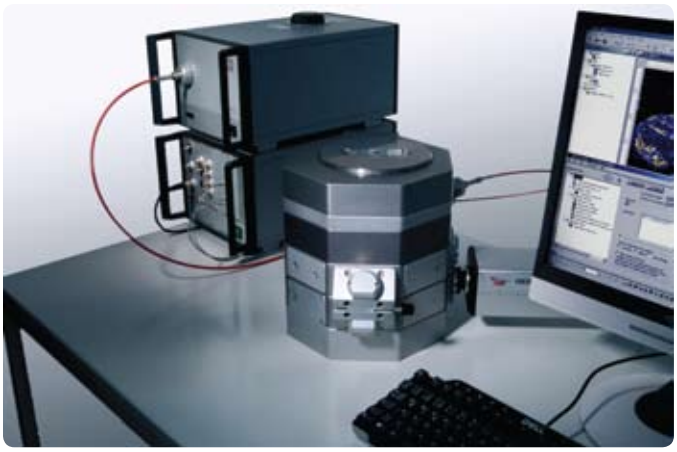
- **More configurations**
- **Lower overall investment**
- **Easier upgrades**

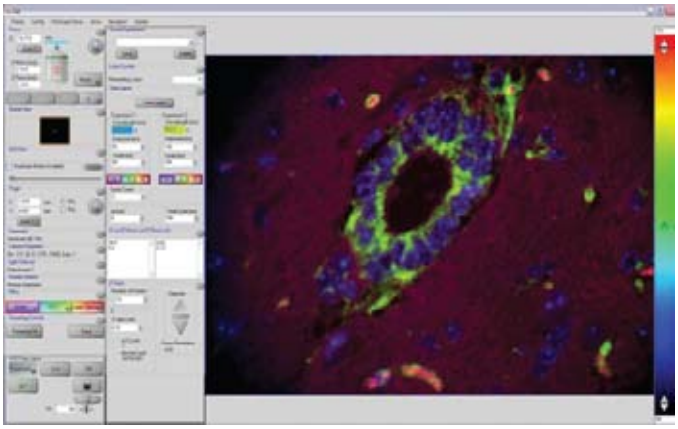


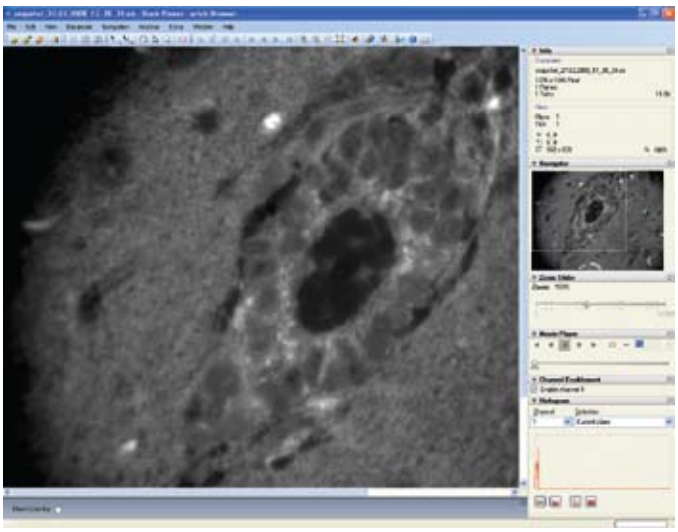
## Work Fast, Work Smart

Agilent understands the dynamic nature of life science applications and knows how to tailor solutions that satisfy even the most challenging requirements. The iMIC achieves high-speed, high-precision protocol execution by using an external digital-signal-processor–based (DSP-based) controller. With microsecond timing, it controls the microscope and triggers the system's CCD camera and light sources. The controller synchronizes several parallel processes, independent from any computer limitations.

The system's computer, meanwhile, is used to specify automation, as well as to display, store, and analyze digital images. This intelligent division of labor helps researchers save time and obtain reproducible results in order to publish data at the highest scientific level.





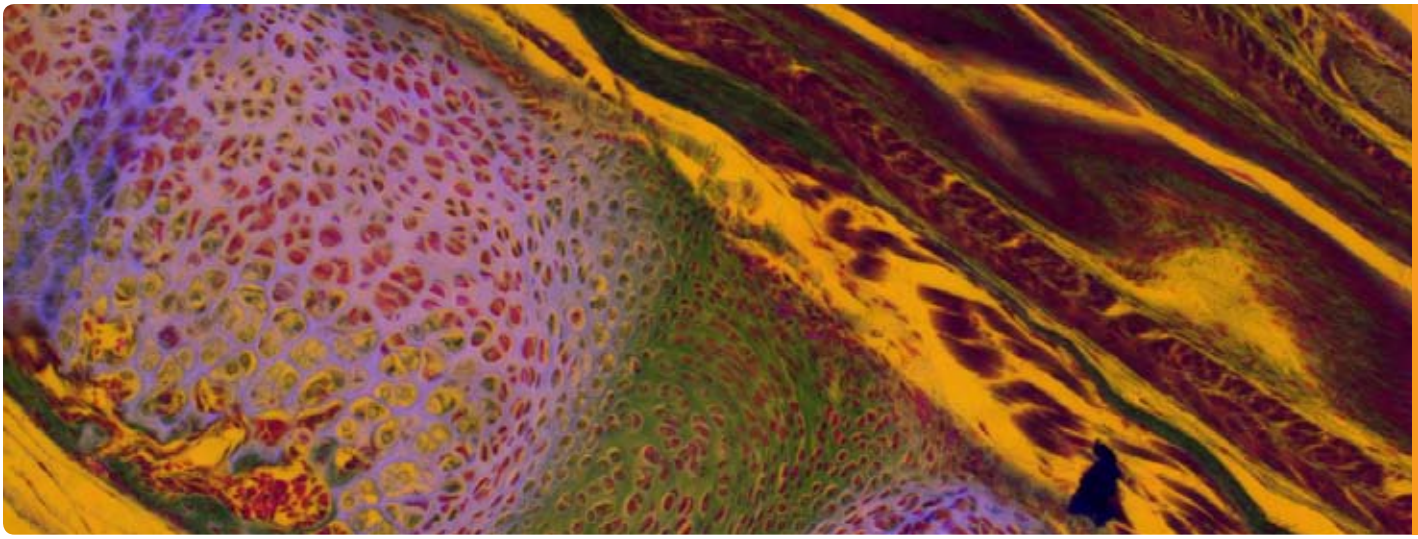


## Software for Scientists

The iMIC includes Agilent's Life Acquisition software, a fast, easy-to-use, intuitive, and robust program that allows a higher resolution of processes. It offers an unprecedented degree of automation and standardization of routine experiments while avoiding phototoxicity and bleaching in order to keep cells alive.

The iMIC system's software provides:

- **PC-based graphical user interface**
- **Front end with fully automated, flexible, and timing-precise hard real-time embedded back end**
- **Support for high-resolution 3D/4D fluorescence imaging, TIRF, FRET, FRAP, ratio imaging, and fast calcium analysis**
- **Real-time 2D/3D over-time browser (fast and scalable to handle massive data demands)**
- **Fully automated, motorized selection of filter sets, objective changers, x-y-z positioning, and monochromatic and laser light sources, as well as wavelength selection**



## Fluorescence Imaging

The iMIC digital microscope platform can be configured for all major fluorescence measurements, including epifluorescence imaging, FRET, ratio imaging, TIRF, and FRAP. During the past few years, fluorescent dyes and markers such as GFP (green fluorescent protein) have contributed greatly to understanding biological processes in live cells. A large number of today's new dyes require the highest flexibility and bandwidth for excitation and emission of fluophores. The display of processes on a cellular and molecular level requires both mature technology and advanced biological understanding.

| | |
|---|---|
| **FRAP** | fluorescence recovery after photobleaching |
| **FRET** | Förster resonance energy transfer |
| **TIRF** | total internal reflection fluorescence |
| **GFP** | green fluorescent protein |
| **RFP** | red fluorescent protein |
| **YFP** | yellow fluorescent protein |
| **CFP** | cyan fluorescent protein |

## FRET & Ratio Imaging

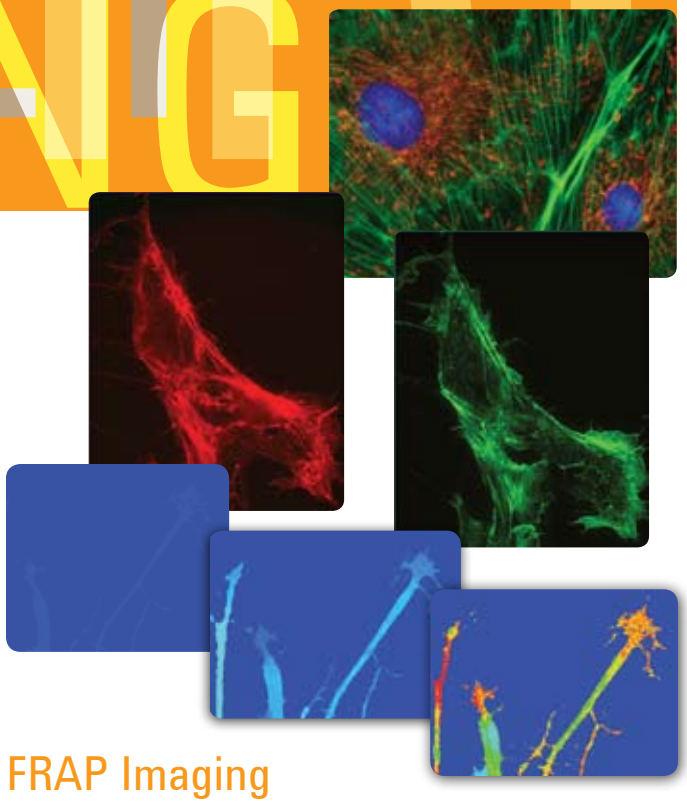
For analysis of protein interaction at the molecular level, the iMIC can be configured for FRET (Förster resonance energy transfer). By adding the Agilent Image Splitter to the iMIC, researchers can split an image into two colors, thus creating a dual-wavelength image on a single CCD. This iMIC configuration also enables scientists to switch between different color-separation schemes via a simple computer command. For optimal FRET ratioing, a custom excitation/emission color matrix can easily be created.

When configured with the Agilent Image Splitter, the iMIC facilitates applications such as:

- **Real-time dual-color imaging**
- **CFP/YFP and GFP/RFP FRET imaging**
- **Calcium imaging with fluo-4/fura red**
- **Dual-emission indo-1 imaging**
- **Simultaneous calcium/pH imaging with fura-2 and BCECF**

Together with the Agilent Polychrome 5000 light source, the iMIC makes FRET experiments and other ratio imaging techniques easier than ever. The continuous wavelength selection of the Polychrome 5000 and the DSP-based real-time imaging bring microsecond precision to imaging protocols.

# IMAGING



## TIRF Imaging

When equipped with an Agilent Mode Switch and a fiber-coupled laser source, the iMIC is perfect for multiwavelength TIRF (total internal reflection fluorescence). In this configuration, the Mode Switch allows the iMIC to switch between different illumination modes and, at the same time, fine tune a preselected TIRF direction and radius.

By combining the Mode Switch with an Agilent Scan Head, the laser beam can be positioned anywhere in the objective's back focal plane — and the adjustment is done within approximately 0.2 ms.

This makes the Mode Switch a remarkably versatile tool, capable of automatically adjusting the depth of the evanescent field (to accommodate changes in excitation wavelength, for example).

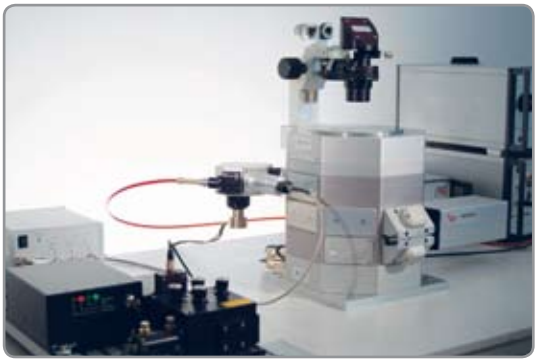
One or more lasers can be used with the iMIC; therefore, Agilent offers a wide range of different lasers with different characteristics. Multiple laser lines from a variety of laser sources can be coupled into the iMIC via Agilent's laser-line combiner.

To select different laser lines, Agilent offers acousto-optic tunable filters that are fully controlled via software. It is therefore possible to attenuate the laser power in small steps. For safe operation, each laser is employed with an electronic shutter and an interlock.

## FRAP Imaging

By adding the aforementioned Mode Switch along with an Agilent Scan Head to the iMIC, the versatile microscope becomes an easy-to-operate, high-precision solution for FRAP (fluorescence recovery after photobleaching) or any other technique requiring a positioned laser beam, such as FLIP or laser micro-dissection.

In this iMIC configuration, a galvanometer-driven scan mirror in the Mode Switch serves as a computer-controlled beam multiplexer element, which can direct beams from a variety of sources into the microscope, where they illuminate the specimen. Switching speeds of 1 millisecond between widefield fluorescence and a laser-FRAP or TIRF mode can be achieved.



## Options & Accessories

The fully automated iMIC digital microscope features a modular, compact design that provides multiple ports for virtually limitless emission/excitation possibilities. Every iMIC system utilizes high-precision optics and is carefully calibrated at the factory.

Many utility-enhancing options and accessories are available for the iMIC, including:

## Stages

The iMIC's fully integrated x-y specimen stage has a range of 25 x 25 mm and resolution better than 1 micron at speeds of 7 and 5 mm/s. This unique microscope feature provides a clean, smooth surface and facilitates the addition of accessories for electrophysiology, microinjection, and fluidics.

An automated microtiter plate stage (large stage) can also be selected for every iMIC. Alternatively, the whole microscope moves in the x and y directions under a stationary microtiter plate. In both cases, the range is 120 x 120 mm and the resolution better than 1 micron at 5 mm/s.

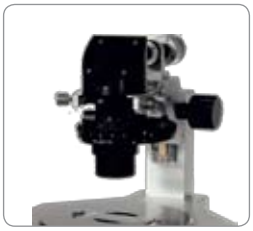
## Light Sources

Agilent offers an ultrafast monochromator with continuous wavelength selection and a fully digital, high-precision, galvanometer-driven grating. This state-of-the-art monochromator is ideal for a broad range of applications, such as high-speed ratio imaging experiments, GFP imaging with a variety of fluorophores to be distinguished, FRET with the faintest signals to be detected, or TIRF with a combination of wide- and evanescent field. Agilent also offers an ultrafast filter-switching device with a fully digital, high-precision, galvanometer-driven mirror.

## Light-Coupling Devices

To ensure that the maximum amount of light is delivered to the specimen plane, Agilent offers epifluorescence condensers optimized for use with the iMIC.

Also available is a laser scan head from Agilent that employs achromatic telecentric relay optics, which image one scan mirror onto the other. This results in a stationary beam on both scan mirrors and identical scan speed for both axes.



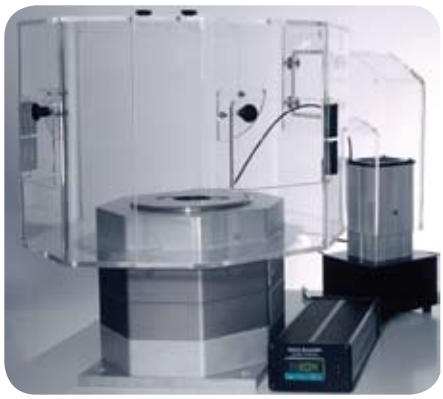
A transmission light accessory is available as well. It comes with a solid-state light source (LED) in different colors (monochromatic: red, green, cyan, blue), as white light, or as a red-green-blue LED. This accessory features a high-end, long-working-distance condenser.

## Environmental Chamber

Agilent's environmental chamber provides tight control over environmental conditions during iMIC experiments. For instance, the environmental chamber lets researchers:

- **Control the temperature of sample and objective simultaneously in steps of 0.1°C**
- **Control the $CO_2$ concentration in the sample compartment**

The chamber allows easy access to the sample and microscope through two front doors, conveniently placed at 45° angles. It also affords ample space for attachments, such as electrophysiology equipment and/or a transmitted light illumination pillar.



## CCD Cameras

Several high-performance CCD cameras are offered for use with the iMIC digital microscope. These cameras provide an impressive range of quantum efficiencies, pixel/array sizes, and readout rates.

Choosing an appropriate camera is largely a matter of matching a detector's sensitivity, resolution, and speed characteristics to key application requirements. Each camera has been thoroughly tested for seamless compatibility with the iMIC system's software.

# SPECIFICATIONS

| | | |
|---|---|---|
| **Dimensions** | 2 beam hubs, top stage | 200 mm x 240 mm x 240 mm (standard configuration)<br>Additional level: +50 mm in height |
| **Weight** | Standard configuration | 12 kg |
| **Setup** | Patented beam hub concept | From simple single-level systems to complex multi-level systems for the most sophisticated applications |
| **Filter cubes** | | 3 filter cubes in 1 beam hub with standard filter sets<br>A single filter cube can address 1 vertical and up to 5 horizontal directions |
| **Detectors** | Up to 5 ports on each beam hub | CCD cameras, PMTs, APDs, photodiodes |
| **Objectives** | Objective revolver | Up to 4 objectives (dry, water, oil)<br>Objectives from Olympus or Zeiss are supported (Leica upon request) |
| **Objective holder** | | W 0.8, M24, M27 threads |
| **Tube lens** | Olympus, Zeiss | Distortion free |
| **Focus drive** | Fine focus<br>(one-for-all nanodrive) | A single piezo drives all objectives<br>z-range: 250 µm<br>Resolution: 50 nm |
| | Coarse focus | Lead screw<br>Drive range: 25 mm<br>z-stepper motor: 2 mm/s<br>Resolution: <1 µm |
| **Illumination** | Transmission | Monochrome LED, gateable, dimmable<br>Long-distance phase contrast condenser: NA 0.55 |
| | Epifluorescence | Up to 2 ports for attachment of different epifluorescence light sources in first level of the microscope<br>(e.g., Polychrome 5000, lasers, scan heads) |
| **x-y stage** | Specimen stage | Fully integrated<br>Mechanical travel range: 25 mm x 25 mm<br>Resolution: <1 µm<br>Speed: 7, 5 mm/s |
| | Microtiter plate stage | Automated stage from Prior |
| **Condensers** | Various models available | Adapted to the light source |
| **Ports** | 1. (upper) beam hub<br>2. beam hub<br>3. beam hub | Typ. 1 max. 2<br>Typ. 3 max. 5 (depending on application)<br>Typ. 3 max. 5 (depending on application)<br>For cameras, PMTs, light sources, etc. |
| **Hardware** | Imaging control unit | Digital I/O's, analog outs, high time resolution, and real-time protocol control capacity |
| **Software** | Experiment control and acquisition software for the iMIC 2000 series | Agilent Live Acquisition and LA Browser 2D, 3D over time, and offline |
| | SDK | Integration of the iMIC 2000 series into various imaging systems |
| **Flexibility** | Modular concept | Upgradeable to all sophisticated applications<br>(e.g., FRET, TIRF, FRAP, FLIM, spinning-disc confocal) |
| **Accessories** | | Specimen stages<br>Microtiter plates, Petri dishes<br>Perfusion chambers<br>Environmental chambers<br>Patch clamp, microinjection<br>Shock- and vibration-damping optical table |
| **Supported camera suppliers** | | Allied Vision, Andor, PCO, QImaging |
| **Environmental** | | 25–40°C<br>10–80% humidity non-condensing |

For more information, go to **www.agilent.com/chem/microscopy**

**Or call 1-800-819-2519** (in the US and Canada)

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