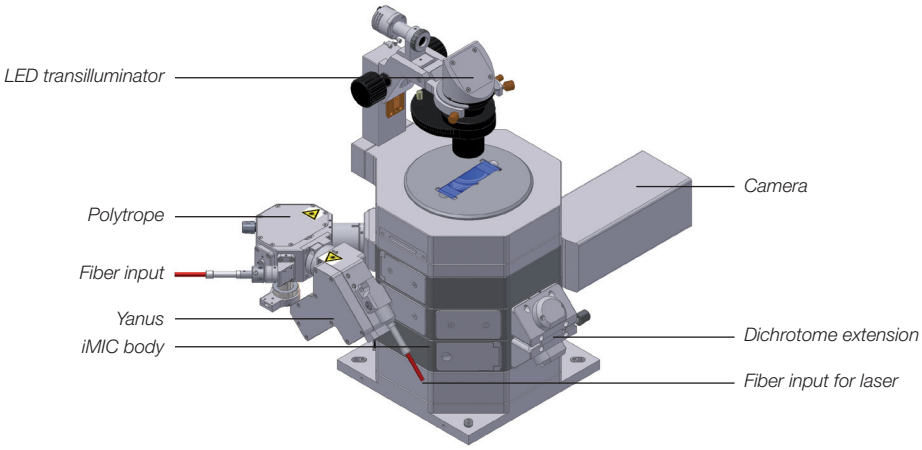


TILL iMIC –
Digital Microscope

General Information

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

Key Features

- Modular concept for more configurations
- Automation to control complex experiments
- Flexible software for changing demands

Key Benefits

- Better data in shorter time by executing different measurement methods in a single unit
- Minimal phototoxicity and bleaching
- Lower overall investment and easier upgrades

Applications

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 for excitation and emission of fluophores. The display of processes on a cellular and molecular level requires both mature technology and advanced biological understanding.

The iMIC digital microscope platform can be configured for all major fluorescence methods, including:

- Epifluorescence imaging
- FRET
- Ratio imaging
- TIRF
- FRAP
- Structured Illumination

TILL Photonics

TILL iMIC

Applications in Detail

Fluorescence Imaging

For fluorescence imaging all the iMIC needs is a light source, such as the TILL Polychrome V monochromator or the TILL Oligochrome rapid filter switch.

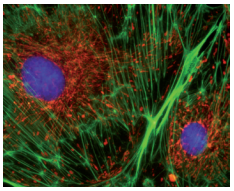


Image 1: Epithelial cells, triple stained

TILL's Live Acquisition software, an external control unit and a high power work station complete the fluorescence imaging set up.

FRET & Ratio Imaging

For analysis of protein interaction at the molecular level, the iMIC can be configured for FRET (Förster resonance energy transfer).

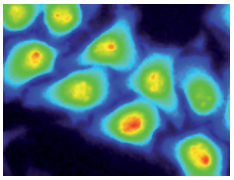


Image 2: Calcium concentration shown in red

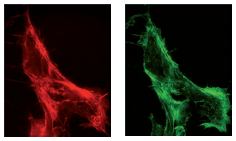
By adding the TILL Dichrotome Dual Emission Extension to the iMIC an image can be split into two colors, creating a dual-wavelength image on a single CCD.
This configuration also enables switching between different color-separation schemes via a simple computer command. For optimal FRET ratioing, a custom excitation/emission color matrix can easily be created. In the Dichrotome configuration the iMIC facilitates:

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

TIRF Imaging

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



Images 3 and 4: Epifluorescence (red) and TIRF (green) image of same cell

By combining the Polytrope with a Yanus IV Scan Head, the laser beam can be positioned anywhere in the objective's back focal plane - and the adjustment is done within ~ 0.2 ms. One or more lasers can be used with the iMIC. Multiple laser lines from a variety of laser sources can be coupled into the iMIC via TILL's laser-line combiner. To select different laser lines, TILL offers acousto-optic tunable filters that are fully controlled via software. It is therefore possible to attenuate the laser power in small steps.

FRAP Imaging

By adding the Polytrope along with a Yanus IV to the iMIC, the microscope becomes an easy-to-operate, high-precision solution for FRAP or any other technique requiring a positioned laser beam, such as FLIP or laser microdissection.

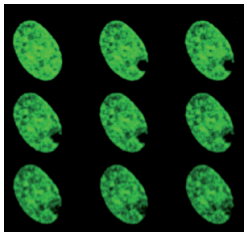


Image 5: Recovery of photobleached region

A galvanometer-driven scan mirror in the Polytrope 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 ms between widefield fluorescence and a laser-(FRAP or TIRF) mode can be achieved.

3D / 4D Imaging

Cells are 3D objects, and to account for this, a microscope must provide means for 3D sectioning. Cells are dynamic, too, and to account for this, a microscope must allow time-lapse studies with high time-resolution.
The iMIC employs the most gentle (i.e. least photo damage) sectioning procedure available - structured illumination. By using a novel, patented approach, the iMIC achieves a combination of image quality and speed unlike any other instrument.

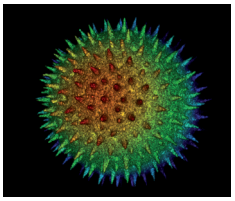


Image 6: 3D rendering of a pollen grain, acquired with structured illumination

In structured illumination the image of a grid is moved over the sample, and images taken from three grid positions are combined into a sectioned image. The grid is positioned in an apochromatically corrected intermediate image plane of the Polytrope, as opposed to the field stop plane of a condenser designed for illumination but not for demanding imaging applications. Using digital galvanometer technology, the Polytrope moves the grid-image from one position to the next in 1 ms. With a suitable camera, sectioned 1,000 x 1,000 pixel images are obtained @ 7 frames/s - almost 10x faster than competing structured illumination devices. Moreover, switching from structured illumination to normal widefield and back is a quick, motorized process.

iMIC Key Specifications

Parameter	Value	
Dimensions	2 beam hubs, top stage	200 mm x 240 mm x 240 mm, standard configuration Dichrotome extension: +50 mm in height
Weight	Standard configuration	12 kg
Operating voltage		100 - 240 V, 50/60 Hz, 3 A max.
Setup	Patented beam hub concept	From simple one level systems to complex, multi-level systems
Filter Cubes	TILL beam multiplexer	3 filter cubes in one beam hub with standard filter sets. A single filter cube can address a 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) 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 (one-for-all nanodrive)	A single piezo drives all objectives Z-range: 250 µm Resolution 50 nm
	Coarse Focus	Lead screw Drive range: 25 mm Z-stepper motor: 2 mm/s Resolution < 1 µm
Illumination	Transmission	Monochrome LED, gateable, and dimmable Long Distance Phase contrast condenser NA 0.55
	DIC	20, 40, 60 x objecives Automatic change between DIC and fluorescence
	Epifluorescence	Up to 2 ports for attachment of different epifluorescence light sources in first level of the microscope
Condensers	Various models available	Adapted to the light source
x-y stage	Specimen stage	Fully integrated Mechanical travel range 25 mm x 25 mm, resolution < 1 µm, speed 7,5 mm/s
	Microtiter plate stage	Motorised stage from Prior
Ports	1. (upper) beam hub	Typ. 1 max. 2
	2. beam hub	Typ. 3 max. 5 (depending on application)
	3. beam hub	Typ. 3 max. 5 (depending on application) For cameras, PMTs, and light sources, etc.
Hardware	ICU	Digital I/O´s, analog outs, high time resolution, and real time protocol capability
Software	Experiment control and acquisition software for the iMIC	TILL Live Acquisition and LA Browser 2D, 3D over time, and offline
	SDK	Integration of the iMIC into custom software
Flexibility	Modular concept	Upgradeable to sophisticated applications: e.g. FRET, TIRF, FRAP
Accessories		Specimen stages Microtiter plates, Petri dishes, glass slides Perfusion chambers Environmental chambers Patch Clamp, microinjection Shock and vibration damping optical table
Cameras	Supported Suppliers	PCO, Andor, Q-Imaging, Allied Vision
Environmental		25 to 40°C 10-80% humidity non condensing CO_2 control

TILL iMIC

Sample Holders

The iMIC can be fitted with an integrated stage or a large microtiter stage to accommodate a variety of specimen glass slides, petri dishes and microtiter plates. The stages are controlled by TILL's Live Acquisition software.
For more specimen platform types please contact your local TILL distributor.

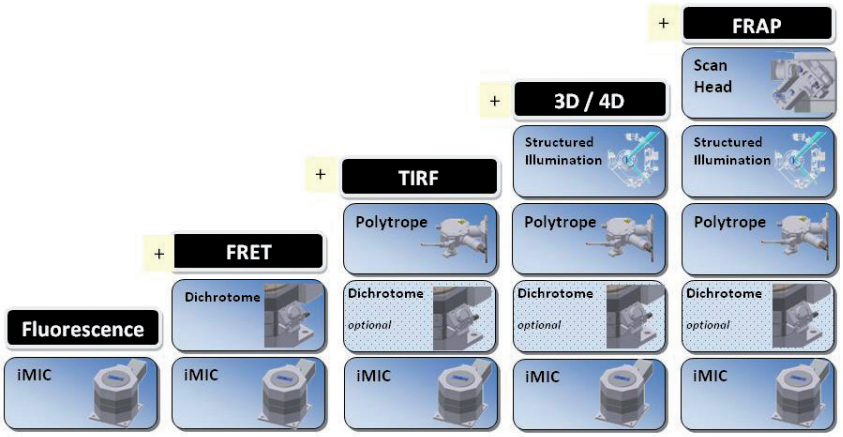
iMIC – Your Complete Microscopy Solution

Extensions make the iMIC the perfect set up for demanding requirements:

- Dichrotome for dual emission imaging
- Polytrope Imaging-Mode Switch for TIRF and structured illumination
- Yanus IV Scan Head for FRAP
- Polychrome V monochromator with variable wavelength selection
- Oligochrome filter switch with advanced optics for maximum light delivery
- Laser Line Combiner for combining up to four different laser lines

Detailed information about the extension is available in the individual data sheets.

The iMIC not only handles all advanced imaging methods – it treats cells gently and ultimately delivers better data quality.



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Fluorescence Microscopy Solutions from TILL Photonics
TILL Photonics offers fully automated, integrated and modular digital microscope solutions for live-cell applications in research and education. For more information call +49 89 895 662-0, or contact your local TILL Distributor.

TILL Photonics GmbH · Lochhamer Schlag 21 · 82166 Graefelfing · Germany
Phone: +49 89 895 662-0 · Fax: +49 89 895 662-101
info@till-photonics.com · www.till-photonics.com

TILL USA · 1286 Blossom Drive · Victor · NY 14564 · USA
Phone: +1 866-547-8455 · Fax: +1 866-863-5581 · sales@till-usa.com