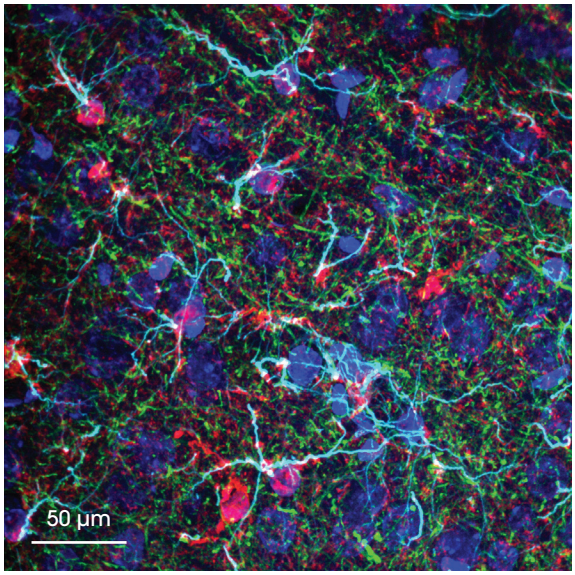
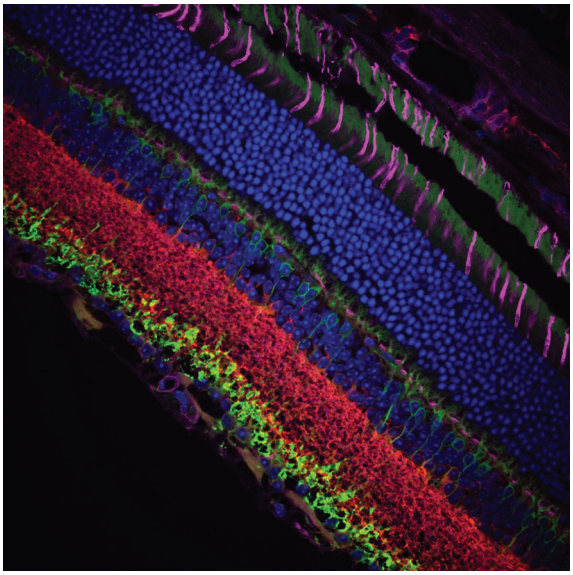
Inverted Microscopy Platform



300 µm x 300 µm wild-type mouse brain section tagged with DAPI (405 nm), Alexa 488 anti-S100B, Alexa 555 anti-Neurofilament, and Alexa 633 anti-GFAP.



A confocal image of cell layers in a mouse retina. (Sample courtesy of Dr. Robert Fariss, Biological Imaging Core, National Institutes of Health, Bethesda, MD.)

Veneto® Inverted Microscopes

Thorlabs' Modular Inverted Microscopy Platform provides a turnkey solution for widefield, confocal, and multiphoton imaging. These powerful and versatile microscopes can accommodate a range of applications such as fluorescence, *in vivo, ex vivo,* 3D, high-resolution, high-speed, and live tissue imaging. We offer configurations that support widefield, brightfield, phase, confocal, and/or multiphoton imaging.

THORLABS

Overview of Veneto® Microscopes

Key Features

- Supports Widefield, Brightfield, Darkfield, Phase, Confocal, and/or Multiphoton Imaging
- Unique Reflected Light Illumination Turret for Easy Access to Filters
- Built-In Motorized Focusing Module Allowing for Users to Image Multiple Z-Stacks Easily
- Trans-Illumination Module Tilts to Allow Large Samples Underneath
- Light Path Selector Allows Users to Switch Between Up to 3 Light Paths
- ThorImage®LS Compatible

Stitched confocal image of a complete *Drosophila* fly head, using a 40X objective.

Inverted microscopes are powerful and versatile research tools that can accommodate a range of applications, such as fluorescence, *in vivo, ex vivo*, 3D, high-resolution, high-speed (video-rate), and live tissue imaging. Our Veneto platform is designed to meet the needs of labs working in cell biology and life science applications that require an inverted microscopy platform with multiple imaging modalities, accessory ports, and easily accessible light paths.

Our Inverted Microscope Platform provides the foundation for a confocal and/or multiphoton system. A multiphoton configuration of the Veneto is shown here, including the Chrolis™ light source, controllers, and a Quantalux® sCMOS Camera.

Two Microscope Systems in One

The Veneto® microscope is a fully enclosed turnkey system. Nevertheless, the engineers behind this microscope did not want to leave users without the option to implement solutions to their unique experimental challenges. Therefore, Veneto microscopes are endlessly configurable. DIY optical paths and sample mounting solutions can be easily added to your pre-configured microscope.

Turnkey System

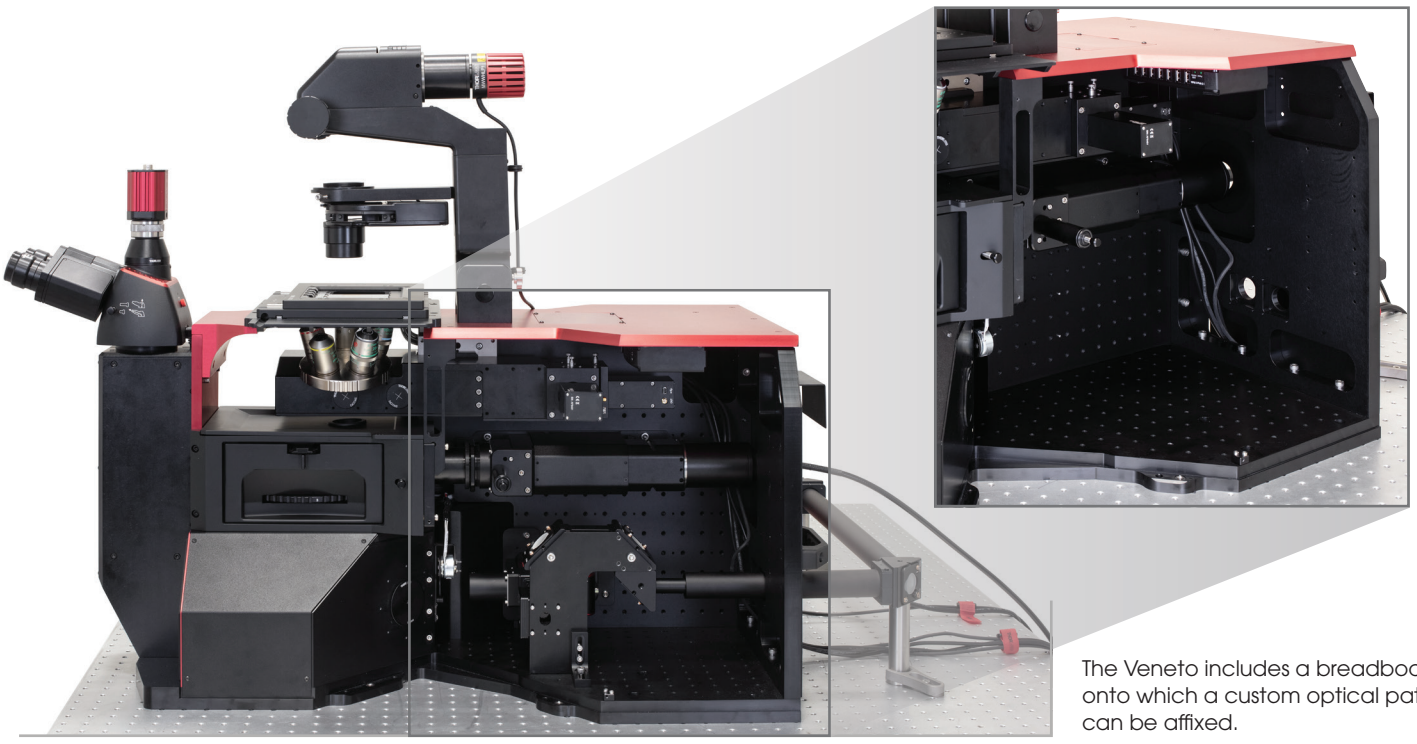
The Veneto microscope is a fully enclosed microscope that comes pre-configured with all the necessary components required to meet the exact needs of an experiment. Thorlabs designs and manufactures the components to ensure seamless functionality and to enable a high level of support from Thorlabs' application engineers.

Veneto microscopes are driven by our ThorImage®LS software, for which we offer lifetime support. This software supports multiple imaging techniques and offers seamless modality changes when switching between light paths.

The enclosed Veneto microscope provides laser shielding and appropriate covering for dust and light. The cover is easily removable for any customizations a user may want to make.

DIY System

This system includes many DIY options, including a breadboard on the bottom and sides of the case. This allows users to create custom optical paths which can be directly incorporated into the Veneto.

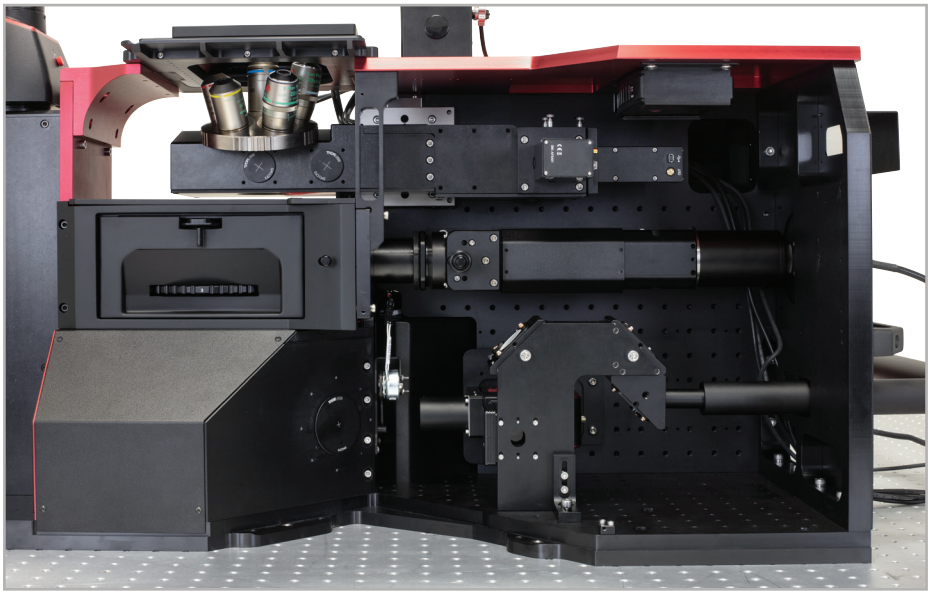


The Veneto includes a breadboard onto which a custom optical path can be affixed.

Veneto® Microscope Tour

Two-Photon & Widefield Configuration

Below is an example configuration which includes a tunable Ti:sapphire laser, a Pockels cell, and a motorized variable attenuator, which together enable two-photon microscopy.



Top Tier
This tier includes two major subsystems--the built-in focusing module, and the non-descanned detection module for multiphoton systems.

Bottom Tier
There are many options for this tier, including attaching your own custom optical path to the optical breadboard. Other options include preconfigured modules with resonant-galvo-galvo scanners, galvo-resonant scanners, or a galvo-galvo scanner.

Features

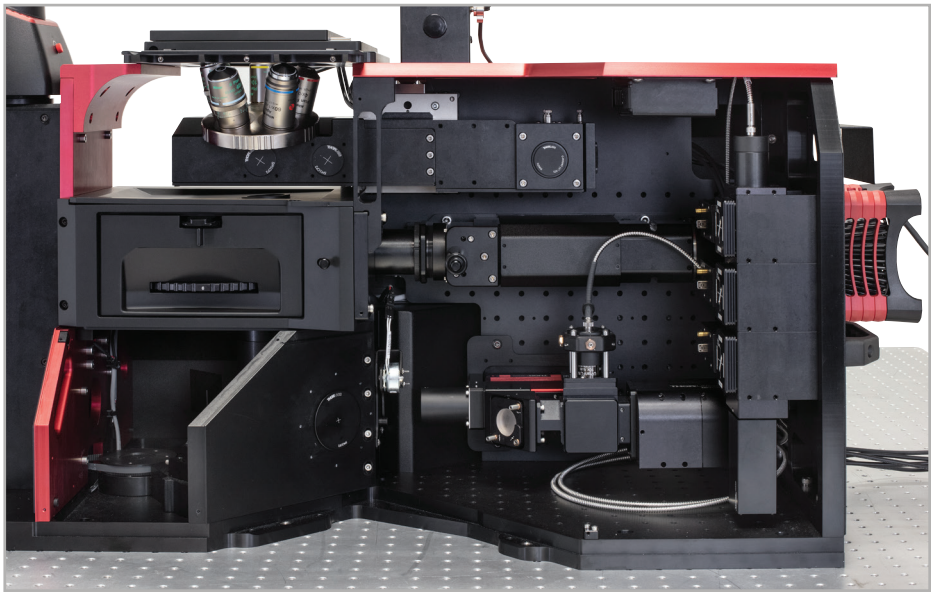
- High-Speed Imaging via Galvo-Resonant or Resonant-Galvo-Galvo Scanners
- Pockels Cell and Motorized Variable Attenuator for Remote Laser Adjustment
- Two-Channel Non-Descanned Detector with GaAsP PMTs

Veneto® Microscope Tour

Confocal & Widefield Configuration

This example configuration includes a four-channel confocal fiber-coupled laser, four PMT detection channels, and a motorized pinhole wheel.

Middle Tier
This tier features the reflected light illumination module and is optimized for even fluorescence illumination from a liquid light guide or LED source.



Features

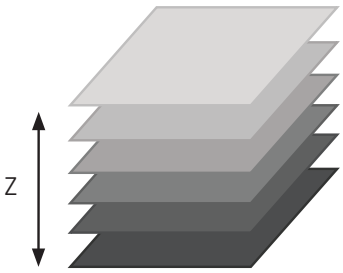
- High-Speed Galvo-Resonant or Galvo-Galvo Scanning
- Motorized Pinhole Wheel with 16 Sizes from Ø25 µm to Ø2 mm
- Four Detection Channels for GaAsP or Multialkali PMTs
- Four-Channel Confocal Fiber-Coupled Laser

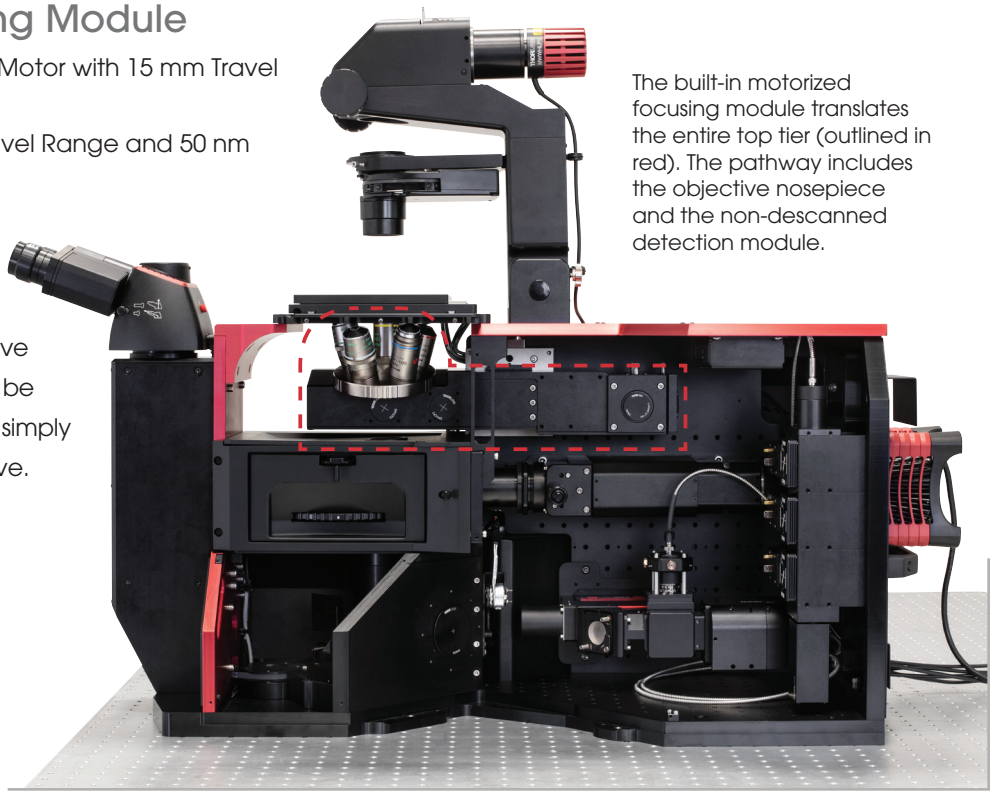
Highlights and Modules

Built-In Motorized Focusing Module

- Whole Module Moves Using Stepper Motor with 15 mm Travel Range and 50 nm Resolution
- Optional Piezo Motor with 100 µm Travel Range and 50 nm Resolution

The Veneto® microscope platform features an innovative built-in motorized focusing module. This module translates the entire five-objective nosepiece, which means a Z-stack can be easily taken with different objectives by simply turning the nosepiece to a new objective.





The built-in motorized focusing module translates the entire top tier (outlined in red). The pathway includes the objective nosepiece and the non-descanned detection module.

10X Super Apochromatic Objective

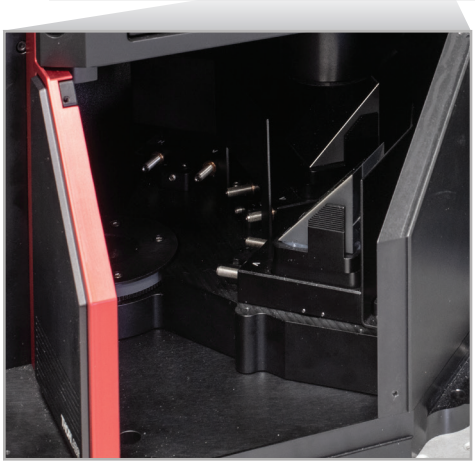
- Ideal for Two-Photon Microscopy
- Infinity-Corrected Dry Objective with Super Apochromatic Axial Color Correction
- 0.50 NA, 7.77 mm Working Distance, 400 to 1300 nm Transmission
- M32 x 0.75 Threading

TL10X-2P
10X Super Apochromatic Microscope Objective

Objective Compatibility

- Five-Objective Nosepiece with M25 x 0.75 Ports
- Single M32 x 0.75 Objective Port

The Veneto microscope is often configured with an objective nosepiece that can accommodate up to five M25 x 0.75 objectives. By removing the standard five-objective nosepiece, M32 x 0.75 threading is made accessible which accepts an objective with a larger back aperture, such as the TL10X-2P 10X Super Achromatic Objective.



The Veneto microscope's light path selector showing the three prism mirrors used to direct light.

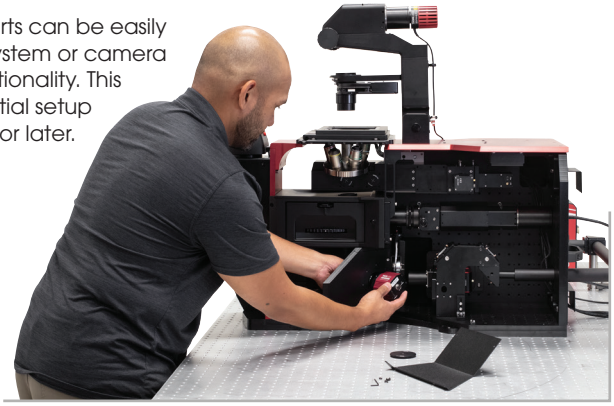
Light Path Selector

The light path selector on the Veneto® microscope platform directs source light on the bottom tier. This selector simplifies switching between imaging modalities, enabling the user to direct light among four microscope ports. With an additional bottom port, this tier of the microscope has five light paths to choose from, catering to various experimental needs. This selector is motorized and can be driven via controller or PC, allowing automated switching between different imaging modalities.

Five Light Path Options for the Bottom Tier

- Primary Imaging Path using the Rear Port
- Trinocular Imaging Path using the Front Port
- Left Side Port with SM2 (2.035"-40) Threads and 60 mm Cage Taps
- Right Side Port with SM2 (2.035"-40) Threads and 60 mm Cage Taps
- SM2-Threaded Port Underneath the Light Path Base Plate

The left and right ports can be easily adapted to a cage system or camera to add additional functionality. This can be done in the initial setup of the microscope or later.

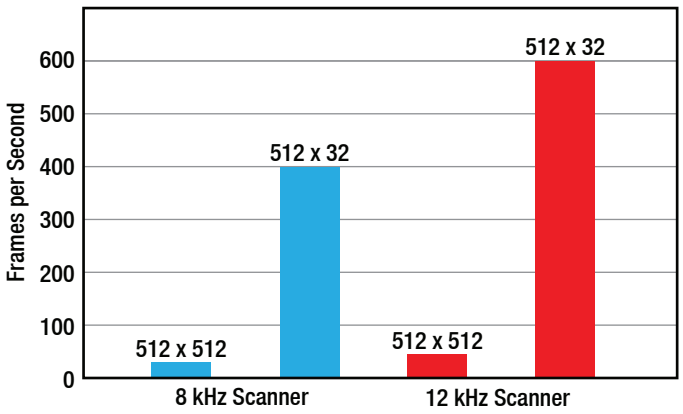


High-Speed Scanners

Veneto microscopes can be configured with one or two co-registered scan paths to propagate, condition, and direct an input laser beam. We offer any combination of galvo-resonant scanners, galvo-galvo scanners, and resonant-galvo-galvo scanners.

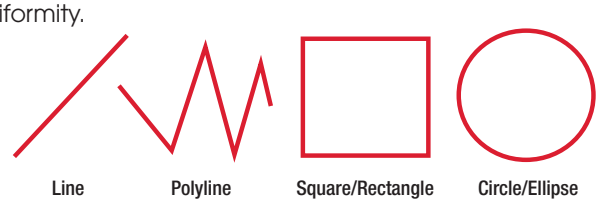
Galvo-Resonant Scanners for High-Speed Imaging

Thorlabs has 8 kHz and 12 kHz galvo-resonant scanners. Our 8 kHz scanners utilize the entire field of view and offer a maximum frame rate of 400 fps, while our 12 kHz scanners provide an increased frame rate of 600 fps.



Galvo-Galvo Scanners for User-Defined ROI Shapes

Galvo-galvo scanners support user-drawn scan geometries (lines, polylines, squares, and rectangles) and also support custom photoactivation patterns (circles, ellipses, polygons, and points). They offer consistent pixel dwell times for better signal integration and image uniformity.



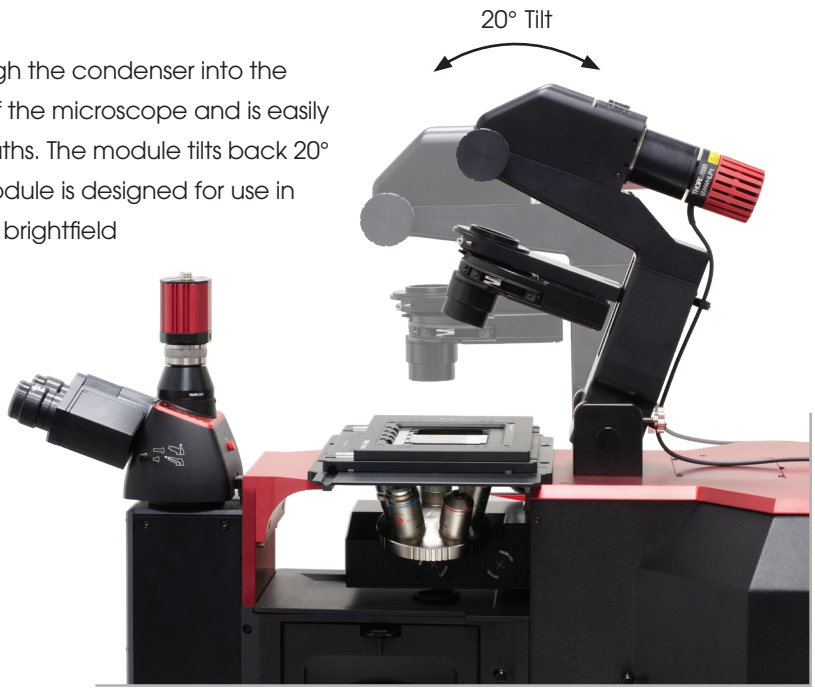
Resonant-Galvo-Galvo Scanners for Multimodal Scanning

Thorlabs offers 8 kHz and 12 kHz resonant-galvo-galvo (RGG) scanners. These multimodal scanners provide features of both the galvo-resonant and galvo-galvo scanners in a single scan head.

Highlights and Modules

Trans-Illumination Module

The Veneto® trans-illumination module steers light through the condenser into the transmitted light optical path. This unit mounts on top of the microscope and is easily removable should you want to use only the inverted paths. The module tilts back 20° to allow for clearance when mounting samples. This module is designed for use in the visible and NIR range (400 – 700 nm) and is ideal for brightfield and oblique illumination.



Mounted LEDs

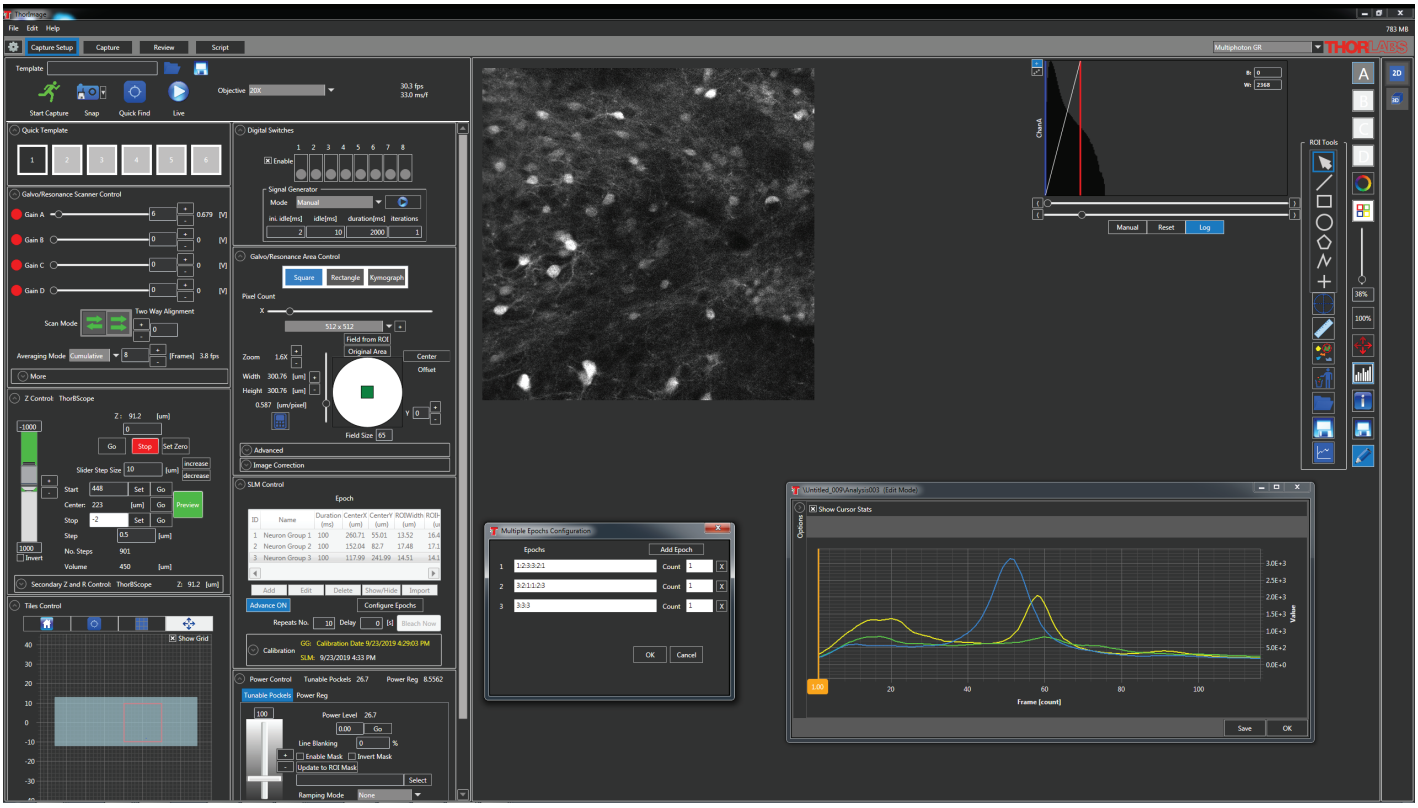
Each uncollimated, mounted LED consists of a single LED mounted to a heat sink. This cold white LED has a broad spectrum.

MCWHLP2
Cold White LED

ThorImage®LS Compatibility

- Lifetime Support
- Image Acquisition Synced with Hardware Inputs and Timing Events
- Live Image Correction and ROI Analysis
- Automated Image Capture with Scripts
- Multi-User Settings Save for Shared Workstations

The ThorImageLS software manages the activities of Thorlabs' microscopes and supplemental equipment to acquire and analyze data sets. This software has a range of features and capabilities, including holographic optogenetics, deep physiological scans, large-area tiling, high-speed imaging, and multi-modal acquisitions.



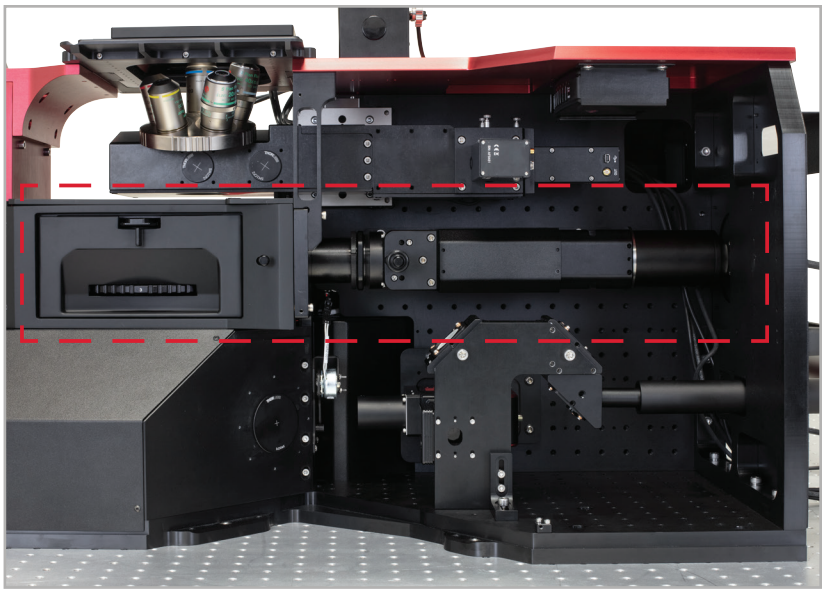
The ThorImage® LS software workspace streamlines the image acquisition and analysis process with a user-intuitive, feature-rich workflow. Panel layouts are completely customizable for different users or imaging modalities. All software features are easily accessible, providing a complete, self-contained software package without compromising ease of use.

Reflected Light Illumination Module

The reflected light illumination module is included with all Veneto® microscopes. Designed for even fluorescence illumination from a liquid light guide or LED source, we commonly configure this with Thorlabs' Solis® High-Power LEDs or Chrolis™ 6-Wavelength High-Power LED source.

CHROLIS-C1
6-Wavelength High-Power LED Source

SOLIS-1D
High-Power LED for Microscopy



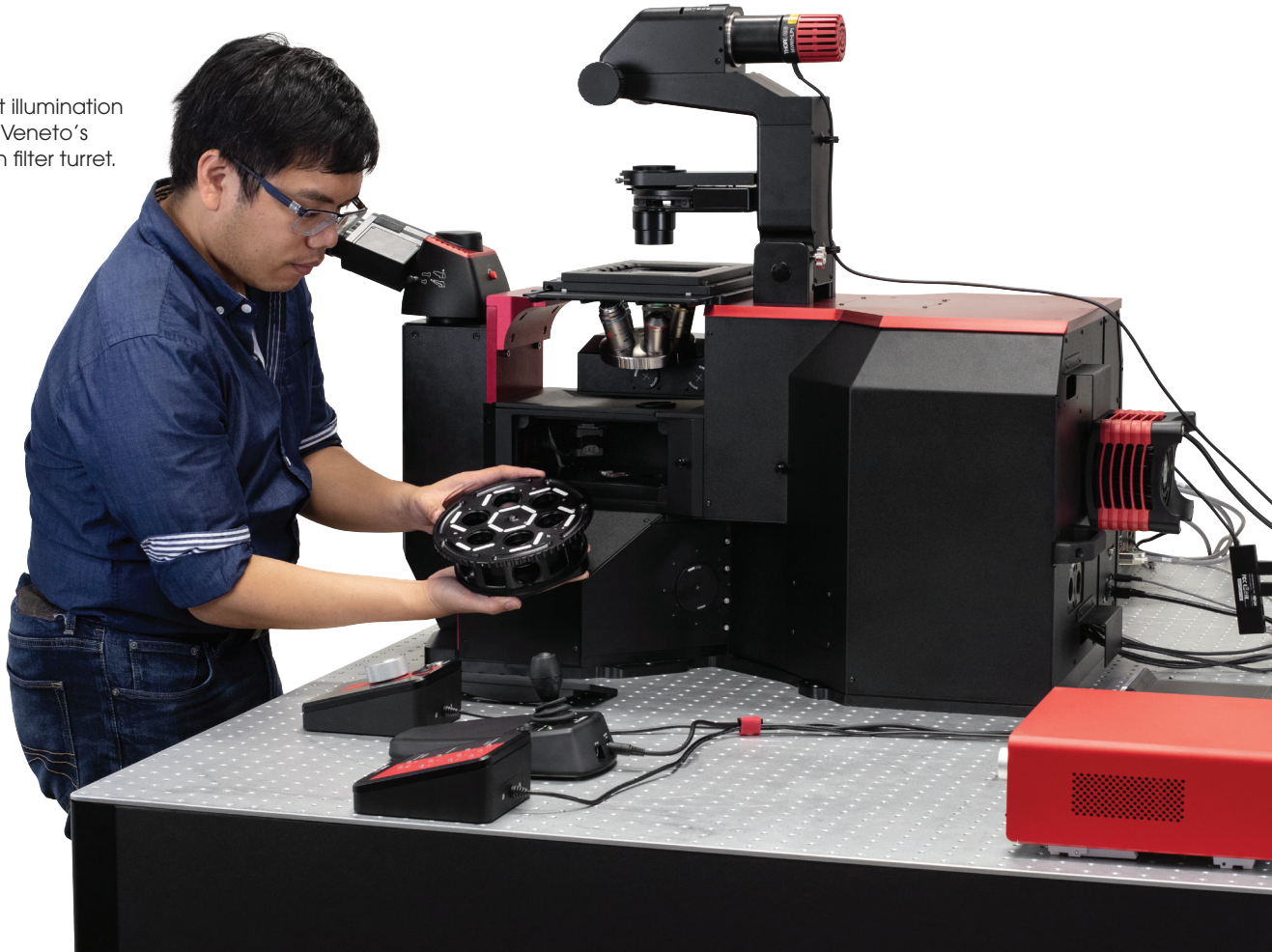
The reflected light illumination module conditions a light source for use with the filter turret.

Six-Position Filter Turret

- Accepts 32 mm x 44 mm Dichroic Filters and Ø32 mm Excitation and Emission Filters
- Easily Removable for Filter Changes
- Optional Motorization Which Can be Controlled via Controller or PC

Veneto is designed with a unique filter turret for easy access to the dichroic filters. Once the turret has been removed from the microscope, its cover can be easily removed. The filters within are held in place using a small spring to ensure the mounting does not produce any mechanical stress on the filter. This turret can be fully motorized and controlled via controller or through software.

The reflected light illumination module contains Veneto's unique six-position filter turret.



Highlights and Modules

High-Speed XY Scanning Stage

- Ultra-Fast XY Scanning Up to 250 mm/s
- High Repeatability: 0.25 µm
- Minimum Achievable Incremental Movement: 100 nm
- Travel Range of 110 mm x 75 mm

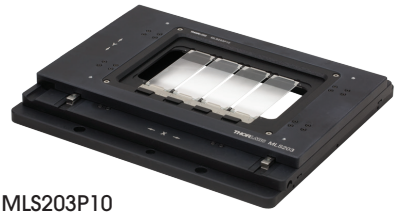
The Veneto® microscope platform supports the MLS203-1 Fast XY Scanning Stage, which has a maximum velocity of 250 mm/s and a travel range of 110 mm x 75 mm. There are many different types of slide holders and accessory plates for this scanning stage including petri dish holders, slide holders, and multiwell plates. Our team can also collaborate with you on a DIY sample holding solution.

The MLS203 stage has many slide holders and accessory plates that are easily swappable.

Sample Holders for MLS203-1 Stages

MLS203P1
Multiwell Plate Adapter, Shown with Multiwell Plate Installed

MLS203P2
Petri Dish/Slide Holder, Shown with Petri Dish Installed



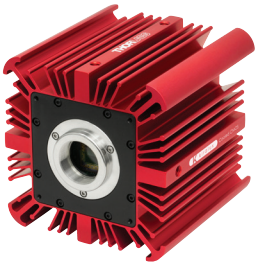
MLS203P10
Multi-Slide Holder, Shown with Slides Installed

Scientific Cameras

- CMOS and sCMOS Cameras Available
- Camera Resolutions from 1.3 to 12.3 Megapixels
- Full-Sensor Frame Rate from 15.1 to 165.5 fps
- CMOS Sensors for Monochrome, Color, NIR-Enhanced, or Polarization-Sensitive Versions
- Housing Options Include Compact, Passively Cooled; Low-Profile, Passively Cooled; or Hermetically Sealed TE-Cooled Housings

CS2100M-USB
2.1 Megapixel Monochrome sCMOS Camera

LP126CU
12.3 Megapixel Color CMOS Camera, Low-Profile



CC505MU
5.0 Megapixel Monochrome CMOS Camera, TE-Cooled

Controllers

- Z-Stage Focus Controller
- Primary Reflector Control
- Fluorescence Turret Filter Selector
- Light Path Selector

These controllers are exclusive to the Veneto microscopes. The controller pictured to the left is the Z-stage focus controller. The other controller is used to select one of the light paths, switch the primary reflector in or out, and, if motorized, switch the filter on the reflected light fluorescence turret. These features can also be controlled through our ThorImage®LS software.

Veneto® Microscope Specifications

Optical System		Infinity Corrected
Optical Field Number		20
Laser Scanning	Scan Path Wavelength Range	450 - 1100 nm, 680 - 1300 nm, or 800 - 1800 nm
	Scan Paths	Resonant-Galvo-Galvo Scanner, Galvo-Resonant Scanners, or Galvo-Galvo Scanners; Single or Dual Scan Paths
	8 kHz Resonant-Galvo-Galvo or Galvo-Resonant Scan Speed	2 fps at 4096 x 4096 Pixels 30 fps at 512 x 512 Pixels 400 fps at 512 x 32 Pixels
	12 kHz Resonant-Galvo-Galvo or Galvo-Resonant Scan Speed	4.4 fps at 2048 x 2048 Pixels 45 fps at 512 x 512 Pixels 600 fps at 512 x 32 Pixels
	Field of View	20 mm Diagonal Square (Max) at the Intermediate Image Plane (12 mm Diagonal Square (Max) for 12 kHz Scanner)
	Scan Zoom	1X to 16X (Continuously Variable)
	Scan Resolution	Up to 2048 x 2048 Pixels (Bi-Directional) (Up to 1168 x 1168 Pixels for 12 kHz Scanners) Up to 4096 x 4096 Pixels (Unidirectional) (Up to 2336 x 2336 Pixels for 12 kHz Scanners)
Observation Tube		Trinoculars with 10X Eyepieces and Camera Port for 1X Camera Tube with External C-Mount Threads
Light Source		Brightfield: Thorlabs Mounted LED Widefield: LED or Liquid Light Guide through Chrolis™ 6-Wavelength High-Power LED Source or Solis® High-Power LED Laser Scanning: Confocal Laser Source Customizable with Up to 4 Excitation Channels, Multiphoton Sources for Two-Photon and Three-Photon Imaging
Condenser		LWD 0.52 NA 3.5 mm Translation with Trans-Illumination Module
Motorized XY Scanning Stage		110 mm x 75 mm (4.3" x 2.95") Travel Range 250 mm/s Max Velocity
Objective Turret		Five Manual Positions with M25 x 0.75 Threads
Focusing Unit		15 mm of Travel Stepper Motor: 15 mm Travel Range, 50 nm Resolution Piezo: 100 µm Travel Range, 50 nm Resolution
Reflected Light Illumination Turret		Six Motorized Positions for 32 mm x 44 mm Dichroics and Ø32 mm Excitation and Emission Filters
Control Units		Stage Joystick and Microscope Control Pad

Confocal Laser Source Options

# of Lasers	**Excitation Wavelengths**				**Included Emission Filters**	
	UV	Blue	Green	Red	Emission Filters (Center Wavelength/ Bandwidth)	Longpass Dichroic Cutoff Wavelength(s)
2	-	488 nm	561 nm	-	525 nm/45 nm and 600 nm/52 nm	573 nm
3	405 nm	488 nm	561 nm	-	440 nm/40 nm, 525 nm/45 nm, and 600 nm/52 nm	495 nm and 573 nm
3	-	488 nm	561 nm	642 nm	525 nm/45 nm, 600 nm/52 nm, and 607 nm/Longpass	561 nm and 635 nm
4	405 nm	488 nm	561 nm	642 nm	440 nm/40 nm, 525 nm/45 nm, 600 nm/52 nm, and 647 nm/Longpass	495 nm, 573 nm, and 647 nm

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