ThorImage® LS is an intuitive, powerful program with diverse functionality and a customizable interface, providing flexible control of Thorlabs' imaging systems.
ThorImage®LS Capabilities

ThorImageLS is a comprehensive software tool for managing Thorlabs’ Bergamo® multiphoton microscopes, Cerna® hyperspectral and epi + DIC rigs, and confocal microscopes, as well as supplementary products, including the Tiberius® laser, scientific cameras, and sample scanning stages. Use one integrated software suite for every step of your imaging experiment.

Deep Physiological Scans

Use Built-In Controls for Scanning Large 3D Volumes:

◆ For deep, high-speed 3D imaging, coordinate between long-travel stepper control and high-resolution piezo motion to traverse large ranges in Z at user-defined steps.
◆ Control our variable beam expander to overfill the objective for higher surface resolution or underfill for deeper sample penetration.
◆ Compensate for tissue scatter with laser power ramping as a function of depth, creating an even signal response throughout a 3D scan.

High-Speed In Vivo Acquisition

Easily Perform In Vivo Imaging via Image Streaming, Time Series, and Z-Stack Acquisition:

◆ Software Supports Both Full-Frame and Fast-Frame-Rate Laser Scanning Image Acquisition
◆ Data Immediately Stored to the Hard Drive
◆ Experiment Sizes Constrained Only by the Size of Available Hard Drive Space
◆ High-Speed Volumetric Imaging Coordinates Fast Z Piezo Travel with Data Collection
◆ Store, Visualize, and Analyze Images with Multiple ROIs Simultaneously with Acquisition at Video Frame Rates

Multi-Modal Imaging

Utilize One Software Package for Multiple Imaging Modalities to Capture Feature-Rich Samples:

◆ Supported Imaging Modalities:
  – Laser Scanning (Resonant-Galvo-Galvo, Galvo-Galvo, and Galvo-Resonant): Fluorescence, Dodt, Second Harmonic Generation (SHG), and Third Harmonic Generation (THG)
  – Widefield: Fluorescence, Brightfield, DIC, Darkfield, and Phase Contrast
◆ Software Workflow Customizable for Each Modality
◆ Simultaneously Obtain Laser-Scanned Images Co-Registered With Widefield Images
◆ Acquire External Camera Data Synced with Microscopy Image Data to Correlate Image Features with Specimen Behavior
Photostimulation

For Optogenetics Research Requiring Patterned Light Control, Choose from Multiple Techniques:

- **SLM Holography**
  - Simultaneously Activate Hundreds of Cells
  - Combined SLM and Galvo-Galvo Control Enable Users to Spread Laser Activation Over Whole Cells to Ensure More Reliable Stimulation
  - Classify Groups of Cells to Activate Independently
  - Synchronize with High-Speed Imaging
- **Galvo Region of Interest (ROI)**
  - Serially Stimulate Thousands of Cells
  - Choose from a Variety of ROI Types and Scan Patterns
  - Tightly Synchronize with Imaging to Maximize PMT Lifetime
- **Full Field**
  - Compatible with LEDs and Laser Configurations
  - Configurable Stimulation Timing
    - Pre- or Post-Imaging Frames
    - Inter-Frame Stimulation

Large-Area Mosaic Tiling

Capture and Stitch Large Tiled Images to View Entire Samples at High Resolution:

- Selectable and Configurable Tiles
- Overlap Tiles in X and Y to Aid Analysis and Post-Processing
- Multiplex with Time Series and Z Stacks
- Enable Tilt Adjustment to Correct for Samples Not Orthogonal to the Objective

Image Credits

**Cover Page:**

Top Left: Coherent anti-Stokes Raman scattering (CARS, red), second harmonic generation (SHG, green and purple), and sum frequency generation (SFG, blue) image of a chicken heart.

Top Right: Patch-clamped neuron. Image courtesy of the 2016 Neurobiology Course at the Marine Biological Laboratory, Woods Hole, MA.

Middle Left: Neurofilaments (green), glial filaments (red), and DAPI nucleic stain (blue) from hippocampus.


Bottom Left: Confocal mosaic image of GFP and NC82 antibodies in a fly brain. Sample courtesy of Dr. Berry Dickson, Janelia Research Campus, HHMI, Ashburn, VA.

Bottom Right: Confocal Z-stack maximum intensity projection of a mosquito eye.

**From the Brochure Contents:**

a. Courtesy of Dr. Hajime Hirase, Katsuya Ozawa, and YOU. H. RIKEN Brain Science Institute, Wako, Japan.

b. Sample courtesy of Dr. Robert Fariss, Biological Imaging Core, National Institutes of Health, Bethesda, MD.

c. Courtesy of Lloyd Russell, Dr. Adam Packer, and Prof. Michael Häusser, University College London, United Kingdom.

d. Courtesy of Dr. Jennifer Kielczewski, National Eye Institute, National Institutes of Health, Bethesda, MD.

e. Courtesy of Dr. Michael Dickinson and Dr. Ivo Ros, California Institute of Technology, Pasadena, CA.
Explore the Workspace

Multi-Modality Support
Capture a data set using multiple imaging modalities without jumping between applications.
- Quickly Switch Modalities to Reduce Wait Times Over a Single Run
- Customize Capture Layouts and Settings for Each Modality

Automated Image Capture
Program routine image acquisitions:
- Create Command Sequences Using a Drag-and-Drop Interface
- Run Fiji/ImageJ Macros
- Execute MATLAB® Scripts

Ease of Use
Intuitive user interface design provides easy access to all necessary hardware control elements.

Customizable Workspace
Visualize only the settings relevant to each aspect of your individual experiment.
- Customizable Multi-Column Layout
  - Save by User
  - Save by Imaging Modality
- User-Defined Keyboard Shortcuts
- Multi-User Settings Saved for Shared Workstations

Screenshot of the Capture Setup tab during an SLM holographic photostimulation experiment using our Bergamo® Multiphoton Microscope.
Coordinated Imaging and Experimentation
Use one software package to control and synchronize experimental processes with captured data.

- **Applications**
  - Photoactivation
  - Multi-ROI Masking and Imaging
  - Laser-Power-Ramped Z Stacks

- **Software Features**
  - ThorSync™
  - Third-Party Script Compatibility
  - Directly Manipulate Open-Source Software Code

Intuitive Visualization
Once acquired, easily explore multi-dimensional datasets.

- Simultaneously Scan Through 2D Slices in the X-Y, X-Z, and Y-Z Planes
- Render and Rotate 3D Volumes to View the Complete Sample and Identify Non-Orthogonal Features

Real-Time ROI Analysis
Select one or more ROIs to perform real-time calculations simultaneously with image acquisition.

- Multiple ROI Shape Options
- Intensity as a Function of Time
- Mean, Minimum, and Maximum Intensity
- Standard Deviations
- Arithmetic Operations
  - \(dF/F\)
  - Ratiometric Imaging
Integrated Acquisition

To provide a flexible user experience, our team has designed ThorImageLS to easily communicate with external hardware and third-party software. The application code is also freely available for complete software customization.

ThorSync™

Integrate ThorImageLS with ThorSync, our supplemental software program designed to record and generate digital/analog signals for timing-critical applications. This enables synchronization of data acquisition with external equipment.

- Create Output Signals to Trigger Image Acquisition, Experiment Stimulation, and Auxiliary Equipment
- Customize Display Settings to Improve Signal Interpretation
- Measure Time and Y-Axis Values Using Location Indicators
- Rollover Statistics for All Signals
- Create or Respond to Signals from Behavioral Devices (e.g. Virtual Reality Environments)
- Digital and Analog Data Saved in an Open HDF5 Scientific Format that is Easily Imported into Analysis Packages

Third-Party Integration

Export data or run third-party scripts directly using ThorImageLS, which standardizes and streamlines automated acquisition and analysis processes.

- Launch and Immediately Open Files in Fiji/ImageJ or MATLAB® with a Quick Connect Button in the ThorImageLS Viewer
- Create ThorImageLS Scripts that Execute ImageJ and MATLAB® (m-files®) Scripts Either Synchronously or Asynchronously
- Simplified Hardware Integration Through Third-Party Scripts
- Open SDKs Enable Users to Code Their Own Device Plugins

Open Source

ThorImageLS is provided with every Thorlabs microscope purchase. Full customization of software features and performance is made possible with open-source availability. Contact us at ImagingTechSupport@thorlabs.com for ThorImageLS source code and technical support.
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<sup>a</sup> For a complete list of software features and user interface upgrades, visit our website at www.thorlabs.com.