

MULTIPHOTON MICROSCOPY SPATIAL LIGHT MODULATOR
NeuraLight 3D Ultra

Most Advanced 3D Holography
for Simultaneous All-Optical Stimulation and Imaging

NeuraLight 3D Ultra for Ultima Systems

The NeuraLight 3D Ultra™ is the next-generation spatial light modulator (SLM) designed for optogenetics experiments to study and understand neural connectivity and function of neural networks. In close collaboration with leaders in neuroscience research at Stanford University, Columbia University, and University College London, Bruker has evolved its SLM technology to deliver optimized functionality to the Ultima multiphoton systems.

NeuraLight 3D Ultra builds upon 15 years of the most capable and advanced multiphoton microscope technology to provide:

- Spiral scanning coupled with SLM selection of 3D points
- Multiplexed, diffraction-limited subcellular photoactivation
- Industry-leading switching time between stimulation patterns
- Complete software integration of imaging modalities and stimulation protocols

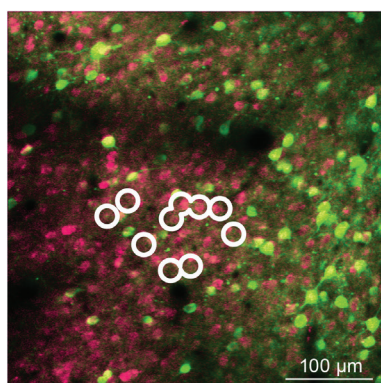


3D Optical Stimulation Module for Your Multiphoton Microscope

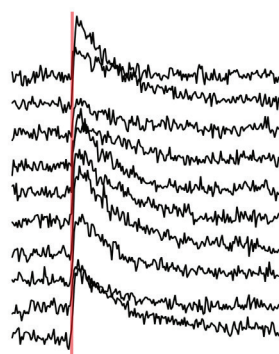
Titrate Precise, Simultaneous, Multi-Cell Stimulation in a 3D Volume

The NeuraLight 3D Ultra SLM leverages the flexibility of Ultima's modular platform design, combined with new licensed technology, to create 3D laser holograms to simultaneously stimulate cells in three dimensions. Coupled with a set of 6-millimeter galvanometers, the SLM enables multiple stimulation points in a spiral scan pattern to be projected in a 3D volume. This scan pattern generates a delivery of light that provides optimal spatio-temporal activation of opsins in soma to produce complete activation of neurons. This in vivo solution is superior to other methods in both total energy required and in the activation characteristics of opsins. The number of targets that can be activated is limited only by the peak power of the laser used for stimulation and the selected addressable field.

Targeted 2P stimulation



- GCaMP6s
- C1V1-2A-mCherry



Optical stimulation of selected cells containing GCaMP6s using NeuraLight 3D Ultra. Cell bodies were stimulated simultaneously by creating a 3D hologram of points with the SLM and spiral scanning all points over the cell body. Courtesy of Adam Packer, Lloyd Russell, Henry Dalgleish, and Michael Hausser (University College London).

Perform Multiplexed, Diffraction-Limited Subcellular Photoactivation

NeuraLight 3D Ultra can also generate precise, diffraction-limited points in a 3D space for subcellular resolution. Stimulation patterns targeting individual synapses or groups of synapses can be produced, allowing researchers to probe neural connectivity and signaling. Sequencing of stimulation patterns enables researchers to automate studies examining signal summation in individual neurons or in groups of neurons.

“

The system is performing very well in our laboratory, and we're excited about the NeuraLight 3D Ultra's speed, field of view, and resolution, which will enable us to perform all-optical interrogation experiments with greater fidelity and precision. ”

– Adam Packer, Ph.D., Wellcome Trust Sir Henry Dale Fellow at the University of Oxford

Target Functional Ensembles of Neurons

Rapidly Switch Between Stimulation Patterns

The fast, 600-hertz switching speed of NeuraLight 3D Ultra allows users to rapidly change stimulation patterns. For in vivo studies, this provides a tool to mimic neuronal firing produced by behavioral stimuli. For subcellular studies examining connectivity and signaling, complex signal summation studies can be quickly executed.

Generate 3D Activation Patterns While Imaging and Recording Electrical Signals

NeuraLight 3D Ultra provides complete software integration. The module includes a complete software toolkit for generating 3D activation patterns while imaging/recording electrical signals and triggering behavioral and electrical stimuli. A calibration wizard ensures a simple and straight-forward process. 3D point location is mapped using an acquired Z series of the specimen. Sequencing of stimulation patterns has been incorporated into the industry-leading Mark Points module. This also allows synchronization with imaging (resonant scanning, scanning line scanning, and point detection), along with electrical recording and triggering of other stimuli, including electrical and behavioral stimuli.

Flexibly Optimize Your SLM for Different Wavelengths

NeuraLight 3D Ultra features a built-in optical path and software for optimizing the SLM to a new wavelength, opening additional experimental opportunities as probes are developed. This flexibility allows for 3D stimulation catered for your specific laser without the need to send any components back to the factory for recalibration.

NeuraLight 3D Ultra is available as an option on new Ultima 2Pplus multiphoton systems or an upgrade to other Ultima systems.

Bruker Fluorescence Microscopy

Madison, WI • USA
Phone +1.608.662.022

productinfo@bruker.com



Multiphoton Microscopy | See Deeper into Brain Activity

www.bruker.com/NeuraLight3D