

## MULTIPHOTON MICROSCOPY

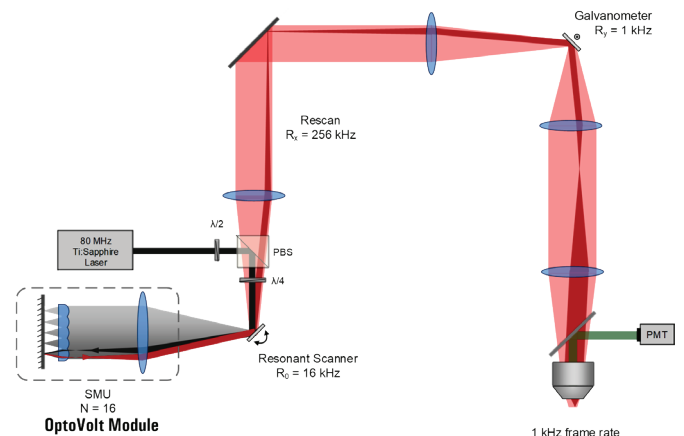
# OptoVolt Module

### High-Speed Voltage Imaging at Single Neuron Resolution

Bruker's OptoVolt™ Module for Ultima 2Pplus multiphoton microscopes delivers unprecedented kilohertz imaging rates to enable voltage imaging neural research. It provides a significant improvement over standard imaging techniques by capturing electrical dynamics at up to 1000 frames per second and providing software-selectable multiplication modes well suited for imaging fast dynamics optimized for speed or field-of-view size. These accelerated imaging speeds allow neuroscientists to capture millisecond dynamics of cell-to-cell neural communication, and with the emergence of fluorescent voltage indicators, it is even possible to measure neural activity with higher temporal resolution than fluorescent calcium indicators have allowed.

#### OptoVolt Technology Features:

- Multiplication optics that re-route the resonant scanning beam for a customized aspheric microlens array
- Large detection optics for collecting scarce photons, in vivo, in deep tissue
- Custom FPGA-based digitizers for weak signal detection
- Seamless integration with Ultima 2Pplus, selectable as a scanning mode for ease of use
- Compatibility with NeuraLight 3D Ultra spatial light modulator (SLM) for 3D optogenetics



OptoVolt multiplication architecture. Diagram courtesy of Sheng Xiao, Mertz Lab, Boston University.

## Collaborative Advancements in Voltage Imaging

OptoVolt's technology leverages advanced voltage indicators, such as ASAP4 from Stanford University and JEDI-2P from Baylor University, ensuring compatibility with the latest developments in the field. The system's modular design retains the depth and resolution of traditional two-photon imaging while enabling flexible adjustments between speed and signal intensity. Additionally, OptoVolt's integration with the NeuraLight 3D Ultra SLM allows for simultaneous optogenetic manipulation and voltage imaging, facilitating comprehensive functional mapping of neural circuits. This capability allows researchers to visualize action potentials and sub-threshold membrane potentials across large neural networks, bridging the gap between single-cell electrophysiology and wide-field calcium imaging.

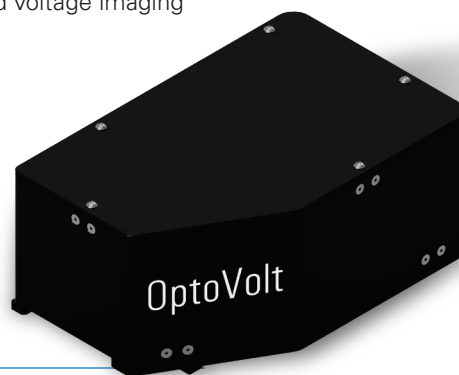
## Enabling Emerging Applications

OptoVolt, as a simple addition to the Ultima 2Pplus or in combination with other neuroimaging techniques, offers researchers the ability to probe input-output relationships of neural ensembles at unprecedented temporal and spatial resolution. This innovative technology opens avenues of exploration for a range of emerging applications, including:

- All-optical functional mapping with a combination of 3D optogenetics and voltage imaging
- Measurement of sub-threshold cellular membrane potentials
- Calcium, vascular, and neurotransmitter imaging

## OptoVolt Specifications

<b>Compatibility</b>	Ultima 2Pplus with Resonant Scanner
<b>Detection System</b>	Bruker rtCore with ioCore electronics
<b>Software</b>	Prairie View version 6.0 or later
<b>Multiplication Modes</b>	Software selectable: x16, 1100 fps; x8, 550 fps
<b>Wavelength</b>	Optimized 920 nm, 700 to 1100 nm compatible
<b>Transmission</b>	Minimum 70%
	Objective dependent, size may vary depending on lens manufacturer
<b>FOV</b>	Accessible Reference FOV: 10x objective: 1980 x 1980 $\mu\text{m}$ ; 16x objective: 1375 x 1375 $\mu\text{m}$  Scan Multiplied FOV area: 10x objective: 215 x 215 $\mu\text{m}$ ; 16x objective: 150 x 150 $\mu\text{m}$
<b>IP License</b>	Boston University, Exclusive License: Scan Multiplier Technology for High-Throughput Scanning



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