MAI TAI

Compact
Ultrafast
Oscillators

Spectra-Physics
The Solid State Laser Company®
Since Spectra-Physics introduced the world’s first commercial mode-locked Ti:sapphire laser, the Tsunami®, in 1990, our customer base has expanded to a very diverse user group—requiring ever-simpler sources of ultrafast laser pulses. We responded to these new market demands with the introduction of the Mai Tai laser in early 1999—the first “one box” product to offer hands-free access to tunable femtosecond pulses. A new generation of Mai Tai lasers takes this concept a step further, providing the same turnkey simplicity with even greater reliability and ease of integration.

**Mai Tai™: The Ultimate Compact Ultrafast Laser Source**

The Mai Tai started with a simple idea: to provide a fully automated and computer-controlled ultrafast Ti:sapphire laser in a compact monolithic single-box configuration. The result is a briefcase-sized, all-solid state laser head that combines our award-winning Millennia® pump laser with Ti:sapphire laser technology based on the field-proven Tsunami. The Mai Tai is permanently aligned and sealed in a Class 100 cleanroom at the factory, eliminating the need for manual adjustment, optics cleaning or skilled maintenance.

This revolutionary product has made ultrafast laser pulses accessible to a broader customer base than ever before, from cell biology to novel uses in semiconductor manufacturing. Indeed, the Mai Tai is the first ultrafast laser that can be used as a simple computer-controlled tool for straightforward integration into industrial and OEM instruments.

**Compact, Seamless Integration**

The Mai Tai Advantage.

- The compact laser head enables the Mai Tai to be readily integrated into end-user systems.
- Advanced thermal management and a monolithic architecture ensure fast warm-up and reliable day-to-day operation.
- Manufactured in a clean room with advanced micro-optical components, the Mai Tai is permanently aligned and sealed—no adjustments, ever.
- With full computer control and a simple PC interface, the Mai Tai offers “hands-free” operation and is well suited for both research and OEM applications.
- Mai Tai offers fully automated broadband wavelength tuning. Regenerative mode-locking and a unique automated dispersion compensation scheme ensure excellent long-term stability and pulse width optimization.
- Use of a single ProLite™ pump diode enhances reliability and reduces overall cost of ownership.

**Reliable Solid-State Technology**

The Millennia is perfectly suited for integration into a sealed industrial head. It has the smallest footprint of any high power diode-pumped visible laser on the market and unlike alternative designs, it has no special cooling requirements. Furthermore, the latest Millennia now uses only a single FCbar™ pump module containing a ProLite™ diode array. This module is remotely housed in the power supply and is easily replaceable without disturbing the alignment of the Mai Tai. Since the pump diode is the only consumable in an all solid state laser, the use of a single pump diode reduces the overall cost of ownership, and maximizes system reliability. Moreover, ProLite represents the most advanced pump diode technology available today, and sets a new industry standard in
diode longevity, with typical lifetimes exceeding 10,000 hours.

The Mai Tai power supply is also on the cutting edge of technology and performance. This module now utilizes completely solid state technology with all thermal management of the pump diode accomplished by use of thermoelectric cooling—eliminating the bulk and moving parts of conventional cryo-cooling systems. As a result, this power supply is compact and electrically very efficient, and is even rack-mountable, saving valuable space in the laboratory or production floor.

The Mai Tai oscillator itself utilizes the same tried and trusted regenerative mode-locking method that is used in the Tsunami. An acousto-optic modulator within the laser cavity provides an active loss modulation and reliably stabilizes mode-locking over the entire Ti:sapphire wavelength range. This mode-locking technique enables broadband wavelength tuning with no pulse drop-outs whatsoever.

### Tunable Pulses with Automated Dispersion Control

The tunable Mai Tai delivers sub 100 femtosecond pulses that are continuously tunable over a broad wavelength range (750 to 850 nm, or 780 to 920 nm). At each wavelength, the intracavity dispersion is automatically adjusted, providing near-transform limited pulses throughout the entire tuning range. This requires no manual or external adjustments whatsoever—all that’s needed is a simple command through a user-friendly PC interface.

While the performance of the Mai Tai is cutting-edge, the packaging is distinctly industrial strength. With a sealed monolithic aluminum structure—a Spectra-Physics architecture that has been perfected over many years as a supplier of OEM laser systems—the Mai Tai is ideally suited for both research and OEM uses. It has already become the ultrafast oscillator of choice for seeding complex Ti:sapphire amplifier systems, while its broad tunability has ensured its wide acceptance as an excitation source in multiphoton microscopy. For example, the extended wavelength range to 920 nm allows efficient excitation of enhanced GFP (green fluorescent protein) for live cell imaging.

### Actively Stabilized Output Beam

The key to integrating any laser into a lab setting or OEM instrument is output beam pointing stability—the beam direction and output power should not change during normal operation of the laser. This is particularly true in ultrafast applications which can require complex downstream optical setups. The latest generation of Mai Tai lasers use a novel StabiLok™ active cavity stabilization system (patent pending). This ensures that the beam pointing direction remains virtually the same, even as the Mai Tai is tuned throughout its entire tuning range. At the same time, the StabiLok system delivers complete output power stabilization over a wide range of ambient temperatures.

### Simple User-Friendly Software Control

There are absolutely no buttons, switches or knobs on the Mai Tai laser head. All functions are controlled by a computer, through the user-friendly software interface. Convenient control via the RS-232 interface allows straightforward integration of the Mai Tai commands into end user software.
Multiphoton Imaging With Mai Tai.

The Mai Tai has already had a major impact on multiphoton imaging, becoming the light source of choice in many of these microscopy applications. Multiphoton excitation provides inherent z-axis spatial resolution, streamlining the acquisition of 3D image data. In addition, this technique significantly reduces light scatter and out-of-focus specimen bleaching that plague traditional confocal microscopy. With the latest tunable Mai Tai, researchers can quickly switch wavelengths to selectively excite different fluorophores, or scan the laser to record multiphoton excitation spectra. And thanks to StabiLok™ technology, there is no need to realign the excitation optics as the wavelength is changed.

“The Mai Tai is a femtosecond laser that is as easy to operate as the air-cooled ion laser supplied with a conventional confocal microscope. The output powers, pulse width, and tuning ranges of the latest Mai Tai laser are ideal for all of our multiphoton imaging applications, from UV-excited probes and calcium indicators to eGFP and three-photon excitation of intrinsic fluorophores such as serotonin and collagen.”