

# Latest Developments in Fiber Lasers and Multi laser Engines for Microscopy

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This presentation focus on ultrafast fiber lasers and multi-laser engines – compact and robust solutions for reliable hands-off operation as excitation light-sources for advanced microscopy and spectroscopy. We will present latest innovations and show how state-of-the-art microscopy techniques can benefit from these developments.

**Ultrafast fiber lasers** Nonlinear microscopy techniques require femtosecond lasers at high pulse energies to compensate for the low absorption probability and to prevent the investigated material from photo damage. Due to multiphoton absorption, these nonlinear imaging techniques (TPEF, SHG, THG) benefit from a deeper penetration depth and higher spatial resolution than conventional microscopy techniques. Therefore the number of nonlinear microscopy applications in general significantly raised throughout the last decade, since the usage of ultrafast lasers were not restricted to experts only due to the increasing availability of easy to use and hands-off operating fiber lasers. To satisfy the increasing demands of modern scientists Toptica launched the third generation of ultrafast fiber lasers. This novel FF ultra laser platform is capable to generate high power femtosecond pulse trains at a wavelength of 780 nm or 1050 nm at outstanding beam quality and stability. In the course of this work we present selected applications proofing for the high suitability of these scientific laser family for a broad variety of microscopic and spectroscopic applications. **Multi-laser engines** Gas lasers played an important role in laser-based microscopy for several decades. By now they have been replaced by more compact and better featured multi-laser engines, based on diode and DPSS laser technology. We will present TOPTICA's latest innovation in that area – the iChrome CLE – a laser engine featuring a proprietary FDDL (Frequency Doubled Diode Laser) as a laser source at 561nm. This concept allows an unmatched level of convenience and reliability for the user at an extremely competitive price point. Multi-laser engines provide several wavelengths to excite various dyes in a sample. The iChrome CLE is an easy-to-use solution for multi-color applications. It includes the four most prominent laser lines 405, 488, 561 and 640nm combined into one single mode polarization maintaining fiber output. Next to its siblings, the flexible iChrome MLE and the field upgradeable iChrome SLE it forms the iChrome family. The inherent challenge in multi-laser systems, the reliable laser-alignment, is solved by COOLAC, TOPTICA's proprietary automatic beam alignment technology that ensures highest, constant power without the need to ever manually align optics in the field