920 nm ultrafast fiber laser for nonlinear microscopy

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This presentation will focus on TOPTICAs novel ultrafast fiber laser FemtoFiber ultra 920 nm for applications in advanced microscopy and spectroscopy. In combination with the established FemtoFiber ultra 780 nm and 1050 nm, the new laser system will push nonlinear imaging techniques like TPEF, SHG microscopy, or CARS towards larger penetration depth, higher spatial resolution, or better label-free imaging capabilities.

Advanced optical microscopy and spectroscopy methods have become a key technology to investigate the structure and composition of biological samples at the cellular level. Using nonlinear optical processes like TPE, SHG or CARS for contrast generation provides large penetration-depth and higher-resolution as compared to conventional microscopy while minimizing photo damage due to the lower photon energy.

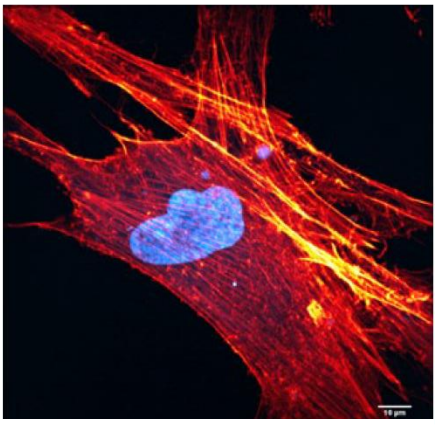

Figure 1: TPEF of human stem cell with ATTO594 labeled actin and DAPI labeled nucleus. The novel FemtoFiber ultra 920 is used for sample excitation. Image recorded in the research group of Prof. Thomas Hellerer at the University of Applied Sciences in Munich.

With the increasing availability of easy-to-use and hands-off femtosecond lasers, multiphoton microscopy and spectroscopy methods have become widely available. In medical or biological laboratories, fiber lasers have emerged to be the ideal choice since they are alignment-free and robust under harsh environmental conditions. However, the important wavelength region around 900 nm addressing specific fluorescent proteins and pulse durations as short as 100 fs remained a challenge for fiber lasers.

TOPTICA Photonics AG has now launched the third generation of ultrafast fiber lasers overcoming these limitations. The novel FemtoFiber ultra laser platform is capable of generating ultrashort pulses not only at a wavelength of 780 nm and 1050 nm, but also most recently at 920 nm, which enables the imaging of the popular green fluorescent protein (GFP) and its derivatives. This presentation will feature selected applications highlighting the suitability of the FemtoFiber ultra laser family for a broad variety of microscopic applications.