TUNABLE INFRARED FEMTOSECOND LASER FOR MULTI-PHOTON MICROSCOPY

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We report on a novel laser source, emitting high energy (20 nanoJoule) femtosecond pulses, in a broad spectrum (250 nanometers). This source is easily tuned from 950 to 1200 nanometers, without any laser adjustment, and delivers sub-300 femtosecond pulses with a 10 nanometers spectral width.

Using an infrared femtosecond laser as an excitation source in a multiphoton microscope offers many advantages, such as lower scattering in biological tissues, optimal wavelength of new intrinsically fluorescent proteins such as DsRed, or minimized auto-fluorescence [1]. Titanium:Sapphire lasers can be tuned to about 1000 nanometers but the operation is not always straightforward, and leads to a significant decrease in output power.

On the other hand, Ytterbium doped laser materials offer a number of attractive characteristics such as a large fluorescence bandwidth and a simple spectroscopic structure allowing for high efficiency and good thermal management. However, when compared to Titanium:Sapphire, Ytterbium based lasers usually have a much shorter tuning range. To overcome this limitation, we propose a new laser source, taking into account the recent developments in the field of holey, or microstructured optical fibers.

We report on a high energy, compact (600x200 mm), diode-pumped Yb:KGW femtosecond oscillator [2], coupled into a holey fiber, with minimum dispersion at approximately 1000 nm. The low dispersion of allows for spectral broadening while femtosecond pulse duration. This two-stage device is easily tuned in the range 950 -1200 nanometers spectral width.

Mouse hippocamp neurons (GFP and Alexa 568)