Solea

NEW

PicoQuant

Supercontinuum Laser

- Spectral range: 525 - 700 nm (ECO mode), 480 - 700 nm (BOOST mode)
- Supercontinuum output or wavelength selected output through built-in tunable bandpass filter
- Emission from a polarization maintaining singlemode fiber with FC/PC connector
- Externally triggerable 1 MHz to 40 MHz
- Internal oscillator: 1.25 MHz to 40 MHz (user selectable)
- Optimized timing / synchronization output for TCSPC or FLIM
- Supercontinuum average output power up to 100 mW (ECO mode) or 250 mW (BOOST mode)*
- Average spectral output power after wavelength selector up to 1 mW / 5 nm (ECO mode) or up to 2.5 mW / 5 nm (BOOST mode)*
- Pulse width down to 90 ps (wavelength and power dependent)

* at 40 MHz repetition rate

Applications

- Time-resolved fluorescence spectroscopy / microscopy (FLIM, FRET)
- Stimulated Emission Depletion Microscopy (STED)
- Multicolor excitation (PIE / ALEX)
- Single molecule spectroscopy (FCS / FLCS, Antibunching)

General Description

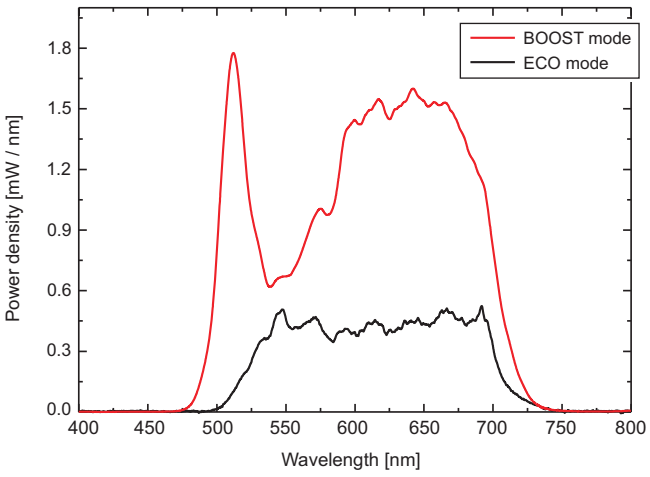
Solea is a stand alone, computer controlled, supercontinuum laser source with an unmatched flexibility in repetition rates. The laser includes a tunable bandpass filter for wavelength selection and emits from a polarization maintaining singlemode fiber with FC/PC connector. It is based on a unique combination of gain-switched, fiber-amplified laser diodes with exclusive, patented fiber pumping control and a well established, state-of-the-art photonic-crystal fiber for supercontinuum generation.

Variable repetition rates up to 40 MHz
A special feature of the Solea is the capability to be operated at various, freely adjustable repetition rates between 1 MHz and 40 MHz. The repetition rates can be either selected using an internal oscillator, which provides six fixed, user selectable repetition rates between 1.25 MHz and 40 MHz. Alternatively, the Solea can even be externally triggered at any repetition rate between 1 MHz and 40 MHz. This unique feature permits to synchronize the Solea with other lasers for e.g. multicolor excitation schemes. The extinction between each pulse is complete, and classical, contrast limited pulse pickers are not needed.

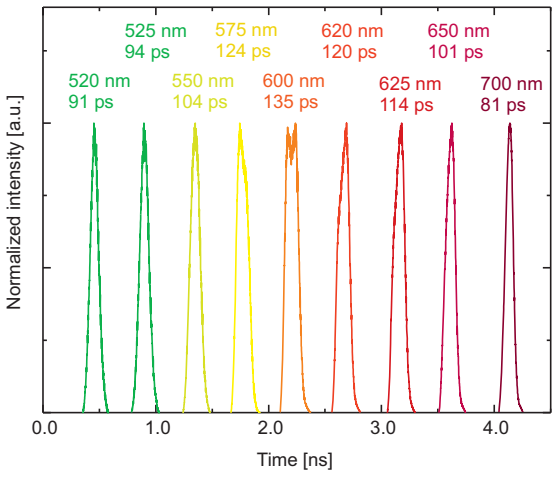
Integrated emission wavelength selector
The Solea is delivered with an integrated dedicated emission wavelength selector based on tunable bandpass filters. The filters feature a high side mode suppression ratio of greater than OD 5 (50 dB), which makes it even suitable for single molecule detection. The wavelength selector permits to set the central emission wavelength as well as the width of the spectral emission to any value between 3 nm and 15 nm. It can also be bypassed in order to have access to the available supercontinuum spectrum.

Polarized emission in the VIS down to 480 nm
The Solea emits from a polarization maintaining singlemode fiber and can be operated in two modes: ECO and BOOST. In ECO mode, the stress induced in the photonic-crystal fiber is lower than in the BOOST mode. In ECO mode, the Solea features a usable spectral range between 525 nm and 700 nm. The average spectral output of the supercontinuum reaches more than 100 mW after the emission fiber at 40 MHz repetition rate, which corresponds to an average spectral density of 0.4 mW / nm. After the emission wavelength selector an average output power of 1.0 mW at 40 MHz repetition rate is available for a 5 nm wide spectral bandwidth.
The Solea can also be operated in BOOST mode, which extends the available spectral range down to 480 nm. The average spectral output of the supercontinuum then reaches more than 250 mW after the emission fiber at 40 MHz repetition rate, which corresponds to an average spectral density of 0.4 mW / nm. After the emission wavelength selector an average output power of 2.5 mW at 40 MHz repetition rate is available for a 5 nm wide spectral bandwidth.

Pulse width down to 90 ps
The output pulse width depends on the output power and selected emission wavelength. It is typically around 150 ps (FWHM) and can reach 90 ps (FWHM) for certain wavelengths. Each pulse is accompanied by a corresponding timing optimized synchronization signal, which can be used to trigger other components such as TCSPC electronics.

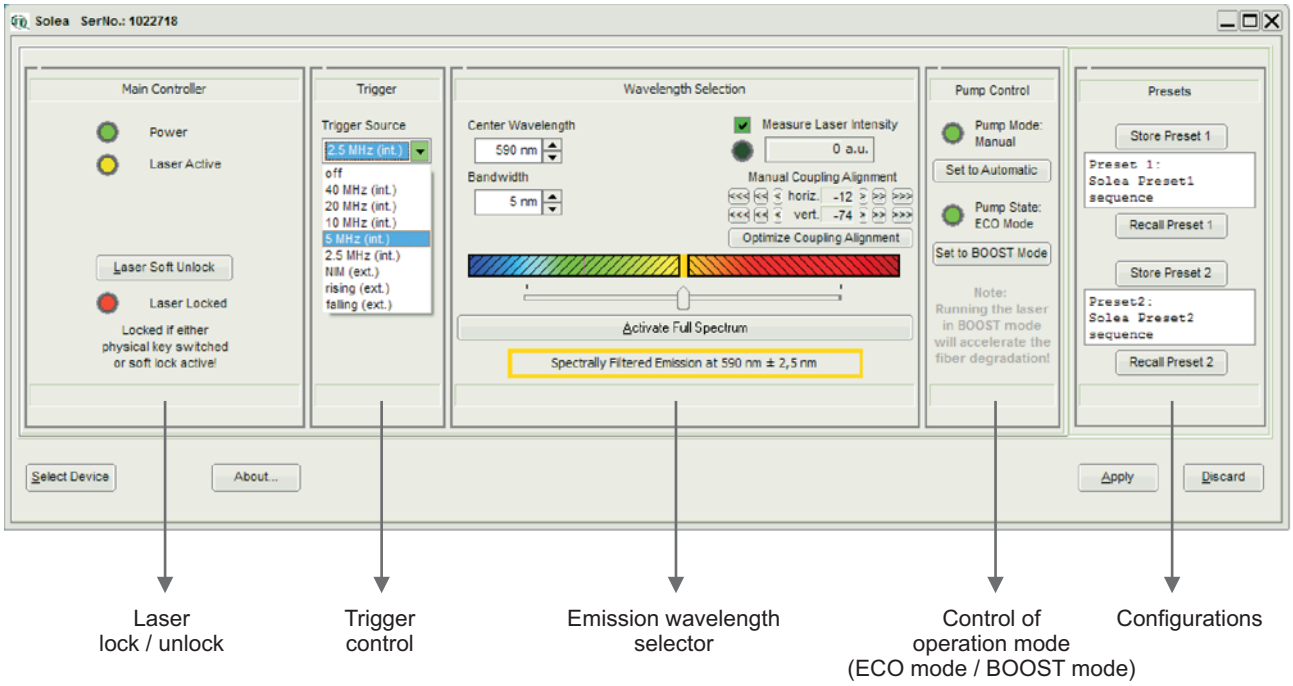


Power density of the supercontinuum output in ECO mode (black curve) at 40 MHz repetition rate. When switching into BOOST mode (red curve) the spectral range extends down to 480 nm and the power density increases (wavelength and usage dependent).



Pulse profiles and pulse widths (FWHM) at different central wavelengths after the emission wavelength selector. The spectral bandpass was set to 5 nm. The Solea was operated in ECO mode.

Full computer control via easy-to-use GUI
The Solea is completely computer controlled by an easy-to-use graphical user interface (GUI) for Windows. The software allows to control pulse repetition rate, operation mode as well as central wavelength and spectral width of the output. Different settings can be pre-defined and saved for an easy change of configurations. A library for custom programming is also provided and allows access to all functions of the Solea from, e.g., LabView or other programming languages.



Laser lock / unlock

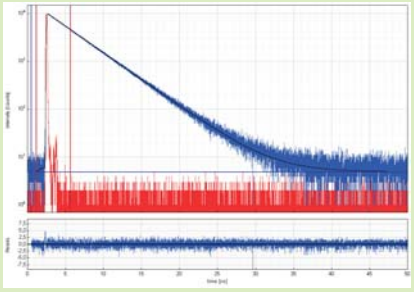
Trigger control

Emission wavelength selector

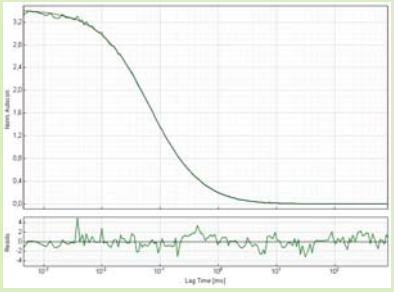
Control of operation mode (ECO mode / BOOST mode)

Configurations

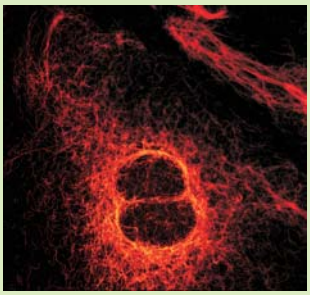
Application Examples



Fluorescence lifetime measurements of ATTO 555 in ethanol. The sample was excited at 550 nm using a spectral bandwidth of 5 nm and a repetition rate of 20 MHz. Data was collected using the TCSPC based spectrometer FluoTime 300. Data analysis using numerical reconvolution resulted in a single liftetime of 3.87 ns (χ^2=1.07).



Fluorescence correlation spectroscopy (FCS) of ATTO 655 in water. The sample was excited at 630 nm using a spectral bandwidth of 5 nm and a repetition rate of 10 MHz. Data was collected using the confocal microscope MicroTime 200. The correlation curve can be nicely fitted and the amplitude of zero at long lag times proves the high stability of the laser output.



STED microscopy using the Solea laser for excitation. The image shows vimentin fibers stained with ATTO 565 via primary and secondary antibodies. A lateral resolution of approx. 50 nm is obtained, which can be expected for a fiber with a diameter of 10 nm, covered by antibodies with a diameter of approx. 8 nm each. (Data courtesy of J. Engelhardt and S.W. Hell, DKFZ Heidelberg, Germany)

Specifications

Optical output after emission fiber
Spectral range (- 3 dB bandwidth). . . . . 525 nm - 700 nm (ECO mode)
480 nm - 700 nm (BOOST mode)
Pulse width (wavelength and output power dependent) . . . . . min. 90 ps; typ. 150 ps; max. 230 ps
Output fiber . . . . . polarization maintaining fiber with FC/PC connector and endcap, length: 3 m

Supercontinuum output after delivery fiber
Average output power @ 40 MHz repetition rate. . . . . > 100 mW (ECO mode)
> 250 mW (BOOST mode)
Average spectral power density @ 40 MHz repetition rate . . . . . 0.4 mW / nm (ECO mode)
1 mW / nm (BOOST mode)

Output after emission wavelength selector
Bandwidth tunability . . . . . 3 nm to 15 nm (FWHM)
Average output power @ 40 MHz repetition rate . . . . . 1 mW (ECO mode, 5 nm bandwidth)
2.5 mW (BOOST mode, 5 nm bandwidth)

Repetition rates
Internal
Range . . . . . 1.25, 2.5, 5, 10, 20, 40 MHz (user selectable)
External via NIM input
Range . . . . . 1 MHz to 40 MHz
Trigger level . . . . . fixed trigger level at - 400 mV
Connector . . . . . NIM-CAMAC
External via TTL input
Range . . . . . 1 MHz to 40 MHz
Amplitude . . . . . - 5 to + 5 V (maximum limits)
Trigger level. . . . . adjustable between - 1 V and + 1 V
Connector . . . . . BNC

Synchronization output
Amplitude . . . . . < - 800 mV into 50 Ohms (NIM)
Connector . . . . . SMA

Dimensions
Base unit . . . . . 465 × 425 × 285 mm (w × d ×h)
Weight . . . . . 32.6 kg

Operation
Operating system . . . . . Windows XP / Vista / 7 / 8
PC interface . . . . . USB 2.0
Temperature range. . . . . 10 °C - 35 °C
Maximum power consumption . . . . . 375 W

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