

FEMTOPOWER™

Ultrafast Multipass Amplifiers

| sub-20 fs | 1 - 10 kHz | up to 10 W | CEP stabilized | High contrast |

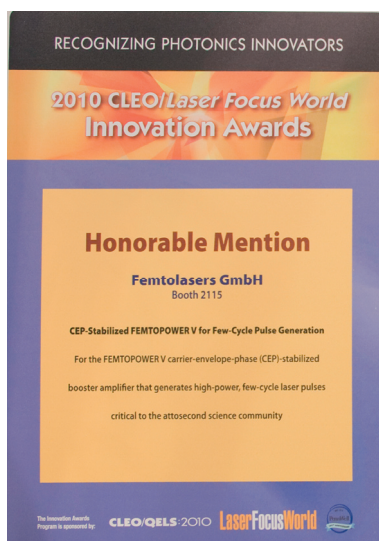
Applications

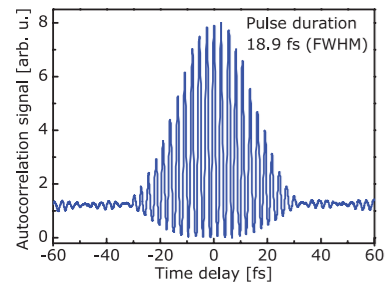
High Harmonics & X-ray generation
 Attoscience
 Ultrafast spectroscopy
 Femtochemistry
 Frontend for TW & PW systems
 Coherent THz generation
 Materials processing
 OPCPA seeding & pumping
 OPA pumping



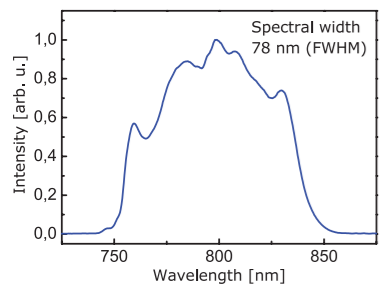
The FEMTOPOWER™ family of ultrafast multipass Ti:Sapphire amplifiers is designed as the optimal light source for the most demanding applications. The FEMTOPOWER™ is the only amplifier consistently proven to provide outstanding CEP stability in a reliable and user-friendly configuration over the longest period of time.

FEMTOPOWER™ incorporates FEMTOLASERS unique patented key technologies, such as the state-of-art FEMTOSOURCE™ rainbow™ DFG seed oscillator. Systems not requiring CEP stabilization are seeded by the likewise successful FEMTOSOURCE™ synergy™ PRO or INTEGRAL™ element™ PRO oscillators. The sub-20 fs provided by the FEMTOPOWER™ PRO set yet a new benchmark in terms of pulse duration.

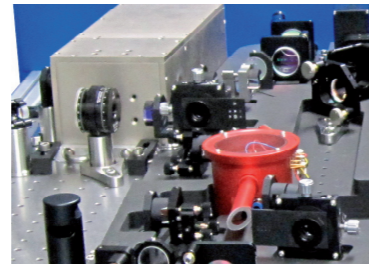




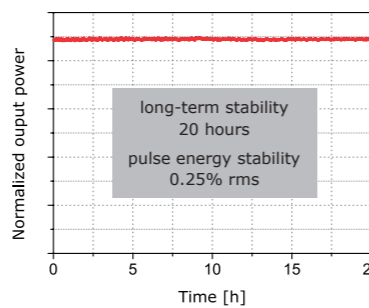
Shortest pulse duration is guaranteed by the large spectral bandwidth in combination with excellent dispersion management. The FEMTOPOWER™ PRO supports more than 70 nm FWHM bandwidth and pulses shorter than 20 fs.



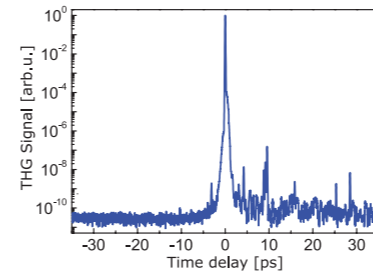
The compact & robust monolithic glass stretcher offers virtually **unlimited bandwidth**, transmission and stability unparalleled by any other design. The unique compact transmission grating compressor leads to unmatched mechanical and thermal stability and overall efficiency exceeding 80 %.



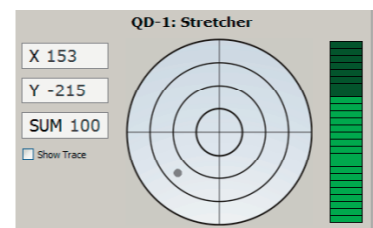
Compact oscillator & amplifier designs lead to a small overall footprint and maximum mechanical stability. Both seed oscillator and core multipass amplifier reside on temperature stabilized base plates to minimize warm-up time and maximize long term stability.



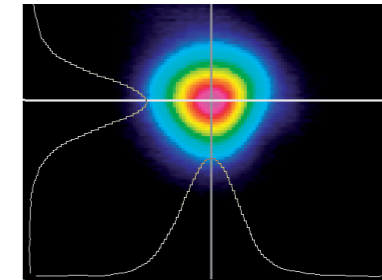
The FEMTOPOWER™ system design is based on numerous patented FEMTOLASERS key technologies and ensures outstanding **long term stability**. It allows strongly decreased dependence on the laboratory environment, resulting in prime performance every day.



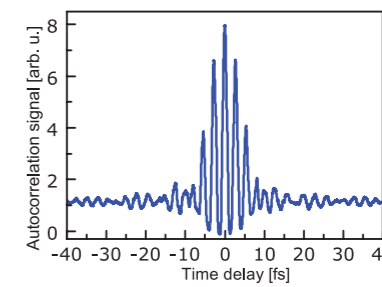
Unequaled pulse quality is ensured by the Dispersive Mirror based seed oscillator and accurate quantitative dispersion management in the amplifier. This leads to cleanest pulses and highest pulse-to-ASE **contrast ratio** on the market. Outstanding CEP stability of the FEMTOPOWER™ is guaranteed by FEMTOLASERS sound dispersion management.



Each FEMTOPOWER™ is equipped with sub- μm accurate BEAMWATCH™ position detectors to ease alignment. To further increase **user-friendliness** each system can be equipped with our BEAMALIGN™ active beam pointing stabilization.



FEMTOPOWER™ amplifiers are equipped with VACTEC™ or VACOOL™, powerful crystal cooling systems dramatically reducing thermal lens effects while avoiding vibrations. The result is an excellent **beam profile** and fast cool down time without adversely affecting the CE-Phase stability.



FEMTOPOWER™ systems can be equipped with the KALEIDOSCOPE™ hollow fiber compressor. This unique device generates **few-cycle pulses**, maintaining CEP stability. It already has become the workhorse for attosecond and HHG experiments.

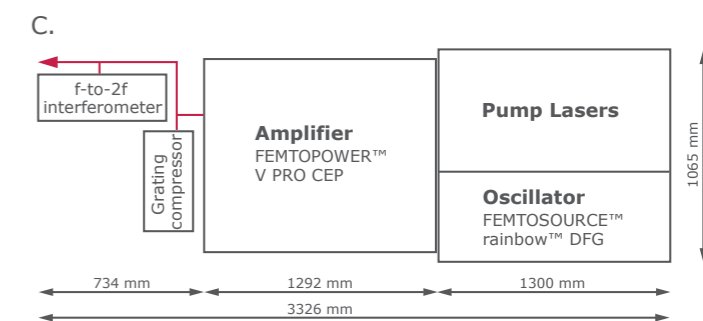
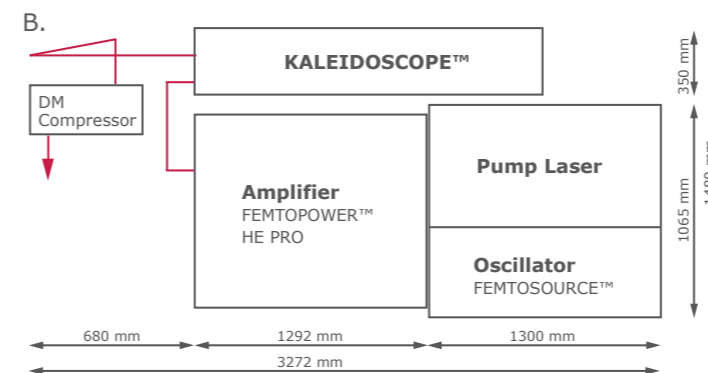
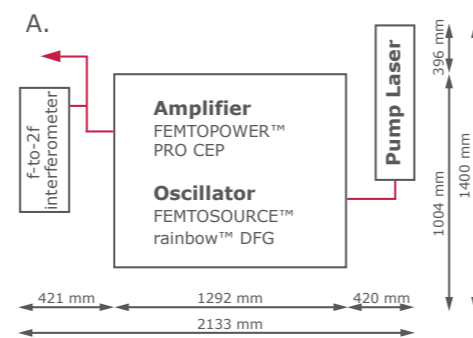
FEMTOPOWER™	compact™	HR	HE	HE/HR	HE/HR ²	V	X	optional		
								1 st amplification stage	Oscillator output	
									CEP	non CEP
Pulse duration								< 30 fs	< 7 fs	< 12 fs < 10 fs
Spectral width (FWHM) @ 800 nm								> 40 nm	> 260 nm @ -10 dB	> 80 nm > 100 nm
Pulse energy (mJ)	0.8	0.8 0.5	1.6 2	1.6	3	5	10	> 800 μJ	> 2.6 nJ	2.3 nJ - 9 nJ
Repetition rate (kHz)	1	3 4 5 10	1	3	3	1	1	1	75 MHz	75 MHz
Peak power	> 25 GW	> 25 GW > 15 GW	> 50 GW > 65 GW	> 50 GW	> 0.1 TW	> 0.16 TW	> 0.33 TW	> 25 GW	> 380 kW	220 kW - 900 kW
Beam diameter	15 - 20 mm	15 - 20 mm	20 mm	20 mm	20 mm	25 mm	35 mm	15 - 20 mm	< 2 mm	< 2 mm
Beam pointing stability optional active stabilization	< 10 μrad rms @ full beam diameter							< 10 μrad rms @ full beam diameter	-	-
Spatial mode	TEM ₀₀ ($M^2 < 1.6$)							TEM ₀₀ ($M^2 < 1.6$)	-	TEM ₀₀ ($M^2 < 1.3$)
Polarization	linear, vertical							linear, vertical	linear, horizontal	linear, horizontal
Pulse to pulse energy stability	< 1.5 % rms							< 1.5 % rms	< 0.1 % rms	< 0.1 % rms
Temporal contrast ASE ¹⁾	< 1:10 ⁻⁹			< 1:10 ⁻⁸			< 1:10 ⁻⁷	< 1:10 ⁻⁹	-	-
CEP stability over 3 hrs (rms single shot) ¹⁾	< 200 mrad			< 300 mrad			< 200 mrad	-	-	-
PRO ¹⁾	< 20 fs < 25 fs	< 20 fs ²⁾ < 25 fs ³⁾	< 20 fs < 25 fs	< 20 fs < 25 fs	< 20 fs < 25 fs	< 25 fs	-	< 20 fs < 25 fs	-	-

¹⁾ optional ²⁾ 3 kHz only ³⁾ 3 | 4 | 5 kHz only

All specifications are subject to change without notice

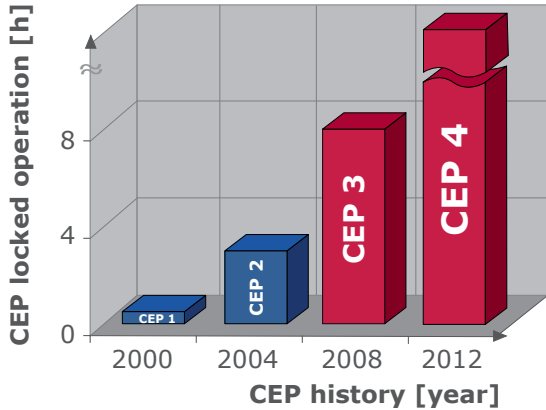
Complete default layouts for FEMTOPOWER™ amplifier system configurations

- A. FEMTOPOWER™ PRO CEP with integrated seed oscillator
- B. FEMTOPOWER™ HE PRO with KALEIDOSCOPE™ (option)
- C. FEMTOPOWER™ V PRO CEP two stage CEP stabilized amplifier

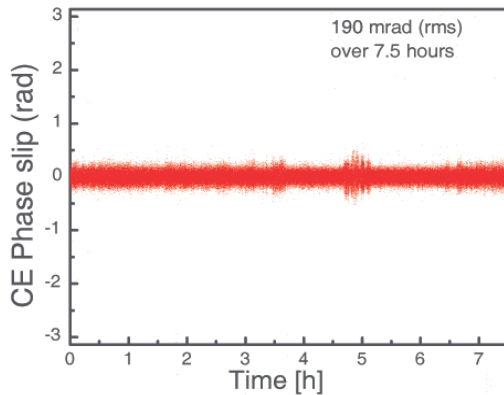


FEMTOPOWER™ CEP

Setting the world's new standards



FEMTOPOWER™ V PRO CEP
CE-Phase stability single shot measurement



FEMTOLASERS Produktions GmbH

is the indisputable leader in CEP stabilized ultrafast oscillators and amplifiers. We are the only manufacturer capable of supplying reliable and high quality CEP stabilized ultrafast laser systems. Contact us to discuss your individual system configuration.

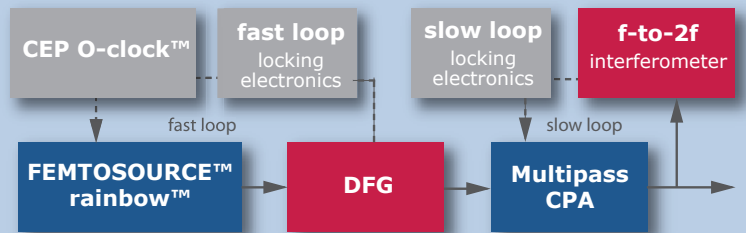
We LIVE in an ULTRAFAST world™
join us !

Solid CEP control

The FEMTOPOWER™ ultrafast amplifiers are based on unique design elements in a multipass configuration. Their unsurpassed performance is a prerequisite for a solid CEP control: the complete system benefits from outstanding active and passive stability. With more than 55 systems already installed in the most renowned laboratories, the FEMTOPOWER™ CEP has evolved to be the first and only choice among scientists worldwide.

CEP3 | Stabilization technology today

FEMTOLASERS exclusive CEP3 generation of ultrafast laser systems is based on independent CEP stabilization of both the FEMTOSOURCE™ rainbow™ DFG seeder and the FEMTOPOWER™ amplifier. Alternative manufacturers still rely on CEP1 dating back to FEMTOLASERS early days in CEP, a decade ago.



- Dispersive Mirrors
- Large bandwidth
- CE-Phase decoupled from beam position
- Monolithic setup
- PPLN based
- Enhanced S/N ratio
- Min. dispersion
- Min. CE-Phase distortion

Patent WO2007149956
A. Verrhoefer | dliss. | Munich (2006)

CEP4 | The direct feed forward approach

FEMTOLASERS is already developing tomorrow's CE-Phase stabilization scheme CEP4

- significantly lower CEP jitter
- chosen set point of CEP offset, incl. $f_{CE}=0$
- no complicated electronics
- free-running oscillator
- CEP drift corrected on-the-fly

S. Koke et al., Nature Photonics 4, p. 462-465 (2010)
FEMTOLASERS patent