UFI UltraFast Innovations

IFNANO INSTITUT FÜR NANOPHOTONIK

YOUR KEY to innovation and success

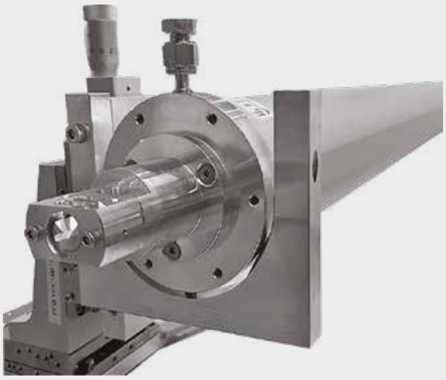
High power stretched flexible hollow core fiber pulse compressor

SAVANNA-HP

SAVANNA-HP is designed to meet the utmost demands of those seeking to achieve high power laser compression, with the ability to compress the original laser pulse duration to unprecedented levels of up to 5-30 times down to the few-cycle regime while maintaining an excellent beam profile and with superior spectral homogeneity.

SAVANNA-HP is the result of a collaboration between UltraFast Innovations (UFI®) and the Institute for Nanophotonics in Göttingen IFNANO. The stretched flexible hollow core fiber (SF-HCF) compressor spectrally broadens high-energy femtosecond input pulses by non-linear interaction with a noble gas of adjustable gas pressure inside a hollow core fiber and subsequently compresses the pulse using chirped mirror technology from UFI.

The state-of-the-art SF-HCF assembly from IFNANO stands out from standard stretched fiber technologies due to its ease of alignment. The technique allows nearly ideal wave guiding reducing the losses to a minimum and accumulation of self-phase modulation over an interaction length of up to 8 m. Moreover, it allows extreme input parameters of energies beyond 10 mJ and average powers beyond 100 W. The design includes an enclosed assembly that makes it extraordinarily robust as well as a high-power shield that reduces the risk of fiber damage.



Combining the SF-HCFs from IFNANO and UFI's chirped mirror technology, we provide an unmatched pulse compression unit for today's state of the art lasers.

Key Product Features:

- Individually tailored ensuring optimal performance
- Input pulse duration: <20 fs up to hundreds of fs
- Input pulse energy: up few tens of mJ
- Typical compression factor: 5-30 x
- Fiber transmission: close to the theoretical limit, up to >90%
- Fiber length: up to 8 m
- Supported input peak power: Up to 400 GW at 10 W average power
- Supported input average power: Up to several hundred Watts at 125 GW peak power
- High-power shield: increases the lifetime of the fiber. No fiber replacement needed if handled properly
- Active cooling for average powers > 20 W
- Footprint: 300-1200 cm x 60 cm

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UltraFast Innovations is a spin-off from the LMU Munich and the Max Planck Society.

Customization options:

- Variable spectrum selection
- Flexible dispersion management
- Custom reflective mirror telescope with astigmatism compensation
- Custom TOD compensation mirrors
- In-coupling / Out-coupling chamber with Z-lock unit
- Pressure-stabilized single/double differentially pumped setup
- Active beam pointing stabilization unit

Ultra-broadband Chirped Mirror Technology:

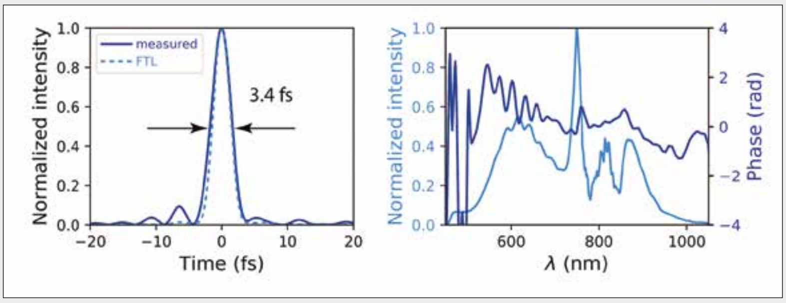
UFI's ultrabroadband chirped mirrors are a key component of the hollow core fiber compressor, providing unprecedented broadband compression. As an example, our PC70 and PC1332 mirrors have been proven to produce pulses with a duration of < 3 fs for an 800 nm input beam. Custom solutions for specific spectral coverage and selection are available.

Typical configurations:

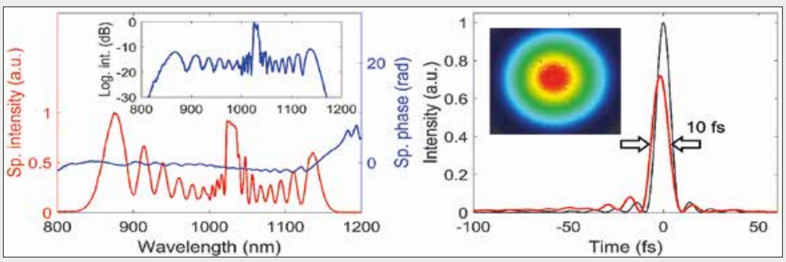
	Conventional	Special		Complex		Extreme
Max. peak power	125 GW	250 GW	125 GW	400 GW	125 GW	400 GW
Max. average power	10 W	10 W	20 W	10 W	100 W	> 100W
Max. fiber length	3 m	4 m		6 m		8 m
Max. lenght of assembly	6 m	7 m		9 m		12 m
Typical transmission*	80 %	75 %		70 %		65 %
Typical spectral broadening	15 x	20 x		30 x		30 x

* at 800 nm with max length, a fiber core of 400 µm and near ideal caustic.

Temporal and spectral pulse characteristics:



Left: Retrieved temporal profile and ideal Fourier transform limited shape (FTL).
Right: Fiber output spectrum supporting 2.9 fs pulses. Input: 24 fs & 10 mJ into 2.5 m fiber, reprinted/adapted from [1].



Left: Spectrum (red) after broadening in a 6 m SF-HCF fiber and phase (blue) after compression.
Right: Retrieved compressed pulse (red) and Fourier transform limited shape (black). Inset: output beam profile. Results achieved by coupling 300 fs & 580 W into a 6 m fiber. Output: 318 W in compressed 10 fs pulses, reprinted/adapted from [2].

References:

[1] M. Ouillé et. al, Relativistic-Intensity near-Single-Cycle Light Waveforms at KHz Repetition Rate, Light Sci. Appl. **9**, (2020).

[2] T. Nagy et. al, Generation of Three-Cycle Multi-Millijoule Laser Pulses at 318 W Average Power, Optica **6**, (2019).