

Novel Fiber Coupling

With Ultrashort-pulse Lasers

Chromacity's next generation of ultrashort-pulse lasers are optimising power delivery, with minimal additional nonlinearities and dispersion, using novel hollow-core fiber coupling technology.

Fiber Coupling

Fiber delivery methods can maximise performance and reduce the number of components required to couple light into a system. There are careful considerations however, related to fiber selection, before achieving these efficiency gains.

Single-mode guidance and high power handling are typically desired. Both aspects require high coupling efficiency from a laser source with high beam quality. For ultrashort pulse sources, maintenance of the pulse duration and temporal quality are also essential.

Hollow-core Fiber

Degradation of high power ultrashort pulses will occur in standard single-mode fibers due to the confinement within a single-mode glass core, thus resulting in high nonlinearities and high dispersion.

Hollow core fibers are designed to confine light in an air core rather than a glass core. This significantly reduces the fiber's nonlinearities, and in some designs the dispersion, while essentially still offering the guiding benefits of an optical fiber.

Specifications

Laser* & Fiber Coupling Specifications	
Average output power	4 W
Wavelength	1035 nm
Pulse duration	123 fs
PRF	99.96 MHz
Connectors	FC or SMA
Transmission efficiency	Up to 99%
Input energy @100fs	< 1 μ J
Input power	< 5 W
Polarisation purity**	> 100:1

Fiber Specifications	
Inner core diameter	57 μ m +/-1 μ m
Outer fiber diameter	320 μ m +/-3%
Attenuation @ 1030 nm	< 100 dB/km
Dispersion @ 1030 nm	1 ps/nm.km +/-0.5
Transmission band	300 nm
Mode field diameter (1/e ²)	39 μ m +/-1
3 dB bend loss radius at 1030 nm	5 cm +/- 2

*Laser specifications based on the Chromacity 1040.

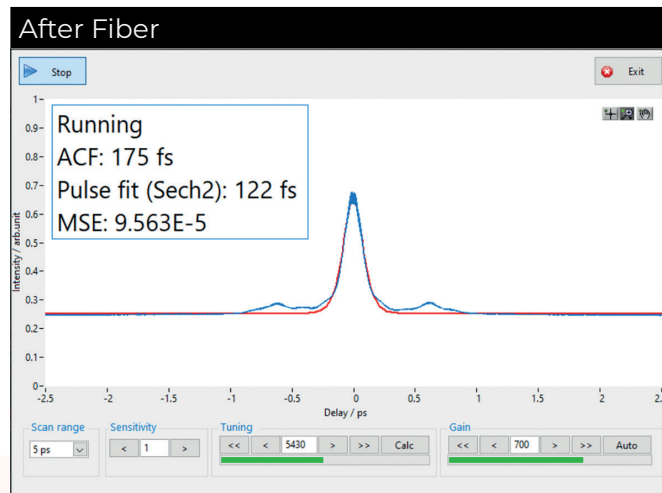
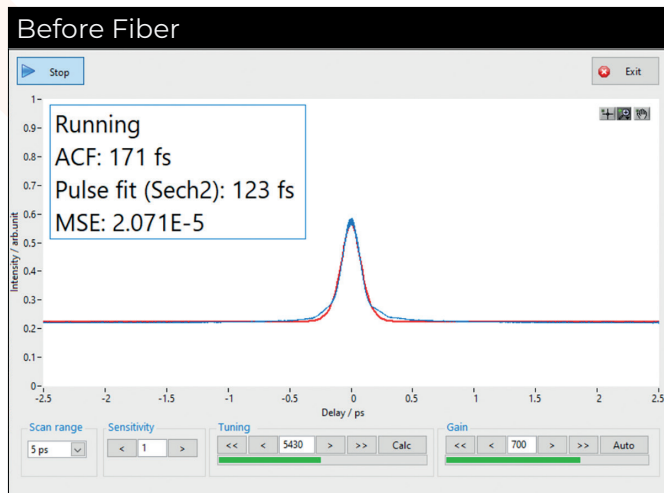
**Polarisation purity >100:1 when s/p orientation optimised with half-wave plate after fiber output.

In this factsheet, we demonstrate high-power retention with near-zero dispersion characteristics by coupling hollow-core fiber, from free-space, using our Chromacity 1040 femtosecond laser.

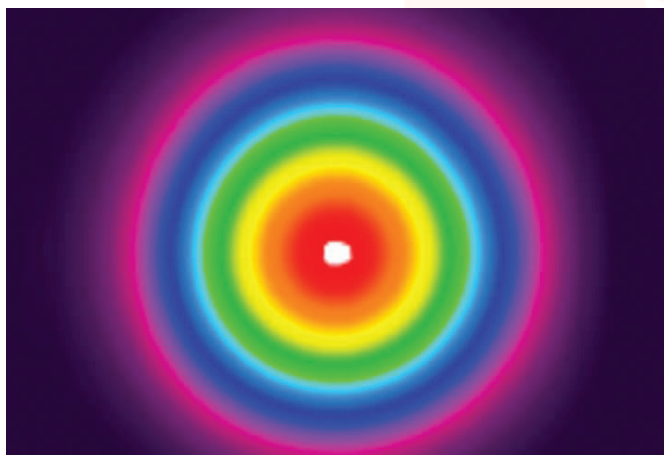
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Pulse Shape



Beam Profile at Fiber Output



Chromacity has demonstrated near single-mode guidance with high power ultrashort-pulse systems at 99% transmission efficiency and minimal degradation to the output pulse quality due to the air guiding nature of the hollow core fiber employed.

Applications

- Fiber delivery can be deployed directly into tissue within life science imaging.
- Integration with multiple microscopes and standard connectors broaden the choice of systems.
- Fiber delivery can be deployed in industrial settings, where operational space is restricted. Fiber length can determine the location of the laser head.

Summary

- Exceptional coupling efficiency achieved (99%)
- Near single mode guidance achieved
- High output power and energy levels retained
- Low dispersion during power scale-up
- Broad spectral wavelength coverage
- Excellent beam profile maintained
- No heating affects or laser-induced damage

For more information about our ultrafast lasers and fiber delivery capability, contact: sales@chromacitylasers

