GLOphotonics

The Hollow-Core PCF & Photonic MicroCell™ company

Hollow Core Photonic Crystal Fibers: Guiding the Ultrafast Lasers

Jean Sauvage-Vincent

CEO

EPIC Technology Meeting on Specialty Optical Fiber - Lannion 12-13 June 2024

EPIC

EUROPEAN PHOTONICS INDUSTRY CONSORTIUM

GLOphotonics: The company

A French ***deep-tech*** company based in Limoges. Incubation in Bath, UK (**2008**). Transfer to and re-incubation in Limoges (**July 2011**). Trading activities in **2013**

Development & supply of ***photonic components***, modules and/or systems based on a ***proprietary Technology***

150 m² clean room (ISO-07)

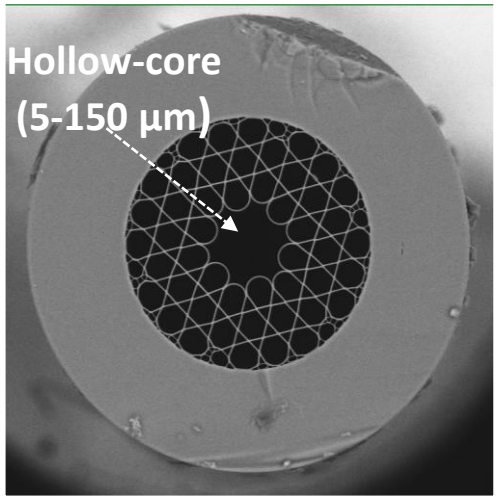
2 drawing fiber towers, unique chain of fiber postprocessing

~20 employees. 80% in R&D, 12 PhD+

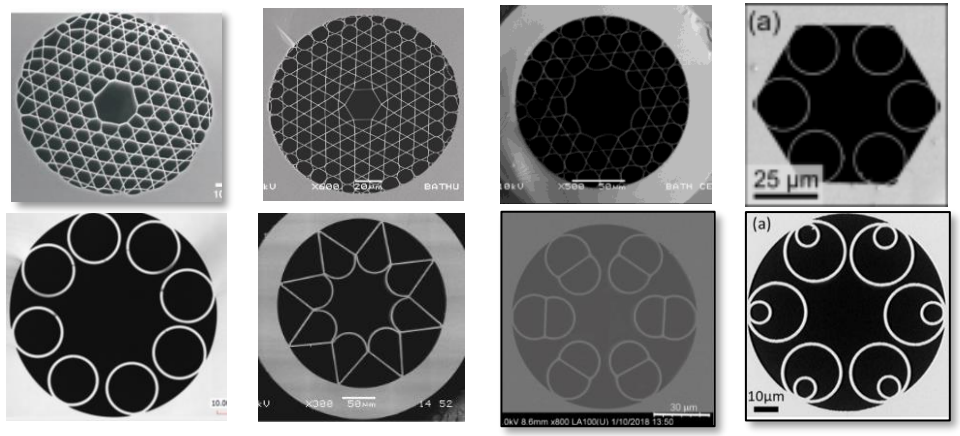
Strategic partnership with CNRS (French National Agency)

Offering ***multi-sector markets high added-value*** products & services that are without equal and first of their kind.

GLOphotonics: the technology Hollow Core Photonic Crystal Fiber (HCPCF)

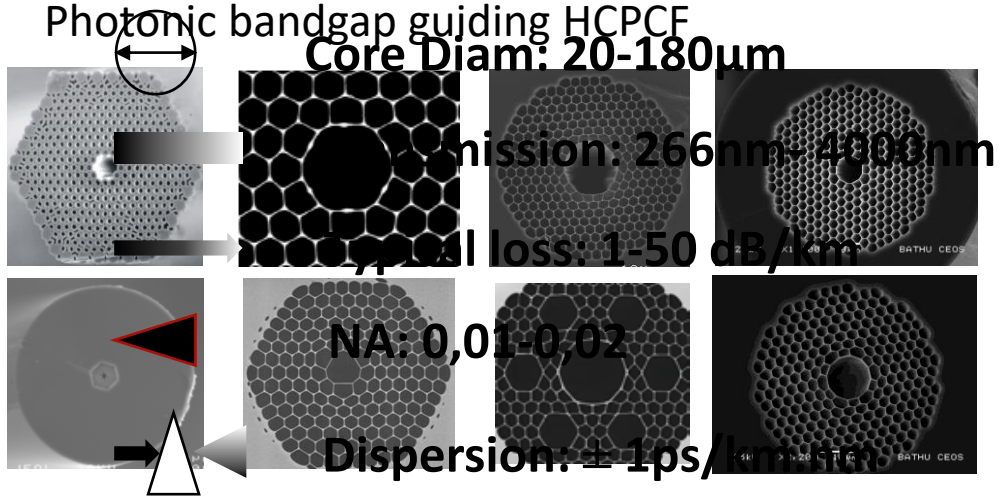


Inhibited-coupling / anti-resonant HCPCF



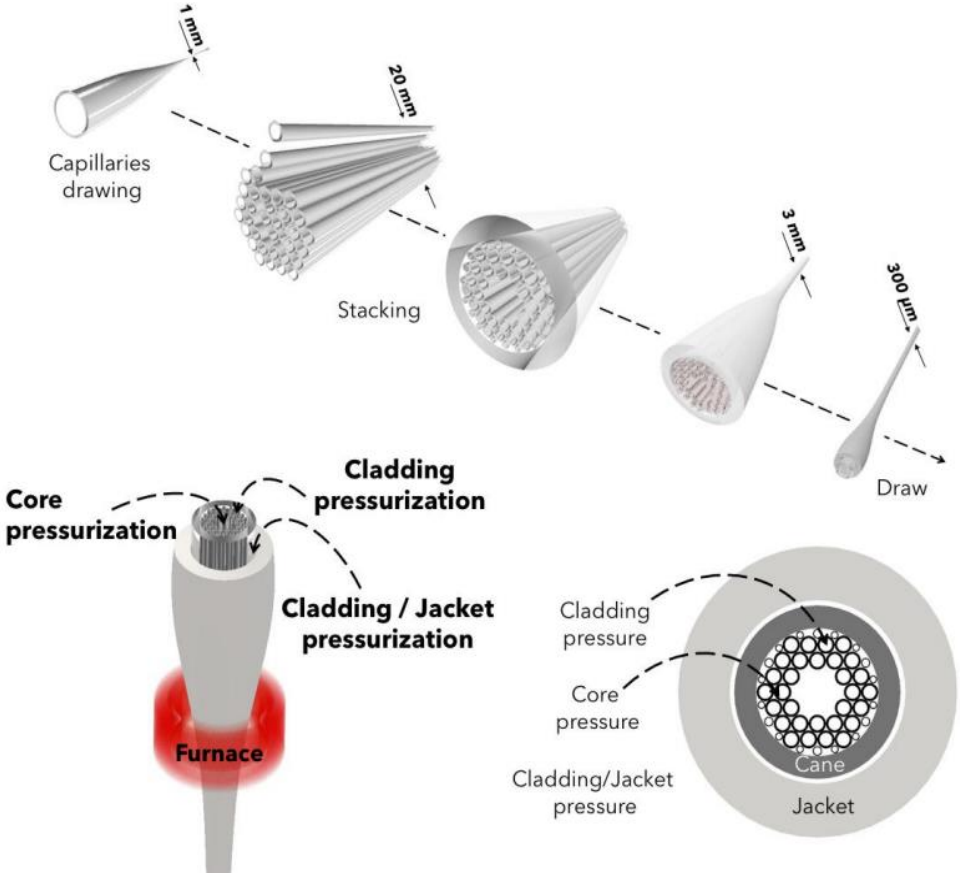
HCF
Ideal for any laser from fs to CW

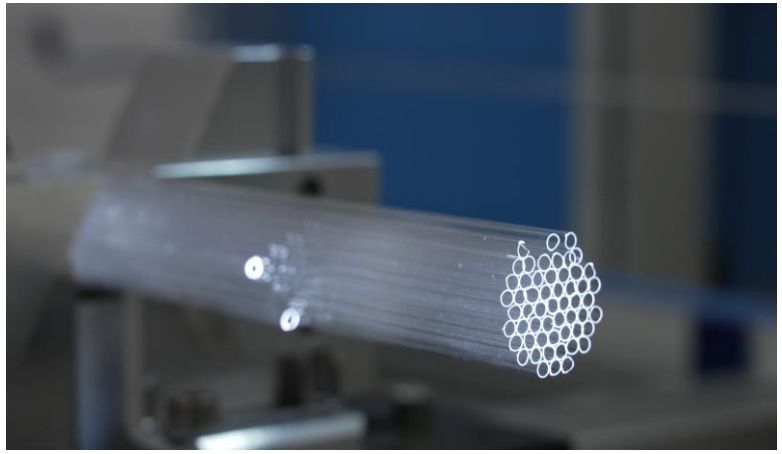
Photonic bandgap guiding HCPCF

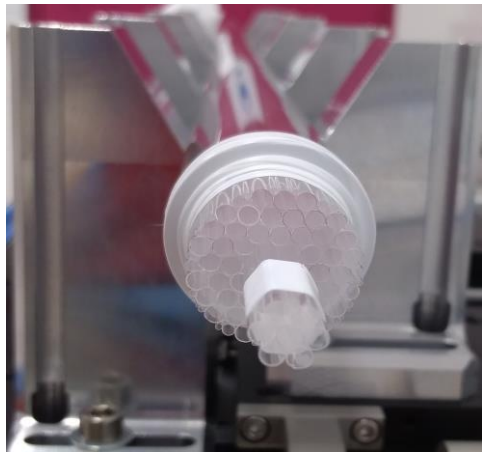


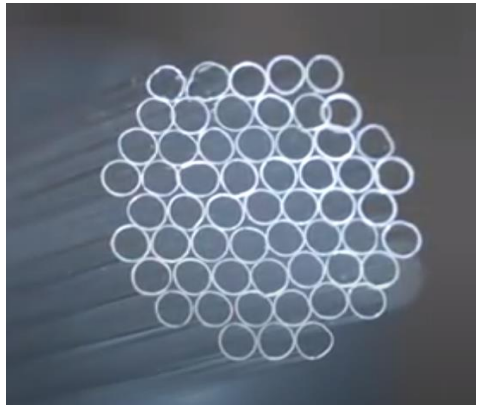
PBF
Ideal for very low power/energy laser

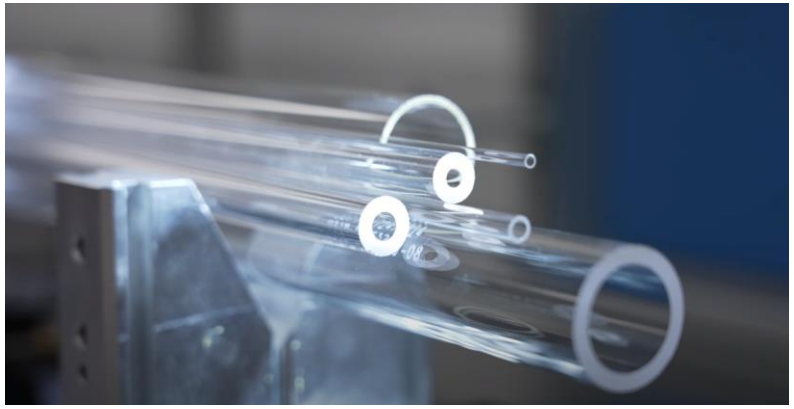
GLOphotonics: infrastructure and know how



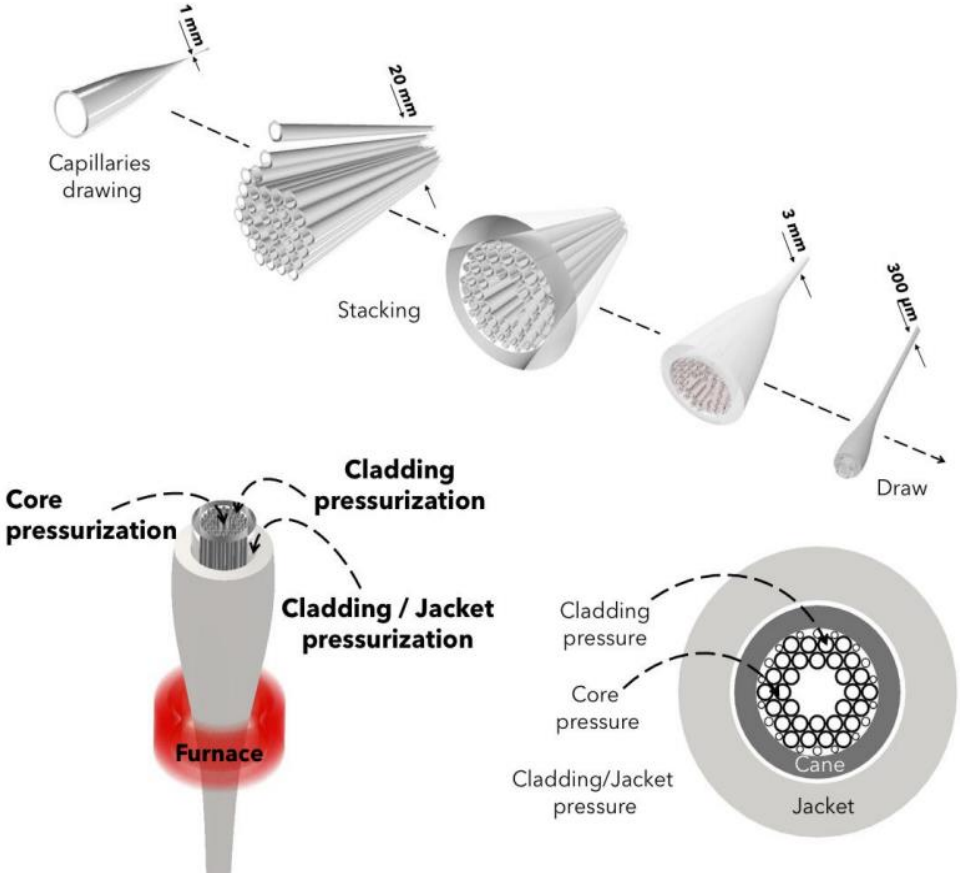


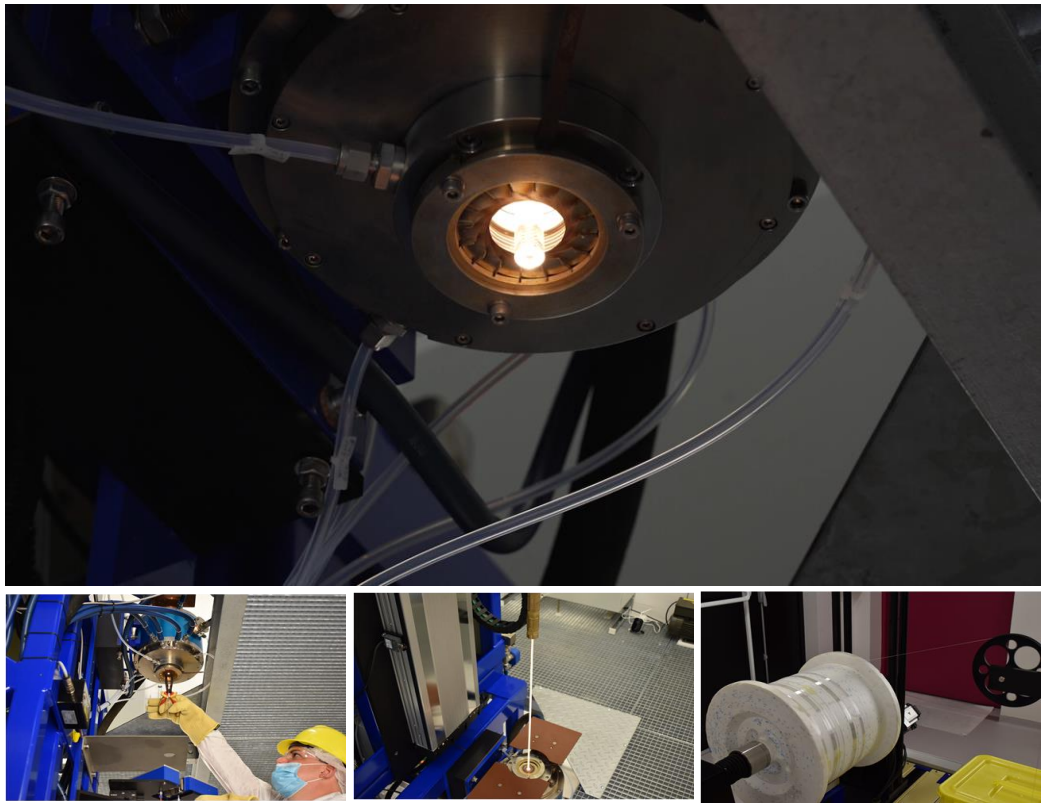






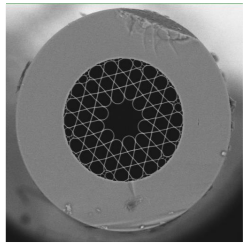
GLOphotonics: infrastructure and know how



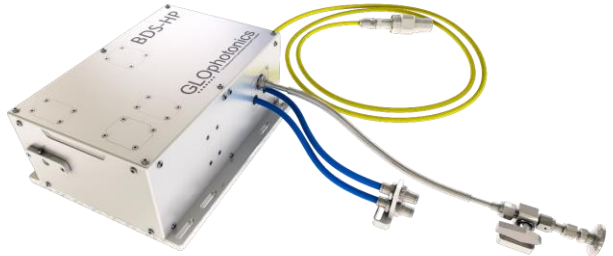


Technology and applications

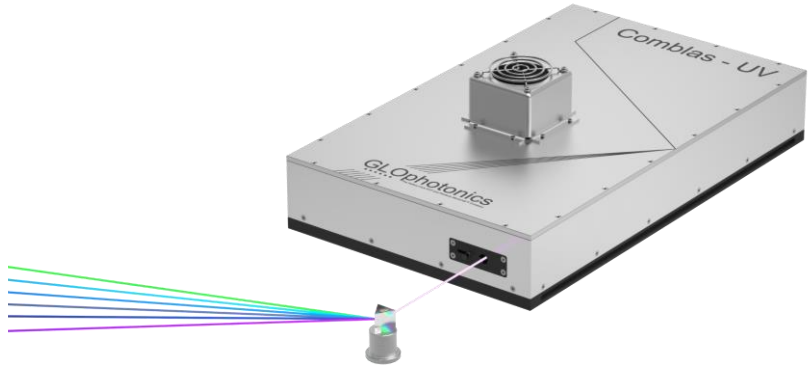
HCPCF



Beam Delivery

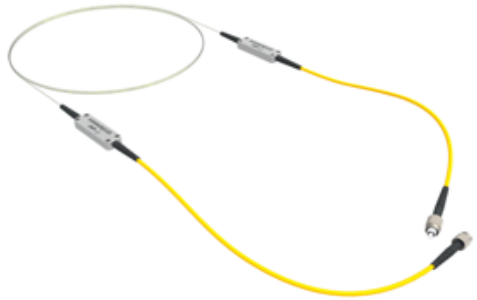


Frequency Conversion

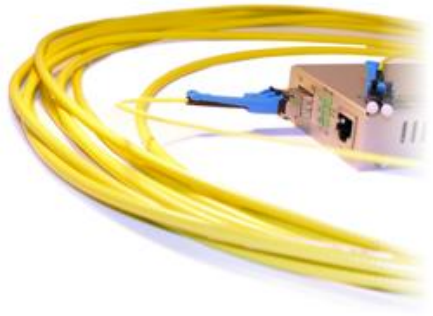


Pulse Compression

Quantum Technology



Telecom



GLOphotonics
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HCPCF: Guiding the ultrafast laser

The needs

Integration into machine!

Security

Maintenance and refurbishment

« movement » of the laser beam

UV!!!!

The offer/technology

The HCPCF has very low overlap with the silica cladding

We overcome the damage threshold of the silica

Low dispersion

From UV to MIR coverage

The problem to solve

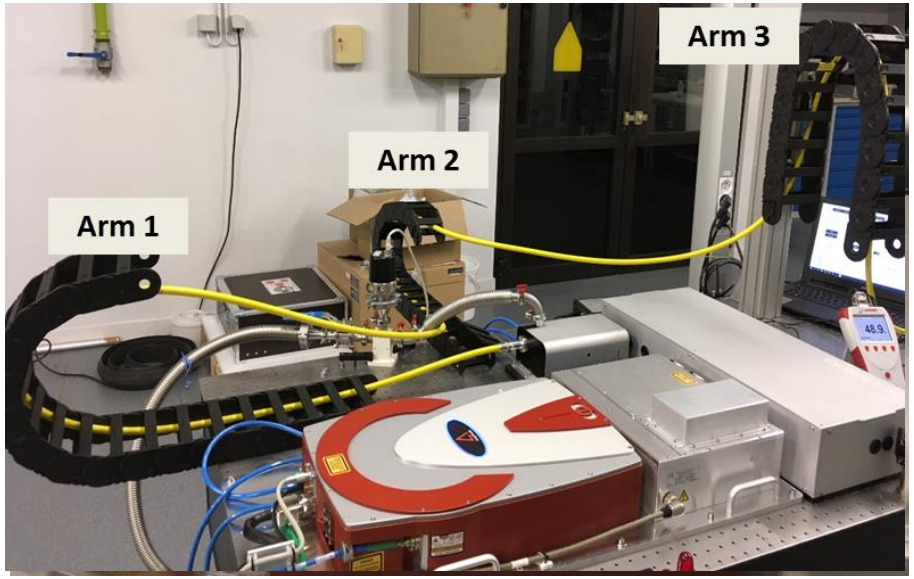
Numerical aperture of the hollow core fiber

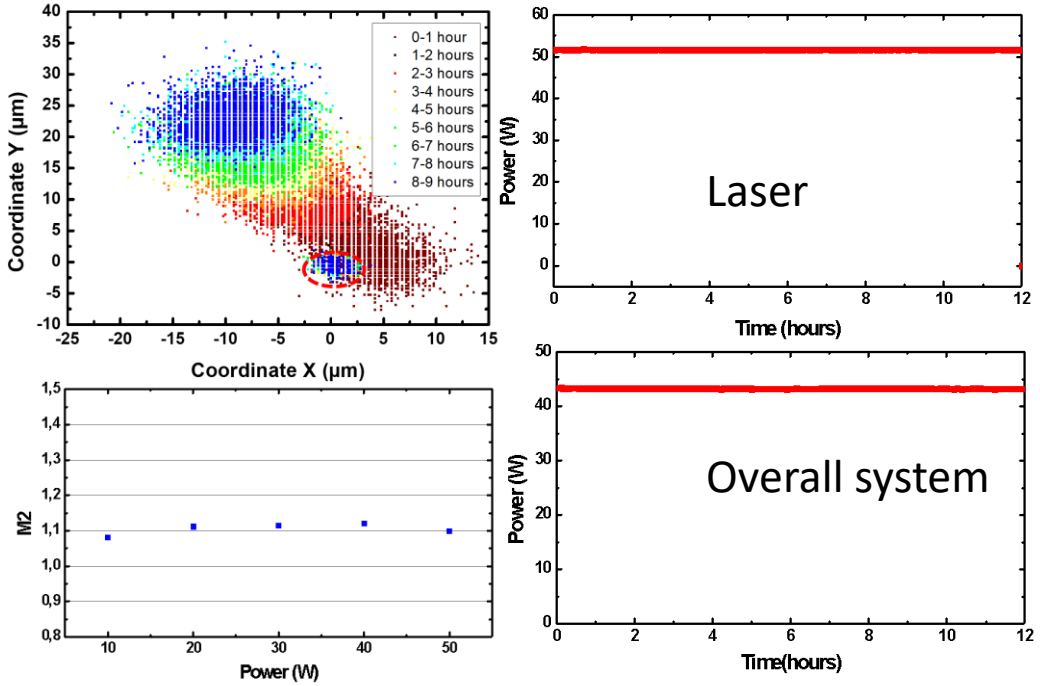
Pointing stability of the lasers !

UV: Photodarkening ?

HCPCF: Guiding the ultrafast laser: 1030nm 250fs 50W 50µJ

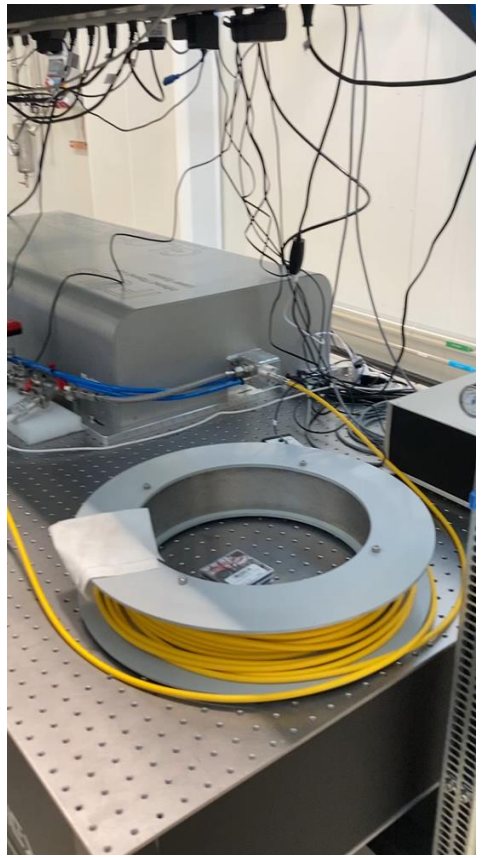
Long time running beam delivery system Transmission: 86±1%





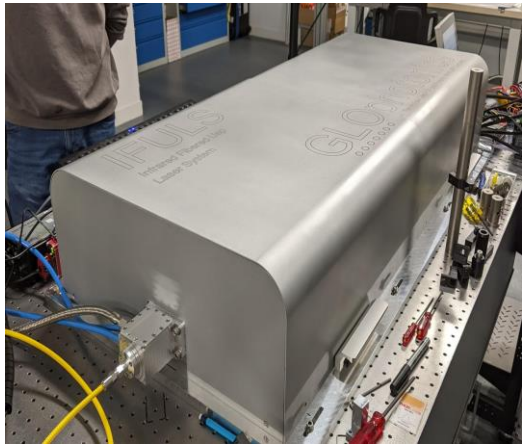
« USP laser with integrated fiber beam delivery for micromachining » M. Chafer et al, 2021

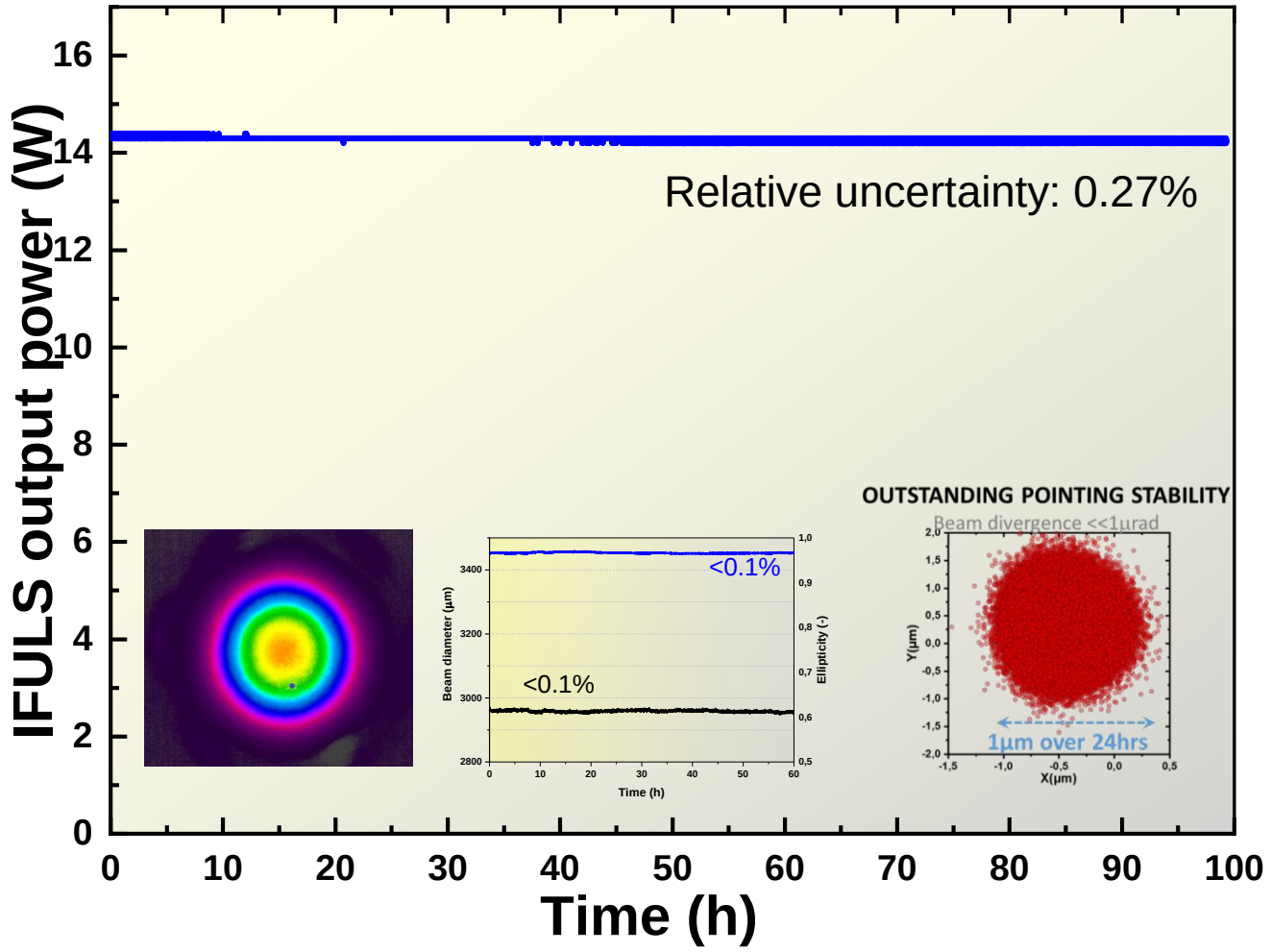
HCPCF: Guiding the ultrafast laser: 1030nm 190fs 14W 20µJ



A fibered USP laser system in a box and designed to run in industrial settings

190 fs 14W 20 µJ
1064nm

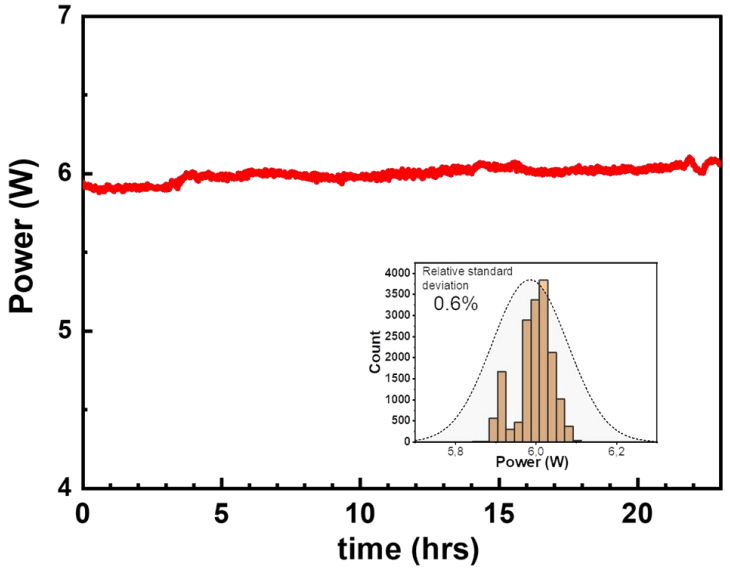




HCPCF: Guiding the ultrafast laser: 532nm 300fs 6W 15µJ

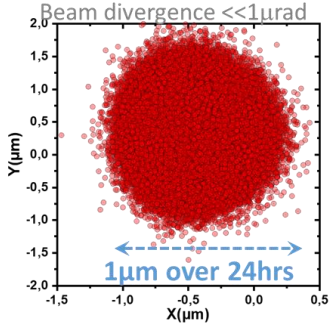
HIGH POWER, HIGH STABILITY AND LONG-TERM ENDURANCE

Endurance >20 hrs & and relative power fluctuation <0.4%



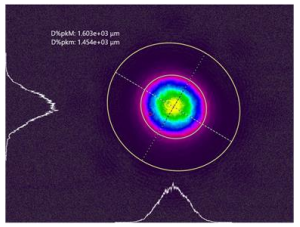
OUTSTANDING POINTING STABILITY

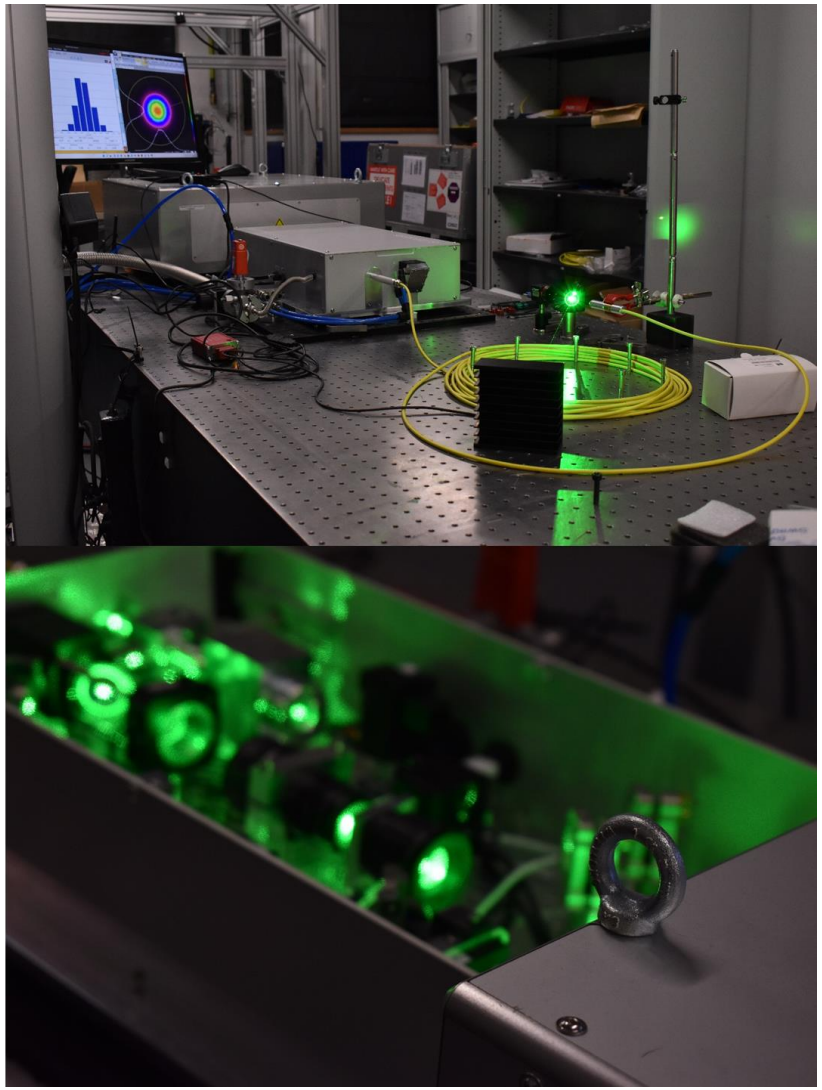
Beam divergence <<1µrad



EXCEPTIONAL BEAM QUALITY

M2<1.1



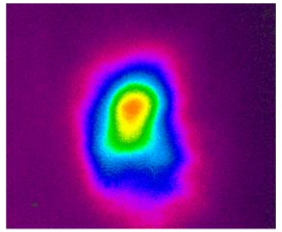


HCPCF: Guiding the ultrafast laser: 266nm 1ns 27,2mW 32µJ

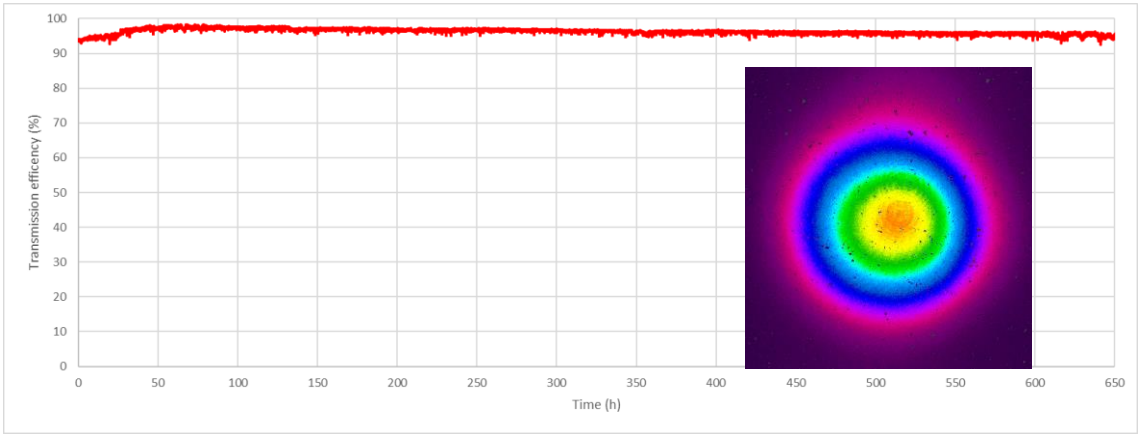
The laser

- Wavelength : **266 nm**
- Beam diameter : 2.1mm / 1.8 mm
- Repetition rate : 1kHz
- Pulse width : 1 ns
- Power after injection optics : 27.2 mW
- Energy after injection optics : 32 µJ

Laser Beam intensity profile



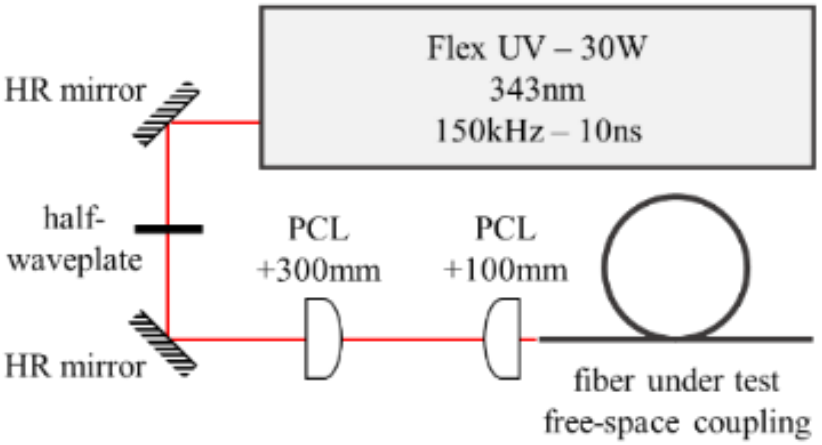
2m long HCPCF cable
92% transmission

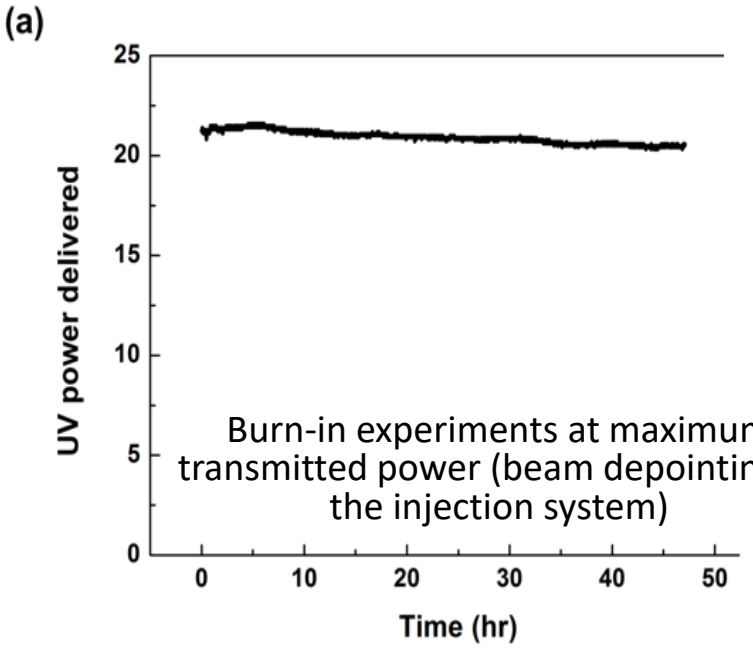


Exceptional UV handling
650 hours of continuous run

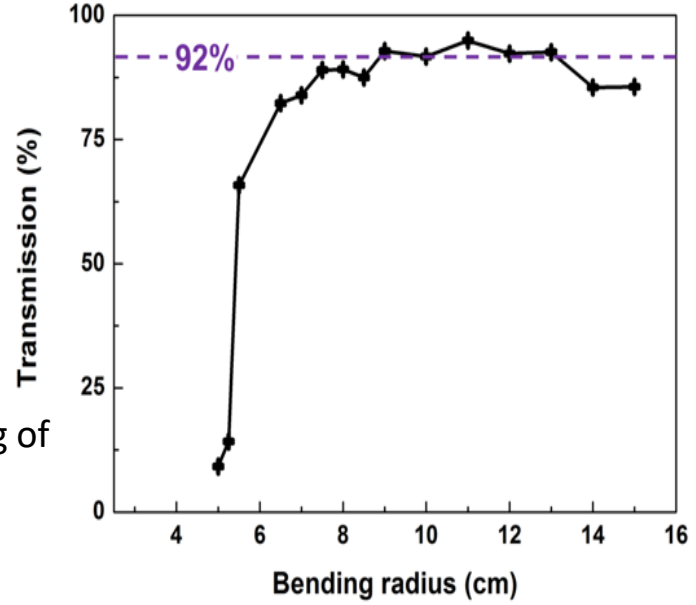
HCPCF: Guiding the ultrafast laser: 343nm 10ns 26W 180µJ

Collaboration with Bloom Laser





Burn-in experiments at maximum transmitted power (beam depointing of the injection system)



Leroi, F., Gérôme, F., Didierjean, J. *et al.* UV 20W-class single-mode nanosecond pulse delivery using a vacuum-free/ambient air inhibited-coupling hollow-core fiber. *Appl. Phys. B* **129**, 116 (2023).

Conclusion

Ultrafast lasers have a solution for the fiber beam delivery: HCPCF

The HCPCF cover from 266nm up to 4000nm - we explore the 193nm and > 4000nm :)

The Hollow Core Fibers are not the crucial point anymore – The laser stability is the ultimate point to solve!

UV has never been so close to have a fiber solution – ps/fs to be demonstrated in the next few months

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MERCI – THANK YOU

jeansauvagevincent@glophotonics.fr

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