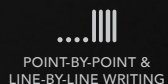


LABCORE-FBG



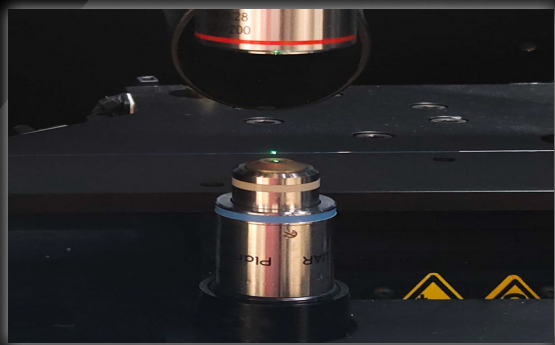
NEXT-GENERATION FEMTOSECOND LASER
WORKSTATION FOR FIBER BRAGG GRATINGS



PRECISION. RELIABILITY. FLEXIBILITY. ENGINEERED IN THE LABCORE-FBG

LABCORE-FBG is a state-of-the-art workstation for manufacturing Fiber Bragg Gratings (FBGs) via femtosecond-laser direct writing. Designed for both R&D and production, it delivers the precision, flexibility, and reliability needed to produce high-quality FBGs on a wide range of fibers.

Built on a vibration-damped, thermally stable granite platform with active and passive isolation, it combines sub-micron accuracy with excellent repeatability. High-precision motion stages, a robust opto-mechanical design, and integrated machine-vision system with dynamic automatic alignment ensure each pulse is delivered at the desired core position.



Unlike UV-inscription systems, the LABCORE-FBG writes directly through the cladding eliminating stripping and UV-sensitization. An optional automated fiber-handling module enables km-scale FBG arrays with maintained alignment and tension making it ideal for sensing networks.

Its proprietary control software offers full control of laser parameters and writing strategies, allowing users to create uniform, chirped, tilted, apodized, or multi-wavelength arrays with optimized spectral performance. All within an intuitive interface made to allow users to prototype, optimize, and scale with confidence.

KEY ADVANTAGES/FEATURES/BENEFITS

Universal Fiber Compatibility

- No photosensitization or hydrogen loading required.
- FBGs can be written directly through the coating in a wide range of standard or specialty fibers, no stripping needed.

Full Control and Advanced Writing Modes

- Supports point-by-point (PbP) and line-by-line (LbL) inscription.
- Achievable pitch down to 1 μm with precise control over reflectivity, bandwidth, and SLSR.
- Enables uniform, chirped, apodized, sampled, tilted, and custom multi-wavelength designs.

Precision Spectral Tailoring

- Fine tuning of grating parameters yields FWHM < 0.15 nm and excellent spectral repeatability.
- Optimized for both single-grating and complex FBGs arrays production.

Automated Long-Fiber Processing Module

- Optional reel-to-reel system enables continuous km-scale inscription while maintaining alignment and tension, ideal for distributed sensing arrays.

Designed for Productivity and Reliability

- Stable granite platform with active/passive isolation ensures sub-micron accuracy.
- Proprietary software optimized for SMF-28 fibers but easily adaptable to different fiber types, providing automatic and dynamic core detection and optimal positioning.
- Intuitive graphical interface accelerates setup, simplifies alignment, and guarantees reproducibility across fibers.

APPLICATIONS

High-Temperature and Harsh-Environment Sensing

- Femtosecond-laser-written FBGs maintain stable performance at temperatures up to 900 °C and in chemically or radiatively aggressive environments.
- Ideal for applications in aerospace, energy, nuclear, and industrial process monitoring, where UV-inscribed gratings degrade or fade.

Structural Health and Distributed Sensing Networks

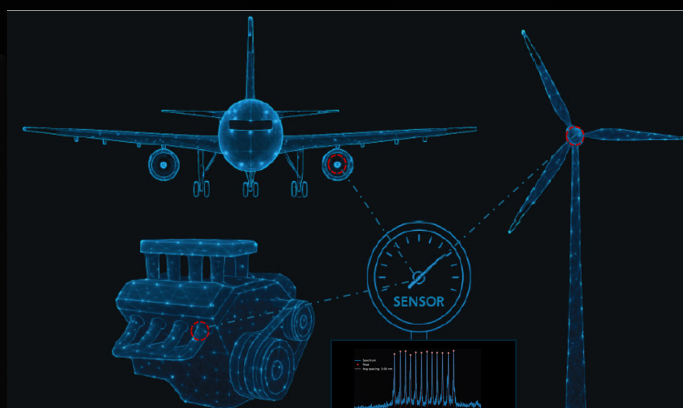
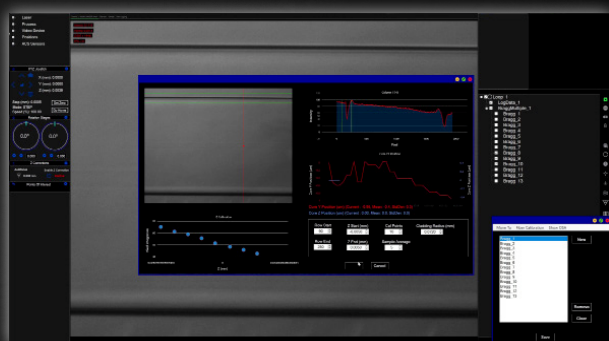
- Continuous km-scale inscription enables the production of dense FBG arrays for strain, vibration, and temperature monitoring in civil infrastructure, oil & gas, wind, rail, and power-transmission systems.

Harsh-Condition Instrumentation and Specialty Fibers

- Perfect for fabricating gratings in polyimide-coated, sapphire, or radiation-hard fibers used in demanding environments.

Beyond FBGs: Multipurpose Femtosecond Micromachining

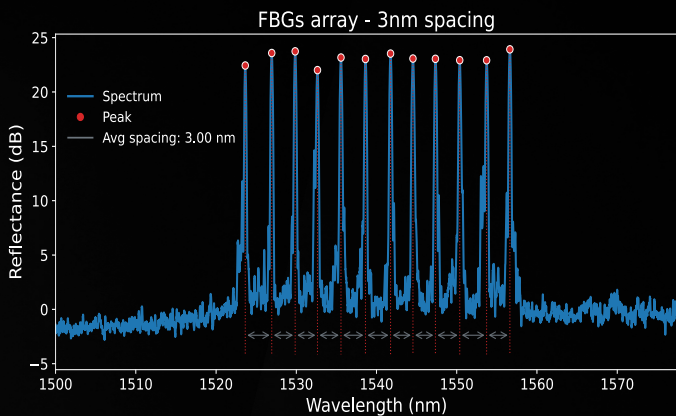
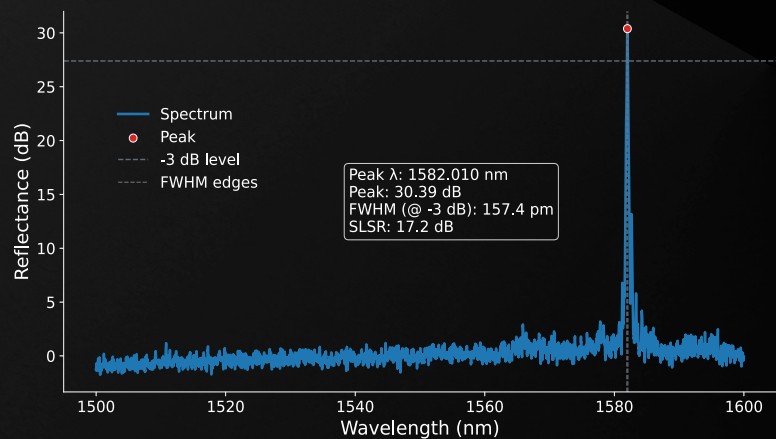
- With a simple platform swap, the LABCORE-FBG becomes a multi-application fs-laser workstation, suitable for micro/nano-patterning of surfaces, micro-drilling of transparent and opaque materials, waveguide writing, photonic integrated circuits packaging, thin-film ablation, and other precision-laser applications.



FBG SPECIFICATIONS

PARAMETER	SPECIFICATION	NOTES / FEATURES
Writing Modes	Point-by-Point (PbP), Line-by-Line (LbL)	Supports chirped, apodized, tilted, and other custom designs
FBG Order	2nd and 3rd order	Configurable via software
Wavelength Range	1460 – 1640 nm (typical)	Compatible with telecom and sensing bands
Wavelength Multiplexing Spacing	Down to 2 nm	Enables dense spectral multiplexing
FBG Lengths	0.05 – 20 mm (typical)	Customizable per design
Minimum Grating Pitch	1 μ m	High-resolution motion stages
FWHM	< 0.25 nm (typical) < 0.15nm (minimum)	Excellent spectral definition
Side Lobe Suppression Ratio (SLSR)	> 10 dB (typical) and up to 30dB	Excellent SLSR achievable
Active Focal Correction	Real-time z-axis for core optimal position finding	Maintains selected core focus position over long inscription runs
Extended fiber length system *	Up to kilometer-scale	Enabled by automated reel-to-reel system
Fiber Types Supported	Standard single-mode, polarization-maintaining, multi-core, doped, photonic-crystal, sapphire	No need for hydrogen loading or stripping
Software Interface	Proprietary GUI	Full control of pulse energy, repetition rate, number of pulses, writing speed and scanning strategies
Interrogation *	Integrated broadband source & optical spectrum analyzer LUNA - Hyperion model	Real-time feedback during inscription
Laser Source	515 nm, < 400 fs pulse duration	High stability and energy uniformity
Beam Delivery	Galvo-scanner + motorized XYZ stages	High-speed scanning with long-range precision motion
Positioning Resolution (XY / Z)	XY: 1 nm resolution / 100 nm repeatability / < 1 μ m accuracy Z: 10 nm resolution / 50 nm repeatability / < 0.5 μ m accuracy	Verified via interferometric calibration
Focusing Optics	40 $\times$ high-NA objective	Optimized for through-cladding inscription
Polarization Control	Manual or automated (linear, circular, elliptical)	Enables polarization-sensitive inscription
Vision System	On-axis transmission light microscopy	Core detection and focus optimization with live vision
Active Focal Correction	Real-time z-position calibration	Maintains focus stability during long runs
Sample Holder	Dedicated fiber holder with automated reel-to-reel mechanism	Allows continuous km-scale fiber inscription

* Optional special specifications



TECHNICAL SPECIFICATIONS

PARAMETER	SPECIFICATION	NOTES / FEATURES
Operating Mode	FBG manufacturing (direct-write)	Configurable for R&D and industrial use
Laser Source	1030 nm, < 400 fs pulse duration 515 nm, < 400 fs pulse duration	High energy stability (low jitter)
Average Power	Up to 5 W	User-adjustable via software
Pulse Energy	Up to 70 μ J (1030 nm) Up to 30 μ J (515nm)	Filtered for nJ-range pulse energies typical for FBGs manufacturing
Repetition Rate	Single pulse – 1 MHz	Flexible for FBG writting or general fs-laser micromachining
Travel Range (XYZ)	100 $\times$ 100 $\times$ 5 mm	Motorized, closed-loop feedback
Positioning Resolution (XY / Z)	XY: 1 nm resolution / 100 nm repeatability / < 1 μ m accuracy Z: 10 nm resolution / 50 nm repeatability / < 0.5 μ m accuracy	Verified via interferometric calibration
Focusing Optics	From 60 mm FL Up to 40x high-NA objective	Optimized for through-cladding inscription
Power Monitoring	Integrated power meter	Real-time energy feedback and safety interlock
Vision System	Dual co-lineal vision system On-axis transmission light microscopy	Core detection and focus optimization with live vision
Sample Holder	General purpose fs-aser micromachining plate	Customized for each application
Vibration Management	Active 6-axis DOF and air passive isolation	Ensures sub-micron accuracies and nm resolution
Noise / Positional Error	XY < $\pm$ 10 nm (RMS) Z < $\pm$ 50 nm (RMS)	Low-noise drive electronics
Connectivity	Ethernet / USB / Remote control	Optional integration with external diagnostics
Dimensions (L $\times$ W $\times$ H)	2.0 $\times$ 1.3 $\times$ 1.8 m	Customizable layout upon request
Weight	~ 650 kg	Granite and steel frame for maximum stability
Power Requirements	230 V AC, 50/60 Hz – 2 kW max	Standard single-phase supply