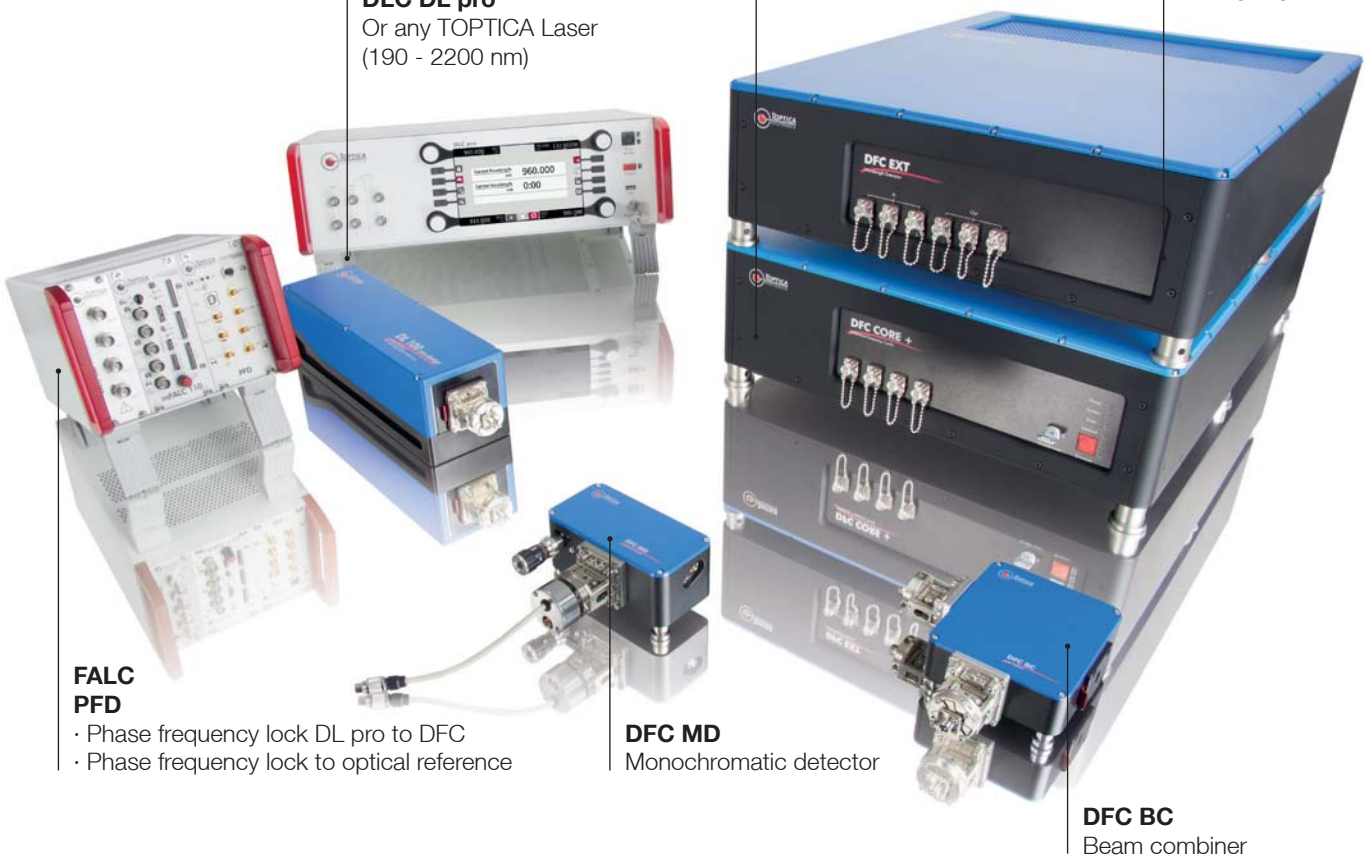
Difference Frequency Comb (DFC)

Compact, robust, high-end



Compact high performance frequency comb

All you need in a small volume
- Turn-key
- Robust
- 19 inch compatible
- No additional electronics needed
- Suitable for high-end applications

TOPTICA engineering
- 20 years of experience building industry-grade lasers
- Comb, diode laser and locking electronics out of one hand
- Complete rack-mounted laser systems, ready to use from day one

f_{CEO}- stabilization by Difference Frequency Generation (DFG)
- Intrinsically stable
- Simple and reliable
- Passive, all-optical phase-lock
- Effective f_{CEO} locking bandwidth of 80 MHz
- $f_n = nf_{rep}$, perfect for use with optical reference Puppe et al., Optics letters 41, 8 (2016)
- Narrow free running linewidth

Convenience
- One central software
- Automatic locking to RF-reference
- Remote control and locking

Applications
- Laser Reference
- High-Resolution Spectroscopy
- Optical Clocks
- Microwave Generation
- Dual-Comb Spectroscopy
- Direct Comb Spectroscopy
- Length Metrology
- Time and Frequency Metrology

TOPTICA PHOTONICS

DFC Specifications & Options

Specifications	DFC CORE	DFC CORE+
Center wavelength	1560 nm (other wavelengths see options)	
Comb spacing	80 MHz	
Laser outputs	4 or 8, fiber coupled, polarization maintaining, FC/APC	
Bandwidth	> 25 nm, each output	
Power	> 10 mW, each output	
Phase stability (RMS)	< 35 mrad, typ. < 8 mrad in 20 s @ [50 mHz, 5 Hz]	
Integrated phase noise	DFG comb advantage: A. Liehl et al., Optics Letters Vol. 42, Issue 10 (2017)	
Reference	DFC RF** (OCXO)	Optical reference** or DFC RF** (OCXO)
Linewidth @ 1560 nm	< 30 kHz, typ. 20 kHz (locked to DFC RF, free running)	< 1 Hz (locked to optical reference)
Bandwidth f_{rep} actuator	> 70 kHz (Piezo)	10 MHz (I_{mod})
Loop bandwidth f_{rep} lock	10 kHz, optimal with DFC RF	> 400 kHz (typ. 450 kHz)
Stability	$1 \cdot 10^{-13}$ in 1 s*	$1 \cdot 10^{-16}$ in 1 s*, $3 \cdot 10^{-18}$ in 1000 s*
Accuracy	$1 \cdot 10^{-14}$ in 100 s*	$1 \cdot 10^{-17}$ in 1000 s*
Dimensions (H x W x D)	133 x 450 x 633 mm, incl. electronics	133 x 450 x 633 mm FALC+PFD: 131 x 184 x 286 mm
Reference input	800 MHz, RF reference (DFC RF)	· High bandwidth I_{mod} (DC - 10 MHz) for optical reference · 800 MHz for RF reference (10 MHz with DFC RF)
Cooling requirements	None	
Power consumption	< 100 W	
Operating temperature	21 ± 5 °C	
Weight	< 30 kg	
Power supply	100...120 V / 220...240 VAC, 50...60 Hz (auto detect)	

* or same as reference, whichever applies first, ** not included

Options	Model	Description
Wavelength extension*	DFC IR	Centered @ 1560 nm, bandwidth > 80 nm, typ. 100 nm
	DFC NIR	Centered @ 780 nm, bandwidth > 35 nm, typ. 40 nm
	DFC DVIS**	Wavelength range 420 - 840 nm, bandwidth typ. 5 nm @ 698 nm, typ. 1 nm @ 420 nm
	DFC SCNIR**	Wavelength range 840 - 980 nm, bandwidth > 50 nm, typ. 100 nm @ 935 nm
	DFC SCIR**	Wavelength range 980 - 2200, bandwidth > 200 nm, typ. 300 nm centered @ 1200 nm
Reference	DFC RF	Low-noise oven-controlled quartz, output: 800 MHz, input: 10 MHz
	DFC GPS	GPS frequency reference, output: 10 MHz, stability: $1.3 \cdot 10^{-12}$ @ 1s, $1 \cdot 10^{-13}$ @ 40000 s
Beat units	DFC BC	Beam combiner for DFC and cw-laser, fiber coupled
	DFC BCF	Fiber beam combiner for DFC and cw-laser, 980 nm, 1030 nm, 1300 nm, 1550 nm
	DFC MD	Monochromatic detector unit, fiber coupled, use with DFC BC / DFC BCF
Locking electronics	FALC	Fast analog 2-channel PID
	PFD	Phase frequency detector
Accessories	DFC SCOPE	Digital oscilloscope with spectrum analyzer (FFT), for beat monitoring up to 4 beats
	DFC COUNT	4 channel counter
	HF-WS/DFC	High Finesse wavelength meter, for convenient determination of comb line number

* other extensions on request, ** tunable (patent protected, US 8284808B2), please inquire for more details

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