Menhir Photonics

The MENHIR-1550-SERIES

EPIC European Photonics Industry Consortium

Industrial-grade femtosecond laser

Product Release March 2022

The vision of Menhir Photonics

Applications of femtoseconds lasers

Machining/Cutting

Medical

Research

Space related /Electronics

Telecom.

Menhir Photonics

Our key values

- Robust and reliable lasers
- Turnkey and easy to use systems
- Customer satisfaction

Our mission

Closing the gap between photonics and electronics

App. 1 – Microwave Photonics

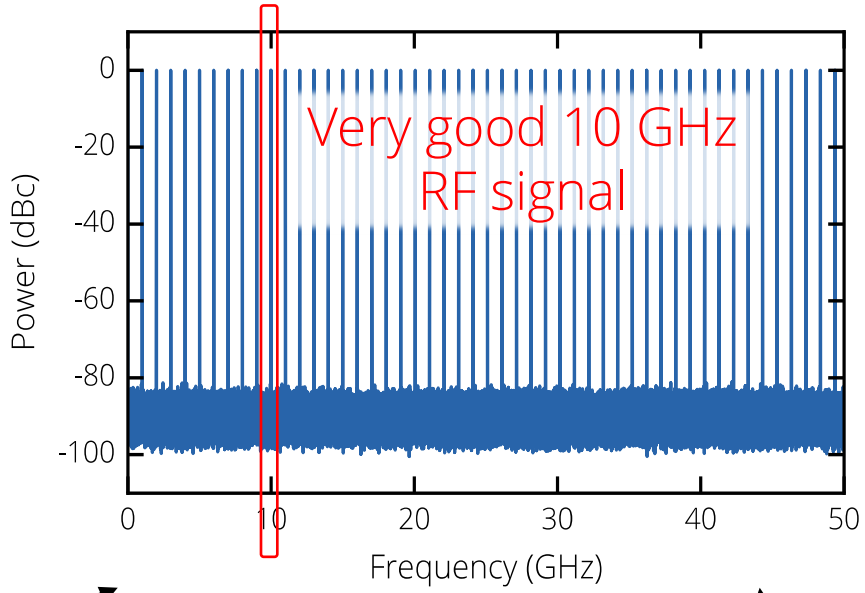
RADIOFREQUENCY GENERATION

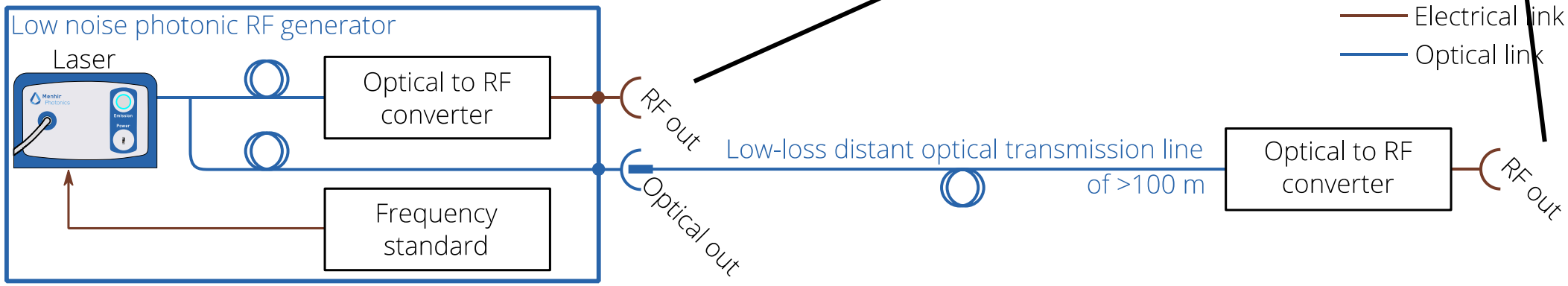
Radiofrequency (RF) sources are widely used in our modern world. All the radar systems, GPS and a broad range of other technologies are based on generating and comparing RF signals. The need to have more precise measurement systems and faster communication solutions puts stringent requirements on phase noise and timing-jitter.

We show here how a photonic solution, using the MENHIR-1550 laser as a low phase-noise oscillator, meets the current and future needs for RF generation. This solution is straightforward to integrate with current RF technology and can be used in harsh environments as well as in laboratory conditions.

Menhir Photonics' product strengths

- Photonic solution with lowest phase noise
- Wide frequency range synthesis capability
- Ultra-high reliability and shock-resistant





App. 2 – Photonics ADC

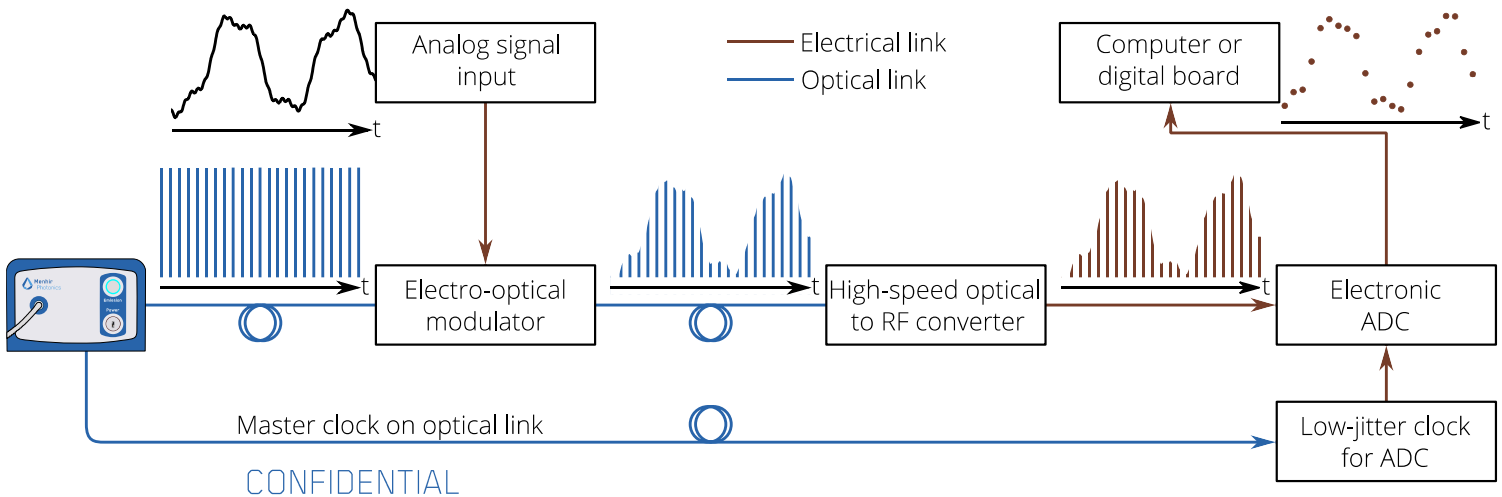
Photonic Analog to Digital Conversion

Digitalization of data opens unprecedented opportunities in telecommunication, radar and signal processing. Almost all sensing systems in use today require analog signals to be converted to digital ones. Signal rates have grown at a rate that has outpaced electronic analog to digital conversion (ADC). This demand for higher bandwidth, speed or digitalization precision puts stringent requirements on the aperture jitter of ADC setups. One way to improve ADC is to use a lower timing-jitter clock source provided by photonic solutions. Photonic ADCs benefit from much more than only improved timing-jitter. Using mode-locked laser sources like the MENHIR-1550 laser enables a wide variety of new ultra-fast photonic digitization techniques.

We show here how the MENHIR-1550 can be used to clock an ADC at much higher bandwidths while at same time achieving timing-jitter below 1 fs.

Menhir Photonics' product strengths

Lowest timing-jitter on the market	High-repetition rates up to 2.5 GHz	Ultra-high pulse amplitude reproducibility



App. 3 – Frequency-comb applications

Self-referenced Optical Frequency Comb

An optical frequency comb (OFC) is a photonic tool similar to a gear in mechanics. It connects the optical frequency domain (THz) to the well-known microwave domain (MHz – GHz). This guarantees a "one to one" correspondence between frequencies that differ by more than five decades, and enables ultra-high optical frequencies to be directly resolved with standard electronics.

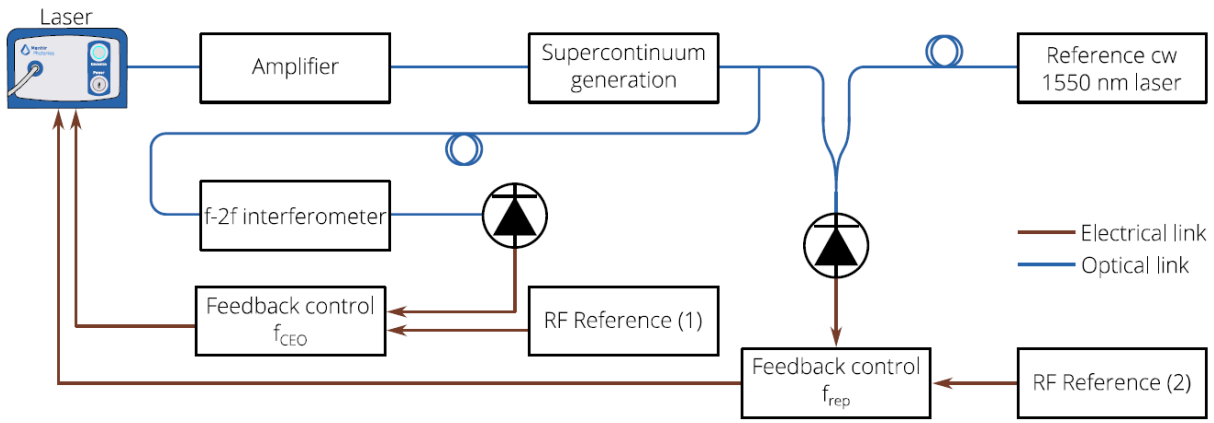
This Nobel-prize awarded technique has many direct applications in various fields, both industrial and scientific. To name a few: frequency comb spectroscopy, precision frequency transfer, distance measurement or low-noise signal generation.

Menhir Photonics' product strengths

High power per comb line
> 50 µW per line

GHz comb-lines spacing

f_{rep} and f_{CEO} actuators for stabilization



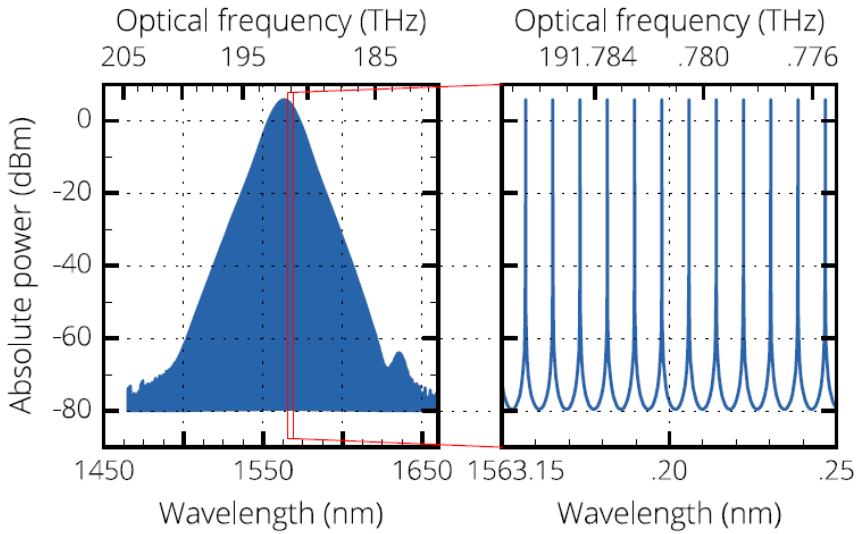
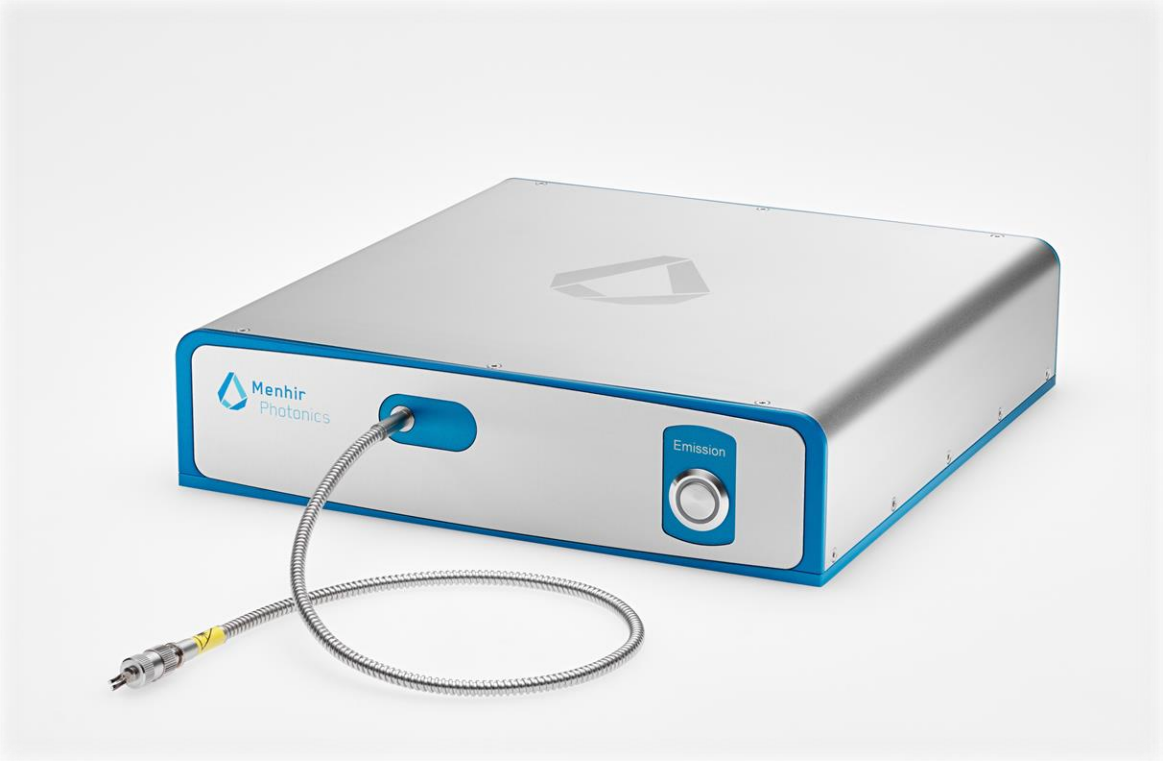


Figure 2 — Illustration of the frequency comb lines. Left: The spectral absolute power, containing roughly 10^6 lines (-20 dBc bandwidth). Right: Zoom on the central part of the spectrum. The comb lines are spaced by 1 GHz and have a linewidth < 20 kHz and SNR > 70 dBc.

First turnkey femtosecond laser of its kind

Key features

- Hermetically sealed
- All-in-one system
- Turnkey system



Key specifications

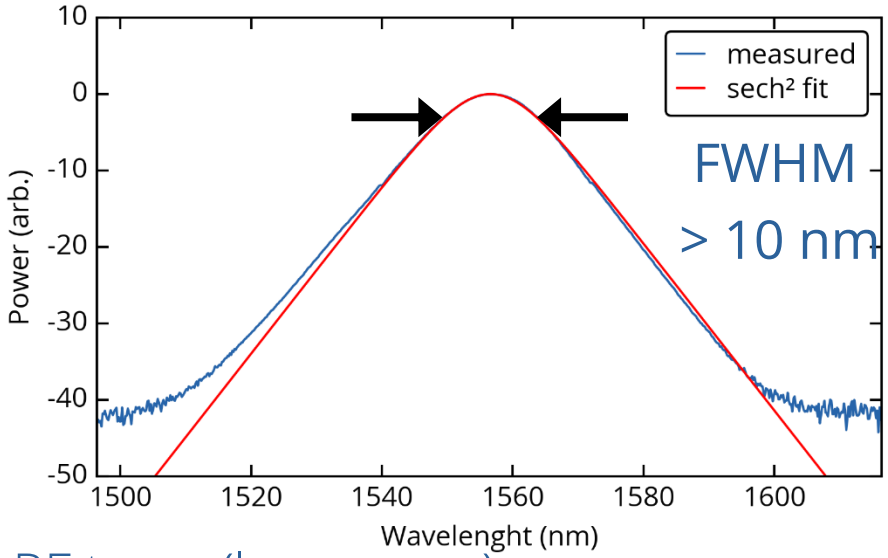
- Repetition rate : up to 2.5 GHz
- Clean soliton pulses: < 250 fs
- Wavelength: 1555 +/- 10 nm
- Lowest phase noise laser on the market

MENHIR-1550 - 1 GHz

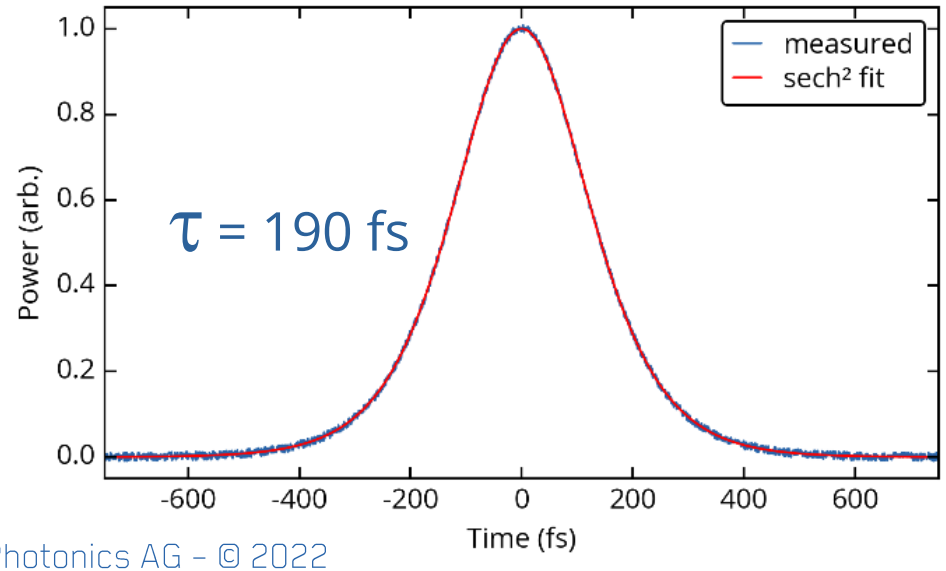
Performances

- f_{rep} = 1.000 GHz
- f_{rep} can be fixed in factory with an accuracy of +/- 10 kHz (i.e.10 ppm)
- > 50 mW of average power

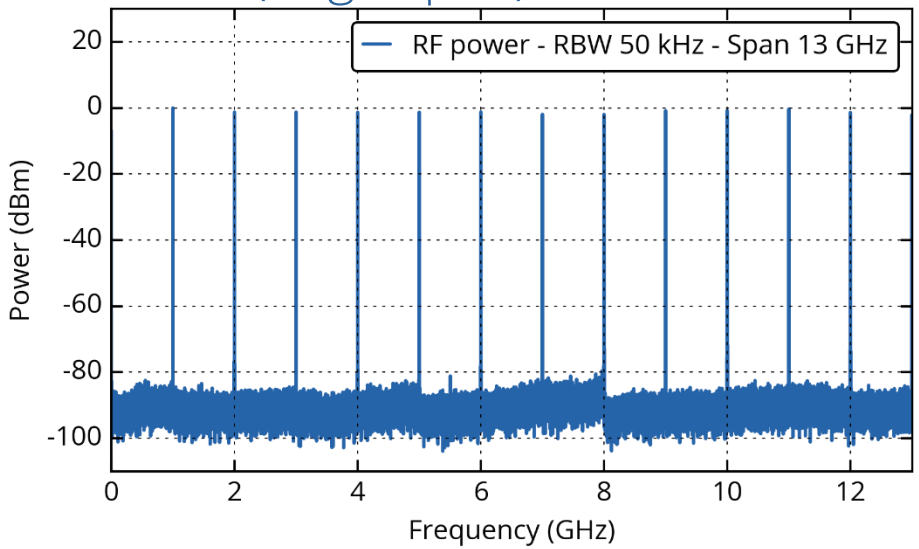
Optical spectrum (log scale)



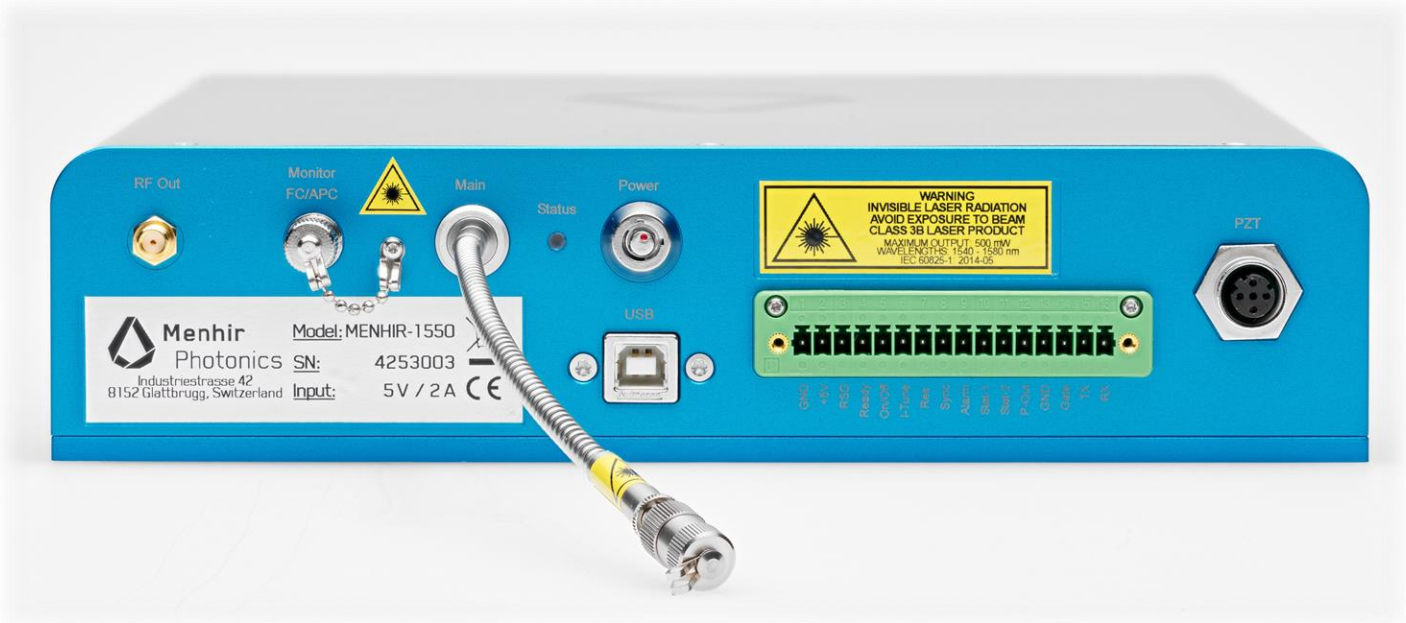
Autocorrelation trace



RF trace (large span)



A laser made for easy integration



Made to be used

- Industrial standard connectors
- Only 5 V/2 A input
- Digital connections (USB and RS232) for long-term monitoring
- All-in-one system including all the optics and electronics

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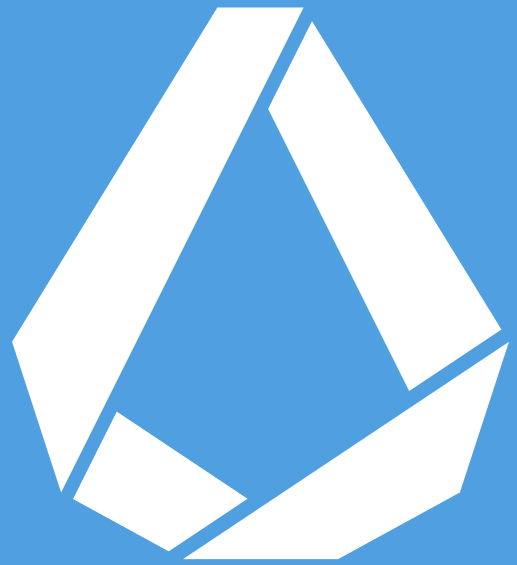

Menhir Photonics AG
Industriestrasse 42
8152 Glattbrugg

+41 61 331 45 45
contact@menhir-photonics.com
https://menhir-photonics.com