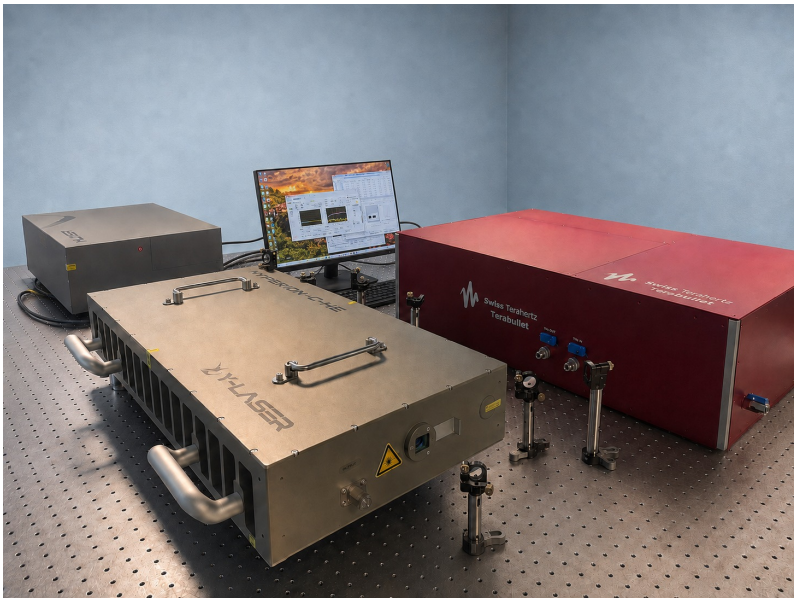
TURNKEY HIGH-FIELD TERAHERTZ

Intense THz Spectroscopy System

STFT flat-top source + HELIOS-HE driving laser + HYPERION-G-HE compressor

SKU WQ-ITHZ-TK1 · FACTORY-INTEGRATED, ALIGNED AND ACCEPTANCE-TESTED



STFT FLAT TOP	PEAK FIELD STRENGTH	ENERGY PER PULSE	FOCUS SIZE
1-4.6 THz	**>10** MV/cm	**4** uJ	**0.14** mm
Within 10 dB - 2.2 octaves	Measured at station 1	0.6-0.9 % conversion	Station 1, tight focus

WHAT THE SYSTEM CONTAINS

- HELIOS-HE femtosecond ytterbium driver, 10 / 20 W, 1-2 mJ, < 250 fs
- HYPERION-G-HE gas multi-pass-cell compressor, typ. 29.2 fs output
- STFT flat-top terahertz source in sealed dry-purge enclosure, 120 x 90 cm
- Optical-pump / THz-probe channel, motorised delay line, lock-in detection
- S2X real-time terahertz camera with f/0.7 imaging objective

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PRODUCT
WQ-ITHZ-TK1
Intense THz System

A NEW CLASS OF TERAHERTZ SOURCE

STFT

Super THz Flat Top Bullet Source

TERABULLET ENCLOSURE · 120 × 90 CM FOOTPRINT

STFT noun — Super THz Flat Top Bullet Source

A terahertz source whose output stays **within 10 dB of its peak right across the working band**, instead of spiking at one frequency and falling away either side. The STFT flat top runs **1.0 to 4.6 THz** — 3.6 THz wide, 2.2 octaves — and arrives in a single pulse.

The STFT flat top, measured

A the electric field arriving, recorded directly in time. **B** the same pulse in dry and in humid air, scaled to the same height. **C** the flat top itself — the band between the two markers. **D** the full span, with the detector's own noise floor. Green is a dry beam path, orange is ordinary room air — water vapour absorbs terahertz light, which is why the path is normally purged.

STFT FLAT TOP	PEAK FIELD STRENGTH	ENERGY PER PULSE	FOCUS SIZE
1–4.6 THz	**>10** MV/cm	**4** µJ	**0.14** mm
Within 10 dB · 2.2 octaves	Measured at station 1	From ≈0.7 mJ pump · 0.6–0.9 % conversion	Station 1, tight focus

Why the STFT flat top matters. Most terahertz sources spike at one frequency and fall away either side, so a measurement is strong at the peak and noisy everywhere else. A flat top holds usable strength right across the band — one scan, even quality, no favoured colour. And above 10 MV/cm the pulse does not merely look at a sample, it **drives** it.

02 Four configurations

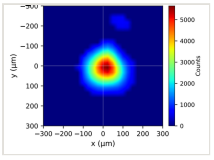
Pump and probe can each be the terahertz pulse or the laser, and the bench is laid out so that all four pairings are reachable without rebuilding it. The choice sets what you learn: the laser addresses electrons across the band gap, the terahertz field addresses what moves slowly — carriers, phonons, spins, bonds.

	PROBE: TERAHERTZ	PROBE: OPTICAL
PUMP: OPTICAL	**Optical pump terahertz probe** A laser flash creates carriers; the terahertz pulse reads the conductivity that appears. Photoconductivity, carrier lifetime, transient screening. SHOWN ON PAGE 3	**Optical pump optical probe** Conventional transient absorption, using the two laser arms already on the bench. Population dynamics above the band gap.
PUMP: TERAHERTZ	**Terahertz pump terahertz probe** The strong pulse drives the sample and a second terahertz pulse reads it. Nonlinear terahertz response, field-driven phase changes, saturation.	**Terahertz pump optical probe** The terahertz field distorts the sample and the laser reads the induced birefringence. This is the route used for the field measurement below. SHOWN BELOW

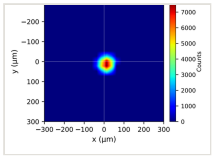
Two focus stations, either way round

Whichever configuration you run, the beams meet at one of two foci. Every frame below is a real camera image — terahertz, laser, and the two overlaid, at each station.

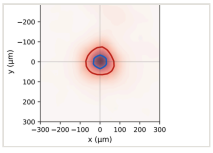
S1 · TERAHERTZ



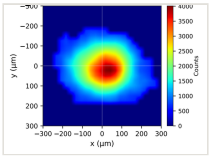
S1 · LASER



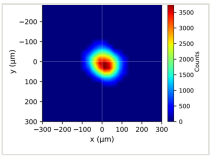
S1 · OVERLAID



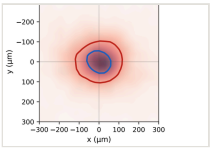
S2 · TERAHERTZ



S2 · LASER



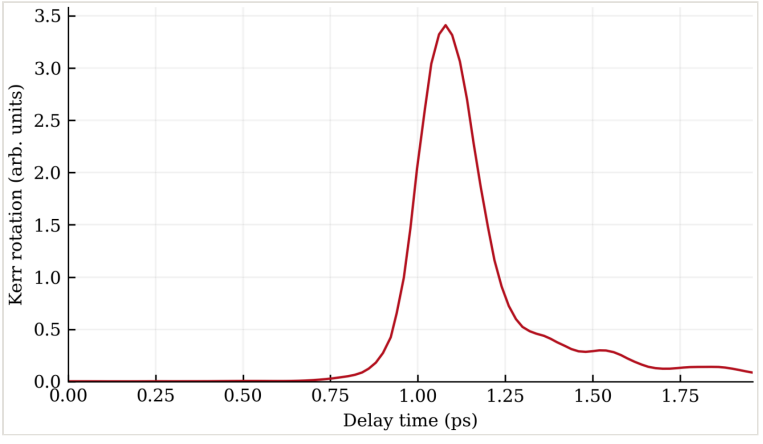
S2 · OVERLAID



Station 1 — tight focus, smallest spot, strongest field `0.14 mm`

Station 2 — sample station, more room around the sample `0.26 mm`

03 How the field is measured



The pulse passing through diamond

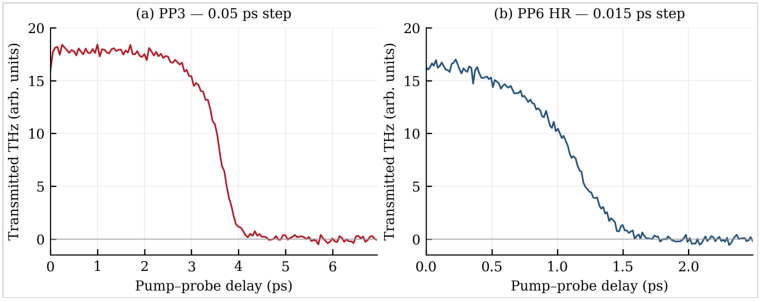
A strong terahertz pulse briefly distorts a diamond crystal. The height of this peak gives the field strength directly — no power meter involved.

The method has been checked against a completely independent calibration on another source and the two agreed to within about 8 %.

Peak field, everyday operation	`> 10 MV/cm`
Guaranteed floor	`8 MV/cm`

For scale, 10 MV/cm is comparable to the field holding electrons to atoms — which is why the pulse can drive a material rather than just probe it.

04 Watching electrons switch on



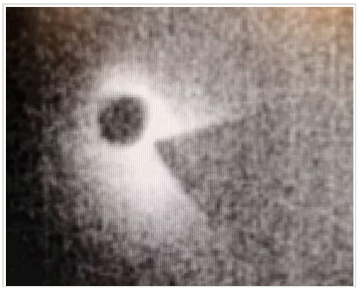
A semiconductor turning conductive

A laser flash frees electrons in the sample; the terahertz pulse arrives a controlled instant later and finds it almost opaque. Two scans, two step sizes, same answer.

Sweeping the delay between the two pulses turns the horizontal axis into a clock. The signal drops by more than 90 % as the electrons appear, and the edge is under a picosecond wide — fast enough to follow the switching itself, not just its aftermath.

Signal change on switching	**> 90 %**
Time resolution	**≈ 1 ps**
Finest delay step	**0.015 ps**

05 Seeing through things



A terahertz photograph

A 3 mm hole and a metal blade, imaged straight onto a terahertz camera. Single short exposure, nothing corrected.

Terahertz light passes through plastic, paper, ceramics and clothing but stops at metal and water. That makes it useful for looking inside sealed packages, coatings and composites without opening or damaging them. The STFT flat top helps here too: every frequency in the band arrives with usable signal, so contrast does not collapse away from one favoured colour.

Camera	**Real time**
Objective	**f/0.7**
Feature size shown	**3 mm**

06 At a glance

SOURCE	VALUE
STFT flat-top band	**1.0 – 4.6 THz**
Flat-top width	**2.2 octaves**
Strongest at	**3.4 THz**
Usable span	**out to 12 THz**
Peak electric field	**> 10 MV/cm**
Energy per pulse	**4 µJ**
Conversion efficiency	**0.6 – 0.9 %**

BENCH	VALUE
Pump pulse energy	**≈ 0.7 mJ**
Focus size, station 1 / 2	**0.14 / 0.26 mm**
Driving laser	**1030 nm, ytterbium**
Beam height	**135 mm**
Footprint	**120 × 90 cm**
Detection	**Field, not power**
Built-in cameras	**Terahertz + laser**
Delay range	**Motorised, ps steps**

Values are from commissioning measurements on this system with the beam path in open air; purging the path raises them. Full measurement records, methods and uncertainties are available on request.

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PRODUCT
STFT
Terabullet Y-series

WHY THE FLAT TOP IS POSSIBLE

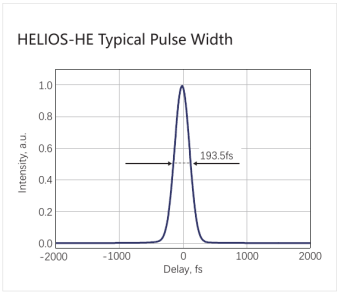
The Driving Laser

HELIOS-10W-HE / 20W-HE femtosecond source, 1–2 mJ + **HYPERION-G-HE** few-cycle compressor

Great terahertz begins with a great laser. The STFT flat top and its **> 10 MV/cm** field (per the STFT datasheet) are possible only because the terahertz pulse is driven by a clean, powerful (**up to 2 mJ**), few-cycle source — the HELIOS-HE laser and HYPERION-G-HE compressor characterised below.

THE LASER & COMPRESSOR — PULSE, SPECTRUM, BEAM QUALITY & BEAM PROFILE

A



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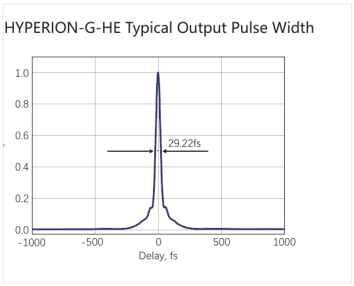

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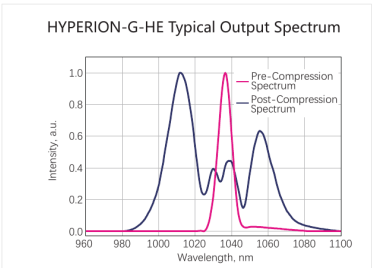

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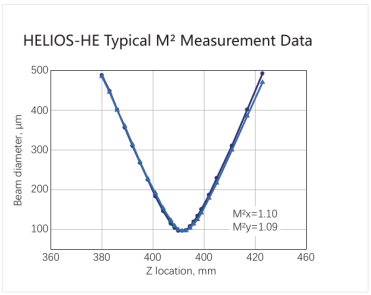

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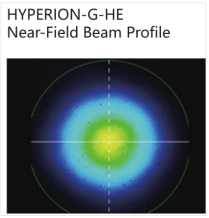
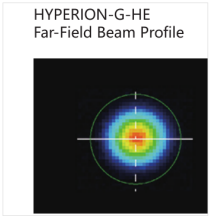


F



A HELIOS-HE laser pulse, 193.5 fs. **B** compressed to 29.22 fs in the HYPERION-G-HE multi-pass cell. **C** the spectral broadening (pre → post compression) that makes that few-cycle pulse possible. **D** a diffraction-limited beam, M² 1.10 / 1.09. **E, F** the compressor output beam in the near and far field — **round, single-lobed and symmetric**, not the butterfly-shaped profile familiar from OPA-driven sources. A clean round beam focuses to a tight, symmetric spot, which is what turns pump energy into peak terahertz field. *Typical product characterisation curves; values as labelled on each plot.*

PULSE ENERGY	PUMP PULSE	COMPRESSED	BEAM QUALITY
1-2 mJ	**193.5 fs**	**29.2 fs**	**1.10 M²**
HELIOS-10W / 20W-HE	HELIOS-HE · typical	HYPERION-G-HE · typical	typical · spec < 1.2

DRIVING LASER · HELIOS-HE	10W / 20W-HE
Max. output power	10 / 20 W
Max. single-pulse energy	1 / 2 mJ
Pulse duration	< 250 fs
Central wavelength	1036 ± 5 nm
Repetition rate	10 - 100 kHz
Pulse-width tuning	250 fs - 10 ps
Beam quality M²	< 1.2
Beam diameter	5±1 / 6.2±0.6 mm
Polarisation	Linear / Vertical
Power stability, 24 h	< 0.5 % RMS

COMPRESSOR · HYPERION-G-HE	SPEC
Input pulse width	150 fs - 1 ps
Input pulse energy	400 - 2000 μJ
Central wavelength	1036 ± 5 nm
Max. compatible power	80 W
Compression ratio	5 - 10
Compressor efficiency	> 90 %
Output pulse width (typ.)	< 35 fs · 29.2 fs
Cascade option	+ HCF → few-cycle
Dimensions (L×W×H)	958×416×222 mm
Weight	85 kg

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