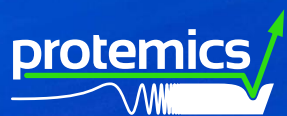




A NEW WAY TO SEE
A NEW WAY TO SEE

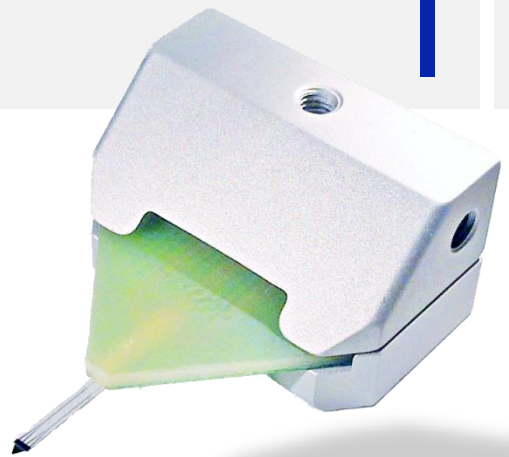




Next generation Terahertz microprobe series

TeraSpike

LT-GaAs photoconductive field detector



With the new device series TeraSpike we proudly introduce the next generation of microprobes for the photoconductive detection of electric fields in the THz frequency range. Based on our customers' feedback and growing application-driven demands a thorough re-design of our previous near-field probe-tip series has been developed. The result is a versatile detector for radiated and surface-near electric fields in the THz-range with unprecedented performance, robustness and applicability. It seamlessly fits into THz time-domain systems with optical excitation wavelengths below 860 nm and is the most cost-efficient solution to turn your system into a powerful high-resolution near-field THz system.

Your laser-based THz system can do much more than just spectroscopy – discover the fascinating world of high-resolution THz applications!

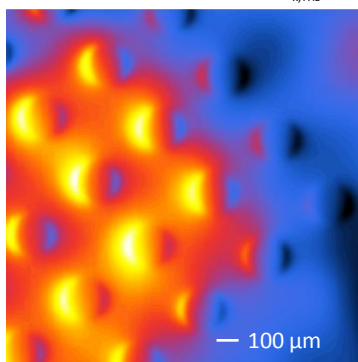
Key features

- Smallest active THz probe-tip on the market with only 1 μm cantilever thickness based on a patented design (DE 10 2009 000 823.3)
- Spatial resolution up to 3 μm
- Frequency range 0 – 4 THz
- Adaptable to all laser-based THz-Systems with $\lambda < 860 \text{ nm}$
- Mounting compatible with standard opto-mechanical components
- Required optical excitation power $< 1 \text{ mW}$

Applications

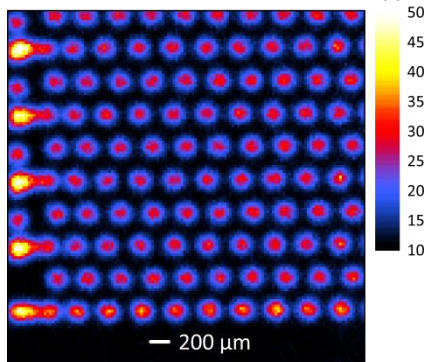
- Terahertz research: Metamaterials, plasmonics, graphene, waveguides, ...
- High-resolution Terahertz near-field imaging
- Contact-free sheet resistance imaging of semiconductors
- MMIC device characterization
- Non-destructive chip inspection
- Time-domain reflectometry (TDR)

electric field, $E_{x,\text{THz}}$ [a.u.]



Measured near-field image of a pulse-excited THz metamaterial surface.

sheet conductivity [mS]



Measured sheet conductivity image of a laser-doped multicrystalline silicon wafer.

Transversal field microprobes

TeraSpike TD-800-X

Technical data

TeraSpike TD-800-X-	HR	HRS	HS
Max. spatial resolution	3 μm	20 μm	100 μm
PC gap size	1.5 μm	2 μm	3 μm
Dark current @ 1 V Bias	< 0.5 nA	< 0.5 nA	< 0.4 nA
Photocurrent (*)	> 1 μA	> 0.6 μA	> 0.6 μA
Excitation wavelength	700 .. 860 nm		
Avg. excitation power	0.1 .. 4 mW		
Connection type	SMP		

Product details

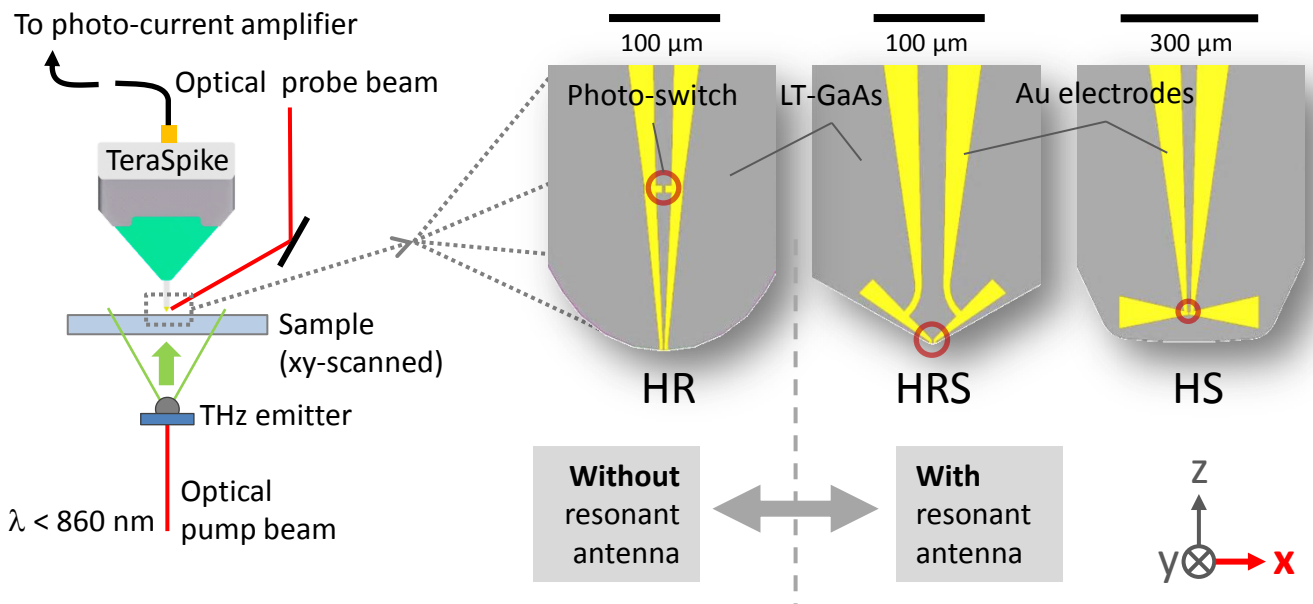
- Photoconductive probe-tip with integrated overvoltage protection optimized for pulsed excitation
- Mount for variable probe orientation
- Simple & safe probe removal from the set-up
- Robust probe storage box
- Test certificate & manual

Accessories

- SMP to SMA/BNC cable connection
- Photo-current amplifier
- Probe-tip dummy structure
- Mounting & focusing units
- Starter Kit

(*) For a focus diameter of circa 20 μm , bias voltage 1 V, average optical excitation power 4 mW.

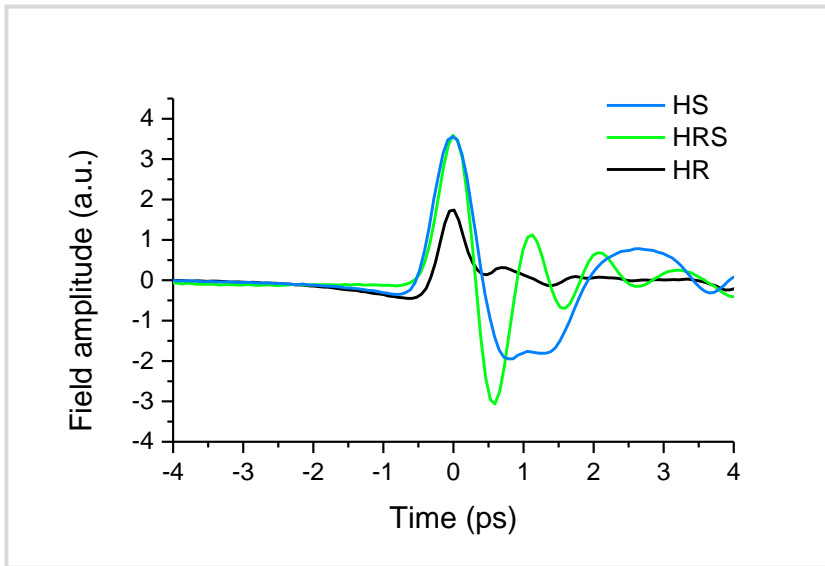
Set-up (exemplary for near-field transmission measurements)



All TD-800-X probes are sensitive to **x-oriented** field components



Time-domain measurement data



HS

Key feature:

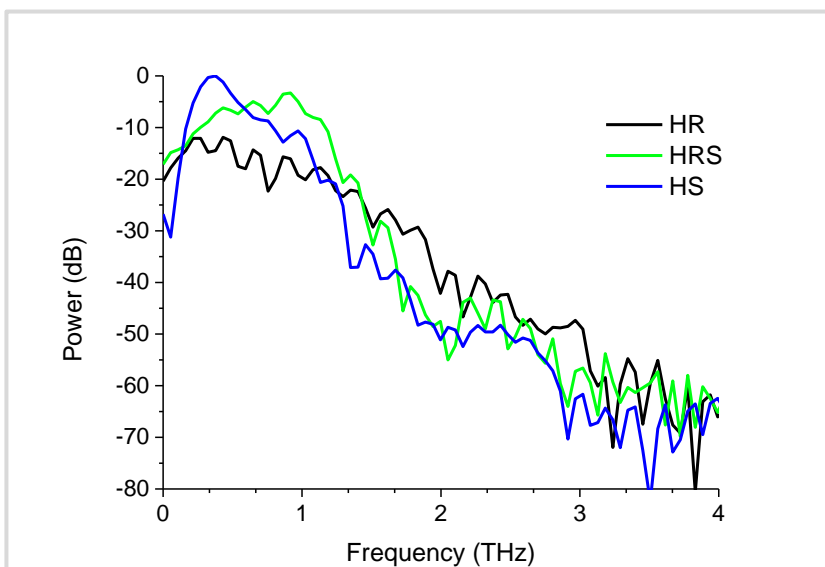
- Highest sensitivity for $f < 0.5$ THz

HRS

Key feature:

- Highest sensitivity for $0.5 \text{ THz} < f < 1.3 \text{ THz}$

Frequency-domain measurement data



HR

Key feature:

- Highest spatial resolution
- Highest bandwidth

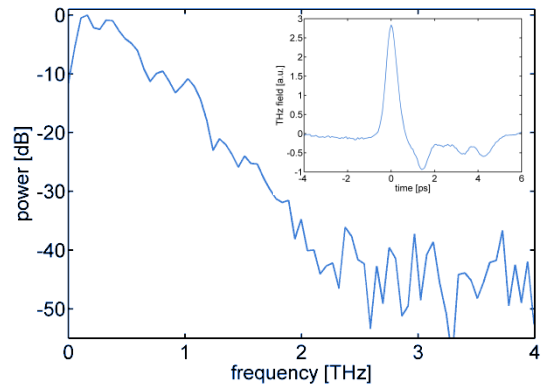
Longitudinal field microprobe TeraSpike TD-800-Z

Technical data

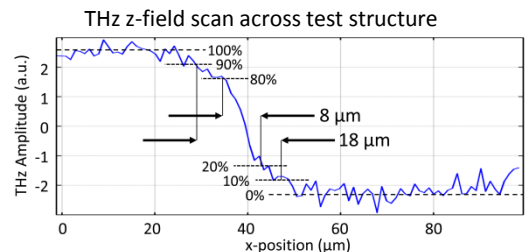
TeraSpike TD-800-Z-	A-500G
Max. spatial resolution	8 μm
PC gap size	5 μm
Dark current @ 1 V Bias	< 0.4 nA
Photocurrent (*)	> 0.5 μA
Excitation wavelength	700 .. 860 nm
Avg. excitation power	0.1 .. 4 mW
Connection type	SMP

(*) For a focus diameter of circa 20 μm , bias voltage 1 V, average optical excitation power 4 mW.

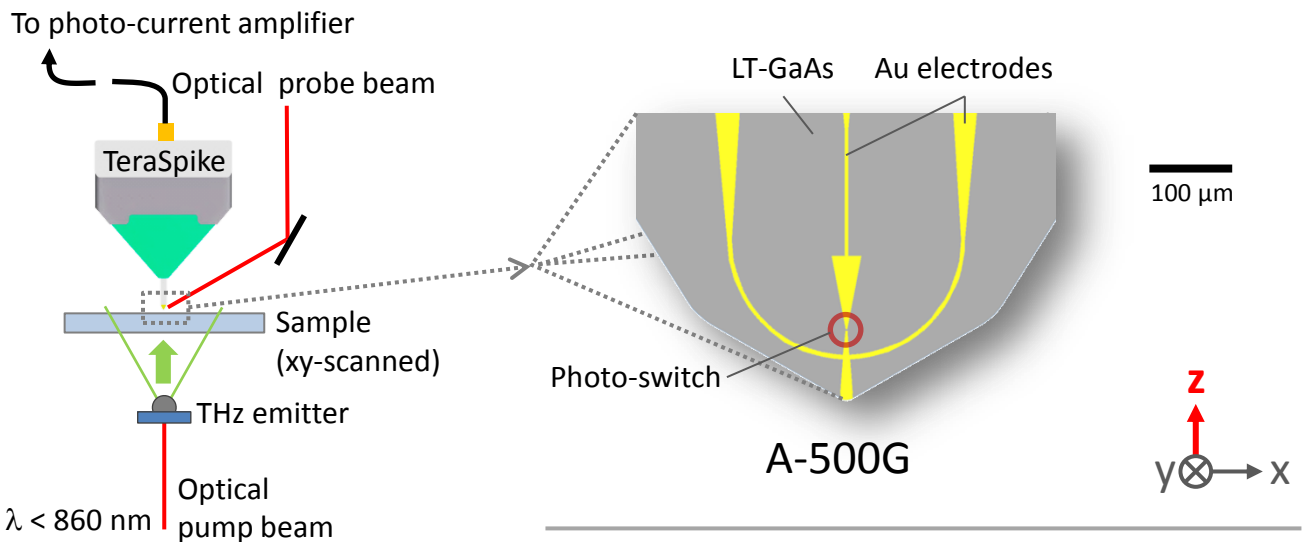
Time-domain (FFT) data



Spatial resolution



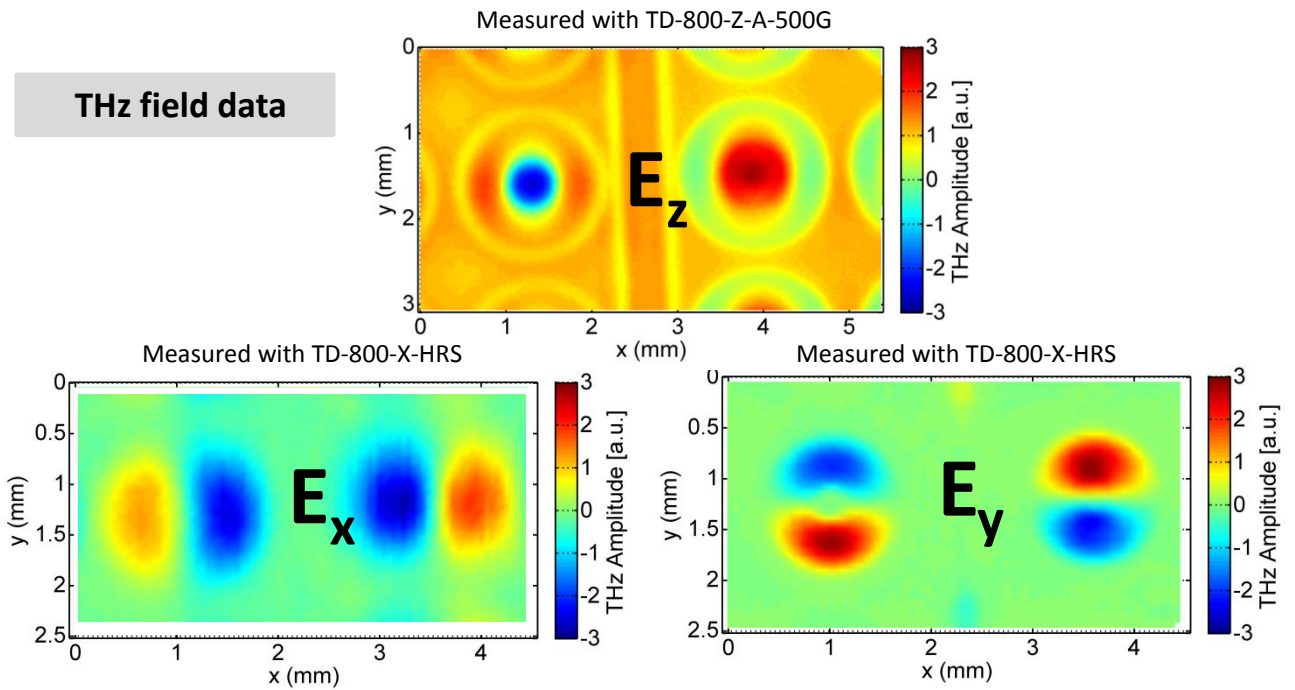
Set-up (exemplary for near-field transmission measurements)



All TD-800-Z probes are sensitive to **z-oriented** field components

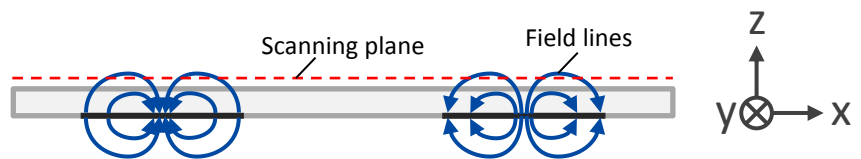
Measurement example: 3D vector field mapping

THz field data

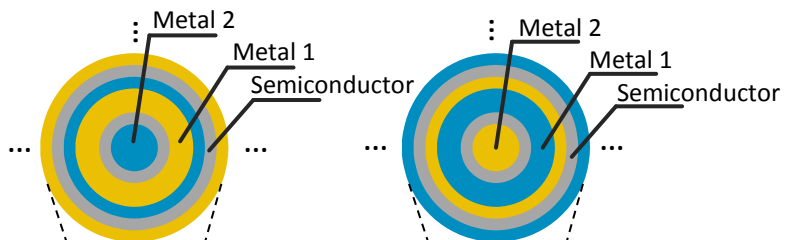


Device under test: Radial-mode emitter pair

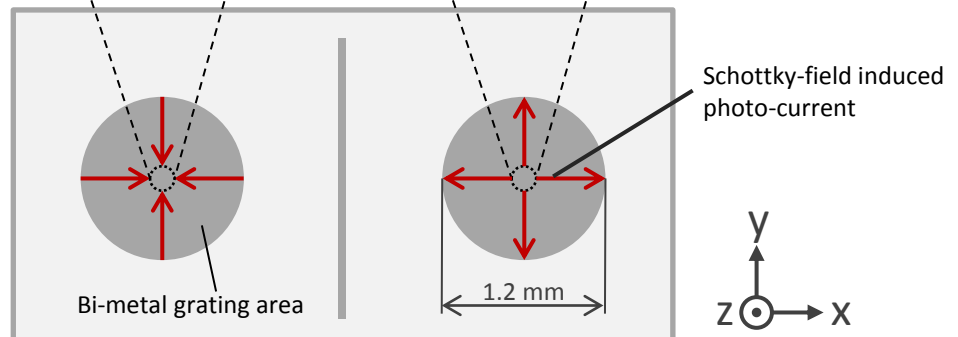
Device cross-section:



Zoom to center regions:



Device top-view:



Pair of radial-mode THz emitters based on planar bi-metal gratings

Bias-free THz pulse generation probe

TeraSpike TD-1550-Y-BF

new

Technical data

TeraSpike TD-1550-Y	-BF
Pulse rise time	<1 ps (down to 0.4 ps)
Bandwidth*	0.01 .. 2.5 THz
Excitation wavelength	700 .. 1600 nm (<860nm recommended)
Avg. excitation power	0.1 .. 4 mW
Cantilever material	InGaAs (n-type)
Lateral tip radius	8 .. 12 μm
Cantilever length	570 .. 600 μm

*For excitation with optical pulses of 90 fs duration.
#Other designs possible on request.

Product details

- Probe-tip for surface-near bias-free optical generation of pulsed THz signals
- Mount for variable probe orientation and simple removal from the set-up
- Robust probe storage box
- Test certificate & manual
- Patent pending DE 10 2013 020 216.7

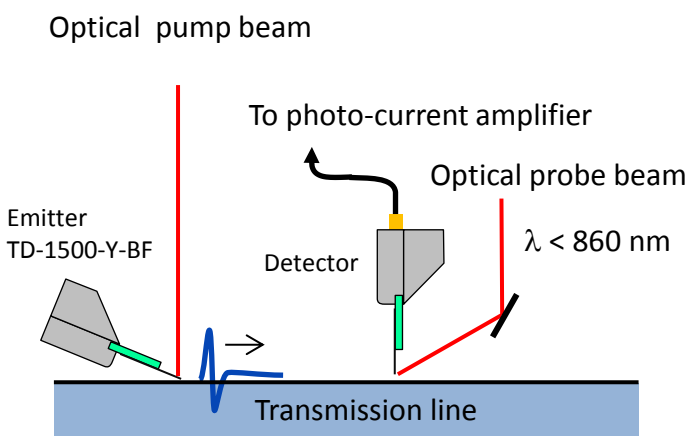
Accessories

- Probe-tip dummy structure
- Mounting & focusing units

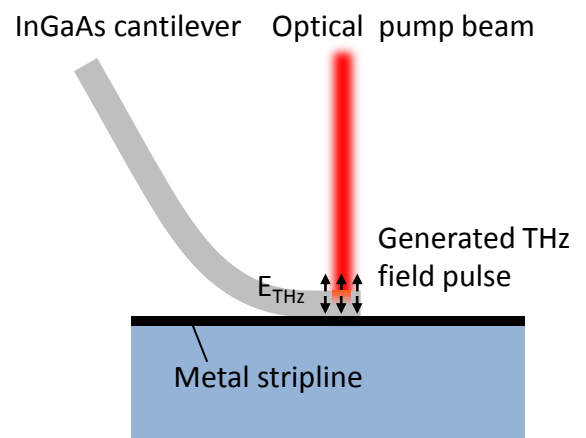
Tip design (standard)

$R = 10 \mu\text{m}$

Set-up (example for TDR)

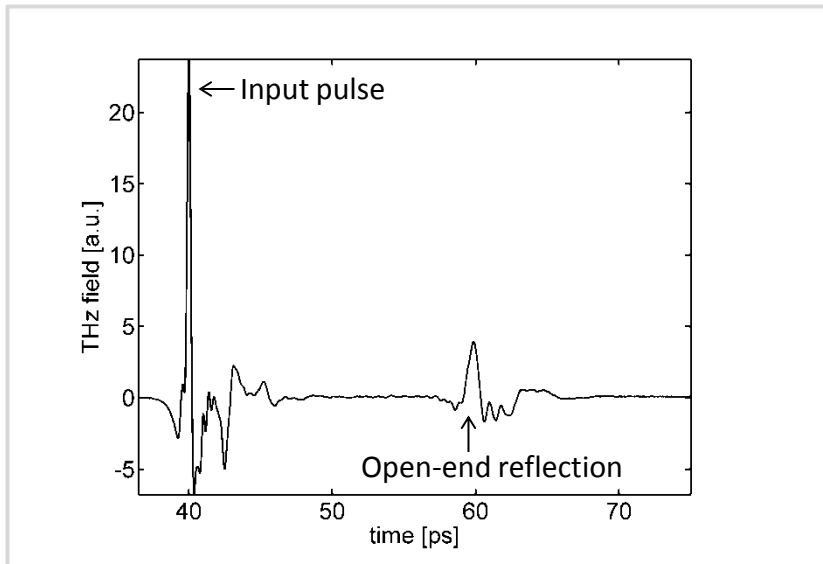


Emitter scheme



Measurement example: THz TDR measurement

Time-domain measurement data

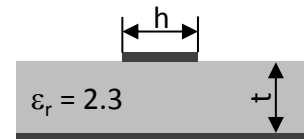


Sample data:

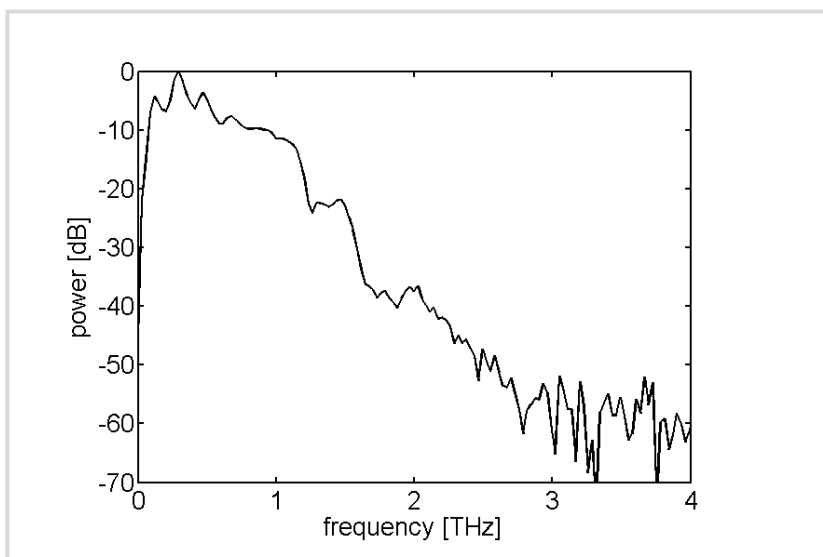
Thin-film microstrip line

- $Z_0 = 110 \Omega$
- $w = 35 \mu\text{m}$
- $h = 57 \mu\text{m}$

Cross-section:



Frequency-domain measurement data



Set-up:

Applied Laser:

- Wavelength: 780 nm
- Pulse length: 90 fs
- Repetition rate: 100 MHz

Emitter:

- TeraSpike TD-1500-Y-BF
- Optical power: 4 mW

Detector:

- TeraSpike TD-800-X-HRS
- Amplification: 10^8 V/A
- Optical power: 3 mW

Terahertz emitter

TeraBlast

new



Background

The new bias-free Terahertz emitter series TeraBlast from Proteemics are optically pumped THz sources which can be used with a wide range of femtosecond laser sources (such as low power oscillators or amplified lasers with wavelengths in the range of 700..1600 nm).

They are ideally suited and tested for near-field imaging applications including TeraSpike micro-probe operation. The TeraBlast is also a great emitter for classic far-field spectroscopy and other THz applications.



Technical data

TeraBlast TD-1550-L-165	
Excitation wavelength range	700 .. 1600 nm
Typ. average excitation power range	5 mW .. 1000 mW
Average THz emission power	> 2.5 μ W ^(a)
Active area diameter	ca. 11 mm ^(b)
Adapter dimension (Outer diameter)	1/2 inch

^(a) Measured with pyroelectric detector (Spectrum Detector Inc. SPI-D-62-THz) for 370 mW optical pump power

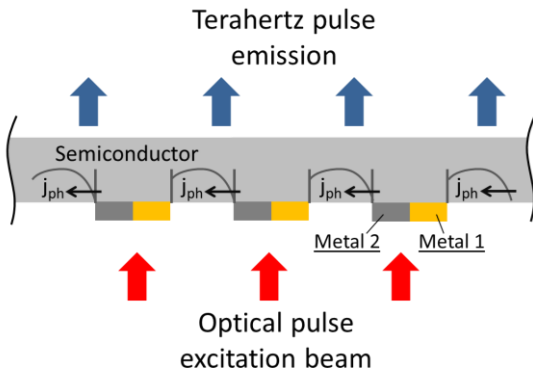
^(b) Larger active areas possible. Please request!

Key benefits

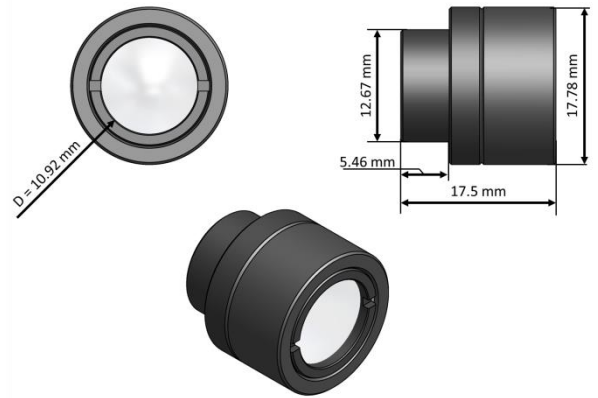
- Recommended THz source for TeraSpike microprobe operation
- High emission power
- Patent pending design (DE102012010926 A1)
- Unmatched simple handling
- Virtually no alignment or focusing effort
- Can be used as a point source or array emitter
- Linearly polarized emission
- Extremely robust due to bias-free operation
- No device failure on local short-cut defects
- No dark current
- No parasitic off-set signal generation in lock-in detection schemes

Terahertz emitter TeraBlast

Emitter scheme

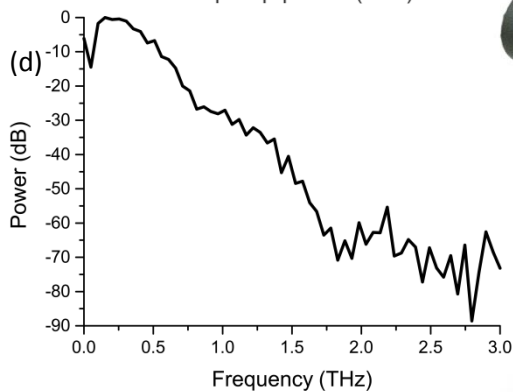
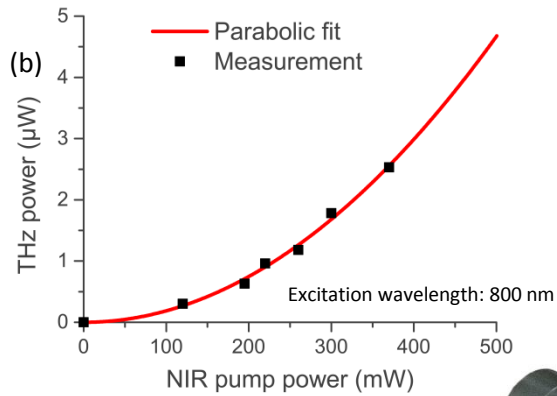
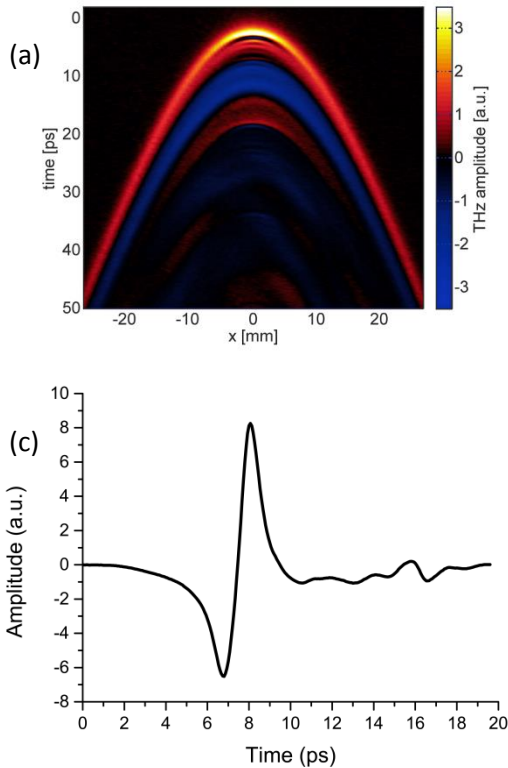


Dimensions



Exemplary measurement data

THz emission measured in 15 mm distance
(without back-surface aperture)



new

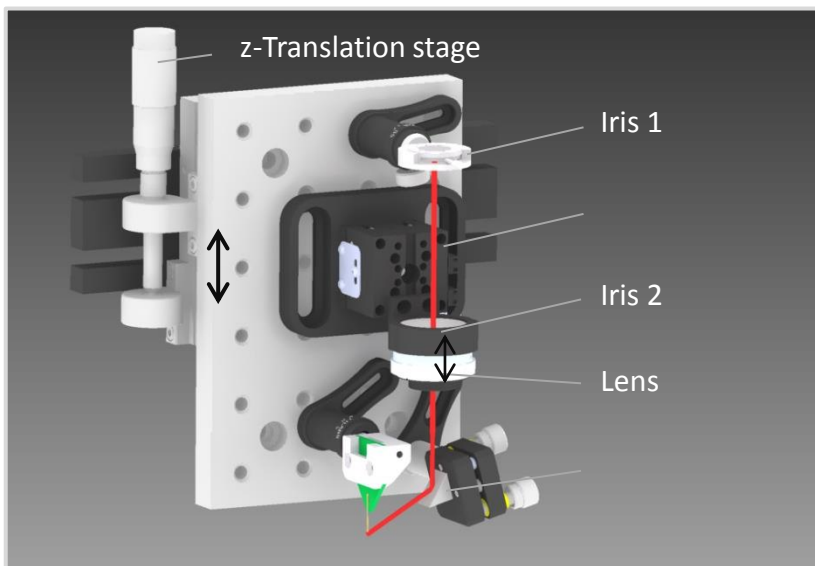


(a) Measured with TeraSpike TD-800-X-HRS, (b) Measured with SPI-D-62-THz from Spectrum Detector Inc.
(c) & (d) Far-field transient measured with THz receiver TM5-R-DP10_25M from Fraunhofer HHI.

Integration components

Sub-system modules

Sub-system D-B1



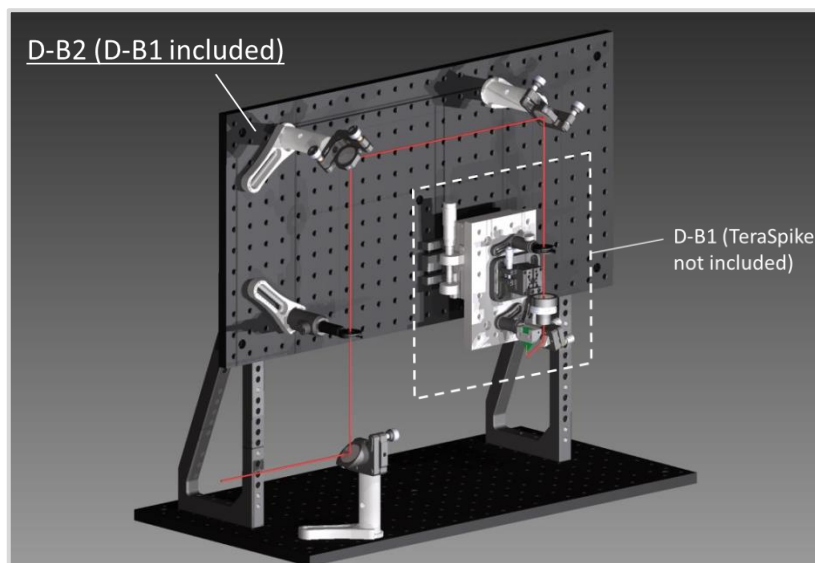
Description

Mini-board set-up with pre-aligned opto-mechanical components for the system integration of TeraSpike microprobes.

Functions:

- Microprobe mount
- Manual beam-to- microprobe focusing
- Manual beam-to- microprobe alignment
- Manual microprobe height variation

Sub-system D-B2



Description

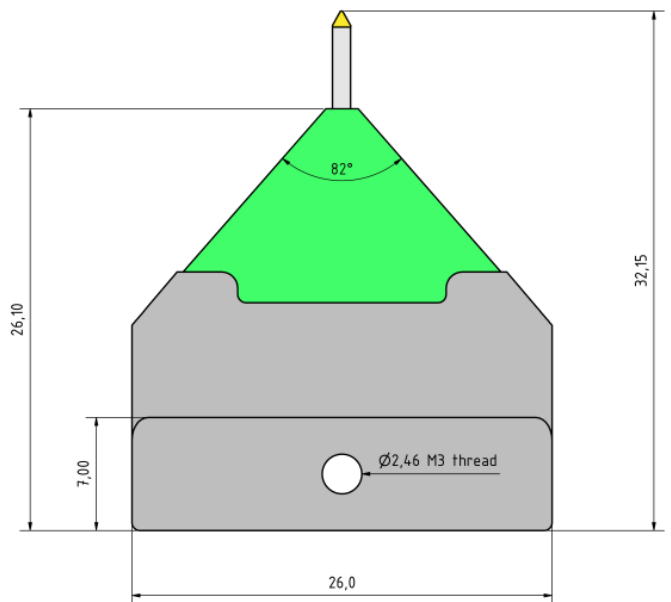
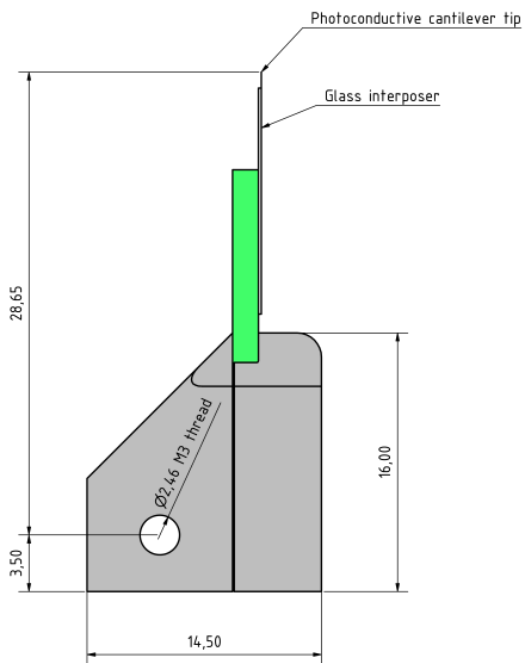
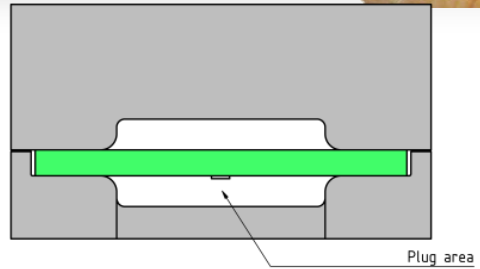
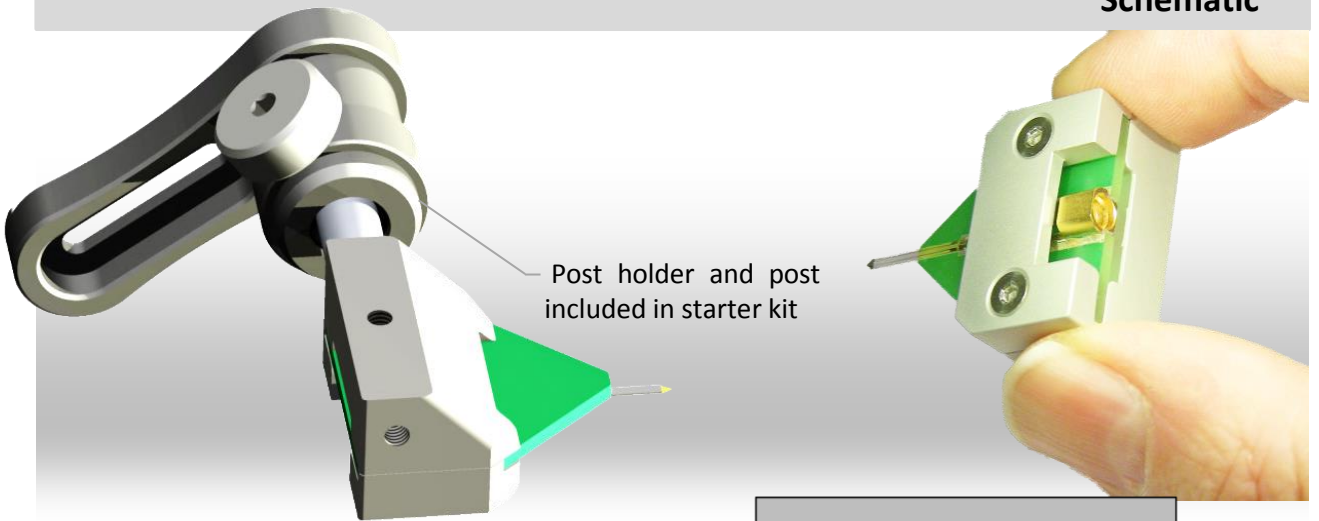
Multi-board set-up with pre-aligned opto-mechanical components.

Functions:

- Motherboard including sub-system D-B1 in customized height
- Assembly brackets
- 2 alignment apertures
- 2 tilt mirrors
- Extendable with CCD camera and distance sensor

THz microprobe series TeraSpike

Schematic





Order information

Terahertz microprobes detectors

TeraSpike	THz photoconductive probe-tip with SMP plug
	Series: TD-800-X- (Type: HR, HS or HRS)
	Series: TD-800-Z- (Type: A-500G)
TeraSpike Starter Kit	Includes: TeraSpike TD-800 microprobe, TS Phantom, TS Cable, mounting post and holde

Terahertz microprobe emitters

TeraSpike	InGaAs cantilever microprobe
	Series: TD-1550-Y-BF

Large-area bias-free Terahertz emitters

TeraBlast	TD-1550-L-165
	Option (-HPF): Back-surface high-pass filter

Sub-system modules

D-B1	Axial positioning, focusing, alignment unit
D-B2	Vertical board base unit including D-B1

Current amplifiers

DLPCA-200	Variable gain current amplifier with 50 kHz Bandwidth @ 10^7 V/A amplification
DHPCA-100	Variable gain current amplifier with 220 kHz Bandwidth @ 10^7 V/A amplification

Accessory

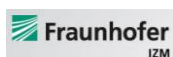
TeraSpike Phantom	Dummy probe-tip device
TS Cable	SMP to SMA/BNC probe connection cable

Service offer

- Not sure how to integrate TeraSpike into your system or do you have other questions? We are happy to advise you!
- Custom microprobe designs are possible on request.
- We offer **measurement services** including detailed data analysis reports for your samples in our laboratories.
- On-site installation support
- Training courses
- Component repair and maintenance services

Terahertz microprobing Solutions

References



BOSCH



ECN

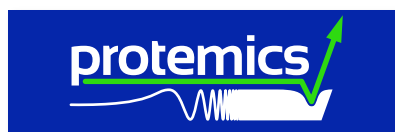
**RWTH AACHEN
UNIVERSITY**



Applications

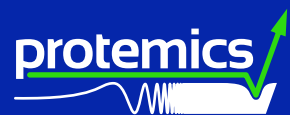
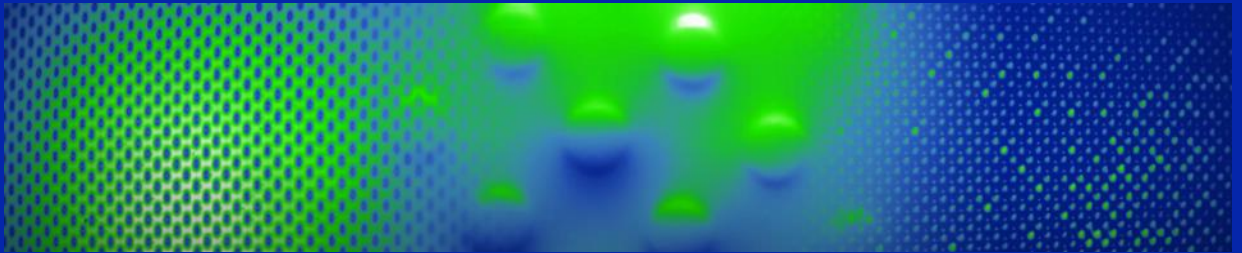


- Non-destructive testing ■
- Terahertz technology ■
- Terahertz research & development ■
- Near-field analytics ■
- Transparent conductors ■
- Flexible electronics ■
- Graphene ■
- Wafer inspection ■
- Thin-film analysis ■
- Metamaterials ■
- Solar cell inspection ■
- Terahertz device analysis ■
- Fault location ■
- Time-domain reflectometry ■
- Terahertz waveguide analysis ■
- Marker-free biosensing ■
- Optoelectronics ■
- Plasmonics ■



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TERAHERTZ MICROPROBING SOLUTIONS