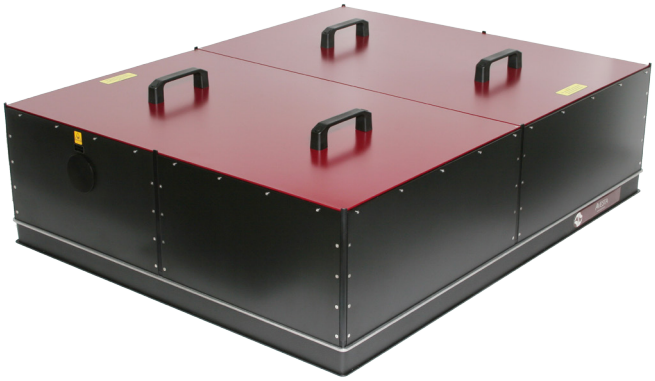
TERA-AX. High-Intensity Terahertz Generator

- THz pulse energy >1000 nJ
- Frequency range 0.5-2.5 THz
- Pulse duration <1 ps
- Cryogenically-cooled MgO:LiNbO3 option
- THz time-domain spectrometer option with electro-optical sampling with USB interface and Windows software
- Pumped by commercial Ti:Sa amplifiers



The Tera-AX optical unit

Product overview

THz science has recently come to a new era: field magnitude of an order of MV/cm has been reached, allowing to study THz nonlinear carrier dynamics in semiconductors, THz acceleration of electrons, electron-packet sampling and many other applications. In order to provide a robust tool for studying nonlinear THz physics and THz imaging, we developed a source of a high-field pulsed THz radiation in the range 0.5-2.5 THz. The TERA-AX generator based on phase-matched optical rectification in MgO:LiNbO3 crystal and can be used with commercial femtosecond Ti:Sapphire regenerative amplifiers such as the REUS series by AVESTA Ltd.

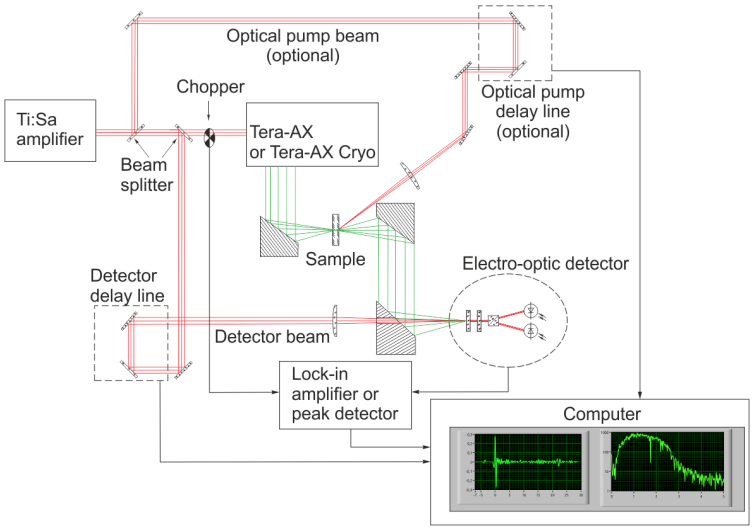
A modification of the TERA-AX system with a cryogenically-cooled lithium niobate crystal is also available. In the TERA-AX-Cryo version, the crystal is placed on a cold plate of a liquid-nitrogen filled cryostat. Cooling the generator crystal drastically decreases its THz absorption and allows to achieve outstanding optical - to THz conversion efficiency of up to 10^{-3} level and improves the long-term stability of conversion efficiency. The optical scheme of TERA-AX-Cryo is pre-adjusted for use at temperature of 93 K, but it can be easily optimized for use at room temperature.

As an option, in both the TERA-AX and the TERA-AX-Cryo, a larger-aperture MgO:LiNbO3 crystal can be utilized in order to accept higher-energy optical pump pulses (we recommend this option for energies of femtosecond pump pulses higher than 2 mJ).

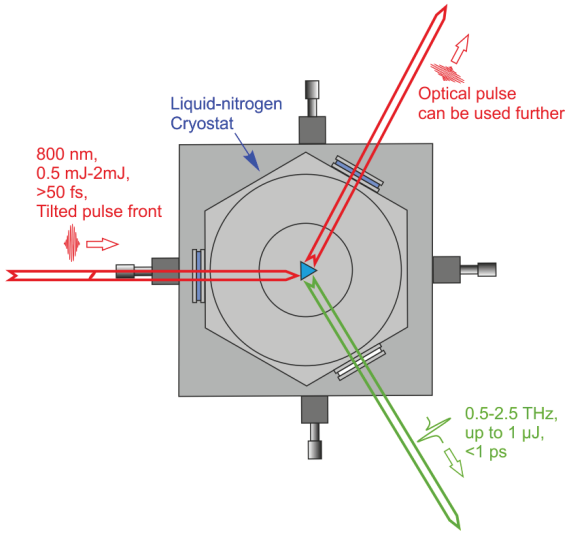
The TERA-AX or the TERA-AX-Cryo generators can either be used as stand-alone units, providing a collimated THz output beam, or as a part of a THz transmission spectrometer equipped with an electro-optical sampling detection (EO TDS). This allows to obtain the temporal profiles of THz field passing the sample under study and get the information on its complex dielectric function in range 0.5-2.5 THz. An optical pump-terahertz probe modification (OPTP) of the optical layout is available upon request.

The complete system may contain the following components:
- the TERA-AX optical unit with THz emitter based on optical rectification in MgO:LiNbO3 crystal with output parabolic mirror; OR
- the TERA-AX-Cryo optical unit with cryo-cooled THz emitter based on optical rectification in MgO:LiNbO3 crystal;
- (optional) the EO-AX terahertz time-domain spectrometer that includes: 1) 3 parabolic mirrors for focusing the THz beam in the sample; 2) Electrooptical detector with lock-in amplifier or highly-sensitive peak detector and digitizer (depending on the repetition rate of the regenerative amplifier) with USB interface; 3) Optical chopper; 4) Windows acquisition and analysis software.

The full system is supplied on main breadboard with a cover box that can be purged with nitrogen if necessary.



Layout of the TERA-AX generator and optional EO-AX detector



Layout of the TERA-AX-Cryo generator

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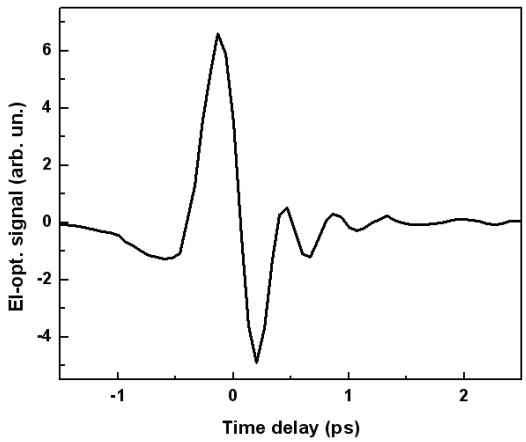
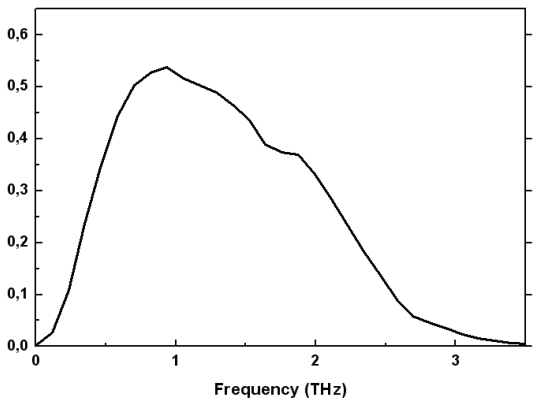
	TERA-AX
THz output specifications	
THz pulse energy	up to 1* uJ
Optical-to-THz conversion efficiency	up to 0.1%
THz pulse duration	0.5-1 ps
Spectral frequency range	broadband, 0.5-2.5 THz
THz beam divergence	45 mrad in vertical direction; 100 mrad in horizontal direction
EO-AX THz time-domain spectrometer parameters (optional)	
Frequency resolution	30 GHz
Temporal scan range	180 ps
Data acquisition and analysis	Windows PC software included; USB 2.0 interface
Possible ranges of optical pump specifications**	
Central wavelength	780-820 nm
Pulse duration	50-500 fs, transform-limited pulse
Pulse energy	0.5-5 mJ
Repetition rate	10 Hz - 10 kHz
Polarization	linear, horizontal
Beam diameter (at 1/e^2 level)	>9 mm
Pulse energy stability (rms)	<1%
Environmental and utility specifications	
Operating temperature	20-25°C
Relative humidity	<60%, non-condensing
Voltage (for EO-AX and TERA-AX-Cryo)	single-phase; 100-240 VAC; 50/60 Hz
Max. power consumption (for EO-AX and TERA-AX-Cryo with vacuum conditioning)	<2 kW
Vacuum port (for TERA-AX-Cryo)	KF16
Operational pressure requirement (for TERA-AX-Cryo)	$<10^{-5}$ mbar
Liquid nitrogen capacity (for TERA-AX-Cryo)	1 litre
Dimensions	
TERA-AX (basic version)	600 x 300 x 200 mm
TERA-AX (extended version to intergate Cryo-AX)	1000 x 800 x 300 mm
Cryo-AX	220 x 220 x 380 mm

** - obtained with the REUS-3m1k Ti:S pump laser with output specs: 1 kHz, 2 mJ, 100 fs FTL, 800 nm CWL;*
*** - each system is tailored to a certain set of optical pump specifications, please indicate complete pump laser specification with your request so we can estimate TERA-AX THz output values;*



TERA-AX time-domain signal



TERA-AX typical FFT amplitude spectrum

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