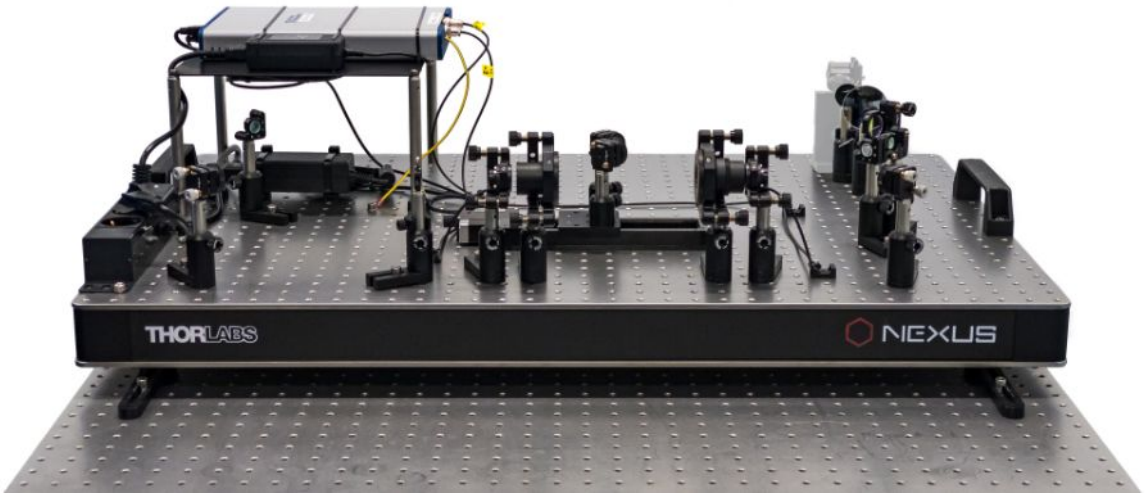
Setup of TDS10XX-wol

Pre-Assembled System



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Setup of TDS10XX-wol

Version 2021-07

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DAQ	**D**ata **Acq**uisition (System)
TDS	**T**ime-**D**omain **S**pectrometer
THz	Terahertz

1 General

All components of the pre-assembled Terahertz (THz) Time-Domain Spectrometer (TDS) are mounted to a bread board. The whole system has to be fixed on an optical table, using the four provided clamps. The laser beam path has been pre-aligned at BATOP to enable a quick setup. Recommended tools for the setup are:

- Laser viewing card[1]
- Infrared viewer[1]
- Optical power meter[1]
- Multimeter

Warning

You are working with invisible short pulsed laser radiation. Please follow all the safety measures recommended by the laser manufacturer. Any disregard may cause serious injury to your eyes.

You will find two apertures in the TDS system to align your laser (Figure 1). A careful setup is crucial, because the laser beam has to be absolutely parallel to the movement of the delay line.
Furthermore it is very important that the laser beam is well collimated. Otherwise, the laser beam diameter will not match up with the chosen aspheric lenses mounted to the free space antennas or the collimators for the fiber-coupled antennas. Please characterize the laser beam profile if you are not sure about the divergence.

Before you can start the pre-assembled TDS system you need to hook up the spectrometer to the laptop and power supply using the provided cables. Subsequently, you will find the data acquisition (DAQ) system (> NI-USB) and the delay line (> active COM port) in the device manager.[2]

In any case you have to begin with the laser beam adjustment as described in the subsequent sections before it makes sense to work on the THz signal.

[1] Suitable for your laser wavelength
[2] See also the manual for T3DS Software

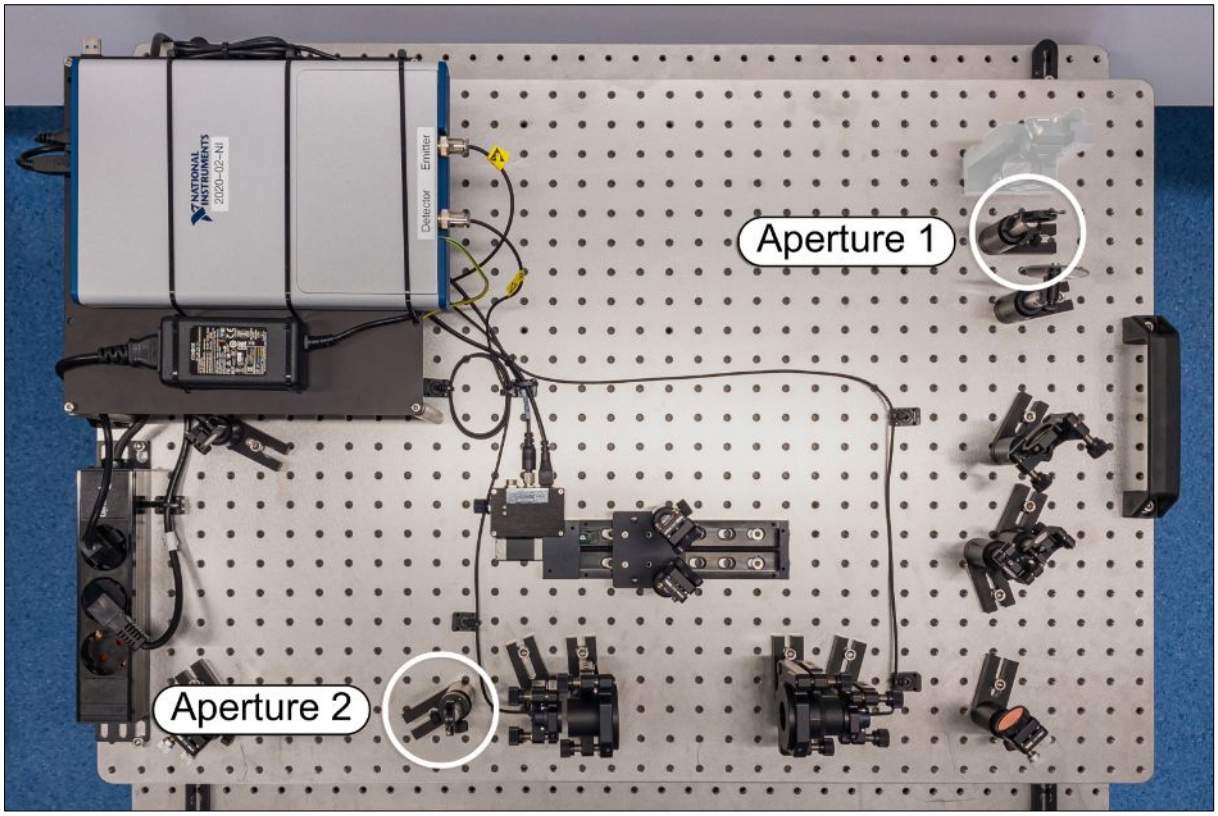

Figure 1: Apertures of the TDS10XX-wol for the alignment of the laser beam

2 Laser Beam Adjustment

Warning

As the pre-assembled TDS system has been tested with a different laser, you need to make sure that the laser beam entering the system does NOT damage the THz antennas. Please check the test report for the laser specifications and measured power levels at different points in the system. Set your power levels accordingly in order to avoid damage to the antennas. Additionally, please note that the laser beam entering the system needs to be p-polarized. Otherwise the beam splitter and other components will not work properly.

The pre-assembled TDS system comes with two apertures to align your laser (Figure 1). The laser beam height above the bread board is about 100 mm. Taking the height of the bread board (incl. feet) into account, you need to set the beam height of your laser at about 187 mm above the optical table. We recommend a mirror close to the edge of the bread board in order to feed the laser into the pre-assembled TDS system. This simplifies the input beam adjustment. If the system comes with the optional housing, a removal of the whole lid enables better access to the optical parts.

The alignment starts by threading the laser beam through the two provided apertures using the infrared viewer (or viewing card). Reduce the aperture diameter step by step to the minimum and readjust the laser beam that is fed into the setup accordingly.

Please check the polarization of your laser beam if the power is not split 1 by 1 by the beam splitter.

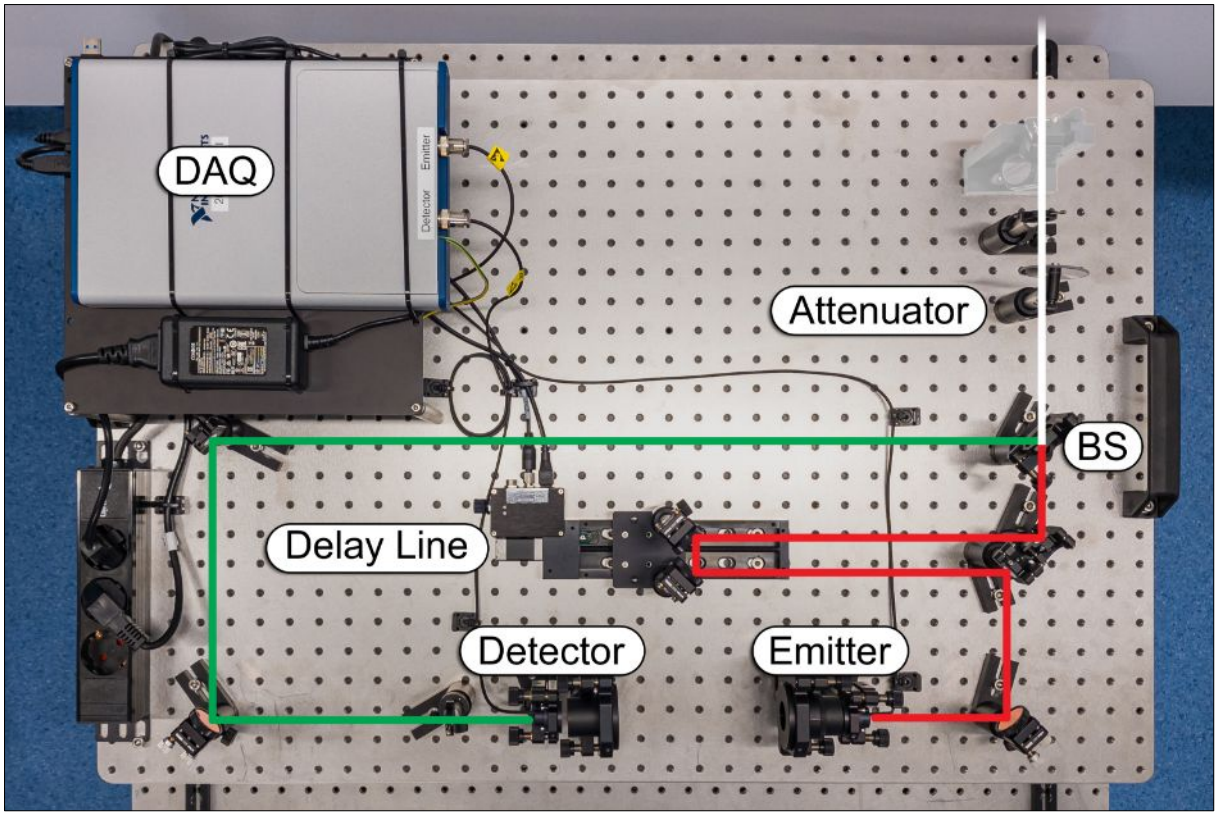

Figure 2: Designated laser beam path with free space antennas

In order to fine tune the laser beam path further, you have to place your optical power meter behind the second aperture and maximize the power level by aligning the entering laser beam. Once the power level is at the maximum, your laser beam is collinear to the one used to pre-align the TDS system. Now, open the apertures.

Warning

Please measure the power levels in front of the antennas one final time and adjust the attenuator if necessary.

Warning

Make sure that the pulse fluence of the laser spot on the antenna gap does not exceed the specifications. As we supply the antennas with a chosen aspheric lens, the optical power needs to be adapted to the beam diameter, repetition rate and pulse duration.

3 Working with Free Space Antennas

To optimize the free space antennas, please connect your multimeter to one antenna using the BNC cable and measure the dark and illuminated resistance. If there is only little change of the resistance upon open/ closing the laser aperture, you can adjust the last mirror before the corresponding free space antenna in order to dial in a low resistance. Once the ratio between the dark and the illuminated resistance matches the test report you can disconnect the multimeter from the BNC cable and repeat the procedure with the other free space antenna.

Once the resistance ratio matches the data sheet you can start the T3DS software and do the fine optimization. Please check the also provided hard- and software manuals for further details.[3]

[3] Manual for TDS10XX System
Manual for T3DS Software

4 Working with Fiber-Coupled Antennas

To optimize the fiber-coupled antennas, please connect your optical power meter to the fiber collimator[4] using the provided optical fiber (Do not detach the fiber from the antenna). Adjust the last mirror before the corresponding fiber collimator and the fiber collimator itself to maximize the optical power.
If you are not able to achieve the power level specified in the test report via the mirror adjustment, you may also need to adjust the focus of the fiber collimator. To do so, please loosen the screw on the tip of the fiber collimator and turn (1/8) the front element clockwise and adjust the mirror and fiber collimator in order to maximize the optical power. Repeat these steps until you match the value from the test report. If the power level decreases, you have to turn (1/8) the front element counter clockwise instead. Finally you have to tighten the secure screw.

Please connect your multimeter to one antenna using the BNC cable and measure the dark and illuminated resistance. The ratio should be equal to the test report. Repeat the procedure with the other fiber-coupled antenna.

Finally you can start the T3DS software and do the fine optimization. Please check the also provided hard- and software manuals for further details.[5]

Warning

Do NOT detach the optical fiber from the antenna!

Notice

If your THz signal is smaller and the bandwidth narrower compared to the test report, than this could be an indication for an inappropriate dispersion compensation for your laser system. The most likely reason is a difference in the wavelength. Another possibility is a much shorter pulse duration/wider bandwidth of the laser leading to higher order dispersion effects.

[4] Fiber port if the system comes with the optional housing
[5] Manual for TDS10XX System
Manual for T3DS Software

5 Contact Details

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