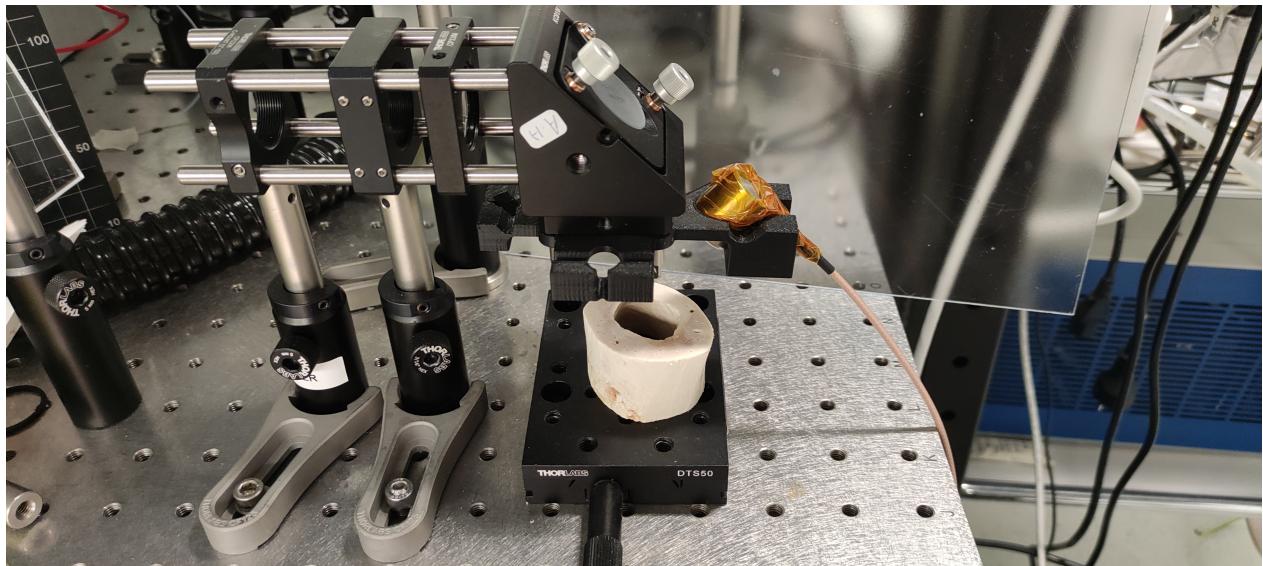


# MANUAL for Acoustic setup

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## 1 Introduction

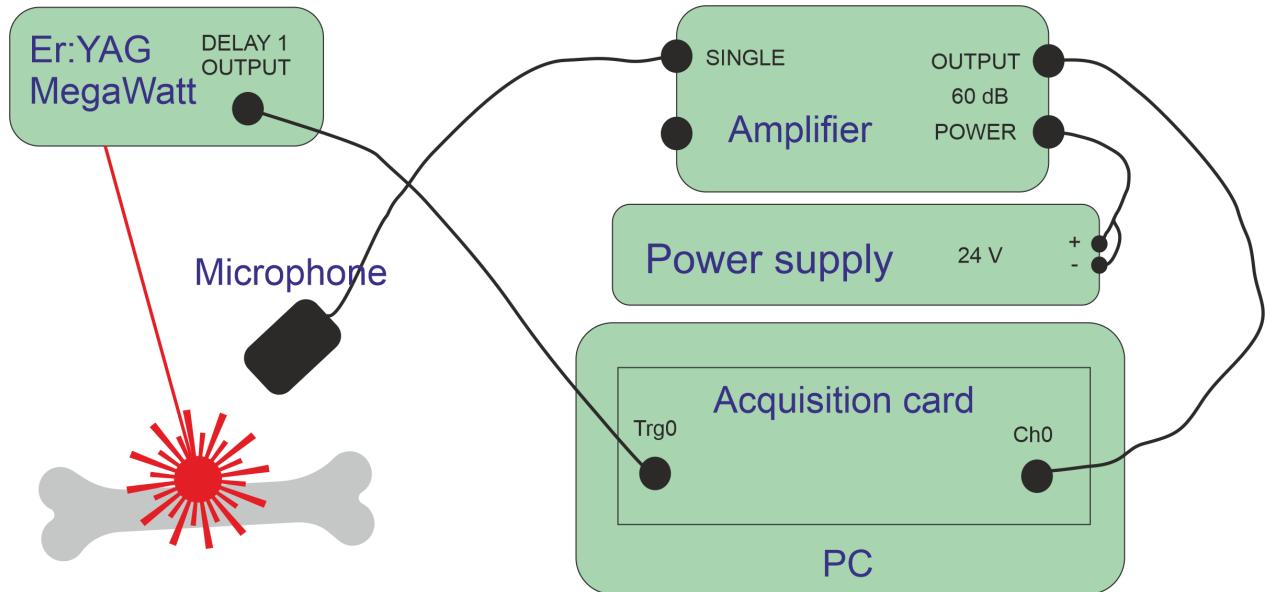
This manual describes how to obtain acoustic data for carbonization or tissue differentiation using Spectrum data acquisition card and Python.

## 2 Connections

Involved devices:

Acquisition card	M4i.44xx-x8 (Spectrum)
Microphone	Micro200HF (Mistras)
Laser	Er:YAG (MegaWatt Lasers)
Amplifier	Mistras

Connections are shown in [Figure 1](#).



**Figure 1:** Scheme of the acoustic setup



**Figure 2:** PC with acquisition card, amplifier and its power supply.



## IMPORTANT

All microphones available at BLOG are contact microphones. I used them as air-coupled transducers, they still detect acoustic shock waves. I am not sure if using air-coupled transducer would collect significantly different waves.

### 3 Settings for data acquisition

Run *DAQ.py* in Spyder on the PC. The code can collect the data into the memory and save them into a text file. It also plots the last data set from all available channels. I usually acquire one empty channel to verify if data collection works correctly and to check if there is any strange noise.

You can use the code triggered externally or in software. To switch between these two options, uncomment one of the code lines:

```
data[:,i] = m4.single_trigger_acquisition(1000, segment, post_trigger)
# data[:,i] = m4.single_software_trigger_acquisition(mV_range, segment, post_trigger)
```

#### *General settings*

```
sample_rate = MEGA(10)
enabled_channels = [0,1]
nr_channels = len(enabled_channels)
```

Here you choose sampling rate of the card. Consult the manual for acceptable values. Select channels where you collect the acoustic input, the numbers correspond to Ch0-Ch3.

#### *Channel settings*

```
mV_range = 10000
```

```
input_path = 0
```

```
termination = 1
```

```
coupling = 1
```

```
compensation = None
```

*mV\_range* (float): measurement range for the channel  
 (buffered path: 200, 500, 1000, 2000, 5000, or 10000)  
 (HF path: 500, 1000, 2500, or 5000)

*input\_path* (int): input path (0: default/buffered; 1: HF/50 Ohm)

*termination* (None or int): If None, then do not update the termination  
 (0: 1 MOhm; 1: 50 Ohm)

*coupling* (None or int): Set the ACDC\_coupling. If None, then do not  
 update the coupling (0: DC; 1 AC)

*compensation* (None or int): If None, then do not update the compensation  
 (0: off, 1: off)

***Trigger settings***

```
nr_triggers = 10
trig_mode = 1
trig_termination = 0
level_high = 4000
```

nr\_triggers - how many acoustic waves do you want to collect. Laser outputs a 5 V trigger pulse, so 4000 mV is sufficient trigger threshold.

```
trig_mode: 0: None, 1: Positive edge, 2: Negative edge, 4: Both, 8: High,
16: Low, 32: Enter window, 64: Leave window, 128: Inside
window, 256: Outside window, 0x01000001: Positive +
re-arm, 0x01000002: Negative + re-arm
termination: input termination 0: 1 MOhm, 1: 50 Ohm
coupling: DC/AC input coupling (0: DC, 1: AC)
level_high: trigger level [mV]
```

***Data settings***

```
segment = 10240*2
post_trigger = segment-1024*4
save_file = 0
folder = 'C:/Users/BLOG/Desktop/Carlo Sandra/20220613 Tissue diff/'
filename_base = time.strftime("%Y%m%d-%H%M%S") + '-Meat_5Hz_450V_Hole6'
```

segment is the length of the acoustic wave, number of sampling points. post\_trigger value manipulates the length of the acoustic wave after the trigger pulse. segment and post\_trigger need to be multiples of 1k = 1024 bytes. save\_file is optional, 1 is on, 0 is off. Each file will have a timestamp in the filename plus additional info about the sample.

***Laser parameters that will be saved in the file header***

```
# Bad Er:YAG #2
pulse_period = 1000 # ms
duty_cycle = 200 # us
# Ferda's Er:YAG
pulse_length = 350 # us
frequency = 5 # Hz
voltage = 450 # V
```

Please comment and uncomment the corresponding lines. They will be written in each file's header.

## 4 Troubleshooting

In case of any issues, contact [@Sandora](#) for support. Before you do that, please try turning the devices on and off again. Python programs can be interrupted with CTRL+C. Consult the manuals for the range of acceptable settings for different devices.

### 4.1 Acquisition card

- When card gets stuck waiting for a trigger, you need to restart Python Kernel. You can find the option under three horizontal bars next to Spyder command line.

### 4.2 Amplifier

- Don't forget to activate its power supply! There is an OUTPUT button.