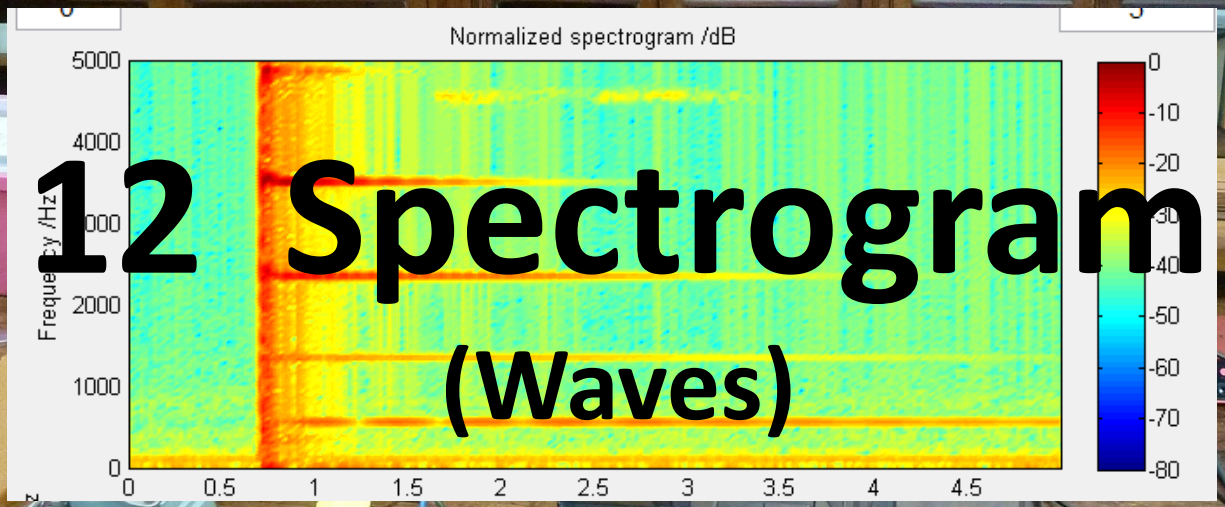
Post-IGCSE Physics Course: **Experimental Physics using Data Loggers and Computers**



12 Spectrogram

(Waves)

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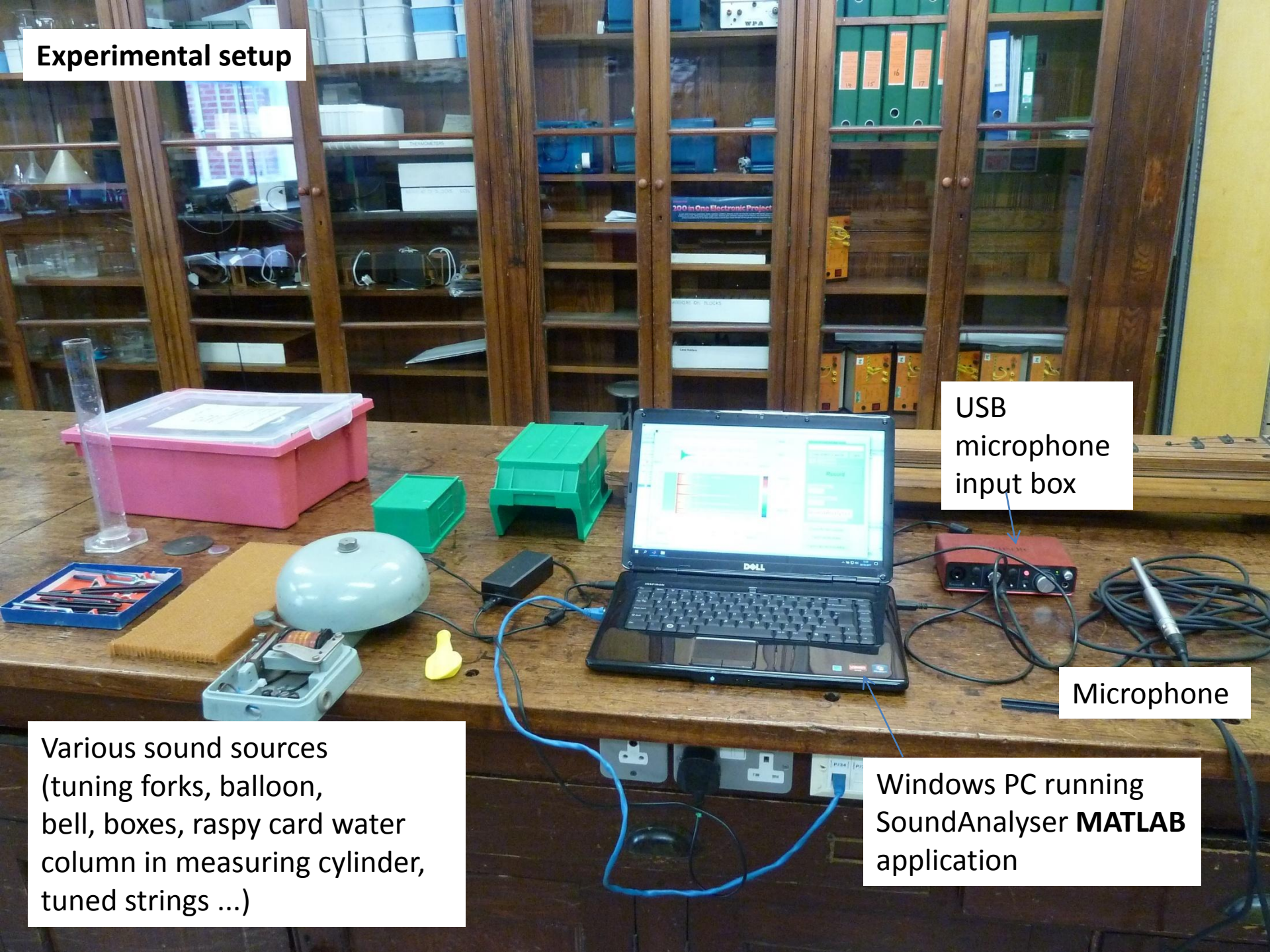
Last updated April/May 2017


Experimental setup
USB microphone input box
Microphone
Various sound sources (tuning forks, balloon, bell, boxes, raspy card water column in measuring cylinder, tuned strings ...)
Windows PC running SoundAnalyser **MATLAB** application


Gain dial
MONITOR
48V
DIRECT MONITOR
Focusrite
USB microphone input box. Make sure 48V ‘Phantom power’ button is pressed.

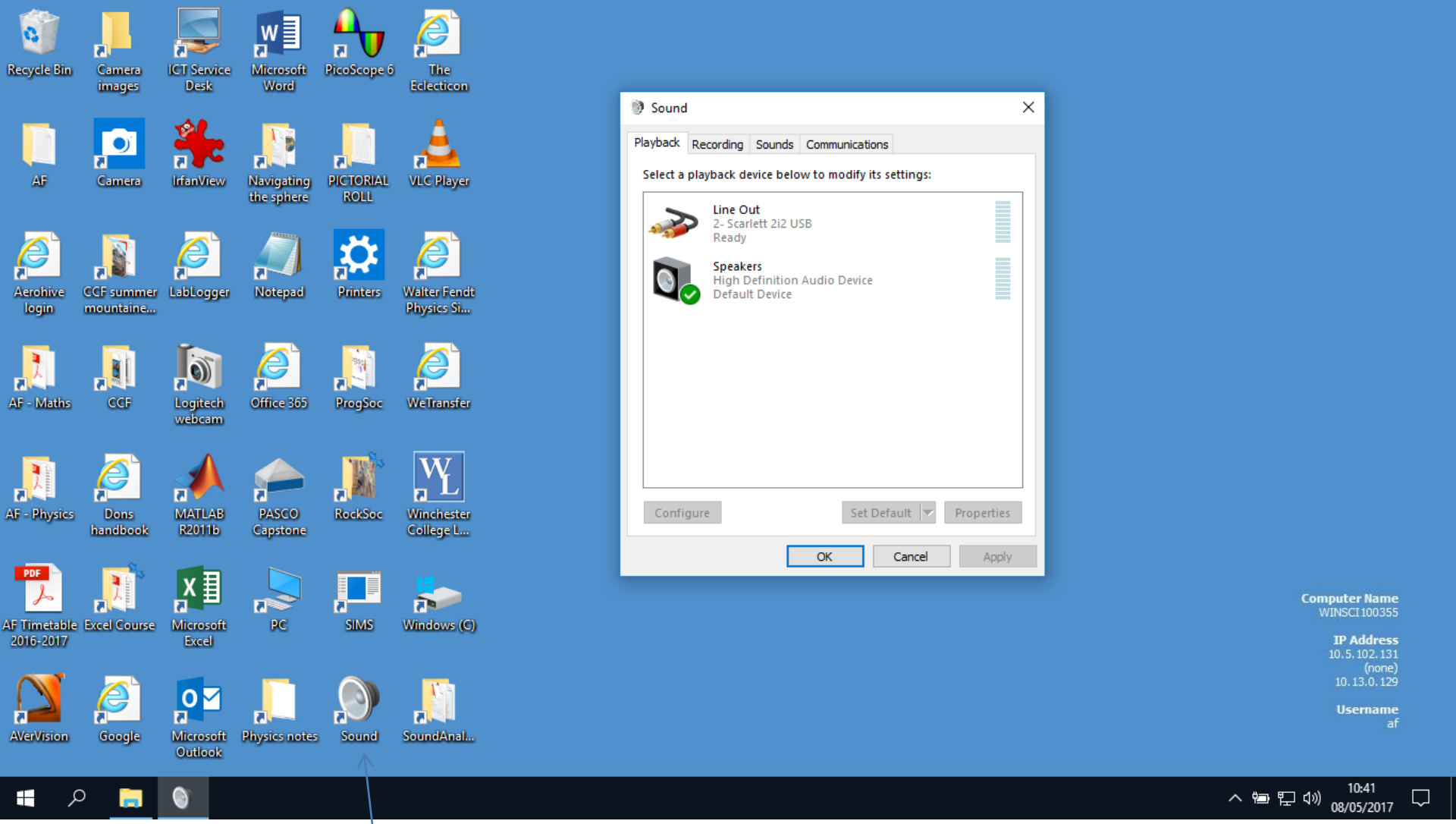
Various sound sources


Tuned strings sound source
Focusrite

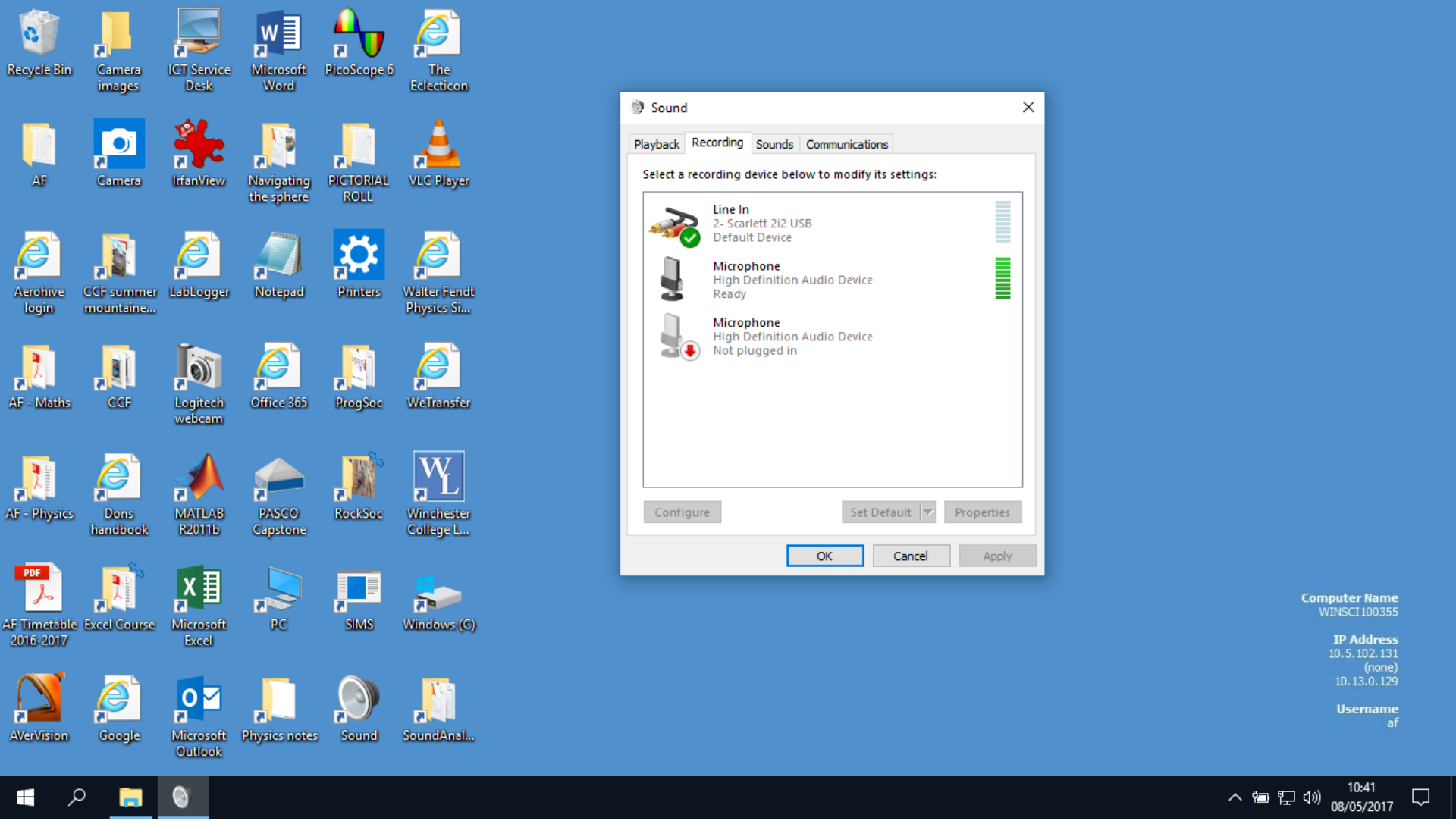
Tuning forks

Discs for spinning!

Various sound sources

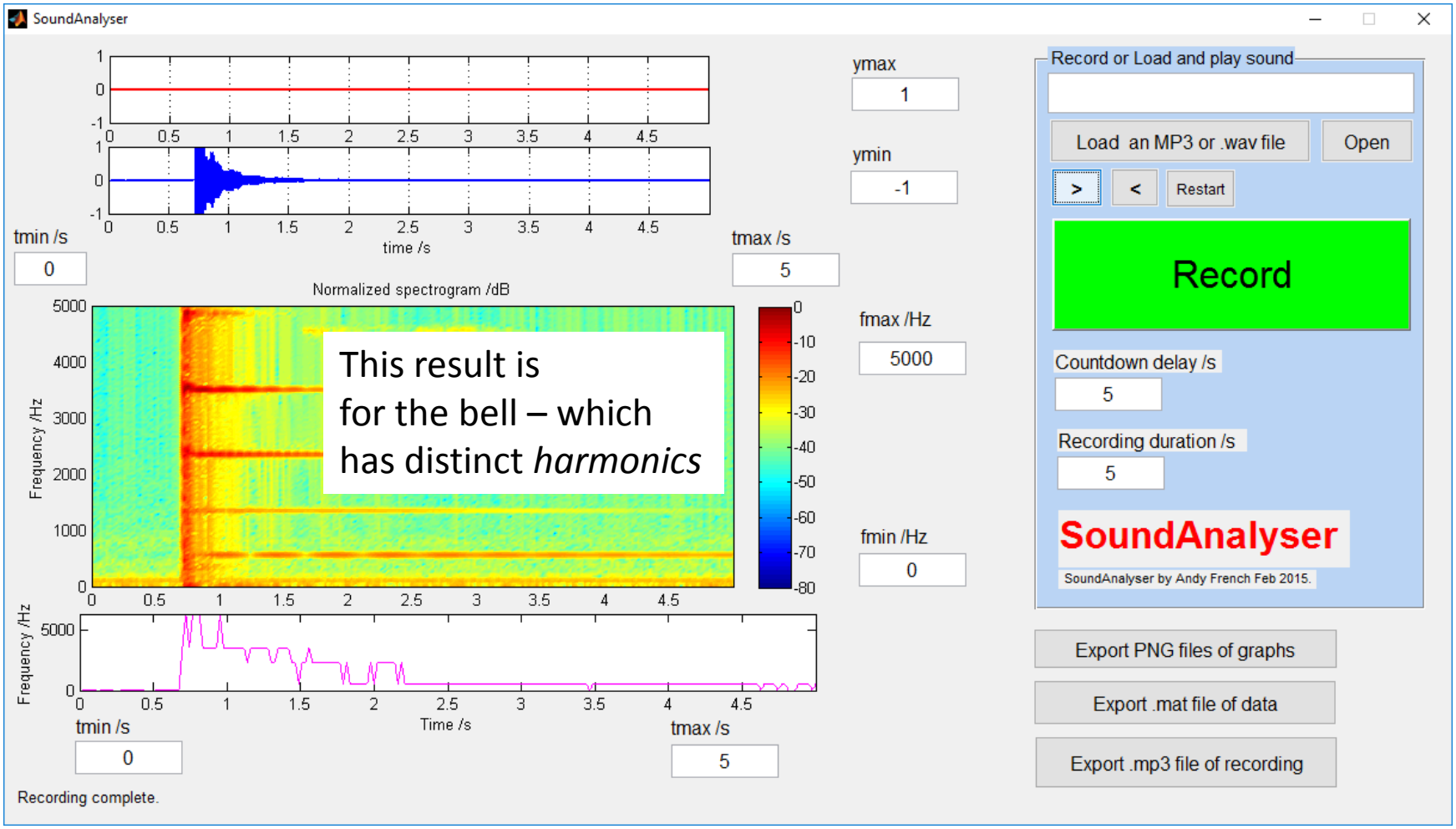


Configure windows **Sounds** settings to be **Speakers** for **playback** ...



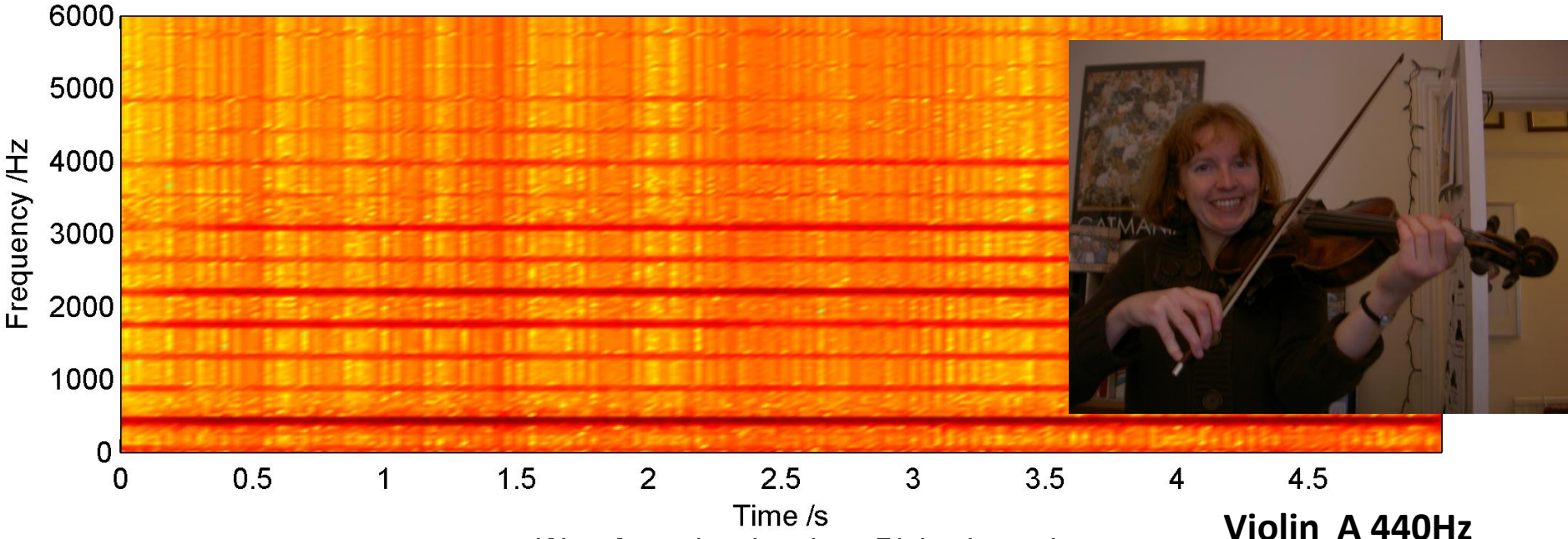
Configure windows **Sounds** settings to be **Line In** for **recording** ...

Run **MATLAB** and run **SoundAnalyser.m** within the MATLAB command window.
The following GUI will appear.



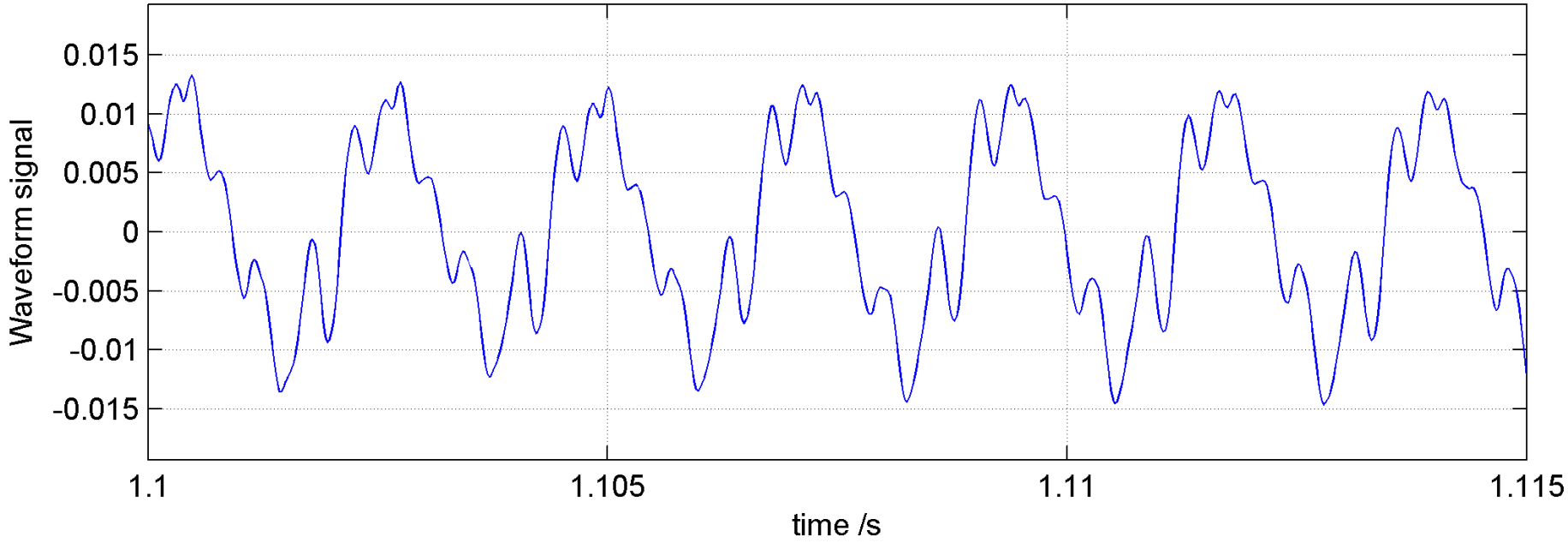
Pressing **Record** will record sound and then analyse it i.e. amplitude vs time and frequency spectrum vs time (plus 'dominant' frequency vs time) graphs will be generated.

Normalized spectrogram /dB: Frequency spectrum variation with time



Violin A 440Hz

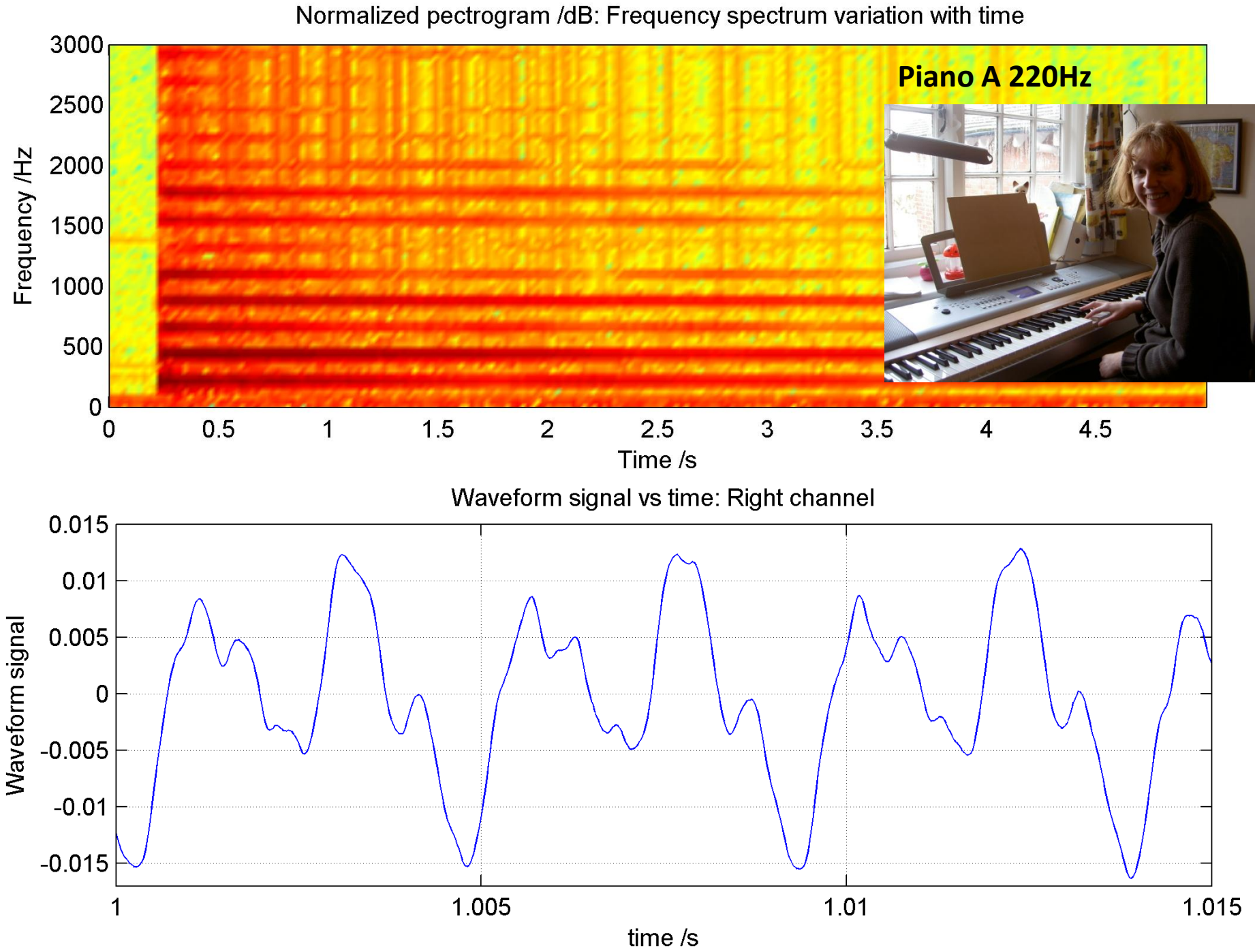
Waveform signal vs time: Right channel



Normalized pectrogram /dB: Frequency spectrum variation with time

Guitar A 440Hz

Waveform signal vs time: Right channel

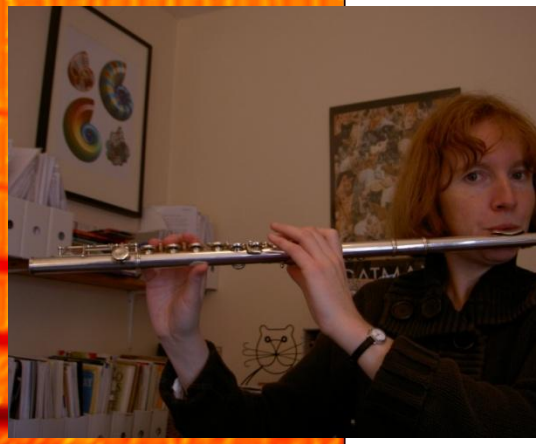

Normalized pectrogram /dB: Frequency spectrum variation with time
Piano A 220Hz
Frequency /Hz
3000
2500
2000
1500
1000
500
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Time /s
Waveform signal vs time: Right channel
Waveform signal
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
1
1.005
1.01
1.015
time /s

Normalized pectrogram /dB: Frequency spectrum variation with time

Recorder A 880Hz

Waveform signal vs time: Right channel

Normalized pectrogram /dB: Frequency spectrum variation with time



Frequency /Hz

3000
2500
2000
1500
1000
500
0

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5

Time /s

Flute A 440Hz

Waveform signal vs time: Right channel

Waveform signal

0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03

1 1.001 1.002 1.003 1.004 1.005 1.006 1.007 1.008 1.009 1.01

time /s