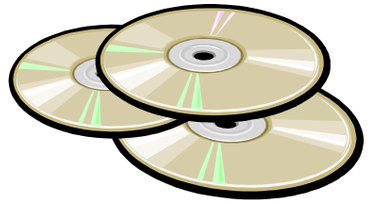
2. Bat Detectors 101

Generic bat recording/analysis system

Microphone

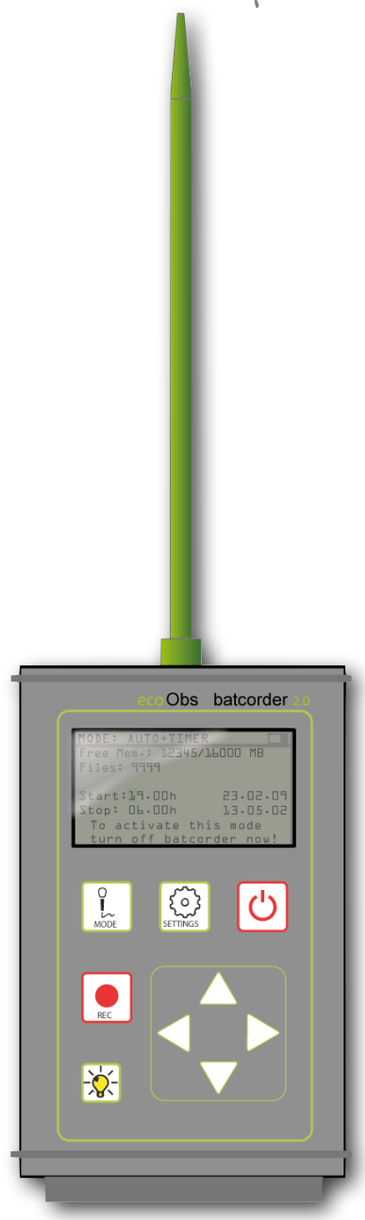
Power source (battery/solar)

Data storage (Laptop/SD card)



Call analysis software

Connect mic to laptop



All in one hand-held unit

Detecting Bat Calls

i) **Heterodyne** - records only a narrow bandwidth

(e.g., tune to 30 kHz, range = 25-35 kHz)

will magnify small differences in the narrow range - good for very similar species

Weakness: listen to only one frequency at a time

ii) **Broadband** - records entire spectrum

(RTE = Real Time Expansion = Full Spectrum)

Strength: simulataneously survey all

Weakness: data intensive

Recording Bat Calls

i) Frequency Division

: Incoming signal divided by a constant factor

e.g. FD-10 converts 40 kHz to 4 kHz

"Chirps" in real-time to observed flight

ii) Time Expansion

: Replay recording at a slower speed

Greatest detail can be seen . . . but can drive you nuts in the field with S L O W - M O.

Viewing Bat Calls

i) Spectral Analysis

ii) Zero Crossing Analysis

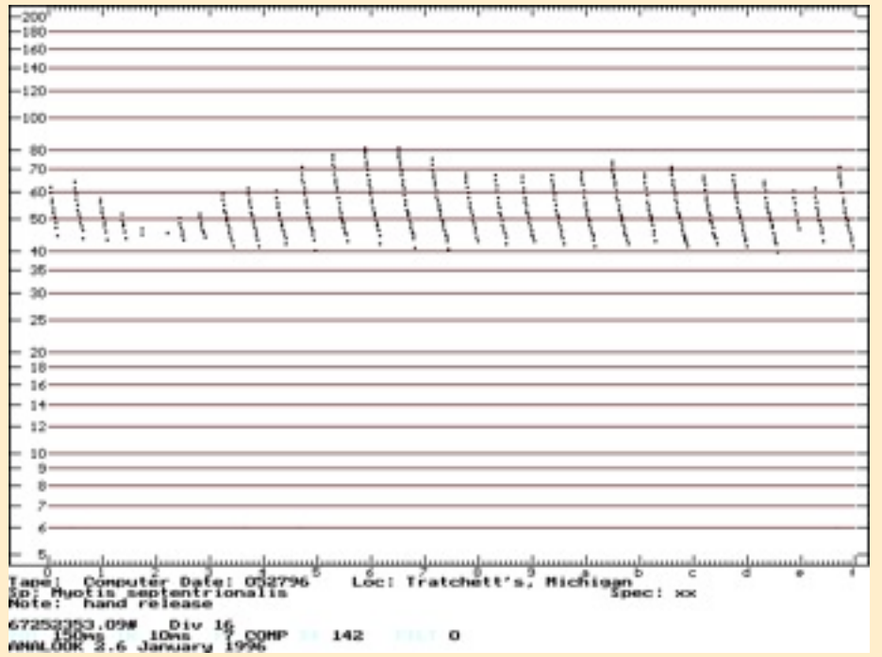
Viewing Bat Calls

i) Spectral Analysis

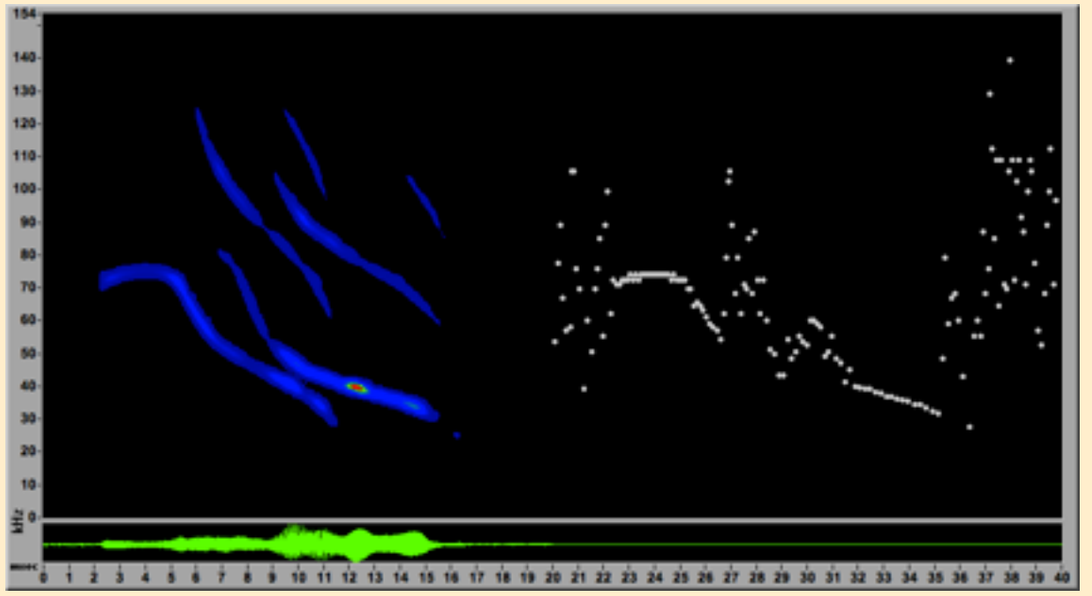
~~ii)~~ Zero Crossing Analysis

[valid, but out-of-date]

Created in the days of 5” floppies!

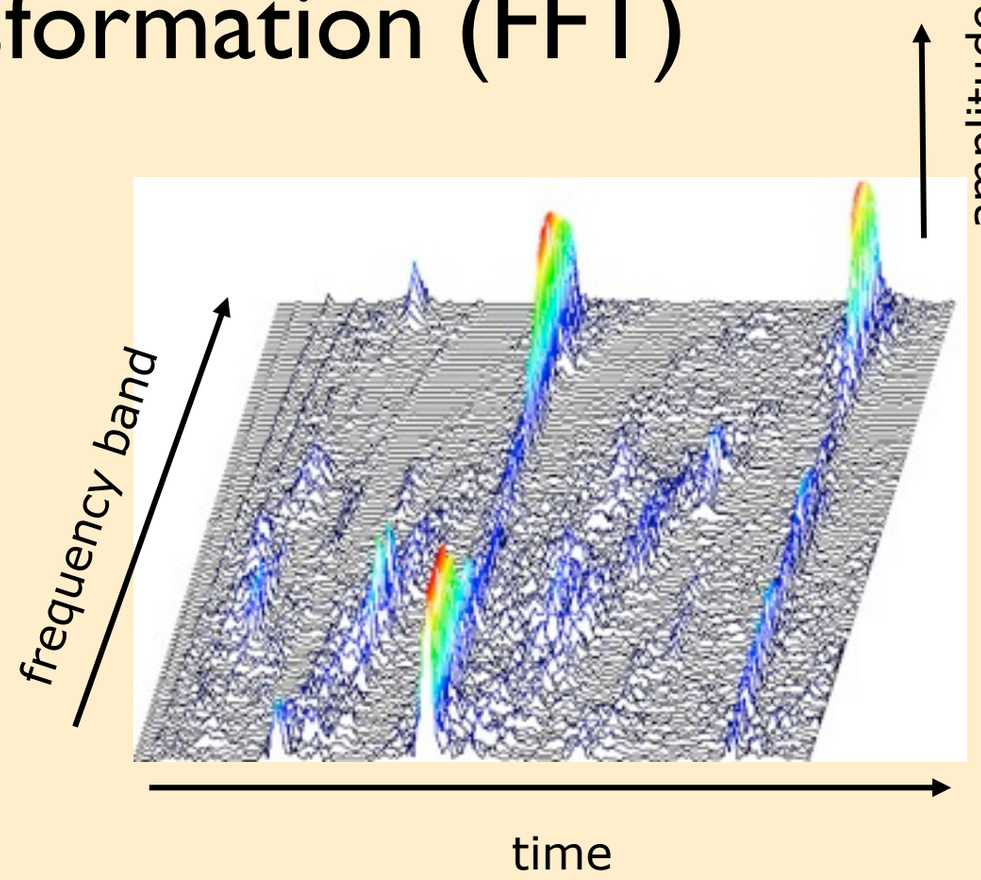


Converts changes in atmospheric pressure created by the signal to electrical signals and measures the time between these changes to determine frequency. No information about call amplitude (intensity) but species ID no problem.

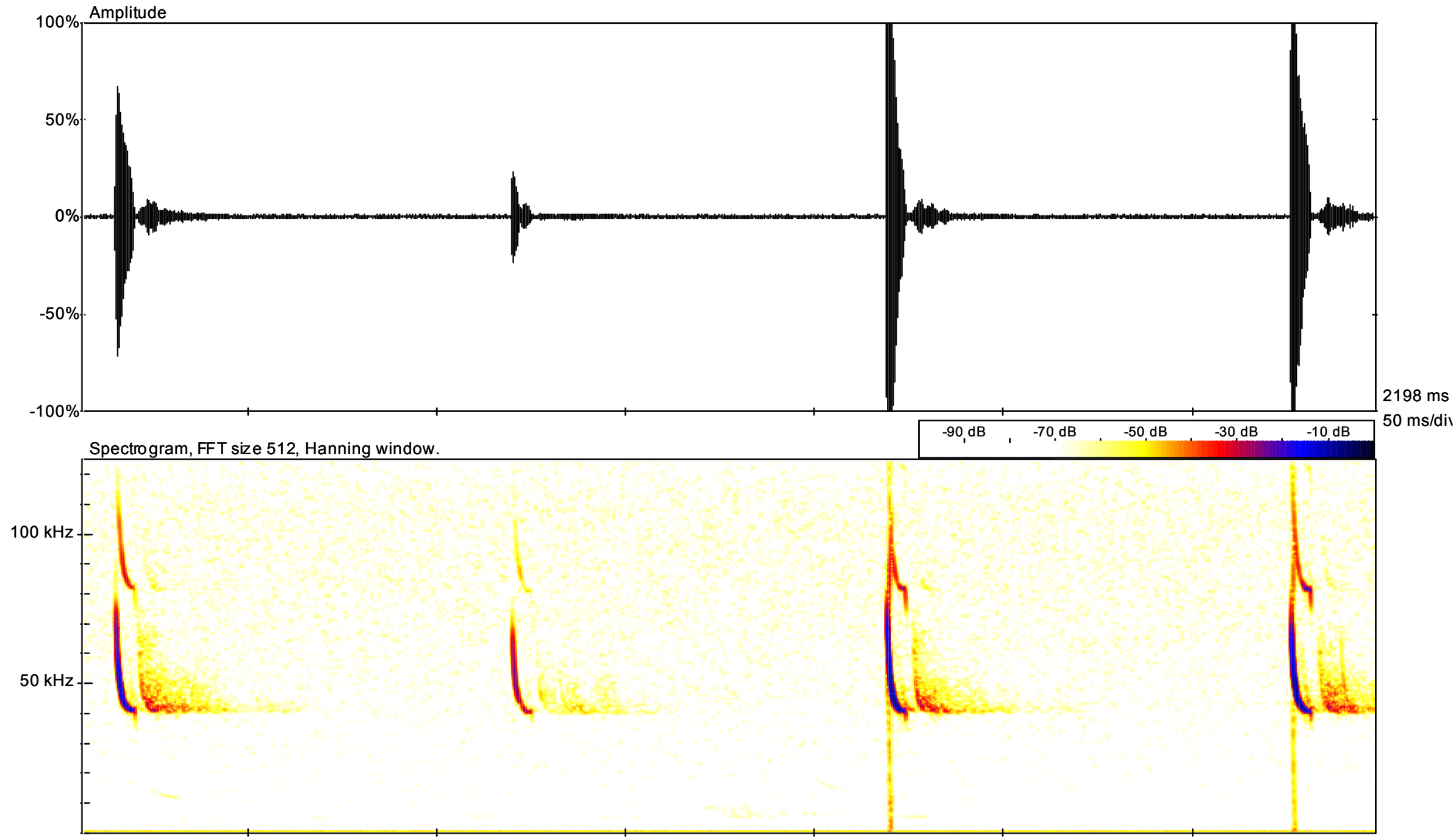


SPECTRAL ANALYSIS

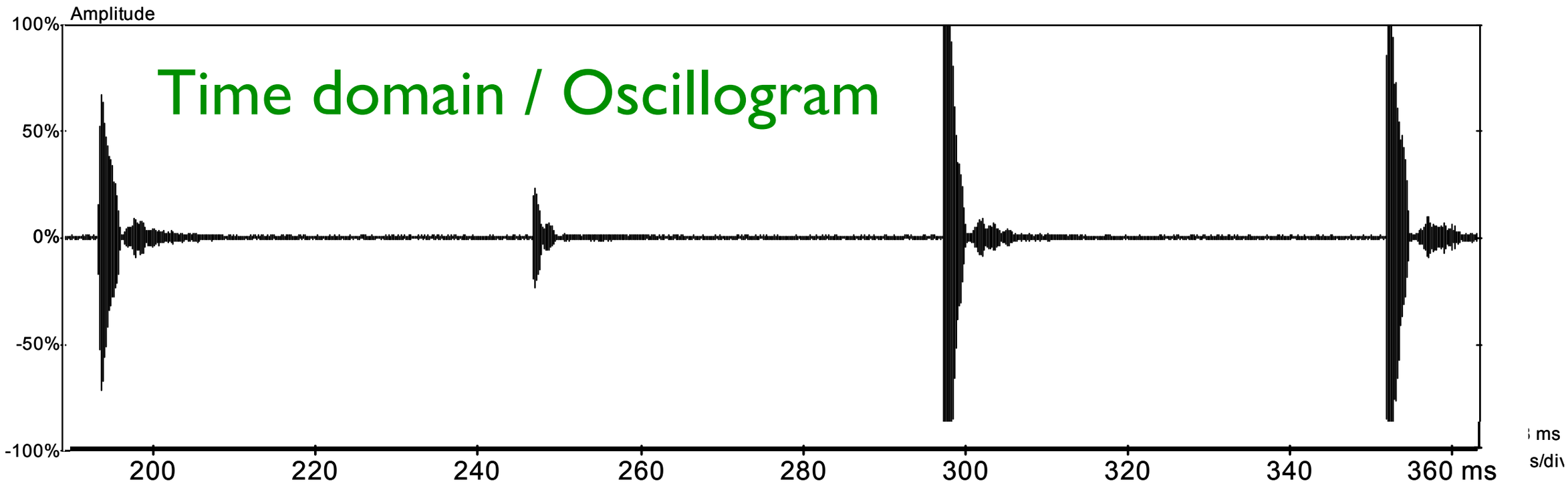
- Recording is filtered at multiple frequencies
- Method called Fast Fourier Transformation (FFT)
- 3-D image generated that includes **changes in frequency** over time and the **call strength** in each frequency division



The output of FFT Spectral Analysis

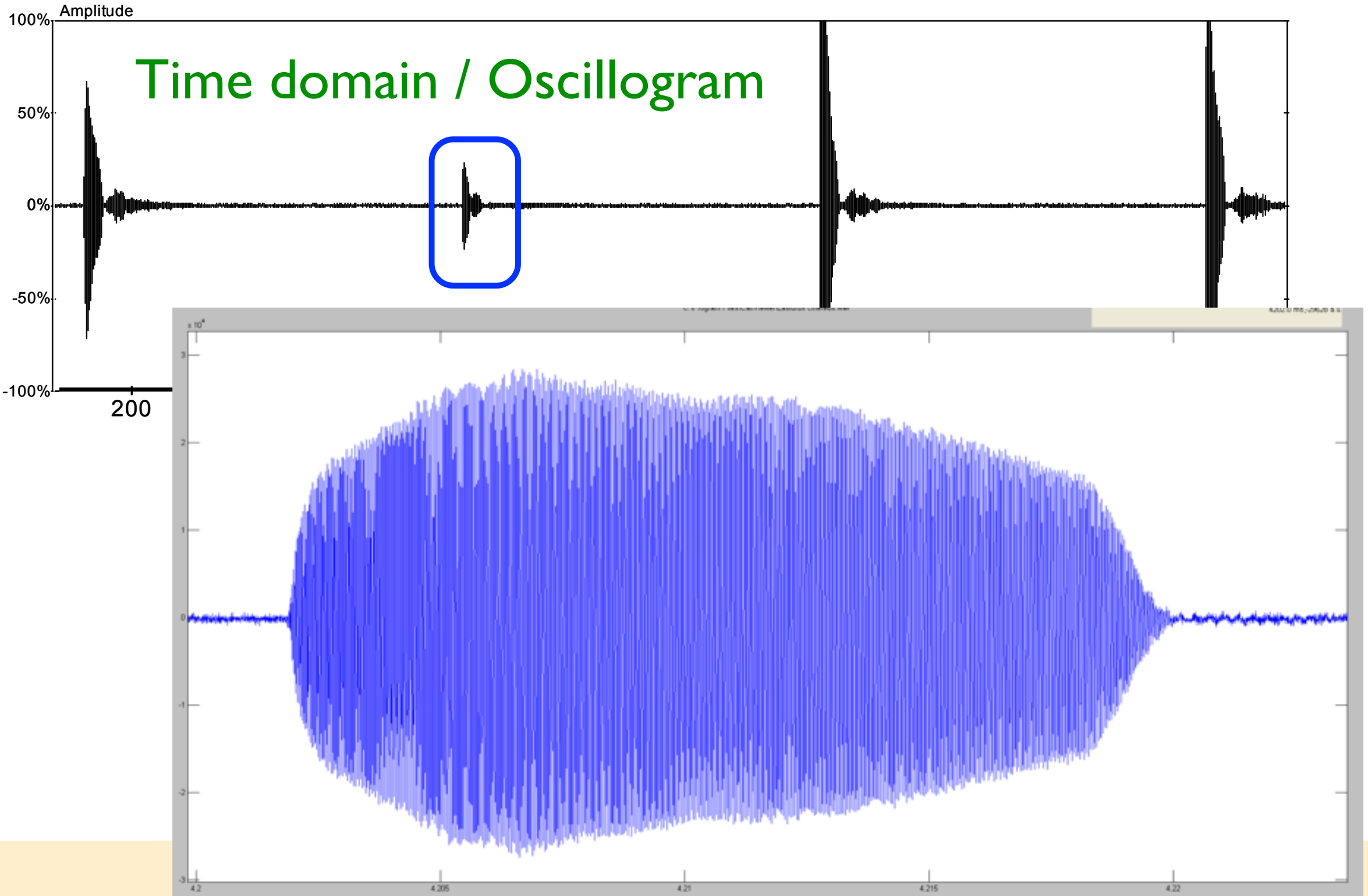


The output of FFT Spectral Analysis



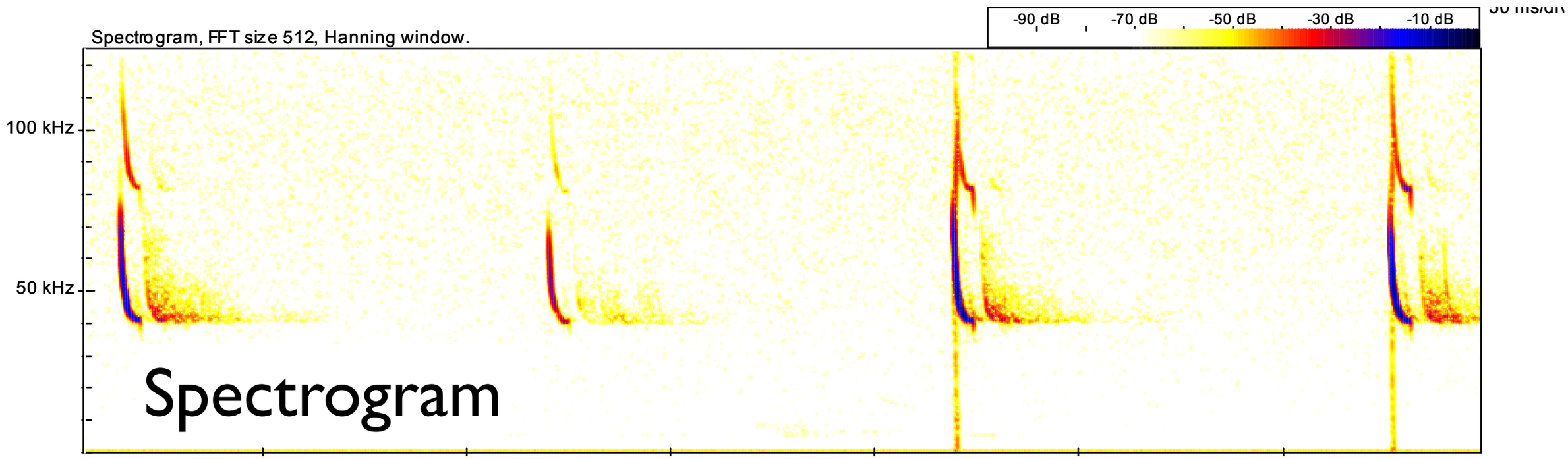
- Used to measure call (single pulse) duration and inter-pulse interval
- Check signal strength is good for accurate measurement and not saturated
- Shows signal strength (amplitude) of recording, BUT NOT the actual strength of the actual sound

The output of FFT Spectral Analysis

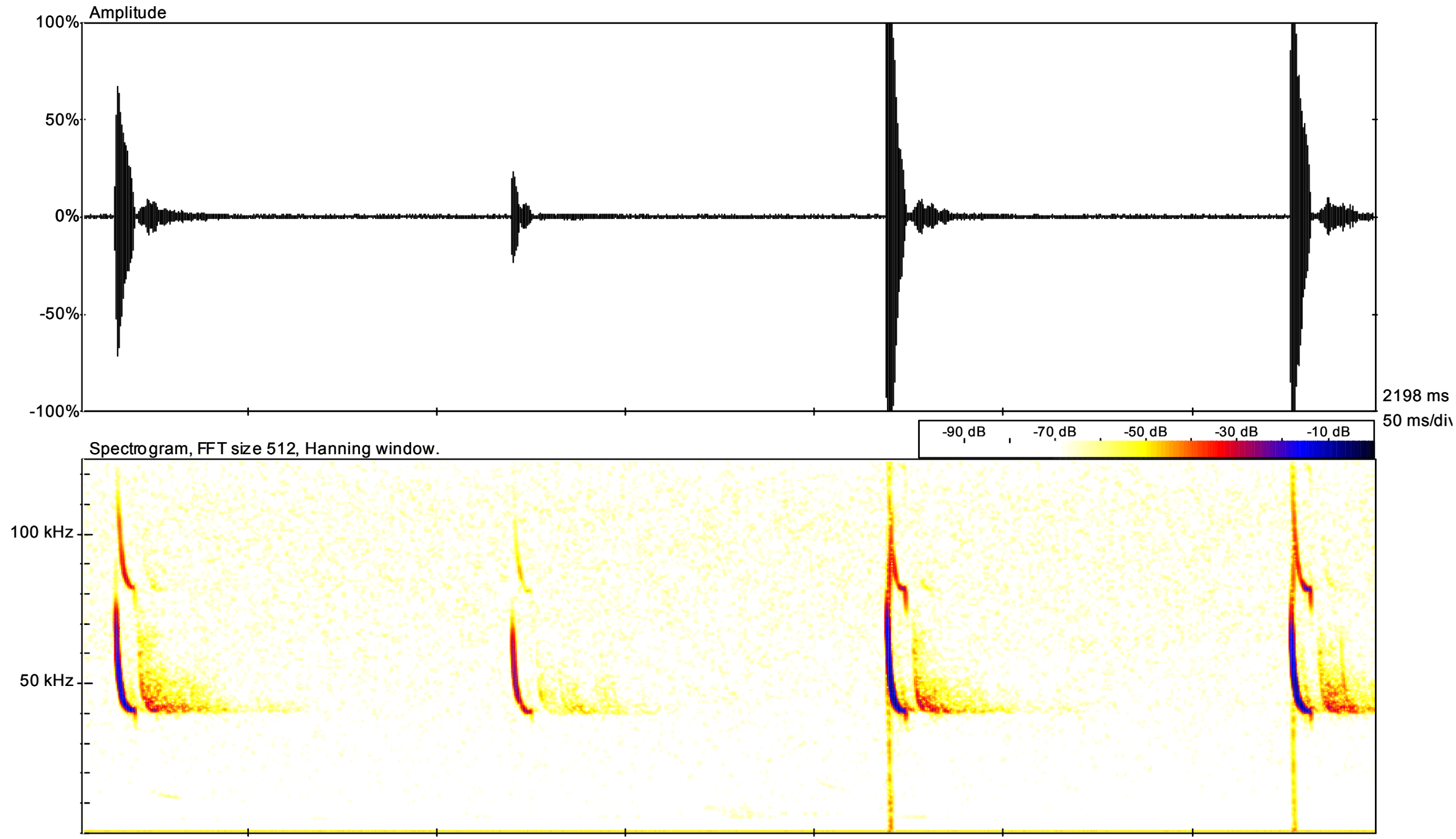


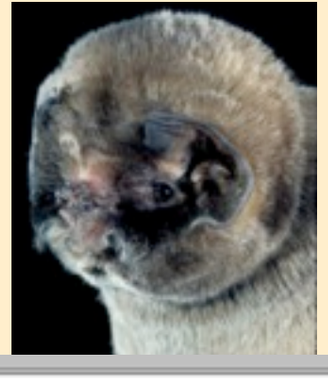
The output of FFT Spectral Analysis

- Shows recorded frequencies of signal and recorded decibel level
- Used to take frequency measurements (e.g., highest & lowest) and to visualise frequency changes
- "See" the shape of the call to identify species

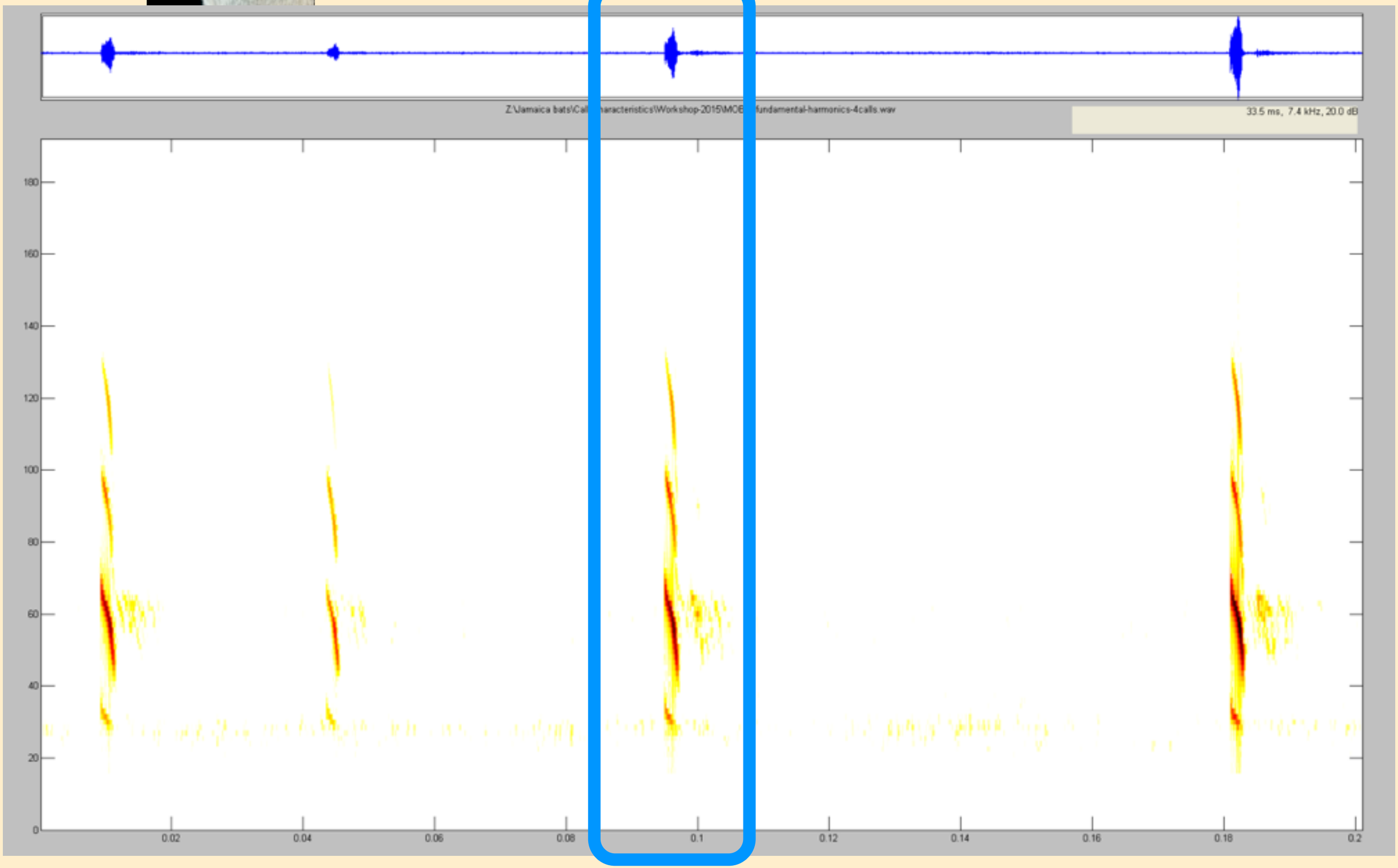


The output of FFT Spectral Analysis





Example: *Mormoops blainvillei*



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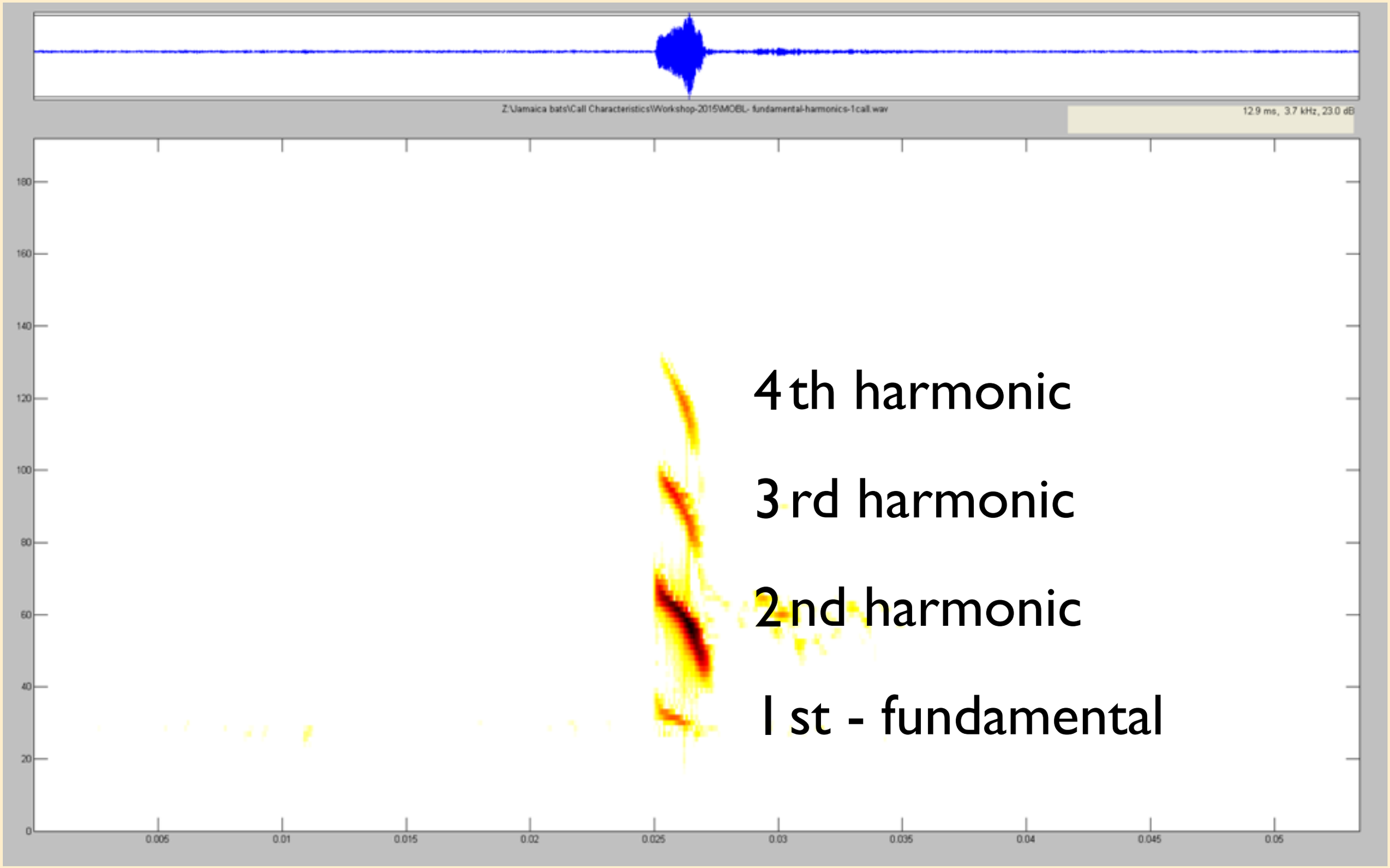
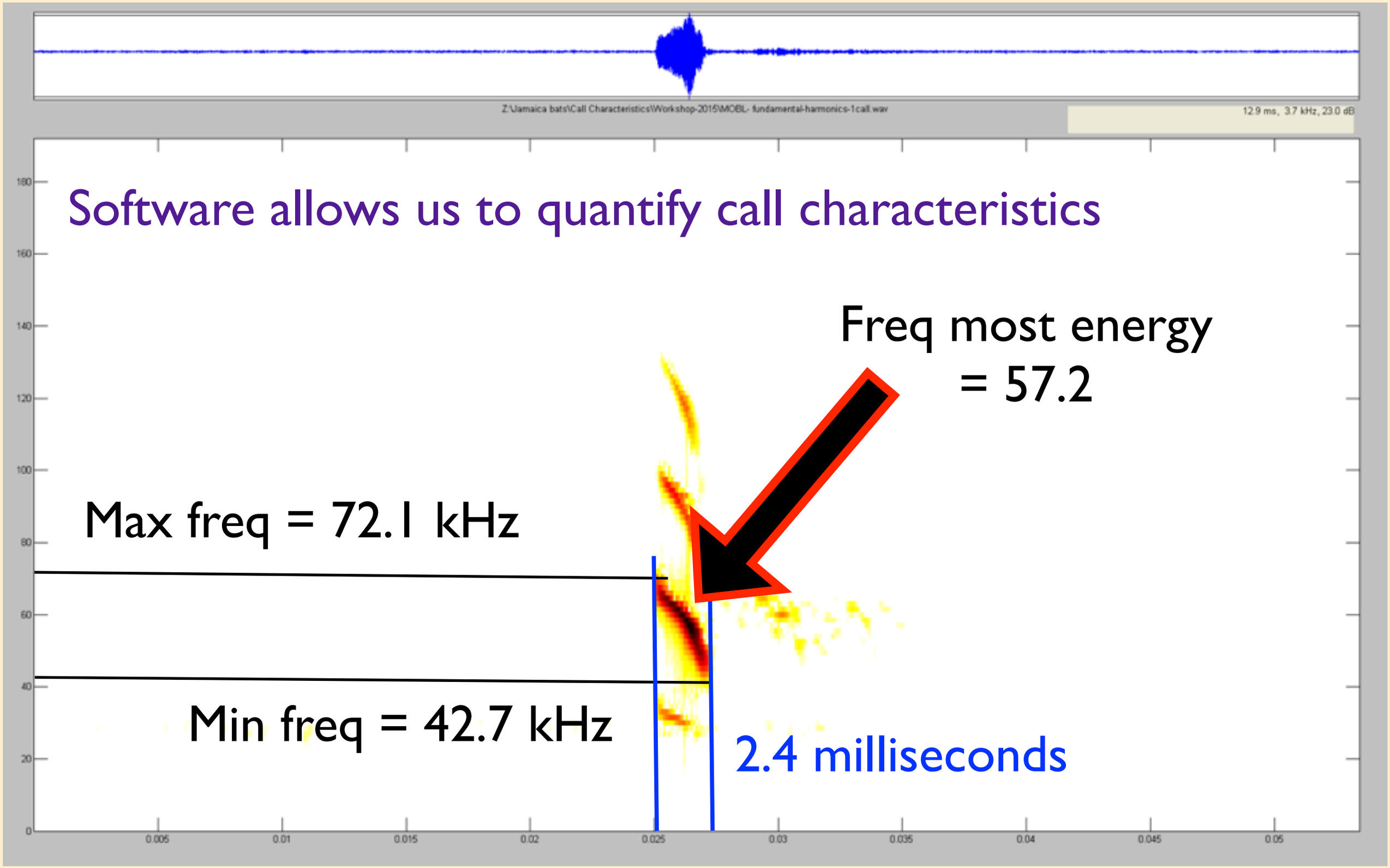
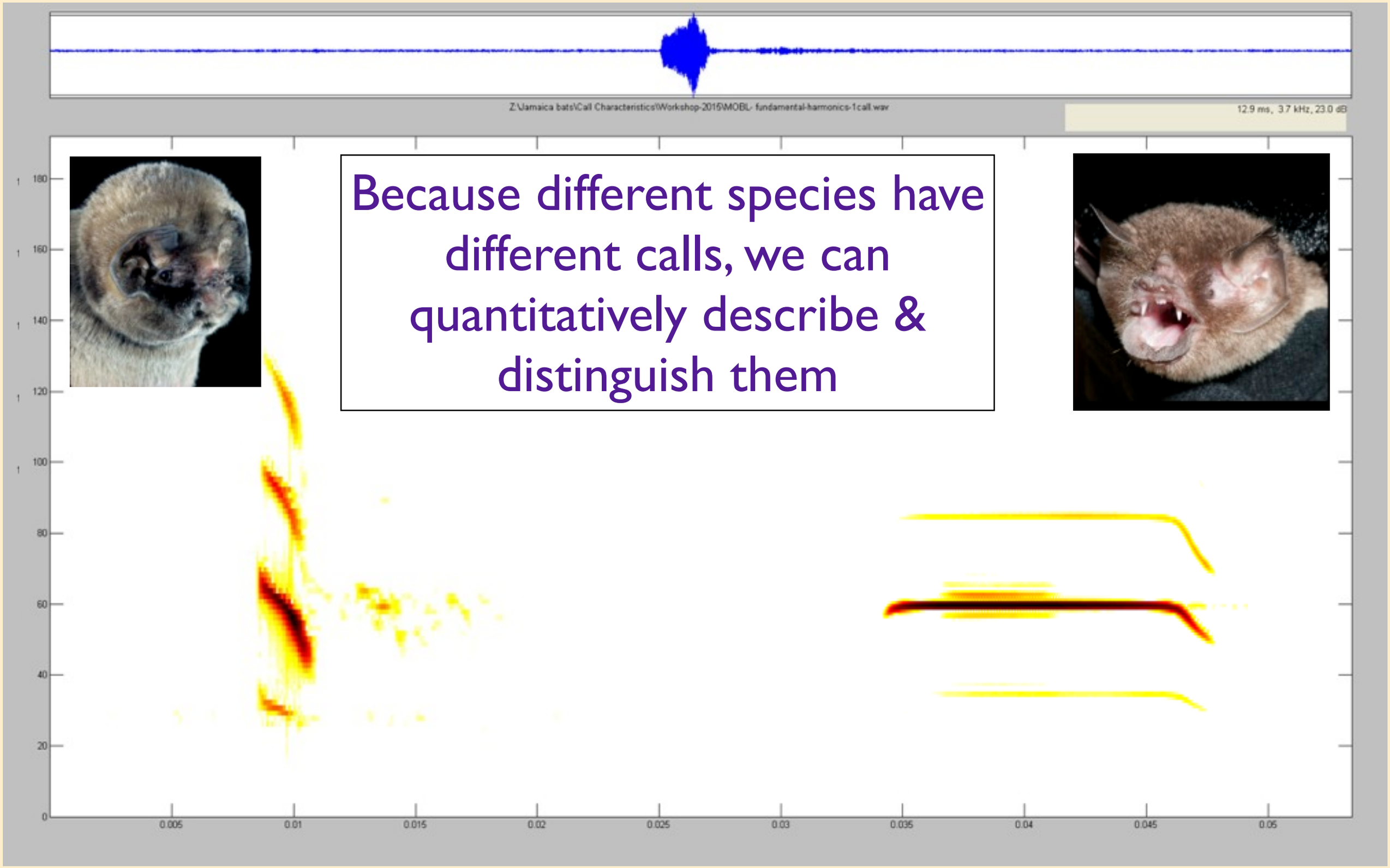


Example: *Mormoops blainvillei*



Example: *Mormoops blainvillei* vs *Pteronotus parnellii*



2. Bat Detectors 101

And we can quantitatively compare bat detectors

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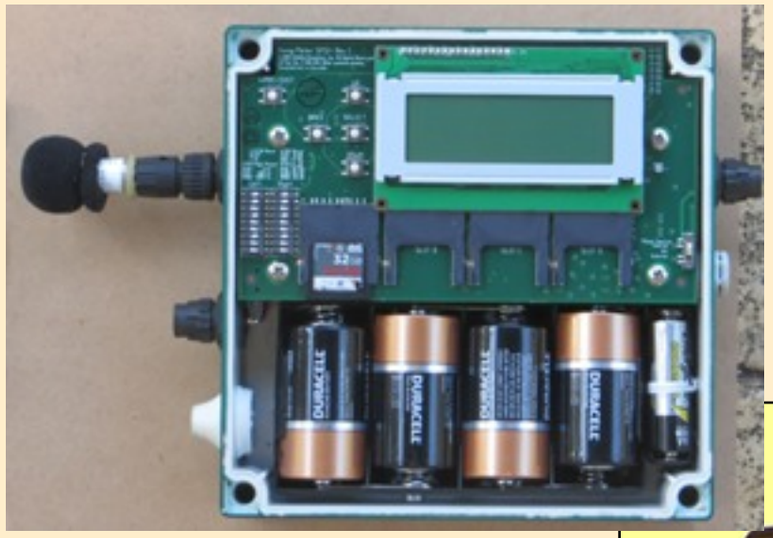

= =

Q1: Are all detectors equal?