



Biased Heterodyne Method

A future technique for sulphide exploration

LABORATORY STUDY & KEMPFIELD FIELD TRIALS

Chargeable Mineralisation: an expensive prospect

- Limitations of geophysical methods
- Chargeable and conductive targets
- \$100-\$200 per metre for drill core

Resistivity

Clays

Shales

Graphite

Groundwater

Sulphides

Chargeability

Clays

Shales

Graphite

Fences!

Sulphides

Collaboration with

- CSIRO
- Fender Geophysics
- Tooronga Resources
- ARCTAN Services
- Quadrant Geophysics



The search for sulphides

- Clays, Shales and Sulphides are Chargeable and Conductive

R. White 1974

A Study of Non Linear Effects in Mineralised Rocks

- Semiconducting behavior of sulphide mineralogy
- Non-linear conduction – a way to discriminate shales and clays
- Heterodyne responses: F_1+F_2 & F_1-F_2

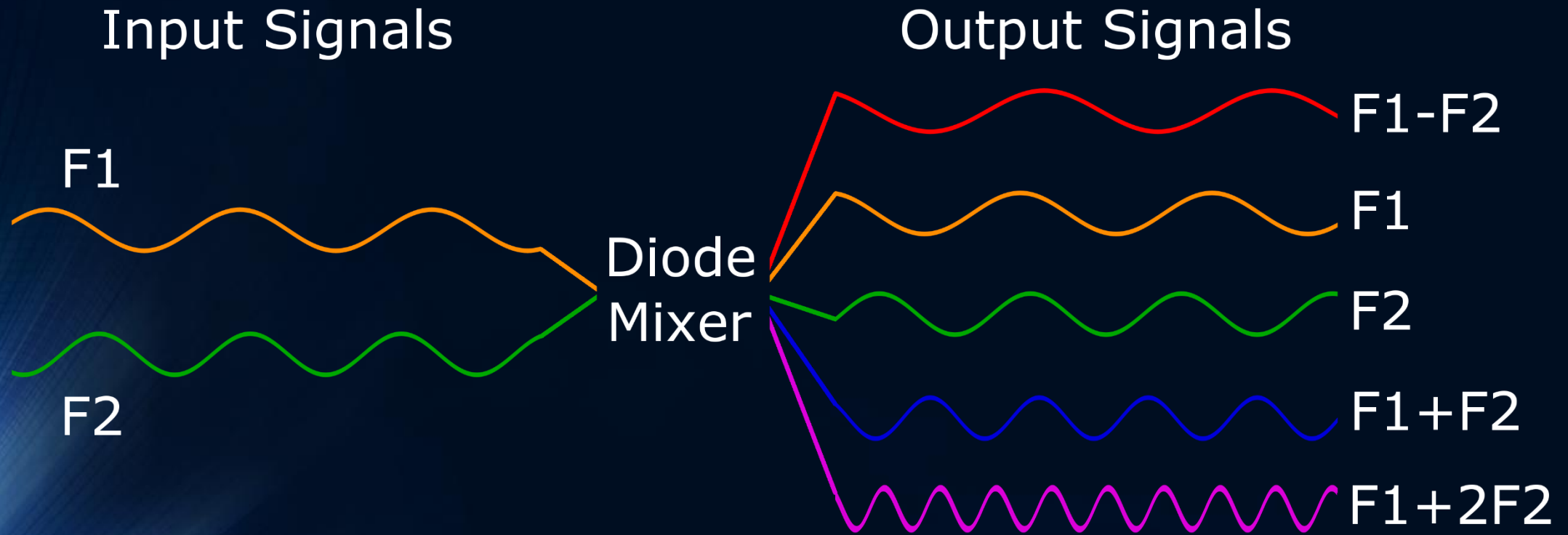
A STUDY OF NON LINEAR
EFFECTS IN MINERALISED ROCKS

BY
ROBERT M. S. WHITE

Thesis submitted in partial fulfillment for the degree of Master of Science at
Macquarie University.

AUGUST 1974

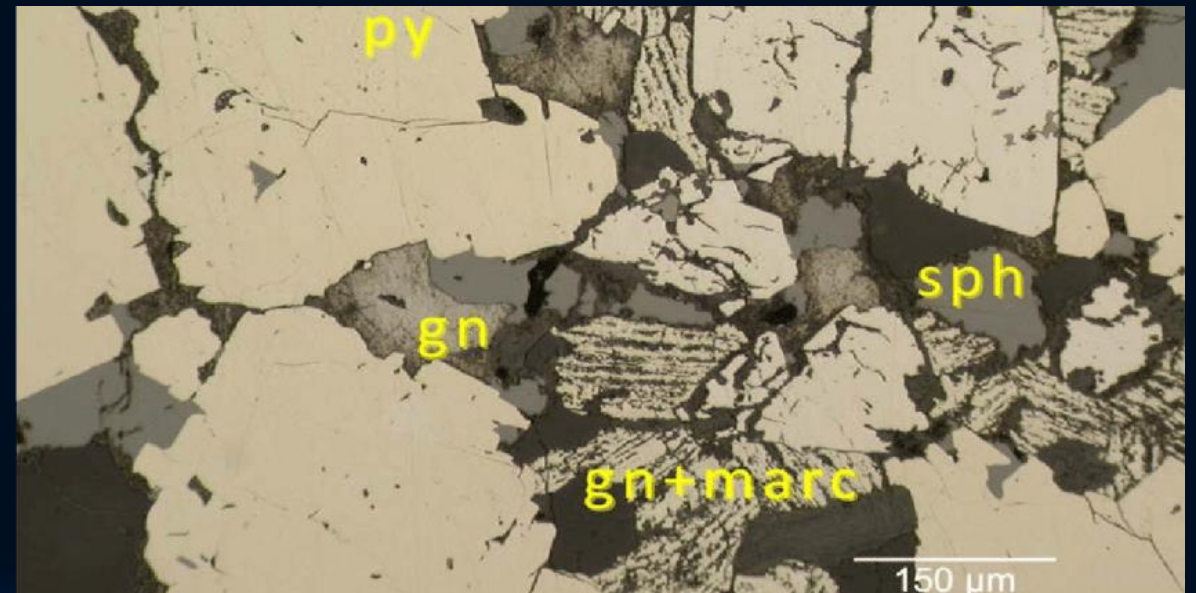
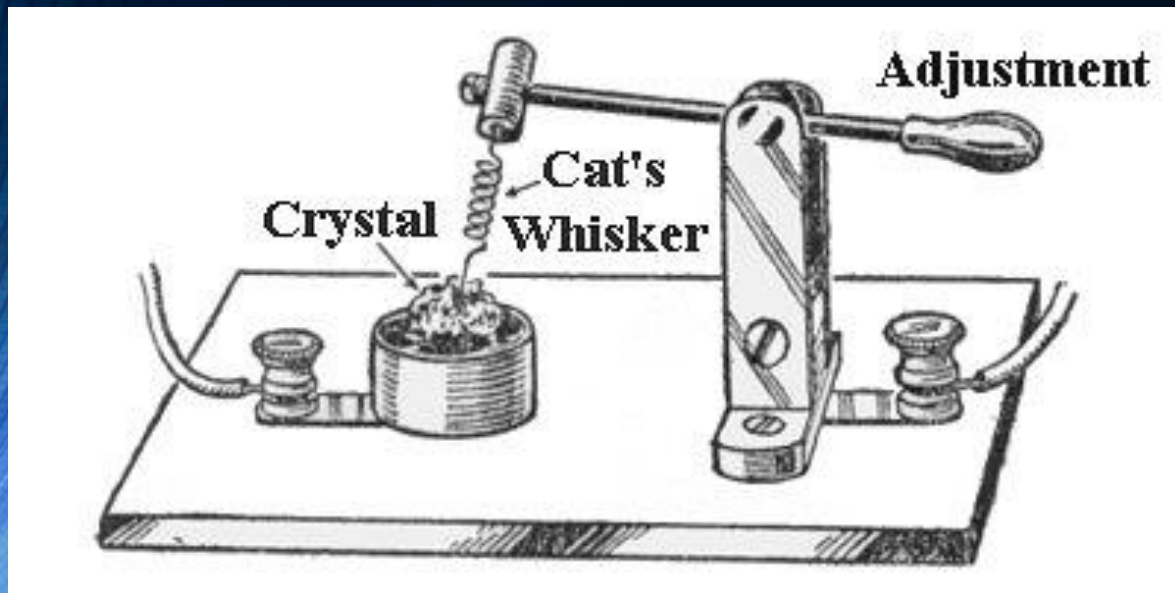
What are Heterodyne Signals?



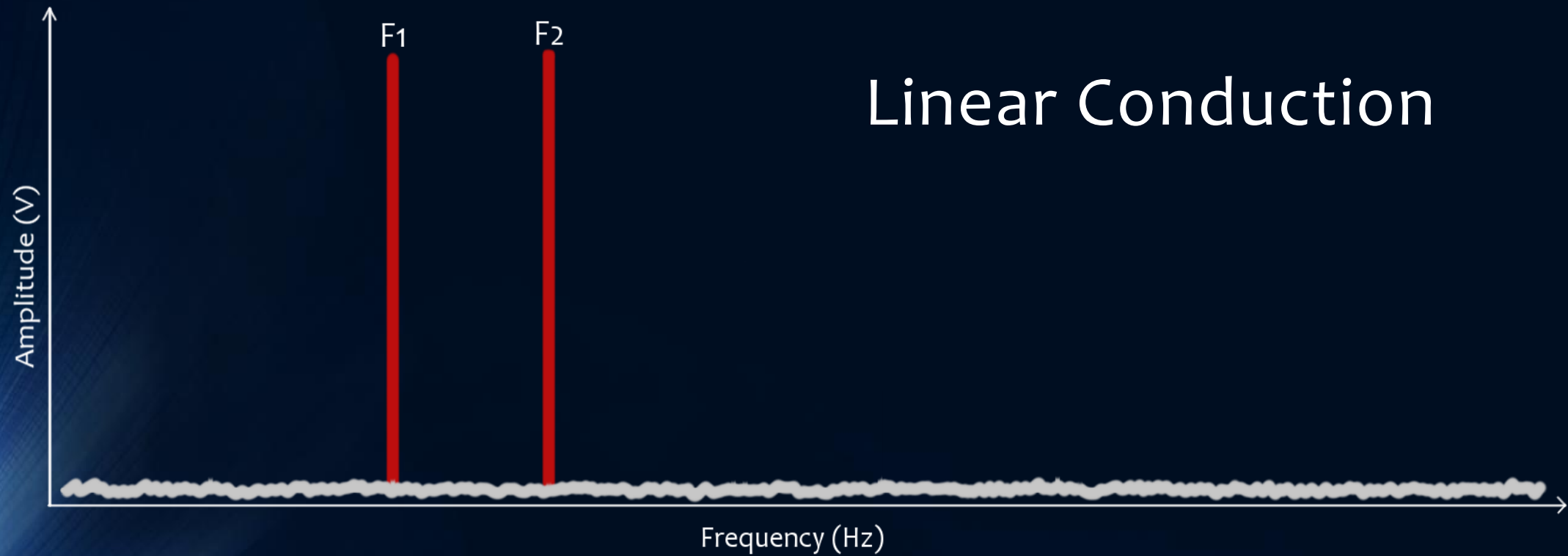
Heterodyne Signals – Mixing Terms

Electronically there is
no difference between
this

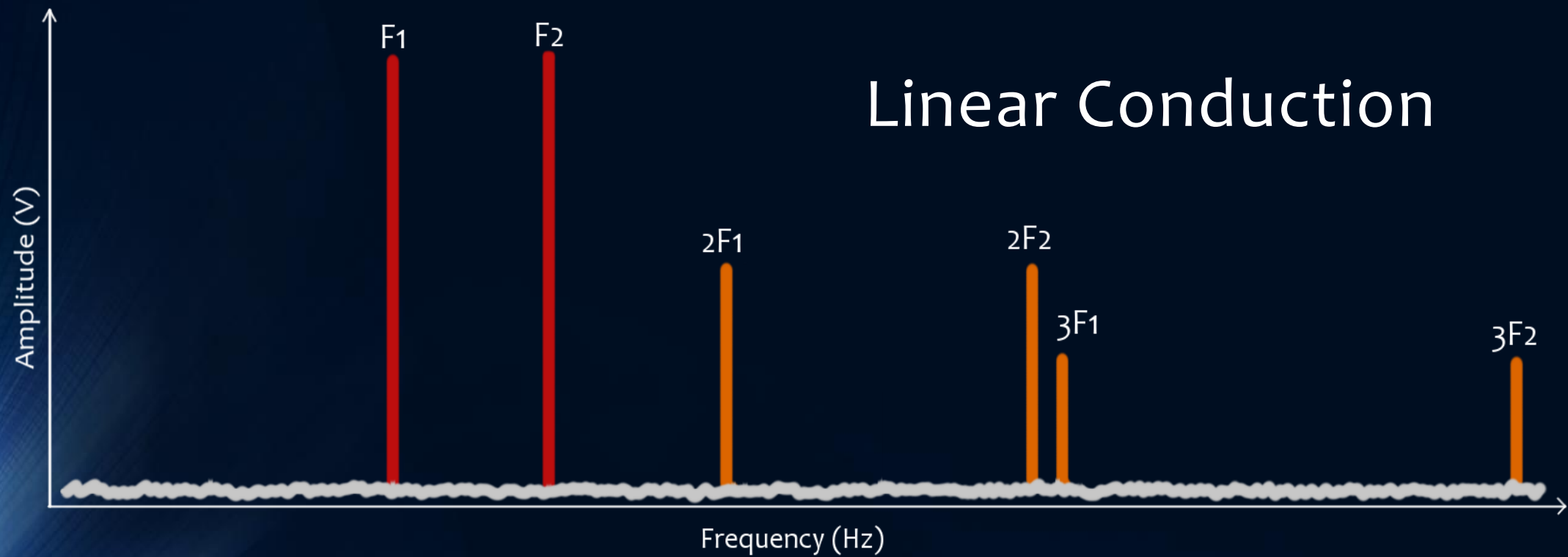
..... And billions of junctions
on sulphide grain boundaries
in an ore deposit.



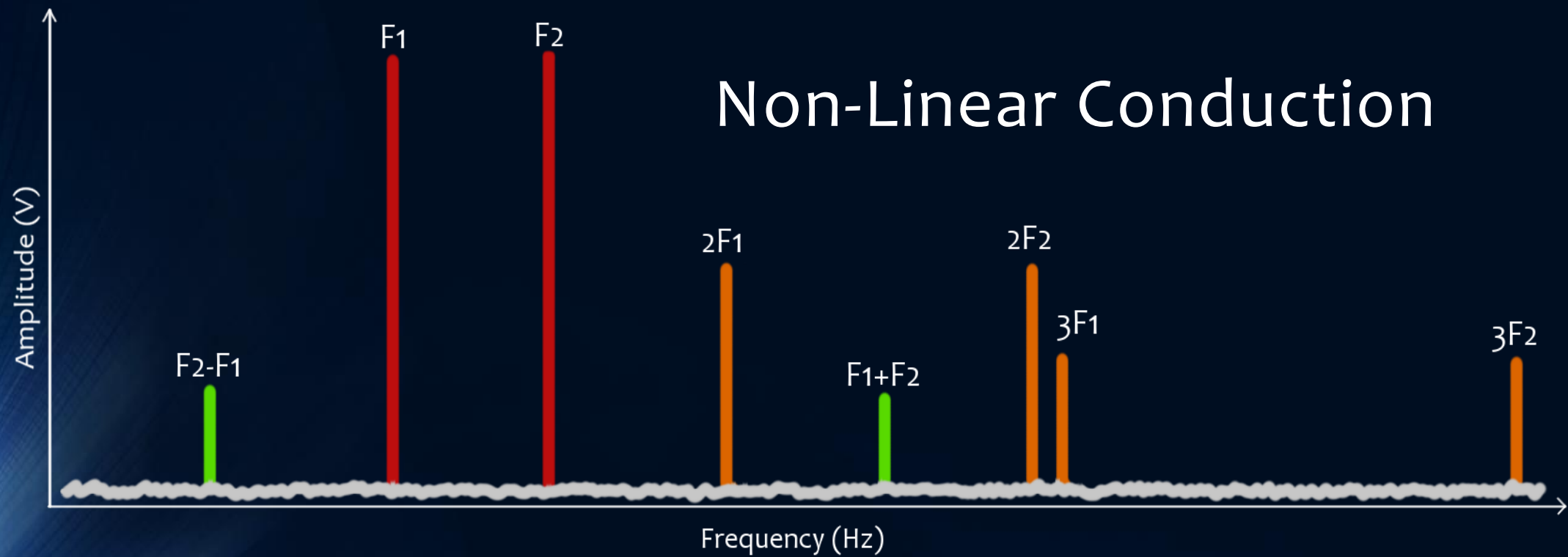
Heterodyne Signals – Mixing Terms



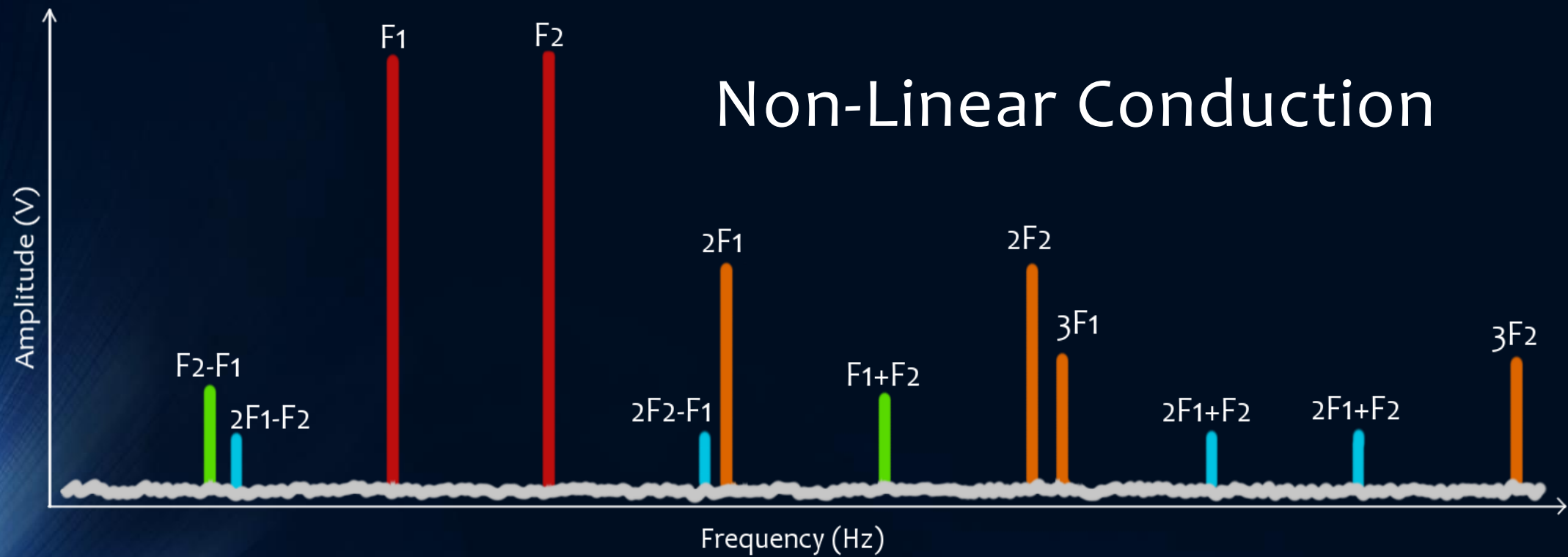
Heterodyne Signals – Mixing Terms



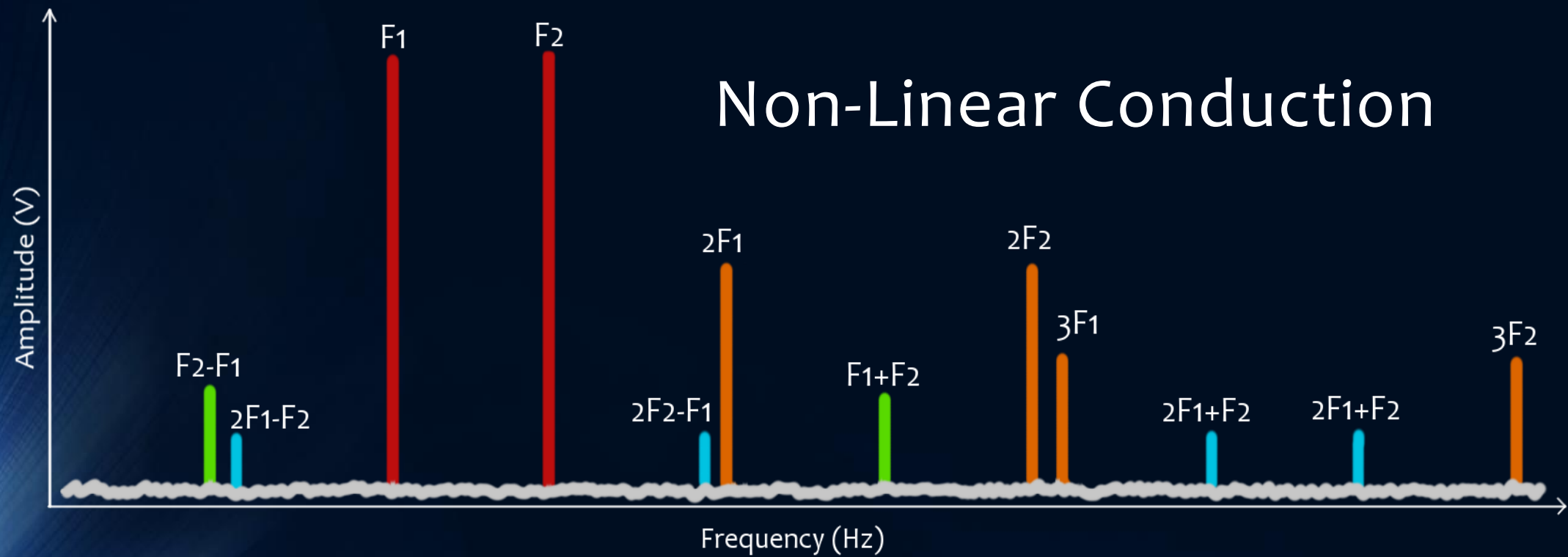
Heterodyne Signals – Mixing Terms



Heterodyne Signals – Mixing Terms

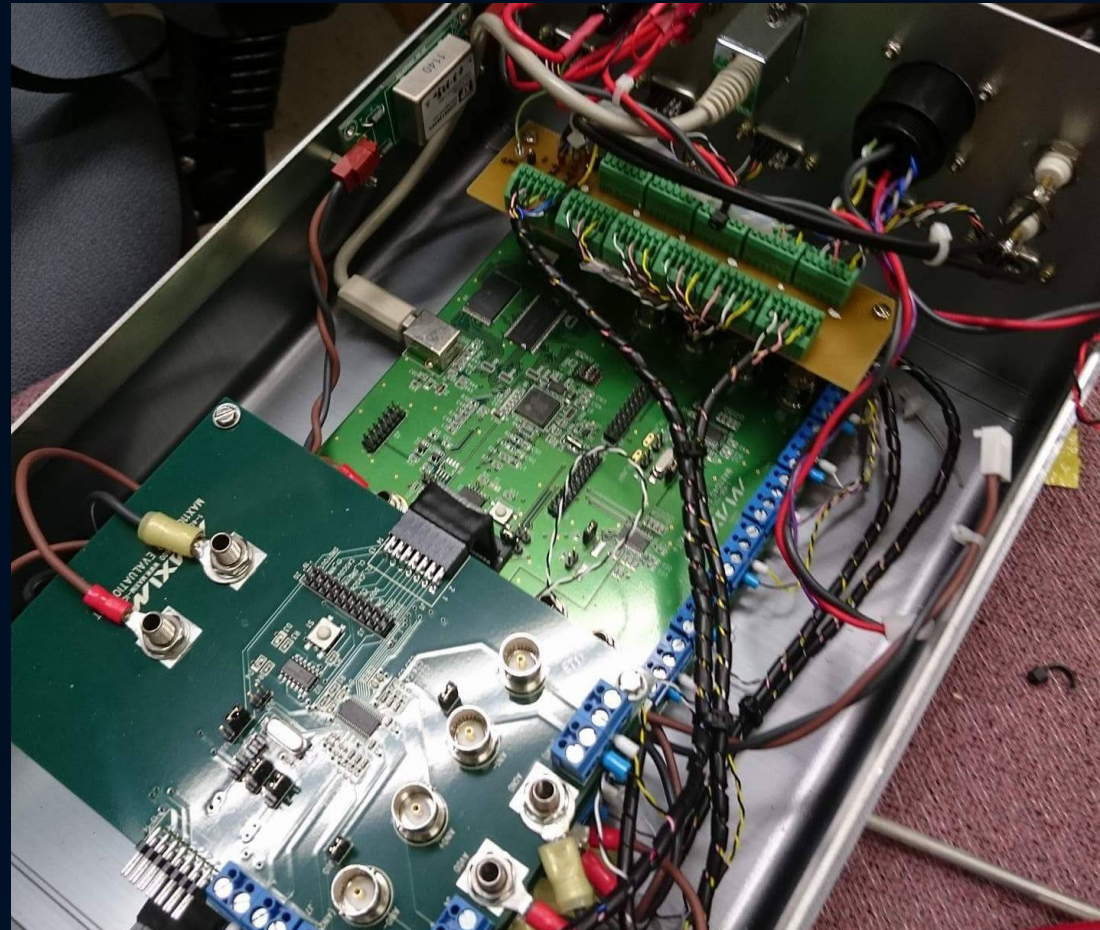


Heterodyne Signals – Mixing Terms



Technology – it has come a long way

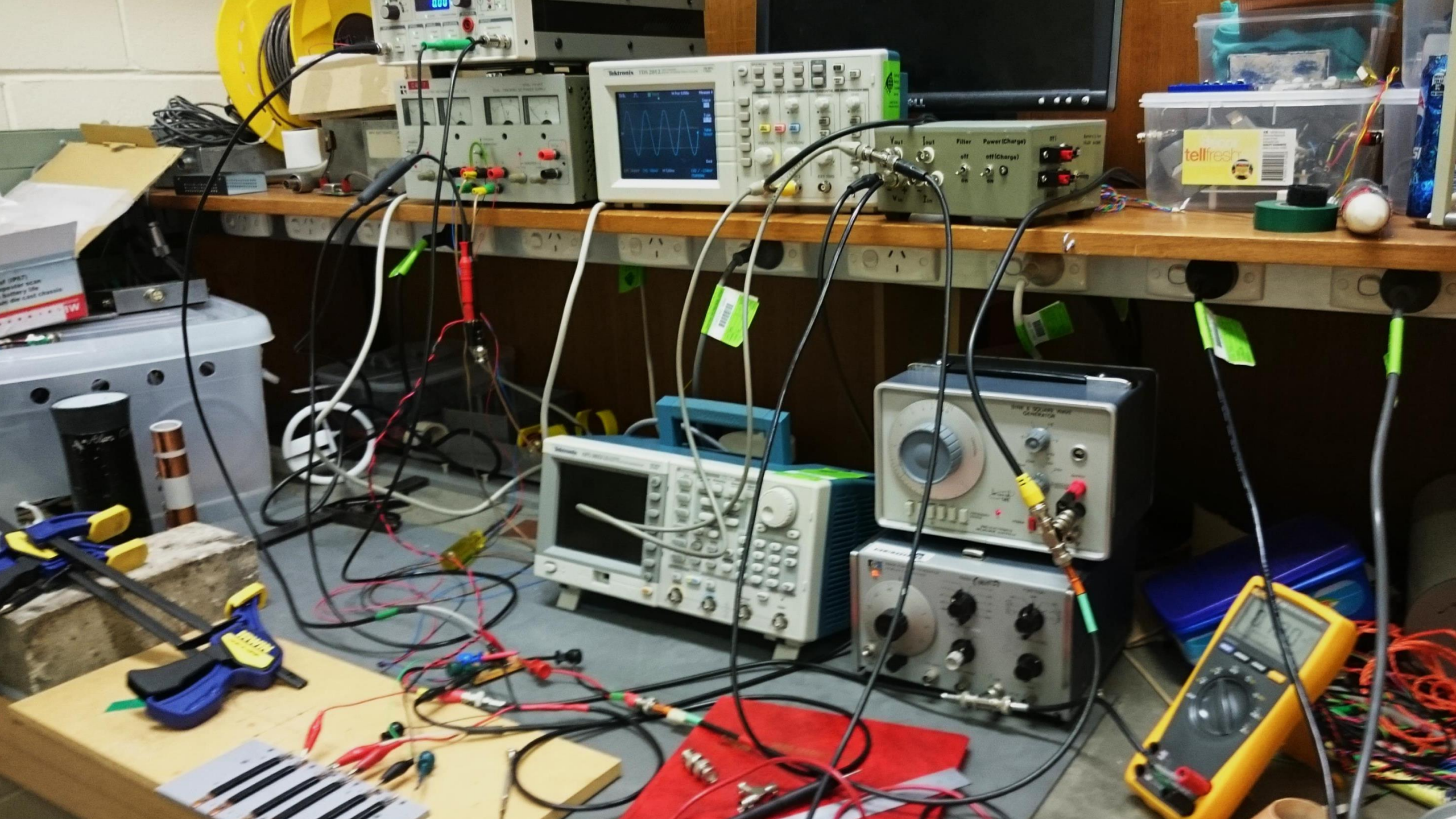
Technology – it has come a long way



CSIRO-built 31-bit analogue to digital converter

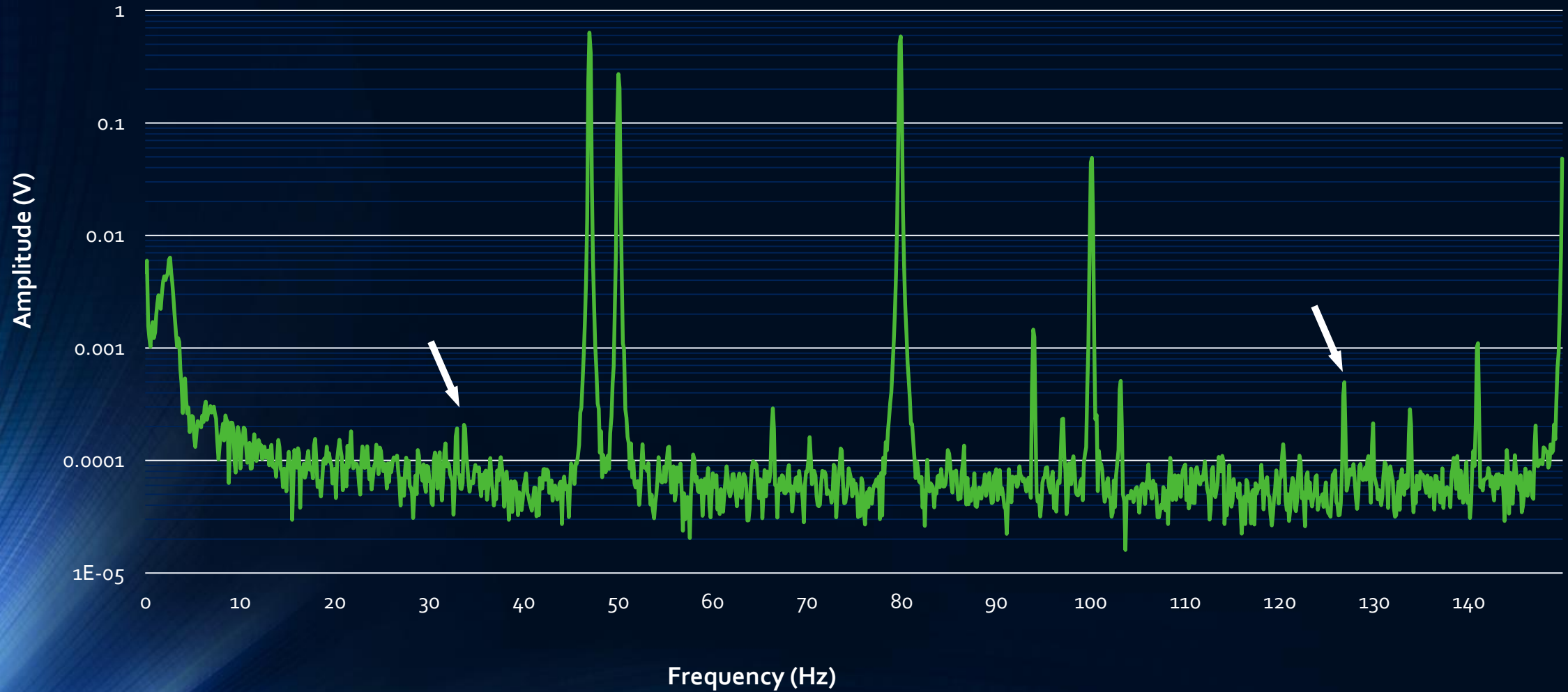
Laboratory Testing

AT CSIRO'S LINDFIELD SITE

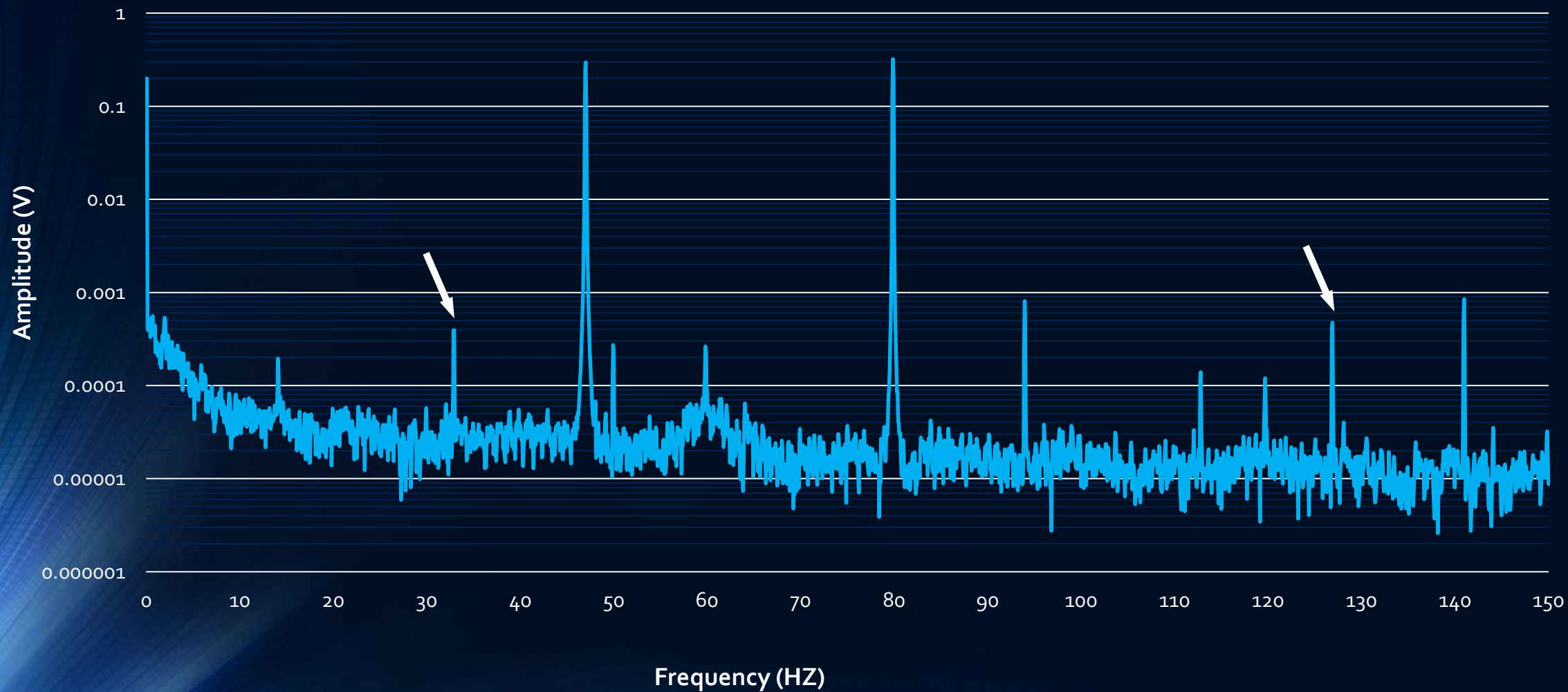




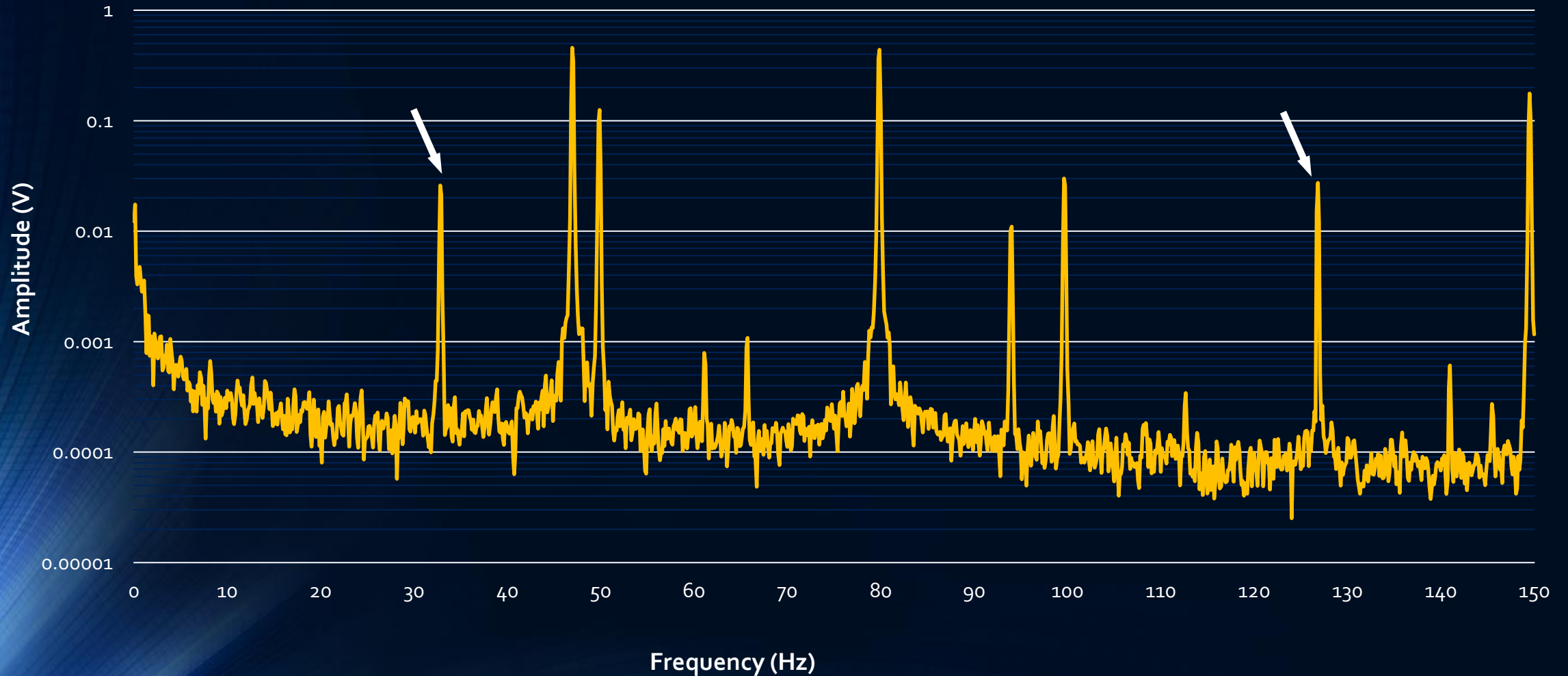
Sample MBDD024



Sample TASBW1



Sample 444-444-2



Kempfield Field Study

CSIRO AND FENDER GEOPHYSICS IN COLLABORATION WITH ARCTAN
SERVICES, TOORONGA RESOURCES AND QUADRANT GEOPHYSICS

Argent Minerals: Kempfield

New South Wales



60km south of Bathurst

Known target

Extensively surveyed
sulphide mineralisation

Kempfield: An Ideal Target

Poly-metallic massive sulphide VMS style deposit

Well defined – hundreds of drill holes

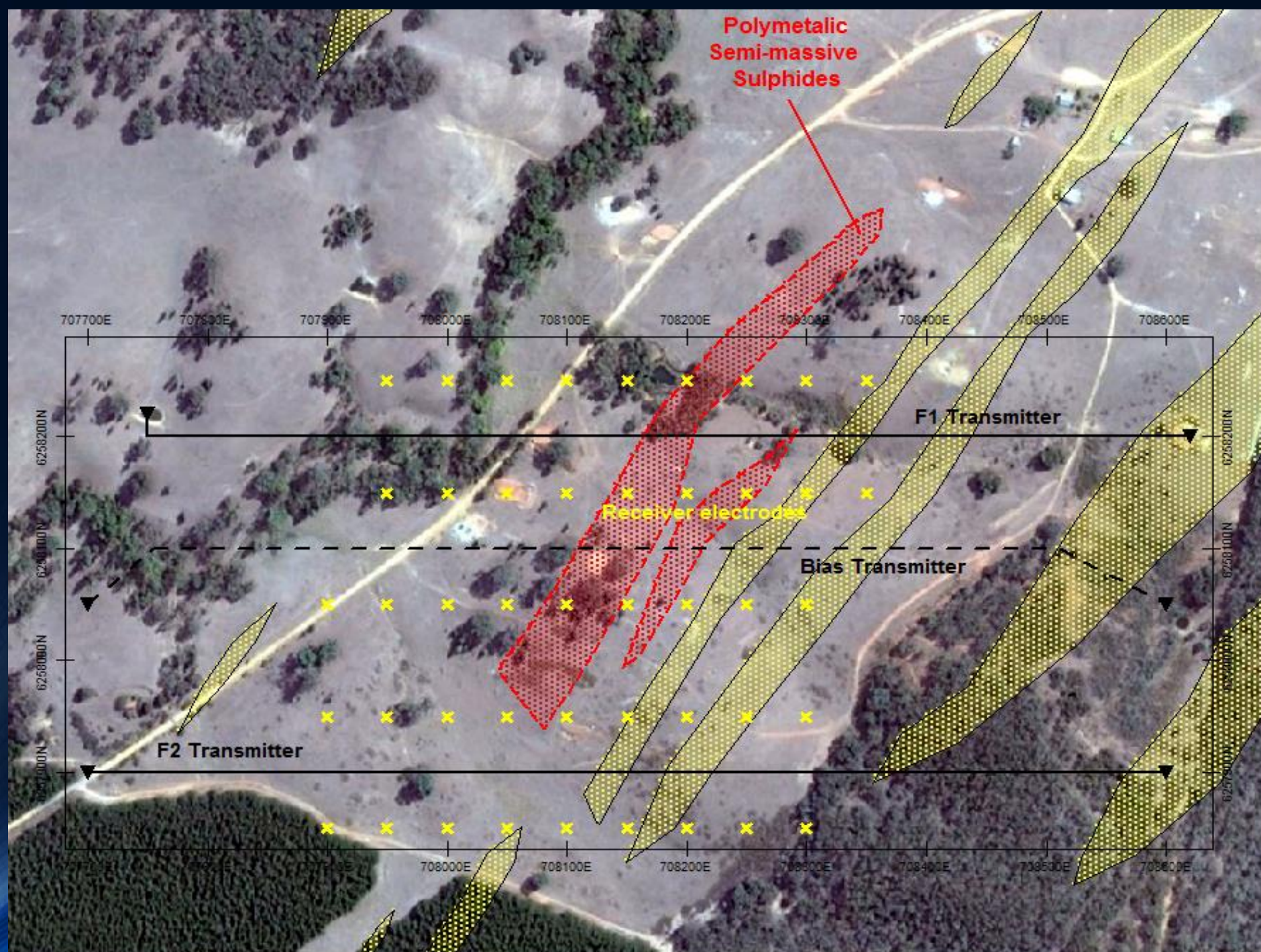
Surveyed with most other geophysical methods

Argent owns property and exploration licence

Accommodation (farmhouse) on site

Secluded – In a blind valley

Close to Sydney – 3 ½ hours



KEMPFIELD





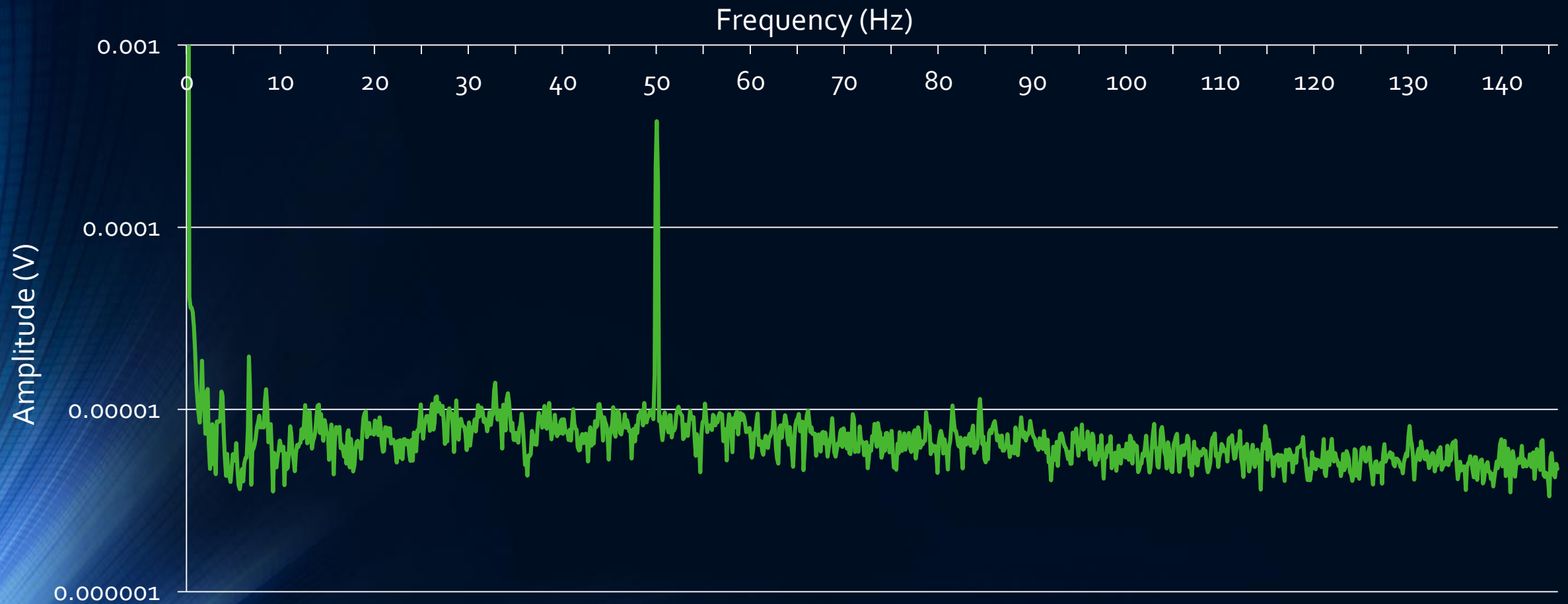




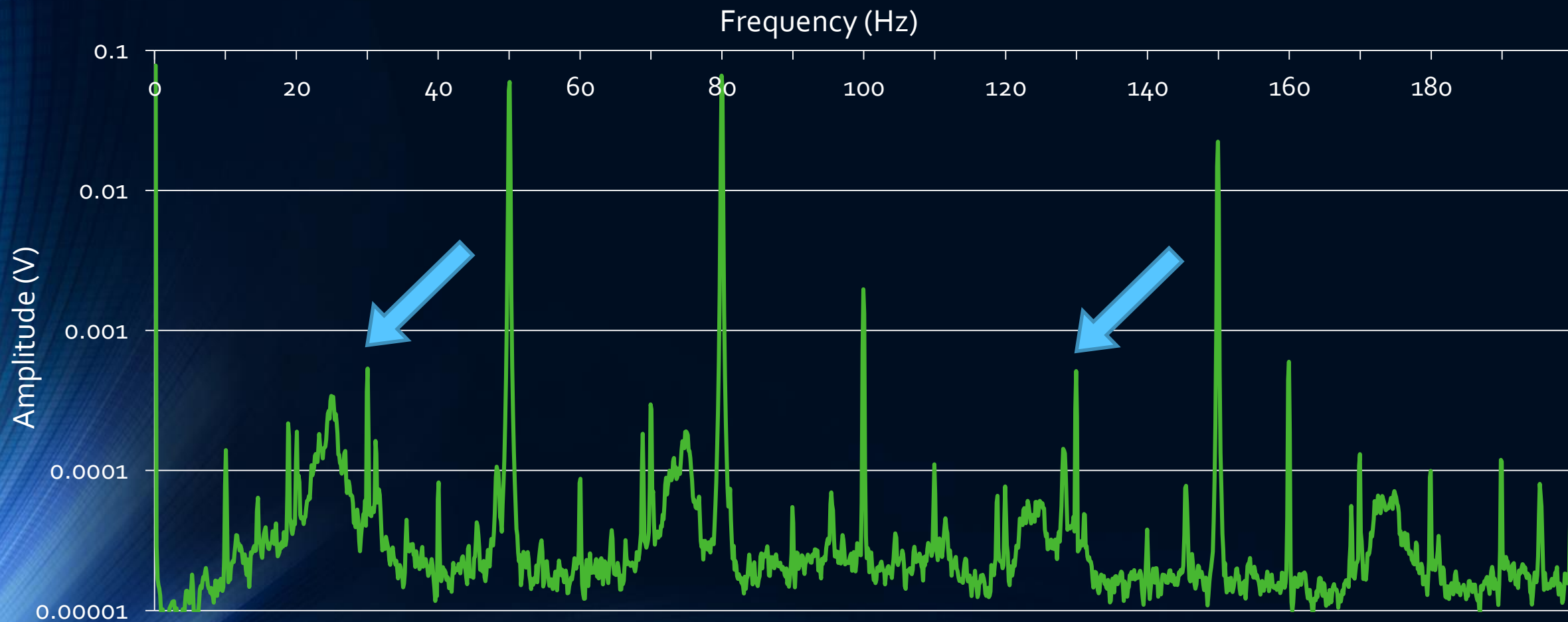




Noise Floor – No Generators

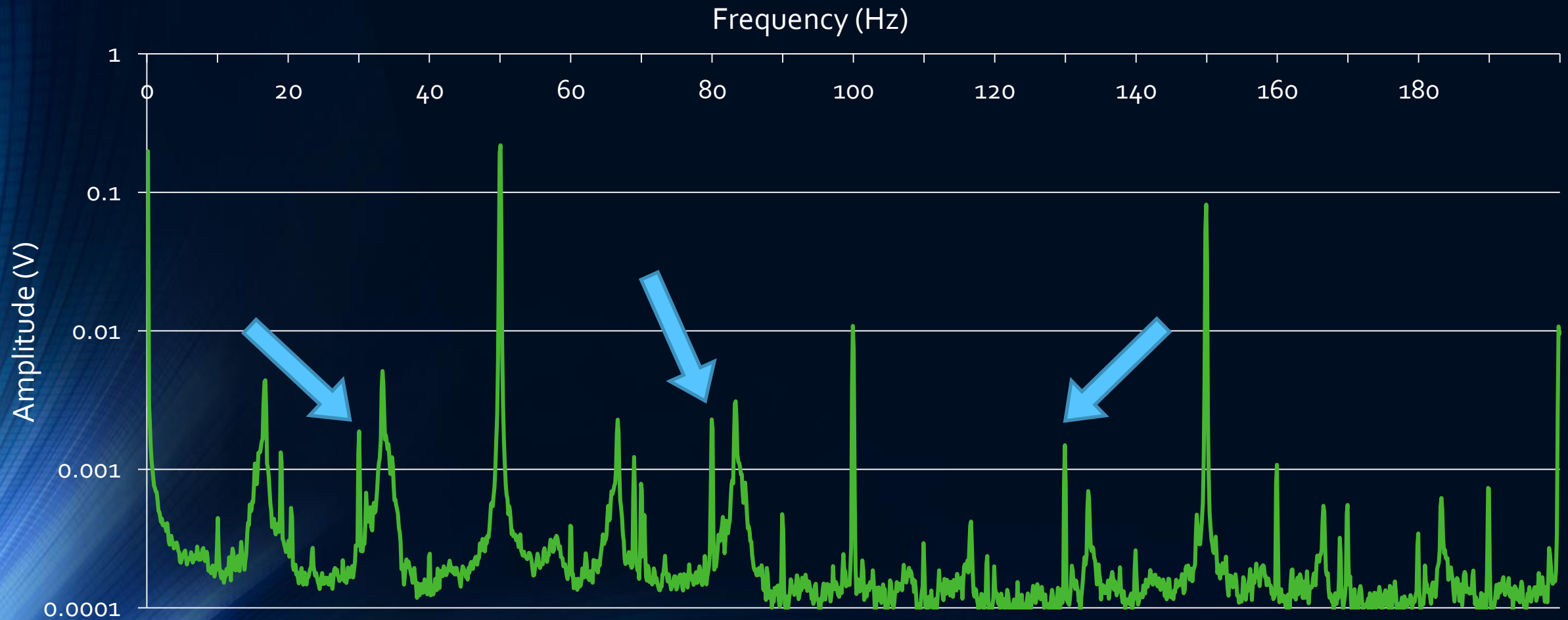


The First Response





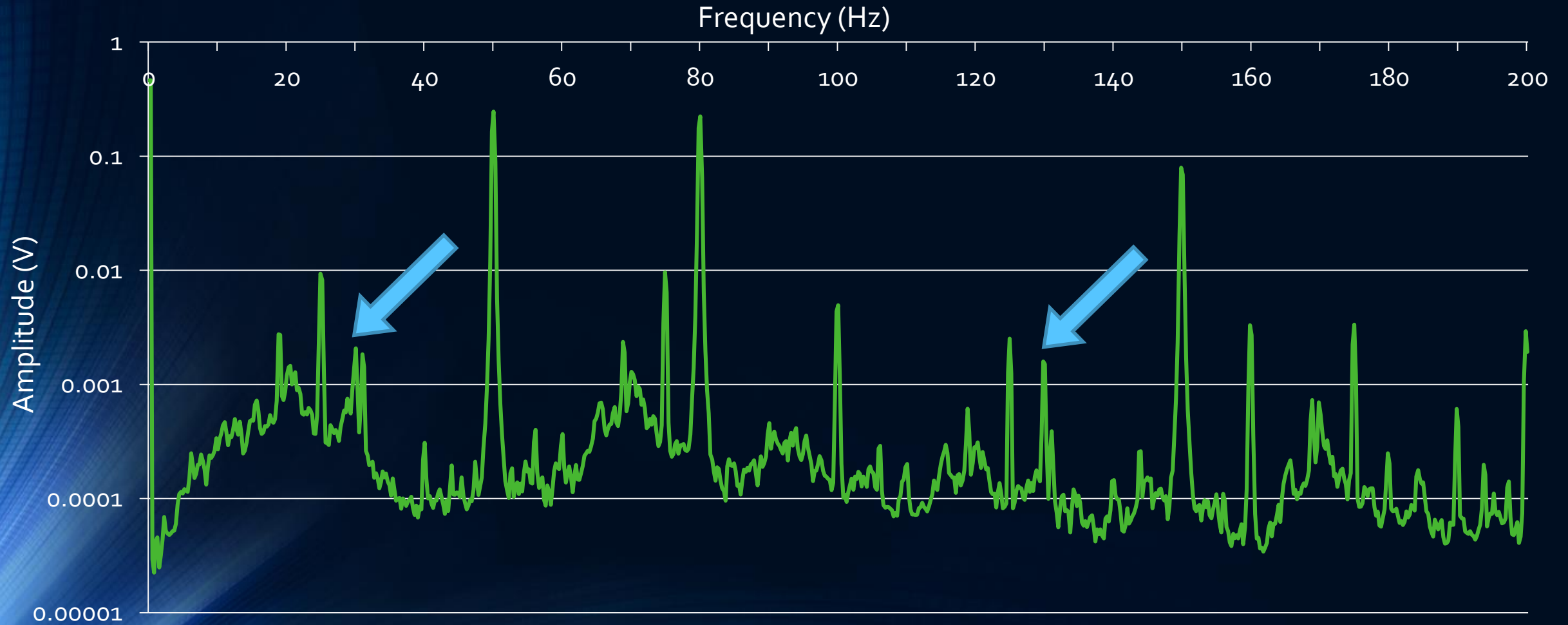
The Generator Terms



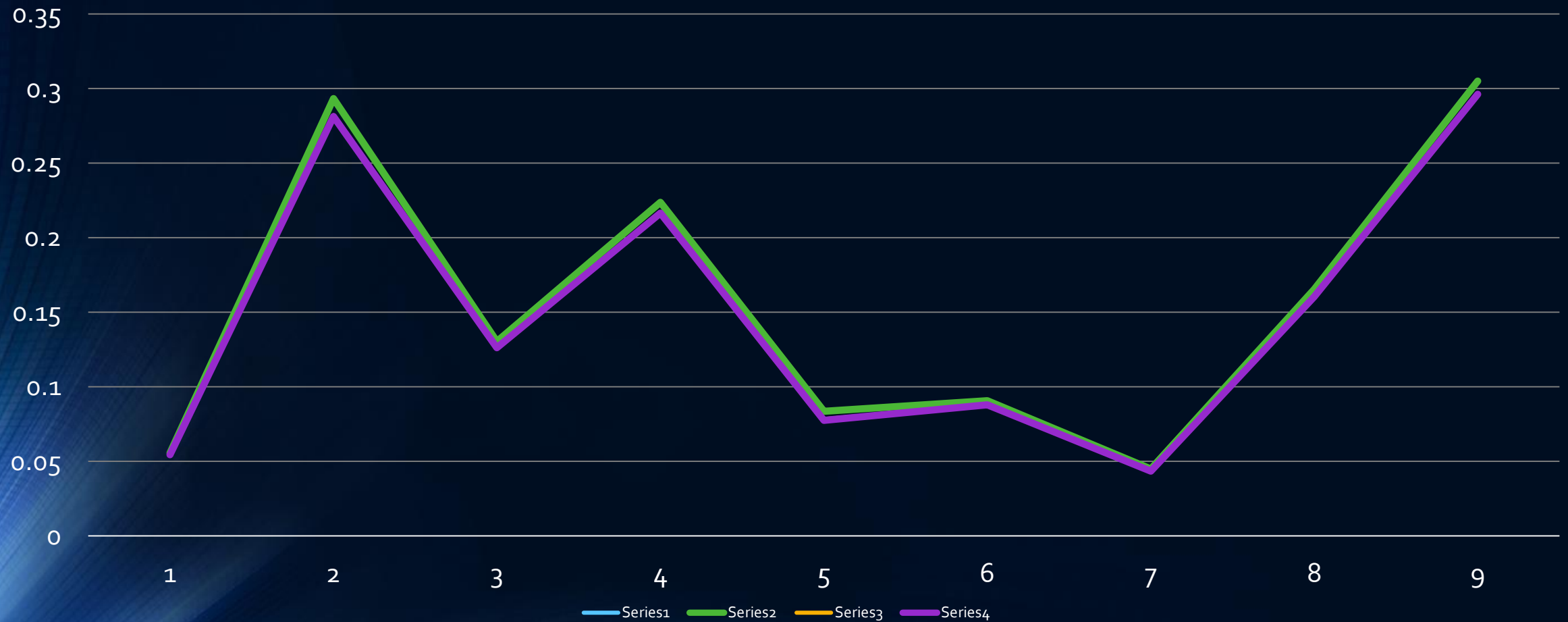
KEMPFIELD



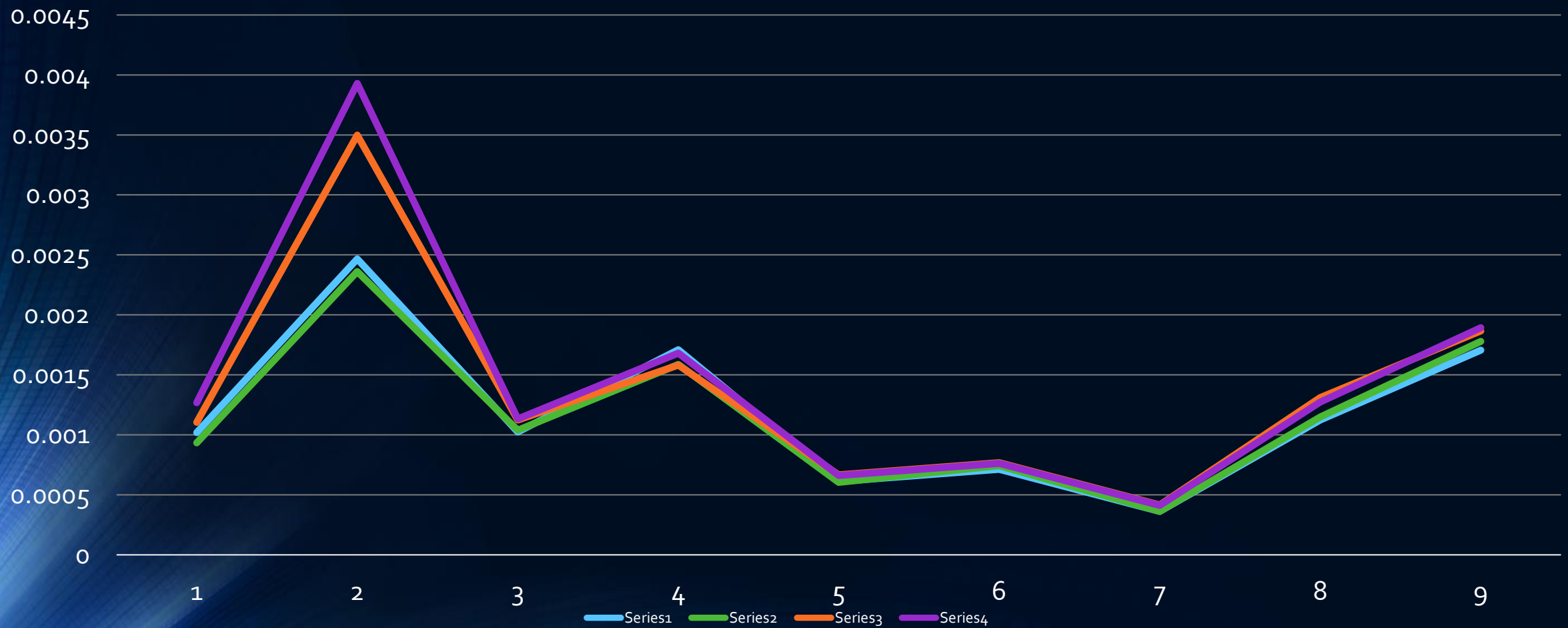
Measuring the Profile



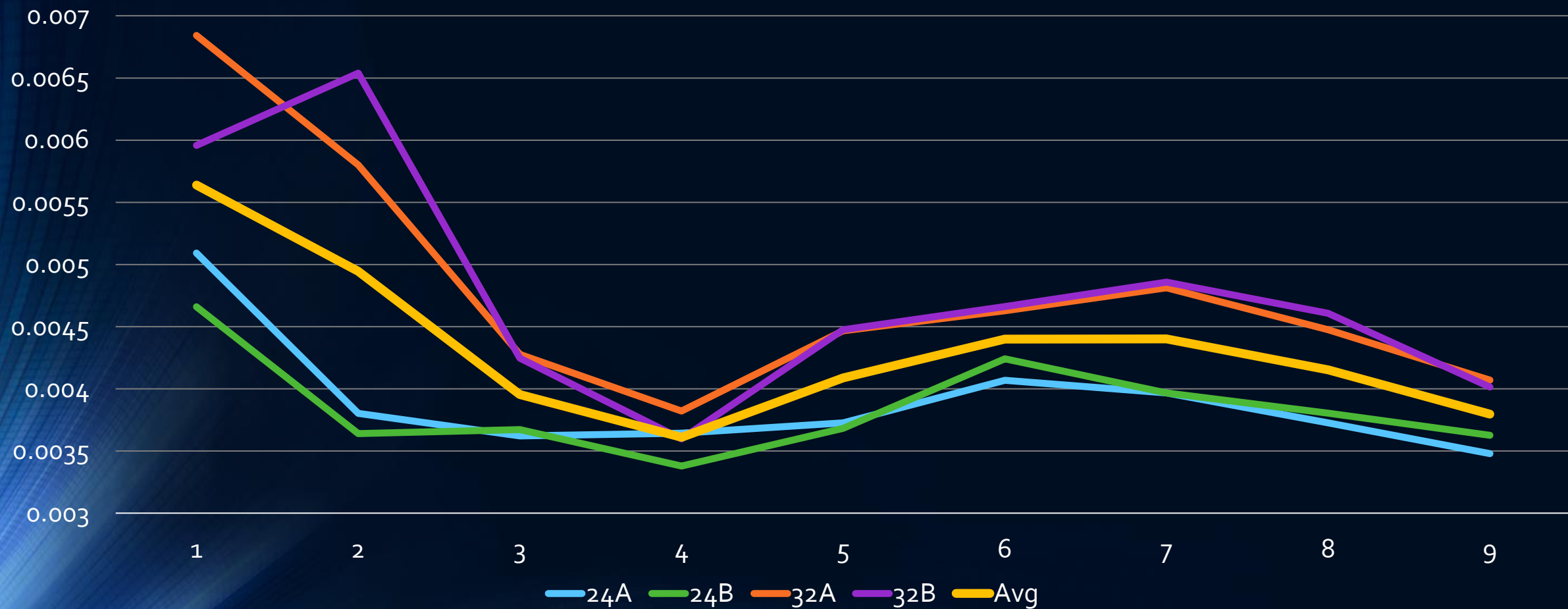
Primary Profile: 80Hz



Secondary Profile: 130Hz



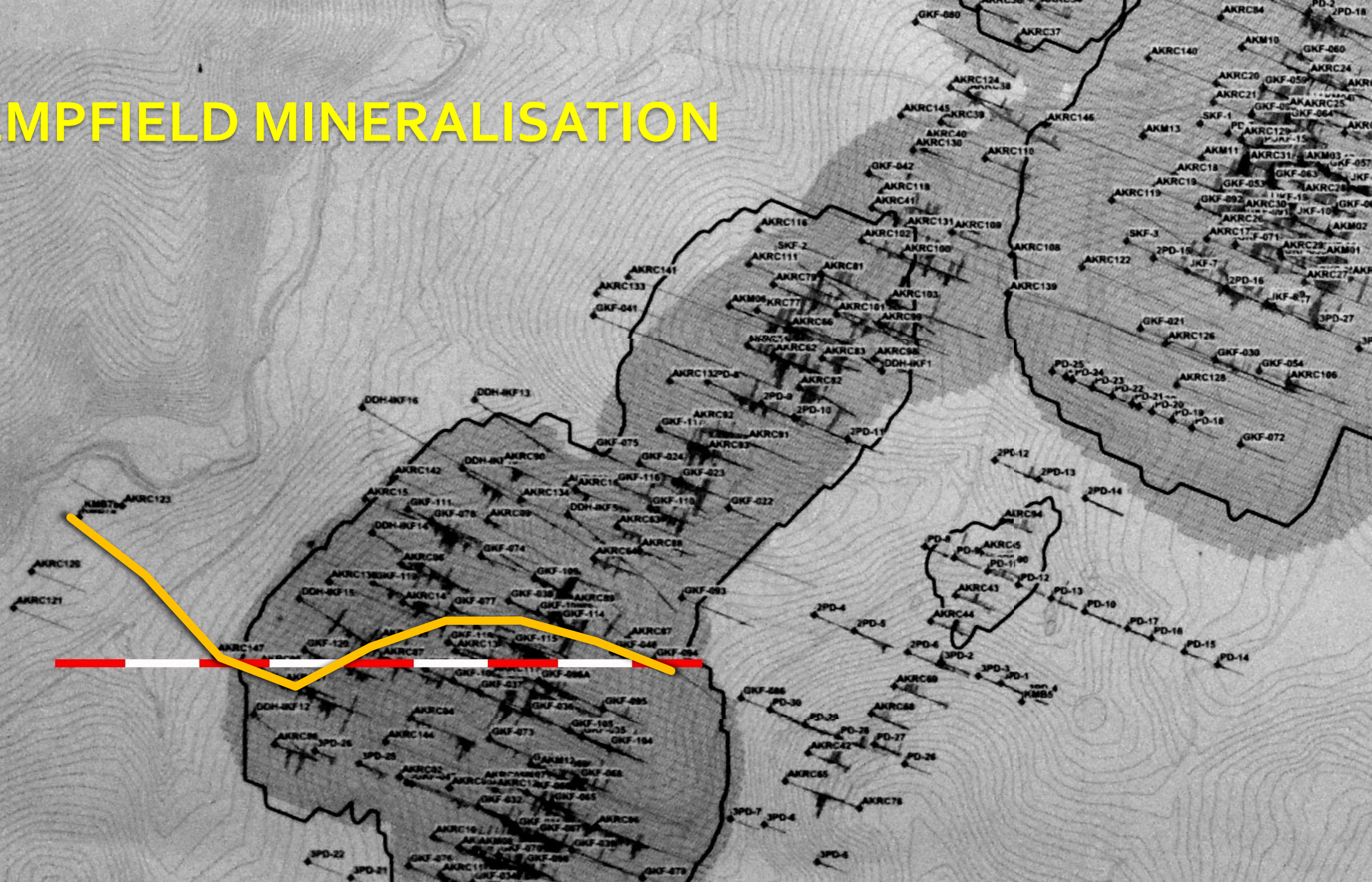
Ratio: 130Hz/80Hz

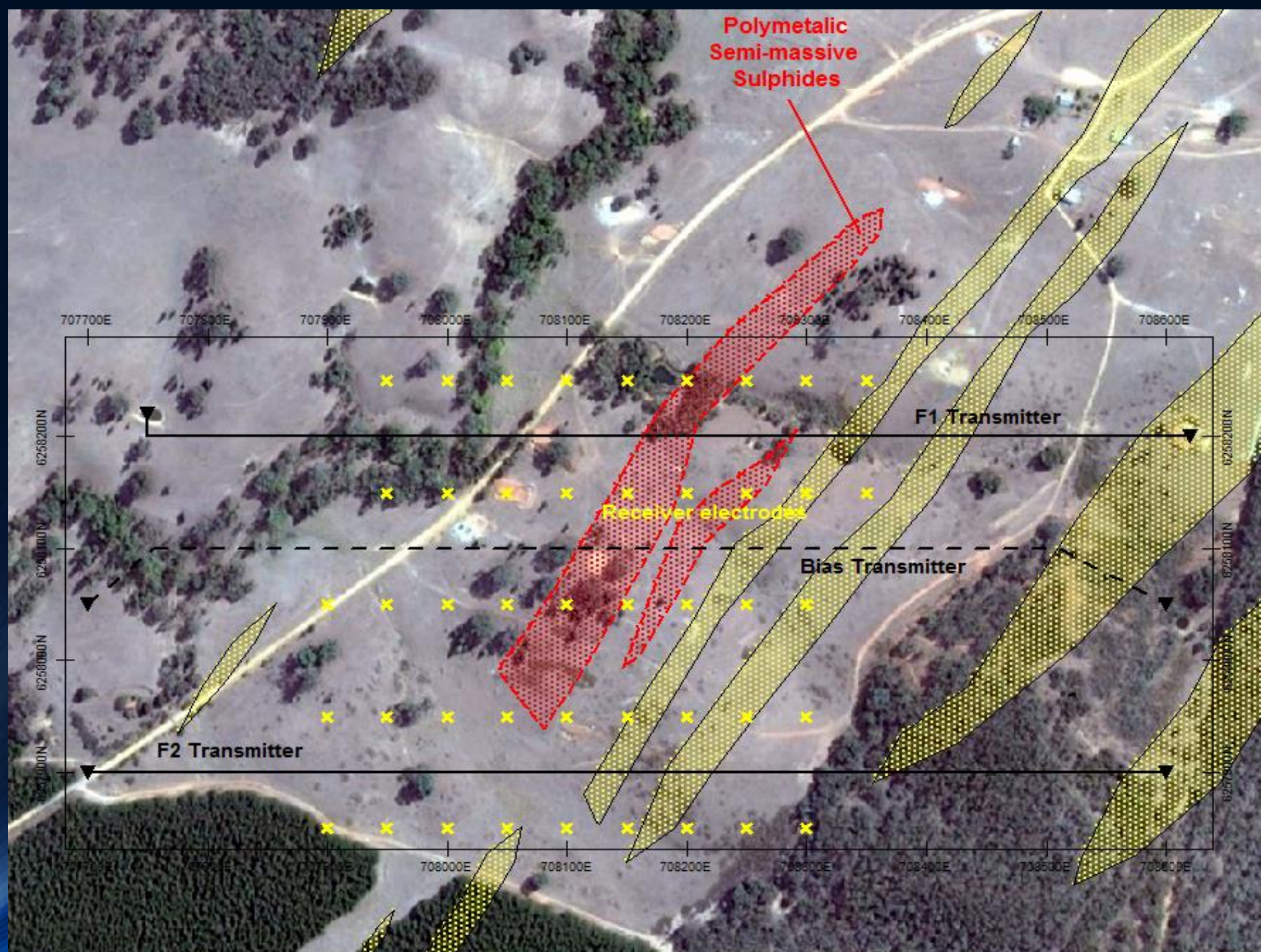


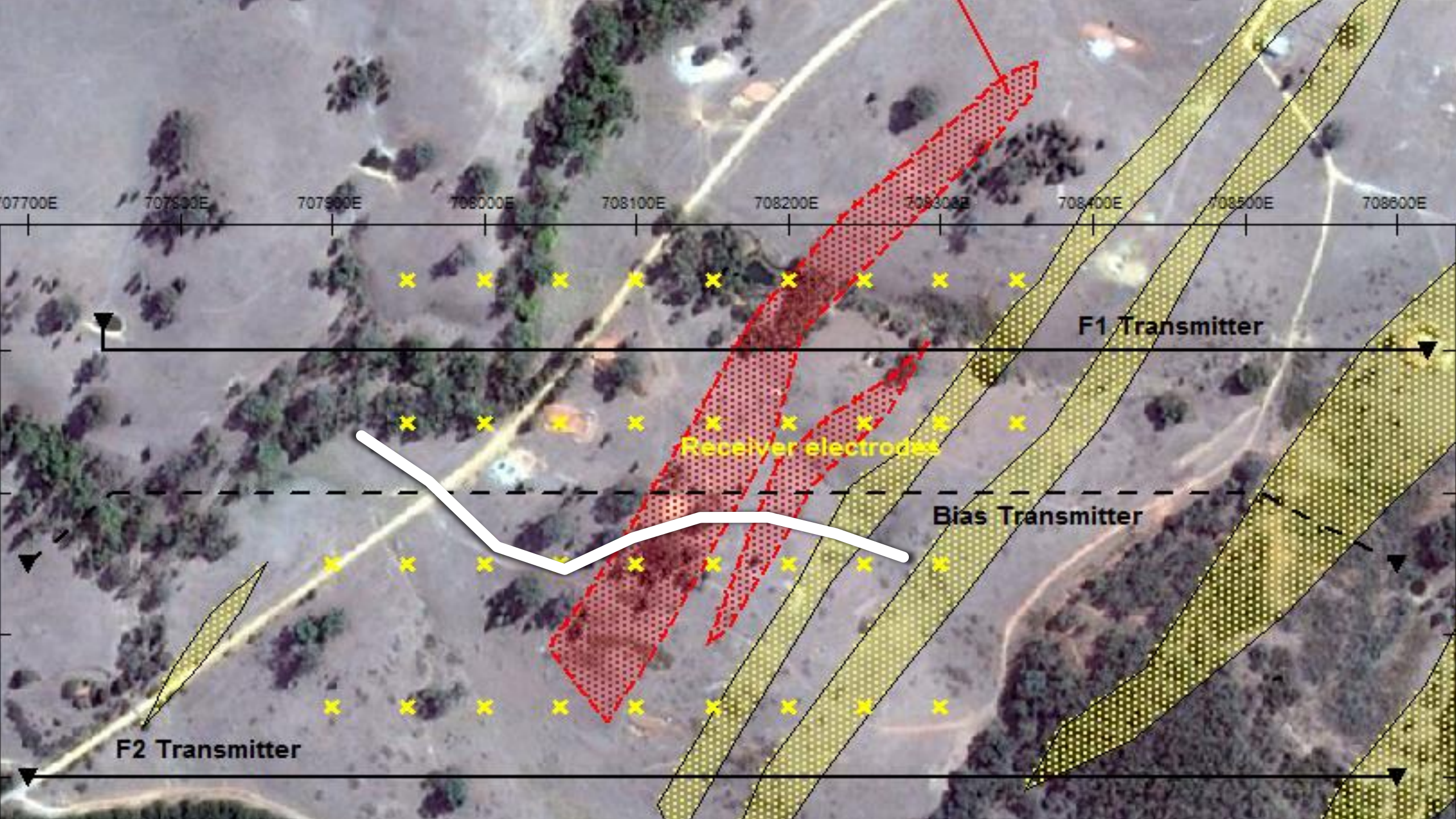
6.258.250) mM



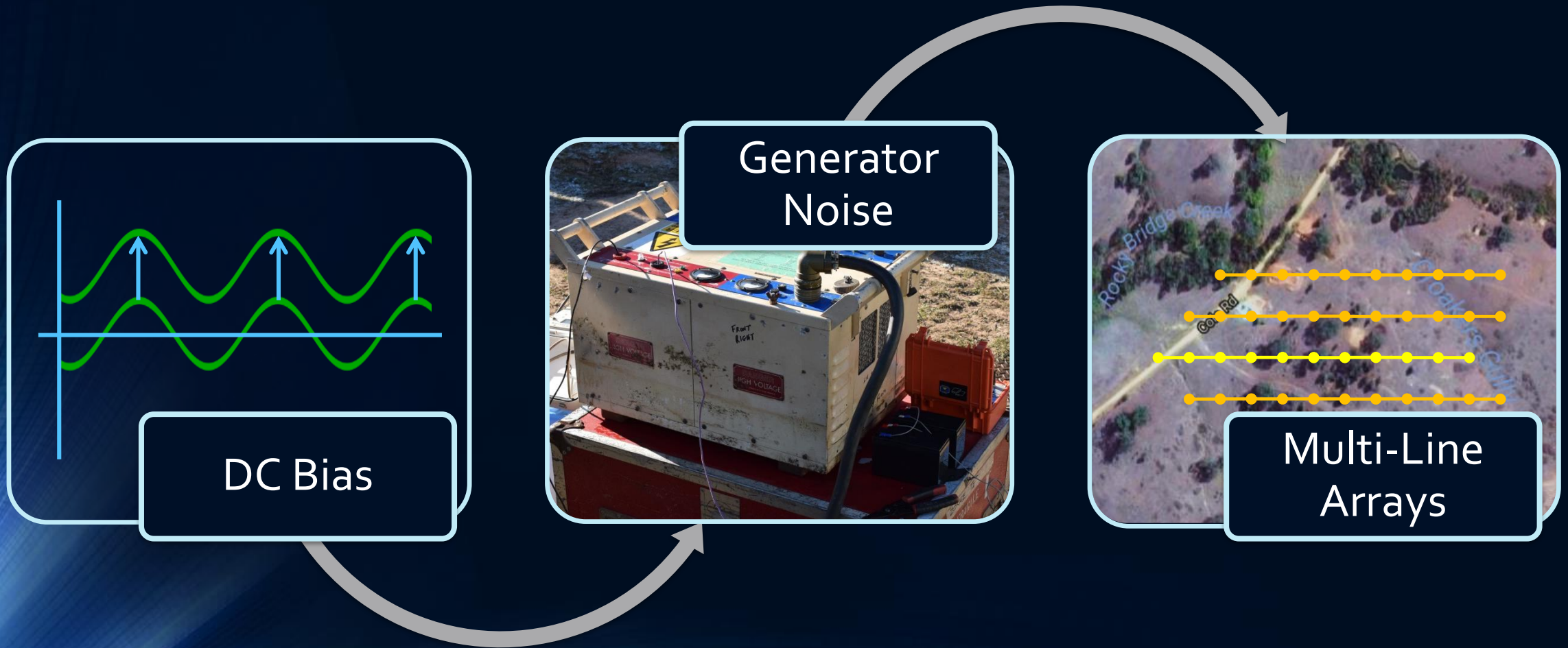
KEMPFIELD MINERALISATION







The Next Stage: Improving the method



Kempfield Field Study #2

CSIRO IN COLLABORATION WITH FENDER GEOPHYSICS, ARCTAN
SERVICES, TOORONGA RESOURCES AND QUADRANT GEOPHYSICS

KEMPFIELD

8250N

8150N

8050N

1 2 3 4 5 6 7 8

7950N

7850N





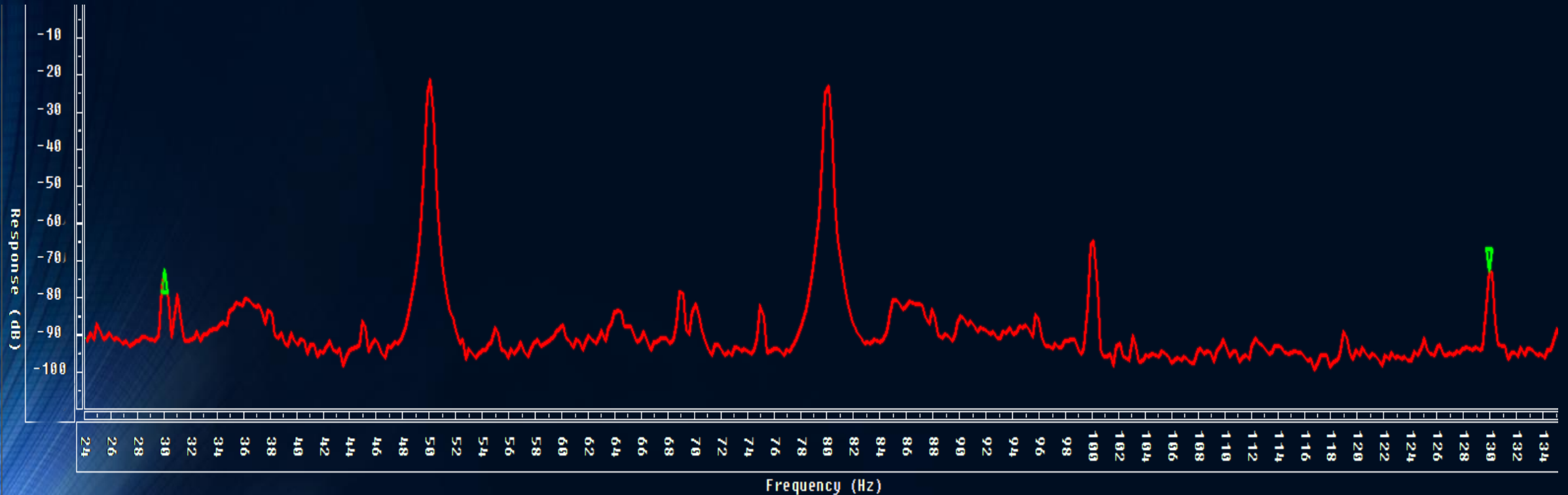




KEMPFIELD

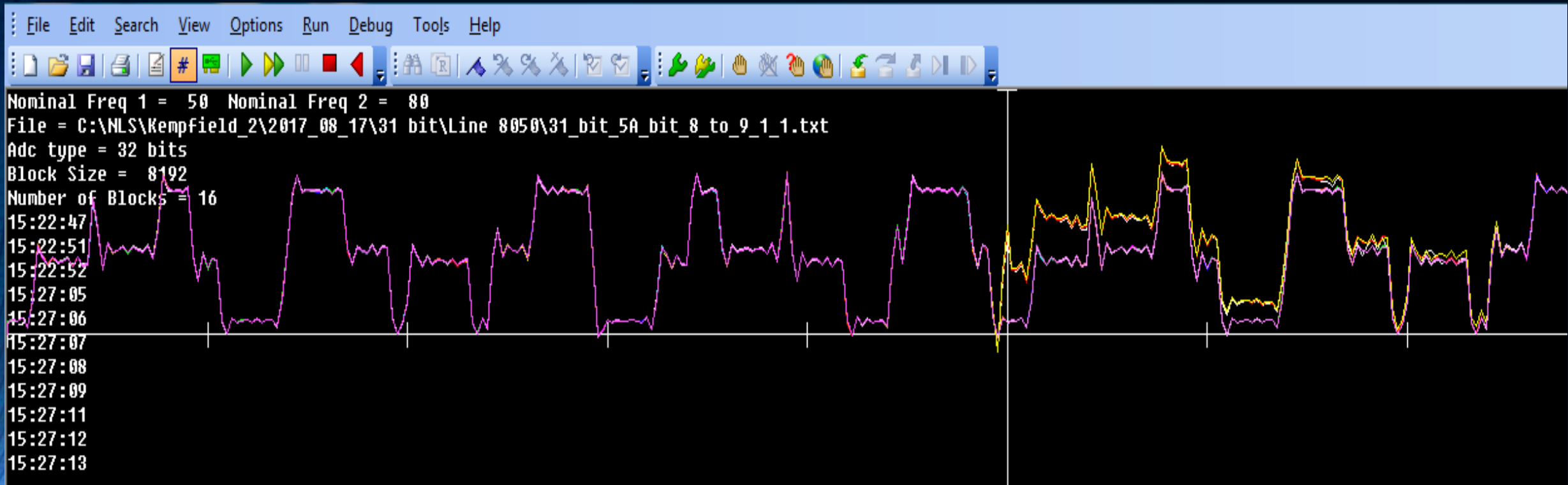


Frequency profile

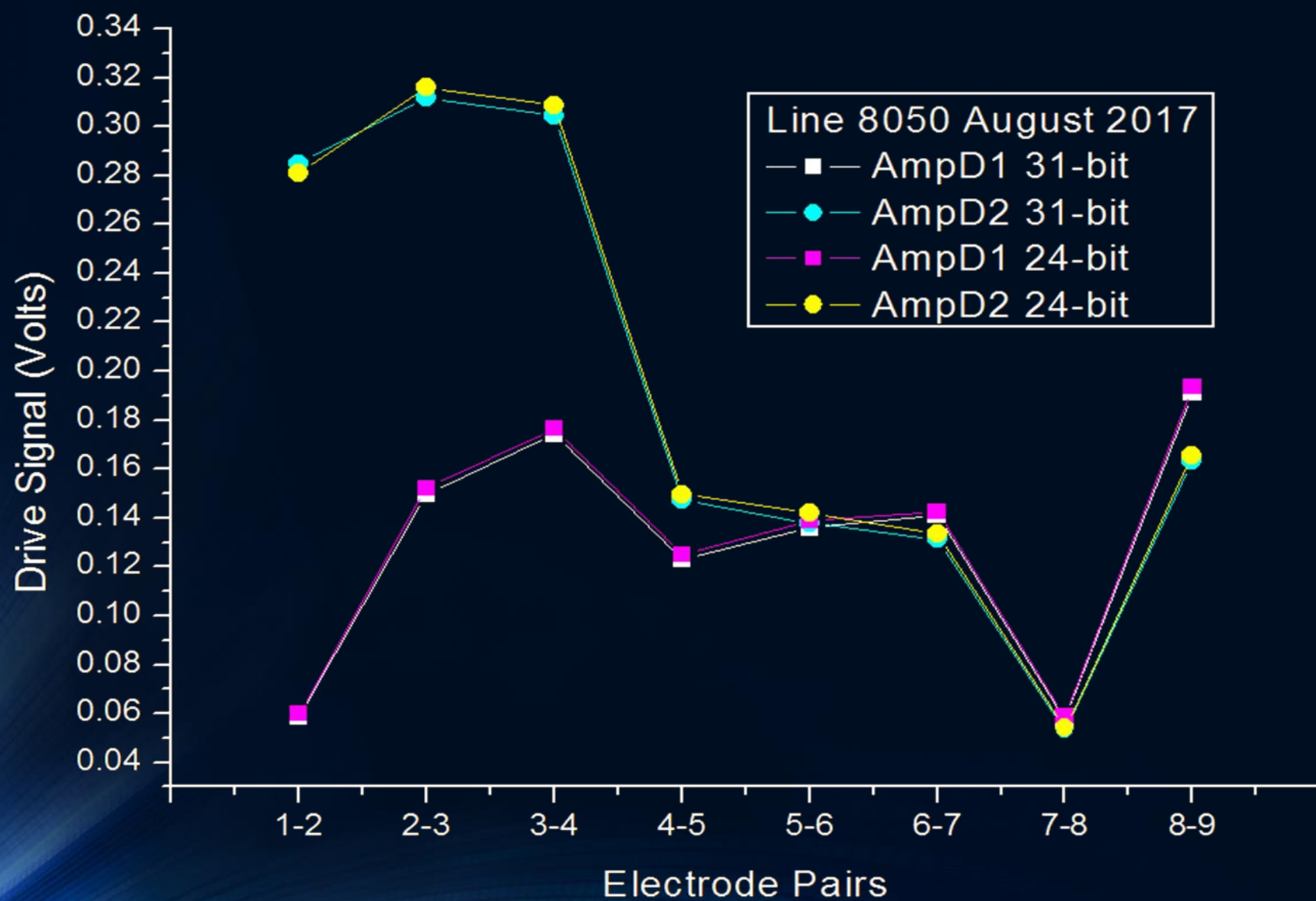


Example profile – Line 8050 electrode pair 8: 31-bit ADC

Data issues: Level Shifts



Example profile – Line 8050 electrode pair 8: 31-bit ADC



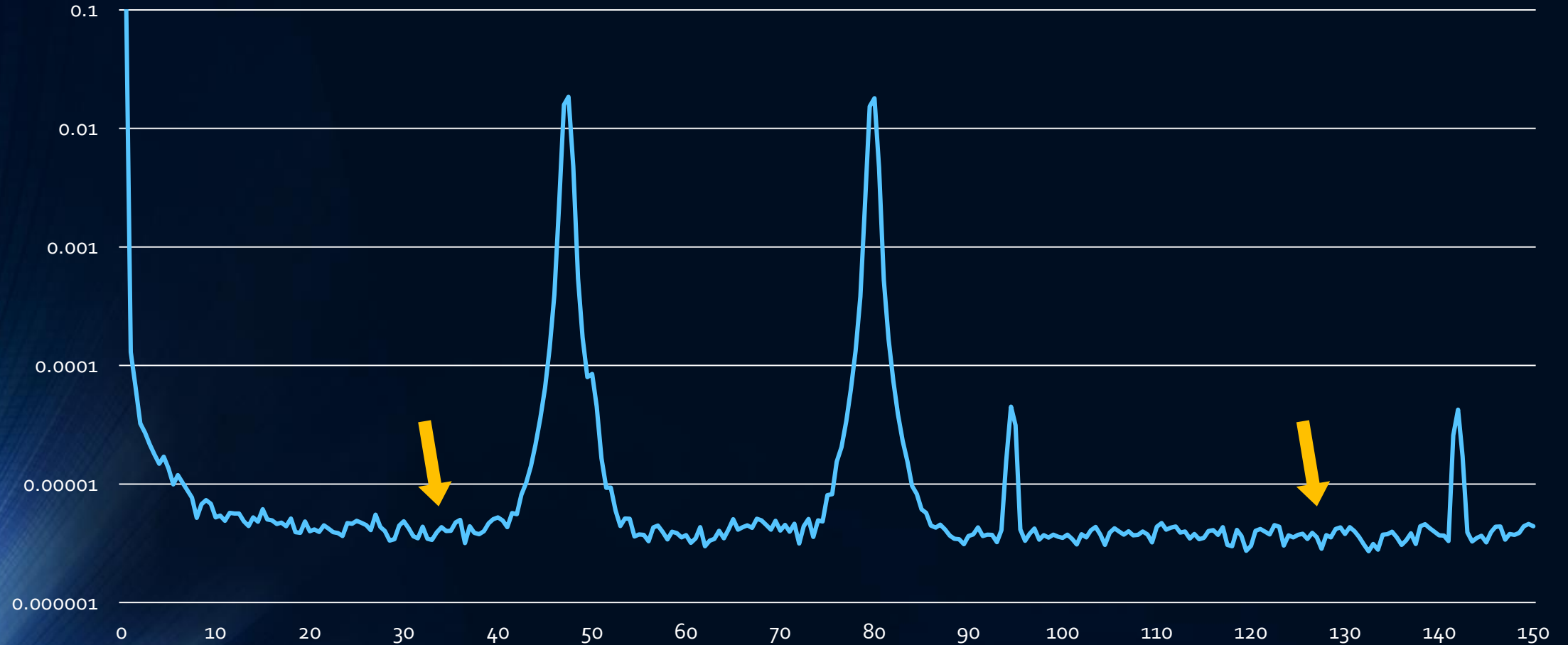
The Next Steps: Improving the method



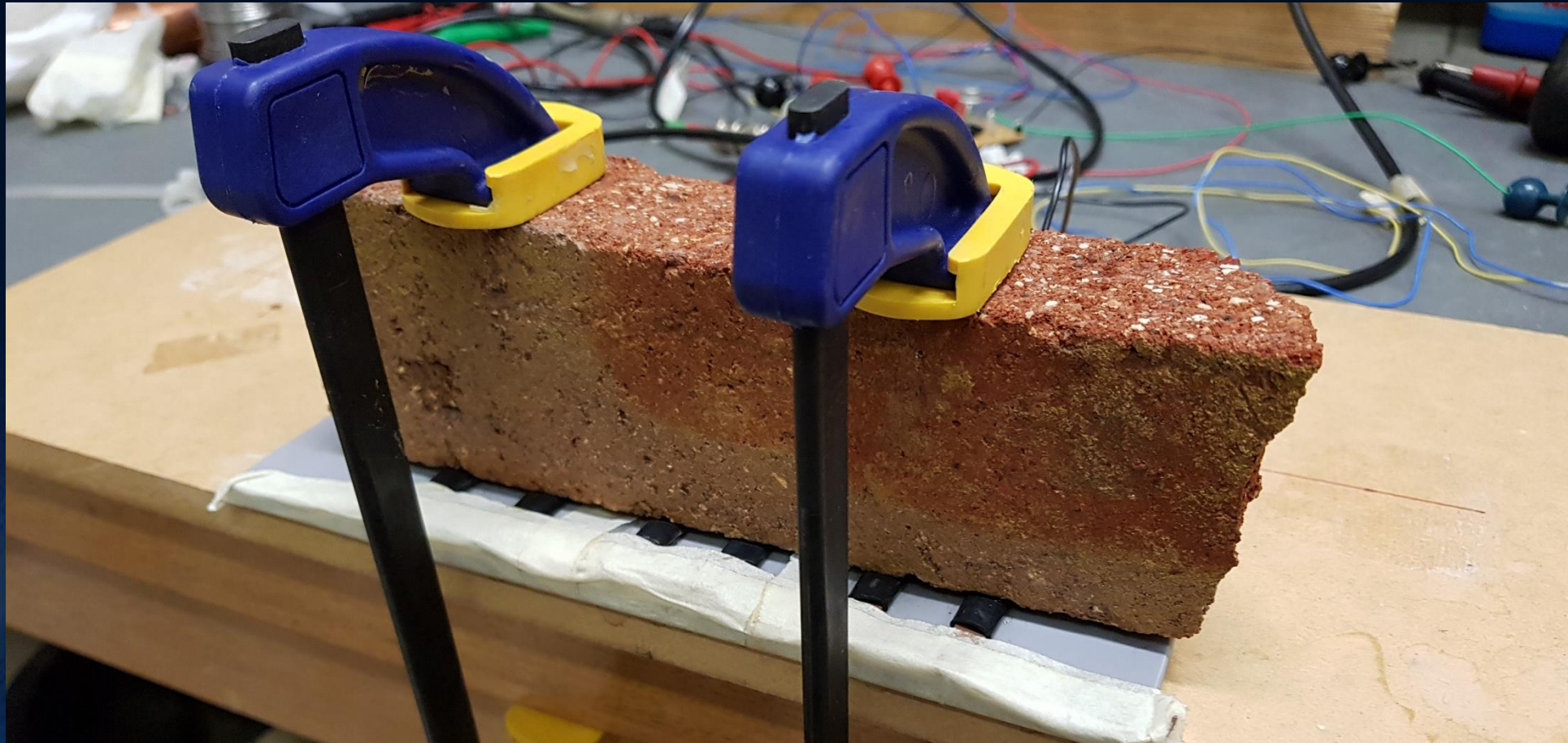
Laboratory Testing Continued

ARGENT MINERALS KEMPFIELD SAMPLES

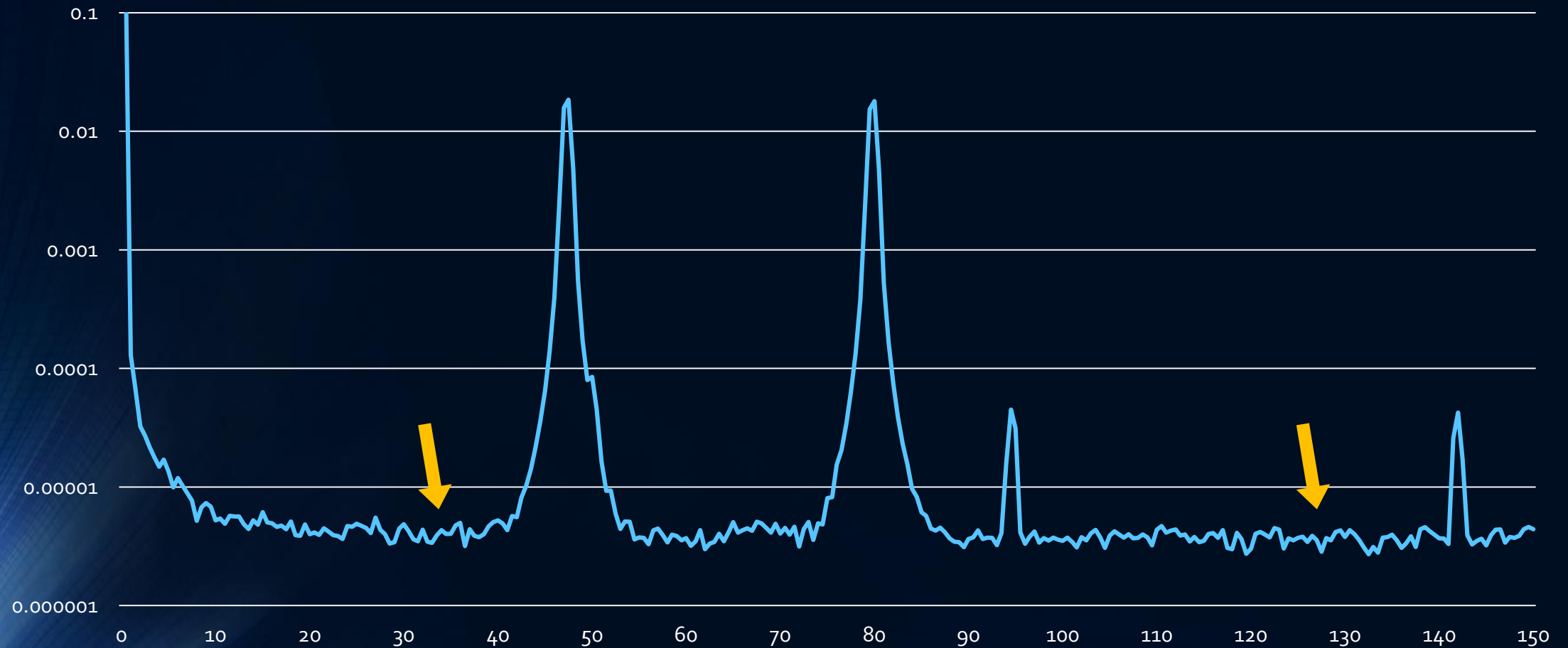
Control Sample: Fired Clay with Aggregate



Control Sample: ~~Fired Clay with Aggregate~~ LUMP OF BRICK



Control Sample: Fired Clay with Aggregate

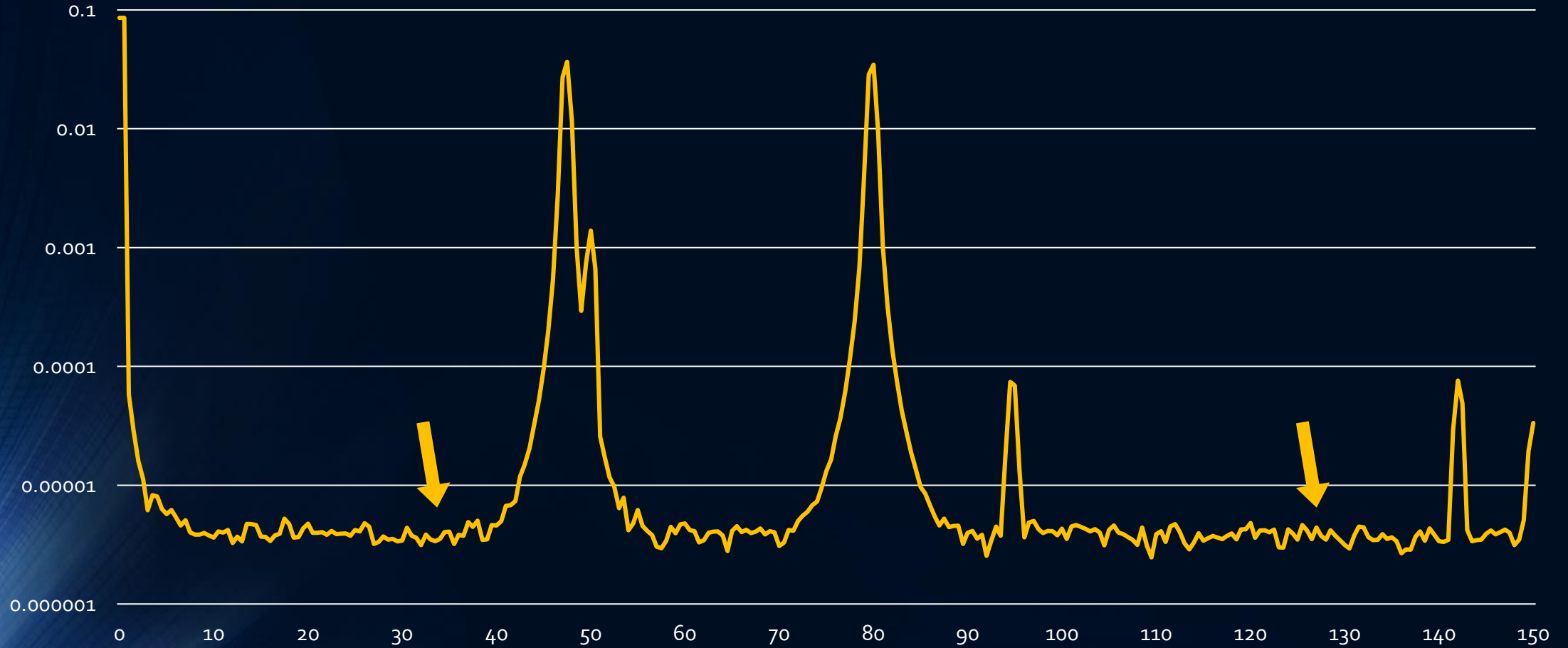




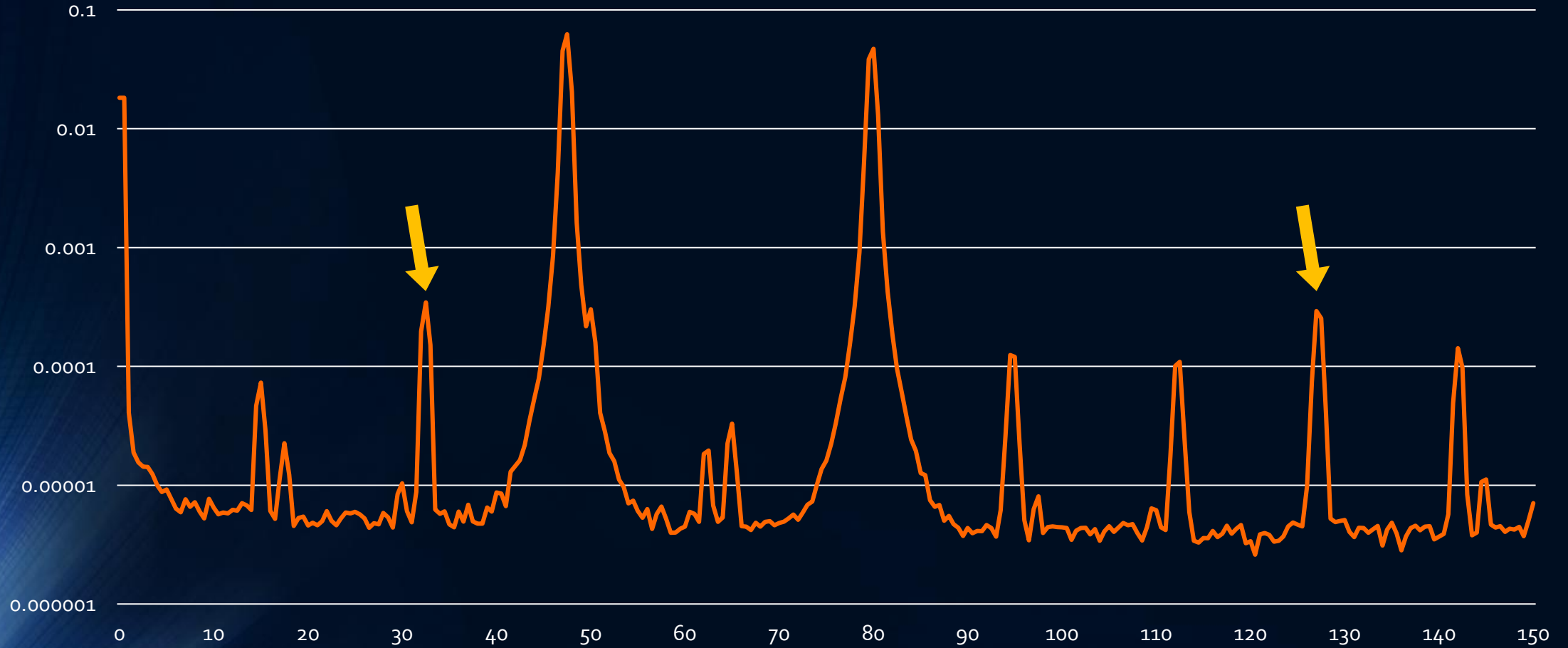
Kempfield Sample 229827



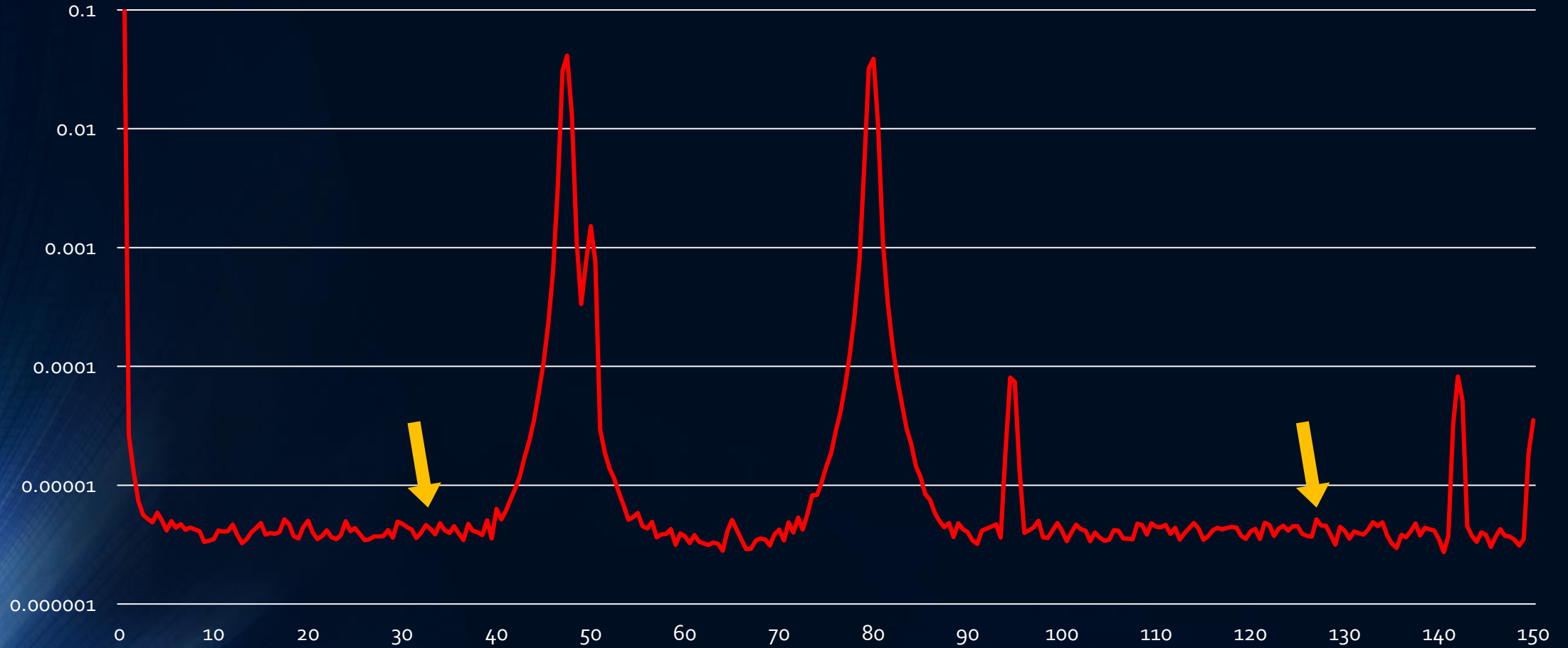
Kempfield Sample 229828



Kempfield Sample 1123696



Kempfield Sample 1123697



Laboratory Summary

MBDD024	- low sulphide content	- low mixing terms
444-444-2	- massive chalcopyrite	- very high mixing terms
TASBW1	- disseminated sulphides	- high mixing terms
229827	- diffuse fine flecks	- low possible mixing terms
229828	- dark fine grained matrix	- no mixing terms
1223696	- visible sulphide grains	- high mixing terms
1223697	- no visible sulphides	- no mixing terms
Brick	- fired clay and aggregate	- no mixing terms

Laboratory Summary

Brick	- fired clay and aggregate	- no mixing terms
1223697	- no visible sulphides	- no mixing terms
229828	- dark fine grained matrix	- no mixing terms
229827	- diffuse fine flecks	- low possible mixing terms
MBDD024	- low sulphide content	- low mixing terms
TASBW1	- disseminated sulphides	- high mixing terms
1223696	- visible sulphide grains	- high mixing terms
444-444-2	- massive sulphides	- very high mixing terms

The background is a deep blue gradient. On the left side, there is a faint, light blue grid pattern that appears to be receding into the distance. On the right side, there are several concentric, curved lines that also create a sense of depth and movement towards the center.

Heterodyne Sulphides: future exploration?

Collaboration with

- CSIRO
- Fender Geophysics
- Toorong Resources
- ARCTAN Services
- Quadrant Geophysics

