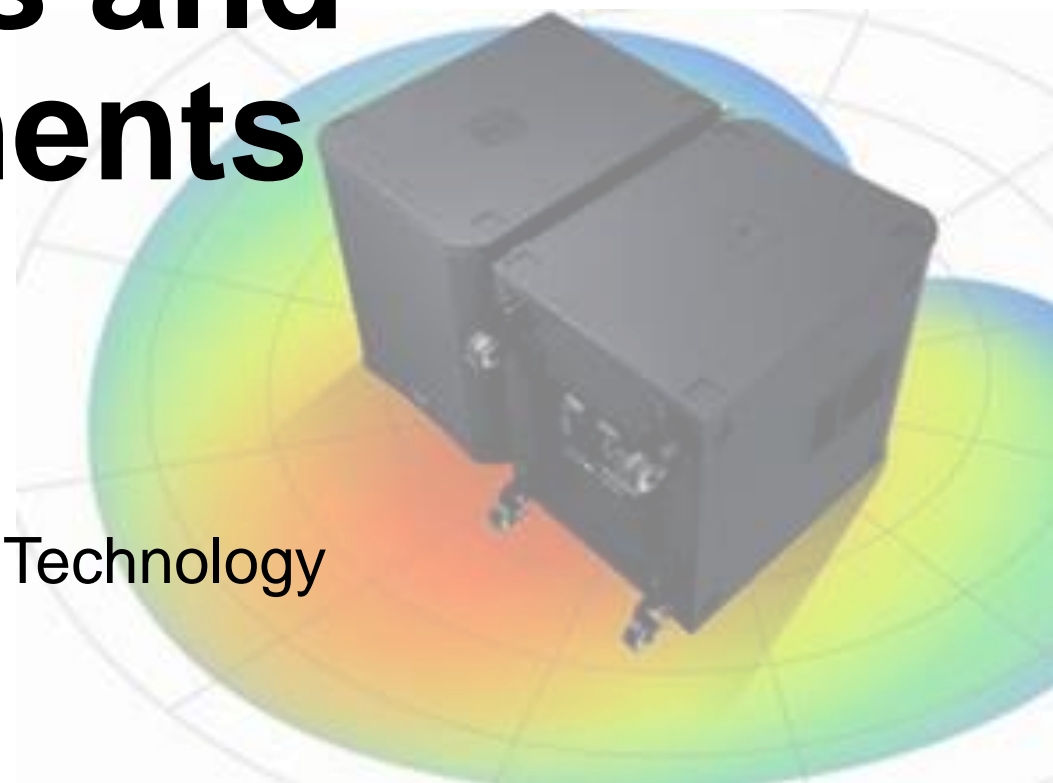


# Subwoofer Array Configurations: Projections and Measurements

Terry Chun

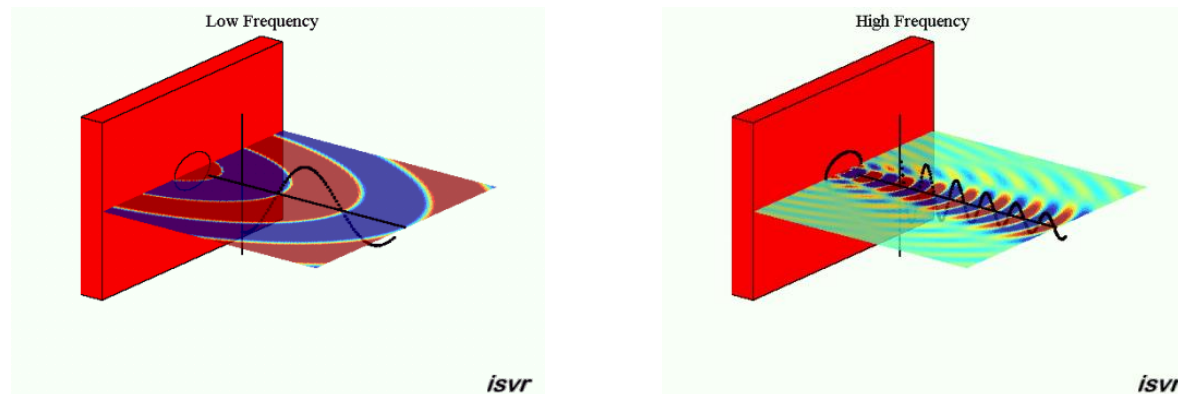
05/17/2022

New York City College of Technology



# Subwoofer Array?

- Low frequency producing loudspeakers  
(frequency range 30 – 100 Hz)
- Longer wavelength radiates in more dispersed pattern  
40 Hz – 28.3 ft ; 5 kHz – 0.22 ft
- Multiple sources of sound waves interfere constructively and destructively

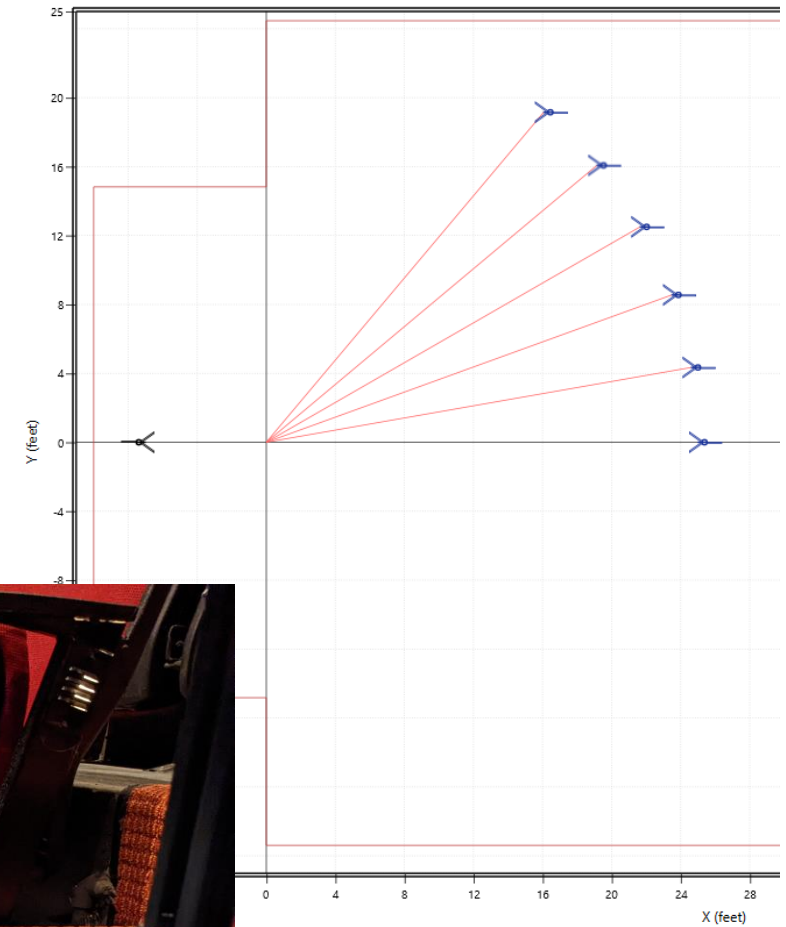


# Fundamental Arrays

- Endfire
- Gradient
- Stacked Cardioid

# Measurement

- 7 Microphones
  - $0^\circ, 10, 20, 30, 40, 50^\circ$  array @ 25'
  - $180^\circ$  @ 7'
- Frequency Response
- Phase Response

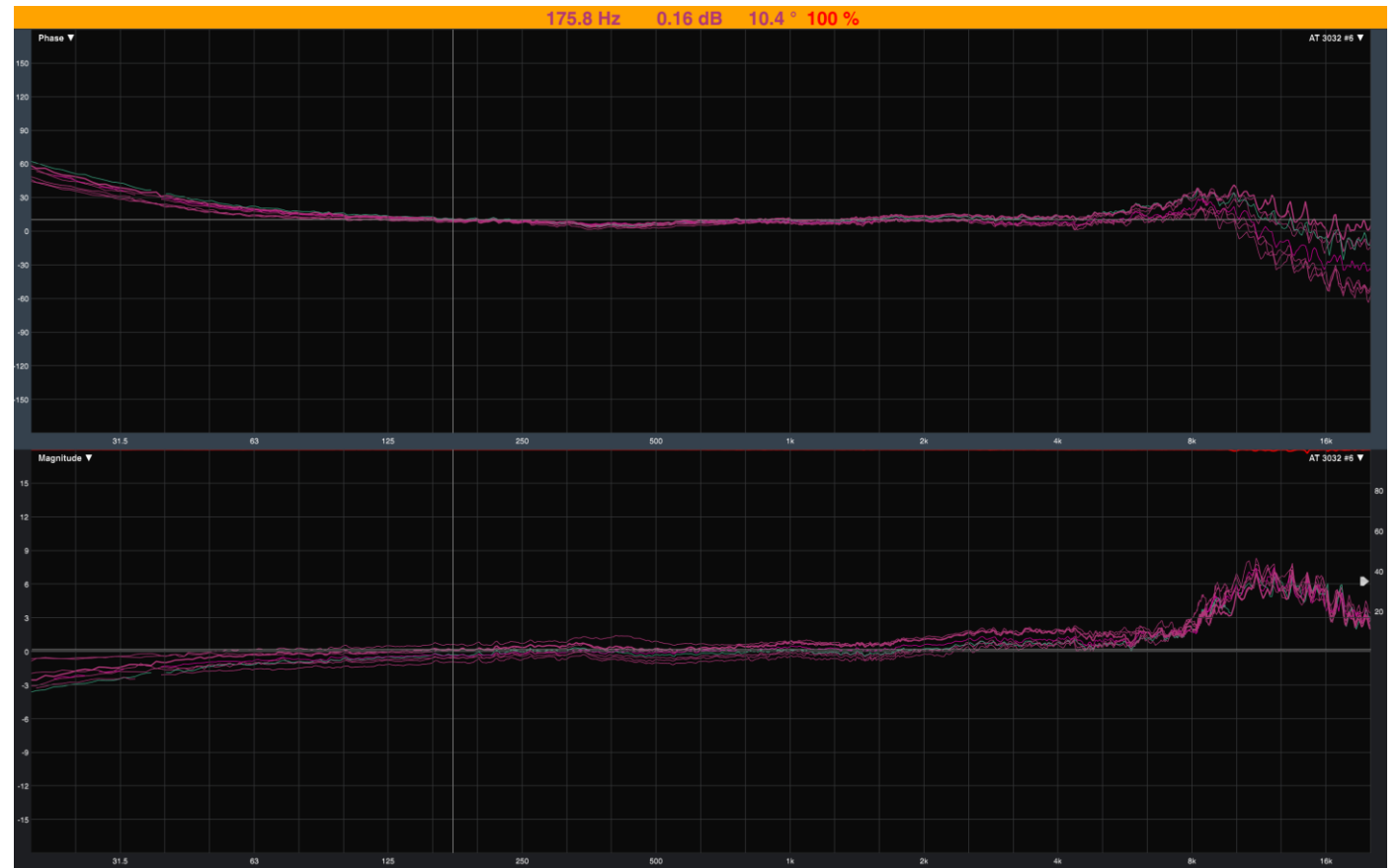












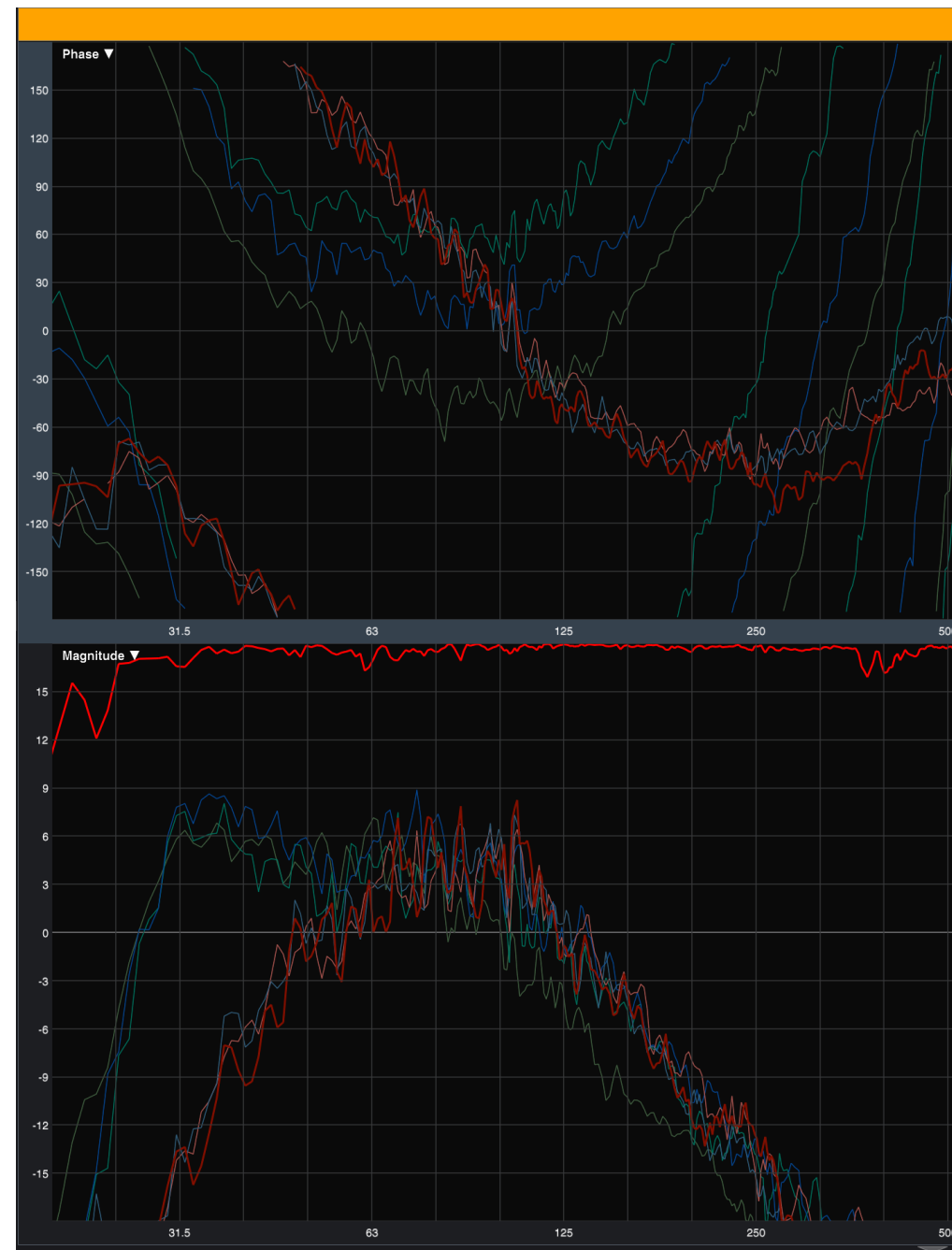
# Microphone Calibration

- 7 x AT-3032  
Maximum 17.6° phase offset  
2.89 dB at 20.5 Hz



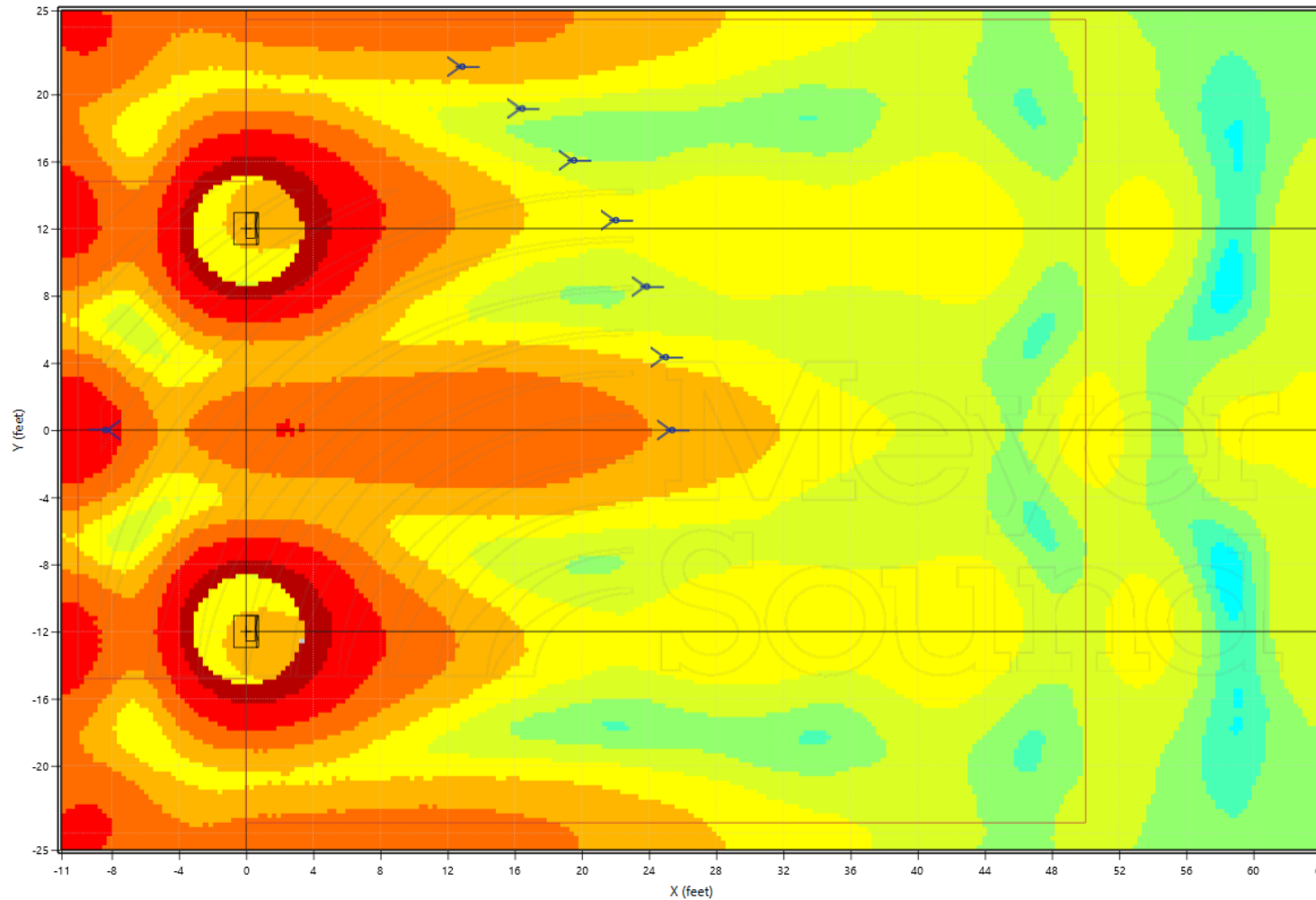
# Speaker Calibration

- 1 x Meyer 650-P 
- 2 x Meyer UMS-1P  
- 3 x EAW SB120iXR   



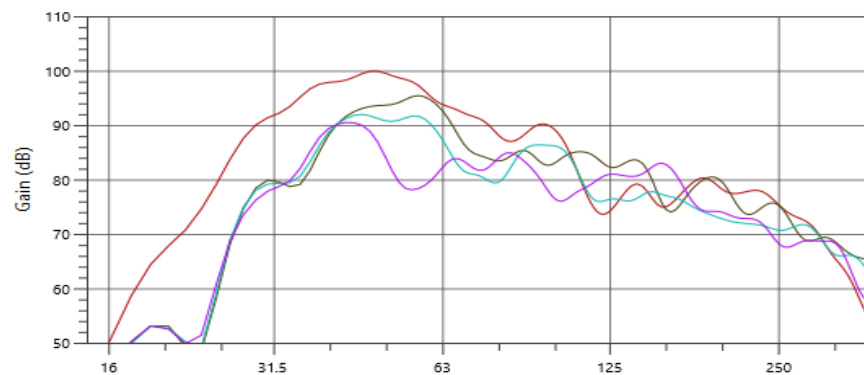
# Config 1A - Stereo LR

- 2 x UMS-1P spaced 24'

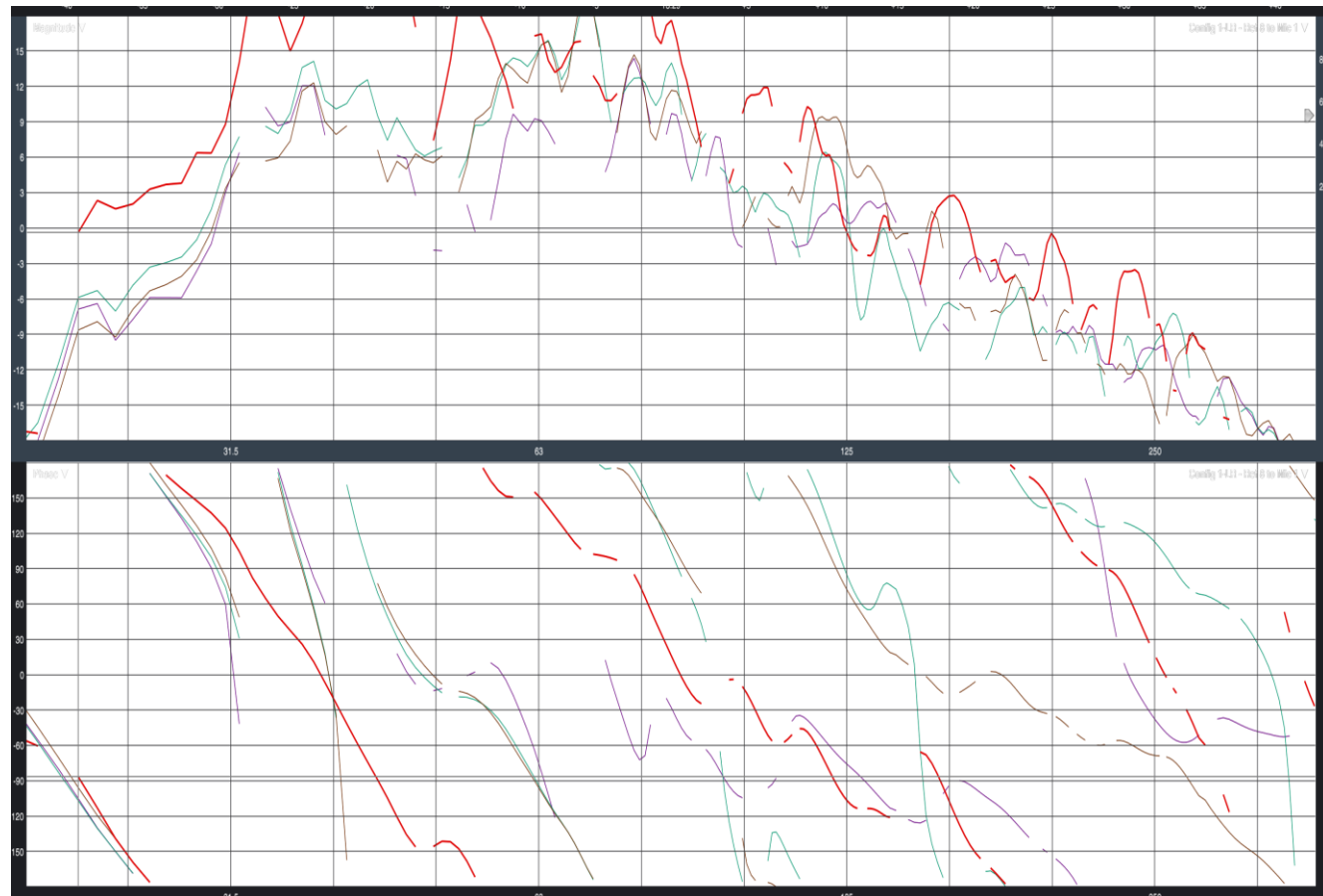
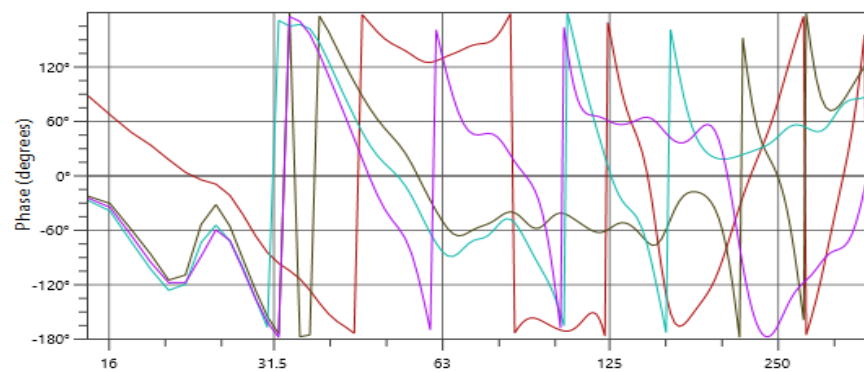




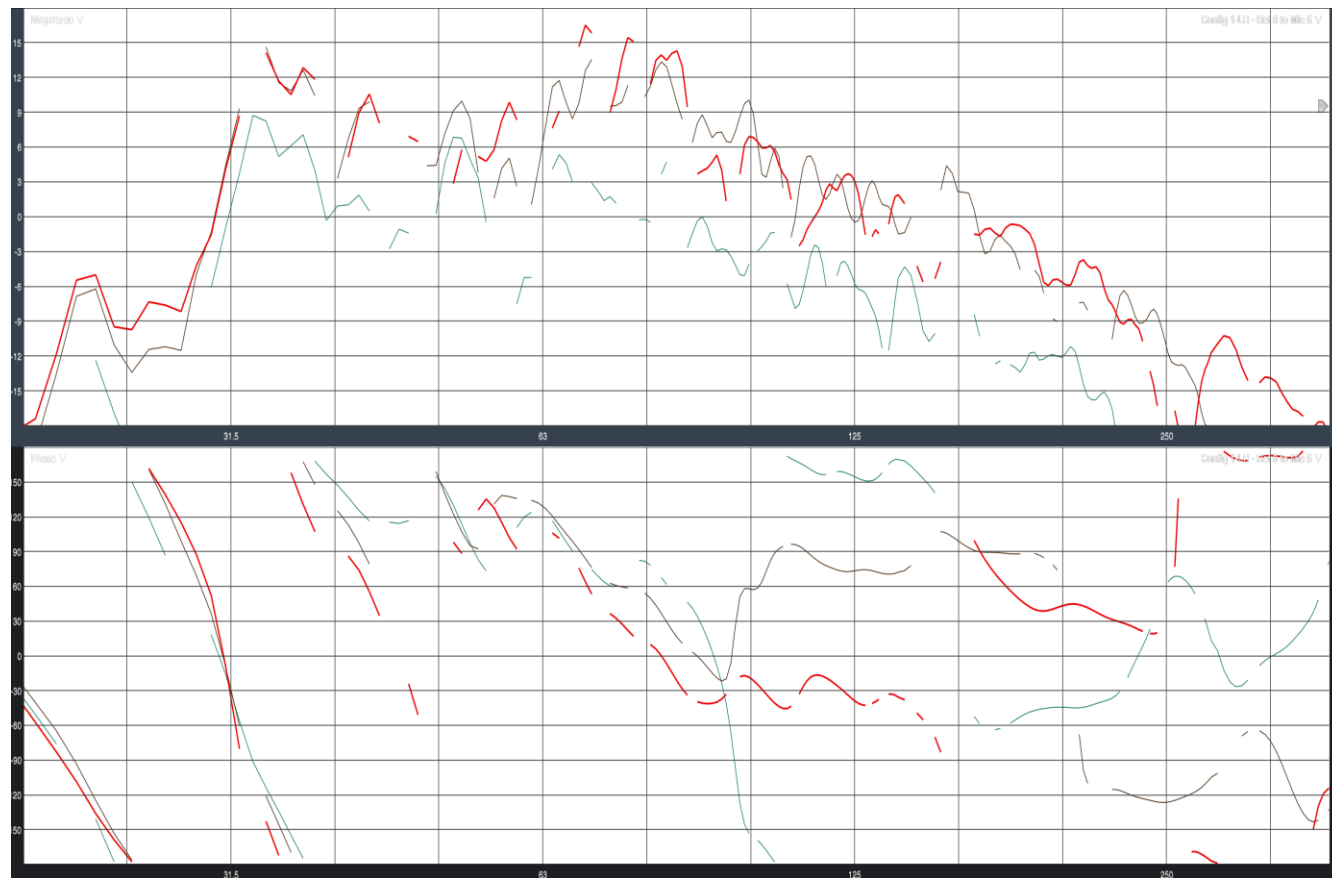
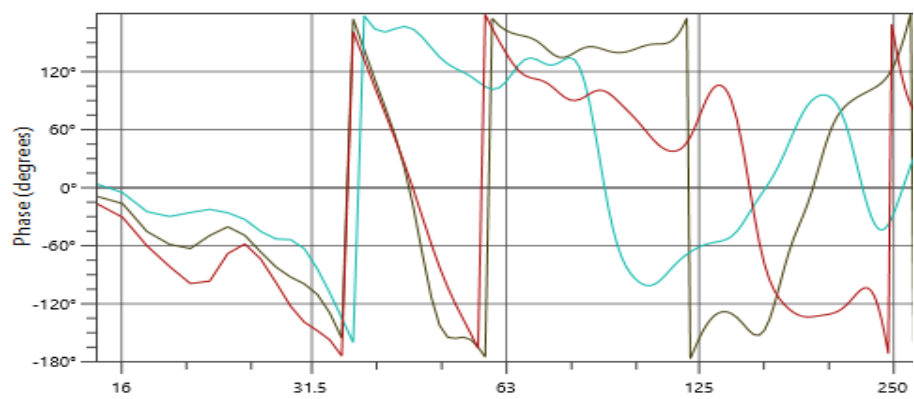
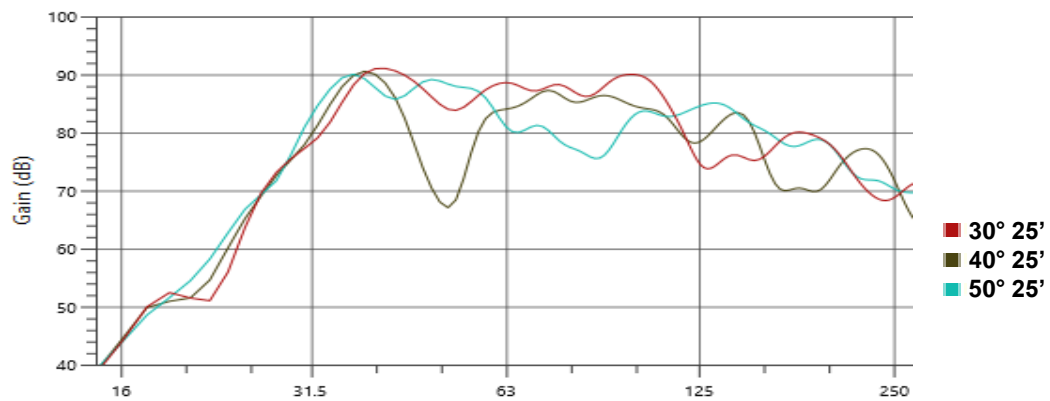
# Config 1A - Stereo LR



- 180° 7'
- 0° 25'
- 10° 25'
- 20° 25'

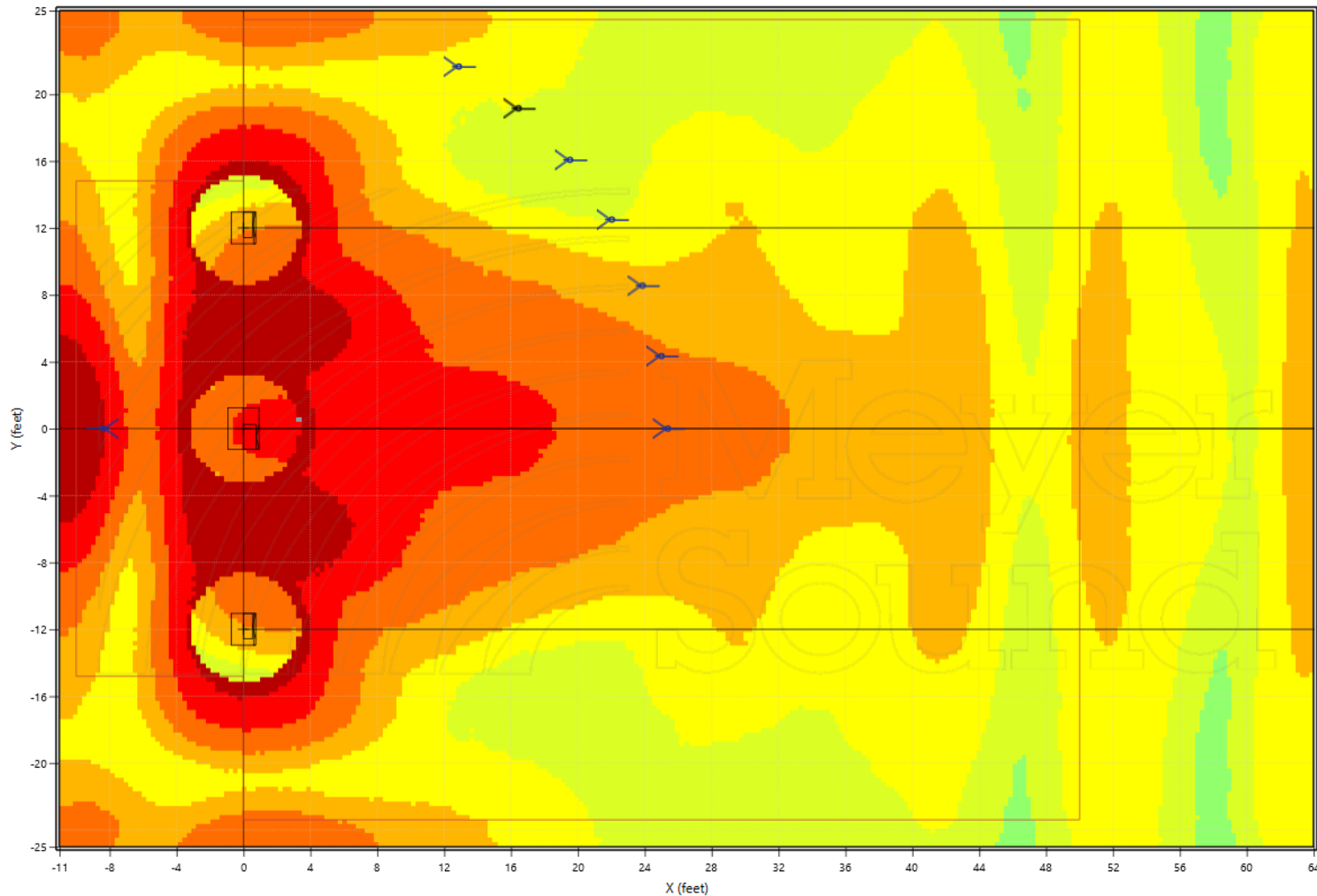


# Config 1A - Stereo LR

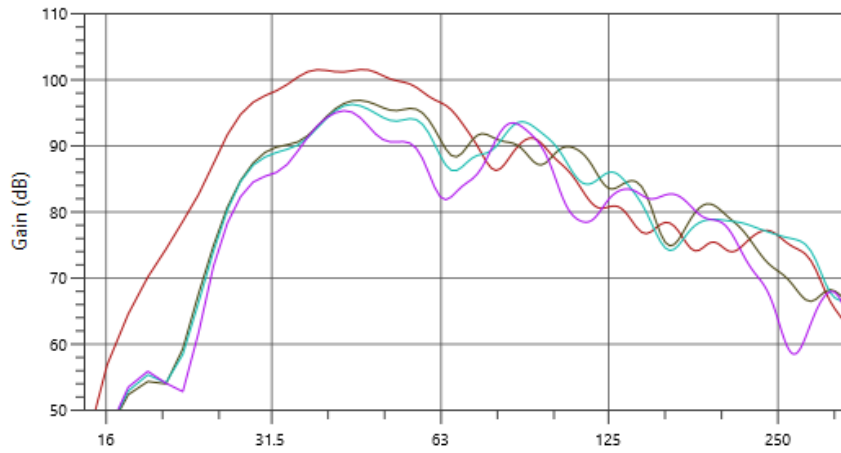


# Config 1B - LCR

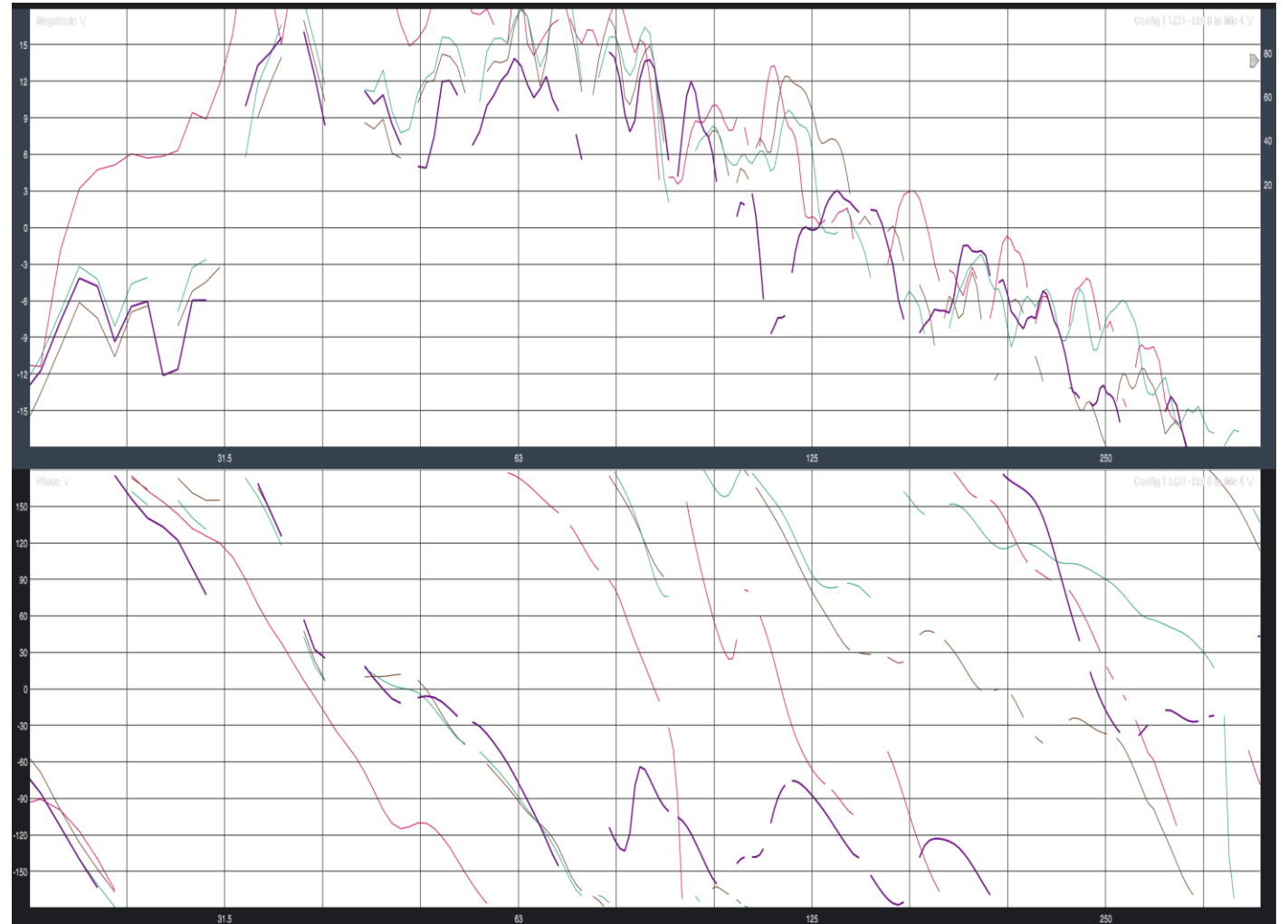
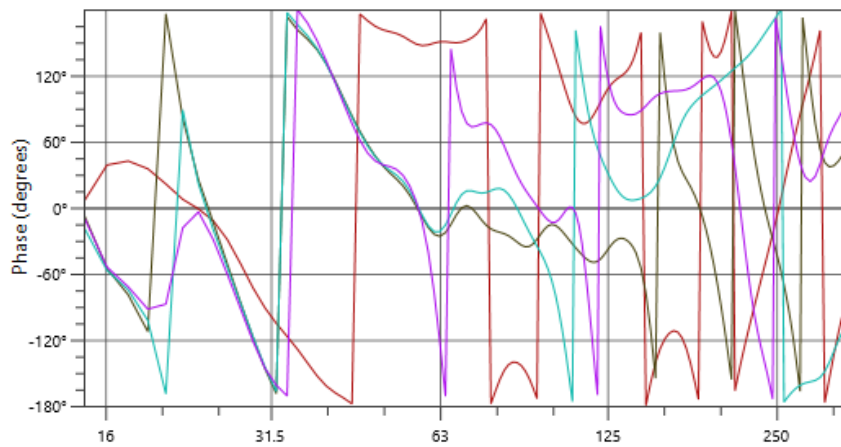
- 2 x UMS-1P spaced 24' + 650-P placed center



# Config 1B - LCR

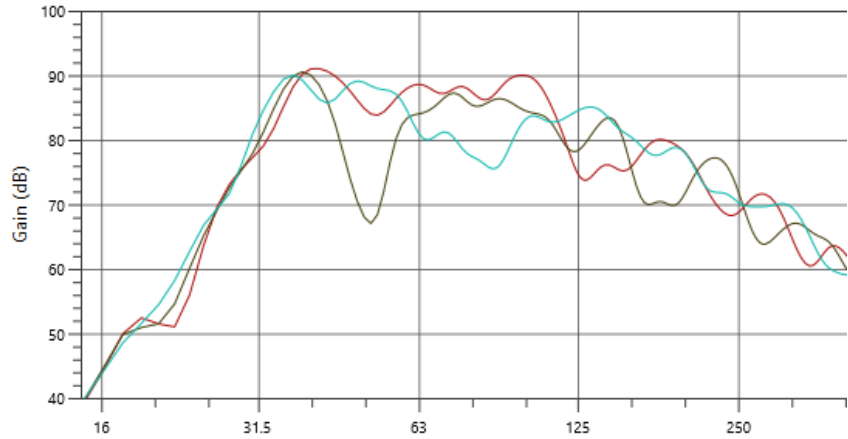


- 180° 7'
- 0° 25'
- 10° 25'
- 20° 25'

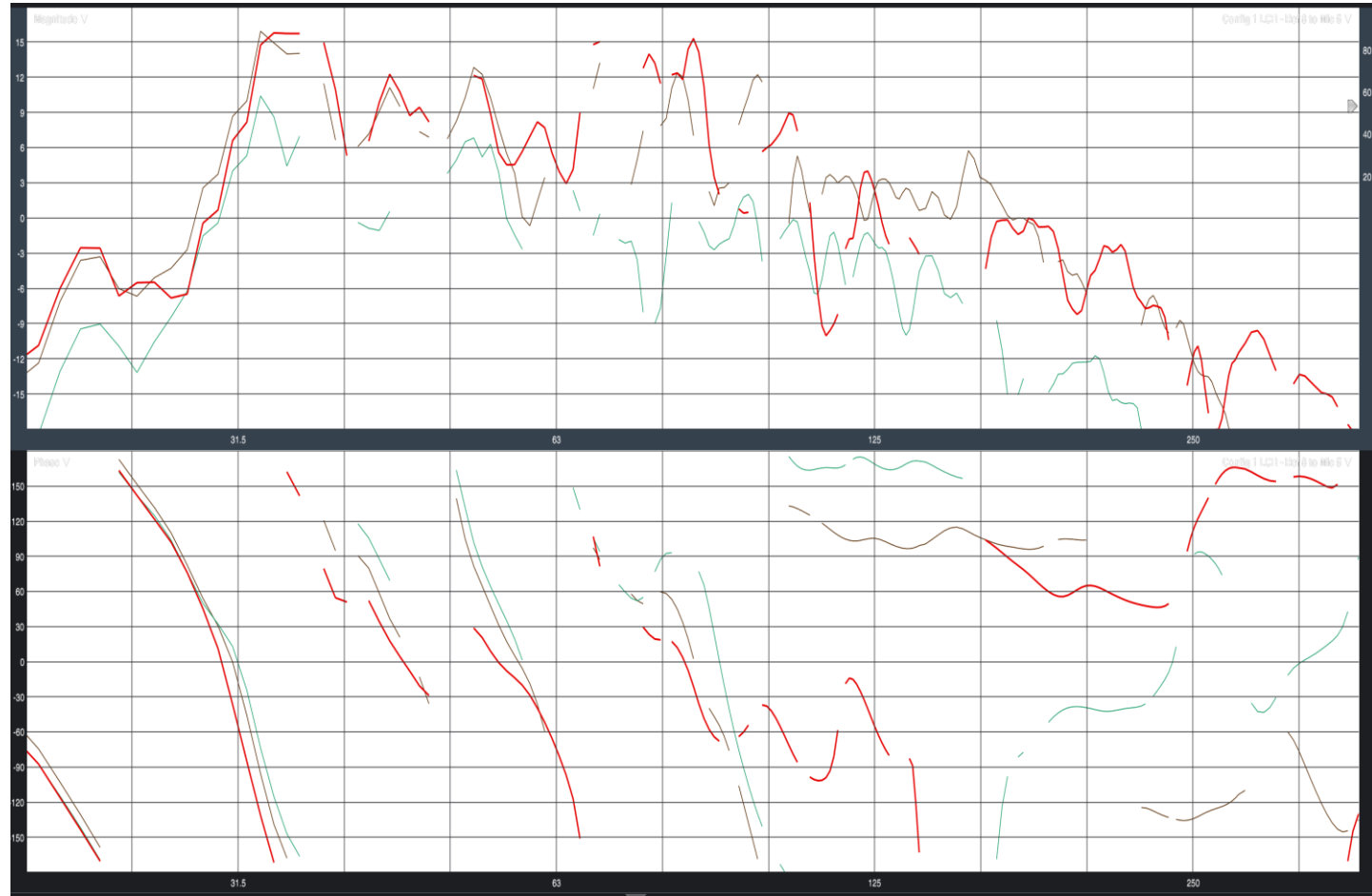
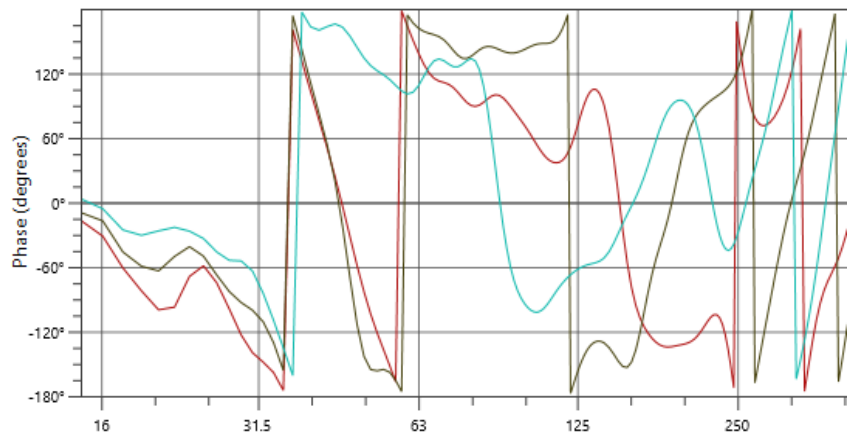




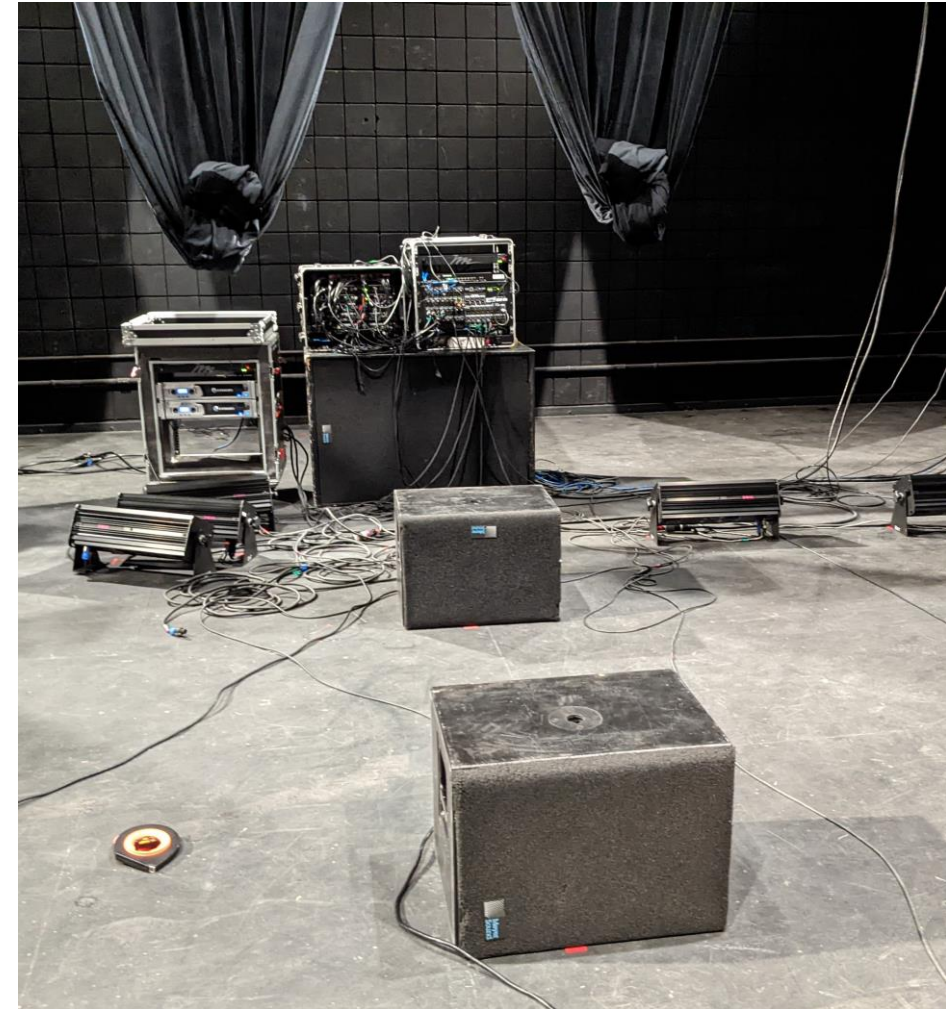
# Config 1B - LCR



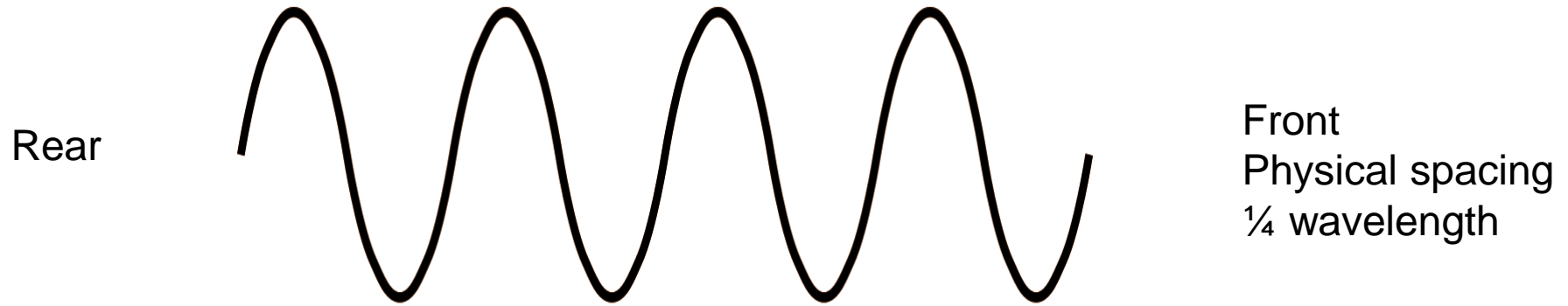
■ 30° 25'  
■ 40° 25'  
■ 50° 25'



# Config 2A – Endfire 2 Speakers



# Config 2A – Endfire 2 Speakers



Delay  
 $\frac{1}{4}$  wavelength

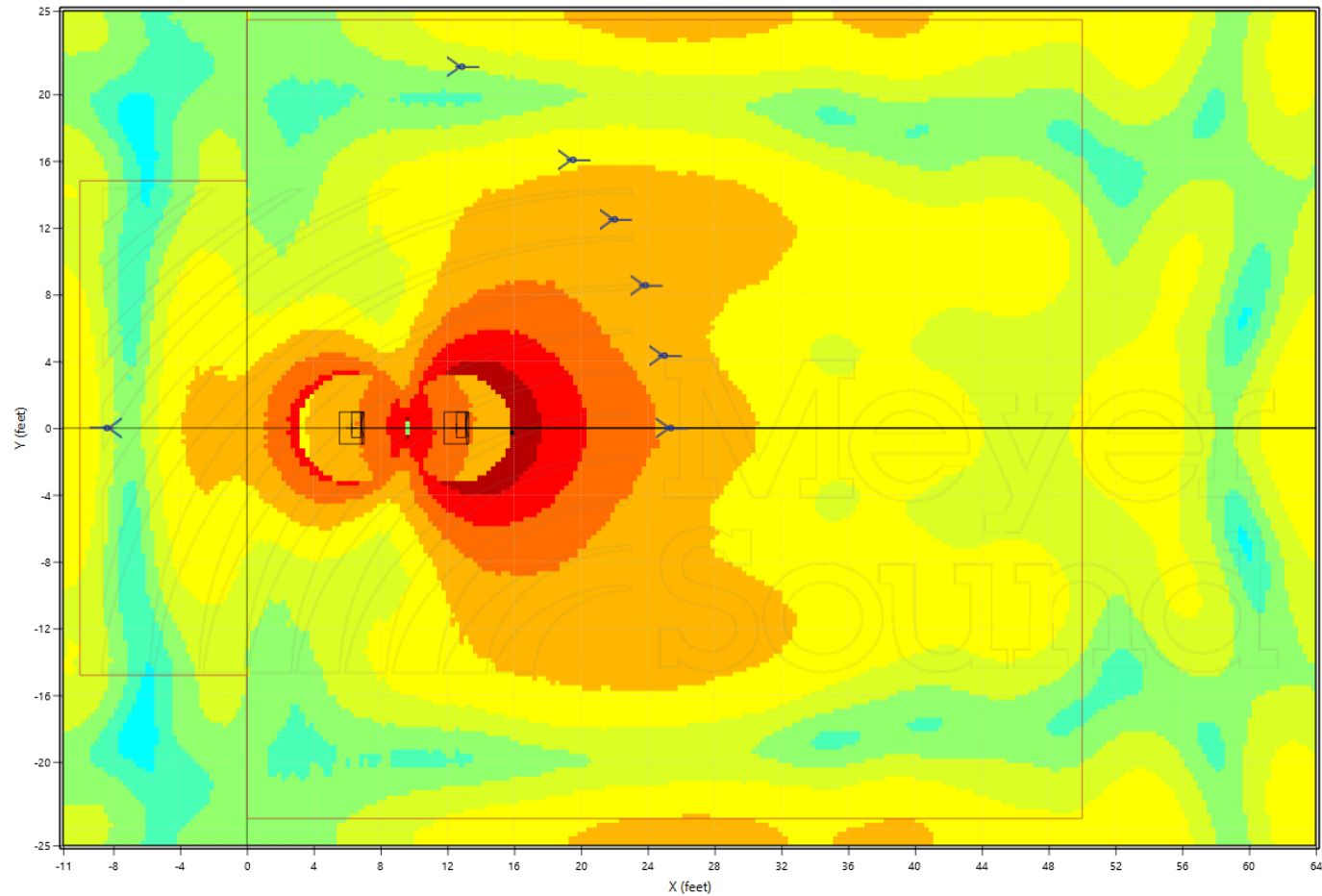


Delay  
 $\frac{1}{4}$  wavelength



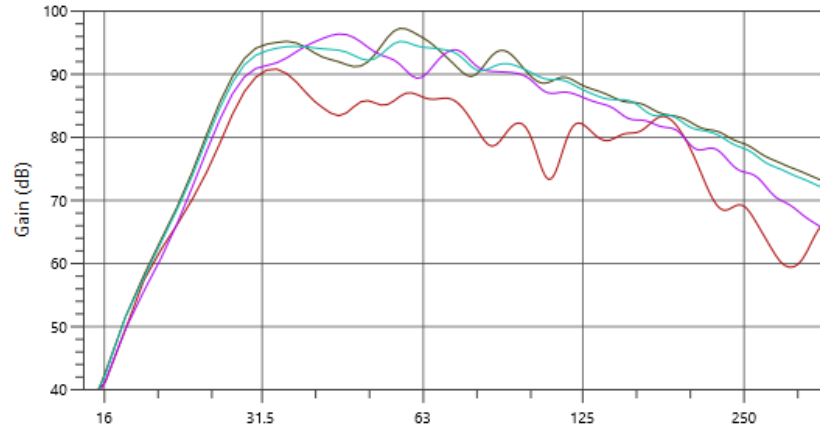
# Config 2A – Endfire 2 Speakers

- 2 x UMS-1P spaced 6'-3¼", Front delayed

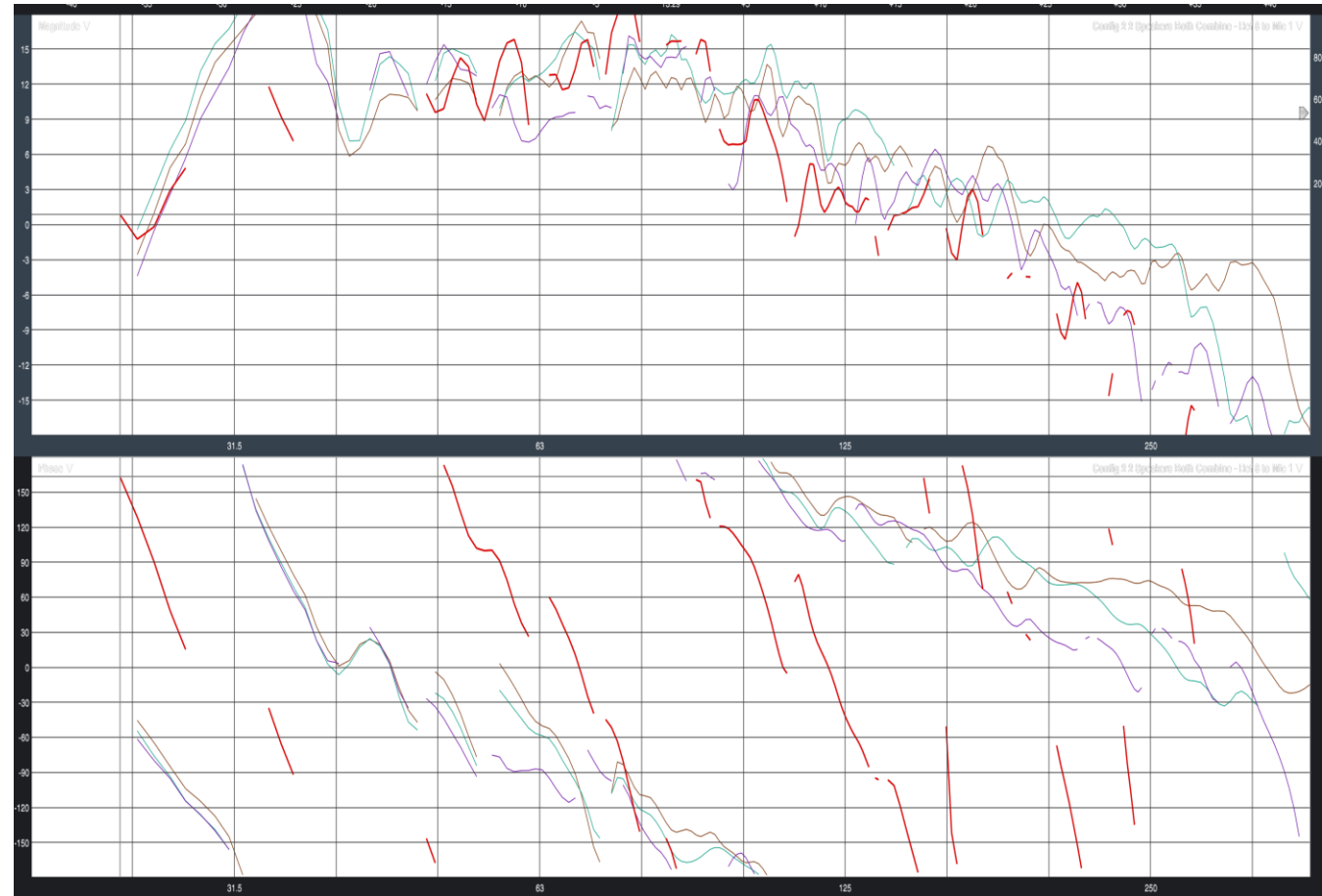
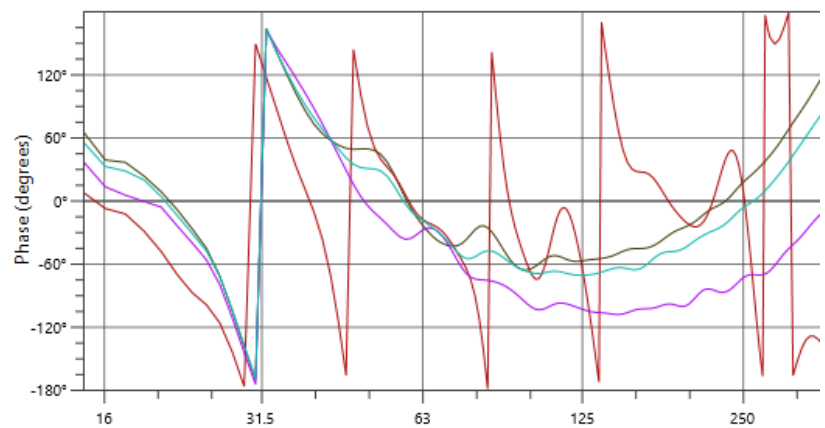




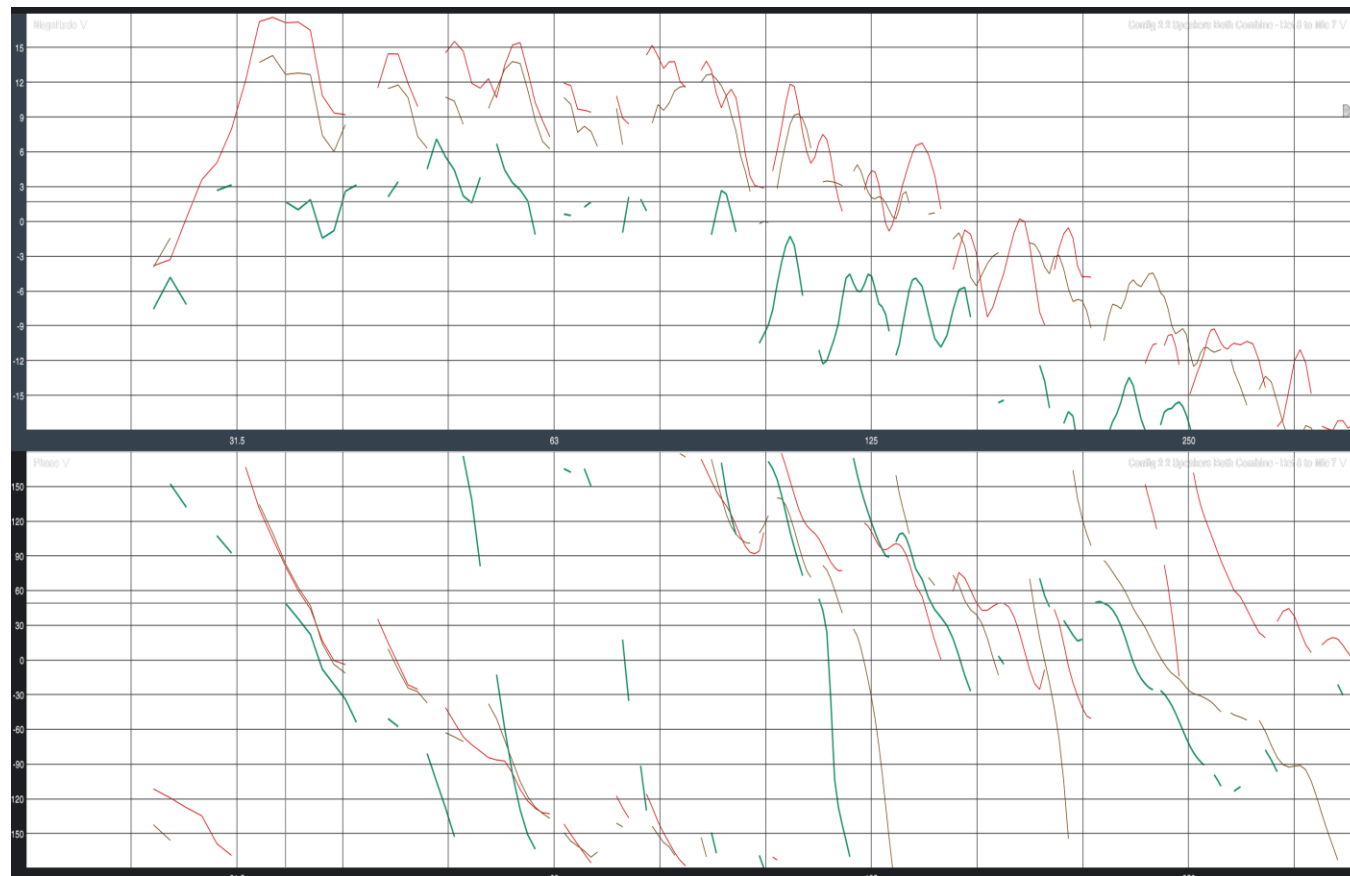
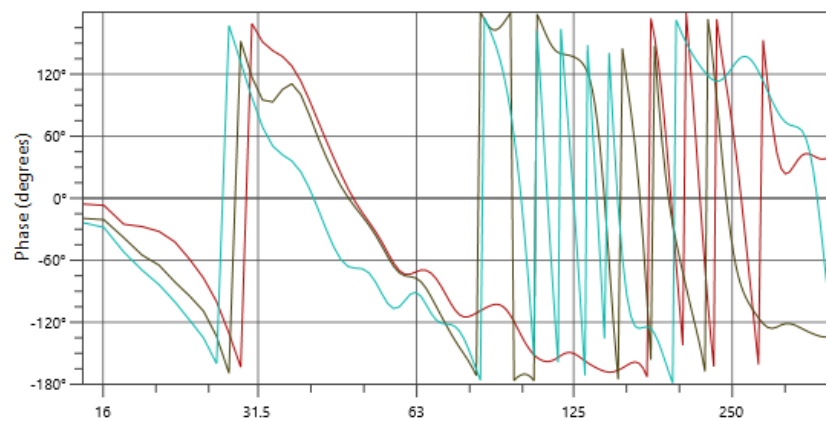
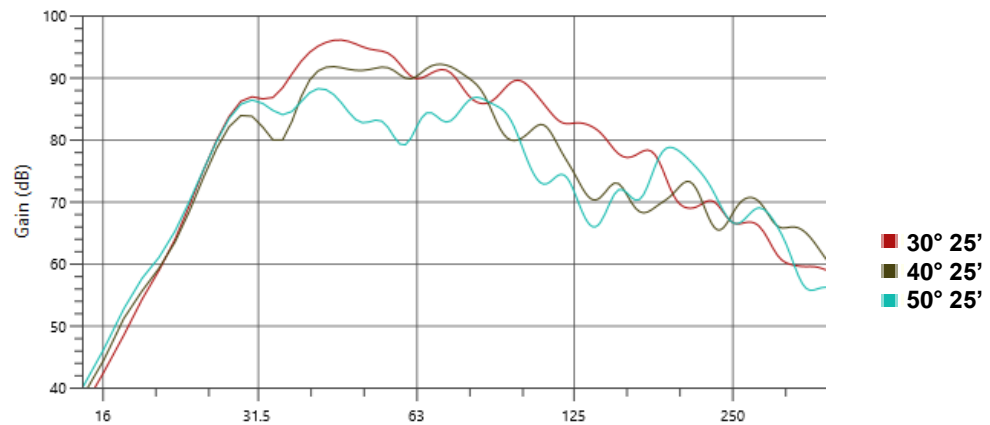
# Config 2A – Endfire 2 Speakers



- 180° 7'
- 0° 25'
- 10° 25'
- 20° 25'

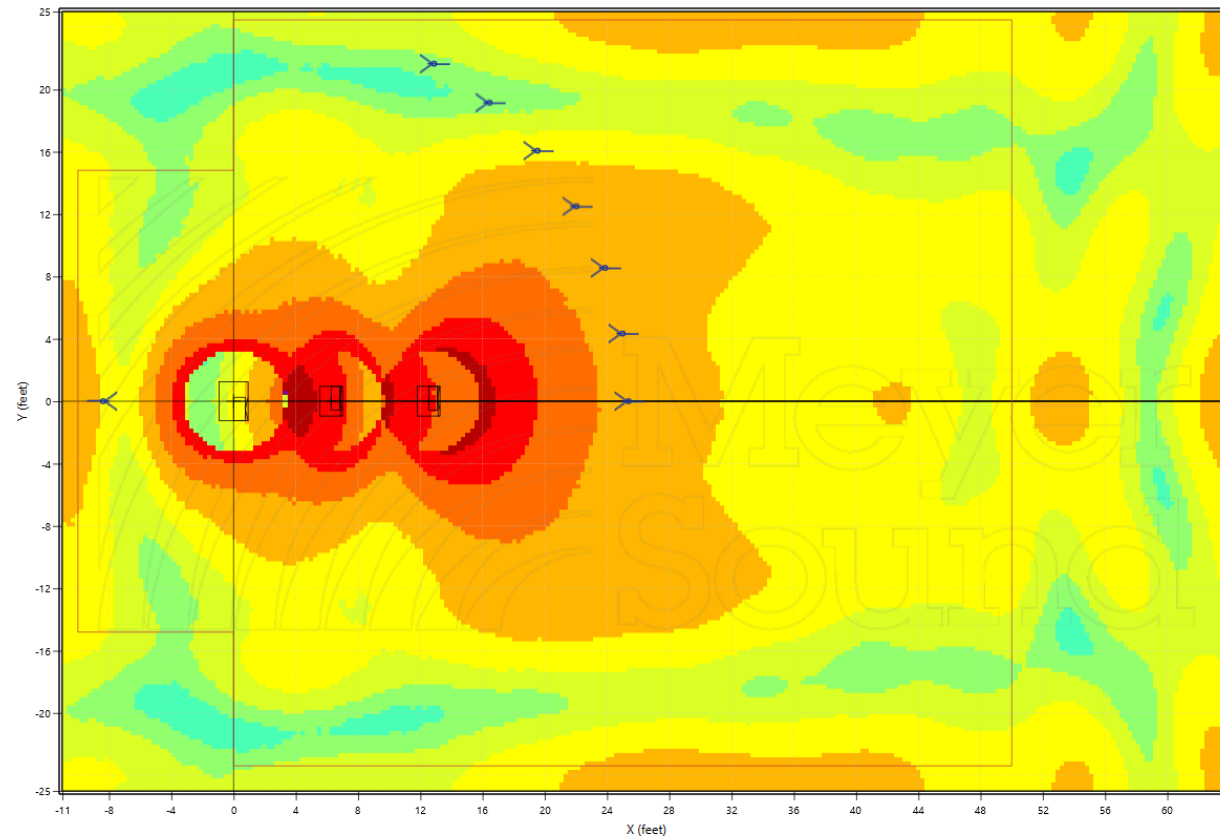


# Config 2A – Endfire 2 Speakers

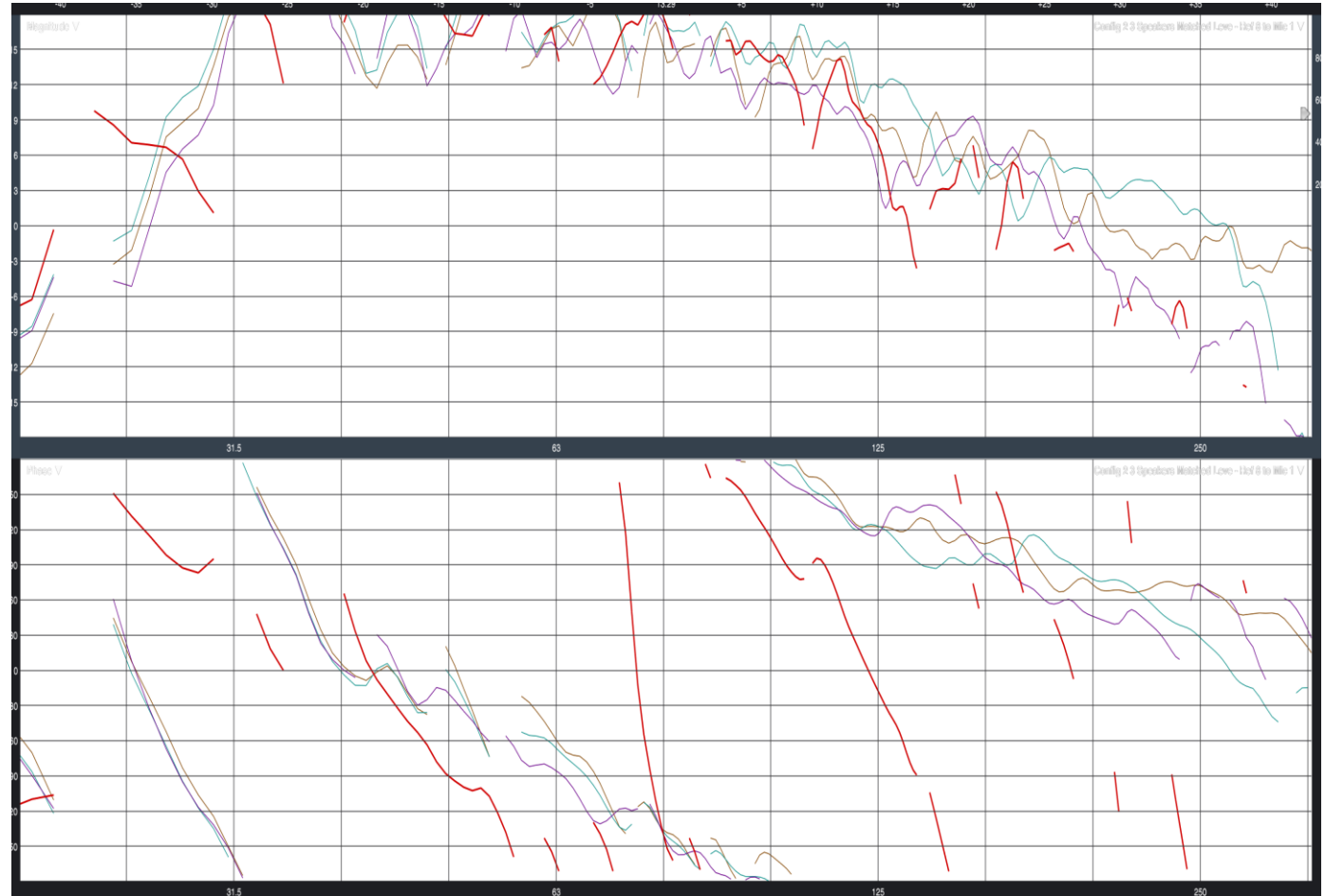
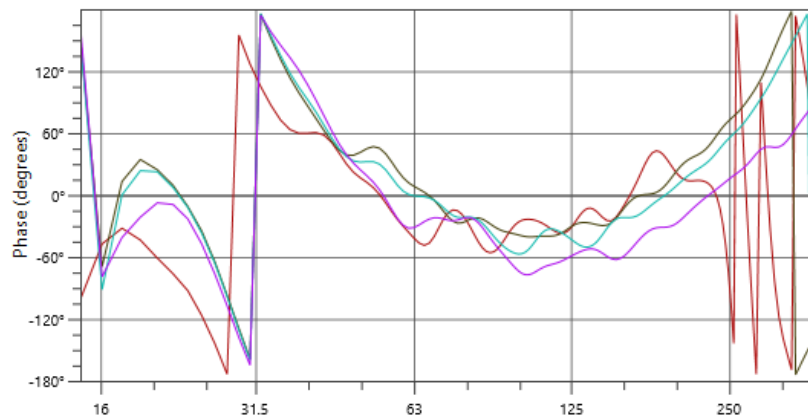
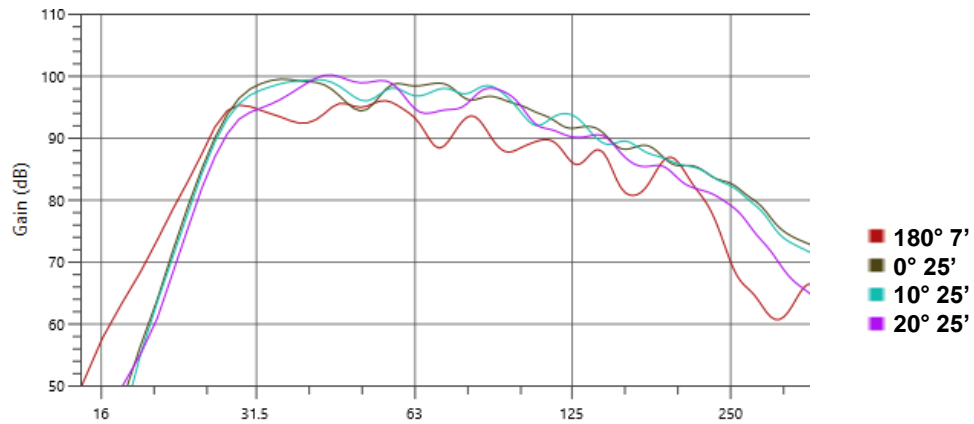


# Config 2B – Endfire 3 Speakers

- 2 x UMS-1P + 1 x 650-P spaced 6'-3¼",  
Middle delayed 5.6ms, Front delayed 11.12ms

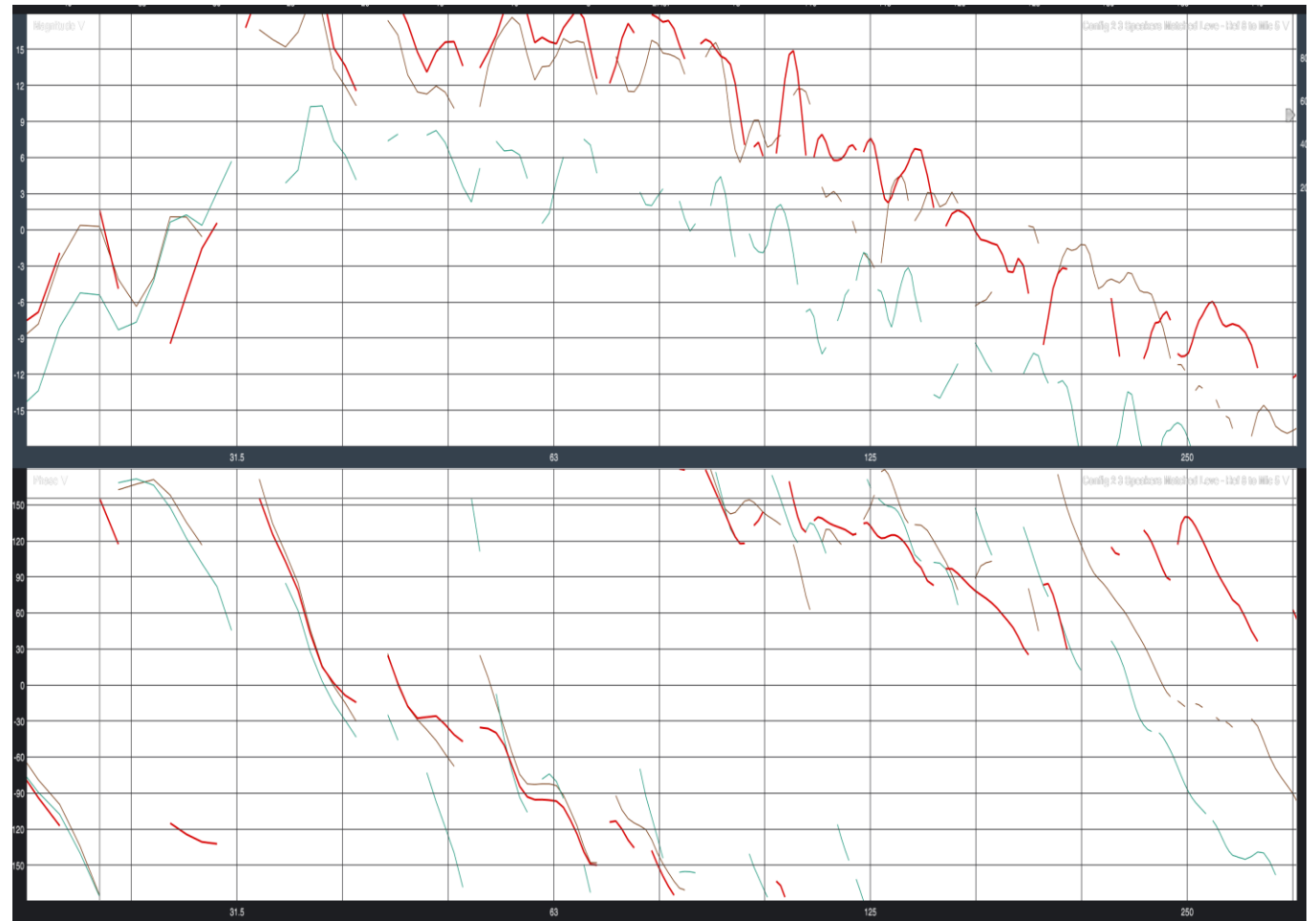
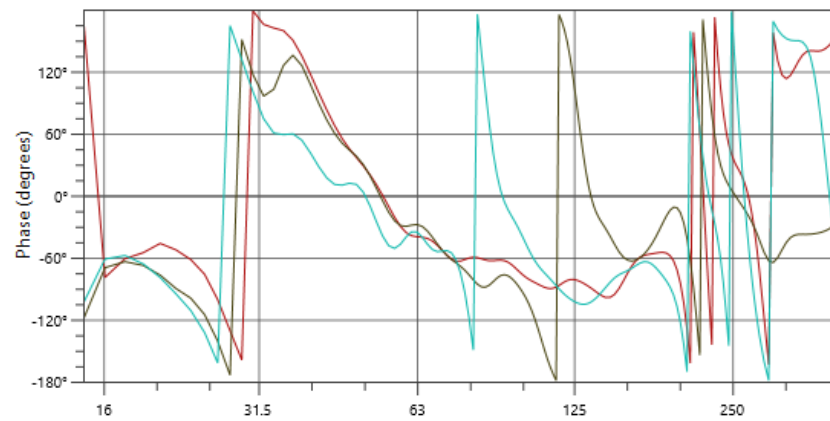
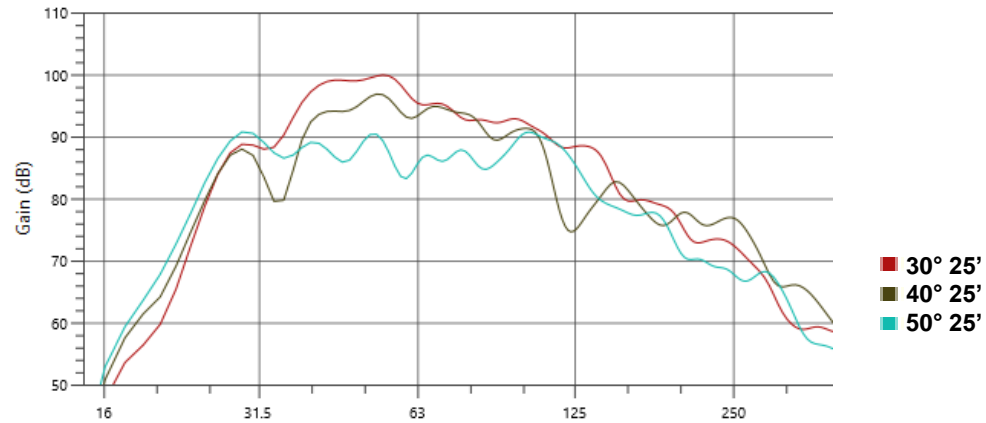


# Config 2B – Endfire 3 Speakers



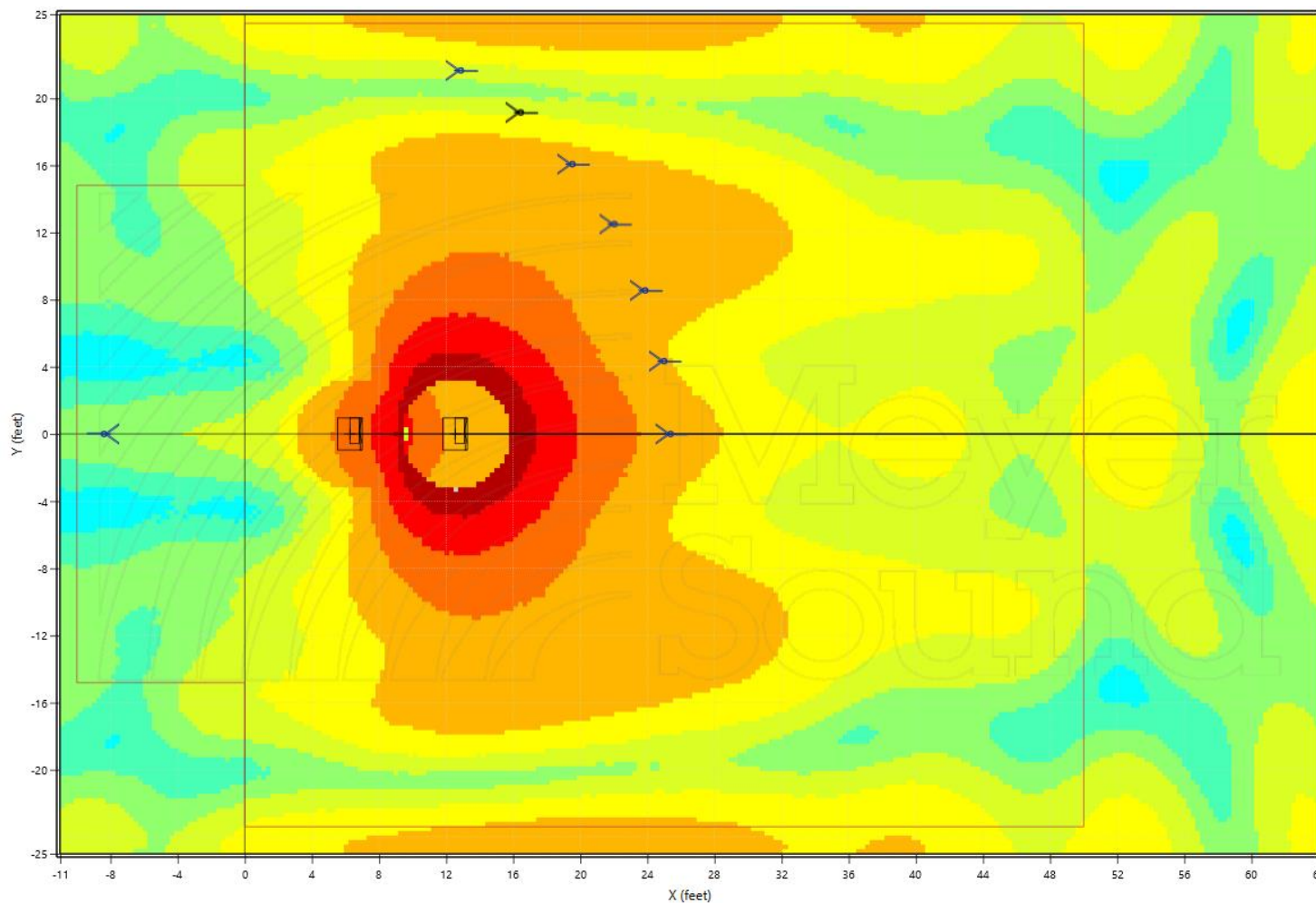


# Config 2B – Endfire 3 Speakers

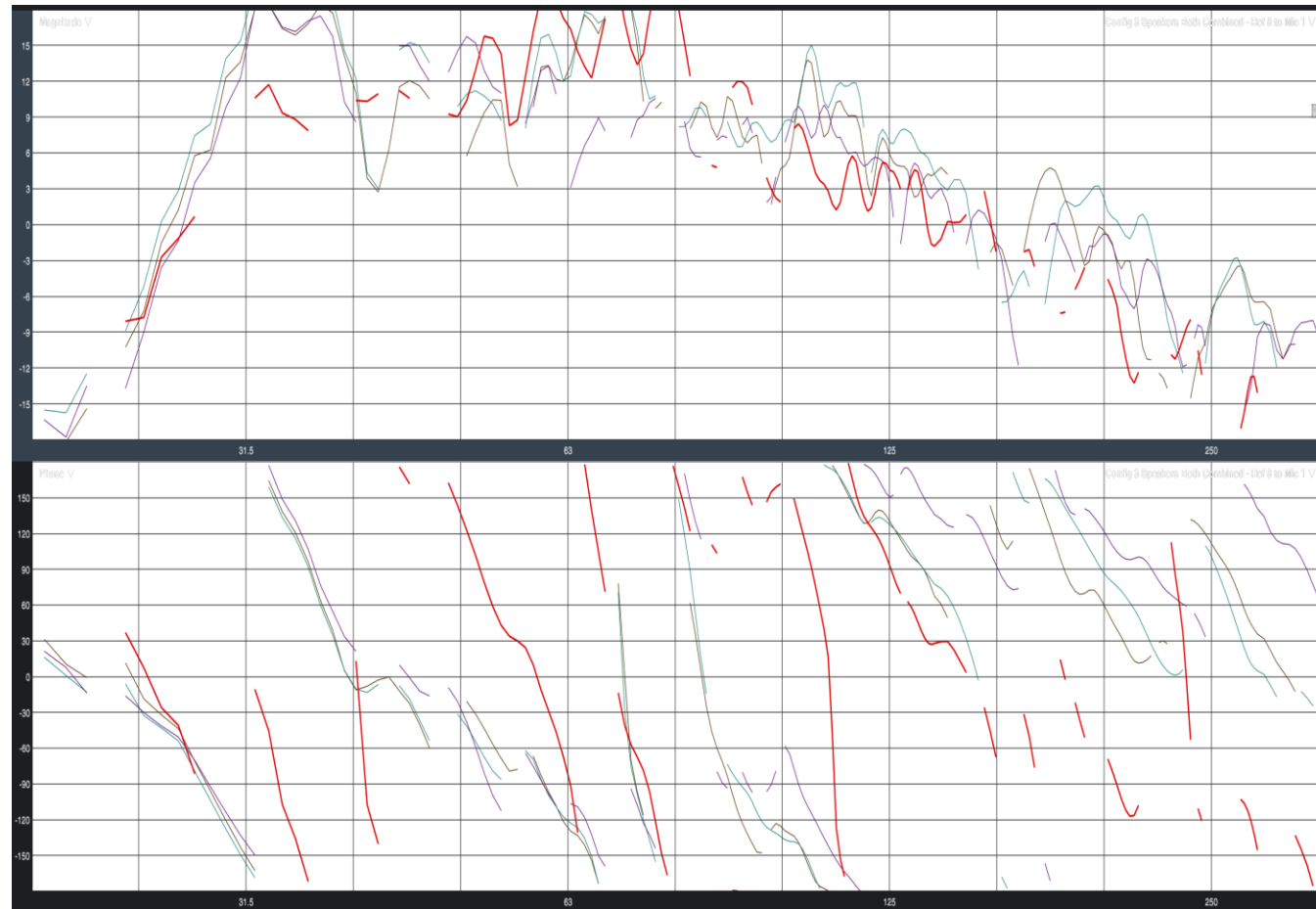
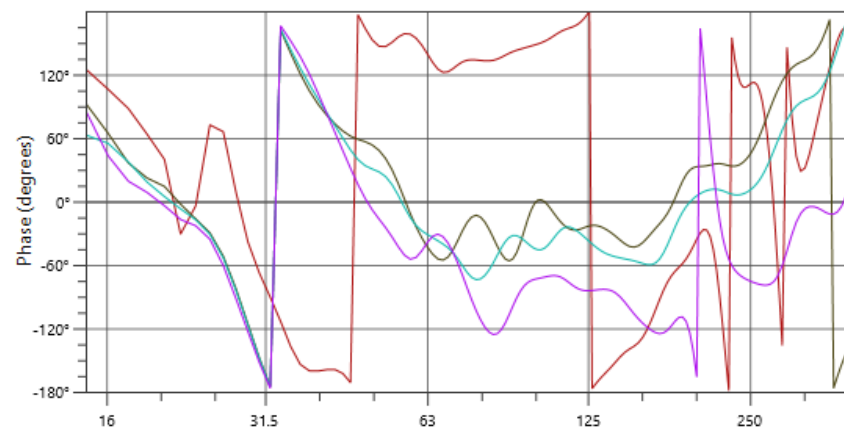
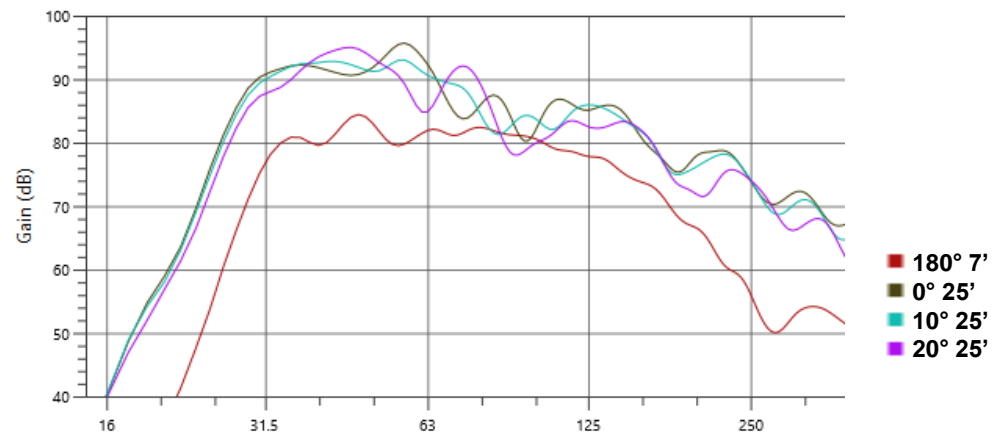


# Config 3 – Gradient

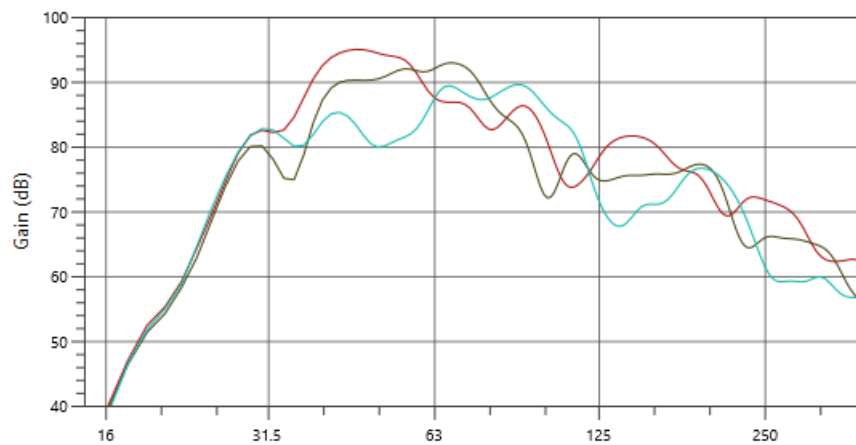
- 2 x UMS-1P spaced 6'-3¼", rear delayed, ∅ switch



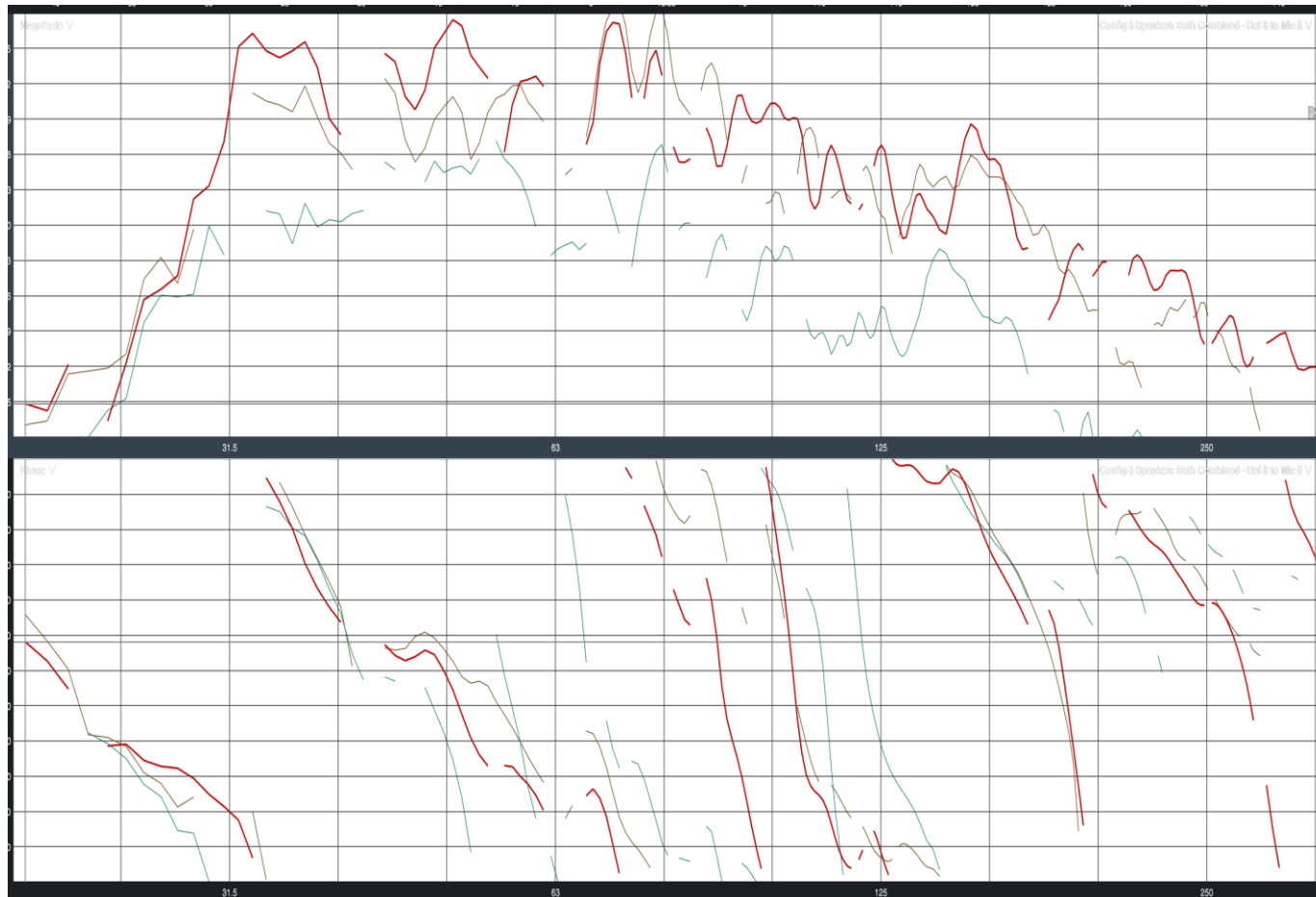
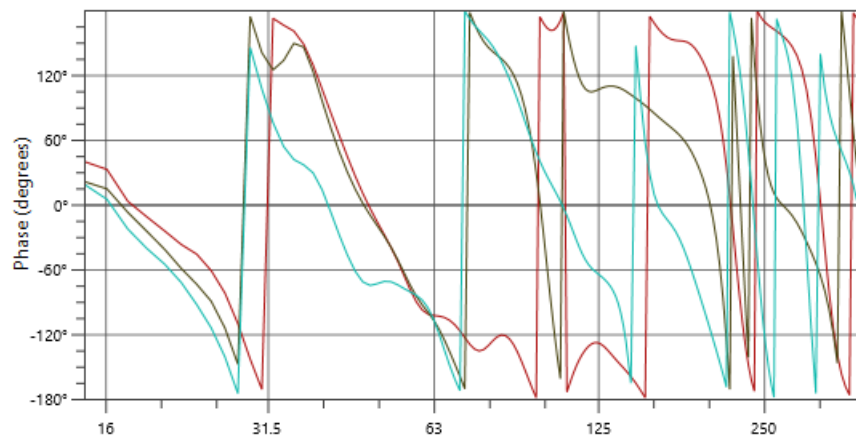
# Config 3 – Gradient



# Config 3 – Gradient



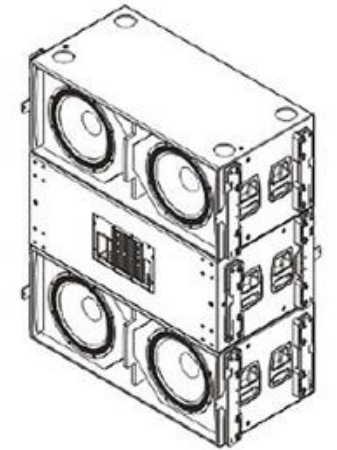
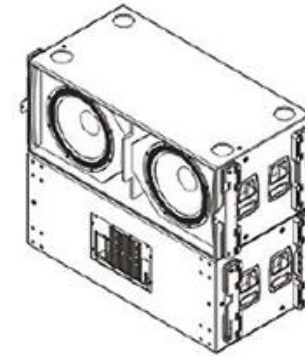
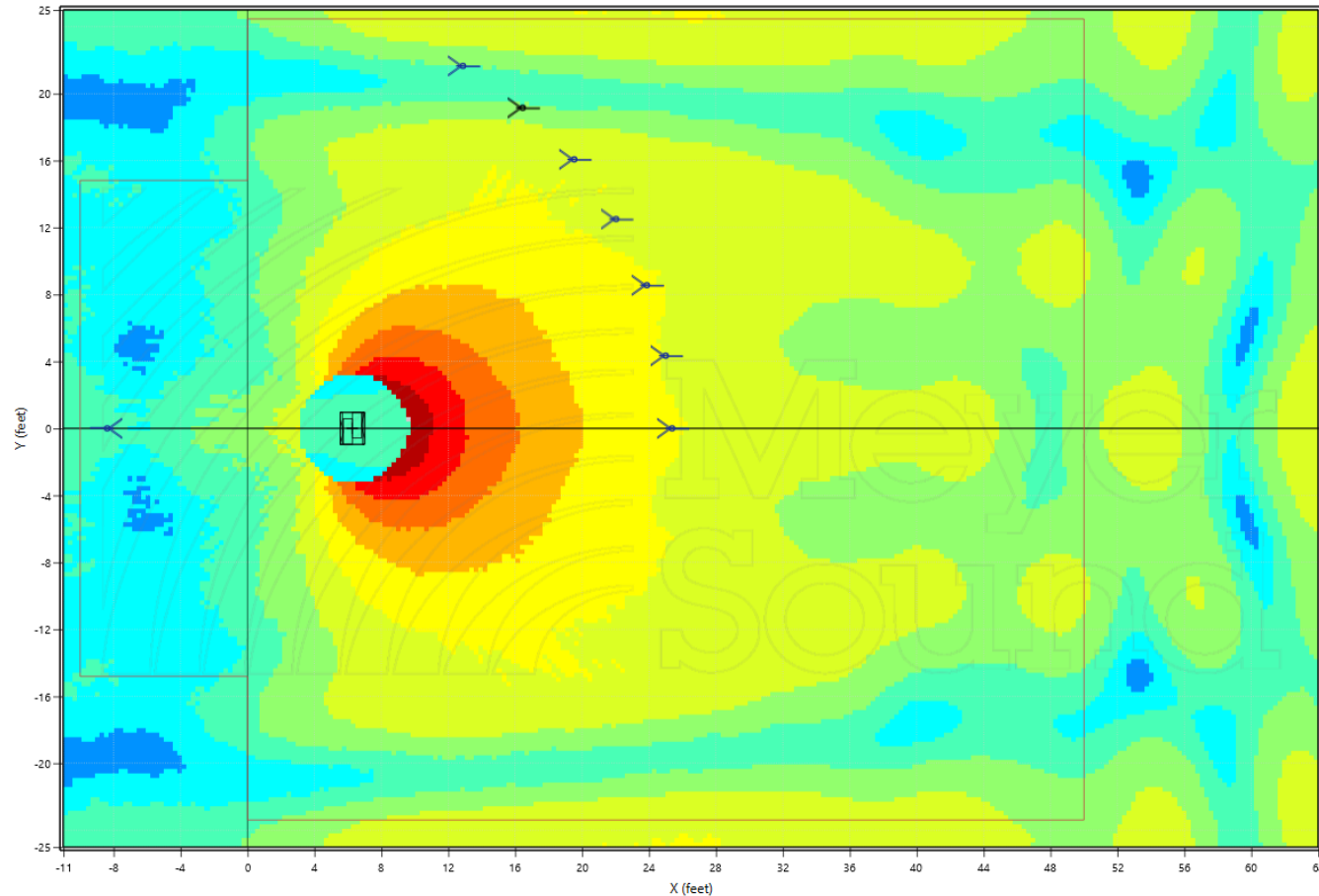
■ 30° 25'  
■ 40° 25'  
■ 50° 25'



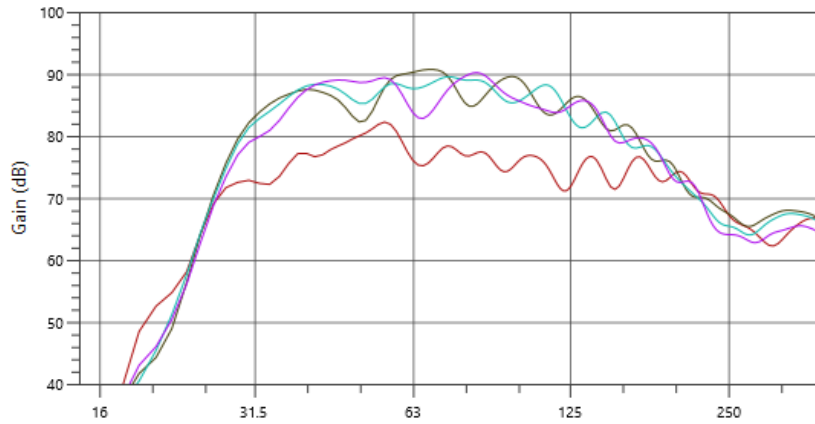


# Config 4 – Stacked Cardioid

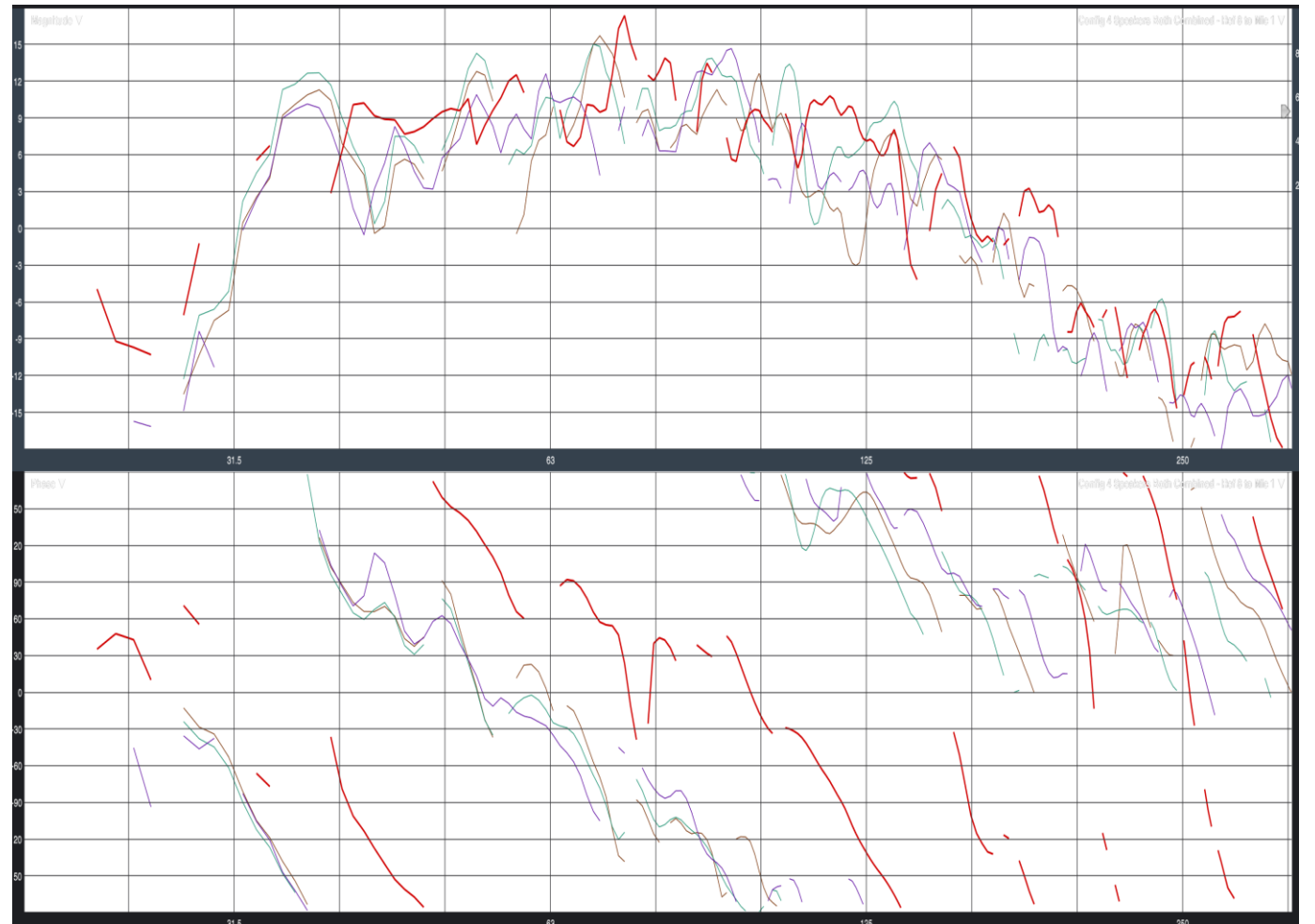
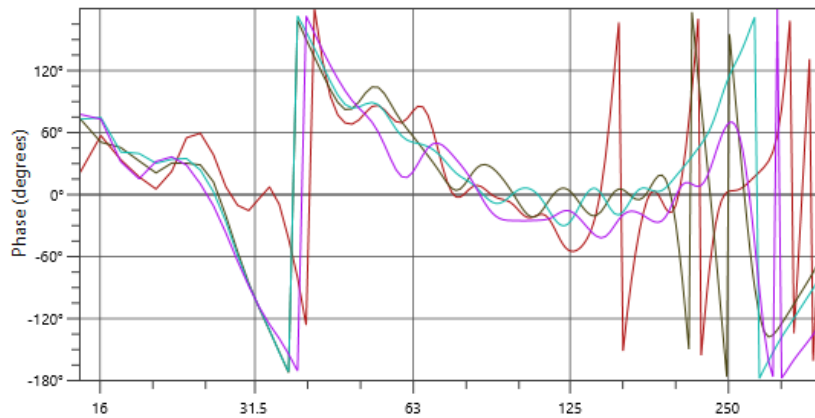
- 2 x UMS-1P, Bottom facing rear, delayed 1.5 ms,  $\emptyset$  switch



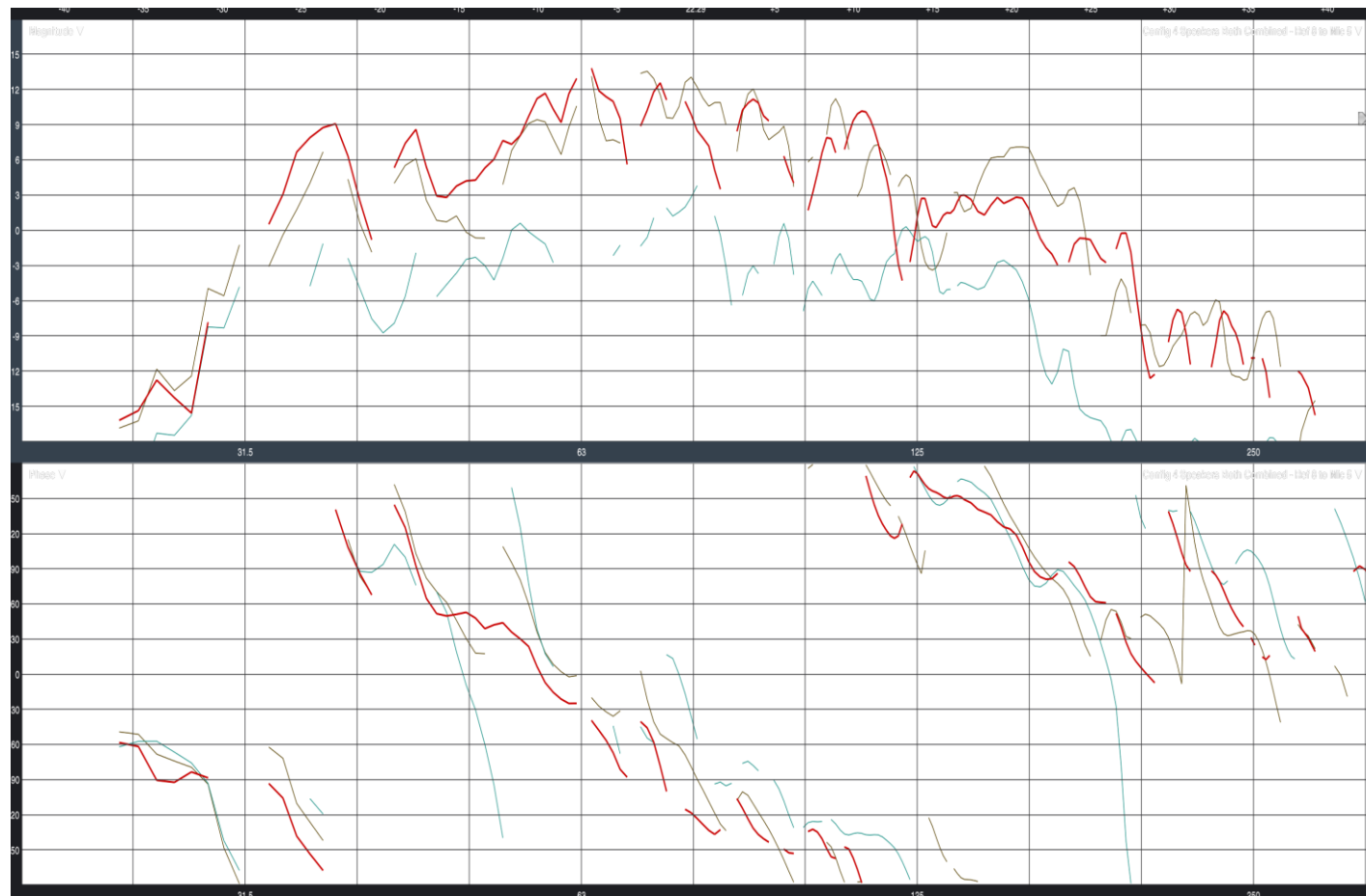
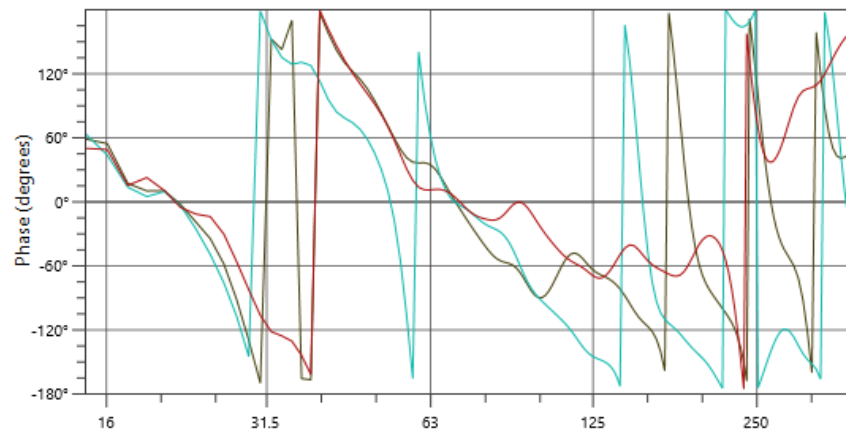
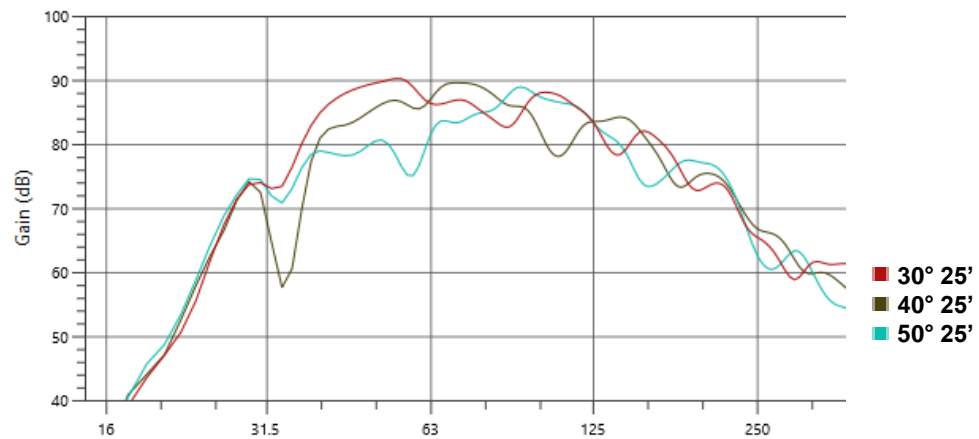
# Config 4 – Stacked Cardioid



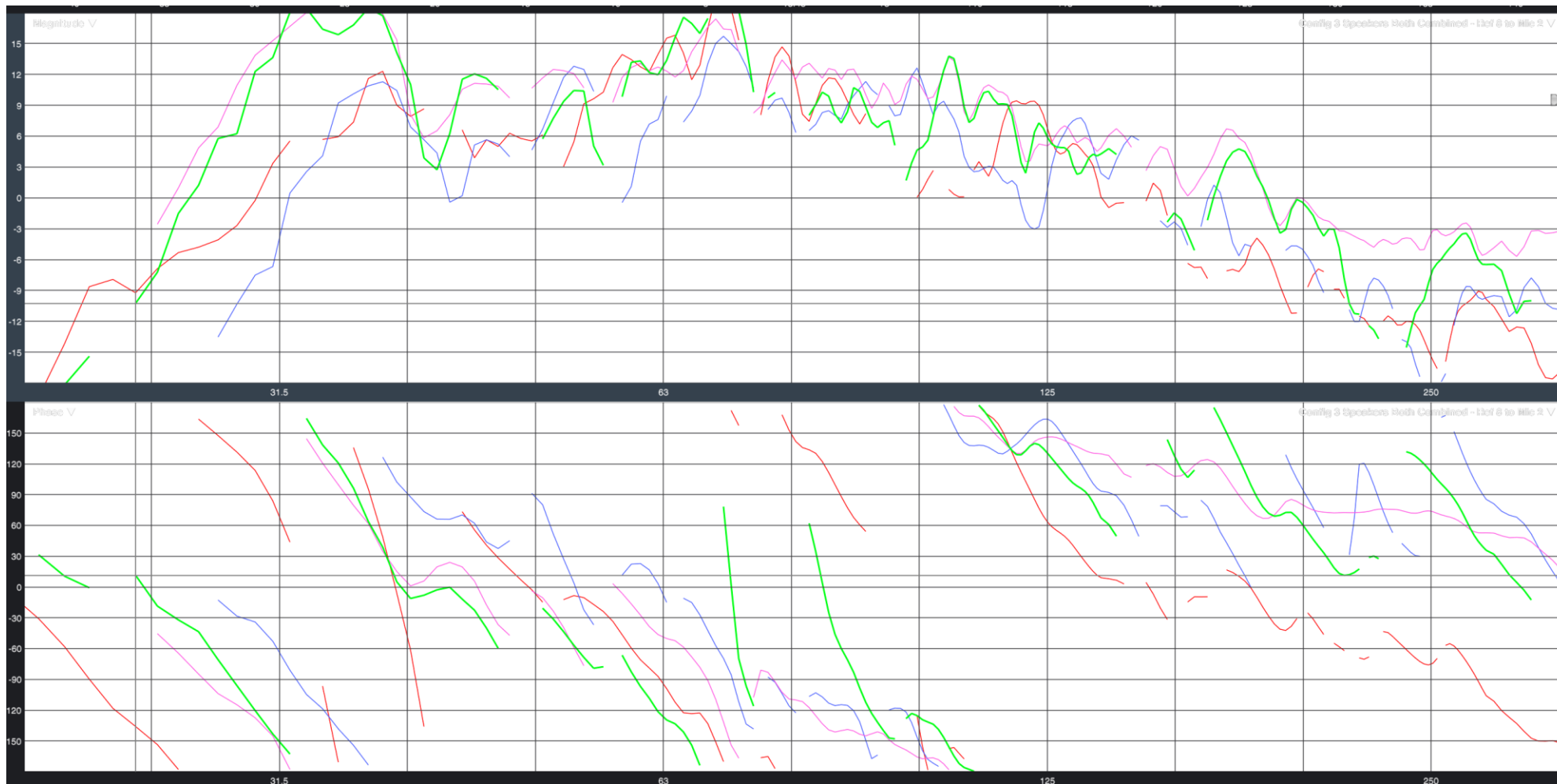
- 180° 7'
- 0° 25'
- 10° 25'
- 20° 25'



# Config 4 – Stacked Cardioid

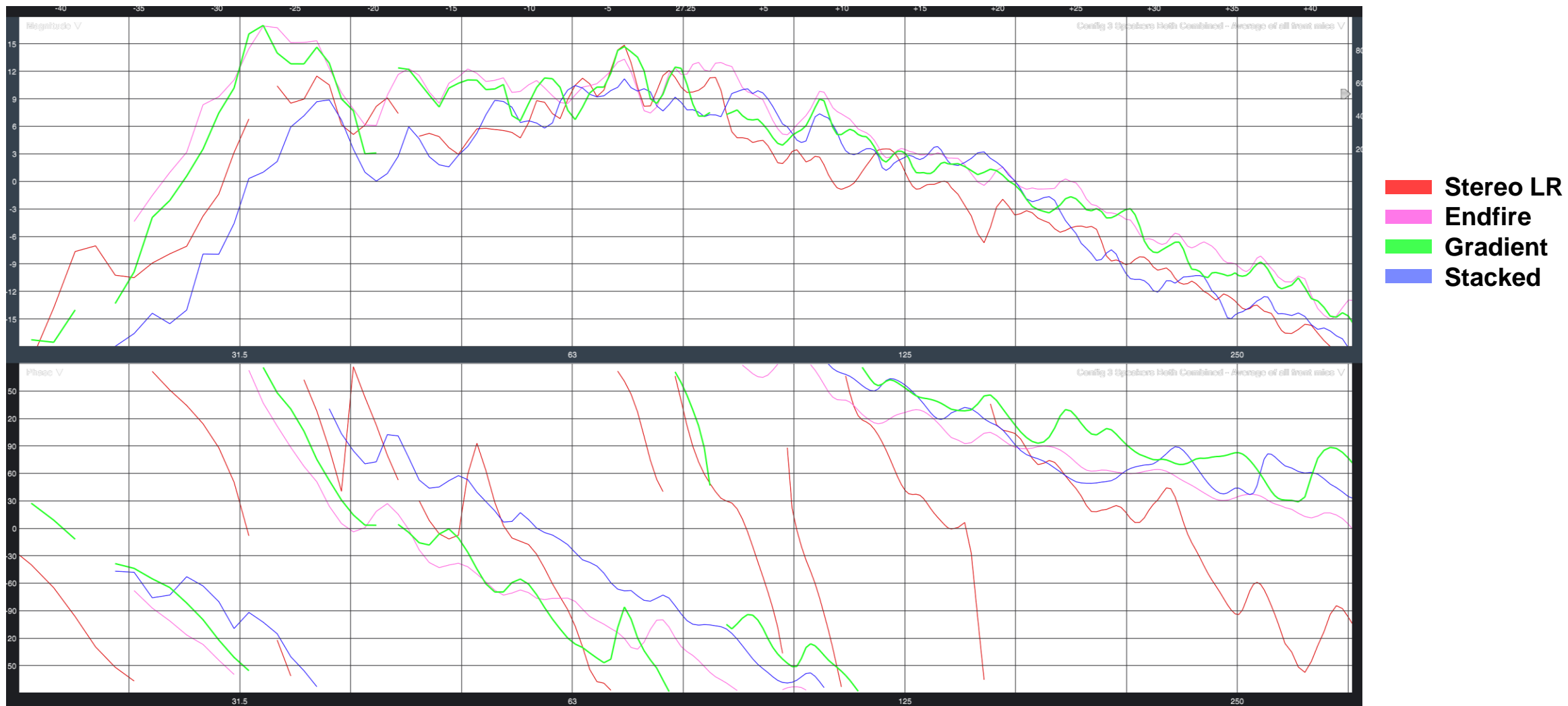


# 2 x UMS-1P at 0° Microphone



- Stereo LR**
- Endfire**
- Gradient**
- Stacked**

# 2 x UMS-1P Average of Front Mic Array



# Questions