PARSONS EXPO 2011
DSP PLATFORM ODDITIES

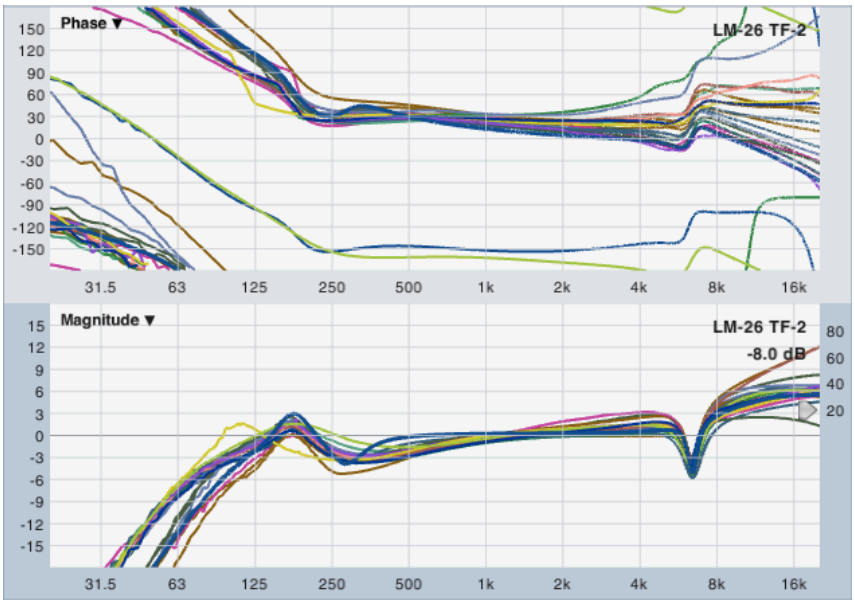
Unpleasant Surprises in Loudspeaker Processing

DSP PLATFORMS DIFFER

- Everyone seems to agree processors are not identical
  - *For what reason?*
  - *How can "good sounding" processors sound bad with some loudspeakers?*
- Other differences ascribed to sample rate, converter quality, country of origin, price tag, phase response, etc.

QUICK & DIRTY DSP STUDY

- Came up with imaginary "loudspeaker preset"
  - *Designed to show variations in filter definition*
- Asked LAB & SoundForums.net members to measure their DSPs
  - *Got nearly two dozen results*
    - *Everything from DSPs to digital mixing consoles*



RESULTS FROM MY STUDY

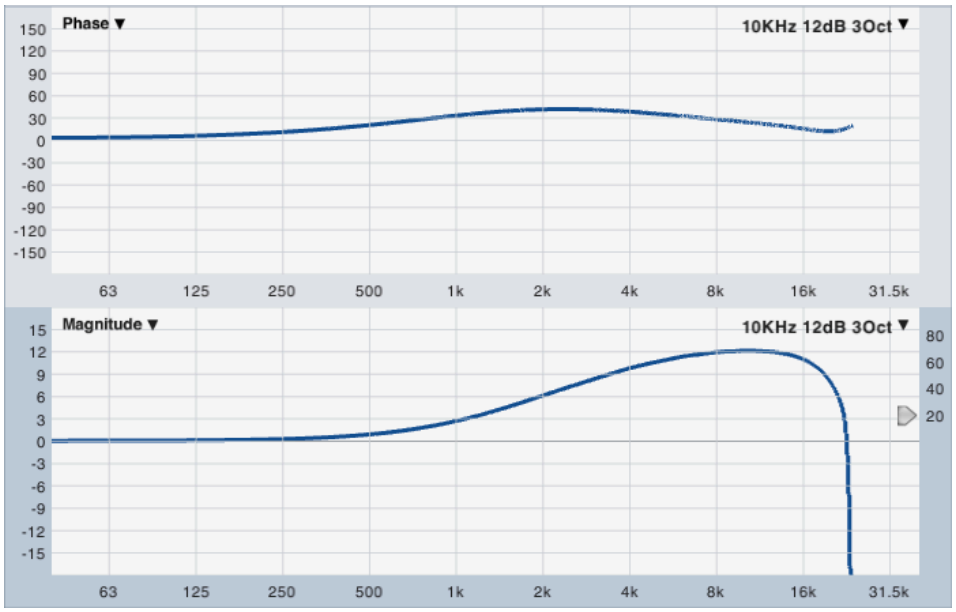
HOW CAN THIS BE?

- Three Effects at work:
  - *Bad DSP Behavior*
  - *Unit Conversion*
  - *Filter Definition*

BAD DSP BEHAVIOR

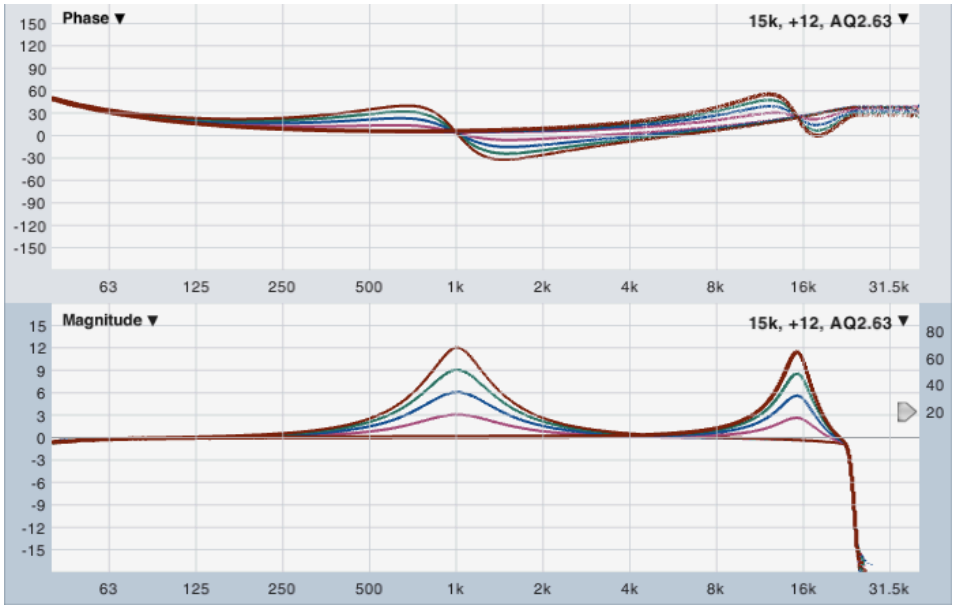
BAD DSP BEHAVIOR

- BZT Filter Warping near Nyquist
- Differing behavior within same family
  - *Or processors branded for different companies by same OEM*
- Errors with Certain Filter Inputs
  - *Math gets FUBARed, DSP doesn't tell you*



BAD DSP BEHAVIOR

Filters narrow as they approach Nyquist

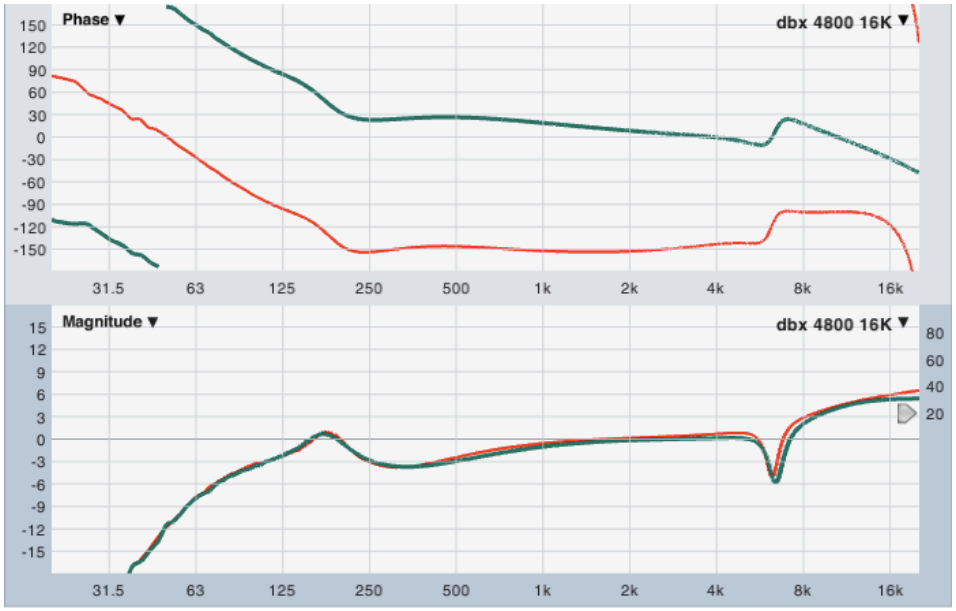


BAD DSP BEHAVIOR

Filters narrow as they approach Nyquist

BAD DSP BEHAVIOR

Filters narrow as they approach Nyquist



BAD DSP BEHAVIOR

Polarity Reversal

Unique to one family of DSPs (so far?)

UNIT CONVERSION

UNIT CONVERSION

- Octaves vs. Q for Bandwidth
- Different bell filter types... Constant Q, Adaptive Q, Raised Cosine?
- What HP/LP filters and slopes are available?
- What Shelf Filter slopes are available?
- Coarseness of available input values

UNIT CONVERSION OCTAVES VS. Q

- Octaves are how you and I probably think about bandwidth
- Q is from the electronics folks
  - *Represents the "Quality" factor of a filter... how well damped it is*
  - Inverse *of octaves, higher Q number is narrower filter*
- Conversions widely available

UNIT CONVERSION

Entering Q into an Octaves Device
(or vice versa)

UNIT CONVERSION SHELF FILTERS

- 6dB Slope
- 12dB Slope
- Bandwidth in Q
- Bandwidth in Octaves
- Bandwidth in "Slope"
- Simply labeled "Shelf"

UNIT CONVERSION CROSSOVER FILTERS

- Everything seems to have:
  - *Linkwitz-Riley & Butterworth*
  - *12 & 24dB/octave*
- Many simply do not have Bessel
- Or odd-order filters (6dB, 18dB/octave and so on)
- God forbid you need a Chebyshev, NTM, or FIR "brickwall" filter.

FILTER DEFINITION

Bell Filters

FILTER DEFINITION
BELL FILTERS

- What does Bandwidth mean?
  - *3dB from peak gain?*
  - *3dB from zero gain?*
  - *3dB at midpoint?*
  - *How is a 2dB boost defined?*

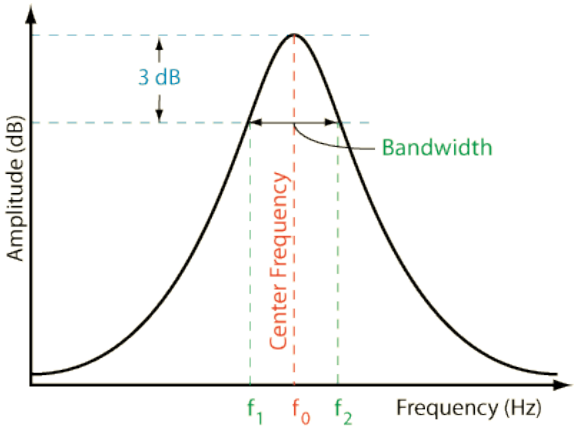
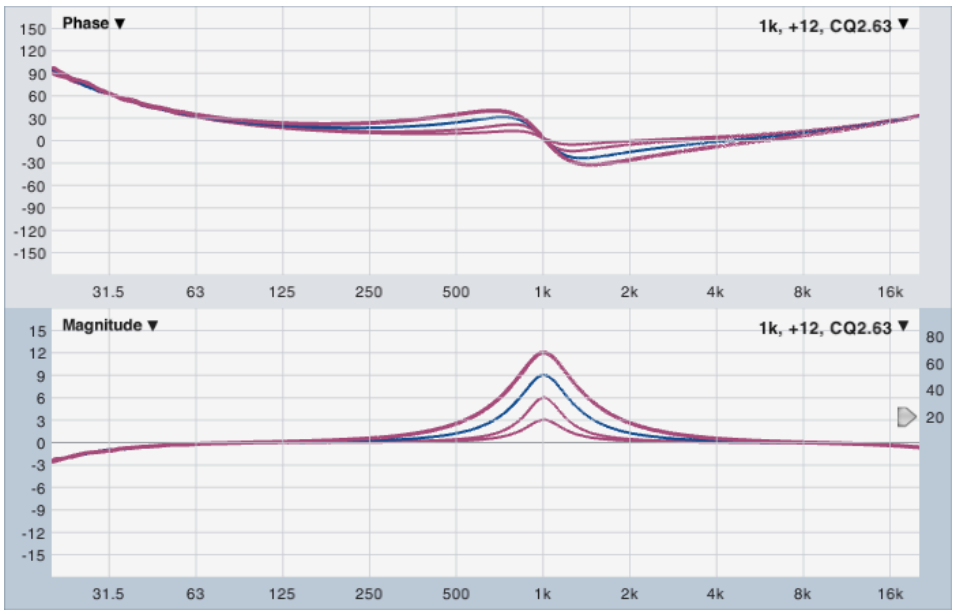
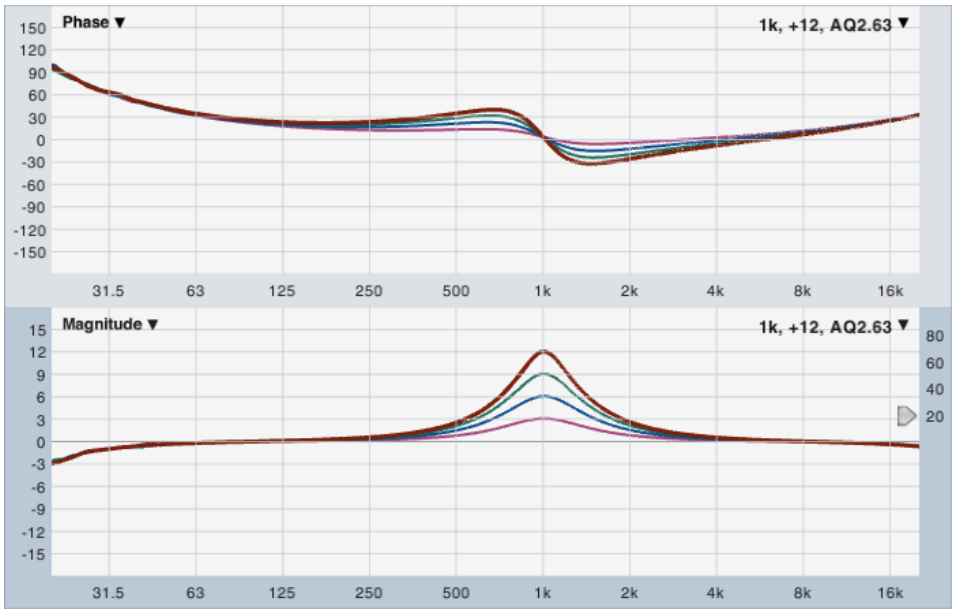


Image Courtesy Rane Corp.



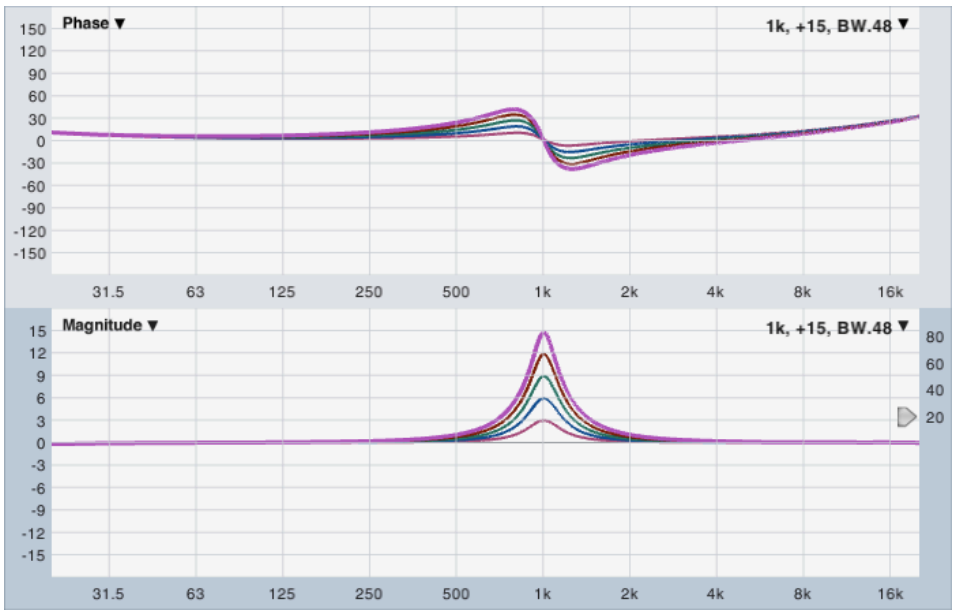
FILTER DEFINITION

Bell Filters: "Constant Q"



FILTER DEFINITION

Bell Filters: "Adaptive Q"

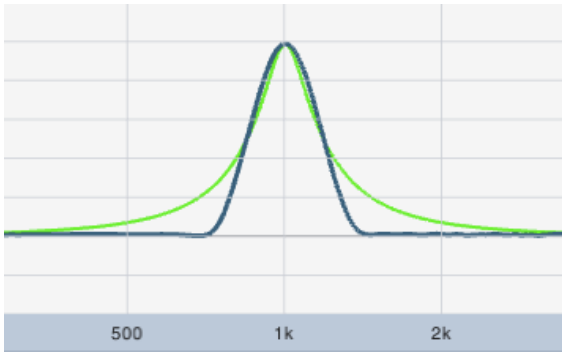


FILTER DEFINITION

Bell Filters: Constant Bandwidth Midpoint

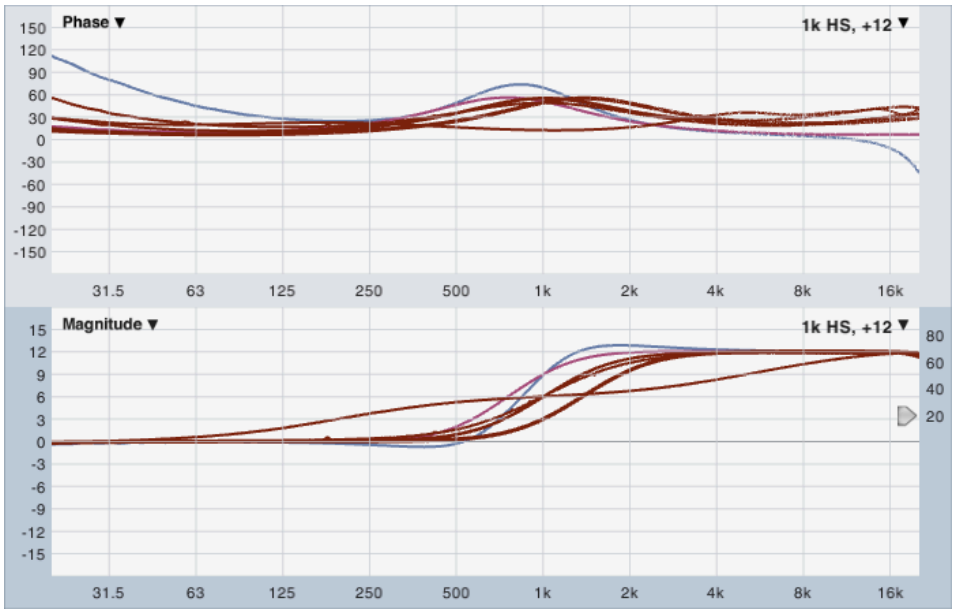
FILTER DEFINITION
LAKE BELL FILTERS

- Input filters are Raised Cosine
  - *Only in use by Lake and Powersoft*
- Output filters are "normal"
- Bandwidth at midpoint
- Where to input settings?



FILTER DEFINITION

Shelf Filters

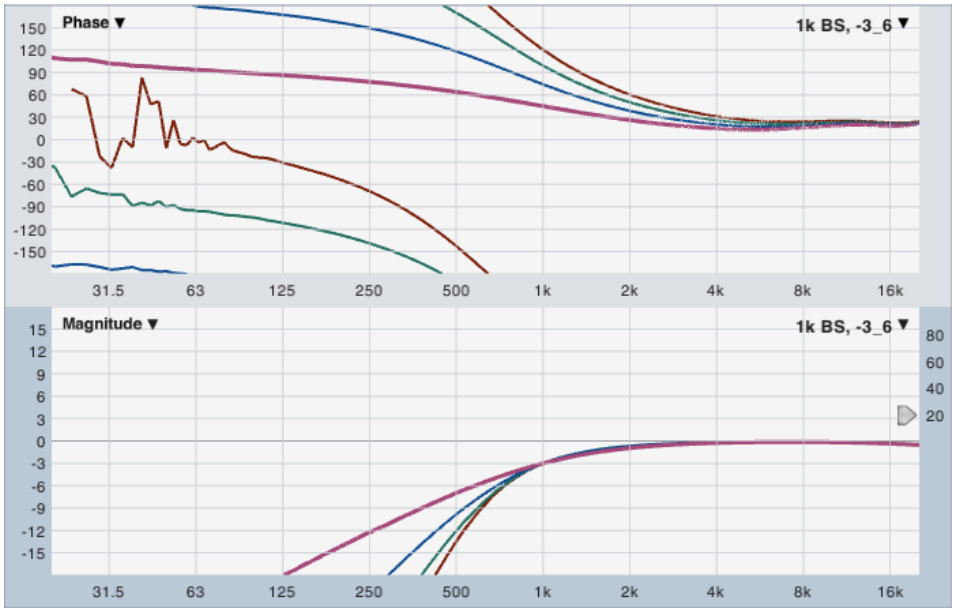


FILTER DEFINITION

Shelf Filters

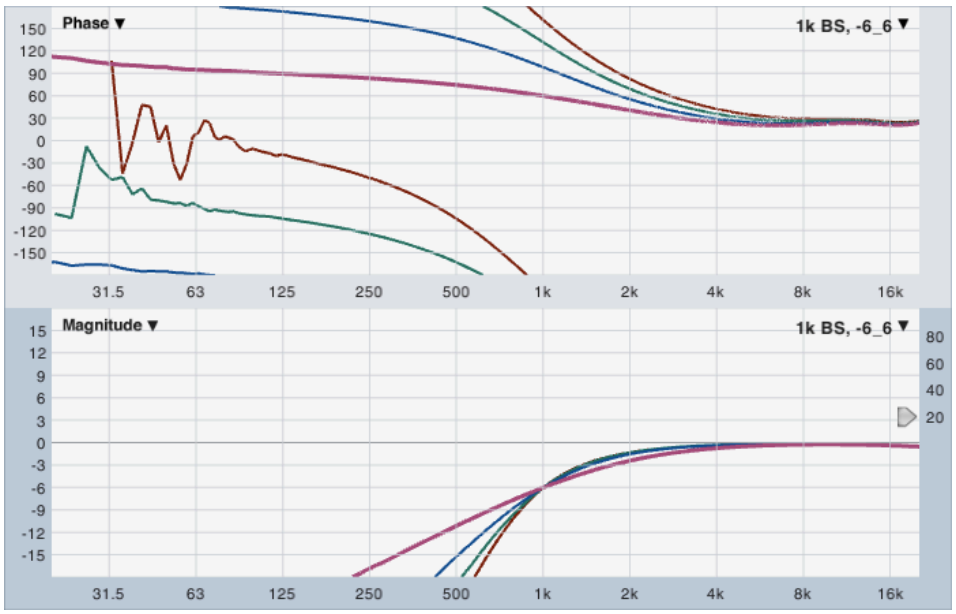
FILTER DEFINITION

Bessel Filters



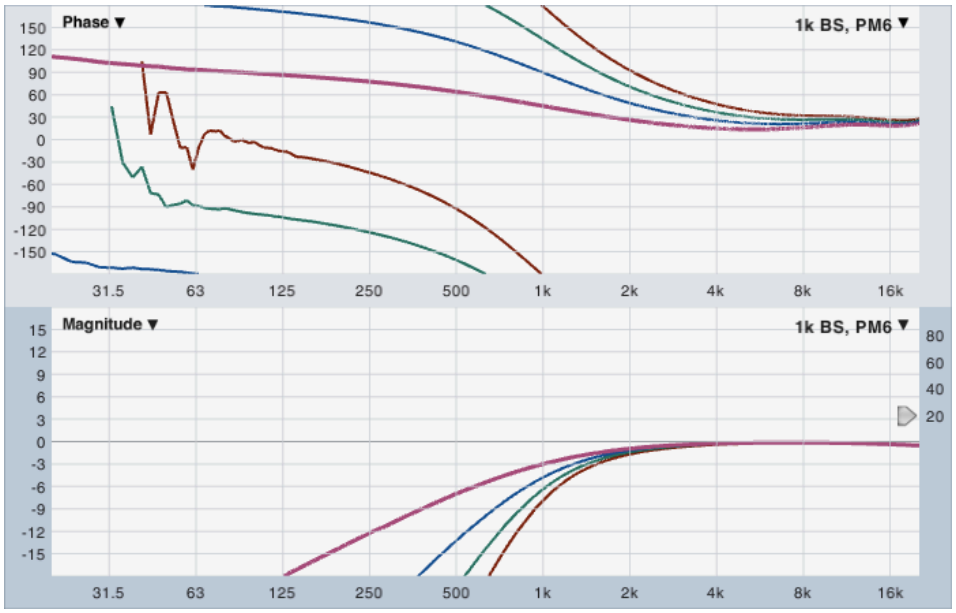
BESSEL FILTERS

-3dB Normalization



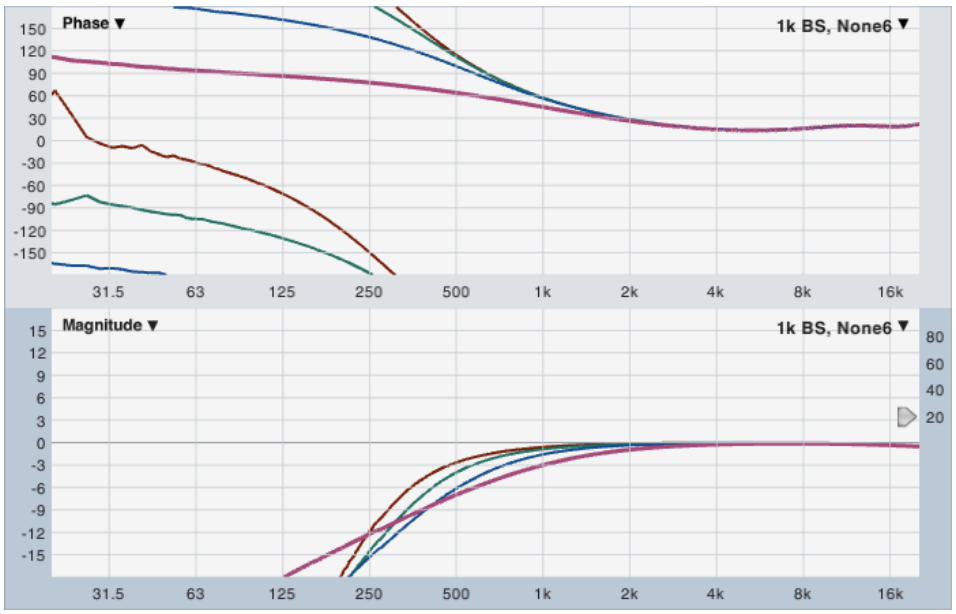
BESSEL FILTERS

-6dB Normalization



BESSEL FILTERS

Phase Match Normalization



BESSEL FILTERS

No Normalization

CONCLUSION

Must Measure to Transfer Settings Between Processors.

QUESTIONS?

Many thanks to Rich Frembes of Fulcrum Acoustic for a large number of the measurements used in this presentation.

BONUS TOPIC: LIMITERS

LIMITER PARAMETERS THRESHOLD

- dBu
- dBFS
- VU
- Volts
- Watts
- Off, -3, -6, -12dB

LIMITER PARAMETERS ATTACK / RELEASE

- Milliseconds / Microseconds
- Seconds
- dB / Second
- ms / dB
- ms / 20dB
- Slow / Medium / Fast

LIMITER PARAMETERS OTHER

- Ratio (1.2:1 - INF)
- Over Easy (0 - 10)
- Knee (Soft, Medium, Hard)
- Overshoot (1 - 6dB)
- Peak Stop (On / Off, Threshold)
- Corner (0 - -100)

LIMITER PARAMETERS LIMITER TYPE

- RMS or Peak detection?
  - *Neither strictly defined.*
- Power limiter (RMS or measured power detection)
- How do you measure the behavior of a limiter?
- Limiter settings that behave predictably in one processor may not do so in another.

THE END