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Jim Mosher

# Summary of K-Horn Findings

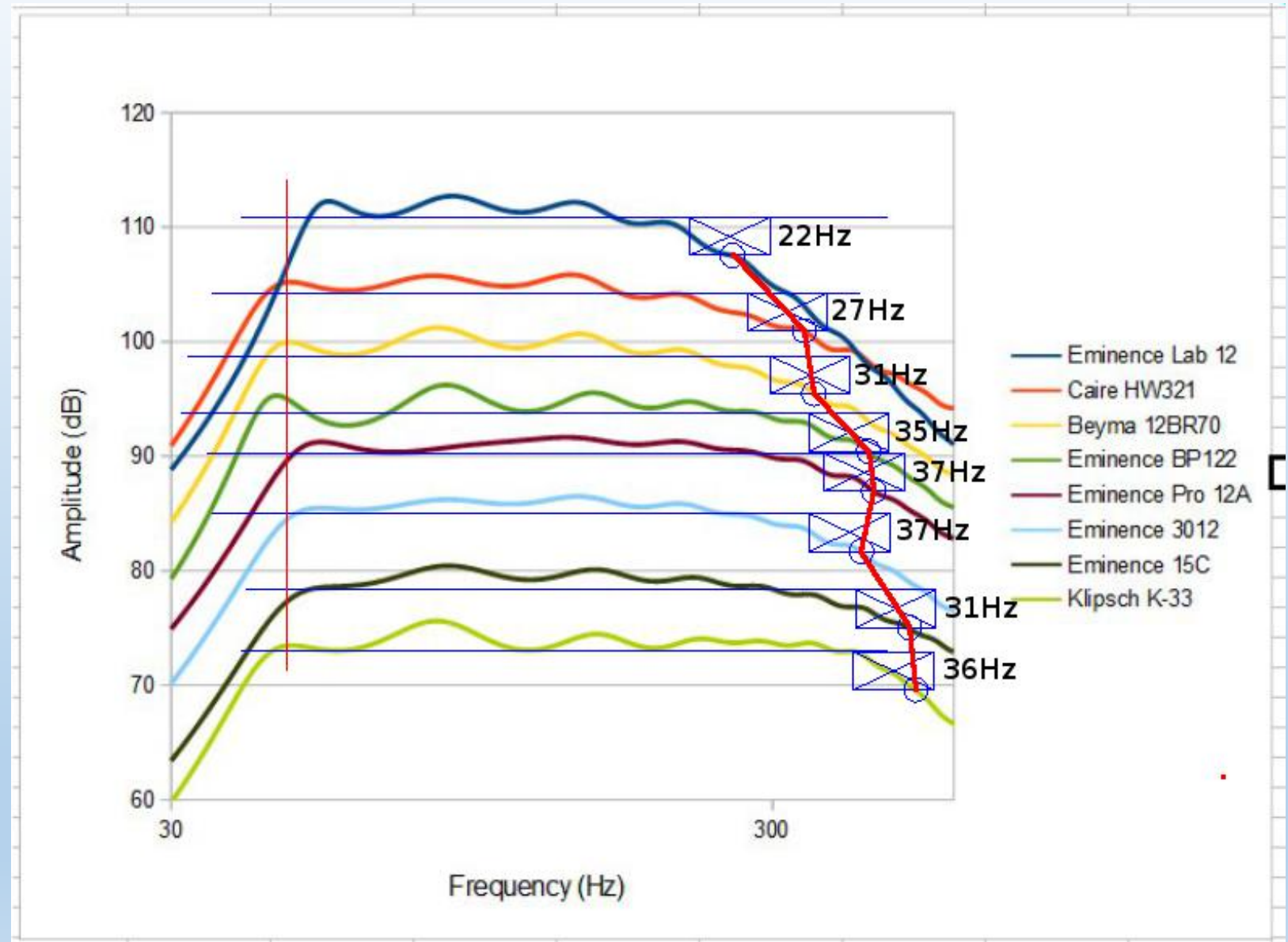
A summary of data accumulated for 12 inch drivers

Klipsch Bass Horn Analysis PDF constructs a full size corner horn using software, and then unfolds the acoustic path for dimensional analysis. It also determines the rear cavity volume in liters.

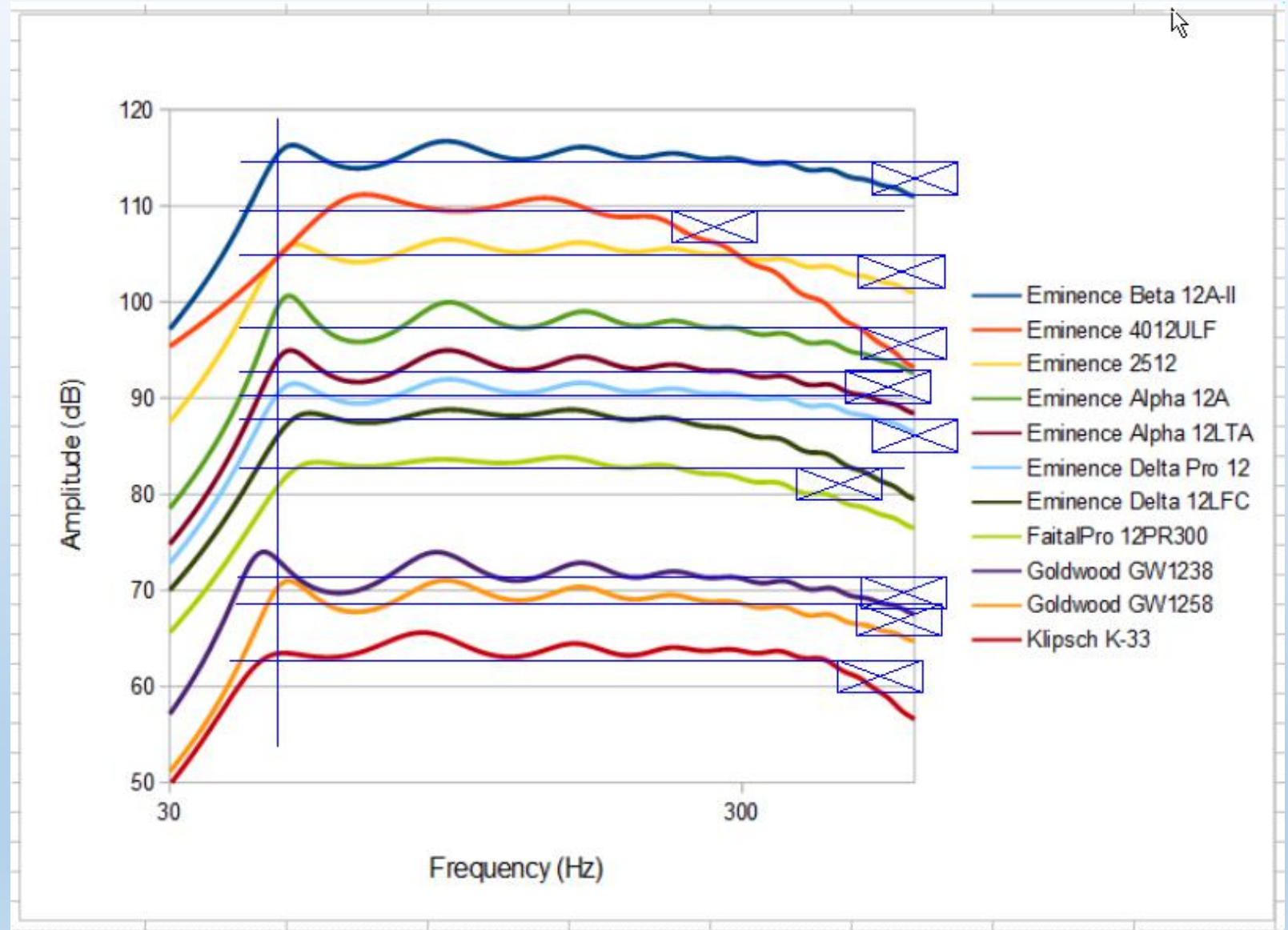
A Design of Experiments (DOE) was done on the standard K-horn cabinet and K-33 driver, to understand how changing driver parameters affects performance. Each of parameters listed below was changed by  $\pm 10\%$ . Parameters are listed by significance. Note that frequencies were broken into “bins” as shown below.

Freq	30.08	41.79	60.62	85.44	122.17	172.20	246.21	347.03	496.19	699.39	Parameter	Note
Sd+	0.13	0.42	-0.52	0.08	-0.34	-0.05	-0.04	0.02	0.25	1.04	Driver Diaphragm Piston Area	Piston size is a balance
Mmd+	0.12	-0.09	0.00	-0.09	-0.10	-0.27	-0.34	-0.42	-0.59	-0.93	Driver Diaphragm/Voice Coil Mass	Less diaphragm mass increases HF output (>120Hz)
Bl+	-0.07	-0.41	0.49	0.00	0.47	0.47	0.60	0.69	0.79	0.91	Driver Magnetic Flux Density	Higher flux density increases HF output (>60Hz)
Re+	-0.41	-0.26	-0.68	-0.46	-0.67	-0.67	-0.68	-0.64	-0.54	-0.40	Driver Voice Coil DC Resistance	Higher DC resistance decreases output
Le+	-0.02	0.02	-0.01	0.01	-0.01	0.00	-0.06	-0.17	-0.33	-0.52	Driver Voice Coil Inductance	Higher voice coil inductance decreases HF output (>350Hz)
Vtc+	0.03	0.01	-0.01	0.00	0.02	0.04	0.09	0.19	0.18	-0.81	Throat Chamber Volume	Chamber throat volume is a balance (>350Hz)
Tal+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.19	-0.20	Rear Chamber Lining Thickness	More rear chamber lining thickness reduces HF slightly (>500Hz)
Vrc+	0.63	-0.26	0.00	-0.06	-0.03	-0.04	-0.02	-0.01	0.00	0.00	Rear Chamber Volume	Rear chamber volume is a balance (<40Hz)
Cms+	0.17	-0.07	0.00	-0.02	-0.01	-0.01	-0.01	0.00	0.00	0.00	Diaphragm Suspension Compliance	Higher diaphragm compliance increase LF slightly (<40Hz)
Atc+	-0.01	0.01	0.00	0.01	0.01	0.03	0.04	0.04	0.01	-0.02	Throat Chamber Sectional Area	
Lrc+	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.02	-0.02	-0.03	Rear Chamber Average Length	
Rms+	-0.02	-0.04	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	Diaphragm Suspension Resistance	
Fr+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Acoustical Lining Resistivity	

Klipsch Driver  
Analysis - I PDF  
shows the acoustic  
performance of  
these drivers when  
coupled with an  
exponential horn.

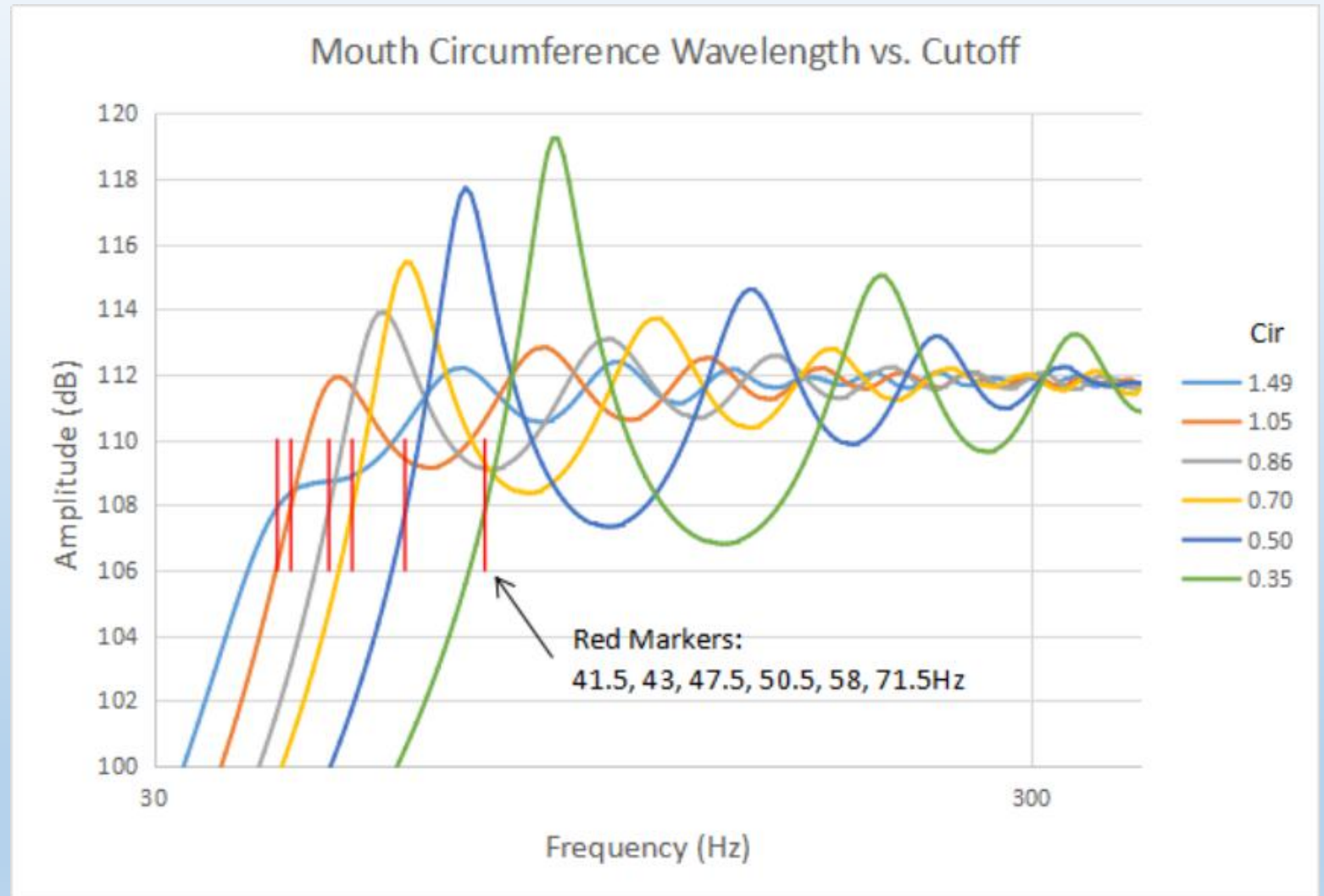


Klipsch Driver  
Analysis - II PDF  
shows more drivers  
in exponential horns.

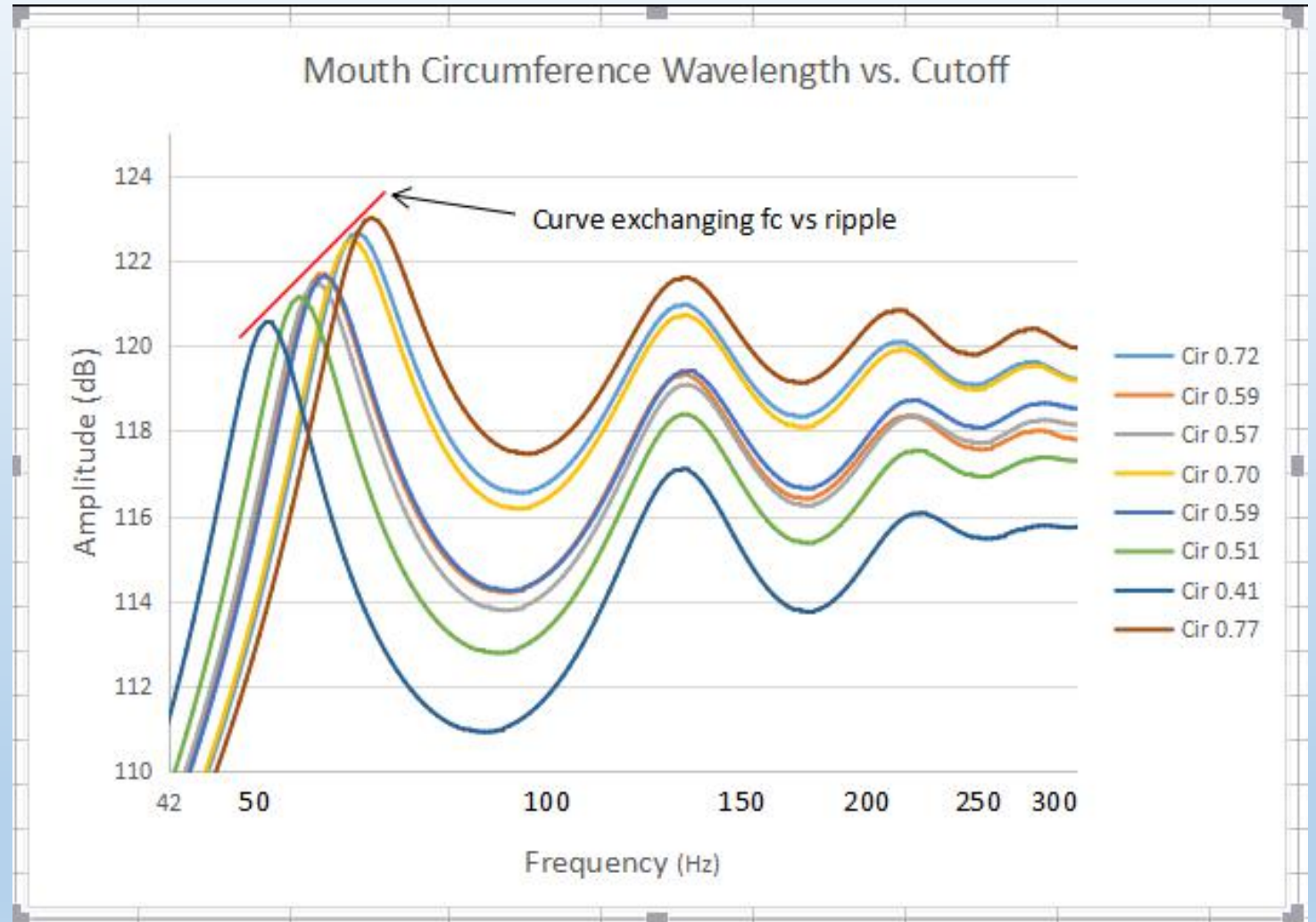




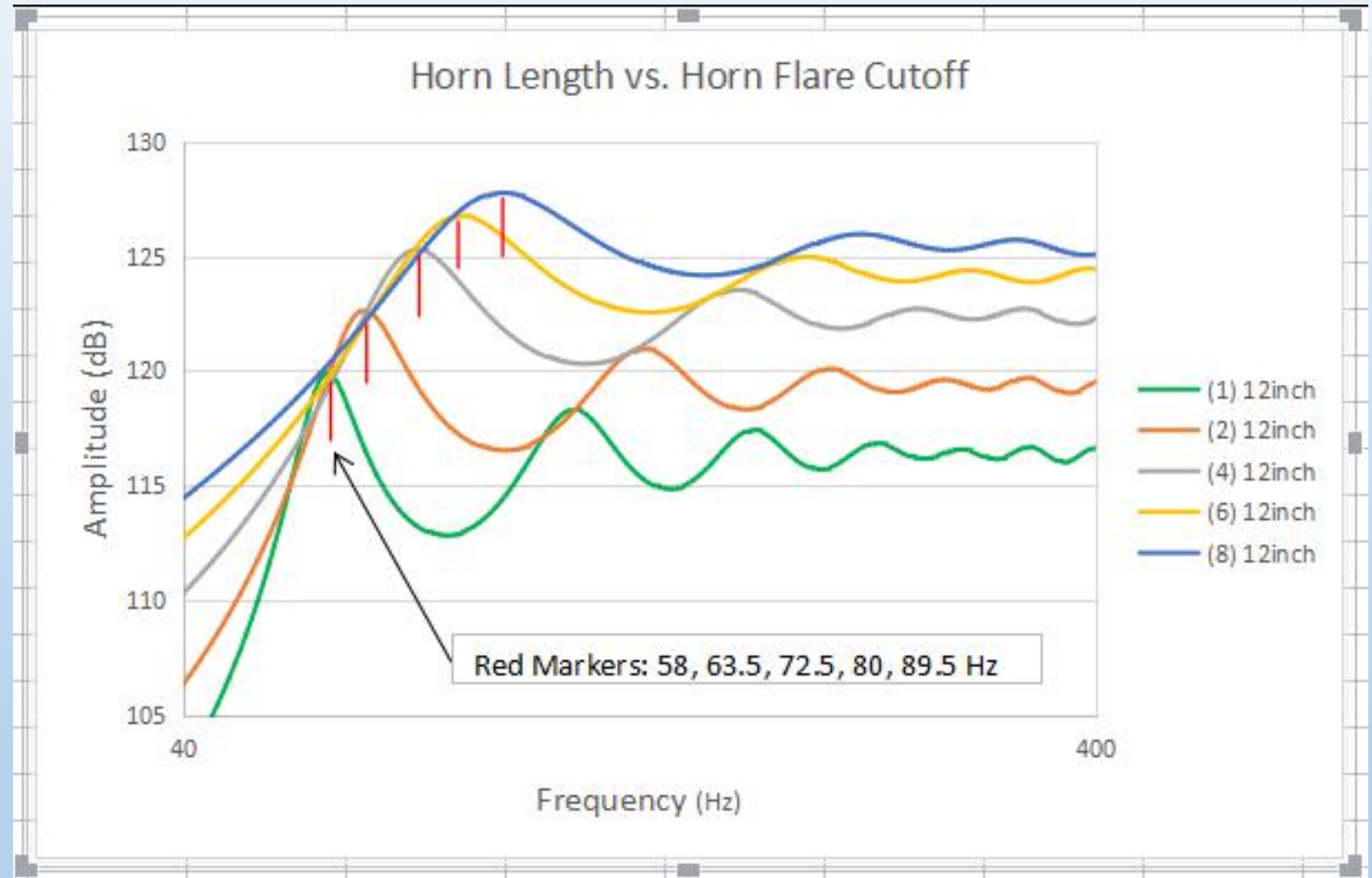
Horn Mouth Size Analysis PDF shows the acoustic performance of six exponential horns with various mouth sizes.



Klipsch Horn  
Optimization PDF  
shows the acoustic  
performance of  
eight high initial  
flare (100Hz) horns  
with various mouth  
sizes.

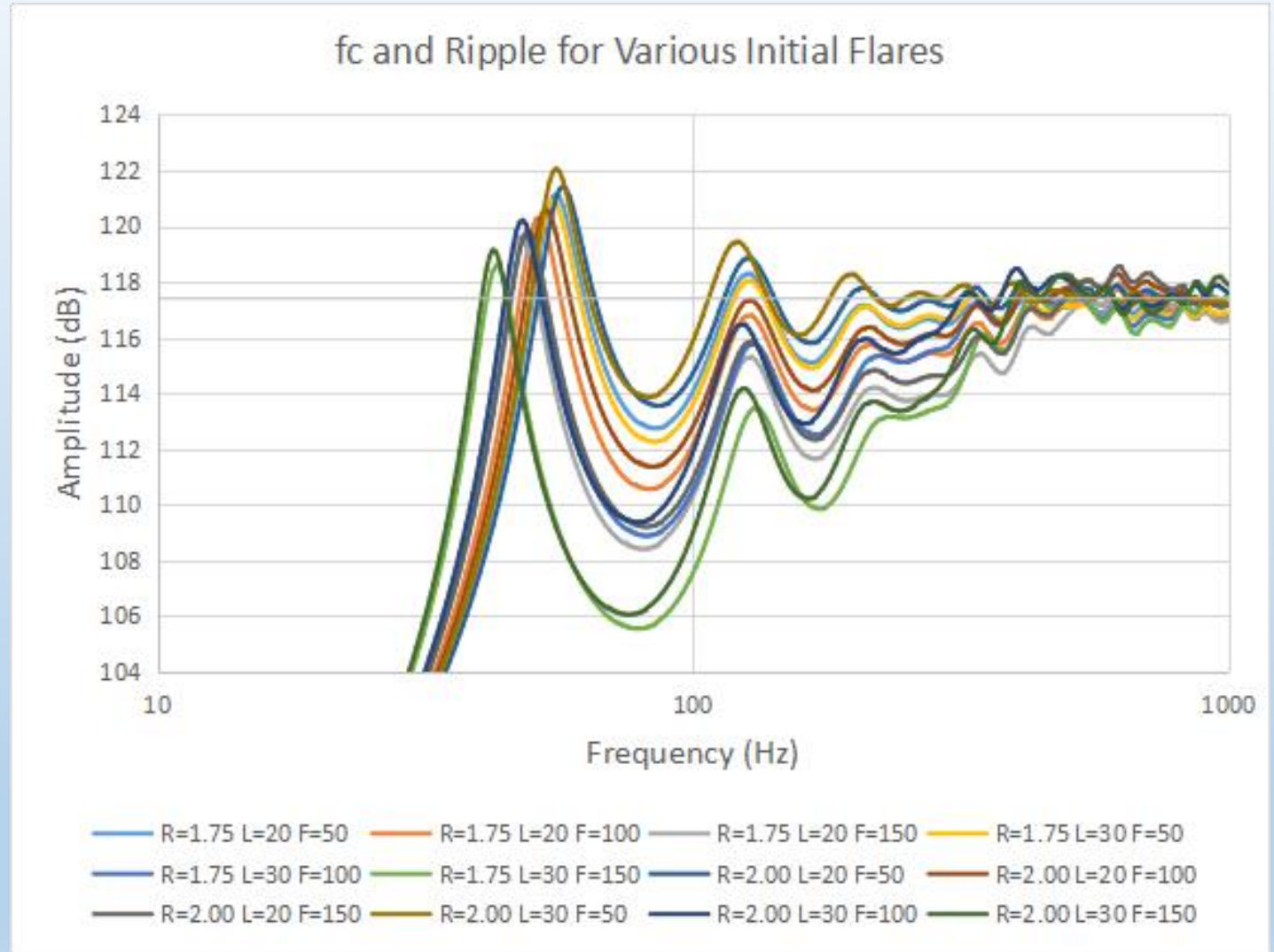


Horn Length  
Reduction PDF adds  
more drivers to the  
horn throat to see if  
this technique  
allows making a  
shorter horn.

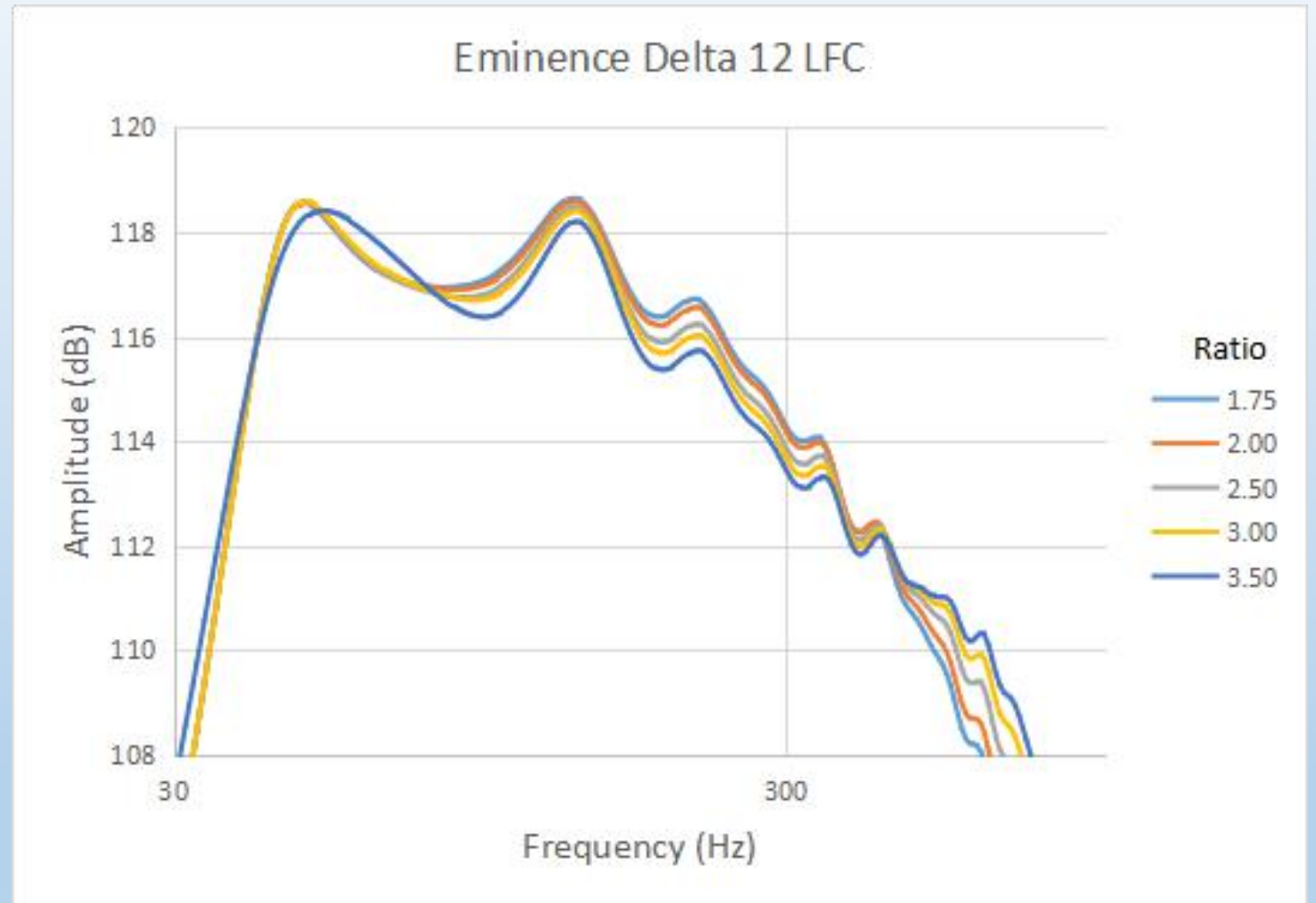




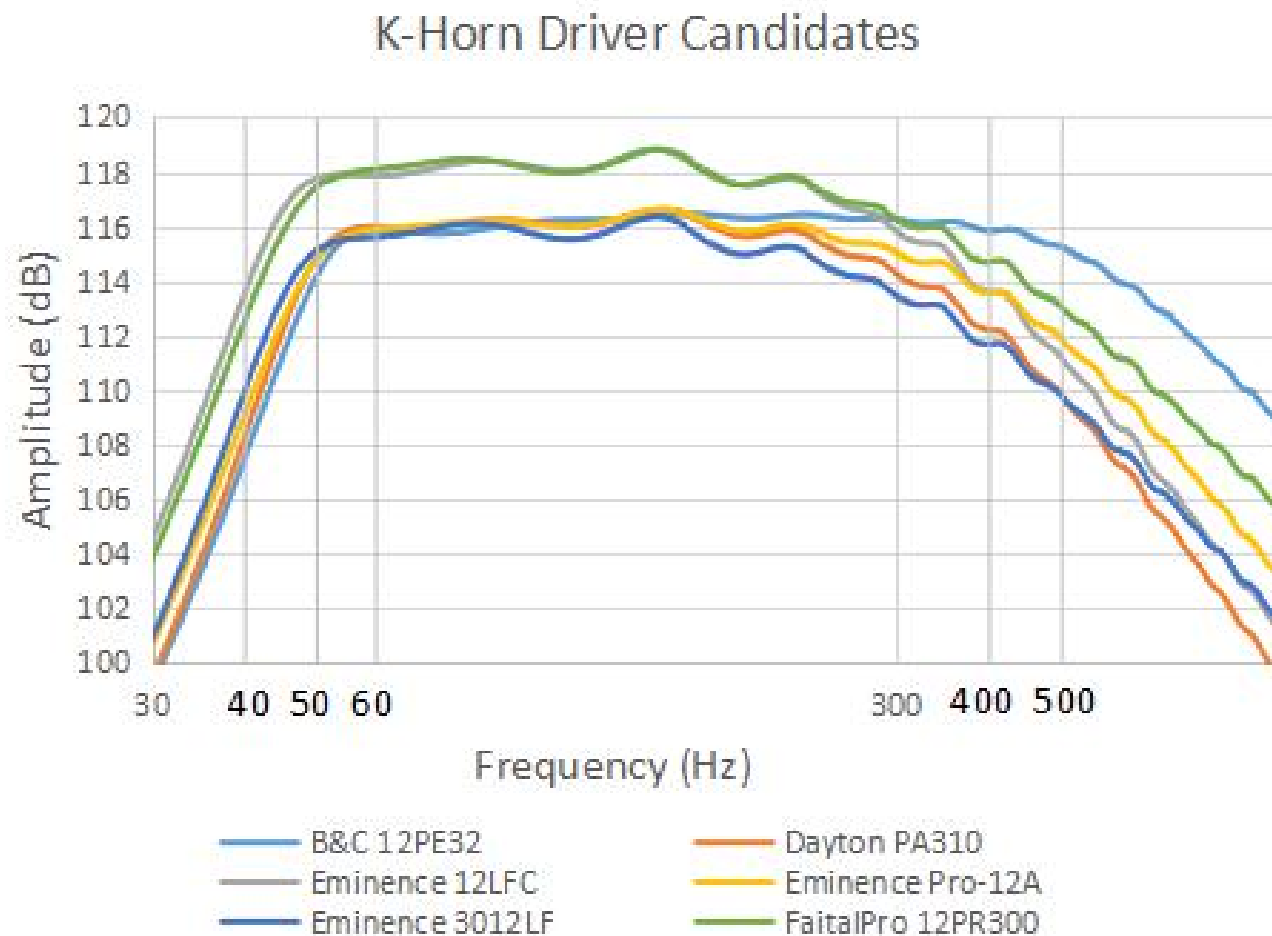
High Initial Flare  
Rate-I PDF looks at  
various high initial  
flare rates and  
lengths, and their  
effect on  
performance.



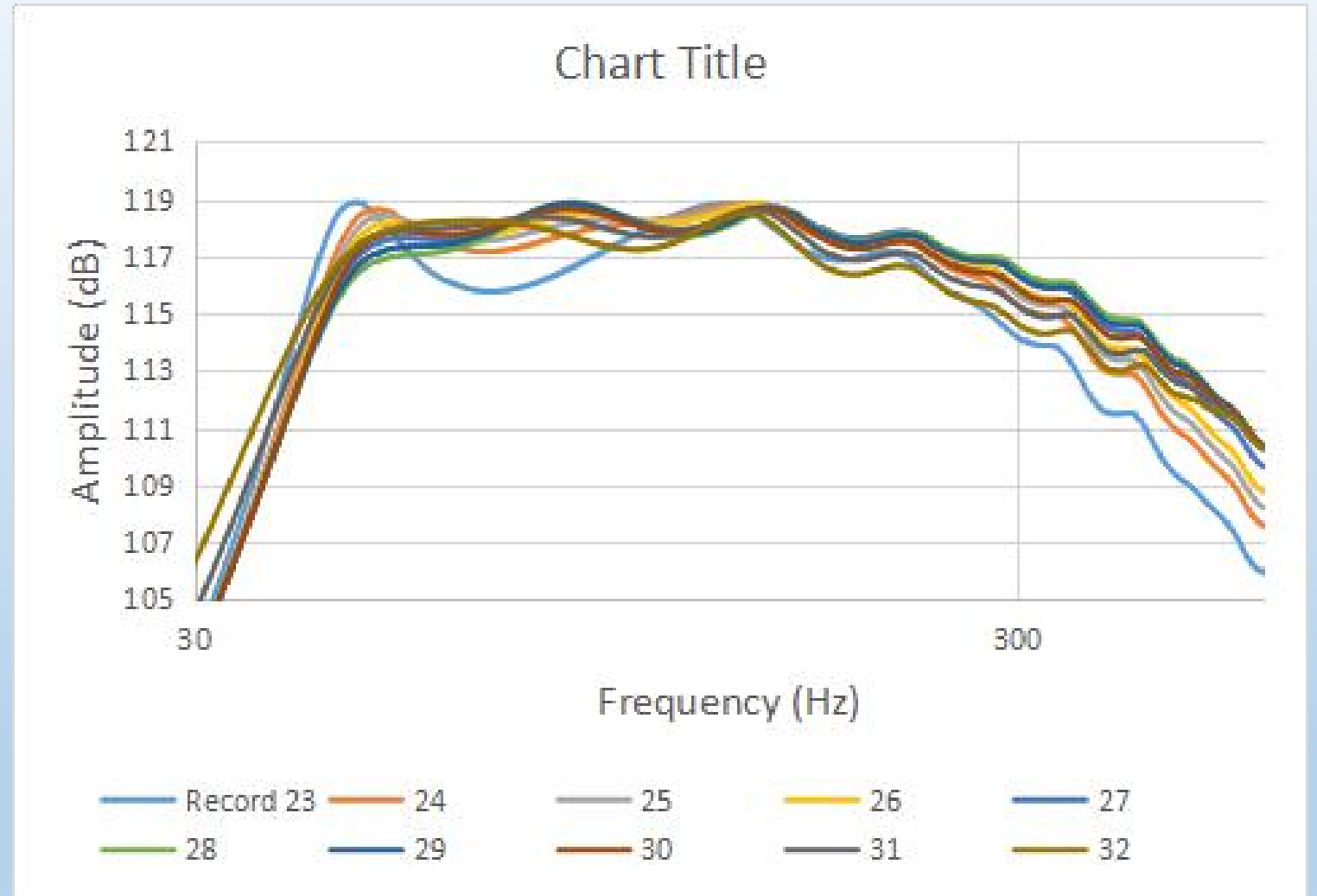
High Initial Flare  
Rate-II PDF looks at  
various high initial  
flare rates and  
lengths, and their  
effect on  
performance.  
Throat ratios give  
essentially the same  
SPL curves.



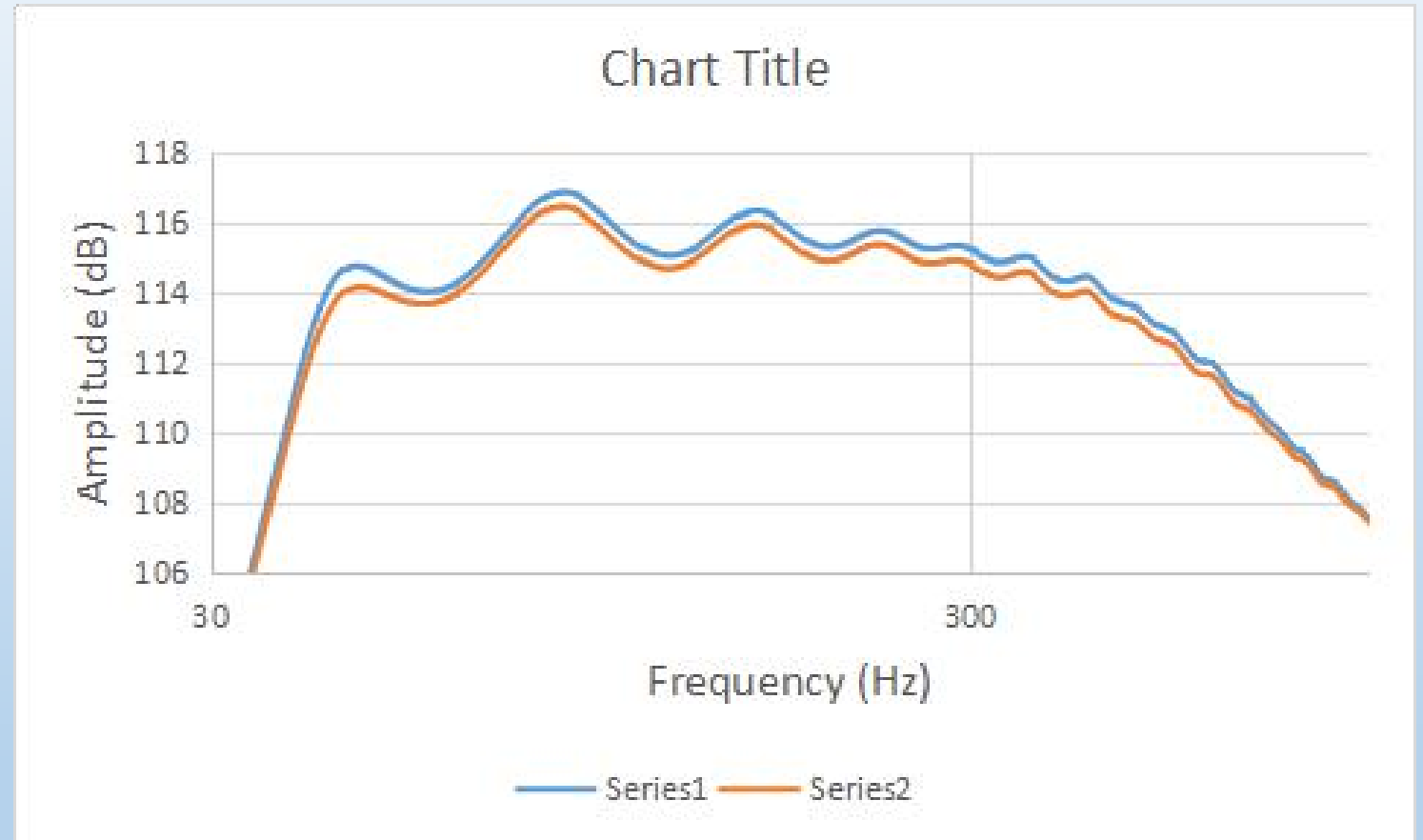
Candidate Drivers  
PDF checks the  
acoustic  
performance of  
these drivers as  
mounted in an  
exponential horn  
using parameters  
defined by Keele.



The Candidate Drivers PDF also checks the performance by utilizing a horn with high initial flare.

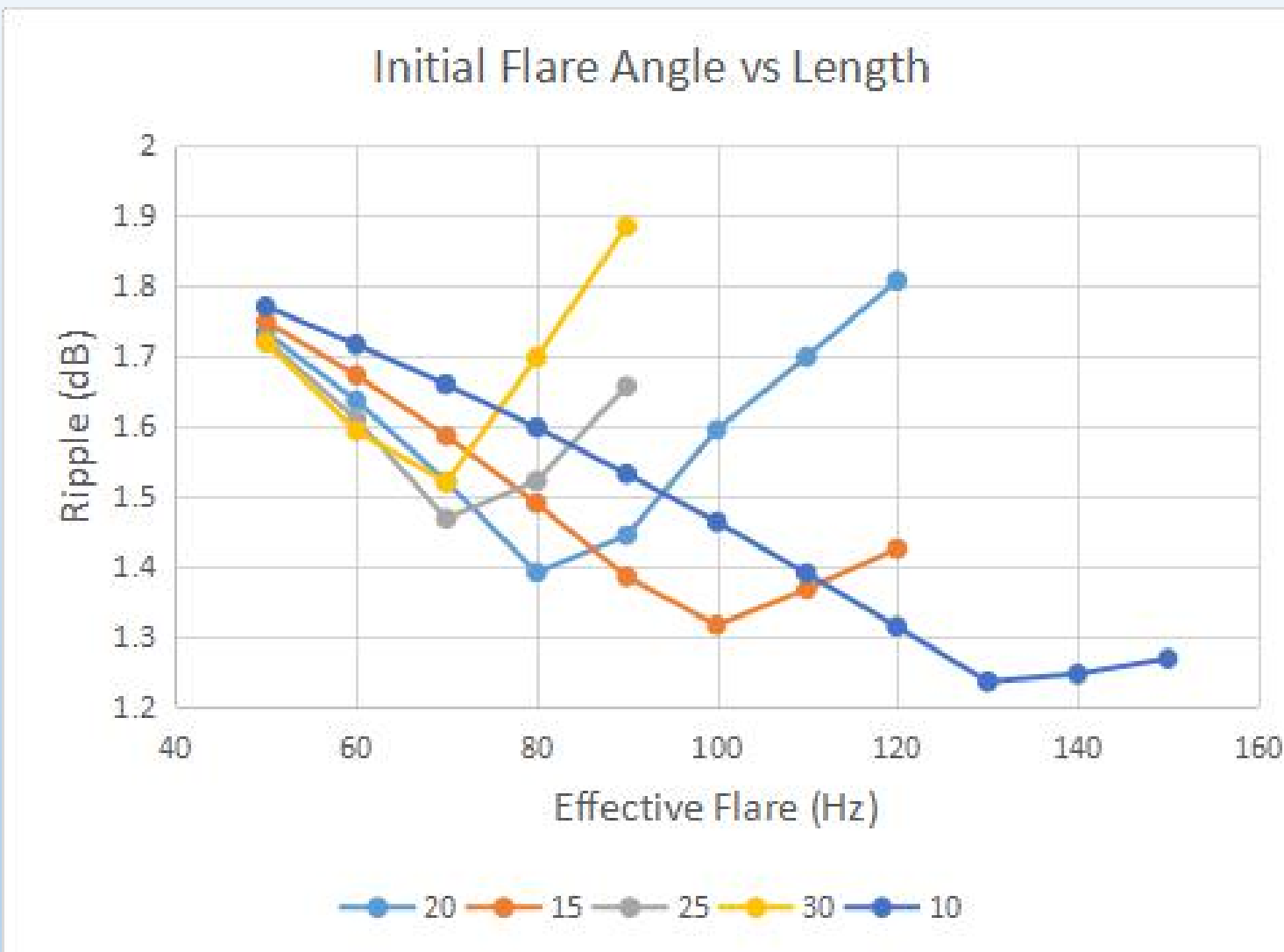


Finally, the Candidate Drivers PDF makes several drivers with optimum parameters for a corner horn. One is a Eminence Delta Pro 12A.






Optimum Horn  
Shape PDF uses a  
Eminence Delta Pro  
12A to develop a  
high initial flare  
horn with optimum  
parameters.



The optimum horn shape for the Eminence driver in shown on the right. The horn shape will be tweaked along with changes to Vtc at a later date.

 **Hornresp - Input Parameters** — □ ✕

File Tools Window Help

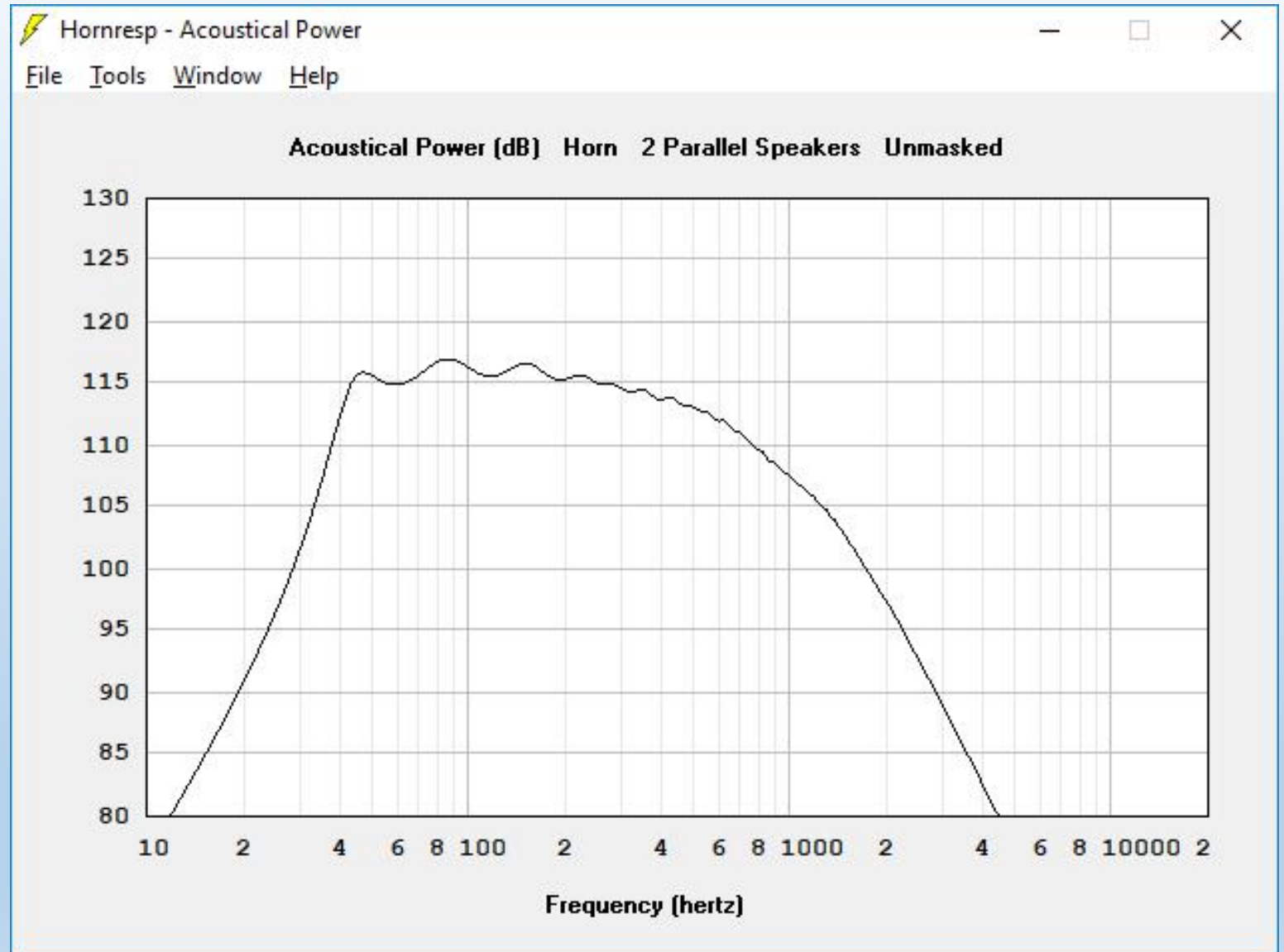
<b>Ang</b>	<input type="text" value="0.5 x Pi"/>	<b>Eg</b>	<input type="text" value="2.83"/>	<b>Rg</b>	<input type="text" value="0.00"/>	<b>Cir</b>	<input type="text" value="0.44"/>
<b>S1</b>	<input type="text" value="177.30"/>	<b>S2</b>	<input type="text" value="318.10"/>	<b>Con</b>	<input type="text" value="20.00"/>	<b>F12</b>	<input type="text" value="0.00"/>
<b>S2</b>	<input type="text" value="318.10"/>	<b>S3</b>	<input type="text" value="2028.05"/>	<b>Exp</b>	<input type="text" value="152.40"/>	<b>F23</b>	<input type="text" value="33.27"/>
<b>S3</b>	<input type="text" value="0.00"/>	<b>S4</b>	<input type="text" value="0.00"/>	<b>L34</b>	<input type="text" value="0.00"/>	<b>F34</b>	<input type="text" value="0.00"/>
<b>S4</b>	<input type="text" value="0.00"/>	<b>S5</b>	<input type="text" value="0.00"/>	<b>L45</b>	<input type="text" value="0.00"/>	<b>F45</b>	<input type="text" value="0.00"/>

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<b>Sd</b>	<input type="text" value="532.00"/>	<b>Cms</b>	<input type="text" value="3.51E-04"/>	<b>Mmd</b>	<input type="text" value="30.22"/>	<b>Re</b>	<input type="text" value="5.04"/>
<b>Bl</b>	<input type="text" value="11.47"/>	<b>Rms</b>	<input type="text" value="1.36"/>	<b>Le</b>	<input type="text" value="0.54"/>	<b>Nd</b>	<input type="text" value="1"/>
<b>Vrc</b>	<input type="text" value="30.00"/>	<b>Fr</b>	<input type="text" value="100.00"/>	<b>Vtc</b>	<input type="text" value="532.00"/>		
<b>Lrc</b>	<input type="text" value="16.00"/>	<b>Tal</b>	<input type="text" value="4.00"/>	<b>Atc</b>	<input type="text" value="532.00"/>		

**Comment**

Here is the SPL data for the Eminence driver, along with the optimum horn shape.



Since there was so much data to process, a tool was created to help with data extraction and number crunching. It utilizes the export data from AllChartData and HornrespRecord. This tool has been used for most of the PDFs created at this point.

The screenshot shows a software window titled "Hornresp Tool". At the top, a text box states: "This program extracts the SPL data from the Hornresp output file, and copies it to the Clipboard." Below this, there are several input fields and buttons. The "File Name" field contains "04.TXT", followed by "LowEnd (Hz): 40.48", "HiEnd (Hz): 452.74", "Ripple (dB): 1.268", "Eff (dB): 115.8", "Vrc (L): 30.00", and "Driver: Eminence Delta Pro 12-450A - 44Hz". To the right of these fields is an "Extract Data" button. Below the input fields, there is a "Clipboard Data" section with two radio buttons: "SPL" (which is selected) and "5 Vars". Further down, there is a "Horn Sections" section with two radio buttons: "Exponential" and "Con/Exp" (which is selected). To the right of this is an "Extract Shape" button. At the bottom, there are three input fields labeled "Plus 10:", "Nominal:", and "Minus 10:", followed by a "Get Plus/Minus" button.

Hornresp Tool

This program extracts the SPL data from the Hornresp output file, and copies it to the Clipboard.

File Name: 04.TXT

LowEnd (Hz): 40.48

HiEnd (Hz): 452.74

Ripple (dB): 1.268

Eff (dB): 115.8

Vrc (L): 30.00

Driver: Eminence Delta Pro 12-450A - 44Hz

Extract Data

Clipboard Data

☒ SPL

☐ 5 Vars

Horn Sections

☐ Exponential

☒ Con/Exp

Extract Shape

Plus 10:

Nominal:

Minus 10:

Get Plus/Minus