
Klipsch Horn Flare Optimization

It has been said that the corner horn can be made smaller by providing an initial flare that is higher than the nominal flare. An initial flare of 100 Hz has been modeled for the first 20 cm distance in this study and compared to full nominal flare of approximately 45 Hz. Drive voltage is set to zero, so we can focus on the affect of the horn shape.

Note that driver surface area is equivalent to (2) 12 inch diaphragms for all models.

The classic flare cutoff of 38 Hz is modeled first, to establish the control SPL curve.

Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	0.00	Rg	0.00	Cir	0.72
S1	355.00	S2	4056.10	Exp	172.40	F12	38.68
S2	0.00	S3	0.00	L23	0.00	AT	4.29
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

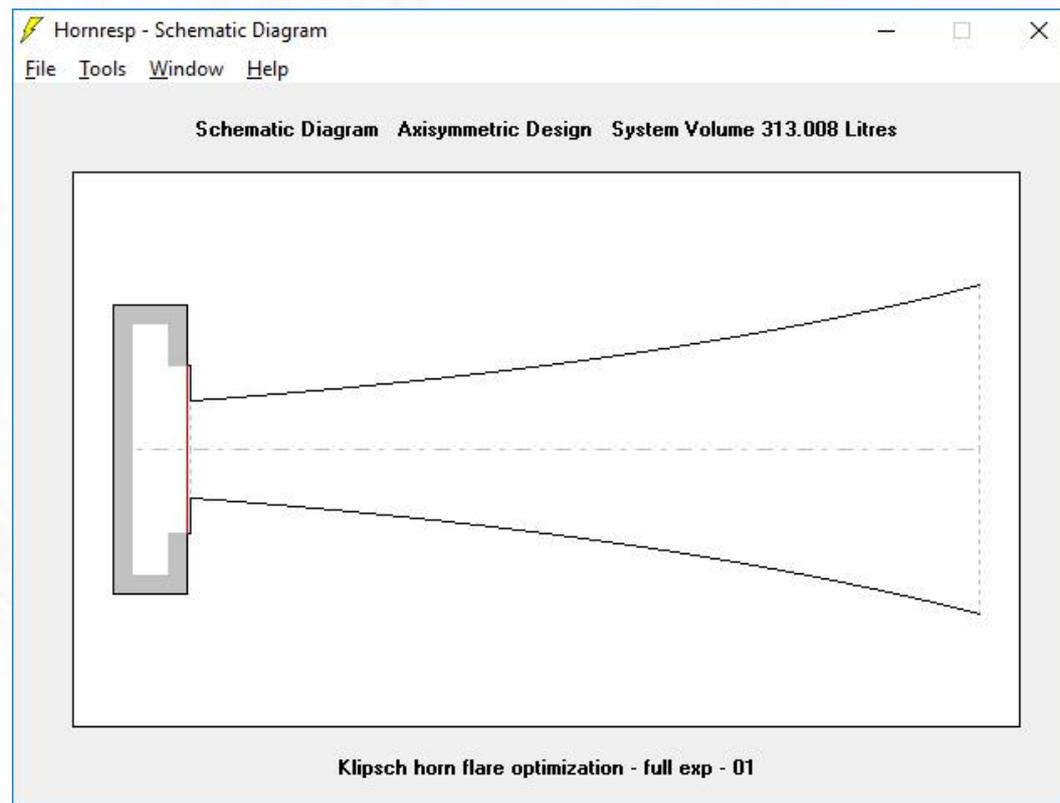
Sd	1060.00	Cms	4.00E-04	Mmd	20.00	Re	6.00
Bl	18.00	Rms	4.00	Le	1.00	Nd	1
Vrc	50.00	Fr	40000.00	Vtc	1060.00		
Lrc	16.00	Tal	4.00	Atc	1060.00		

Comment Klipsch horn flare optimization - full exp - 01

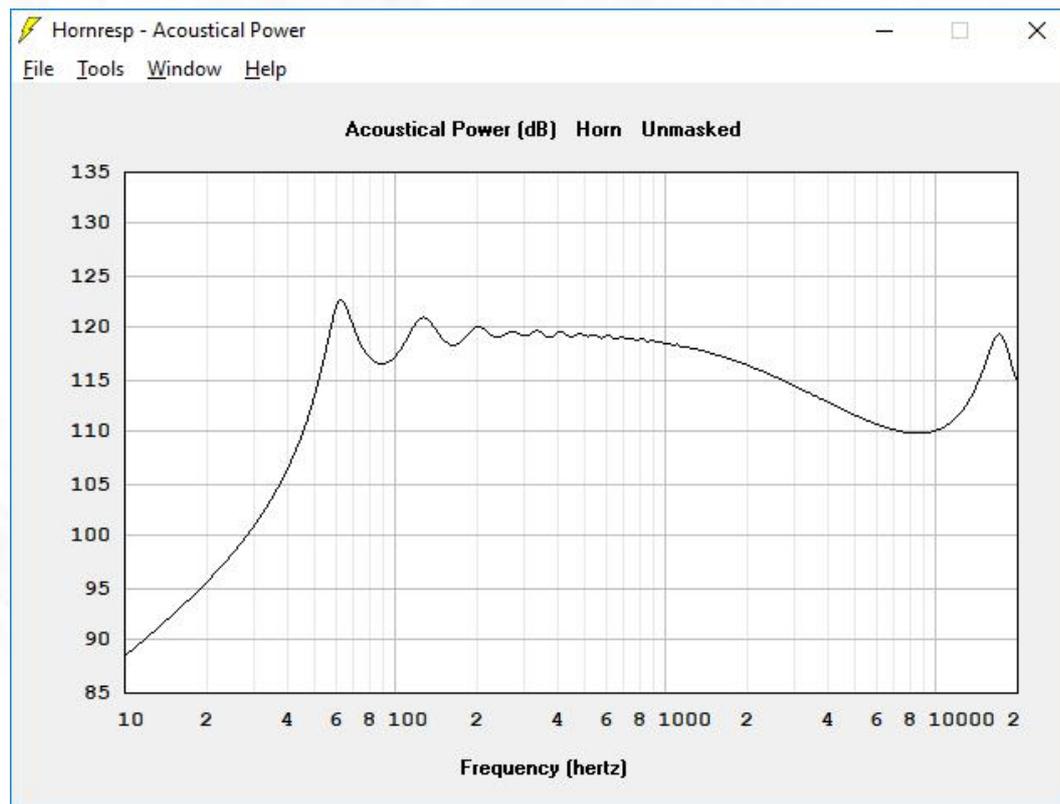
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S1 Horn segment 1 throat area (sq cm) Sd / S1 compression ratio = 2.99 : 1

Full exponential horn shape.



Full exponential SPL



Classic Klipsch Flare with stepped throat

Hornresp - Input Parameters

File Tools Window Help

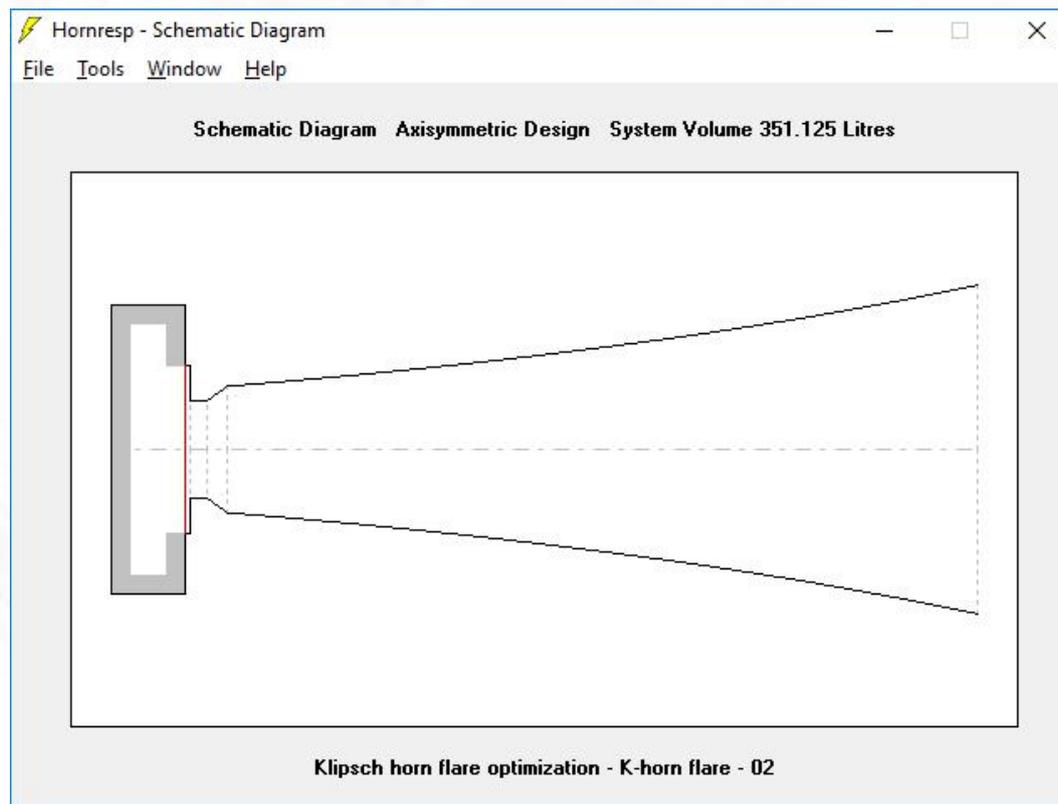
Ang	0.5 \times Pi	Eg	0.00	Rg	0.00	Cir	0.59
S1	355.00	S2	355.00	Con	3.80	F12	0.00
S2	355.00	S3	600.00	Con	4.50	F23	0.00
S3	600.00	S4	4056.10	Exp	164.00	F34	31.90
S4	0.00	S5	0.00	L45	0.00	F45	0.00

Sd	1060.00	Cms	4.00E-04	Mmd	20.00	Re	6.00
Bl	18.00	Rms	4.00	Le	1.00	Nd	1
Vrc	50.00	Fr	40000.00	Vtc	1060.00		
Lrc	16.00	Tal	4.00	Atc	1060.00		

Comment Klipsch horn flare optimization - K-horn flare - 02

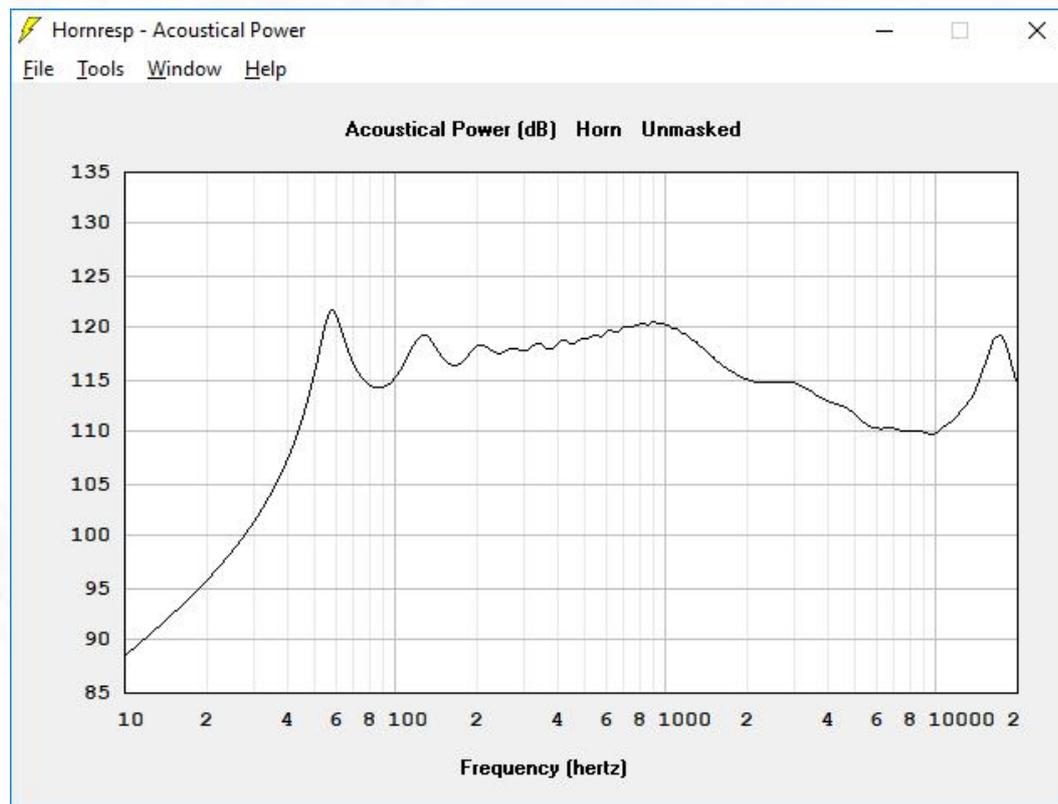
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Classic Klipsch Flare Shape



Classic Klipsch Flare SPL

Notice that the SPL level is already lower than the pure exponential flare. This trend continues for all prototypes modeled.



High Initial Flare #1

Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	0.00	Rg	0.00	Cir	0.57
S1	355.00	S2	740.00	Con	20.00	F12	0.00
S2	740.00	S3	4056.10	Exp	152.40	F23	30.56
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

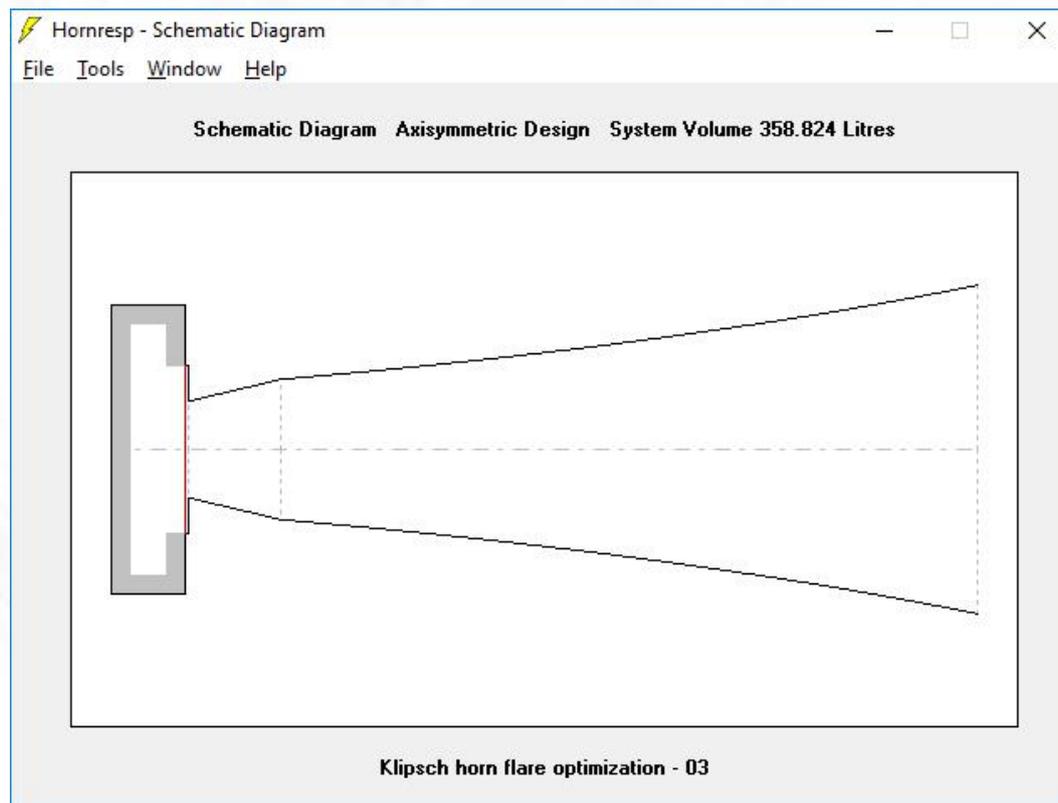
Sd	1060.00	Cms	4.00E-04	Mmd	20.00	Re	6.00
Bl	18.00	Rms	4.00	Le	1.00	Nd	1
Vrc	50.00	Fr	40000.00	Vtc	1060.00		
Lrc	16.00	Tal	4.00	Atc	1060.00		

Comment Klipsch horn flare optimization - 03

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Show next record

High Initial Flare #1 Shape



High Initial Flare #2

Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	0.00	Rg	0.00	Cir	0.70
S1	350.00	S2	500.00	Exp	20.00	F12	48.82
S2	500.00	S3	4056.10	Exp	152.40	F23	37.60
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

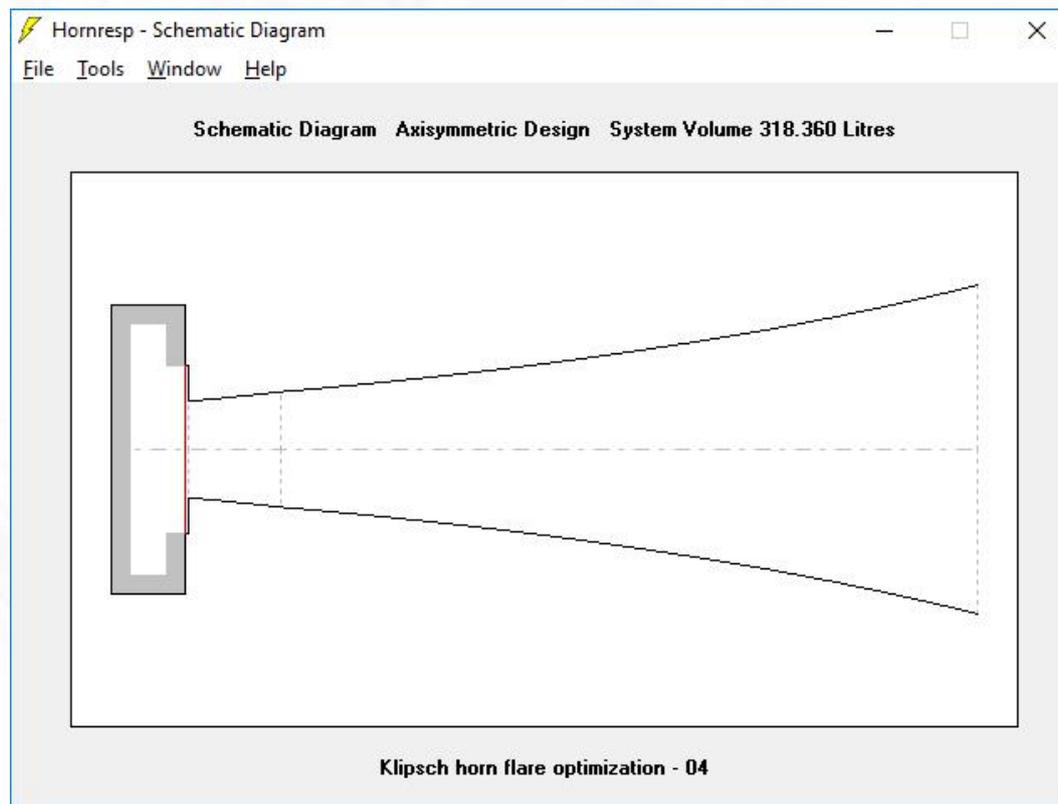
Sd	1060.00	Cms	4.00E-04	Mmd	20.00	Re	6.00
Bl	18.00	Rms	4.00	Le	1.00	Nd	1
Vrc	50.00	Fr	40000.00	Vtc	1060.00		
Lrc	16.00	Tal	4.00	Atc	1060.00		

Comment Klipsch horn flare optimization - 04

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Show next record

High Initial Flare #2 Shape



High Initial Flare #3

Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	0.00	Rg	0.00	Cir	0.59
S1	330.00	S2	685.00	Con	20.00	F12	0.00
S2	685.00	S3	4056.10	Exp	152.40	F23	31.95
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

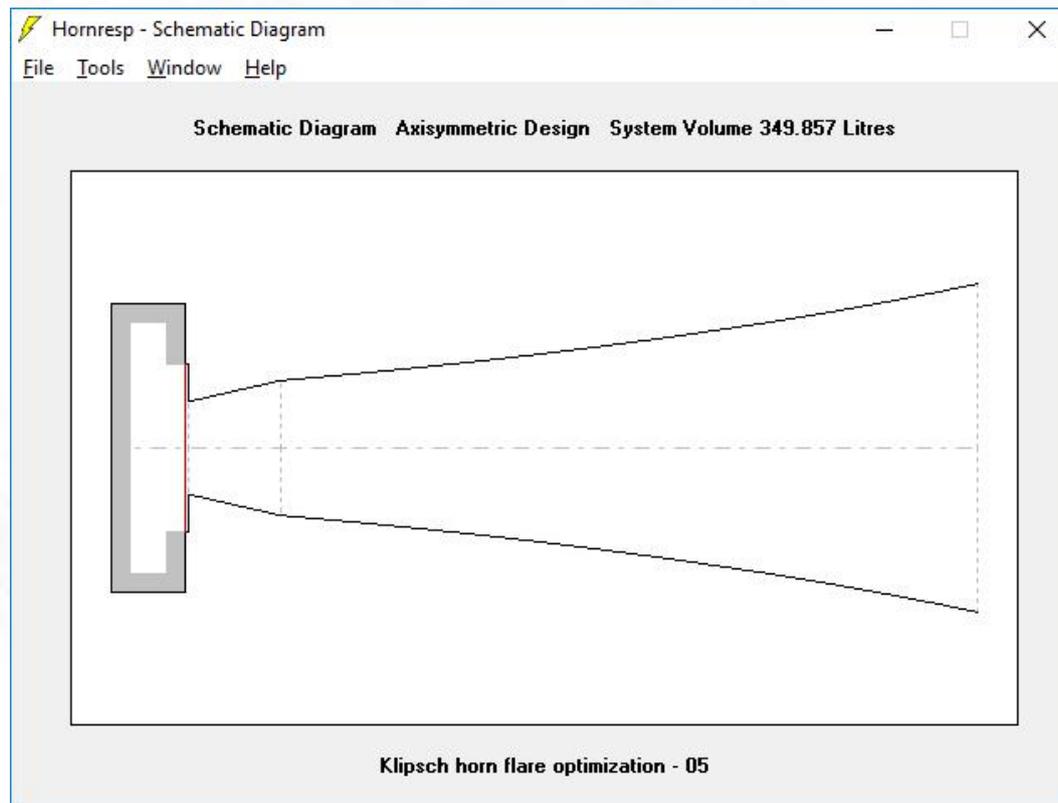
Sd	1060.00	Cms	4.00E-04	Mmd	20.00	Re	6.00
Bl	18.00	Rms	4.00	Le	1.00	Nd	1
Vrc	50.00	Fr	40000.00	Vtc	1060.00		
Lrc	16.00	Tal	4.00	Atc	1060.00		

Comment Klipsch horn flare optimization - 05

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High Initial Flare #3 Shape



High Initial Flare #4

Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	0.00	Rg	0.00	Cir	0.51
S1	420.00	S2	875.00	Con	20.00	F12	0.00
S2	875.00	S3	4056.10	Exp	152.40	F23	27.55
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

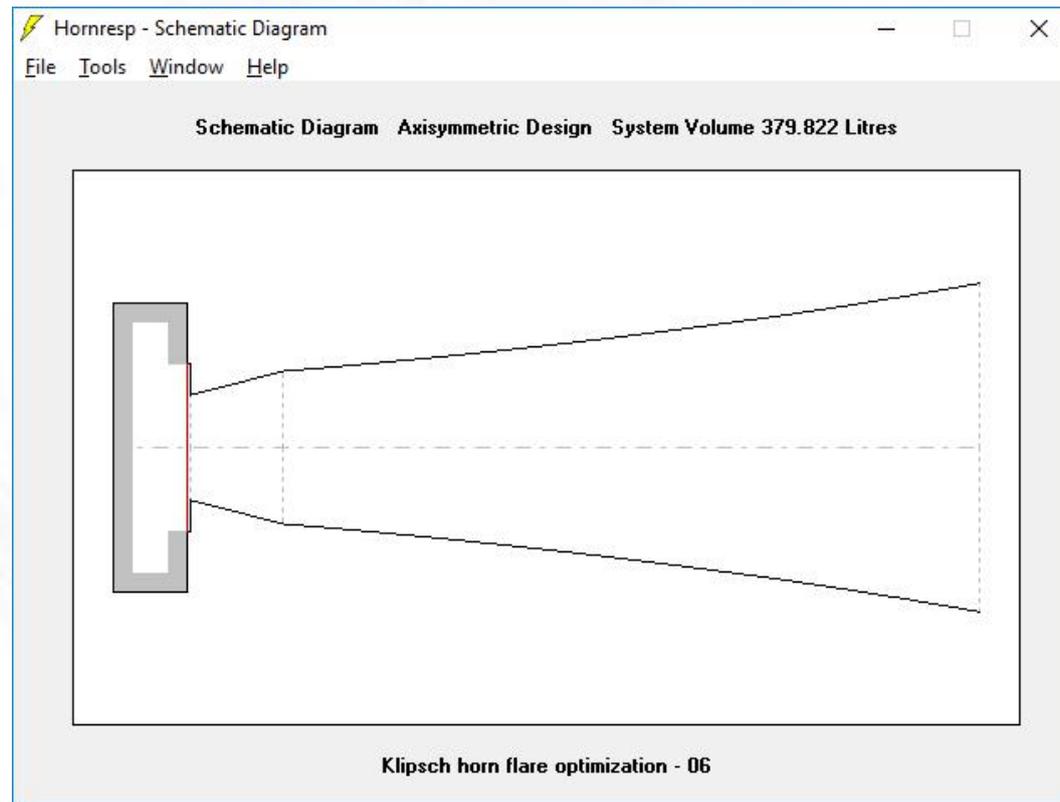
Sd	1060.00	Cms	4.00E-04	Mmd	20.00	Re	6.00
Bl	18.00	Rms	4.00	Le	1.00	Nd	1
Vrc	50.00	Fr	40000.00	Vtc	1060.00		
Lrc	16.00	Tal	4.00	Atc	1060.00		

Comment Klipsch horn flare optimization - 06

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High Initial Flare #4 Shape



High Initial Flare #5

Hornresp - Input Parameters

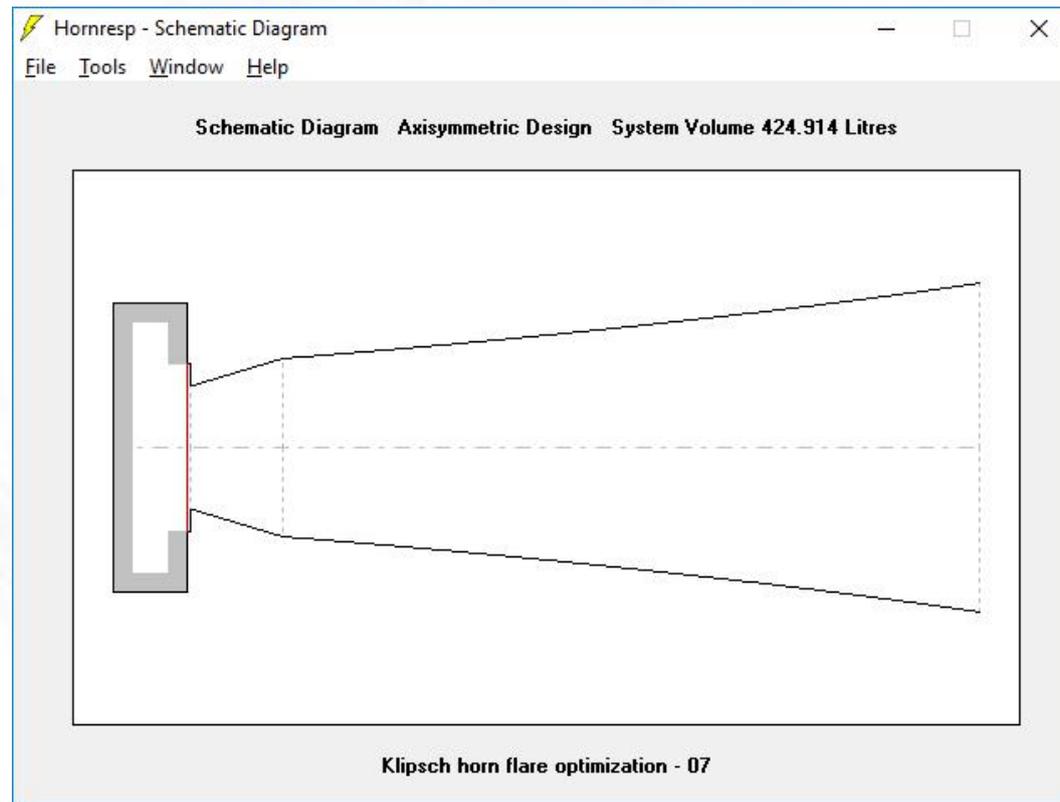
File Tools Window Help

Ang	<input type="text" value="0.5 x Pi"/>	Eg	<input type="text" value="0.00"/>	Rg	<input type="text" value="0.00"/>	Cir	<input type="text" value="0.41"/>
S1	<input type="text" value="574.00"/>	S2	<input type="text" value="1193.00"/>	Con	<input type="text" value="20.00"/>	F12	<input type="text" value="0.00"/>
S2	<input type="text" value="1193.00"/>	S3	<input type="text" value="4056.10"/>	Exp	<input type="text" value="152.40"/>	F23	<input type="text" value="21.98"/>
S3	<input type="text" value="0.00"/>	S4	<input type="text" value="0.00"/>	L34	<input type="text" value="0.00"/>	F34	<input type="text" value="0.00"/>
S4	<input type="text" value="0.00"/>	S5	<input type="text" value="0.00"/>	L45	<input type="text" value="0.00"/>	F45	<input type="text" value="0.00"/>

Sd	<input type="text" value="1060.00"/>	Cms	<input type="text" value="4.00E-04"/>	Mmd	<input type="text" value="20.00"/>	Re	<input type="text" value="6.00"/>
Bl	<input type="text" value="18.00"/>	Rms	<input type="text" value="4.00"/>	Le	<input type="text" value="1.00"/>	Nd	<input type="text" value="1"/>
Vrc	<input type="text" value="50.00"/>	Fr	<input type="text" value="40000.00"/>	Vtc	<input type="text" value="1060.00"/>		
Lrc	<input type="text" value="16.00"/>	Tal	<input type="text" value="4.00"/>	Atc	<input type="text" value="1060.00"/>		

Comment

High Initial Flare #5 Shape



Full Exponential with Tiny Throat

Hornresp - Input Parameters

File Tools Window Help

Ang	0.5 x Pi	Eg	0.00	Rg	0.00	Cir	0.77
S1	300.00	S2	4056.10	Exp	172.40	F12	41.35
S2	0.00	S3	0.00	L23	0.00	AT	4.22
S3	0.00	S4	0.00	L34	0.00	F34	0.00
S4	0.00	S5	0.00	L45	0.00	F45	0.00

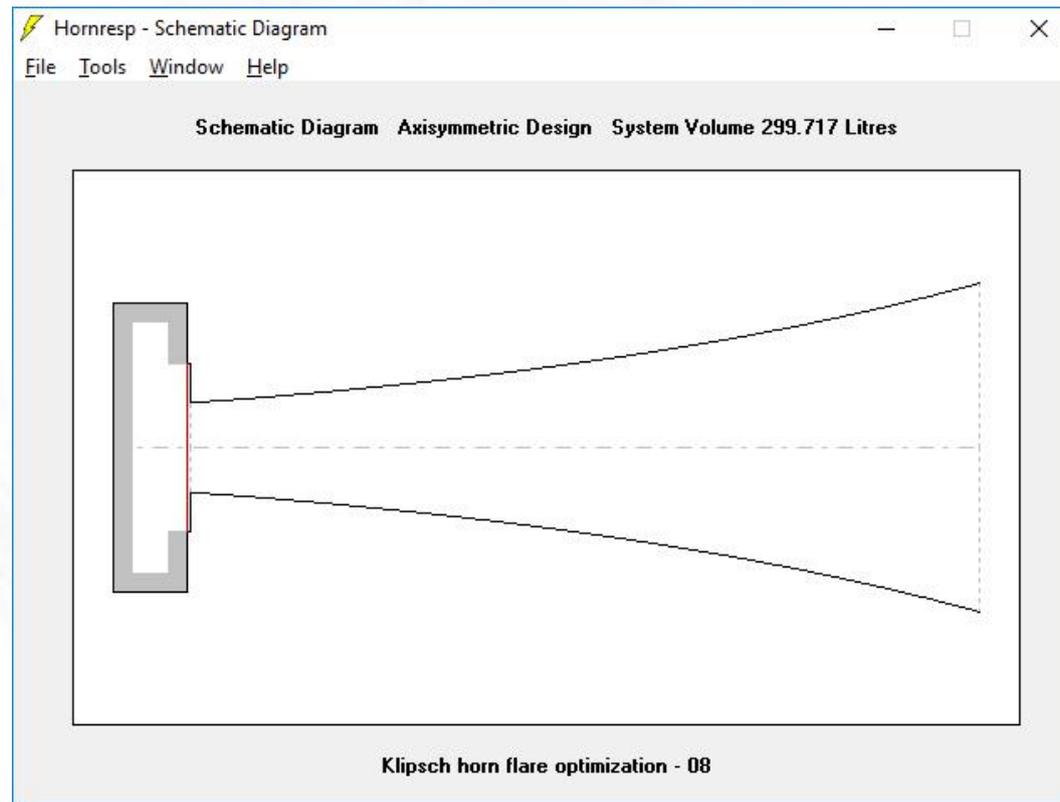
Sd	1060.00	Cms	4.00E-04	Mmd	20.00	Re	6.00
Bl	18.00	Rms	4.00	Le	1.00	Nd	1
Vrc	50.00	Fr	40000.00	Vtc	1060.00		
Lrc	16.00	Tal	4.00	Atc	1060.00		

Comment Klipsch horn flare optimization - 08

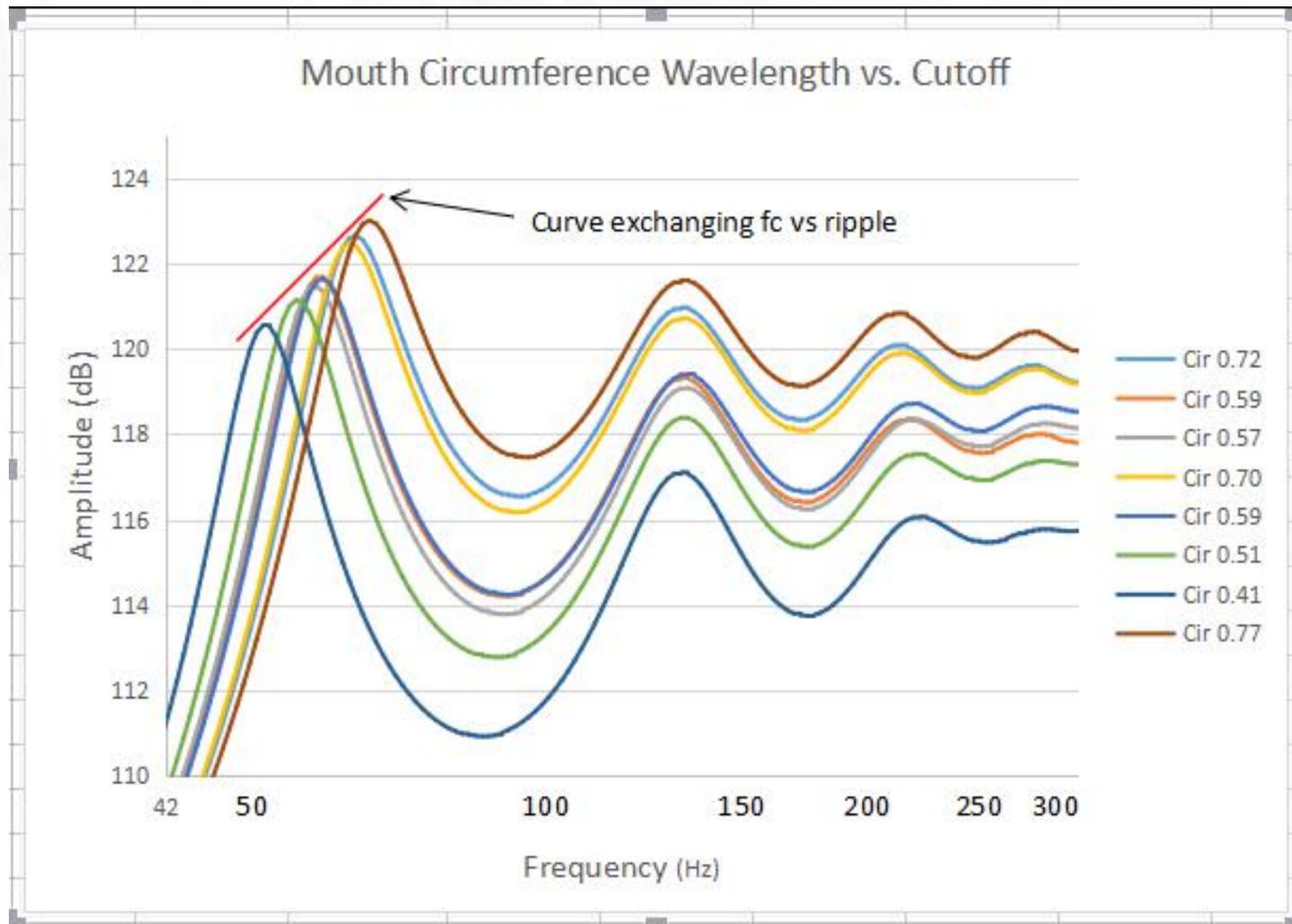
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Comment Explanatory note on horn loudspeaker configuration Pmax = 100 watts Xmax = 5.0 mm

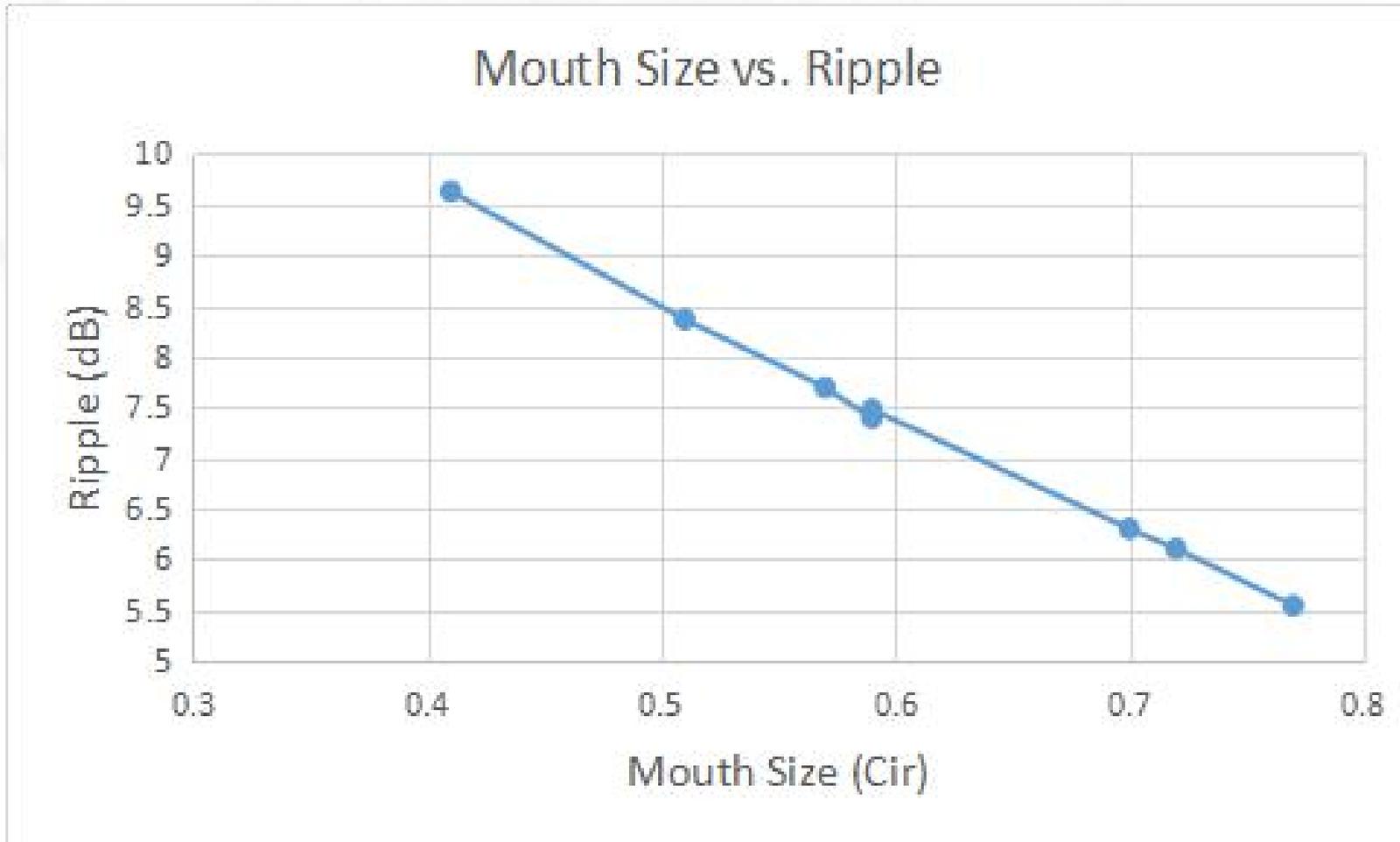
Full Exponential with Tiny Throat Shape



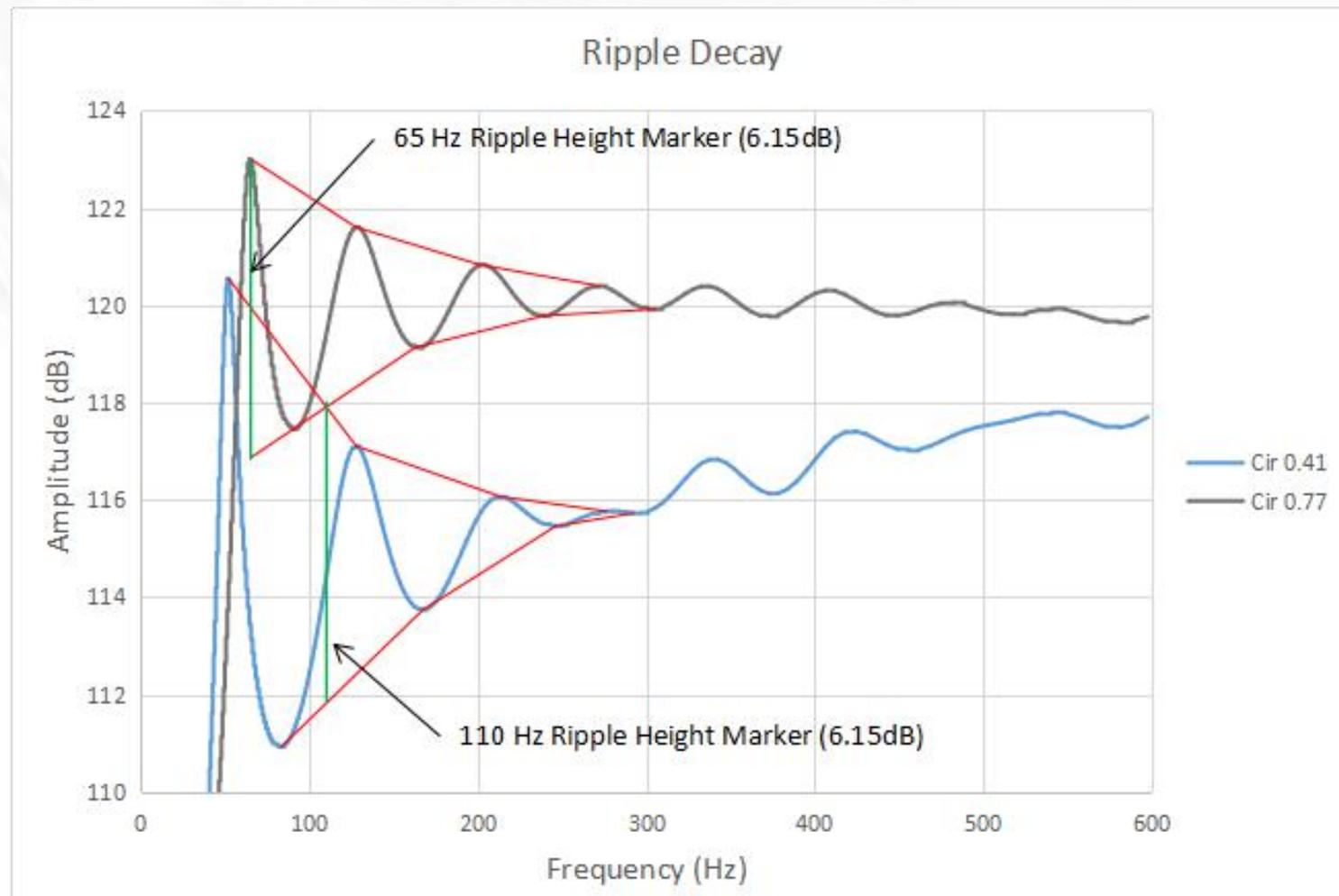
All eight curves are shown below. Notice that curves that rise to a lower “fc”, also have higher ripple. There is a linear relation between low ripple and larger Cir as indicated by the short red line.



Here is the relation between Mouth Size (Cir) and Ripple (dB).



Shown below is the amount of ripple present for horns with two effective mouth sizes relative to f_c . Notice that the ripple stability for $\text{Cir } 0.77 = 65\text{Hz}$ and $\text{Cir } 0.41 = 110\text{Hz}$.



Conclusion - High Initial Flare

After modeling several examples of corner horns that have an initial flare close to 100 Hz, it appears these shapes all produce acoustic responses with less damping, and rise to their f_c quicker, but also take longer for the SPL curve to go asymptotic.

The classic exponential horn shape is better damped, has a higher f_c , but assumes a flat response quicker.

The classic exponential shape has the highest efficiency.