Horn.ell.a

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INTRODUCTION

ABOUT THIS MANUAL

This User's Manual explains the **Horn.ell.a** software version 1.0.0.

WHAT THIS USER MANUAL DOES COVER

The Horn.ell.a software is a tool to fast designs 3D Horns. There are thousands of books and papers on many of the topics that Horn.ell.a handles. This User Manual is intended not to explain the horn theory, this issue is left to the reader to explore through large available literature, but only as a guide to allow the user to quickly become efficient with the user interface Horn.ell.a software.

LICENSE AGREEMENT AND WARRANTY

THANKS

Thank you for purchasing your Horn.ell.a software. We hope that your experiences using Horn.ell.a will be both productive and satisfying.

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website: www.speakerlab.it
e-mail: info@speakerlab.it

Technical support is free and unlimited at this time; however we reserve the right to charge for this service in the future as conditions, overhead, and support personnel requirements dictate.

INSTALLATION

SYSTEM REQUIREMENTS

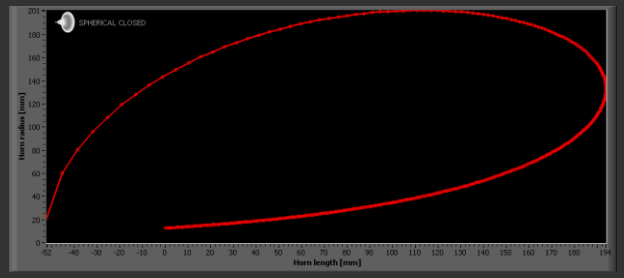
Horn.ell.a software is an extremely intensive numerical application. The program contains hundreds of numerical mathematics algorithms, some of which are extremely large and place very high demands on the CPU's floating point performance. Horn.ell.a software requires a full 32 bit operating system and can be installed in any personal computer with the following minimum system requirements:

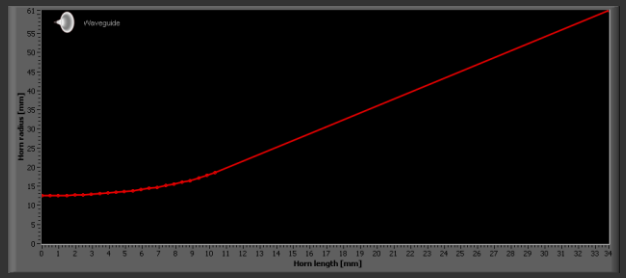
- Pentium IV processor (suggested 1GHz)
- 250 MB RAM (suggested 1GHz)
- Mouse and Keyboard
- 300 MB free HDD space
- 800 x 600 resolution video adapters (suggested 1280 x 720)
- Microsoft Windows XP, 7, 8, 8.1, 10 (suggested Win7)
- Adobe Acrobat Reader

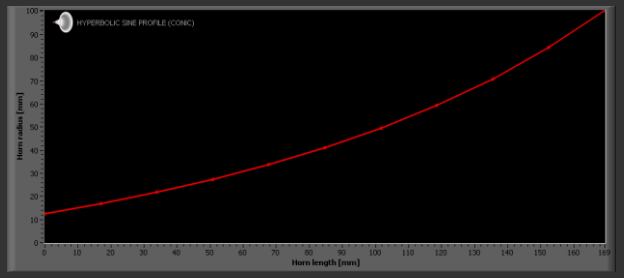
SOFTWARE INSTALLATION

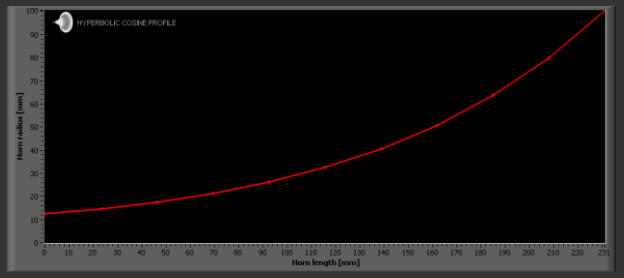
- Delete all previous installations, included Demo Version
- Place the distribution CD into your CD-ROM drive
- If the CD does not AutoRun, locate and run the Horn.ell.a.exe file
- Follow the instructions on the screen
- After installation Shutdown and Restart OS
- Run Horn.ell.a from relative link on desktop or from SpeakerLAB folder on Start Menu
- At first launch Horn.ell.a create a code on desktop
- Send this code to the factory: copy or attach it in the e-mail info@speakerlab.it

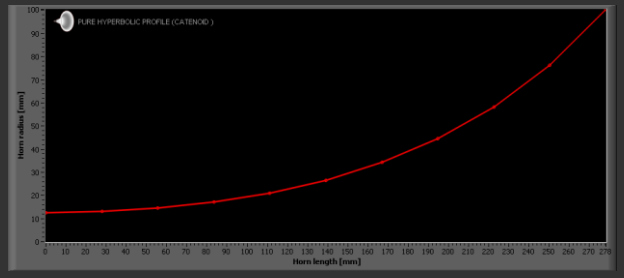
PROFILE EXAMPLES



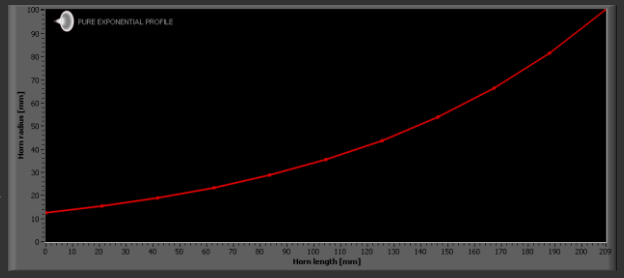


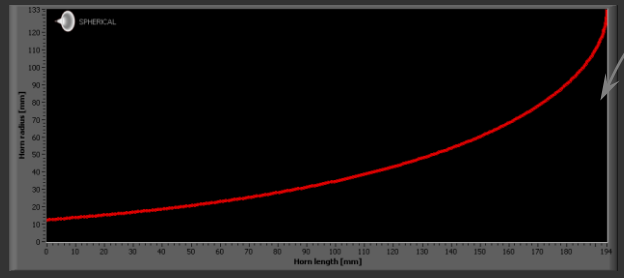


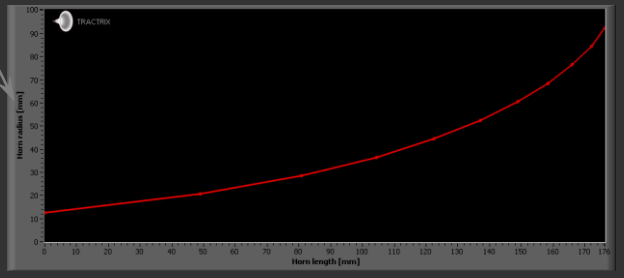




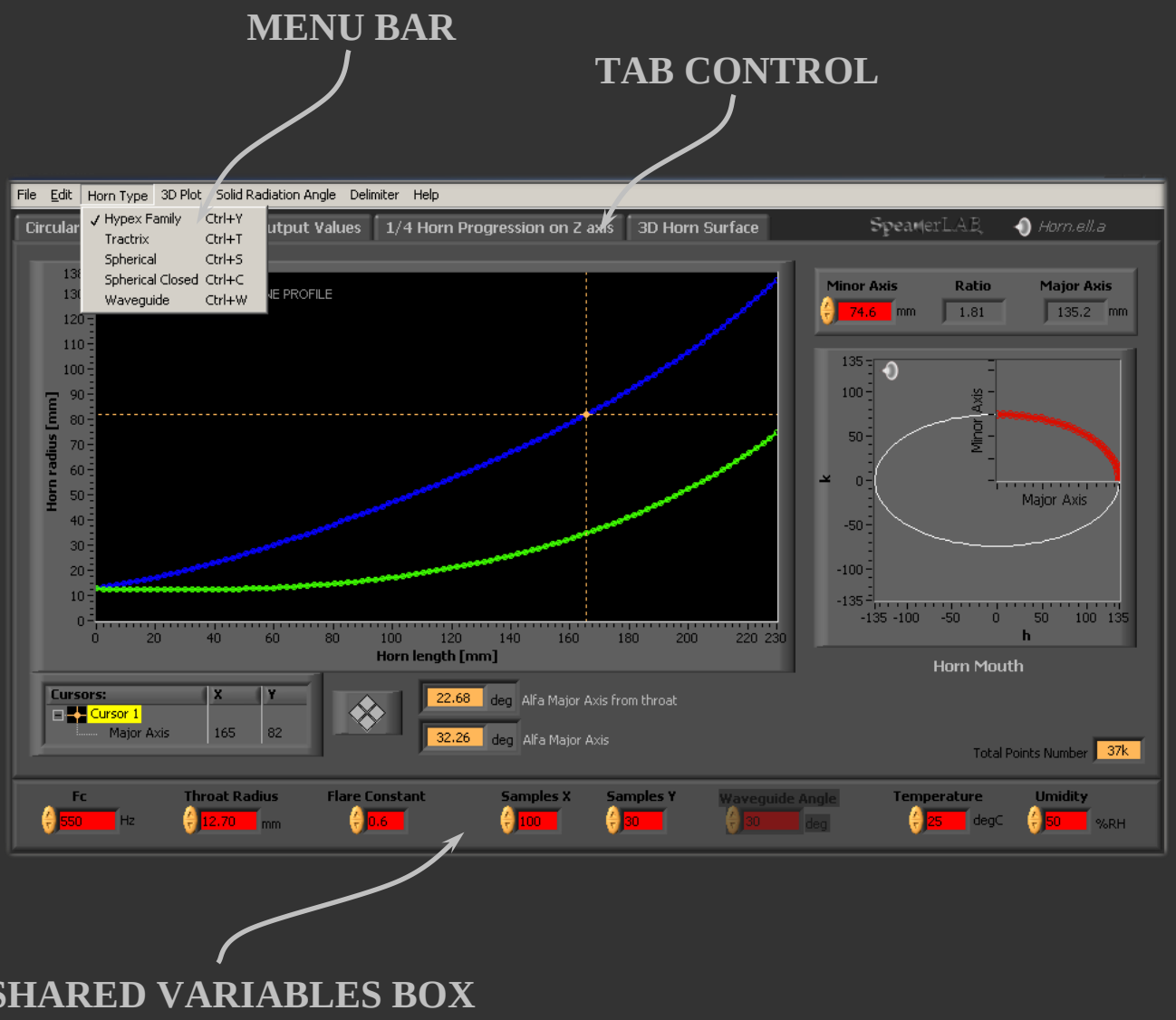
PROFILE
EXAMPLES







INTERFACE OVERVIEW

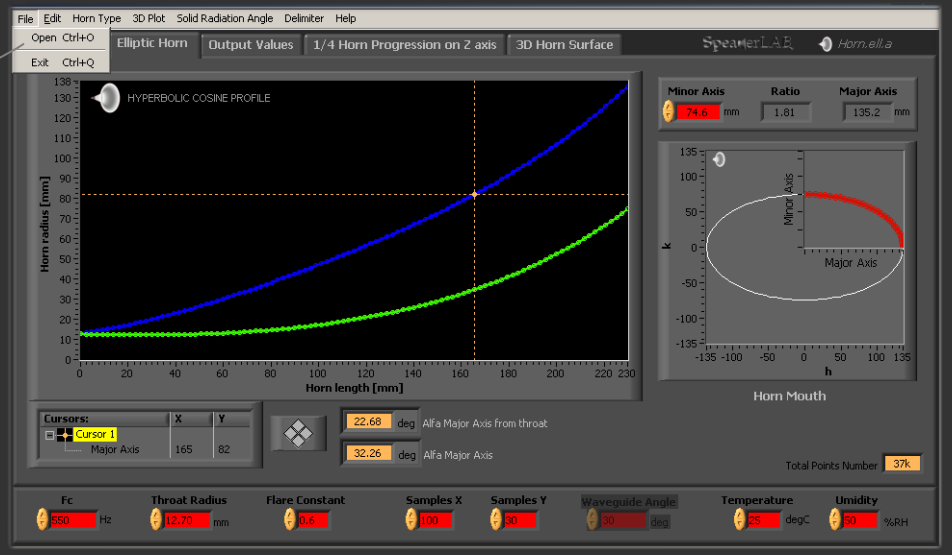


MENU BAR

File

Open **Ctrl+O**
Select a *.DAT file to read and open a saved project from “Horn db” database

Exit **Ctrl+Q**
Quit and exit from Horn.ell.a. After you select Exit the software ask you a confirmation of this action

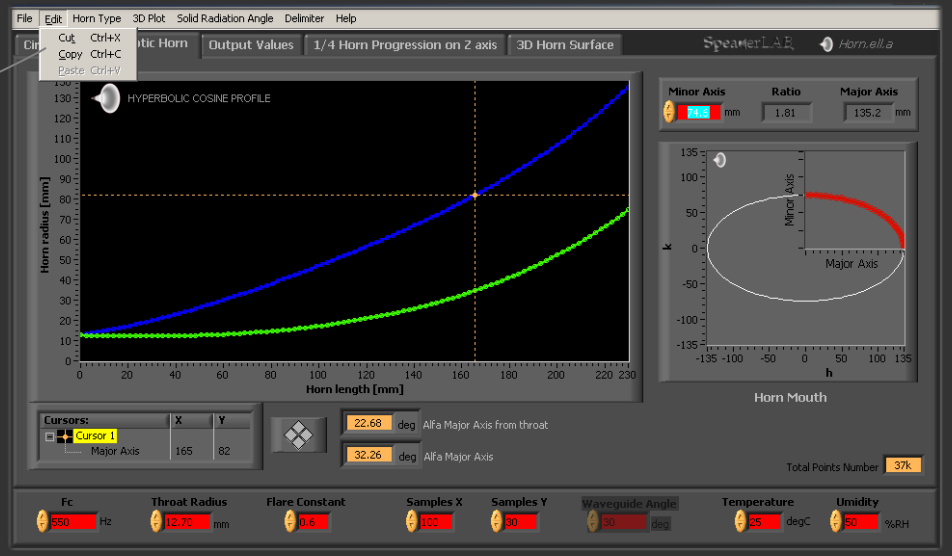


Edit

Cut **Ctrl+X**
Cut data from clipboard

Copy **Ctrl+C**
Copy data from clipboard

Paste **Ctrl+V**
Paste data into clipboard



Horn Type

Hypex Family **Ctrl+Y**
Hyperbolic expansions are:
1) Catenoid (FC=0)
2) Exponential (FC=1)
3) Hyperbolic Cosine (FC<1)
4) Hyperbolic Sine (FC>1)
5) Conic (FC>>1)
Any value of FC is possible (0<FC<+∞)

Tractrix **Ctrl+T**
Tractrix expansion

Spherical **Ctrl+S**
Spherical expansion

Spherical Closed **Ctrl+C**
Spherical Closed expansion

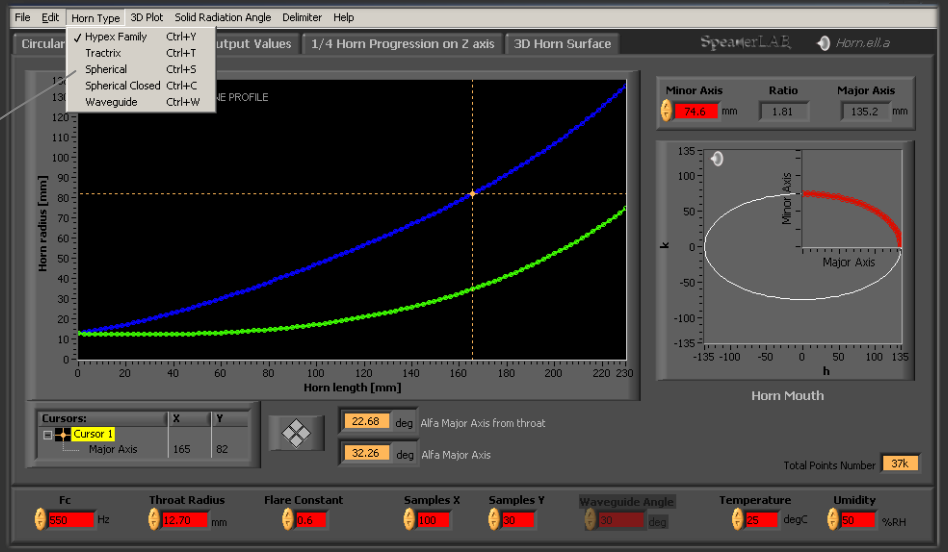
Waveguide **Ctrl+W**
Quadratic Waveguide expansion

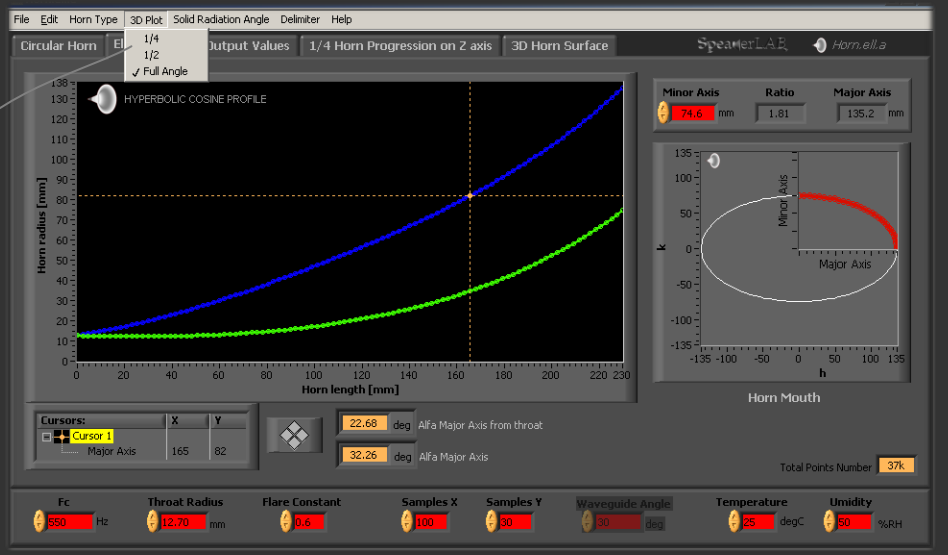
3D Plot

¼
Plot ¼ of the geometry

½
Plot ½ of the geometry

Full Angle
Plot entire geometry





Solid Radiation Angle

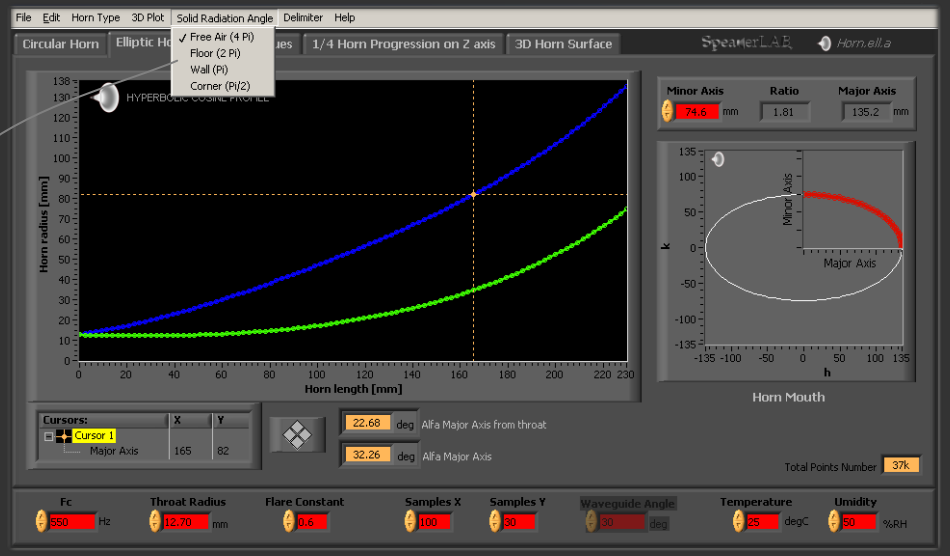
Free Air (4π)
Free space placement

Floor (2π)
Floor placement

Wall (π)
Floor placement against a wall

Corner (π/2)
Corner placement

Use **4π** usually for mid and high frequency horn, the others for low frequency



Delimiter

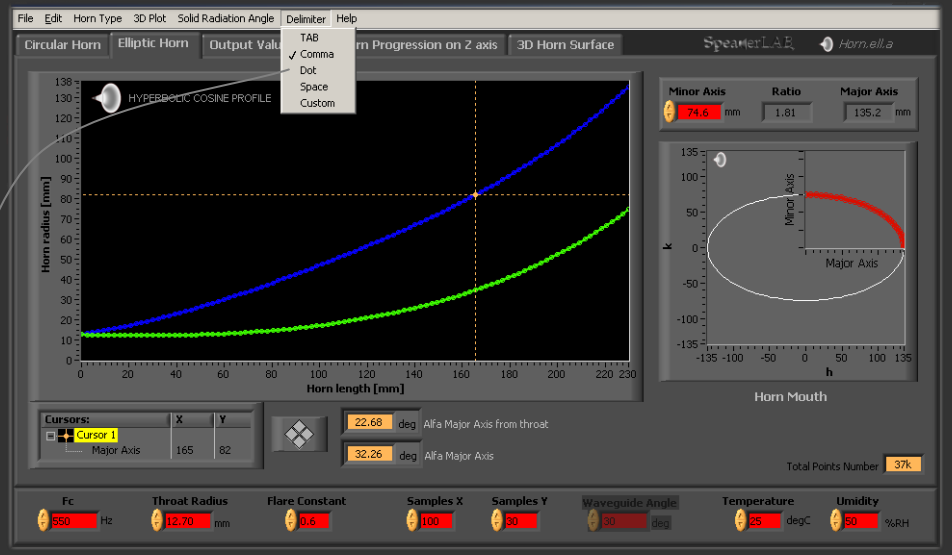
TAB
Saved data separated by TAB

Comma
Saved data separated by comma

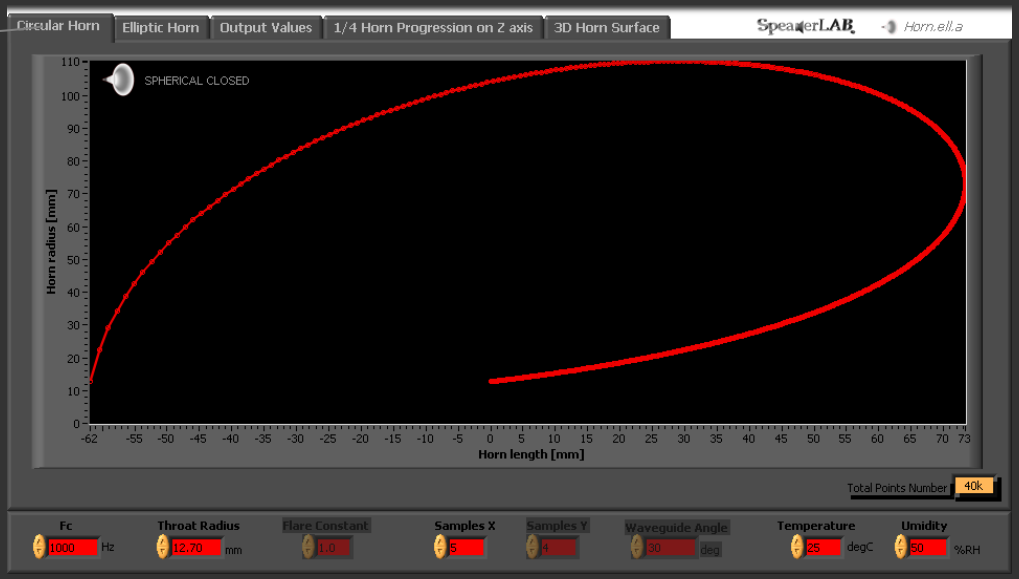
Dot
Saved data separated by dot

Space
Saved data separated by space

Custom
Saved data separated by a free custom delimiter



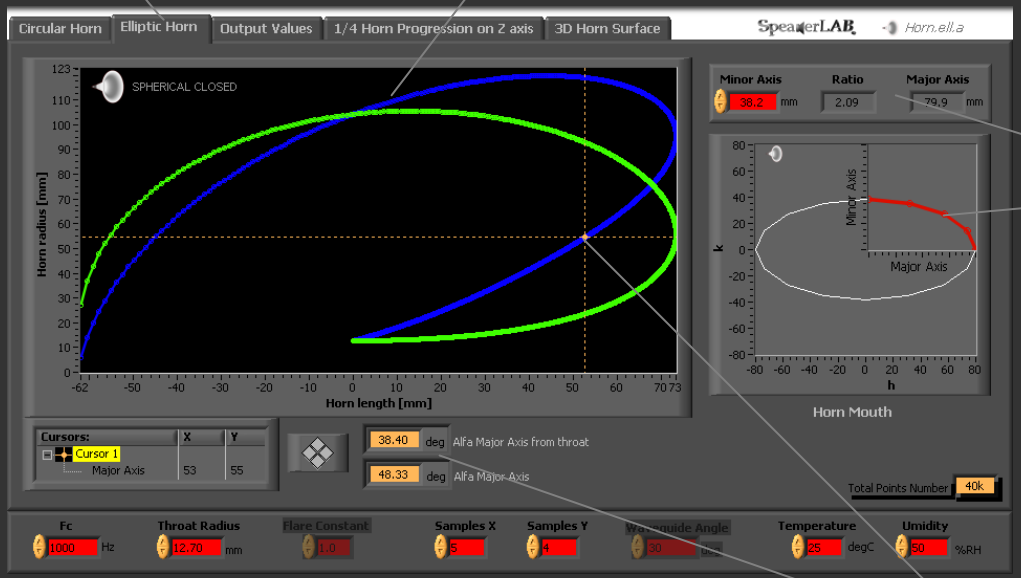
TAB CONTROL



Circular Horn

In the first TAB you can edit the common variables to modify the circular mouth horn shape. In this graph is visible the axis symmetric ½ section profile. On Y axis there is the horn radius, on X axis the horn length.

In the graph area are visible the axis symmetric ½ sections profile along the **Minor Axis** (green spline) and **Major Axis** (blue spline). On Y axis there is the horn radius, on X axis the horn length.



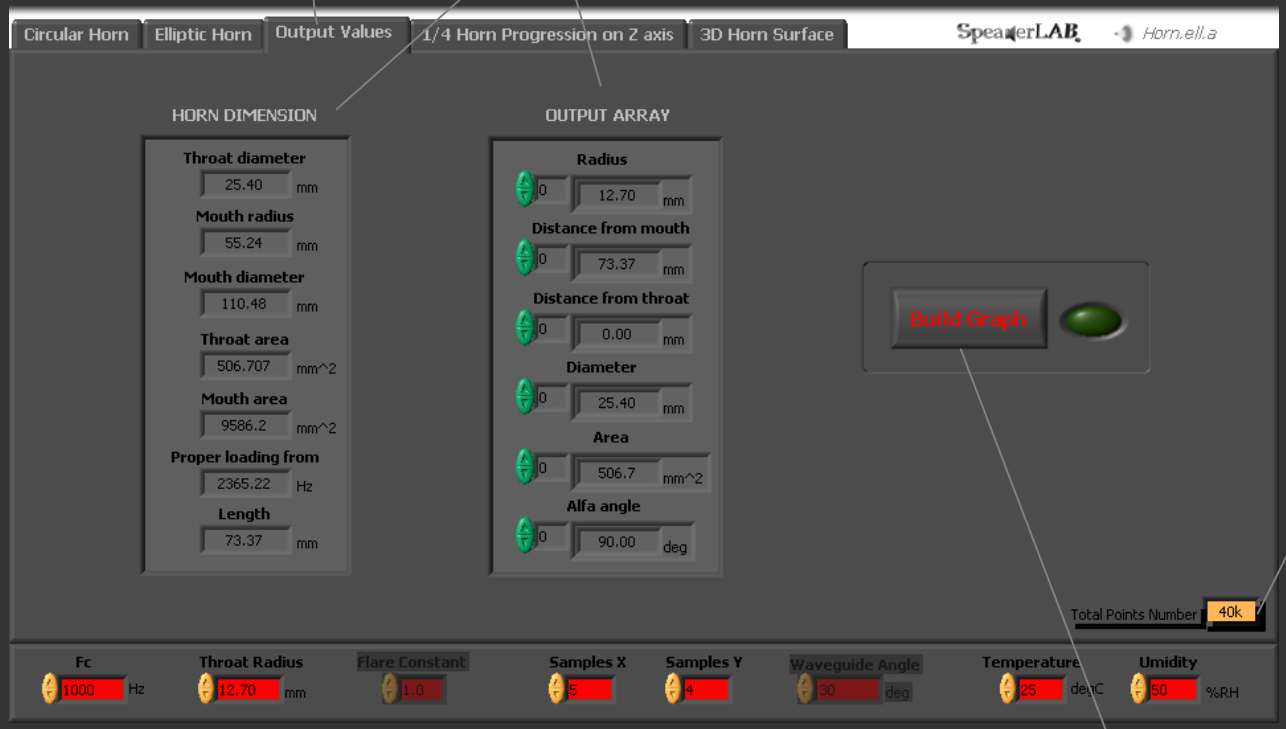
In the **Horn Mouth** graph there is the drawing of mouth. In the **upper box** is possible to edit **Minor Axis** value to give the required aspect ratio of mouth shape. Aspect Ratio is an indicator of the horizontal and vertical coverage angle.

In some cases it's useful to know the aperture angle down to the horn profile.
In ex. in compression driver it's possible to connect the throat initial section with driver exit.
Dragging cursor position **(yellow point)** and move along splines permits to obtain the aperture angles.
Aperture angle from coordinate (0,Y) to actual cursor position (upper yellow display).
Aperture angle of the segment line before cursor position (lower yellow display).

Elliptic Horn

In the second TAB you can edit the common variables to modify the pseudo elliptic horn shape. In the **left graph** is visible the axis symmetric ½ section profile. In the right graph there is the horn mouth.

On the **left box** there are single values. On the **right box** there are the array values. Each array dimension matches the Sample X integer.



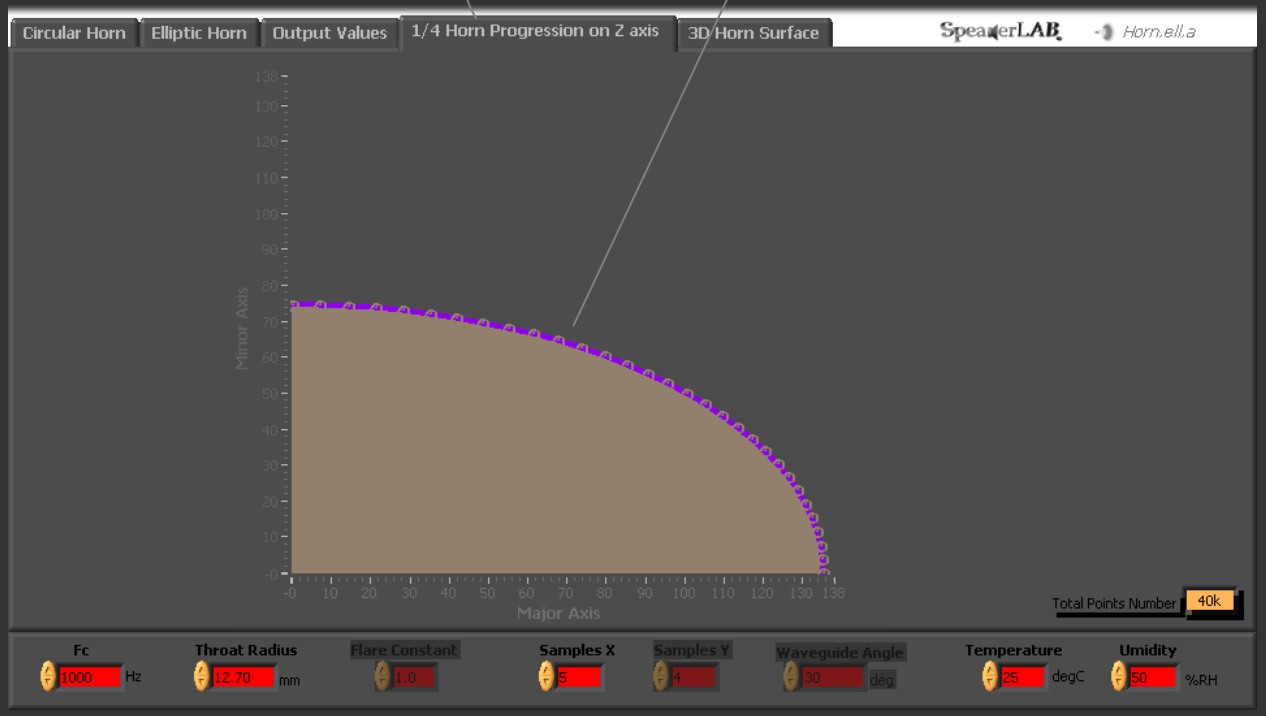
Before push **Build Graph** button see **Total Points Number**, if this is too high on 3D Plot Menu Bar select ½ or ¼ of the total geometry.

Output Values

In the third TAB you can visualize horn dimension values and build the 3D graph project.

When you terminate the project and set all parameters, you can build 3D Graph.

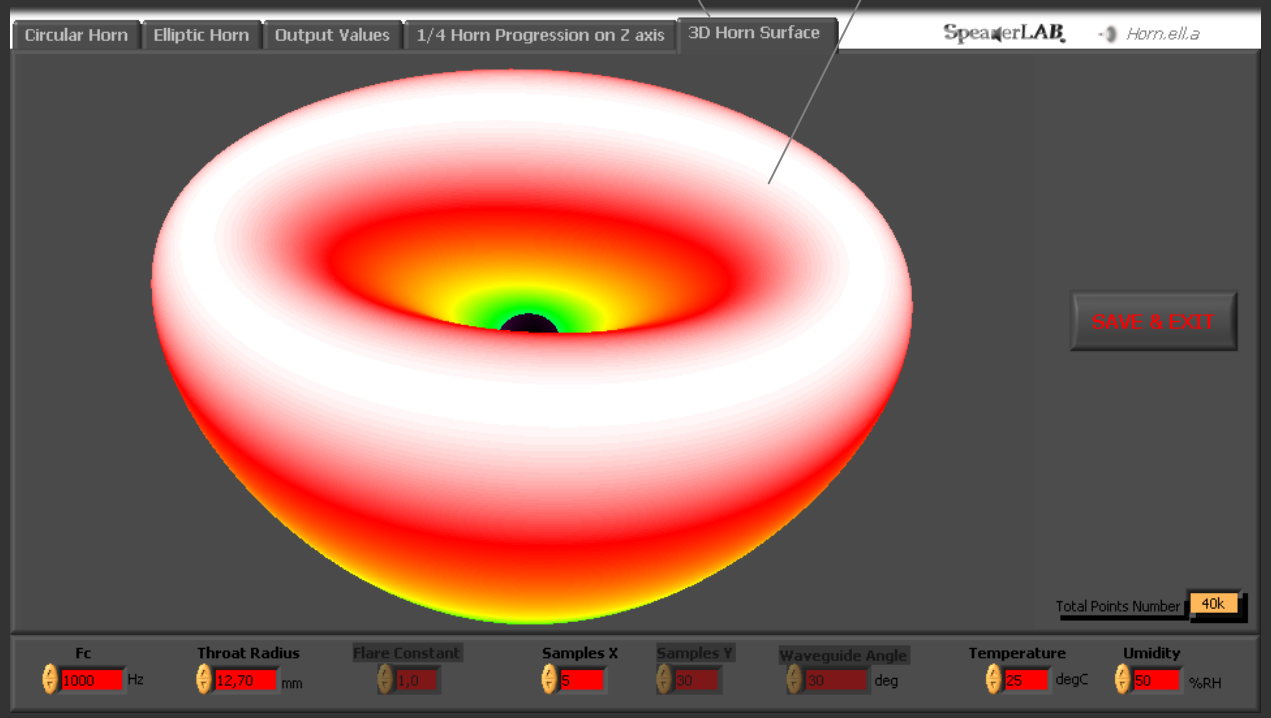
In this graph Horn.ell.a interpolate the functions and integrate the internal mesh for each sample X section down to Z axis.



¼ Horn Progression on Z axis

In the forth TAB you can visualize a quarter of horn progression on Z axis.

It’s possible to drag and rotate the 3D view, then save the project in database.



3D Horn Surface

In the fifth TAB you can visualize final horn design and build the 3D graph project.

SHARED VARIABLES BOX

Waveguide Angle
Waveguide Angle is the semi-aperture angle of the circular horn.

To change the aperture angle in different planes (horizontal and vertical) setting the **Minor Axis** in the **Elliptic Horn TAB**.
To read the semi-aperture angle in different planes you can put **cursor** at the mouth of horn, reading minor or major axis.

Fc
Frequency cut-off is one of the values that mainly influence the horn size.

Minimum Fc= 1Hz
Maximum Fc= depends by other input parameters.

Throat Radius
Throat Radius is the circular radius of the horn throat.

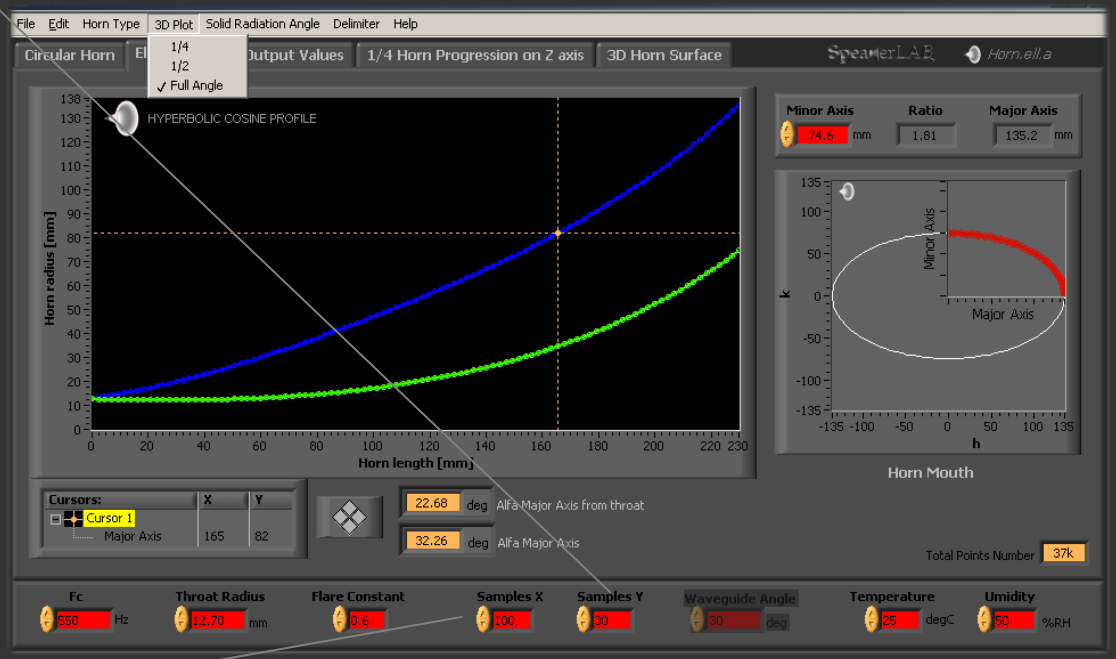
Flare Constant
Flare Constant is the degree of hyperbolic expansion. (Active for Hypex Family only)
If Flare Constant= 0 the expansion is Catenoid.
If Flare Constant= 1 the expansion is purely Exponential.
If Flare Constant< 1 the expansion is Hyperbolic Cosine.
If Flare Constant> 1 the expansion is Hyperbolic Sine.
If Flare Constant tends to +∞ the expansion is Conic.

Temperature
Environment working temperature of the horn.

Humidity
Environment working humidity of the horn.

Sample Y
Samples Y is the quantity of segments to split a quarter of the horn mouth profile (see the red line of **Horn Mouth** graph).

When you select a ½ **3D Plot**, Sample Y is multiplied by 2.
When you select a **Full Angle 3D Plot**, Sample Y is multiplied by 4.



Note: you need to pay attention to the increment of **Total Points Number** under process when select a ½ or **Full Angle 3D Plot**, or when is necessary to increase the precision of horn design expanding the number of Samples X, Y.

Sample X
Samples X is the quantity of segments to split the horn length.
1) In the case of **Hypex Family** and **Tractrix** shape, Sample X is the quantity of segments to build the profile.

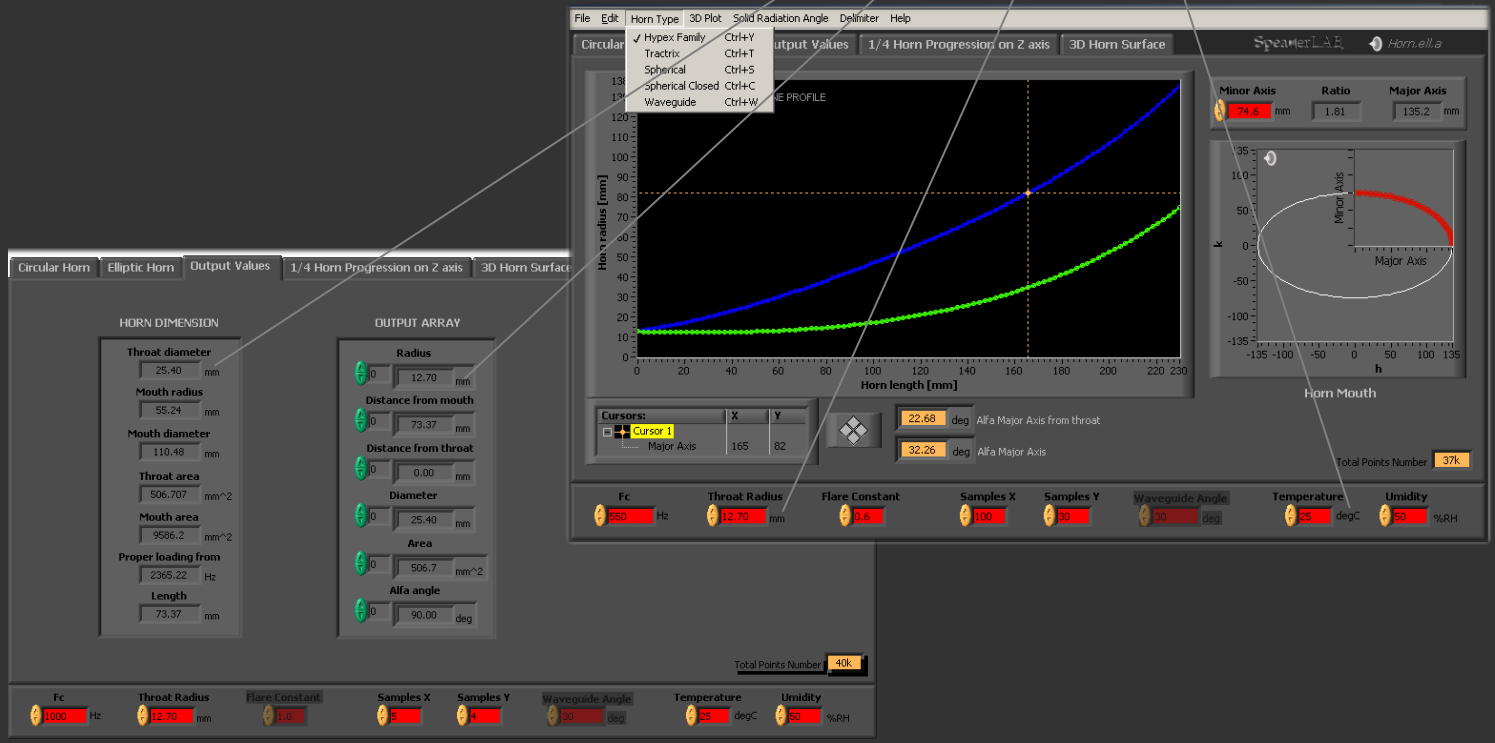
2) In the case of **Spherical** and **Spherical Closed** shape, Sample X is the multiplication of a minimum quantity of superimposed segments. Particularly in this case you need to pay attention to the Total Points Number, in some cases it's possible the computer memory is full, in this case start with number of samples= 1.

3) In the case of **Waveguide** profile, Sample X is the quantity of segments only for the curved section of the horn.

UNITS AND PREFIXES

Horn.ell.a recognizes both **SI units** and units from other systems of measurement. It's possible to directly convert unit string writing on the unit box your preferred unit.

Some length unit examples are **m**, **cm**, **mm**, **in**, **ft**, etc.
Some temperature unit examples are **K**, **degC**, **degF**, etc



Horn.ell.a recognizes also a prefix to a unit. To apply a preferred prefix select the prefix in this listbox.

SI prefixes

- y yocto (10^{-24})
- z zepto (10^{-21})
- a atto (10^{-18})
- f femto (10^{-15})
- p pico (10^{-12})
- n nano (10^{-9})
- u micro (10^{-6})
- m milli (10^{-3})
- c centi (10^{-2})
- d deci (10^{-1})
- da deka (10^{1})
- h hecto (10^{2})
- k kilo (10^{3})
- M mega (10^{6})
- G giga (10^{9})
- T tera (10^{12})
- P peta (10^{15})
- E exa (10^{18})
- Z zetta (10^{21})
- Y yotta (10^{24})

SAVED DATA FORMAT

Saved Data
Inside Horn.ell.a.exe directory path, the software automatically creates the database **Horn db and** putting inside all saved designs.

When saving the design Horn.ell.a generates a directory with the name you selected.

If you don't type any name for a design, Horn.ell.a save the files in the **Last Routed** directory. This operation is useful in case of forget to type a name, or due to fortuity button pressing.

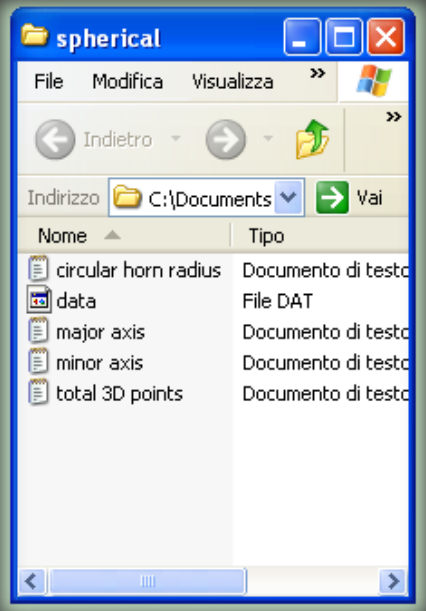
Each directory inside **Horn db** appears with this style

Circular horn radius, **major axis**, **minor axis** are 2D design text files, with this format:
X,Y

Total 3D points is 3D design text file, with this format:
X,Y,Z

(X,Y,Z are floating-point numbers by 6 fractional format digits)

Data is a .DAT file, it's required to reopen the project with all saved configuration.



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