Horn.ell.a 2.0

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INTRODUCTION

ABOUT THIS MANUAL

This User's Manual explains the **Horn.ell.a** software version 2.0.0.

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 software user interface.

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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SpeakerLAB provides detailed electronic manuals and on-line help within the program as the primary source for user information and assistance regarding the use of this product. If these sources do not contain the answers to your questions, for technical problems, bug reports, or suggestions for future software enhancements contact SpeakerLAB via any of the following methods:

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

Technical support is free 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

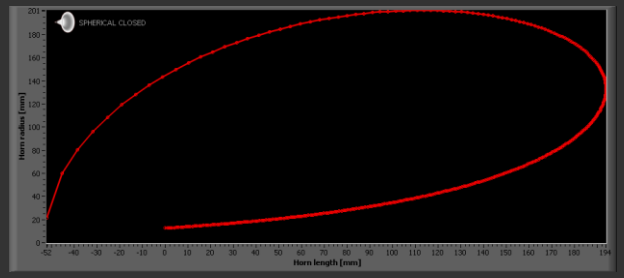
Horn.ell.a software is an extremely intensive numerical application. The program contains hundreds of numerical mathematics algorithms, some of which are extremely large and place very high demands on the CPU's floating-point performance. Horn.ell.a software requires a full 32 bit operating system and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

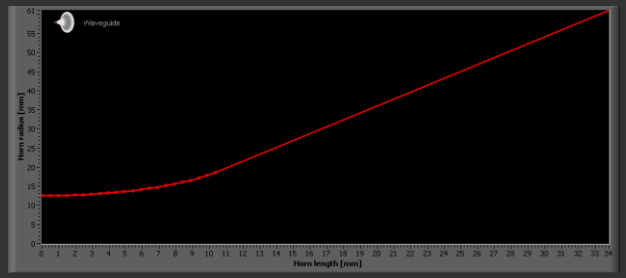
- Pentium IV processor
- 500 MB RAM
- Mouse and Keyboard
- 300 MB free HDD space
- 800 x 600 resolution video adapters
- Microsoft Windows XP, 7, 8, 8.1, 10
- Adobe Acrobat Reader

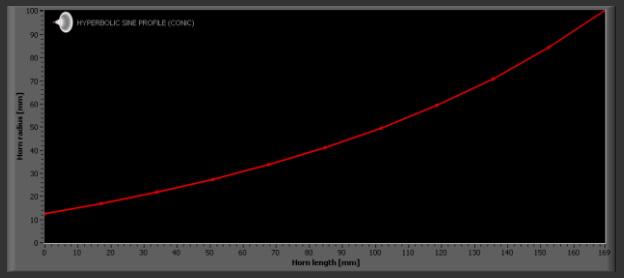
SOFTWARE INSTALLATION

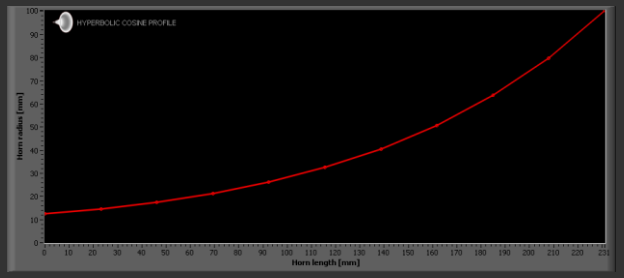
- Delete all previous installations, included Demo Version
- Place the distribution CD into your CD-ROM drive
- If the CD does not AutoRun, locate and run the Horn.ell.a.exe file
- Follow the instructions on the screen
- After installation Shutdown and Restart OS
- Run Horn.ell.a from relative link on 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

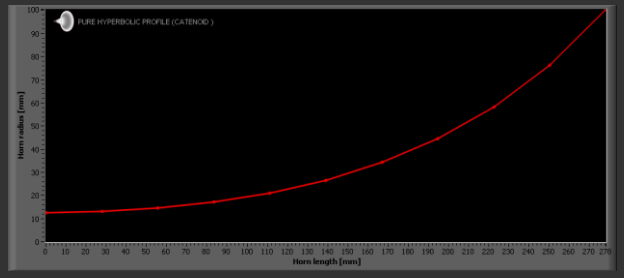
PROFILE EXAMPLES

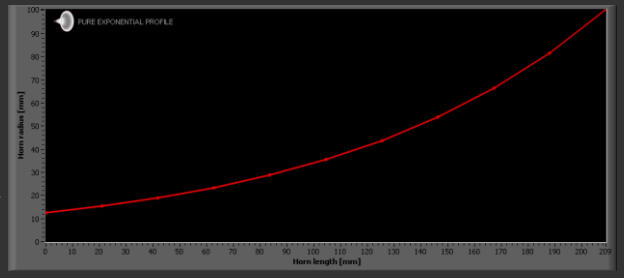




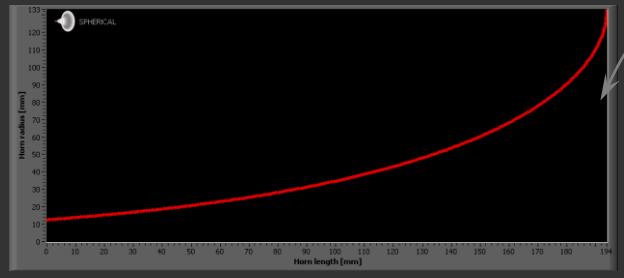


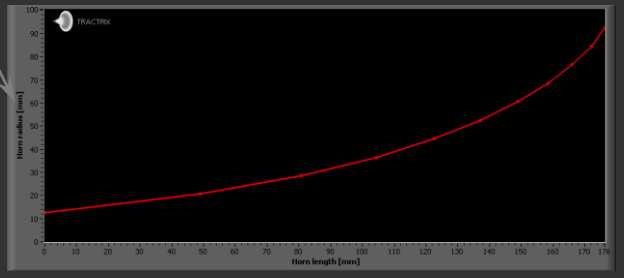






PROFILE
EXAMPLES





INTERFACE OVERVIEW

MENU BAR

TAB CONTROL

SHARED VARIABLES BOX

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 the Flare Constant 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 solid geometry

½
Plot ½ of the solid geometry

Full Angle
Plot entire solid geometry

Solid Radiation Angle

Free Air (4π steradian solid angle)
Free space placement

Floor (2π)
Floor placement

Wall (π)
Floor placement against a wall

Corner (π/2)
Corner placement

It's suggested to use **4π** usually for mid and high frequency horn, the other solid angles for low frequency

Delimiter

TAB
Saved data separated by TAB

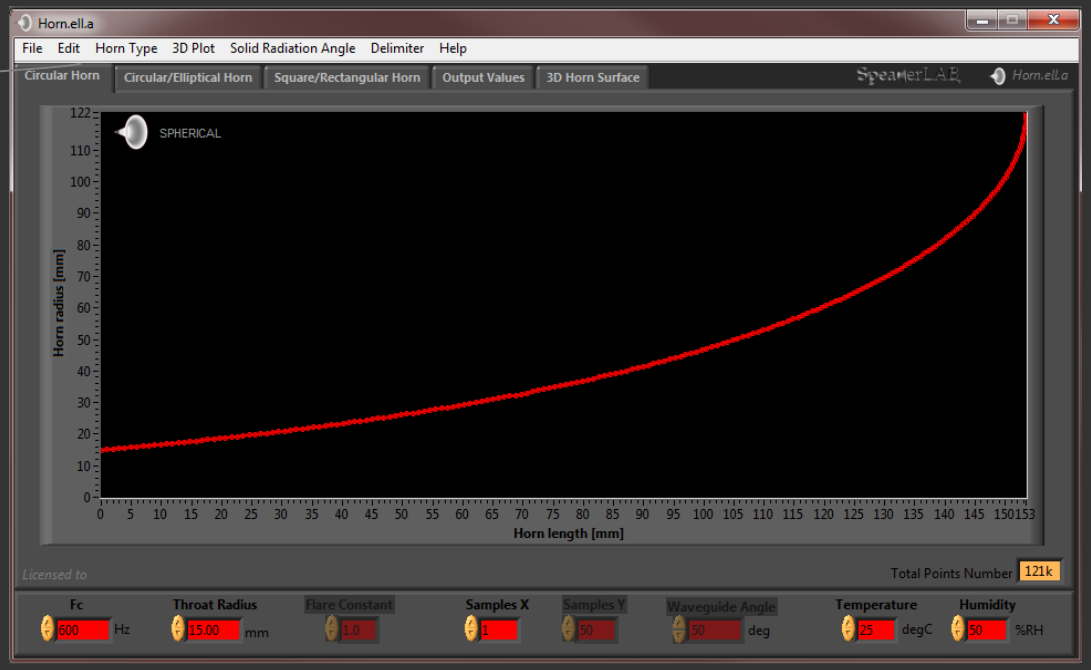
Comma
Saved data separated by comma

Dot
Saved data separated by dot

Space
Saved data separated by space

Custom
Saved data separated by a free custom delimiter

TAB CONTROL



Circular Horns

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

In the graph area there are the axis symmetrical 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.

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

Reset to back to the circular mouth.

Circular and Elliptical Horns

In the second TAB you can edit the common variables adapting the circular into pseudo-elliptical horns. On the left graph is visible the axis symmetrical ½ section profile. On the right graph is visible the horn throat and the mouth variation.

Moving the cursor it's possible to know the aperture angle down to the horn profile.
Very helpful for compression driver when connecting the horn throat initial section with driver exit.
Dragging cursor position **(yellow point)** and move along splines permits to obtain the aperture angle values.
Aperture angle from coordinate (0,Y) to actual cursor position (upper yellow display).
Aperture angle of the segment line before cursor position (yellow display).

Increasing the value of Corner Radius, it reduces sharp edges on acoustical path inside the horn.

Reset to back to the square mouth.

Square and Rectangular Horns

In the third TAB you can edit the common variables adapting the square into rectangular horns. On the left graph is visible the axis symmetrical ½ section profile. On the right graph is visible the horn throat and the mouth variation.

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 passing to the next TAB **Building Graphs** pay attention to the **Total Points Number**, if this is too high on 3D Plot Menu Bar select ½ or ¼ of the total geometry.

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

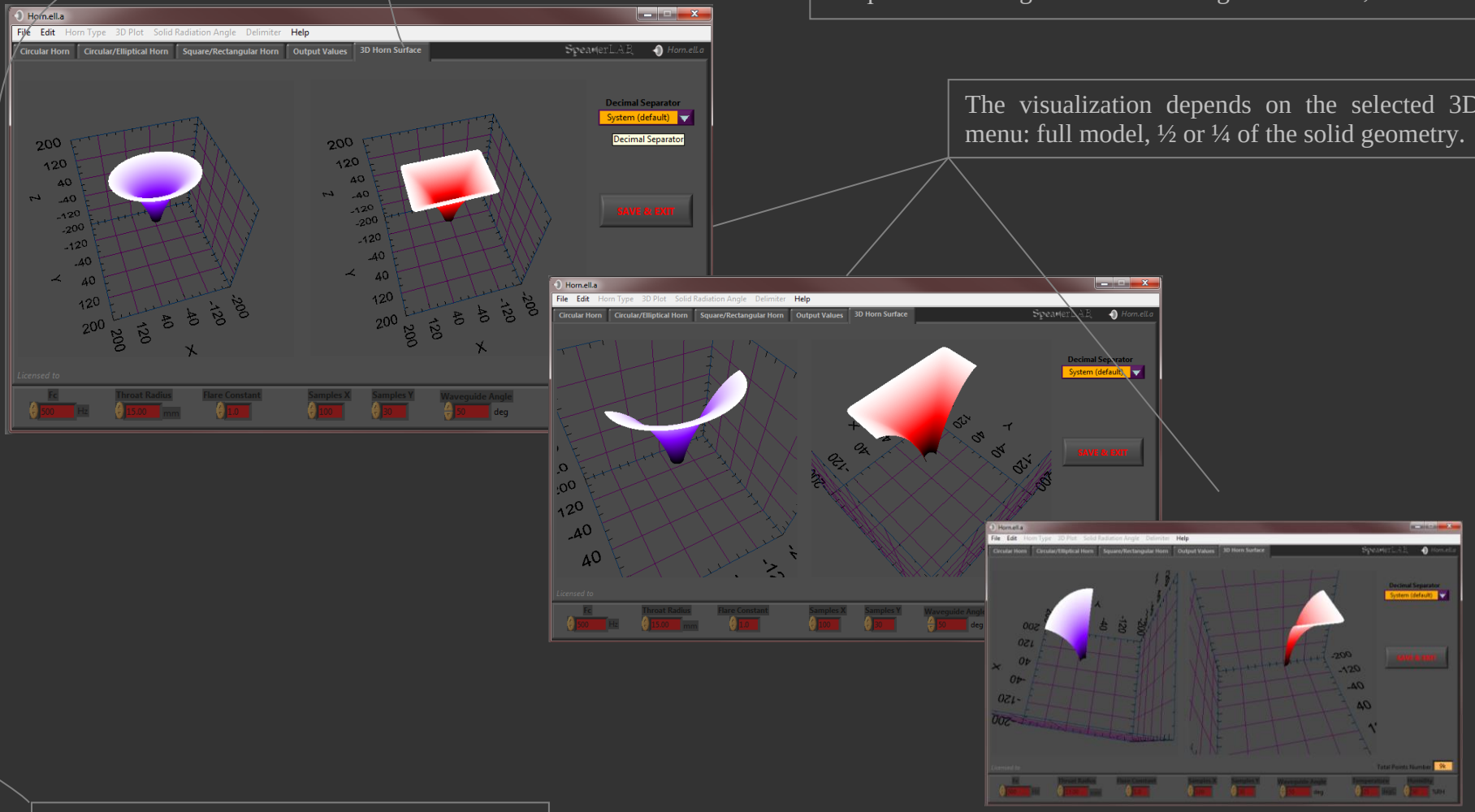
Output Values

In the fourth TAB you can visualize circular horn dimension values.

In this graph Horn.ell.a interpolates the functions integrating the boundary mesh and building the horn surface.

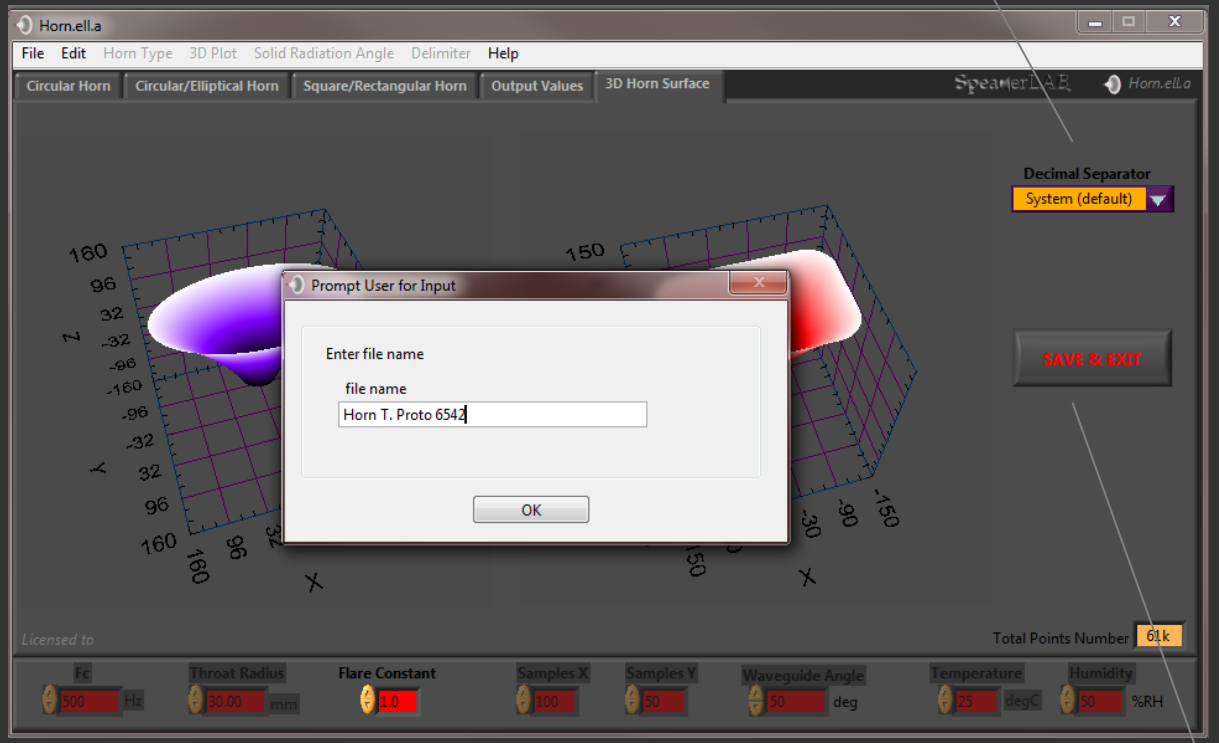
It’s possible to drag the model rotating the 3D view, before saving.

The visualization depends on the selected 3D Plot menu: full model, ½ or ¼ of the solid geometry.



In the fifth TAB you can visualize the final horn design and building the 3D graph

Before saving it's necessary to select the desired decimal separator. This is important for permitting to your CAD to open files. The same decimal separator is used for all saved files.



When SAVE & EXIT is pressed you can type the folder name.

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 **Elliptical or Rectangular 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= it depends by other input parameters.

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

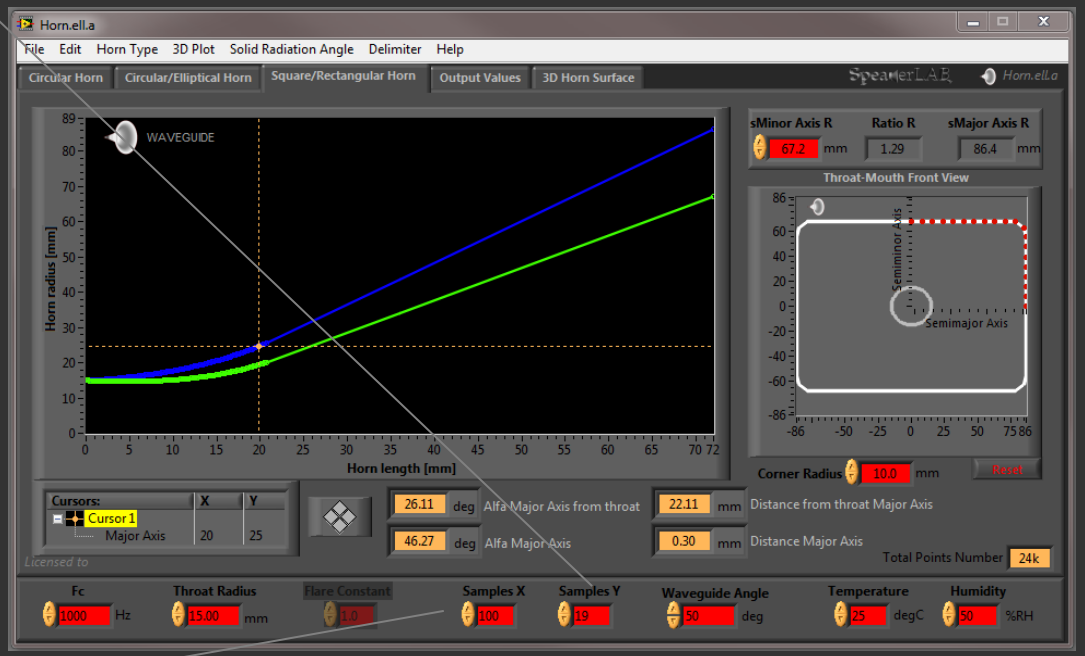
Flare Constant
Flare Constant is the degree of hyperbolic expansion.
(It is active for the Hypex Family only)
If Flare Constant= 0 the expansion is Catenoid.
If Flare Constant= 1 the expansion is purely Exponential.
If Flare Constant< 1 the expansion is Hyperbolic Cosine.
If Flare Constant> 1 the expansion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

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.



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.

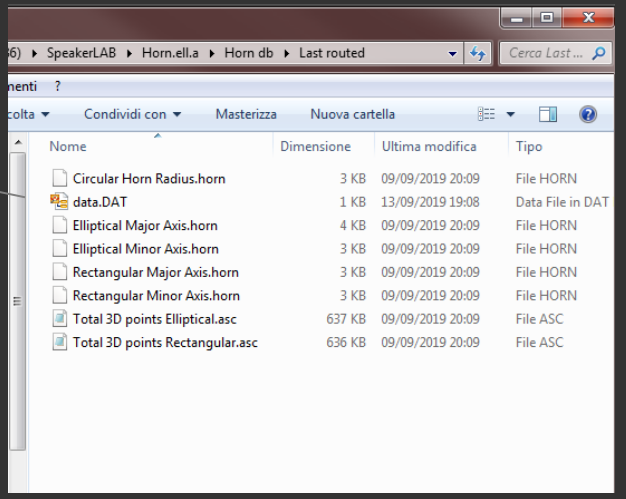
SAVED DATA FORMAT

Saved Data
Inside Horn.ell.a.exe directory path, the software automatically creates the database **Horn db** saving all horns 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. This will be the default project when running the software next time.

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



Circular horn radius, **major axis**, **minor axis** are 2D design text files, .horn extension and the following format:
X,Y

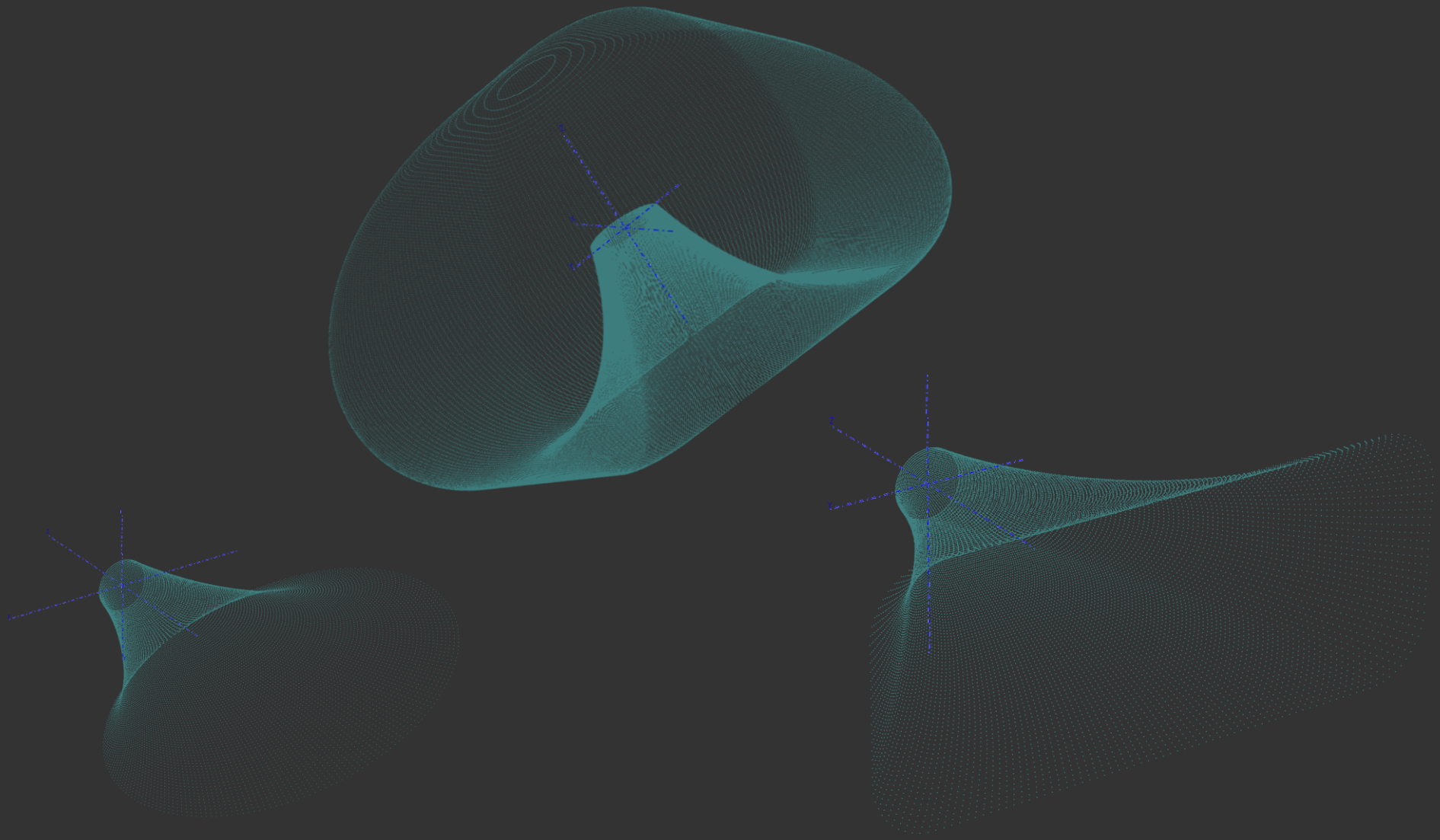
Total 3D points is 3D design .asc ASCII file and the following format:
X,Y,Z

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

Data is a .DAT file, it's required to re-open the project with saved configuration.

Note: you can modify .horn file extension in .asc, .txt or any other kind of file extension useful to import 2D data in your own spreadsheet or CAD system.

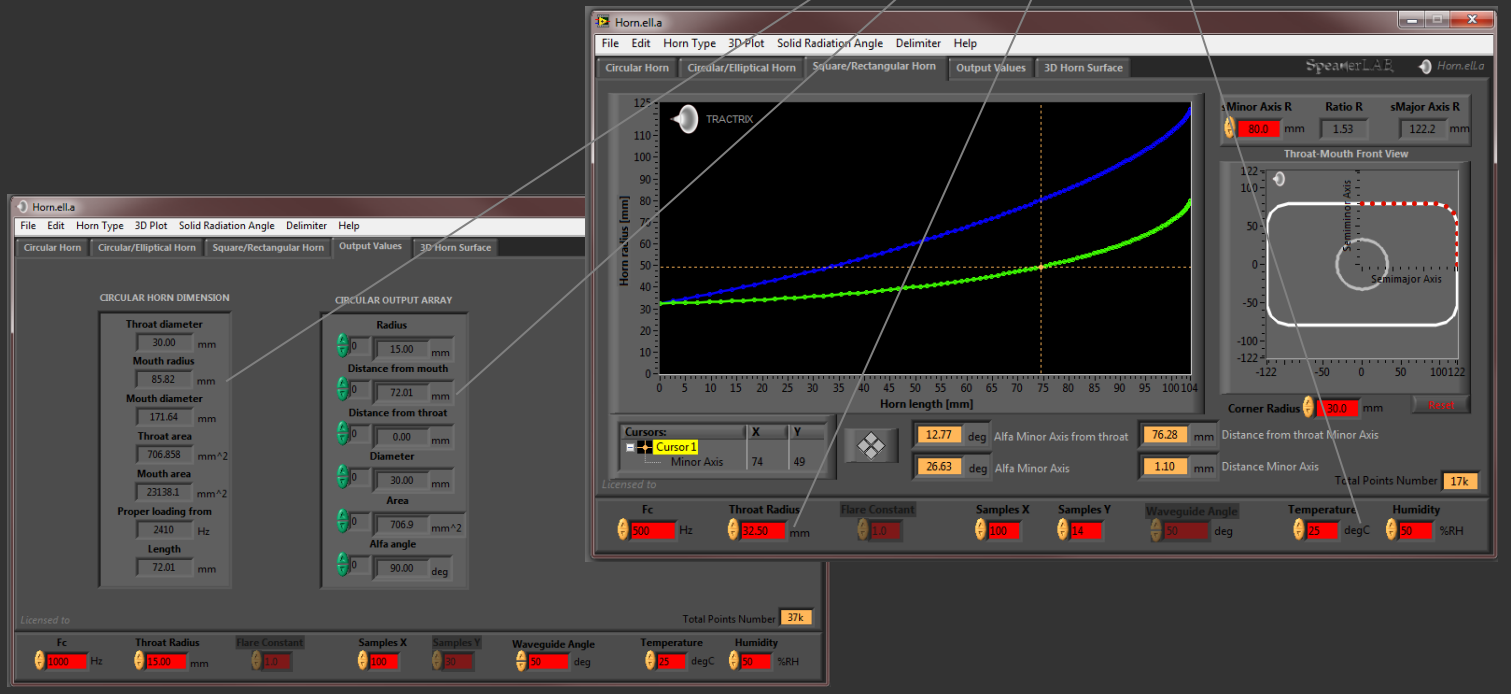
3D .asc file
Example of full geometry 3D models opened with a CAD after they have been saved with Horn.ell.a in .asc format.



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})

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