Phase Plug Support

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INTRODUCTION

ABOUT THIS MANUAL

This User's Manual explains the **PPS** software version 1.0.0.

WHAT THIS USER MANUAL DOES COVER

The PPS software is a tool to fast design 2D Phase Plug. There are several documents on many of the topics that PPS handles. This User Manual is intended not to explain Phase Plug theory, this issue is left to the reader to explore through the available literature, but only as a guide to allow the user to quickly become efficient with the user interface PPS software.

LICENSE AGREEMENT AND WARRANTY

THANKS

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

SpeakerLAB's WARRANTY

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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

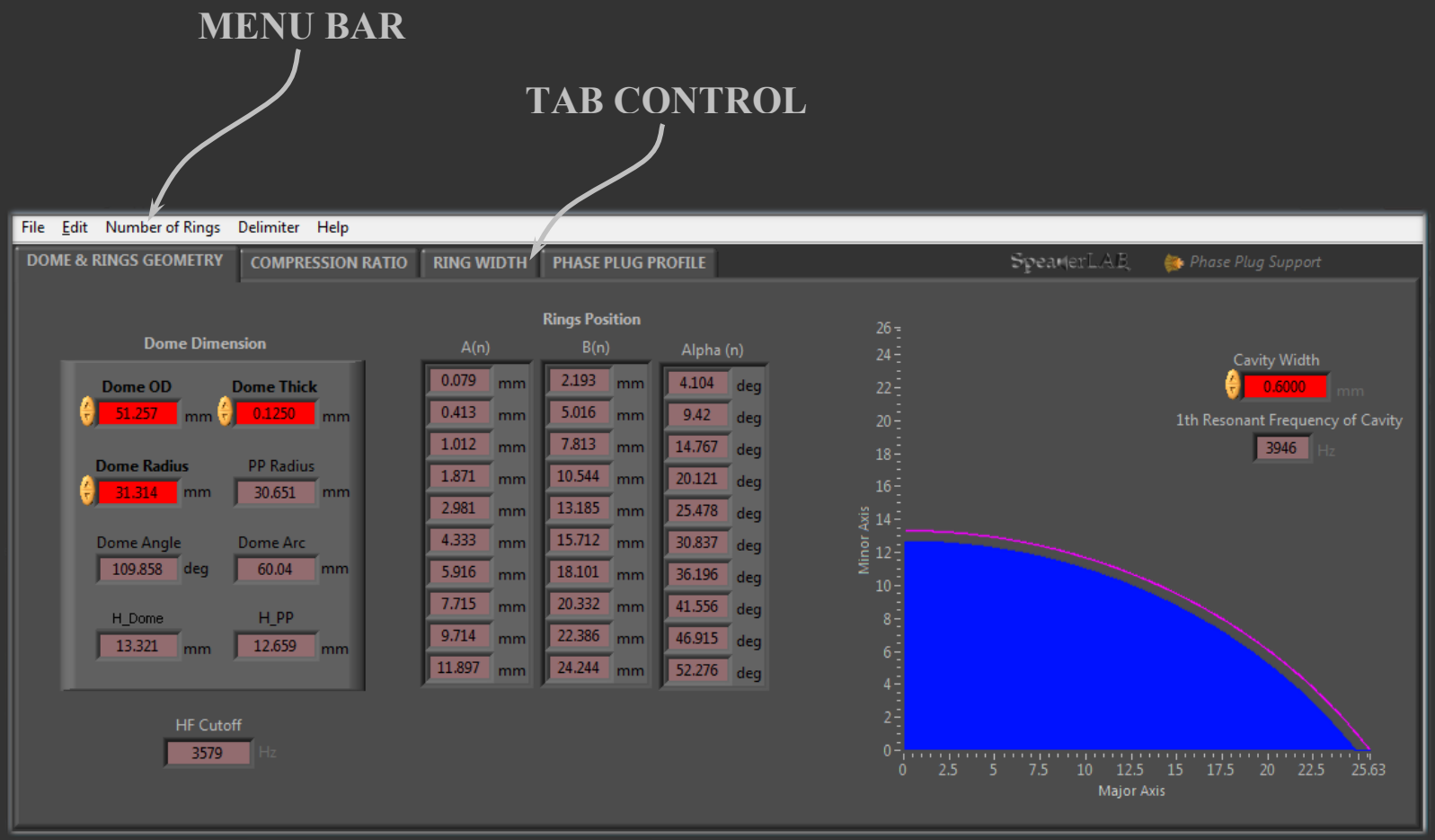
PPS software is an extremely intensive numerical application. The program contains hundreds of numerical mathematics algorithms, some of which are extremely large and place very high demands on the CPU's floating-point performance. PPS software requires a full 32 bit operating system and can be installed 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 Phase Plug Support.exe file
- Follow the instructions on the screen
- After installation Shutdown and Restart OS
- Run PPS from relative link on desktop or from SpeakerLAB folder on Start Menu
- At first launch PPS create a code on desktop
- Send this code to the factory: copy or attach it in the e-mail info@speakerlab.it

INTERFACE OVERVIEW

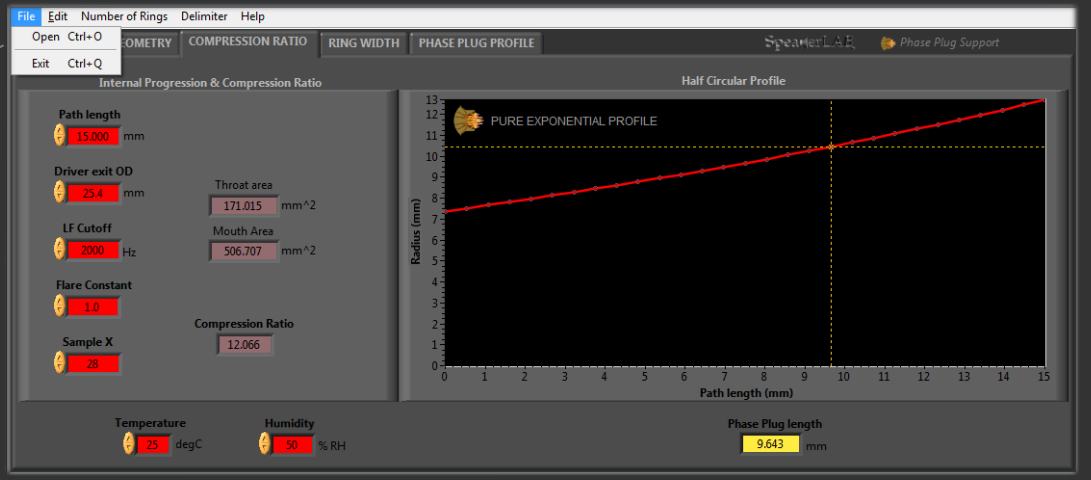


MENU BAR

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

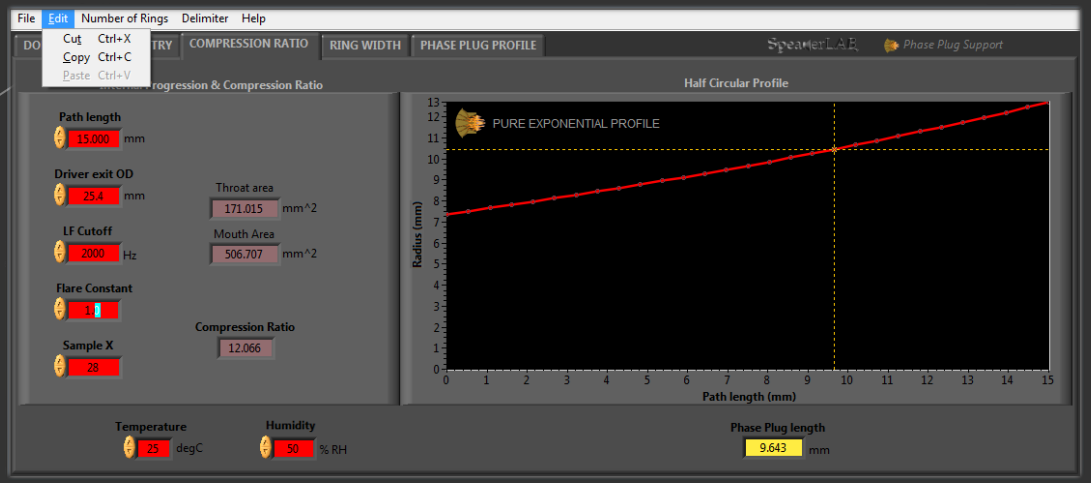


Edit

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

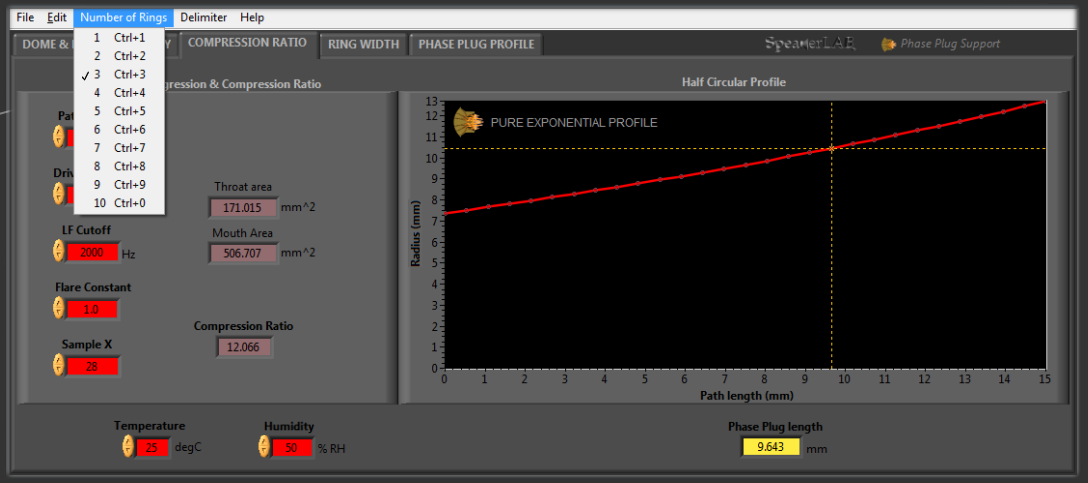
Copy **Ctrl+C**
Copy data from clipboard

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



Number of Rings

Number of phase plug rings. If NR= 1 there is a single channel. Max NR= 10.



Delimiter

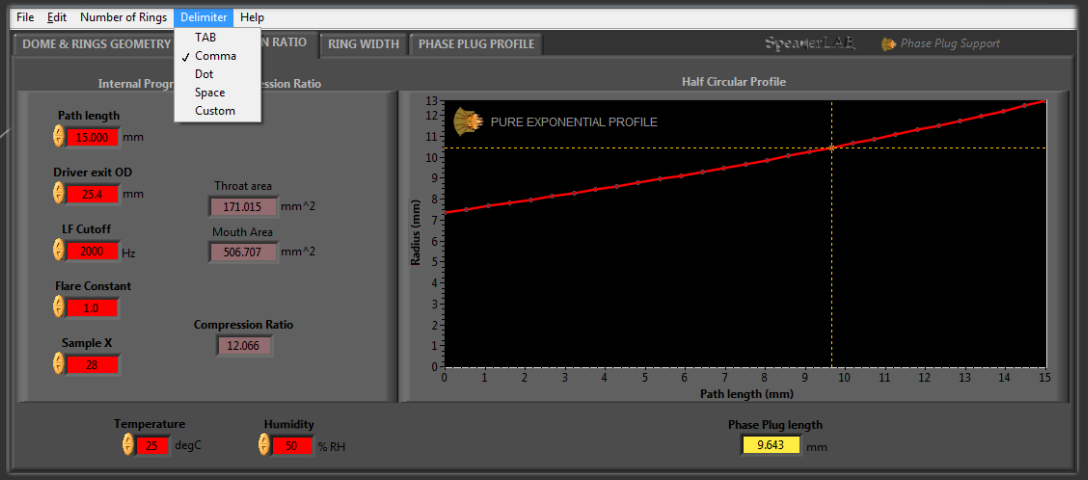
TAB
Saved data separated by TAB

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



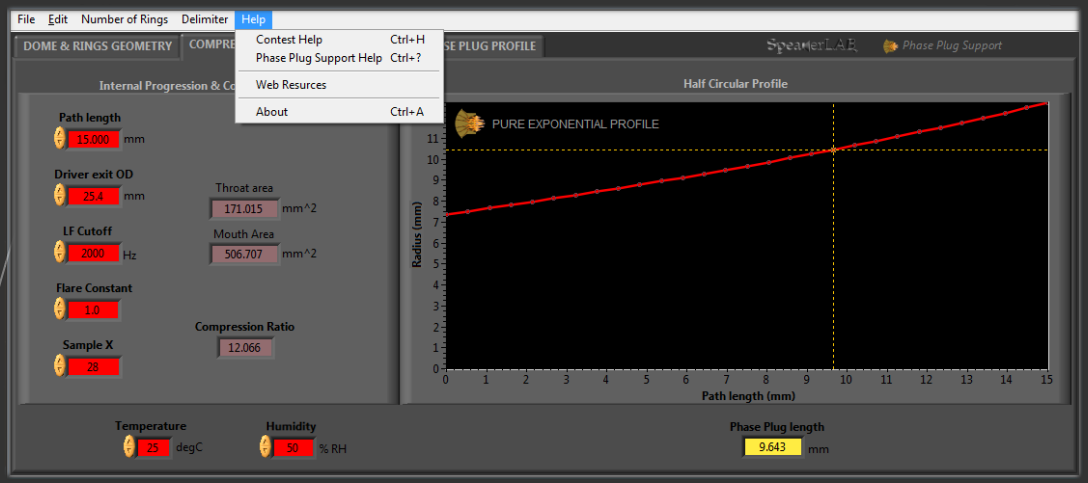
Help

Contest Help
Instantaneous on-line information on mouse passage

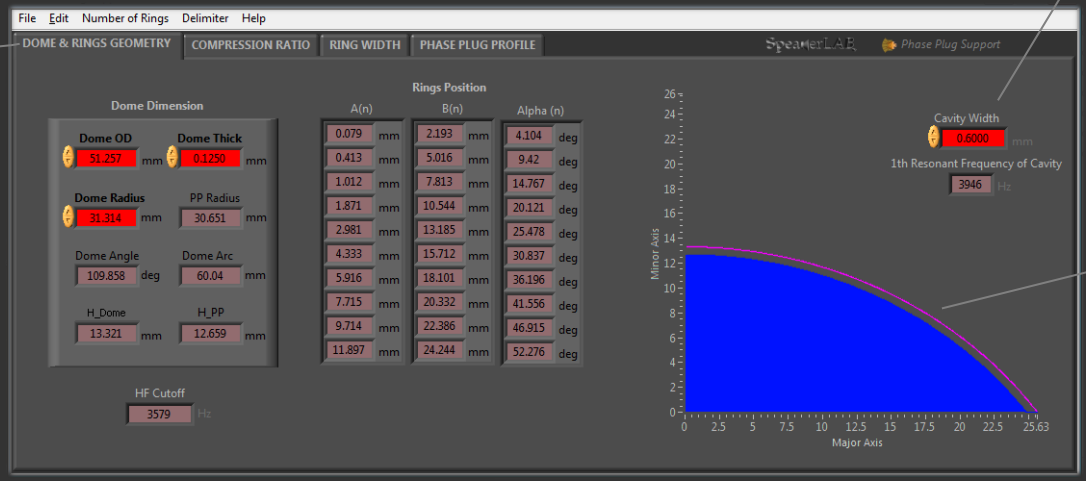
Phase Plug Support Help
Open this pdf manual

Web Resources
Open factory web site on a default internet browser

About
Open product information



TAB CONTROL

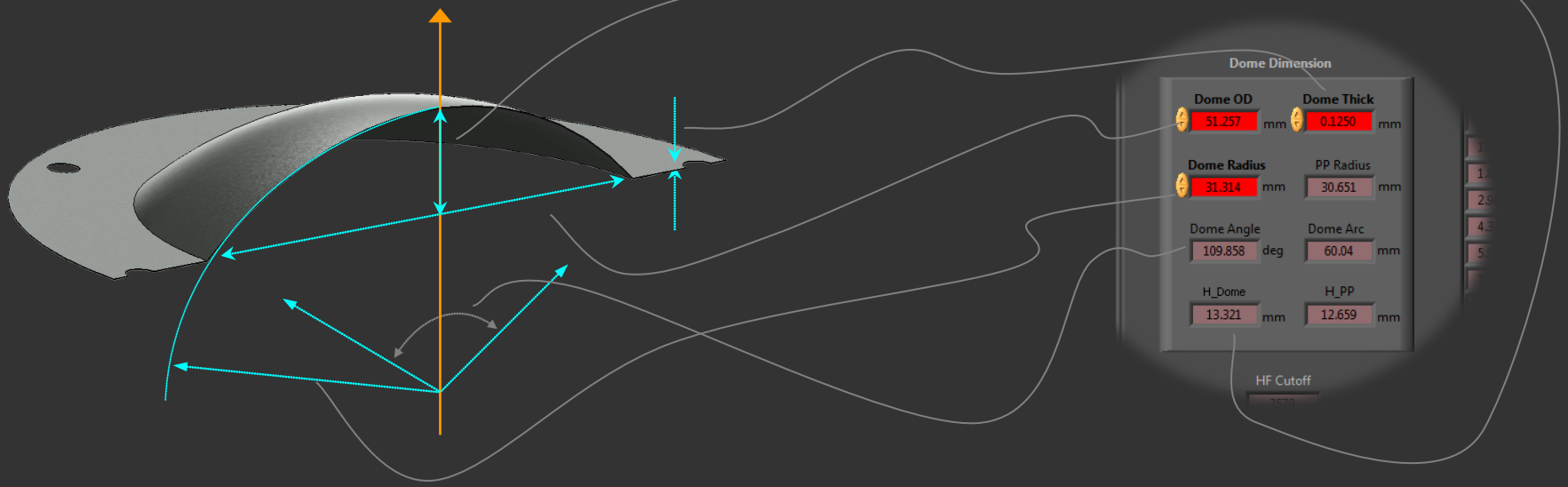


Cavity width
is the volume area between Dome and Phase Plug.
In other words, this gap is the distance between the inner diameter of the dome and the outer diameter of phase plug.

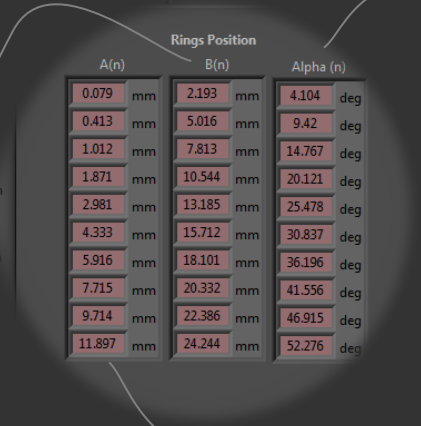
In this graph is visible the axis symmetric half section profile of **Dome** (pink line) and filled **Phase Plug** (blue area).

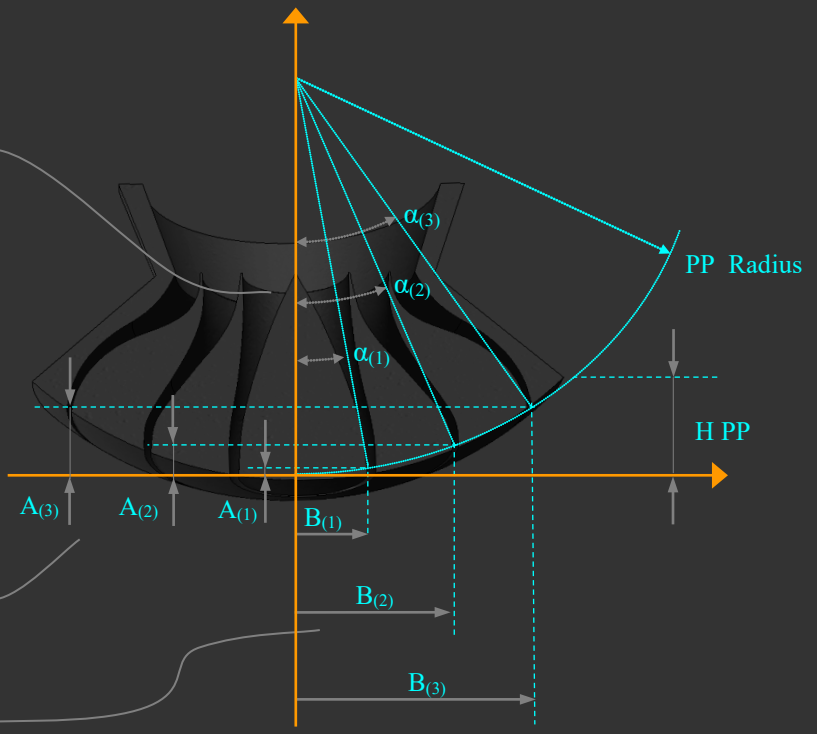
DOME & RINGS GEOMETRY

In the first TAB you can edit the dome variables (red displays). In the central table Phase Plug Support resolve the axis position and Alpha angle of each selected rings.



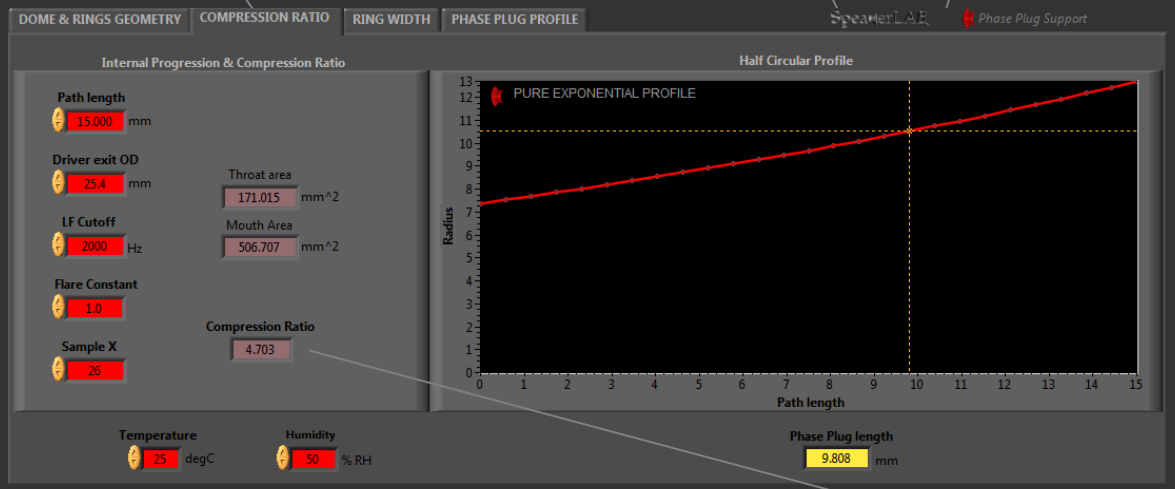
Dome Dimension
Dome OD
51.257 mm
Dome Thick
0.1250 mm
Dome Radius
31.314 mm
PP Radius
30.651 mm
Dome Angle
109.858 deg
Dome Arc
60.04 mm
H_Dome
13.321 mm
H_PP
12.659 mm
HF Cutoff


Rings Position
A(n)
B(n)
Alpha (n)
0.079 mm 2.193 mm 4.104 deg
0.413 mm 5.016 mm 9.42 deg
1.012 mm 7.813 mm 14.767 deg
1.871 mm 10.544 mm 20.121 deg
2.981 mm 13.185 mm 25.478 deg
4.333 mm 15.712 mm 30.837 deg
5.916 mm 18.101 mm 36.196 deg
7.715 mm 20.332 mm 41.556 deg
9.714 mm 22.386 mm 46.915 deg
11.897 mm 24.244 mm 52.276 deg


α(3)
α(2)
α(1)
PP Radius
H PP
A(3)
A(2)
A(1)
B(1)
B(2)
B(3)

Moving yellow point **cursor** is possible to set the required **Phase Plug Length**. By this way the designer has the channels path on left side and the compression driver exit on right side (usually integrated in the pole plate). Positioning the cursor on maximum path length it's possible to design a full path phase plug.

In the **Half Circular Profile** graph there is the half section profile of the total volume area of phase plug.



Compression Ratio
is the ratio of the projection of radiating membrane area in the direction of vibration to the area of the surface of compression cavity.

Environment information
are the environment average working temperature and humidity of the internal path of compression driver. This information is very important to obtain a high-quality final result of expected low frequency response.
In ex. for **High Fidelity** applications a temperature values range could be about 310÷330 K, for **Professional** applications a range about 330÷360 K.

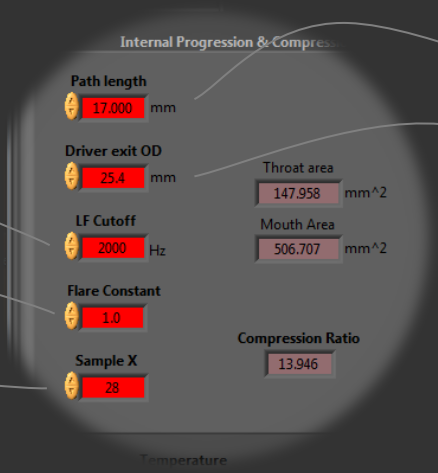
COMPRESSION RATIO

In the second TAB you can edit channels opening and path profile to adjust the required Compression Ratio.

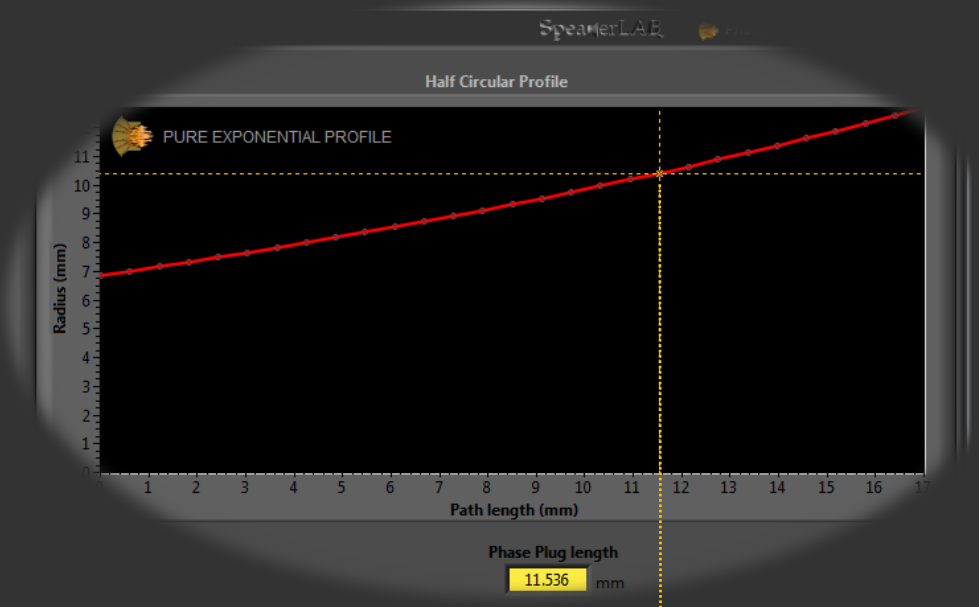
Flare Constant
is the degree of hyperbolic expansion.

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.

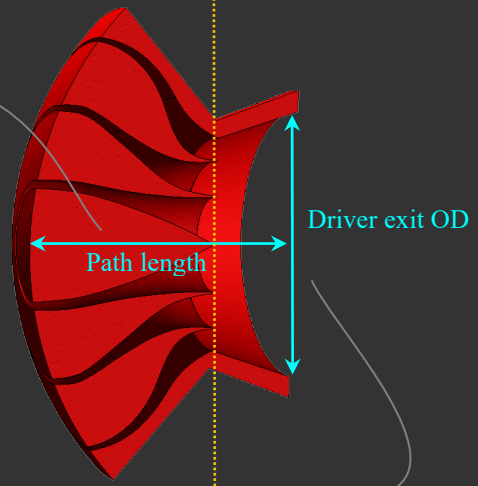
LF Cut-Off
is the lower crossover frequency



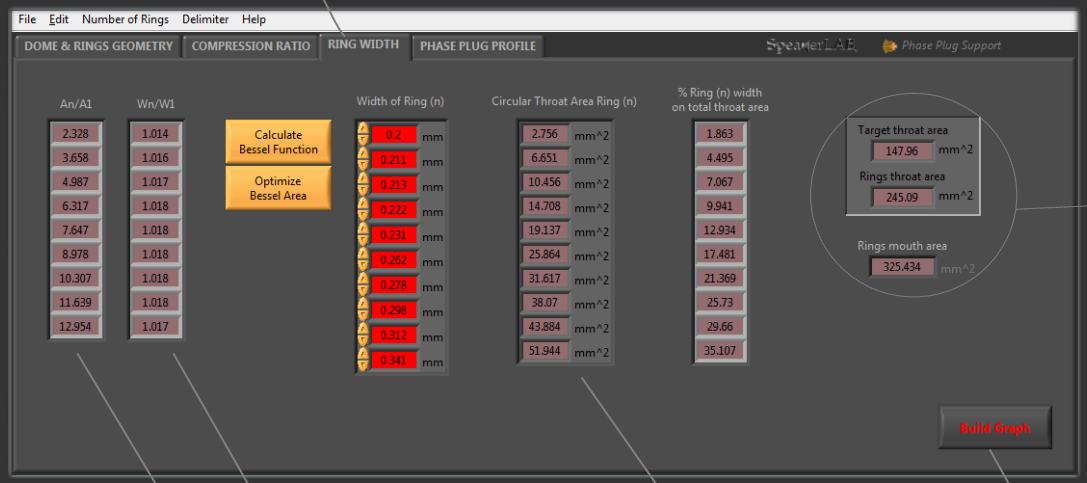
Sample X
Samples X is the quantity of segments to split the total phase plug length.

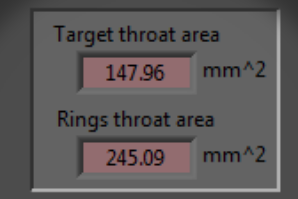


Channels side ⟵ ⟶ Pole Plate side



Target throat area is obtained in COMPRESSION RATIO TAB.
To achieve target Compression Ratio value setting **Width of Ring (n)** array, to obtain a value of **Rings throat area** next to **Target throat area**.





Ring Width ratio

Ring Area ratio

If you need to build a phase plug with **Radial** slots, consider this data and convert it into radial throats.

Sum of the rings exit area

When you terminate the project and set all parameters, you can build 2D Graph.

RING WIDTH

In the third TAB the goal is to set the required rings width to achieve target Compression Ratio.

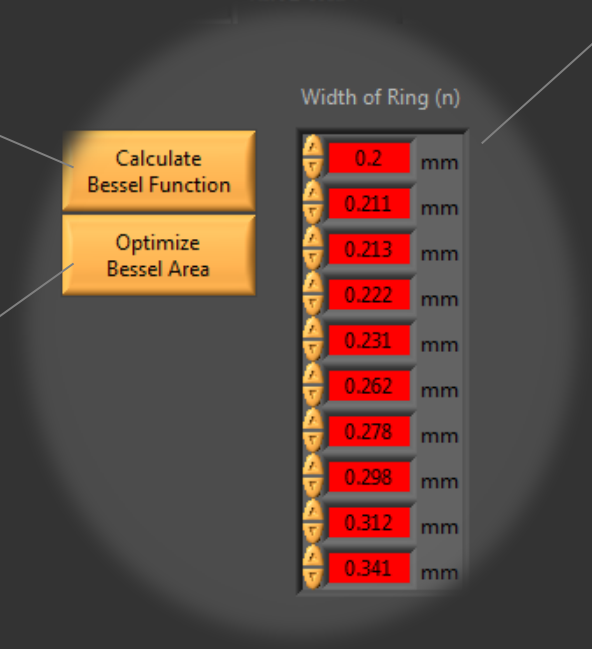
Width of Ring (n)
Setting different **Width of Ring (n)** values you can modify the **Rings throat area**. There are 3 techniques to set the rings width array:

- **Manual Setting**
- **Calculate Bessel Function**
- **Optimize Bessel Area**

NOTE: the calculus is done in cylindrical coordinates.

Calculate Bessel Function
Set only the first value of ring width and push **Calculate Bessel Function** button to obtain the other values with Bessel Function. The default first value is 1 mm.

Optimize Bessel Area
Push **Optimize Bessel Area** button to start the automatic fitting process to set all rings width values. This process finish when the value of **Rings throat area** reaches the value of **Target throat area.**



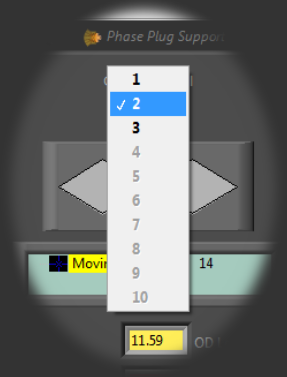
Manual Setting
Possibility to free edit all single display values.
This technique is useful in case of external optimization of rings width; coming for example from a FEA simulation, or from other analytical solutions (using Legendre function in spherical coordinates) or experimental study.

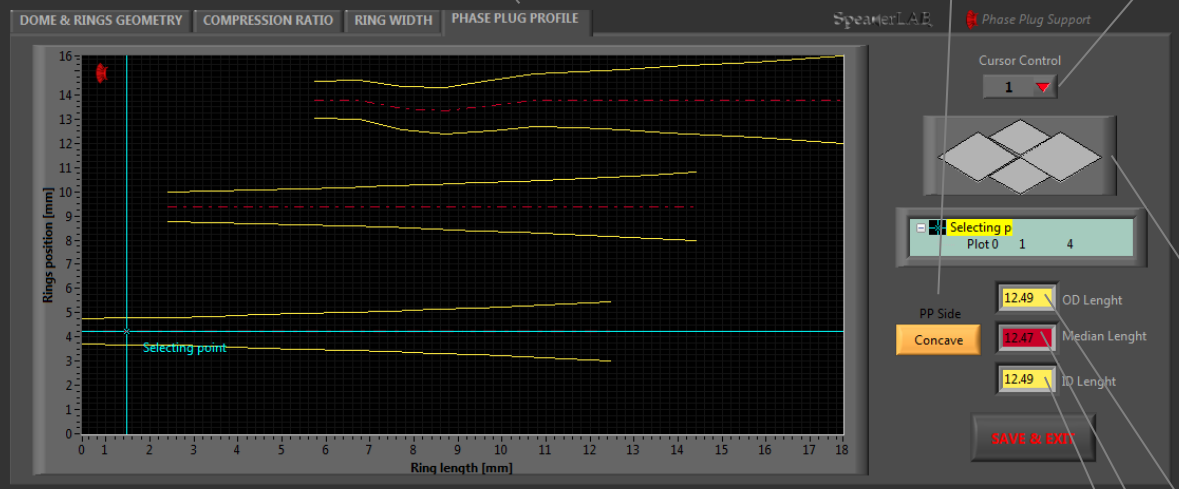
To modify phase plug path:

1) Select channel with **Cursor Control**
2) Move cursor with mouse along the channel profile and positioning cursor on the requested point
3) Press space bar to edit the point
4) Drag the selecting point on new position on the space
5) Press space bar to drop the point

PP Side
selecting the membrane side for the phase plug position (convex or concave side)

Select channel to measure & edit





Arrow buttons for selecting or modifying the cursor position. As a precise alternative of mouse.

Outer length of channel (upper yellow line) where is the active cursor.

Median length of channel (red line) where is the active cursor.

Inner length of channel (lower yellow line) where is the active cursor.

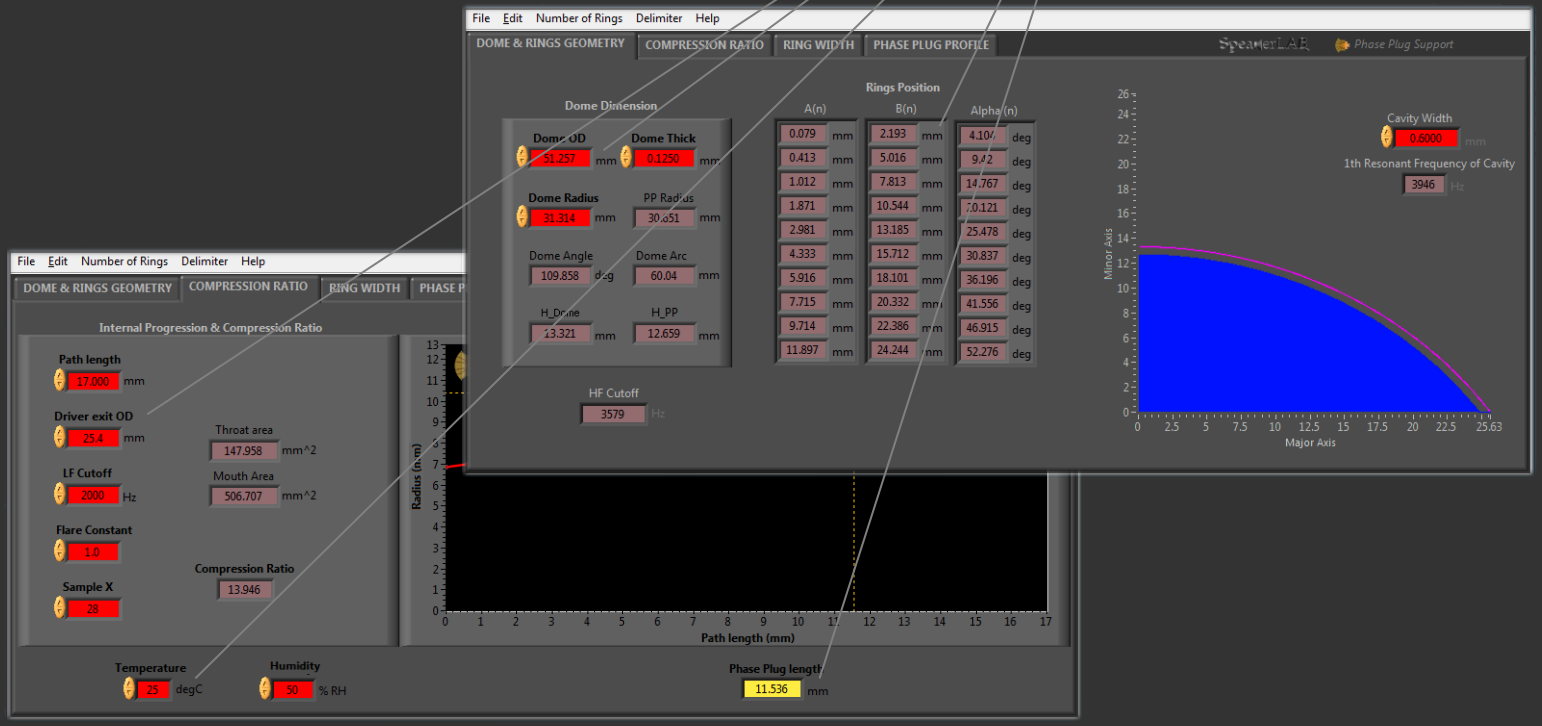
PHASE PLUG PROFILE

In the fourth TAB you can visualize the half section of phase plug progression. It's possible to edit every point position to modify the required phase plug shape.

UNITS AND PREFIXES

PPS 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



PPS recognizes also a prefix to a unit. To apply a preferred prefix selects 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 Phase Plug Support.exe directory path, the software automatically creates the database **Phase Plug db and** putting inside all saved designs.

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

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

Each directory inside **Phase Plug db** appears with this style

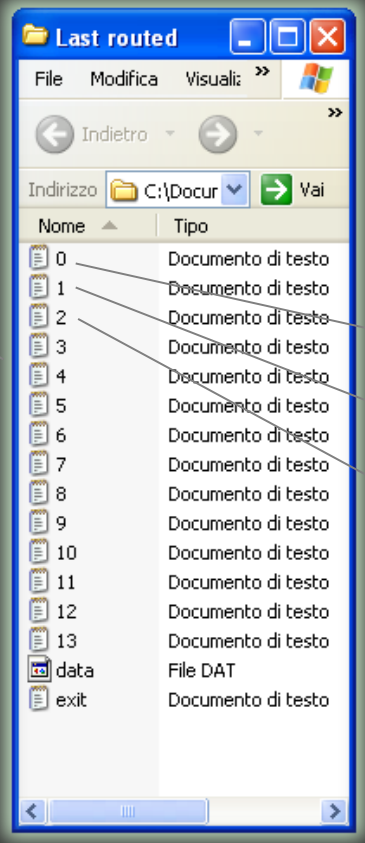
0 ÷ N are 2D design text files, with this format:
X,Y,Z

N= (Number of phase plug rings x 2) − 1
N= odd numbers → inner channels profile
N= even numbers → outer channels profile

(X,Y,Z are floating-point numbers by 6 fractional format digits. In all cases Z=0)

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

Exit (if ≠ 0) is a 2D text file of the compression driver exit profile (usually integrated in the pole plate).



In this example:
a phase plug with 7 rings

inner first channel profile

outer first channel profile

inner second channel profile

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www.speakerlab.it

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