# CHAMP

# Design of rotationally symmetric horn antennas -

## With optimizer engine

**CHAMP is the software solution for the advanced horn designer who designs rotationally symmetric horns and requires high accuracy and speed in the design process.**

With this software tool you will be able to design and optimize your horn in very simple iterative steps. Setting up can be done within a few minutes, and your analysis can begin.

The built-in optimizer engine allows you to choose between 4 different optimizing methods. Set the volumetric and manufacturing constraints, specify the variables of your choice to be used for optimization and set your goals for the optimization.

Start the optimization and a few moments later, your new and improved horn will be ready ! It's really that easy.

You also have the possibility to include a subreflector (rotationally symmetric) in your design.

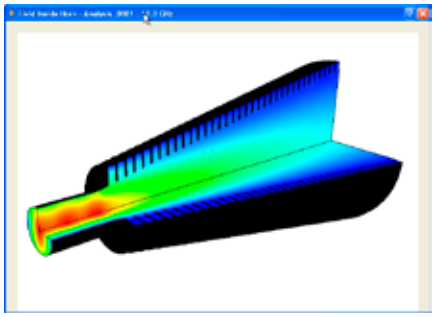
With CHAMP you will be able to really fine-tune and optimize your horn to an extent that has never been possible before. The intelligent iterative optimizer will assist you to go beyond what many experts think is possible. With CHAMP you will spend less time and efforts to design the new high performance horn of your choice.

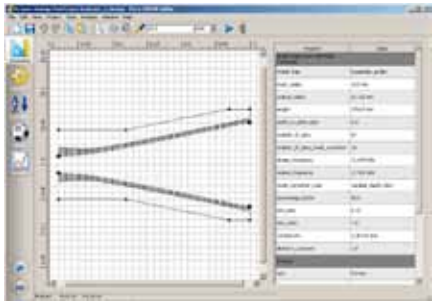
And you can rely on the calculations. Verified by some of the best in our industry, it is as accurate as it can be.

The high flexibility for designing the horn is obtained with a very general formulation of the optimization scenario in combination with a modular overall horn modelling. It enables an easy-to-manage performance driven design procedure where more and more refined designs are produced in a sequence of optimizations.

TICRA
*Pioneering Antennas*

TICRA is an antenna engineering company with world leading expertise in software tools and consultancy services within design, analysis and measurement techniques for antennas. Based in the centre of Copenhagen, Denmark, TICRA employs highly skilled professionals with over 240 man-years of expertise in their fields.



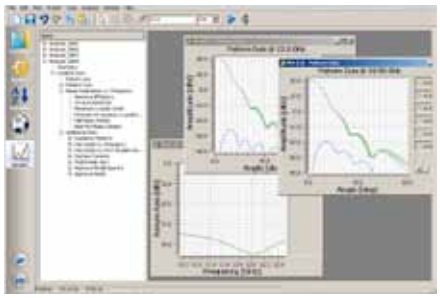


*A corrugated horn section shown in the Geometry Designer and in 3D-view*

The high flexibility for designing the horn is obtained with a very general formulation of the optimization scenario in combination with a modular overall horn modelling. It enables an easy-to-manage performance driven design procedure where more and more refined designs are produced in a sequence of optimizations.

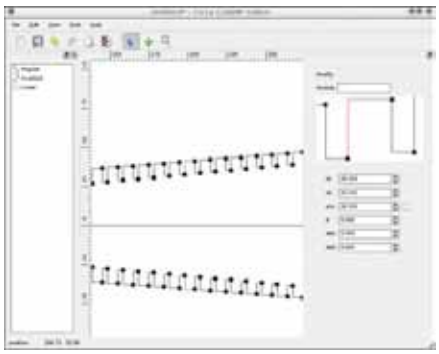
**Intelligent iterative optimisation**

The selection of the geometrical parameters to be used as optimization variables has been made in an overly general way. Each design parameter given as a real value (i.e. non-integer value) may be selected as optimization variable simply by assigning a name to the parameter in the GUI. Also functional expressions may be used to link other design parameters to the optimization variable.



*Plots of results are easily available from the Results Manager*

The user specifies the required RF-performance in terms of a number of so-called optimization goals. To ease the user input, several goal types are available, e.g., goals for the return loss, for the maximum level of the cross polarization, etc. The selection of goals and the individual weighting of these are of utmost importance for the success of the horn synthesis. CHAMP offers a toolbox of goal types, but a strong user-interaction is required to monitor and change the goals during the optimization.



*A circularly symmetric subreflector may be included in the analysis*

The horn may be divided into several sections, and in each section, the horn profile may be modelled by a pre-defined profile function, with the advantage that the overall horn geometry is described in terms of a few parameters only and thus well suited for optimization. During the optimization procedure, the geometry may be refined, using spline functions and/or a detailed description corrugation-by-corrugation allowing an intelligent iterative optimization.

**Mode matching - horn interior**
The analysis kernel of CHAMP is based on a full-wave modal expansion of the field in each elementary module into cylindrical waveguide modes, followed by a subsequent mode matching at the interfaces between the different elementary modules. Evanescent modes are fully accounted for, and by cascading the scattering matrices of all modules, the overall generalized scattering matrix for the horn inner structure - throat to aperture - is obtained.

**Method of Moments - horn exterior**
The modal description provides the aperture field, which is integrated to obtain the far field radiated from the horn. Experience has shown that for horns with apertures smaller than approximately 3-4 wavelengths in diameter, the aperture discontinuity, the flange and outer appendages affect the return loss as well as the radiation pattern, particularly the cross-polarization. This effect can be modelled by using the moment method solver integrated in CHAMP. This accounts for the aperture distribution as well as the currents on the outer geometry of the horn, and improves the accuracy compared to the simple aperture integration. Also, the influence of a circularly symmetric subreflector on the horn performance may be analysed using the moment method solver.

**Primary excitation**
The normal excitation mode is the fundamental TE11 mode in a circular waveguide. However, CHAMP will also analyse the performance of tracking mode excitations with TE21, TE01 and TM01 modes.

**Output**
Directivity, return loss, ohmic loss, peak cross-polar level, beam width, radiation patterns, best-fit phase centres and aperture fields are displayed in the graphics interface and can also be stored on files in an open format. Spherical wave expansion coefficients are automatically generated and stored on file. This ensures a seamless interface to other analysis programs such as GRASP.

**A highly reliable tool**
The tailoring of the full-wave mode matching to the basic elements composing a feed results in a very fast and very accurate software package. The software package has been used by the space and ground segment industries for two decades, and is well established as a highly reliable tool, which enables you to bypass a lengthy prototyping in the production process.

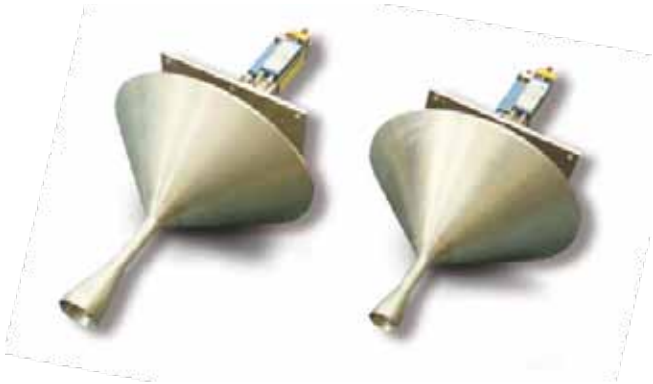
The graphical interface makes CHAMP the ideal tool, not only for analysis of conical corrugated horns, but also very much as a design tool. The palette of basic horn layouts facilitates the setup of corrugation geometries. These can easily be adapted to the user's requirements by specifying a minimum of parameters, such as input and output aperture diameters, number of corrugations and pitch etc. This, combined with the high speed of the analysis, ensures a turn-around time from initial input to final output that enables the engineer to optimize a design within just a few steps.

**CHAMP users**
The graphics interface and superior analysis accuracy makes CHAMP the ultimate software package for all manufacturers involved in the design and production of rotationally symmetric corrugated horns.

In particular CHAMP is indispensable for manufacturers of

- Reflector feeds
- Telemetry- and global-horn antennas
- Tracking feeds
- Radiometers

The heritage ensures that the user gets a reliable tool which sets an unsurpassed industry standard for corrugated conical horn design and analysis.



*TICRA used CHAMP to develop this patented near-field probe design*


# We are here, worldwide

## Visit us on our website www.ticra.com

**Israel**
MSI Engineering Software Ltd.
14 Imber St.
Kiryat-Arie
P.O. Box 3769
Petach-Tikva 49130
Phone: +972 8 9353230
Fax: +972-3-9227755
e-mail: msi@netvision.net.il

**Japan**
Farad Corporation
Nikko Building 10F
34, Tansu-machi, Shinjuku-ku
Tokyo 162-0833
Phone: +81 3 5261 3091
Fax: +81 3 5261 3093
e-mail: farad@farad.co.jp

**China**
Beijing ViRe Technologies Co. Ltd.
High-Tech Mansion BUPT
Room 1222
Haidian District, Beijing 100876
Phone: +8610 6228 1510
Fax: +8610 6228 1510
e-mail: info@vi-re.com

**United States**
Milligan & Associates
8204 West Polk Place
Littleton, CO 80123
Phone: (303) 977-7268
E-mail: TMilligan@ieee.org

**India**
Western Systems
76, BDA Complex
Indiranagar
Bangalore - 560 038
Phone: +91 80 528 49 43
Fax: +91 80 528 59 46
e-mail: wsysind@vsnl.com

**Taiwan**
Hungchi Aerospace Service Co.
2F, 264, Minchuan E. Road
Sec. 6, Taipei 114
Phone: +886 2 2634 9343
Fax: +886 2 2634 9342
e-mail: hungchi@hasco.com.tw
Fax: +8610 6228 1510
e-mail: info@vi-re.com

## Other countries - contact TICRA

TICRA
*Pioneering Antennas*