

RAMSETE

Acoustic forecast software

User manual
Version 1.0
1.1.94

GENESIS

Software and acoustic consulting

This manual has been written by Paolo Galaverna with the collaboration of Marzia Giabbani and the supervision of Angelo Farina and translated by Guido Truffelli.
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1. How to read this manual

This manual has been written also for people that are not skillful computer users. For this reason we apologize to more skilled users for the frequent repetitions of the most simple Windows usage techniques.

INTRODUCING RAMSETE shows the organization of the package and the basic algorithms used by its components: Ramsete can be used nearly by everyone, but you can't become a do-it-yourself acoustic engineer. If you really desire to exploit every feature of the program you need a deep knowledge of its inner physical-mathematic heart.

KNOWING RAMSETE briefly shows step by step, the nine modules of the the package. By this way the user can have a global view of the entire system.

USING RAMSETE is a practical example of a complete working session.

RAMSETE COMMANDS is the exhaustive list of all commands of every program of the package. This section can be in its completeness or one paragraph at time as you need it.

RAMSETE MATERIALS includes all the standard materials contained in Material Manager by default, their description and acoustic properties.

RAMSETE SOURCES contains all Source Manager's standard noise/music sources.

RAMSETE TROUBLESHOOTING describes known bugs or obscure error conditions that could rise by using the program.

1.1. Legend



EFILE MENU Select a menu item: you can activate it by clicking on it with the left mouse button, otherwise you can press the "Alt" key followed by "F" (without releasing it).




New Select a menu command: you can select a command from a menu clicking on the desired item or by pressing the underlined letter of its name (usually the first one). You can also use the arrow keys to move onto a command and press Enter to select it.



Cut (Shift+Del) Using a short-cut: if you can see a key combination on the right of a menu command you can recall it simply by pressing the displayed keys, there's no need to open the corresponding menu.

 See also...

 Warning!

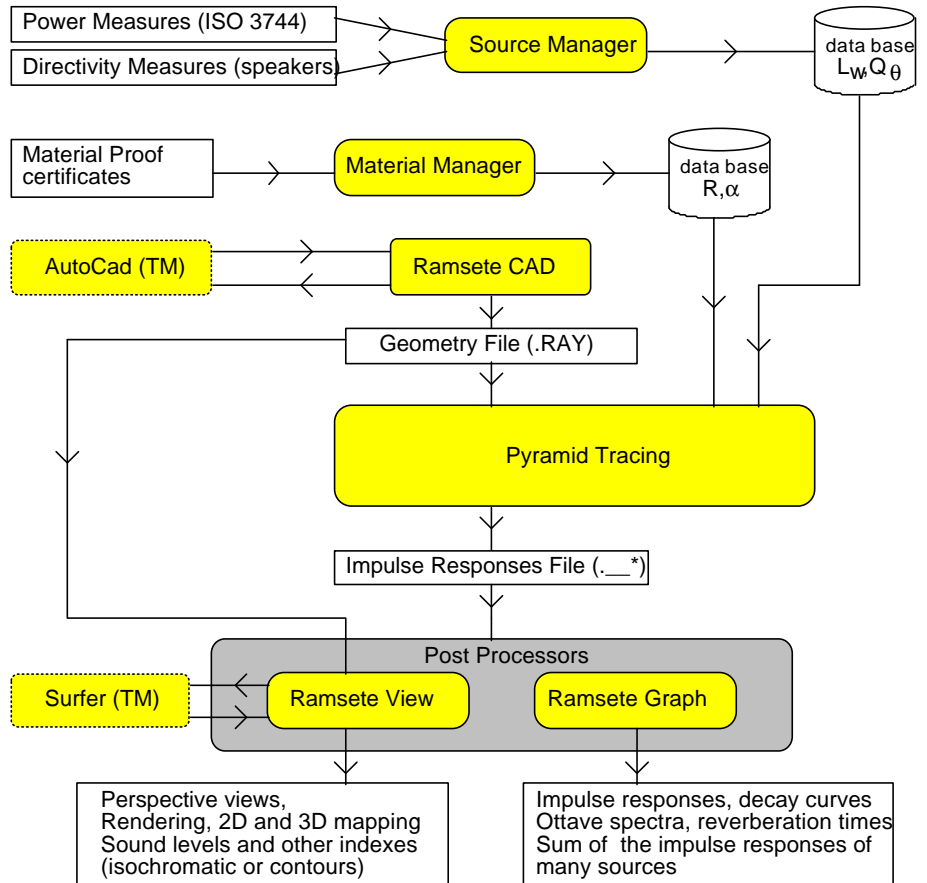
2. Introducing Ramsete

Ramsete is an advanced software package for the acoustic phenomena simulation. Thanks to its powerful features it can be used to study concert halls, auditoriums and theaters, or industrial acoustic treatments and external noise sources.

It is a modular system that can be easily updated and used even by non professionals.

2.1. Features

This program has been developed for the Windows operating system: so we've obtained an advanced user interface, a fast learning curve, a full integration with the most popular PC working environment. The system is composed by many modules connected in the following way:



The system includes a simple 3D CAD, Ramsete CAD, that features axonometric and orthogonal views of the room and can import/export DXF files generated by AutoCAD.

Material Manager and Source Manager have a good internal data base that can be edited by the end user, who can let enter new materials and sources with all their acoustic parameters that can be experimentally measured or automatically computed.

At the heart of the package there is Ramsete Trace, that receives a Ramsete CAD model as input and computes the impulse responses for further processing. This program is based on a pyramid tracing algorithm and geometric acoustics.

Ramsete Graph can post-process these impulse responses and give a graphic or tabular view of the data. For each one of the ten frequency bands and for each receiver it can display the impulse response, linear and A weighted; the SPL levels; the Schroeder decay curve and the reverberation times: EDT, T₁₀, T₁₅, T₂₀, etc..

Ramsete View can display perspective views of the geometric models and it can render and map the following data in two or three dimensions:

•	SPL	Sound Pressure Level	
•	L_{dir}	Direct Wave level	
•	L_{rev}	Reverberated field level	
•	R/D		
•	$L_p - L_w$		
•	C_{50}	Klarheitsmass	Dresda group
•	C_{80}	Klarheitsmass	Dresda group
•	T_{bar}	Barycentric Time	Cremer, Kürer
•	A_{eq}	Equivalent Reflection Amplitude	Ando
•	STI	Speech Transmission Index	Houtgast & C
•	RASTI		
•	LE	Lateral Efficiency	Jordan
•	A_{eq2}		
•	ITDG _{eq}	Initial Time Delay Gap	Beranek

In the last release has been added the possibility of anechoic music convolution with the impulse response.

The customer may ask for personalized program versions in order to solve specific problems.

2.2. Computation Method

We chose pyramid tracing because it guarantees the following benefits:

- short computation times;
- high resolution of the impulse response;
- precise receivers positioning (modeled as points, not spheres).

The beam tracing, i.e. the modelling of the spherical sound waves through beams of various shapes, is a natural evolution ray tracing. The simplest way to obtain a beam tracing is to implement a normal ray tracing with spherical receivers, whose radius grows as the square of the ray length. In this way we can keep constant the quotient between the sphere's maximum circle and the global surface hit by the rays, reducing the minimum number of rays to compute. But there is a big drawback with this approach, the receiver keeps getting bigger and bigger, growing well past the room dimensions, thus it could receive energy even from rays on the other side of a wall or outside the room.

A much better way to achieve the same effect is to trace diverging rays or cones and to use point-shaped receivers. When a receiver is contained into a cone it receives a energy intensity computed with the following formula:

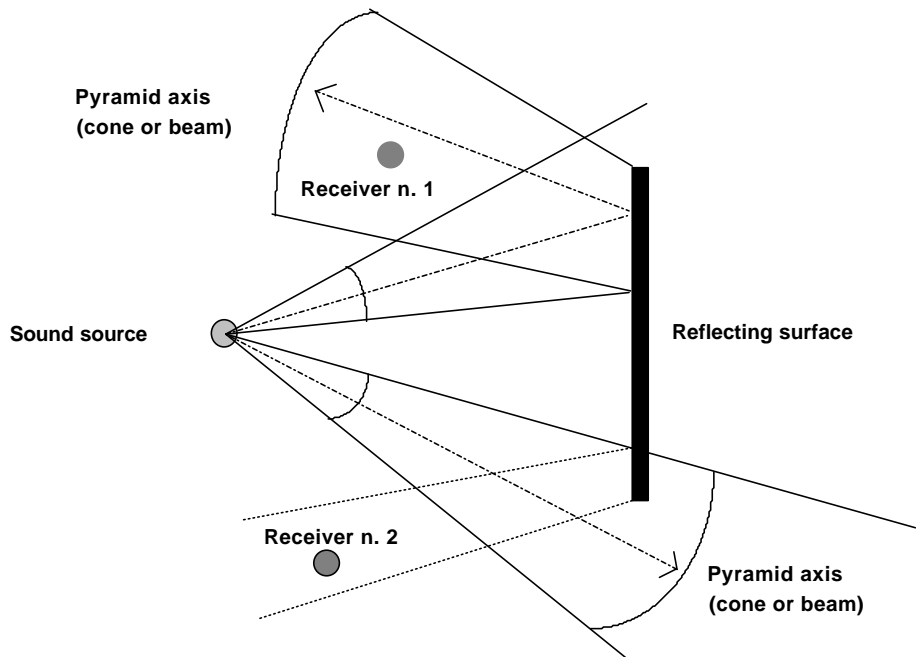
$$L_p = L_w + 10 \cdot \log \left(\frac{Q_J \cdot \prod_i (1 - a_i)}{4 \cdot p \cdot r^2} \right) \quad (1)$$

that's equivalent to the image sources formula. With this approach we have another problem: we can cover the entire sphere surface with circles without overlapping them at least partially. Pure cone tracing has been improved with a statistical method in which the energy decreases like a Gaussian curve with the distance from the cone axis. This is the algorithm adopted in Epidaure, a program written by Vian, Martin and Maercke.

Naylor, in the Odeon package, uses a cone tracing preprocessor for a image source method. He removes duplicate sources by using the reflection tree of the overlapping cones. This program can achieve better results than the former one, adopting a nearly deterministic method.

Lewers is the first to successfully implement pyramid tracing, so that radically solves the beam overlapping problem but loses the contributes of high order image sources. He tried to solve this shortcoming superimposing a diffusive model to the deterministic pyramid tracing.

The biggest drawback of beam tracing is the incapacity to compute the reverberation queue precisely, in fact, as the cones grow larger, a bigger number of image sources has been lost. Let's try to explain it with the following example:

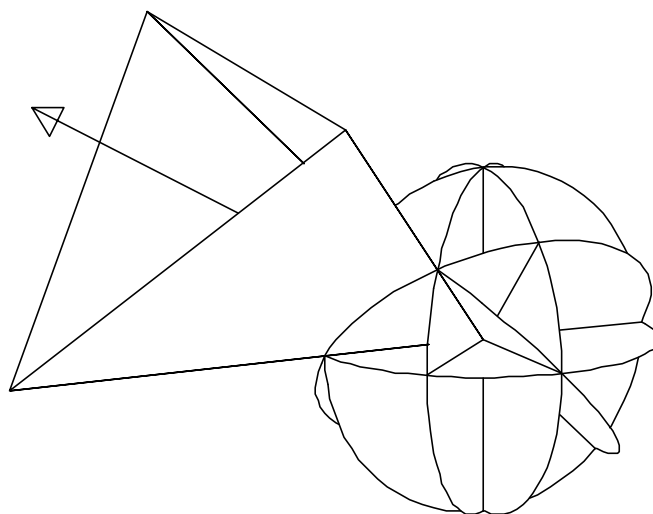


In this way we need to correct the computed impulse response through an additive or multiplicative method, but neither one can be safely applied in these conditions, where statistical acoustics hypothesis are not met.

Ramsete has been developed with the explicit intention of solving all the limits of these kind of modelling that fits well in wide environments such as theaters and factories.

Our pyramid tracer keeps in account the diffraction caused by free edges of shielding wall or other hurdles, and computes the energy that passes through surfaces with a finite phono-insulating property.

Next picture shows the isotropic sphere subdivision according to an algorithm studied by Tanenbaum et al, based on the progressive bisection of the spherical surface starting from eight triangles:



The tracer follows a pyramid's history to a fixed depth or on a time basis, in order to build the full sound queue of each receiver. It doesn't make any assumption on the acoustic field diffusion, so that we can have different reverberation times for each point, double slope decays, highly delayed echoes, etc.

The necessary sound queue correction is of multiplicative type. It's based on the assumption that the number of impact on a receiver in the time unit $n(t)$, can be mathematically described by the following relation, according to Maercke/Martin:

$$n(t) = \frac{4 \cdot \mathbf{P} \cdot c_0^3 \cdot t^2}{V} \cdot \left(1 - e^{-\frac{l_{cm}^2 \cdot N}{4 \cdot c_0^2 \cdot \mathbf{b} \cdot t^2}} \right) = \frac{4 \cdot \mathbf{P} \cdot c_0^3 \cdot t^2}{V} \cdot \left(1 - e^{-\frac{t_c^2}{t^2}} \right) \quad (2)$$

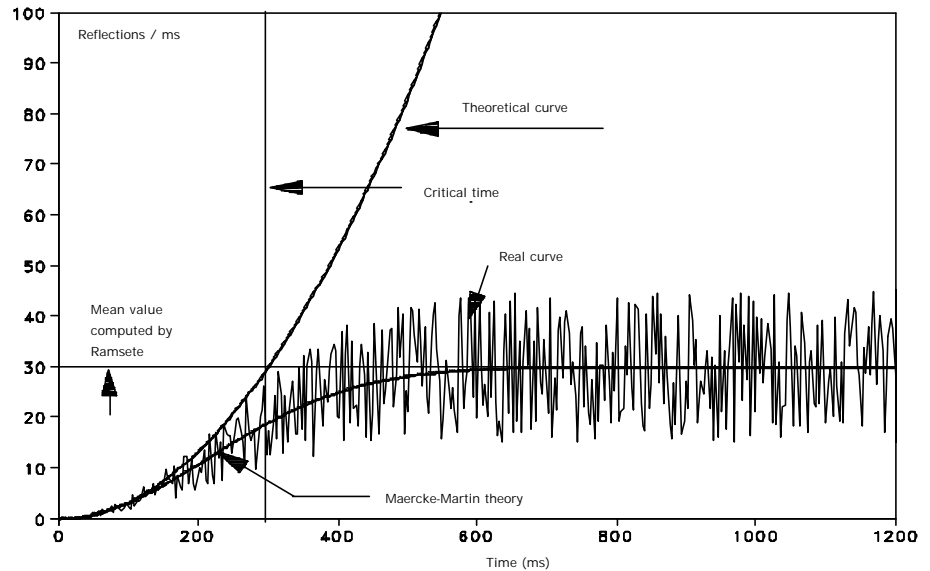
The theoretical behavior of this curve is represented by the first factor of the above relation, ignoring the bracketed term, thus it grows with the square of the time.

As far as the variable "t" reaches infinity, the relation (2) gives the number of impact into the time unit:

$$n(\infty) = \frac{N \cdot c_0 \cdot l_{cm}^2}{V} \cdot \frac{\mathbf{P}}{4 \cdot \mathbf{b}} \quad (3)$$

In the two formulas above there are two parameters that depend on the acoustic field nature: the minimum free path or l_{cm} , that Ramsete computes following the axis of each pyramid, and the adimensional coefficient \mathbf{b} that depends on the sabinian properties of the acoustic field (in a perfectly diffused field we have $\mathbf{b}=0.3$).

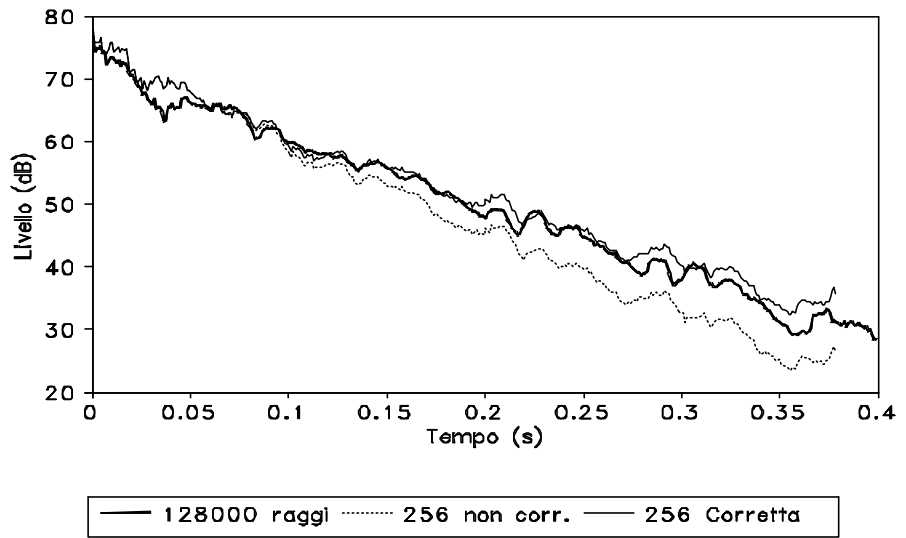
The critical time that appears in the relation (2), represents the ideal separation point between the first half of the acoustic queue, in which all image sources are correctly found, and the second half in which we have a constant energy addition per time unit. The following picture shows the comparison between real situation and theoretical assumptions:



The correction of the reverberating queue is computed by dividing the sound energy by the bracketed term of equation (2), that's always less than 1 and decreases with time t linearly.

In practice the estimate of the t_c parameter is tied to α proper value of the b coefficient that minimizes the difference between the exact curve and the estimated one. When we have found a good value for \mathbf{b} we can safely trace as few as 256 pyramids without any significant precision loss.

The following graph compares the energetic impulse responses obtained with an high number of pyramids (128,000) and a small number (256) of them with two different queue correction coefficients ($\beta=0.3$ and $\beta=0$):

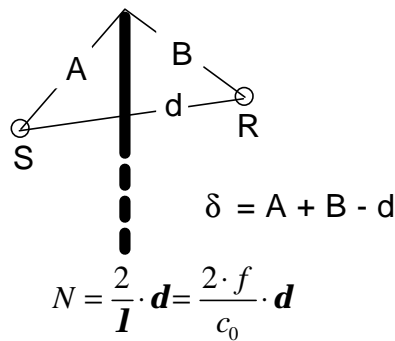


We can see that in a non-sabinian room, the queue correction can obtain very good results with a small computational effort (a couple of minutes).

In Ramsete we have the possibility of declaring some surfaces as “obstructing” in order to give the system the chance to compute the energy faction that passes through some faces and hits receivers on the other side, or diffracts along their free edges. This energy is computed with the Keller/Maekawa formula:

$$L_{diff} = L_{dir} - 5 - 10 \cdot \log \left(\frac{\sqrt{2 \cdot p \cdot |N|}}{\tanh \sqrt{2 \cdot p \cdot |N|}} \right) \quad (4)$$

where L_{dir} is the direct level, assuming no obstructing face between the source and the receiver, and N is the Fresnel number i.e.:



Thanks to these features, Ramsete can study the acoustic propagation in geometrically complex rooms, with partial or total shields. It allows also the computation of the noise emission towards receivers outside the room containing the source.

We can use this system in external environments where the distance between a fixed source and the receivers is not very long, so that we can ignore atmospheric conditions.

2.3. Versatility

Versatility is one of the key points of the package: it can be used inside industries, where the sound pressure level is the main variable. SPL can be computed in 10 octave bands (31.5 - 16,000 Hz), keeping into account the room geometry, the materials and their acoustic properties.

The noise generated by the machines can be simulated by sources freely placed, of which we know the emitted power spectrum. We can introduce shields or barriers in order to simulate the noise source encapsulation assigning a particular emission spectrum.

Each source emission is computed separately, so that we can value the incidence of each one on the total level, suggesting the source that needs a particular care in shielding process.

Inside an auditorium or a concert hall the most important variable elements (other than the impulse response) have been listed by many research groups in the last years and Ramsete can compute nearly all of them.

We can introduce omnidirectional and isofrequencial sources, or real loudspeakers with a precise frequency response and spatial dispersion.

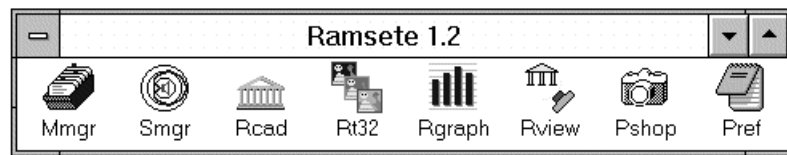
2.4. Required Hardware

The minimal required hardware is a 80386 processor, better if coupled with a 80387 math coprocessor. Ramsete is an intensive CPU user and it works better on faster machines (486 or Pentium) but has not excessive RAM requirements: 4 Mb will suffice, but we all know that Windows can be used productively starting from 8 Mb. You need at least a 20Mb of hard disk space in order to set up Ramsete and run a simple working session. A good sound card is optional.

3. Ramsete applications

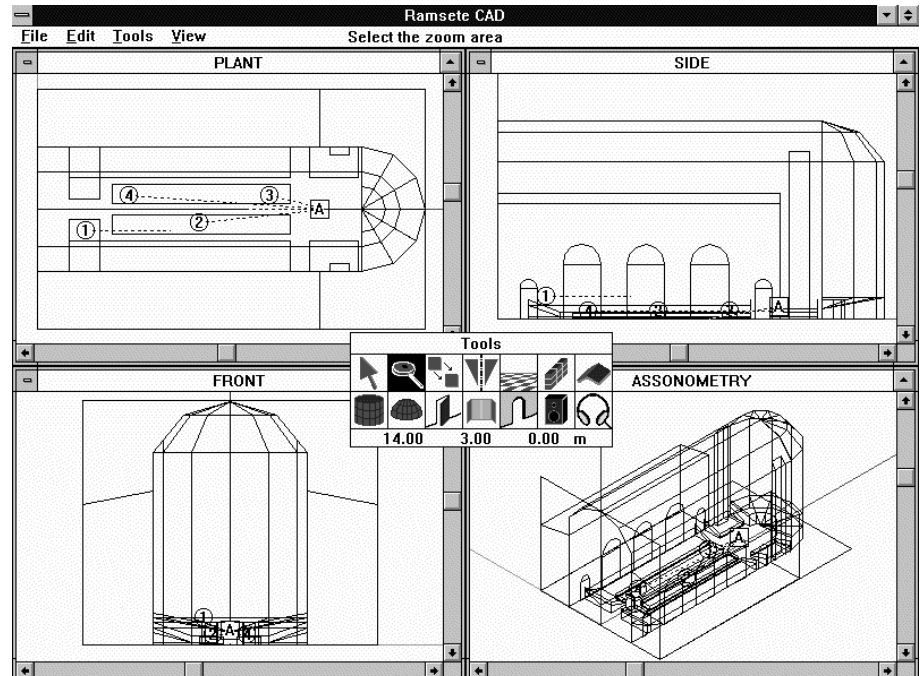
The Ramsete package is composed by the following programs:

- Ramsete CAD
- Material Manager
- Source Manager
- Ramsete Trace
- Ramsete Graph
- Ramsete View
- Preferences
- Paint shop pro

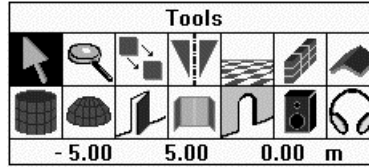


3.1. Ramsete CAD

This program is a real 3D CAD system that can import DXF files generated by AutoCAD. You can work on many views at the same time: plant, sections and axonometry. This is an example of a typical Ramsete CAD screen:



There's a floating toolbar that allows the selection of all the main geometric entities: floor, wall, roof, door, window. The current cursor position is always displayed in the bottom line of the tools window.



You can insert sources and receivers, all with their orientation. This is very important for directive sources and for Lateral Efficiency computation. Geometric model are saved in a human readable .RAY format or in .DXF format readable by AutoCAD.

3.2. Material Manager

This program has a spreadsheet-like interface where you can enter the acoustic properties of your materials. You can display and edit the following parameters for each frequency band: absorbing coefficient α , phonoinsulating power in dB R.

Material Manager 1.0											
		<input checked="" type="radio"/> α <input type="radio"/> R		Update File		Quit					
N.	Frequency (Hz)	31.5	63	125	250	500	1k	2k	4k	8k	16k
0	Nessuno	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	intonaco calce (s.r.)	0.03	0.06	0.06	0.06	0.06	0.07	0.09	0.14	0.23	0.28
2	intonaco ruvido	0.01	0.01	0.02	0.03	0.04	0.05	0.04	0.03	0.02	0.02
3	intonaco liscio	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.03	0.02	0.02
4	int. calce fresco (T.R.)	0.01	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.1
5	int. calce maturo (T.R.)	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.11
6	int. calce degrad.(T.R.)	0.03	0.05	0.06	0.07	0.07	0.07	0.09	0.11	0.21	0.25
7	int. gesso liscio legno (P)	0.02	0.03	0.04	0.05	0.06	0.07	0.07	0.06	0.06	0.07
8	int. gesso liscio ferro	0.01	0.01	0.02	0.03	0.03	0.04	0.02	0.03	0.03	0.04
9	piastrelle stuccate (g)	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.05
10	legno di pino (C)	0.05	0.1	0.1	0.1	0.1	0.09	0.1	0.12	0.3	0.36
11	legno verniciato (g)	0.06	0.11	0.11	0.12	0.12	0.12	0.1	0.1	0.1	0.12
12	legno compensato (C)	0.06	0.11	0.11	0.11	0.12	0.12	0.1	0.1	0.1	0.12
13	pavimento legno (B)	0.01	0.02	0.03	0.04	0.06	0.12	0.1	0.17	0.23	0.28
14	pavimento legno (C)	0.05	0.09	0.09	0.1	0.08	0.08	0.1	0.1	0.1	0.12
15	pavimento marmo (B)	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06
16	pavimento moquette (B)	0.03	0.05	0.05	0.05	0.1	0.2	0.3	0.59	0.5	0.6
17	pavimento moquette (C)	0.03	0.07	0.08	0.1	0.2	0.25	0.3	0.35	0.36	0.43
18	pavimento gomma (B)	0.0	0.01	0.02	0.04	0.05	0.05	0.1	0.05	0.05	0.06
19	pavimento linoleum (m)	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.06	0.07

3.3. Source Manager

This application can generate or display .SPK files, that contain all sound source data. With the ISO 3744 (3746) module you can input directly the sound level of a sound/noise source experimentally measured:

ISO 3744 [3746] 1.0

Number of Microphones:

length (2a)
width (2b)
height (c)
Test Room Volume

Freq. (Hz)	31.5	63	125	250	500	1000	2000	4000	8000	16k
Lp(1) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(2) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(3) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(4) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(5) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(6) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(7) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

You can use conform surfaces with 8 microphones, parallelepipedal surfaces with 5 or 9 microphones or hemispherical surfaces with 10 microphones.

All these parameters can be edited in tabular form and displayed in graphical form.

Source Manager 1.0 - D:\RAMSETE\SOURCES\EV\LONGHP\EVHP904&.SPK

File Edit View Window Help

Balloon

Frequency:

Angle of plot = 0°

Angle of plot = 90°

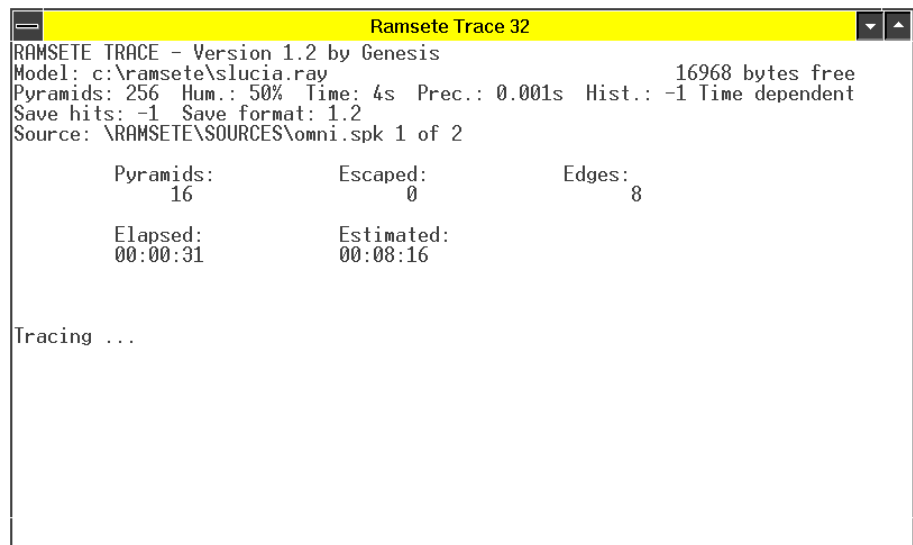
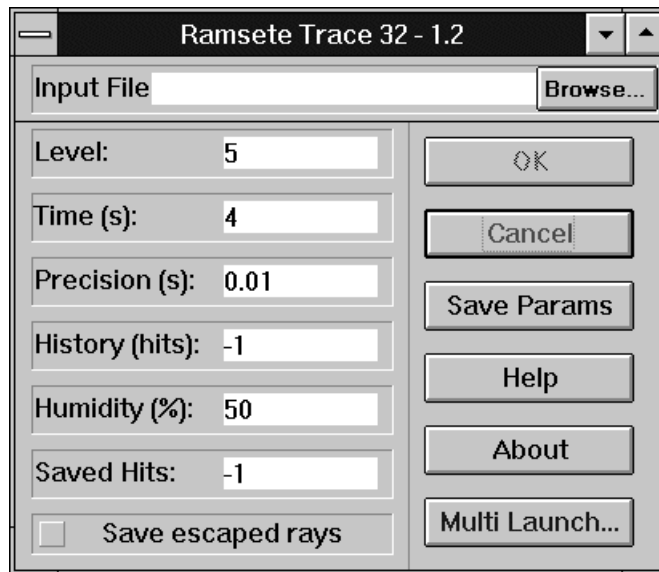
Polar Plot Frequency

Frequency Band:

Source Manager can import .MDL files generated by Modeler (Bose Corporation).

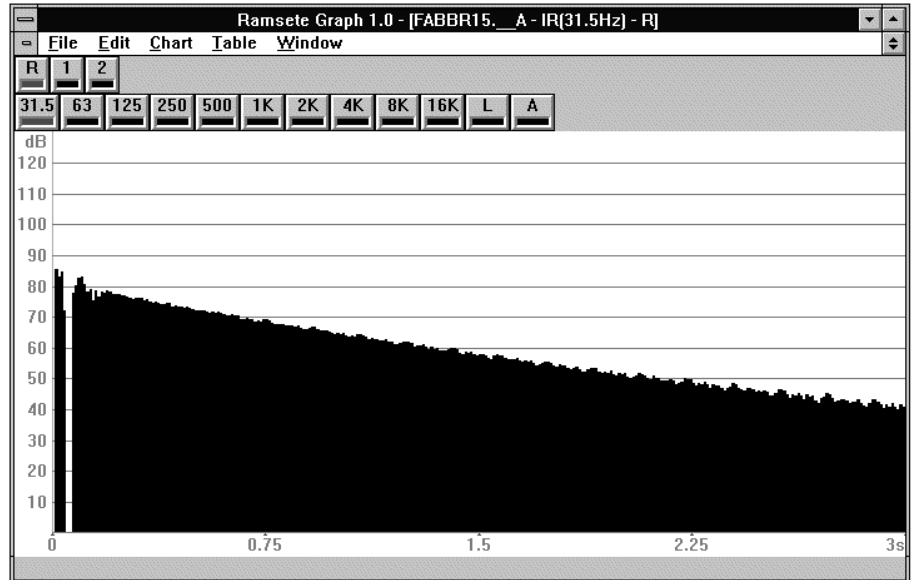
3.4. Ramsete Trace

This program is the pyramid tracer, the computation engine of the system:

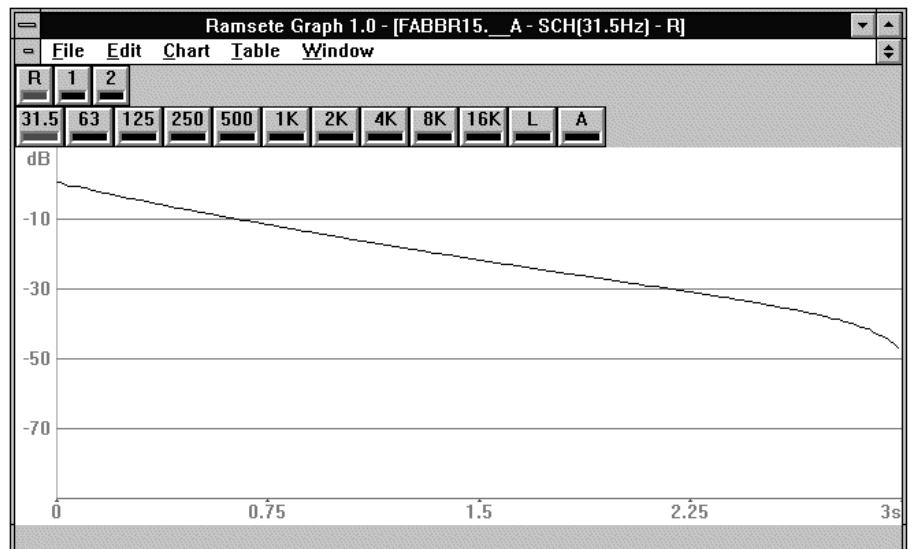


3.5. Ramsete Graph

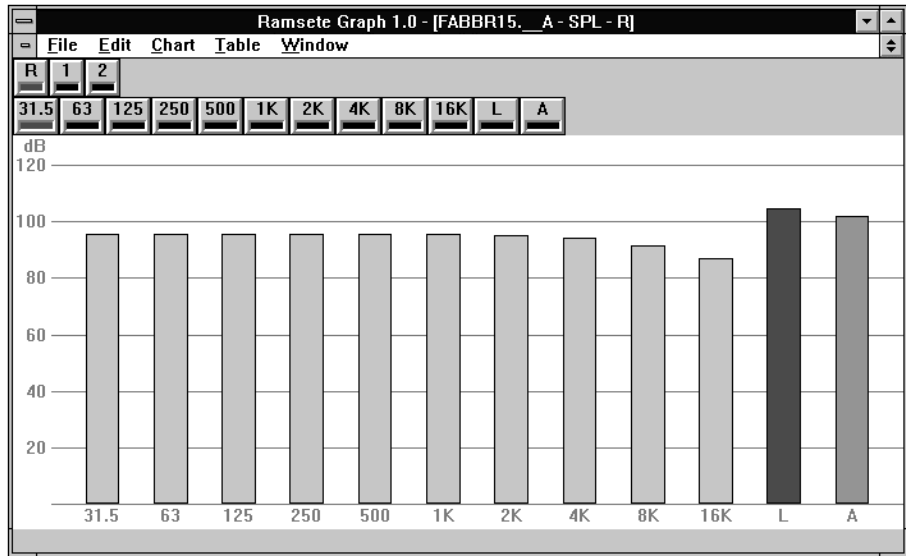
This program displays in tabular or graphical form the results of the pyramid tracer, such as impulse response in each receiver point or mean of the room:



integrated response (Schroeder decay curve):



octave spectrum in every receiver point:



numerical tables (SPL, reverberation times):

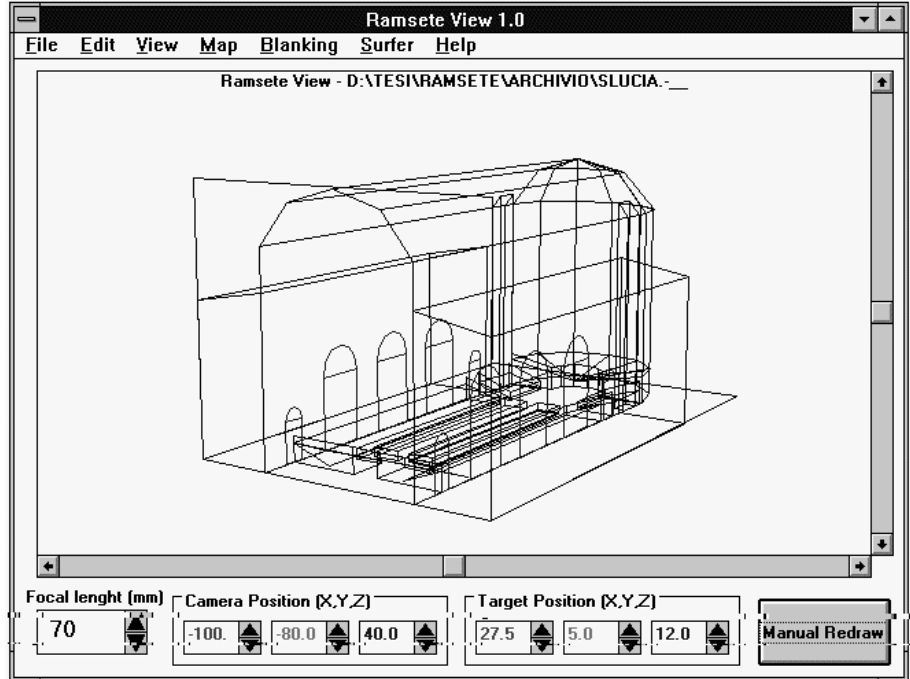
FABBR15. A - T60													
	31.5Hz	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz	16KHz	L	A	
R	4.404	4.403	4.401	4.394	4.366	4.256	3.865	2.843	1.270	0.420	4.308	4.099	
1	4.439	4.438	4.436	4.429	4.401	4.290	3.892	2.852	1.267	0.426	4.338	4.125	
2	4.359	4.359	4.357	4.350	4.323	4.216	3.832	2.831	1.274	0.425	4.270	4.070	

FABBR15. A - SPL													
	31.5Hz	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz	16KHz	L	A	
R	95.4	95.4	95.4	95.4	95.4	95.3	95.0	93.8	91.1	86.7	104.5	101.4	
1	96.2	96.2	96.2	96.2	96.2	96.1	95.8	94.9	92.8	89.4	105.4	102.4	
2	94.5	94.5	94.5	94.5	94.5	94.4	93.9	92.4	88.4	77.6	103.4	100.2	

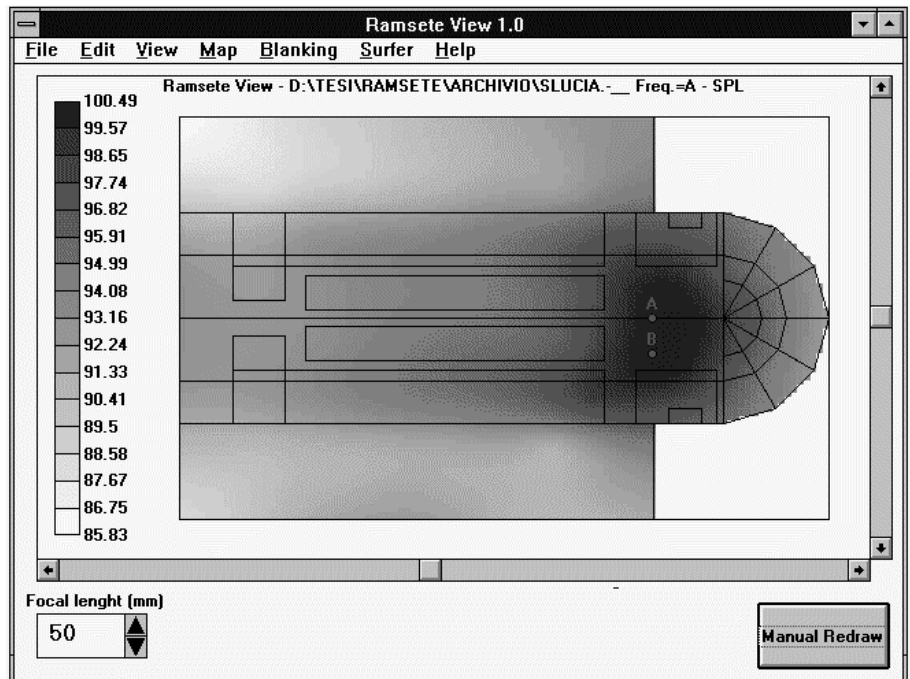
These tables can be easily exported to any spreadsheet application (Excel or Quattro-pro) by performing a simple "copy and paste" clipboard operation.

3.6. Ramsete View

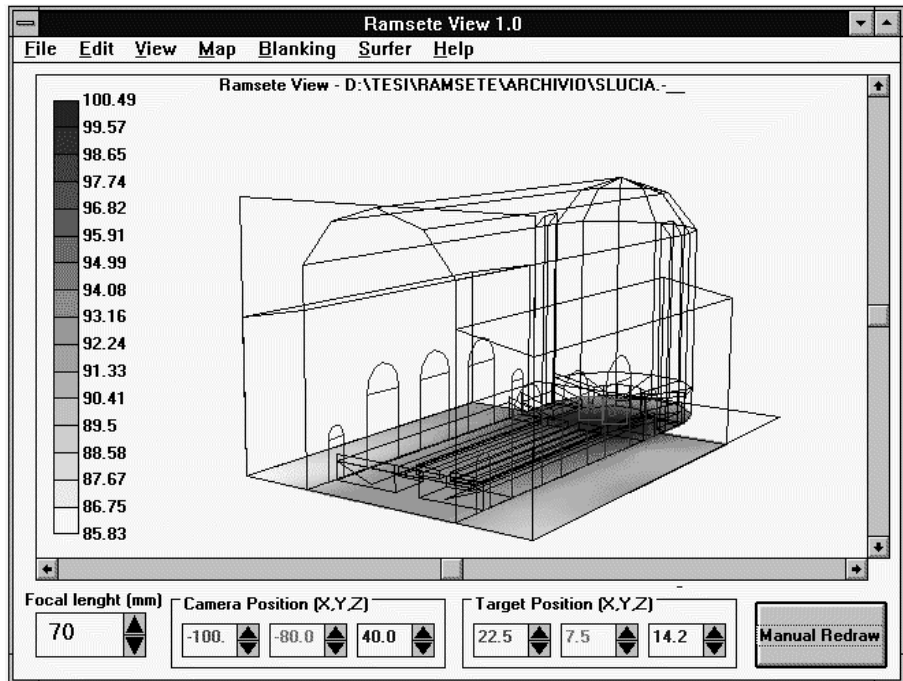
The program postprocesses CAD models and Ramsete Graph data and generate perspective views of the rooms mapping all the acoustic data in three dimensions. You can display the room from every point of view by simple positioning of an imaginary camera:



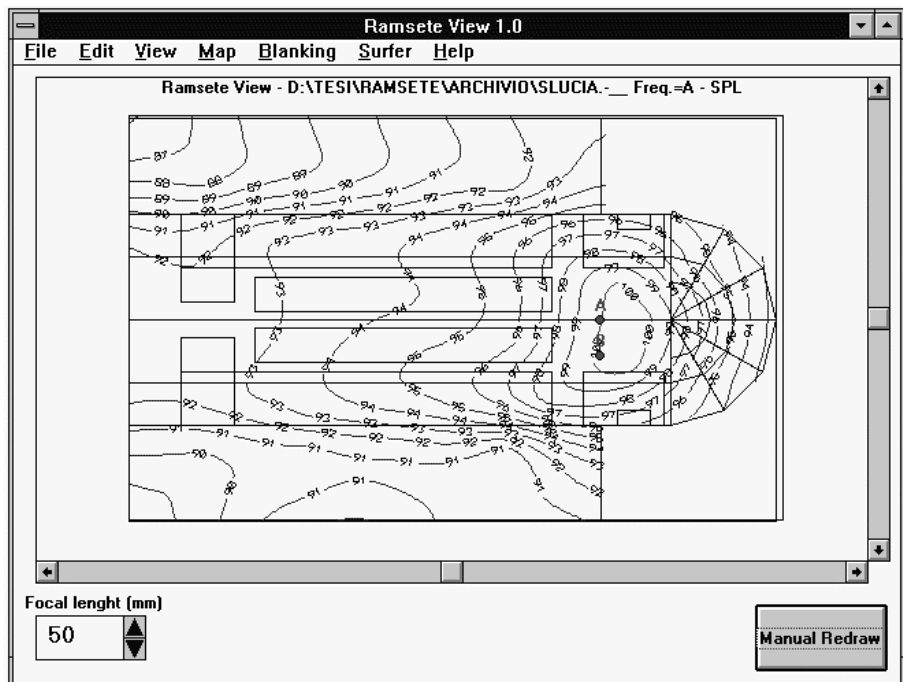
You can map the computed parameters in two dimensions:



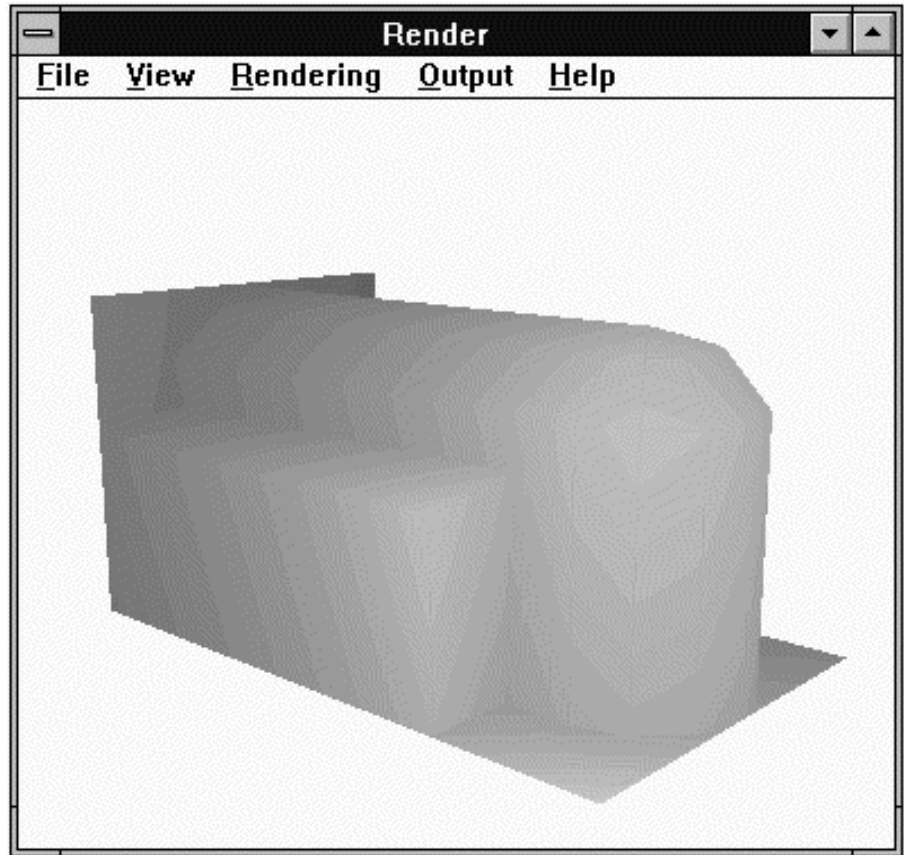
or three dimensions:



You can map isolevel curves in two or three dimensions:

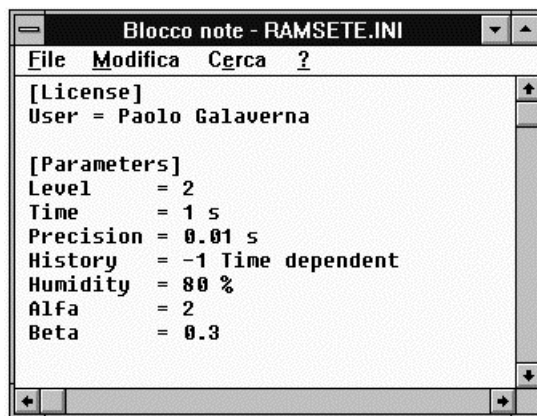


You can choose between many rendering effects, so you can create professional looking presentation without any complex dedicated software:



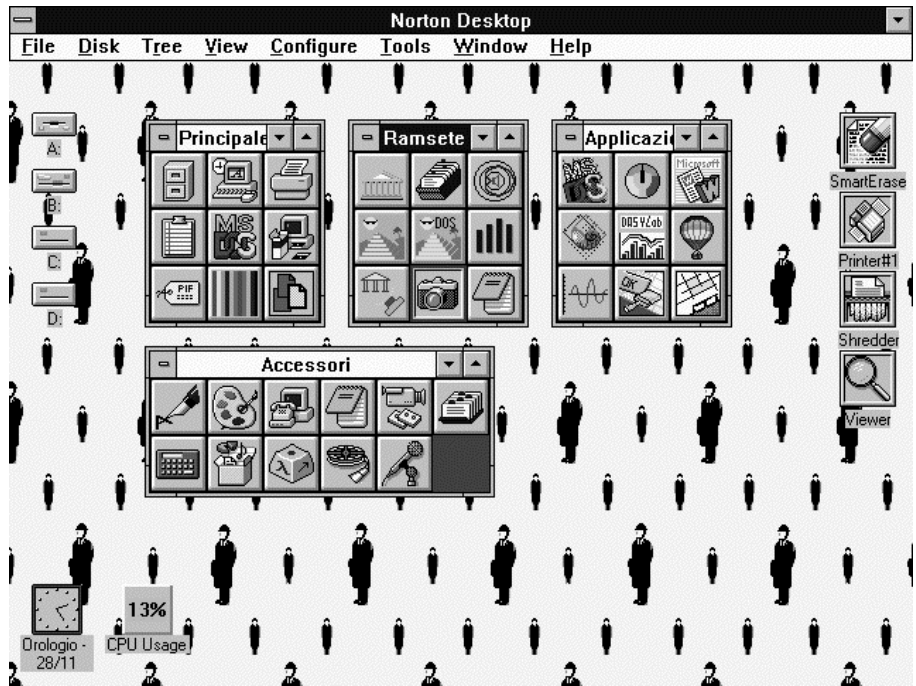
3.7. Preferences

Using the notepad Windows applet you can edit the default parameters of Ramsete.



3.8. Paint Shop Pro

This a very powerful shareware program that let you capture, edit and print any kind of image with the desired color depth:



4. Using Ramsete

Now we'll try to learn the basics of Ramsete following all steps of a typical application.

We want to map the situation created by a concentrated noise source in a reverberating environment, i.e. a factory. We measured on site the reverberation time and the sound pressure level of the noise source according to ISO 3744 (3746) standard. We also annotated the size and the materials the factory was made of.

- We'll start inserting into Source Manager all the data measured with the phonometer in order to create a noise source with the same characteristics of the real one.
- Then we'll sketch the factory geometry using Ramsete CAD, assigning the proper material to each face. Finally we'll properly place the noise source and the receivers.
- We'll use Ramsete Trace to create a file with all the results.
- Finally we'll use Ramsete Graph and Ramsete View to analyze these results, verifying the similarity between the computed reverberation time and the one measured on site. We'll have to modify the geometric model and the source parameters until the two reverberation times are equal.
- Now we'll be able to study an intervention to improve the acoustic situation. We'll edit our model with Ramsete CAD and recalculate the result file in order to verify the benefits or the drawbacks of our improvements.

Below we are presenting the data measured following the ISO 3744 (3746) standard with a parallelepipedal envelope surface with five measure points. The machinery dimensions are:

width: 2 m

length: 2 m

height: 4 m

The pressure level and the reverberation time T_{60} (temperature = 20, humidity = 65%) are:

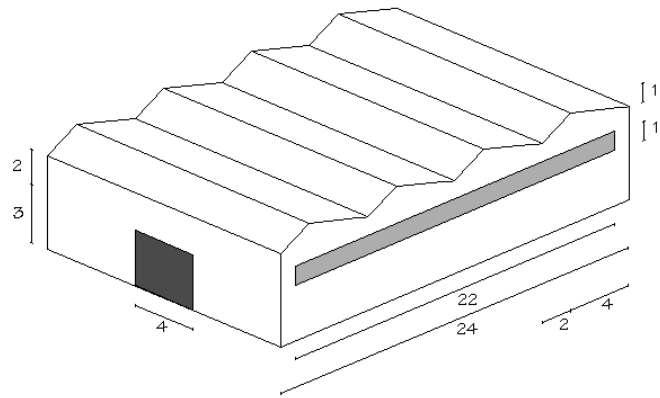
Frequency:

	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16KHz
Lp(1)	92.50	91.00	96.40	97.30	95.20	92.50	94.60	90.40	90.20	90.50
Lp(2)	98.90	99.70	94.50	96.60	97.40	92.40	91.50	93.50	93.50	92.90
Lp(3)	85.80	88.30	85.60	82.40	85.40	86.40	85.80	82.30	84.30	85.20
Lp(4)	77.30	76.90	73.40	79.40	76.80	75.60	76.40	74.40	72.30	71.30
Lp(5)	66.30	68.90	63.90	70.40	72.10	65.40	62.60	64.60	66.40	61.90

RevTime:

	31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	16KHz
T	12.2	12.0	10.6	8.5	7.4	7.0	7.0	5.2	2.2	0.6

The factory volume is 2112 m³.



The floor is made of concrete, the walls and the roof are made of rough-cast, the main door is made of iron.

Now we can create our noise source following these steps:

- click on Source Manager's icon
- click on File menu item
- click on the Crate Source ISO 3744... item

Now a dialog box will pop up to let us doing the following operations:

- Select the number of microphones (5) from the corresponding list box;
- Input length (2 m), width (2 m) and height (4 m) in the proper edit boxes;
- Input the factory volume in the corresponding edit box (2112 m^3);
- Fill the first five lines of the spreadsheet with the sound pressure of each frequency band;
- Fill the last line with the reverberation times of each band.

Now the dialog box should look like this:

ISO 3744 [3746] 1.0

Number of Microphones:

Parallelepiped Surface (5 mics)

Freq.(Hz)	31.5	63	125	250	500	1000	2000	4000	8000	16k
Lp(1) - dB	92.5	91.0	96.4	97.3	95.2	92.5	94.6	90.4	90.2	90.5
Lp(2) - dB	98.9	99.7	94.5	96.6	97.4	92.4	91.5	93.5	93.5	92.9
Lp(3) - dB	85.8	88.3	85.6	82.4	85.4	86.4	85.8	82.3	84.3	85.2
Lp(4) - dB	77.3	76.9	73.4	79.4	76.8	75.6	76.4	74.4	72.3	71.3
Lp(5) - dB	66.3	68.9	63.9	70.4	72.1	65.4	62.6	64.6	66.4	61.9
RT (s)	12.20	12.00	10.60	8.50	7.40	7.00	7.00	5.20	2.20	0.00

length (2a)
width (2b)
height (c)
Test Room Volume

- click on the "OK - proceed" button to accept all the inserted values;
- the dialog box will disappear, now we should save our source data;
- click on the "File" menu item;
- click on the Save As... item;
- save the file as "proof.spk" in the "machines" directory;
- click on the "File" menu item;
- click on the "Exit" item to quit the program.

Now we can use Ramsete CAD to draw the factory's geometry remembering the following simple rules:

- Don't exceed in drawing particulars that are mostly irrelevant from the acoustic point of view but that can increase dramatically the computation times;
- Use as few surfaces as possible;
- Don't place a receiver at less than 1 m far from the nearest source;
- Don't place a receiver at less than 10 cm from the nearest surface;
- Check if all the edges are well closed (matching) to avoid undesired pyramid escapes.

Let's start drawing the floor:

- Execute Ramsete CAD by clicking on its icon from the Program Manager;
- Click on "LENS" icon and adjust the window scaling right-clicking with the mouse until you can see an area of 24 x 16 m;

- Click on "Floor" icon;
- Place the mouse cursor at position 0.00, 16.00, 0.00 and keep the left button pressed until you reach position 24.00, 0.00, 0.00;
- Input a "0" elevation for the floor in the dialog box and press the "OK" button;
- Select the "Concrete floor (g)" from the material dialog box and press the "OK" button;

Now we are going to draw the walls:

- Click on "Wall" Icon;
- Click on the origin (0,0,0);
- Drag the pointer to 0.00, 16.00, 0.00 and release the mouse button;
- Input "0" and "6" in the elevation dialog box and press "OK";
- Choose "Rough-cast" from the materials dialog box and press "OK";
- Repeat the preceding steps for the other walls following these coordinates:
0.00,16.00,0.00; 16.00,24.00,0.00; 24.00,16.00,0.00; 24.00,0.00,0.00; 0.00,0.00,0.00.

Now we are going to draw the roof:

- Click on "Roof" icon;
- Click on position 0.00, 16.00, 0.00 and drag the pointer to 2.00, 0.00, 0.00
- Input "5" in the first elevation dialog box and click "OK"
- Input "6" in the second elevation dialog box and click "OK"
- Input "6" in the third elevation dialog box and click "OK"
- Choose "Rough-cast" from the materials dialog box and press "OK";
- Repeat the same steps for the other three parts of the roof

At last we'll draw the windows and the main door:

- Click on the "Pick" icon;
- Select one of the walls;
- Click on the "Window" icon;
- Click on the middle of the wall;
- Input "22", "1", "3" in the dialog box with the window data
- Select the "Glass (g)" material and press "OK" on the material dialog box;
- Repeat the same steps for the other wall;

And now the main door:

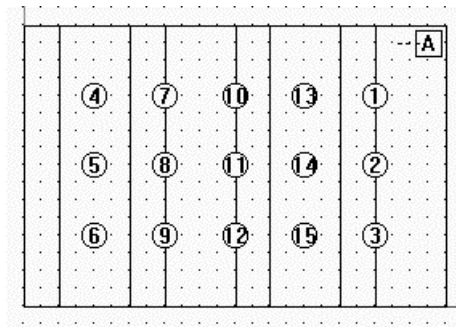
- Click on the "Pick" icon;
- Click on the "Door" icon;

- Click on the middle of the wall;
- Input "4" and "3" in the dialog box with the door data
- Select the "Iron door" material and press "OK" on the material dialog box;

Now we'll insert the source and the receivers:

- Click on the "Source" icon;
- Click at position 23.00,15.00,0.00 and drag the pointer horizontally;
- Input "1" for the source elevation;
- Select "proof.spk" for the source name
- Click on the "Receiver" icon;
- Click on an imaginary grid with a 5m step to fill the floor with receiver
- Input "1.7" for each receiver's elevation

You should get the following situation on the "Plant" window:



Before leaving Ramsete CAD save the file as "proof.ray" using the common Save File dialog.

If you want to import an AutoCAD DXF file you should follow these advice:

1) Surfaces

Use 3DFACE entities, place them in a layer with the same number of the face material. Obstructing faces will have a number increased by 1000.

2) Doors and Windows

Use 3DPOLY entities placed on the layer corresponding to the material

3) Holes

Use 3DPOLY entities placed on the "HOLES" layer

4) Sources

Use the ATTDEF entity on the "SOURCES" layer giving a tag that identifies the file with the source data, i.e. C:\RAMSETE\SOURCES\OMNI.SPK. Use the two point curve fitting to specify the position and orientation of the source.

4) Receivers

Place LINE entities on the "RECEIVERS" layer to specify their positions and orientation.

By now we've completed the data insertion phase. Now we're ready to process these data with Ramsete Trace.

- Click on "Ramsete Trace" icon;
- Load the file "proof.ray" with the common Open File dialog box;
- Input the following parameters:
- Level = 5;
- Time = 6;
- Precision = 0.01;
- History = -1;
- Humidity = 65%;
- Press OK to proceed with the computation.

Now we'll analyze the processed data with Ramsete Graph and Ramsete View:

- Click on Ramsete Graph icon;
- Load "proof.__a" with the common Load dialog box;
- Select T60 from the "Table" menu item;
- Let's compare the reverberation times with the ones measured on site:

Measured:

	31.5Hz	63Hz	125Hz	250Hz	500Hz	1khz	2khz	4khz	8khz	16KHz
T	12.2	12.0	10.6	8.5	7.4	7.0	7.0	5.2	2.2	0.6

Ramsete "proof":

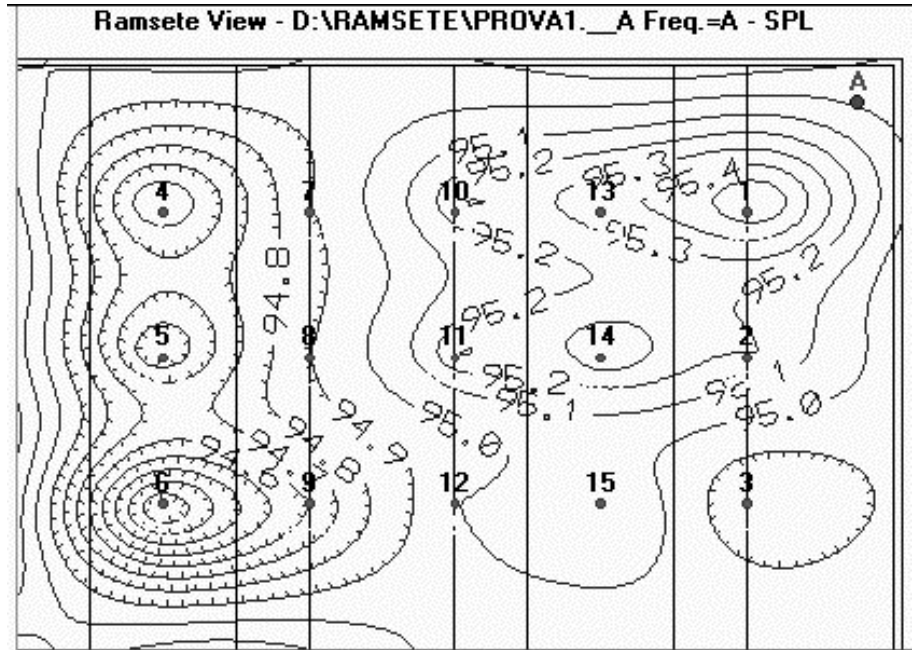
	31.5Hz	63Hz	125Hz	250Hz	500Hz	1khz	2khz	4khz	8khz	16KHz
T	12.322	11.827	10.597	8.741	7.767	6.959	6.900	5.269	2.088	0.611

We can see that there's a little difference between the experimental and simulated times, so we can be really sure that we have built a good geometric model.

Now we'll map the SPL of the factory using Ramsete View:

- Click on Ramsete View icon;
- Select Open Response+Geometry File... from the File menu;
- Load the "proof.__a" file;
- Press "OK-done" on the "STI-Options" dialog box;
- Use the "View Menu" in order to select the items that you want to be displayed or not;

- Select "Mapping Options" from the "Map" menu item;
- Check "Use Surfer™s Grid" box and press "OK"
- Select "Do Contour 2D..." command and press "OK" on the options dialog.



Now we'll use Ramsete CAD to edit the original model in order to reduce the SPL:

- Follow the standard procedure to load "proof.ray" in Ramsete CAD
- Click on the "Wall" icon and draw a wall from 21.00,16.00,0.00 to 21.00,13.00,0.00 with height of 3 m.
- Select "Intonaco calce (s.r.)" from the material dialog and remember to check the "Obstructing" box, in fact the new wall is inserted between the source and the receivers.
- Save the modified model as "progect.ray" and exit the program.
- Now you should repeat the same operating cycle we described before in order to compute "progect._a" with Ramsete Trace and display the T60 table with Ramsete Graph:

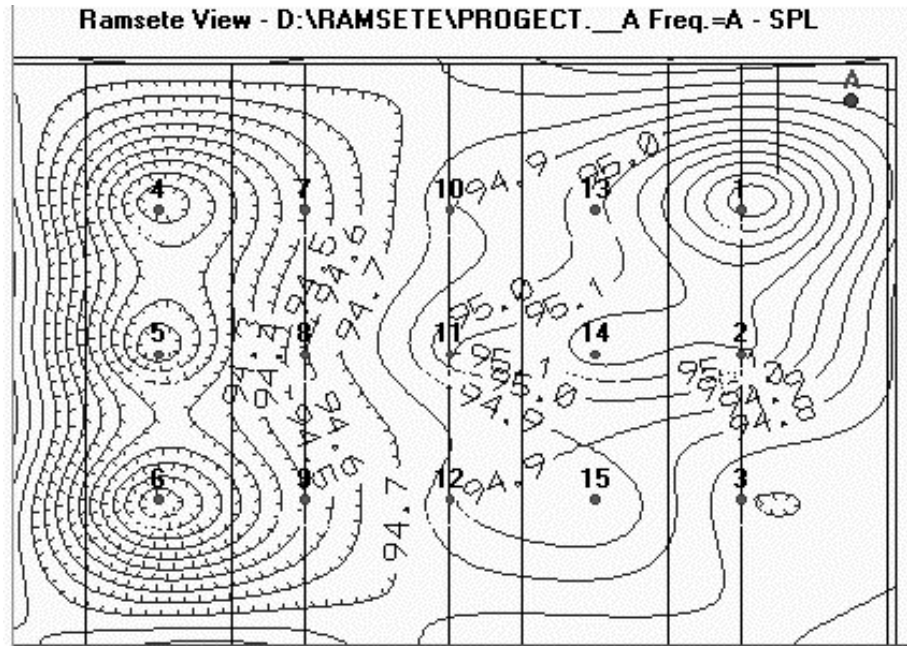
Ramsete "proof":

	31.5Hz	63Hz	125Hz	250Hz	500Hz	1khz	2khz	4khz	8khz	16KHz
T	12.322	11.827	10.597	8.741	7.767	6.959	6.900	5.269	2.088	0.611

Ramsete "Progect":

	31.5Hz	63Hz	125Hz	250Hz	500Hz	1khz	2khz	4khz	8khz	16KHz
T	12.171	11.453	10.369	8.731	7.829	7.040	6.908	5.214	2.049	0.608

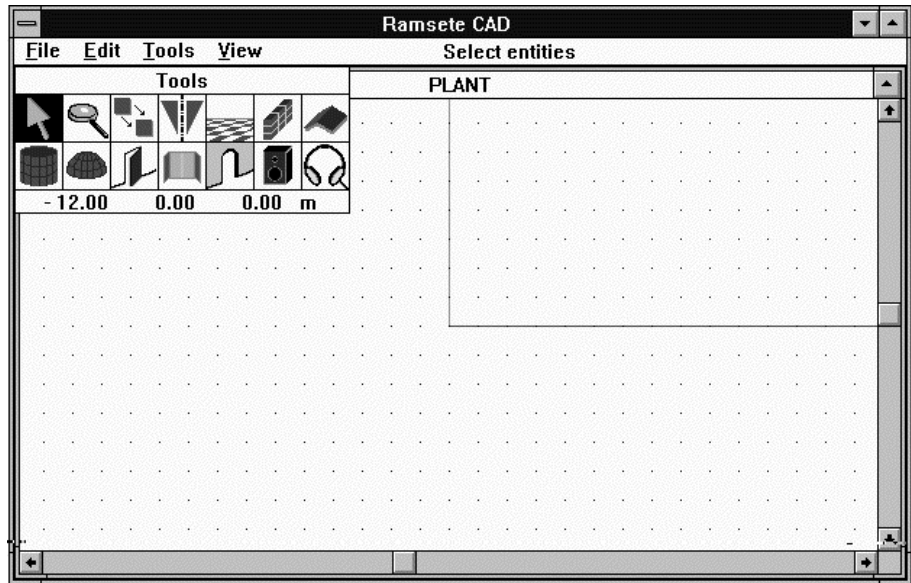
As we could expect: the reverberation time isn't changed very much. Now we'll use Ramsete View to map the SPL, following the above mentioned procedure:



IMPORTANT: This is a pure didactic example and the author declines every responsibility on the improper use of the acoustic data in real projects.

5. Ramsete CAD

The opening window will look like this:



Now we are ready to edit an old file or to input a new model. The right side of the menu bar displays a short description of the current drawing tool.

5.1. File menu



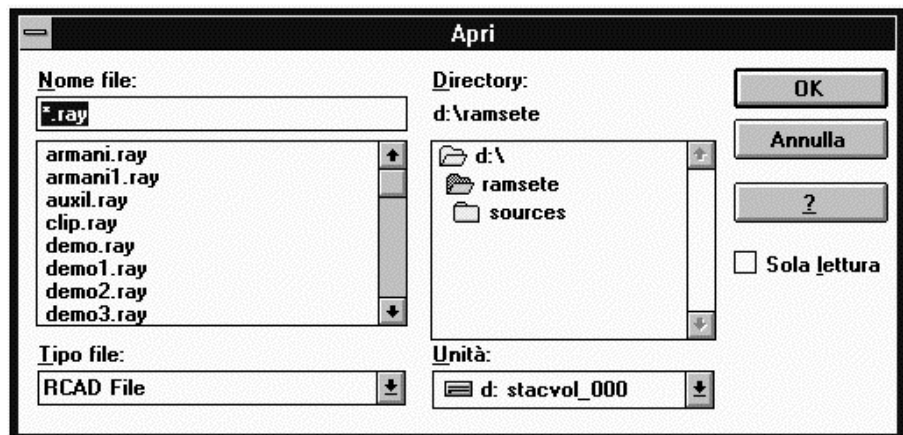
New

This item let you create a new drawing, if you are already editing a model you'll be asked to save the work done, if you have modified it.



Open...

This command displays the common "Open File" dialog box, prompting you for the next .RAY file to load.



If you want to load a .DXF file you should select this option from the listbox on the bottom left corner as usual.



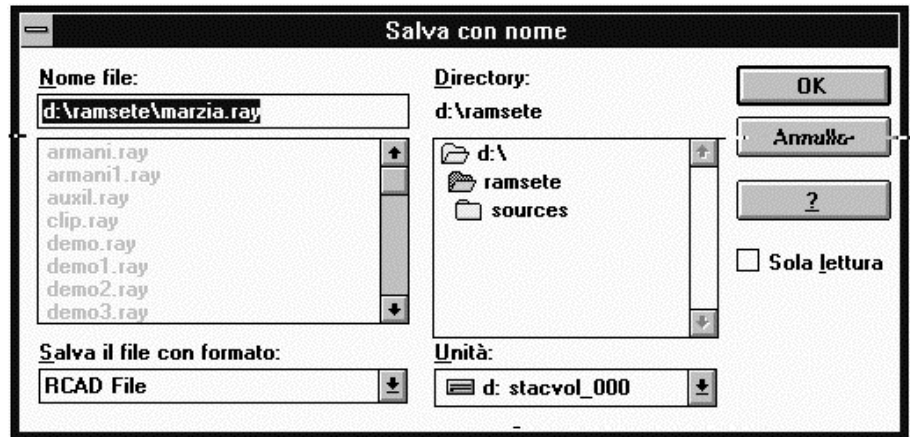
Save

This command saves the current drawing, if you haven't saved it yet, you'll have to name it in the Save as dialog box, described below.



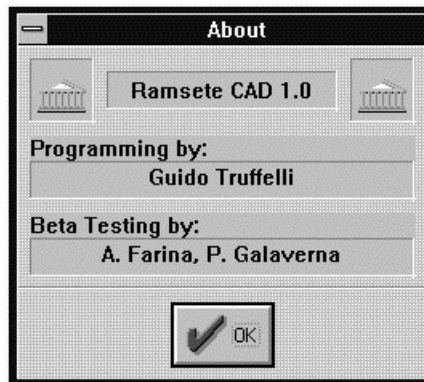
Save As...

Selecting this item you can open the common Save as... dialog and give a name to your drawing. You can select any disk or directory as a destination of your file. The default extension is .RAY.



About...

This item displays some information on the application version and authors.





Exit (Alt+F4) This command quits the program.

5.2. Edit menu



Cut (Shift+Del) This command deletes the current selection and puts it into the clipboard. You can recall it with the Paste command.



Copy (Ctrl+Ins) Copies into the clipboard one or more selected entities.



Paste (Shift+Ins) Pastes the previously copied entities from the clipboard



Duplicate (Alt+Ins) This command is a shortcut for the combination of copy and paste commands.



Resize This command resizes the currently selected items. It prompts you for a scaling factor that can range between 0.001 and 99999.





Ino This commands displays the characteristics of the selected item, if more than one entity has been selected it shows a dialog box for each item. If you select a source, its name and path would be displayed, if you select a wall, or any other surface you'll get a material dialog.



Select All (F2) Selects all the entities of the current model.



Unselect All (Shift+F2) Unselects all selected items

5.3. Tools menu



Tools Displays or hides the "Tools" window.



Pick This tools enables the selection of drawn entities in two different ways: you can click on a single entity to select cyclically or deselect it, otherwise you can keep the mouse button pressed and trace a rectangle around the group of entities you'd like to select.




Lens You can center the model into the current view clicking the left mouse button, while the right button reduces its size. If you keep the button pressed you can zoom into the selected rectangular area.



Move This command allows you to define a vector along which the current selection will be moved. In order to move one or more entities you should select them with the pick tool, then you need to click on the starting point and release the mouse button upon the destination. This command is mostly used in conjunction with the duplicate command.

 THIS COMMAND IS NOT AVAILABLE IN THE AXONOMETRY VIEW.



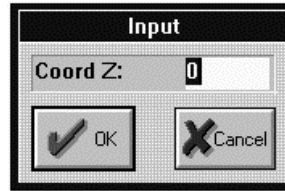
Mirror This commands mirrors the selected entities with respect to a segment that can be drawn in the same way of the move command ( Move). A dialog box will ask you if you want to delete the selected items after mirroring or duplicate them,



 THIS COMMAND IS NOT AVAILABLE IN THE AXONOMETRY VIEW.

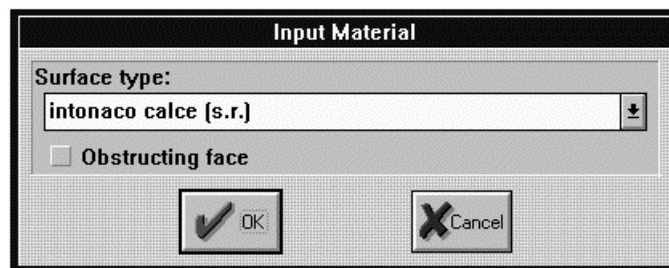


Floor This tool allows you to draw rectangular surfaces clicking on a corner and dragging the pointer to the opposite one. When you release the mouse button you'll be required the floor elevation (in the plant view):



 YOU CAN INPUT NEGATIVE COORDINATES TOO.

After that you'll prompted for the floor material:



The listbox contains all possible materials for any surface, you can select them with the arrow keys, pressing the material initial letter repeatedly, or directly with the mouse. If the surface hides other surfaces or receivers remember to declare it as "obstructing" clicking the checkbox. This procedure is the same for any surface entity (floor, wall, roof):



Obstructing face

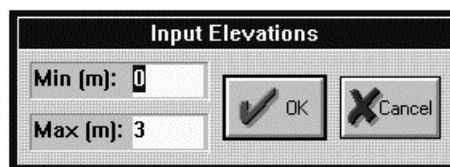
 A WALL IS OBSTRUCTING IF IT CAN BE POSITIONED BETWEEN AN IMAGE SOURCE AND A RECEIVER

 THE NUMBER OF OBSTRUCTING FACES SHOULD BE KEPT AS SMALL AS POSSIBLE, IN FACT IT INFLUENCES HARD THE COMPUTATION TIMES.


 YOU CAN'T DRAW FLOORS IN THE AXONOMETRIC VIEW.



Wall In the plant view you can draw a wall as a segment ( Move), in the front or side views you'll draw a rectangle ( Pick, Lens). When you've placed the segment you'll be asked for the minimum and maximum elevation of the wall:



 ALL COORDINATES CAN BE NEGATIVE.

In the side or front view you'll be prompted for the missing coordinate only with the standard dialog box ( Floor).

 YOU CAN'T DRAW WALLS IN THE AXONOMETRIC VIEW.



Roof The procedure to draw a roof is very similar to the one used for the floor (Floor), but when you've drawn the rectangle you'll be prompted for the elevations of three points, the fourth we'll be computed automatically:

Input
Coord Z: 0
OK Cancel

YOU CAN INPUT A NEGATIVE COORDINATE.

The procedure will end with the standard material dialog box (Floor).

YOU CAN'T DRAW A ROOF IN THE AXONOMETRIC VIEW.



Cylinder In order to draw a cylinder you have to define the circumference arc of its base clicking onto three points to define the arc itself limits. If you want to draw a complete circle you should click onto two points defining the diameter and click on the first point again to finish. At this point you'll have to insert the cylinder elevations in the following dialog box:

Input Elevations
Min (m): 0
Max (m): 3
OK Cancel

ALL COORDINATES CAN BE NEGATIVE.

For computation efficiency purposes, all circular surfaces are approximated to a number of rectangles, you can specify this number in this dialog box:

Input
Steps: 6
OK Cancel

At last the material dialog box will appear (Floor).

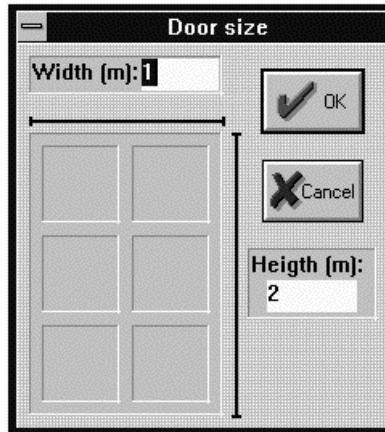
YOU CAN'T DRAW A ROOF IN THE AXONOMETRIC VIEW.



Sphere The procedure that defines a spherical surface is identical to the one we have described for the cylinder (🌀 Cylinder). This tool can't draw a complete sphere but only a fraction of it, but you can draw a semi-sphere and use the mirror tool in order to have the work done.



Door When you want to draw a door you have to select the wall that it belongs to and click on the position in which you want to place it. Now you have to specify the door dimensions in the following dialog box:



🔔 THE SELECTED POINT IS THE MIDDLE OF THE DOOR BASE.

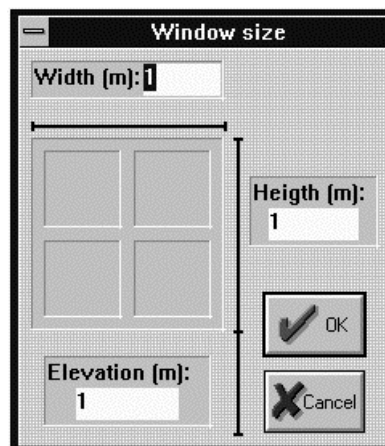
At last the material box will appear.

🔔 YOU CAN'T DUPLICATE OR MIRROR DOORS WITHOUT SELECTING THEIR WALL.

🔔 YOU CAN'T DRAW DOORS IN THE AXONOMETRIC VIEW.

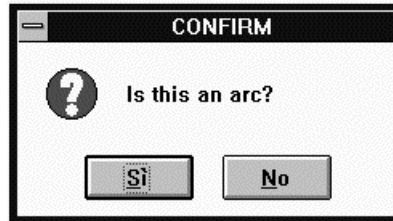


Window The procedure to draw a window is similar to the one described for a door (🌀 Floor), the only difference is the elevation dialog box:

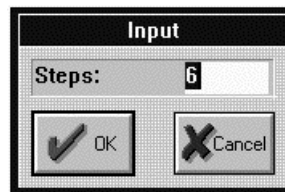





Hole This tool allows you to make holes into walls. First of all you should select the wall to perforate than you describe a closed polygon clicking on its vertices. The last point of the polygon should coincide with the first one. If you draw a polygon with three vertices only you'll be asked if you are trying to draw an arc:



If you answer "No" a triangular hole will be drawn, otherwise it will pop up a dialog asking you the number of segments that approximate to the arc:



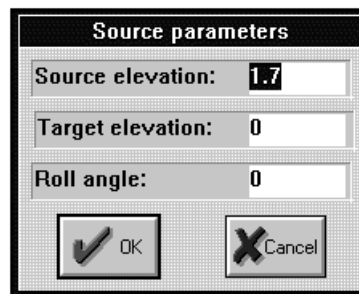
The number of steps is automatically suggested by the program and you can increase it if you wish, but keep it as small as possible to reduce computation times.

 YOU CAN'T DUPLICATE OR MIRROR HOLES WITHOUT SELECTING THEIR WALL.

 YOU CAN'T DRAW HOLES IN THE AXONOMETRIC VIEW.

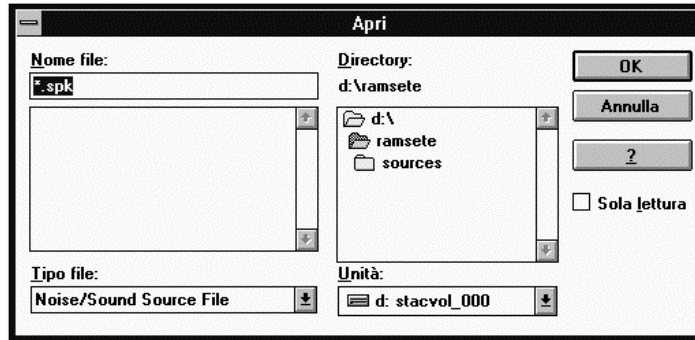


Source You specify the position of a source drawing a segment from its real position to the point it's aimed at. This is very important for the correct computation of the sound field of directive sources. At this point you'll be asked for the elevation of the source and of its target point:

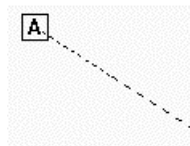


The roll angle defines the rotation of the source axis with respect for the floor plane (xy plane).

At last you've to define the full path of the source parameters file in the common open dialog:



When you press "OK", the screen should look like this, where the letter is a progressive identifier for the source:



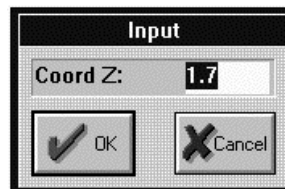
DON'T PLACE A SOURCE EXACTLY ONTO A WALL OR ANY OTHER SURFACE, YOU SHOULD KEEP AT LEAST 10 CM OF DISTANCE.

YOU CAN'T DRAW HOLES IN THE AXONOMETRIC VIEW.

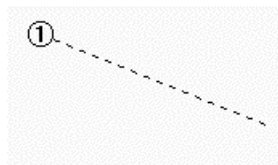


Receiver A receiver represents a microphone, any measure equipment or a person. The tracer results will always be relative to the receiver's position, they shouldn't be considered the mean value of the room, so you should use more than a receiver in order to analyze a room properly. The more receiver you place the more precise results you get, but remember that the resulting file will be much larger and the computation times longer.

You can place a receiver with the same steps described for a source, but you'll be asked for the receiver elevation only because the target point is always at the same height. This piece of information is fundamental for the computation of LE parameter.



At last you should get the following situation on the current view:



Each receiver will be automatically identified by a progressive number.

DON'T PLACE A SOURCE EXACTLY ONTO A SOURCE, YOU SHOULD KEEP AT LEAST 1 M OF DISTANCE FROM THE NEAREST SOURCE.

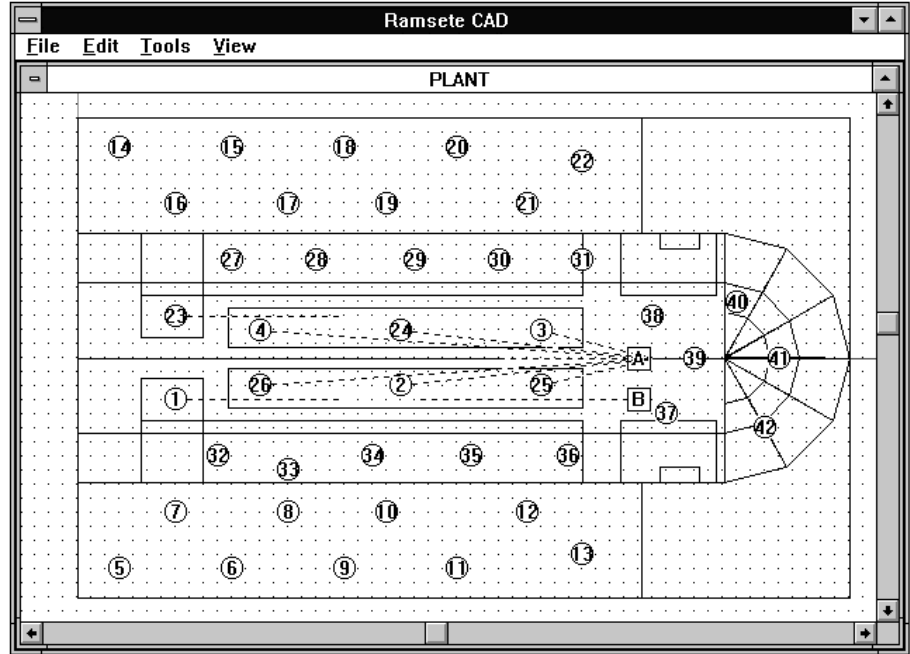
DON'T PLACE A RECEIVER EXACTLY ONTO A WALL OR ANY OTHER SURFACE, YOU SHOULD KEEP AT LEAST A DISTANCE OF 10 CM.

YOU CAN'T DRAW HOLES IN THE AXONOMETRIC VIEW.

5.4. View menu



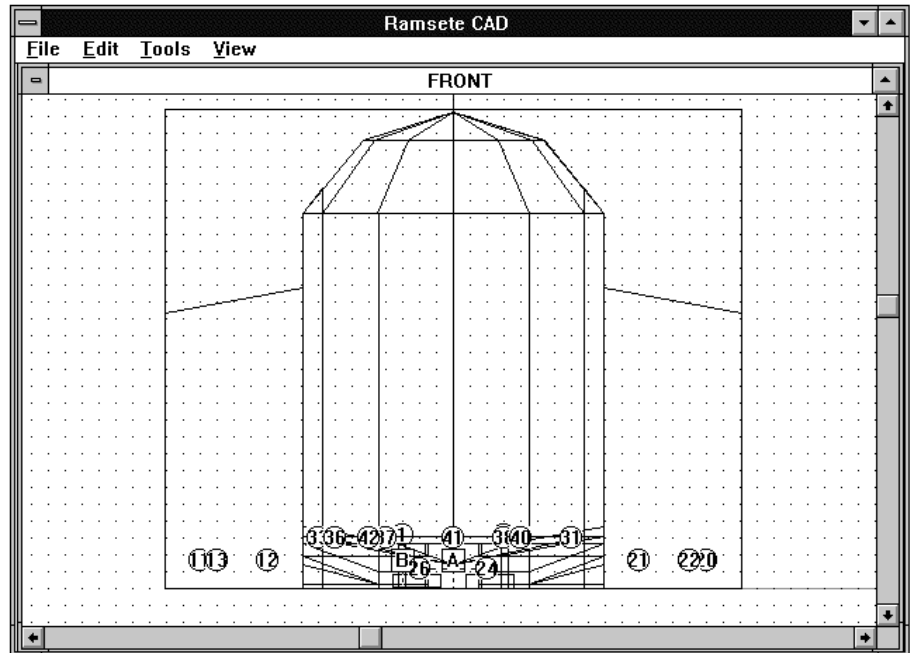
Plant This command activates the plant view of the model:



IN THIS VIEW ALL THE TOOLS CAN BE USED.



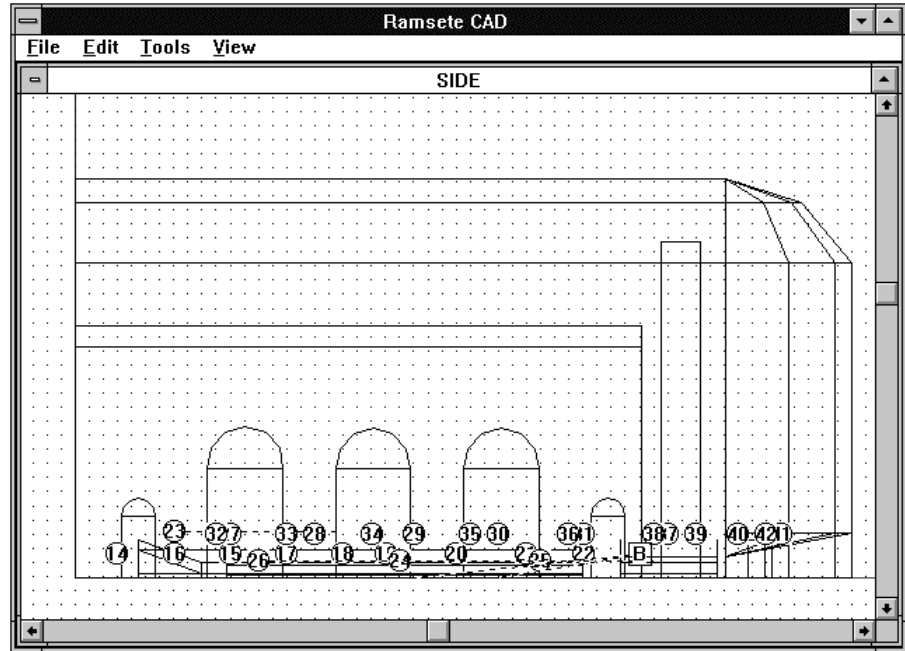
Front This command activates the front view of the model:



IN THIS VIEW ALL THE TOOLS CAN BE USED.



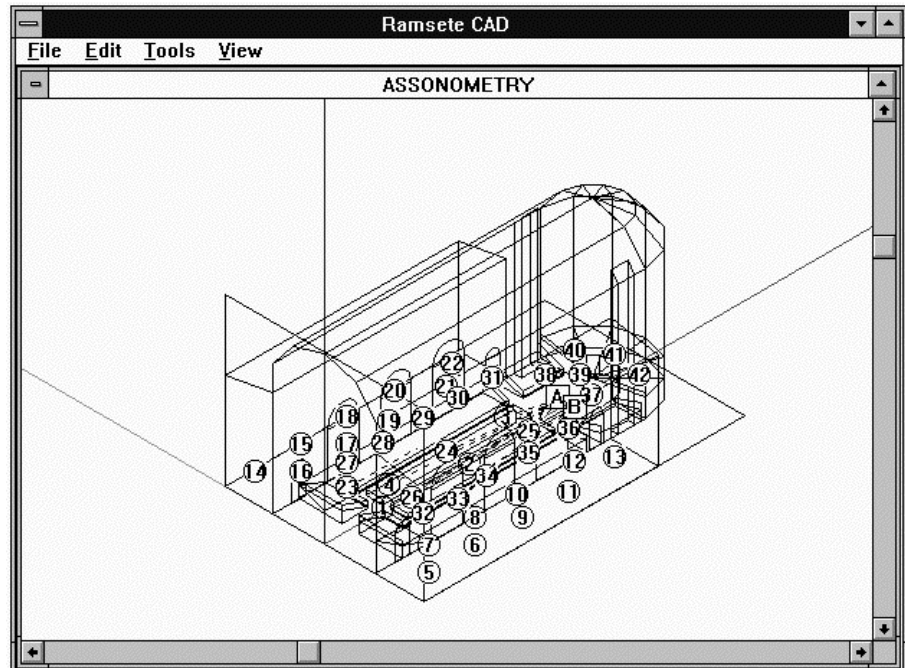
Side This command activates the side view of the model:



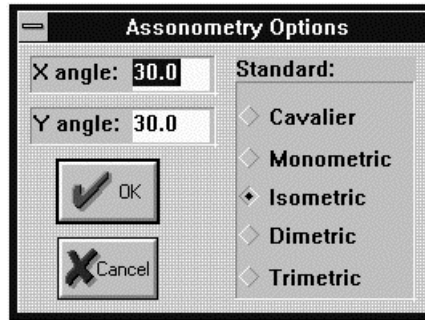
 IN THIS VIEW ALL THE TOOLS CAN BE USED.




Axonometry This command activates the axonometric view of the model:



If you click the right mouse button inside this window you can define the axonometry type:

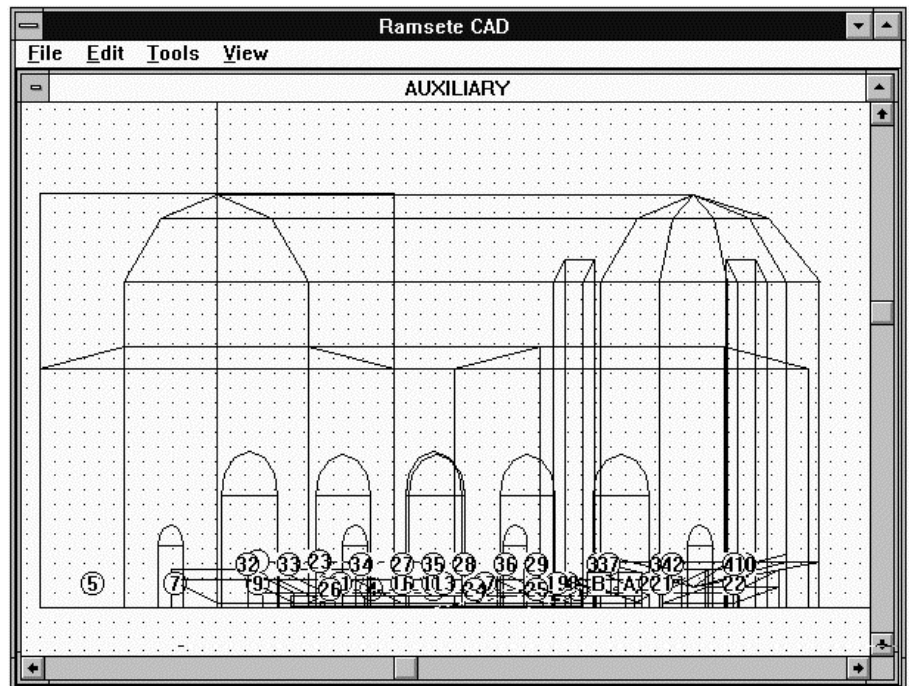


If you want define a customized axonometric view you should insert the desired values in the edit boxes, otherwise you can select a standard axonometry with the radio buttons on the right.

 IN THIS VIEW YOU CAN USE THE PICK AND LENS TOOL ONLY. THE COORDINATES OF THE CURSOR ARE DISABLED.



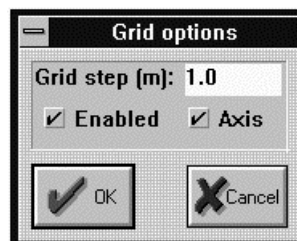
Auxiliary This command activates the auxiliary view of the model, i.e. a view parallel with the selected wall:



 IN THIS VIEW THE FLOOR, WALL, DOOR, WINDOW AND HOLE TOOLS ARE DISABLED.



Grid Options... You can define the snapping grid step with the following dialog box:



With the bottom check boxes you can show or hide the grid itself or the X, Y and Z axis.



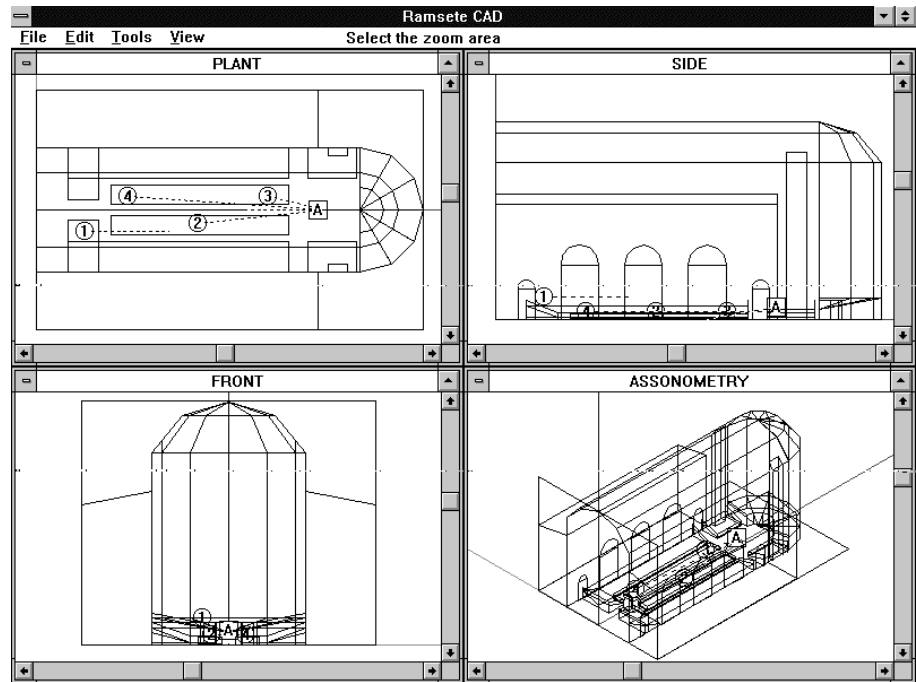
Cascade (Shift+F5) This command places all the view in cascade.



Tile (Shift+F4) This command tiles all open views filling the main window.



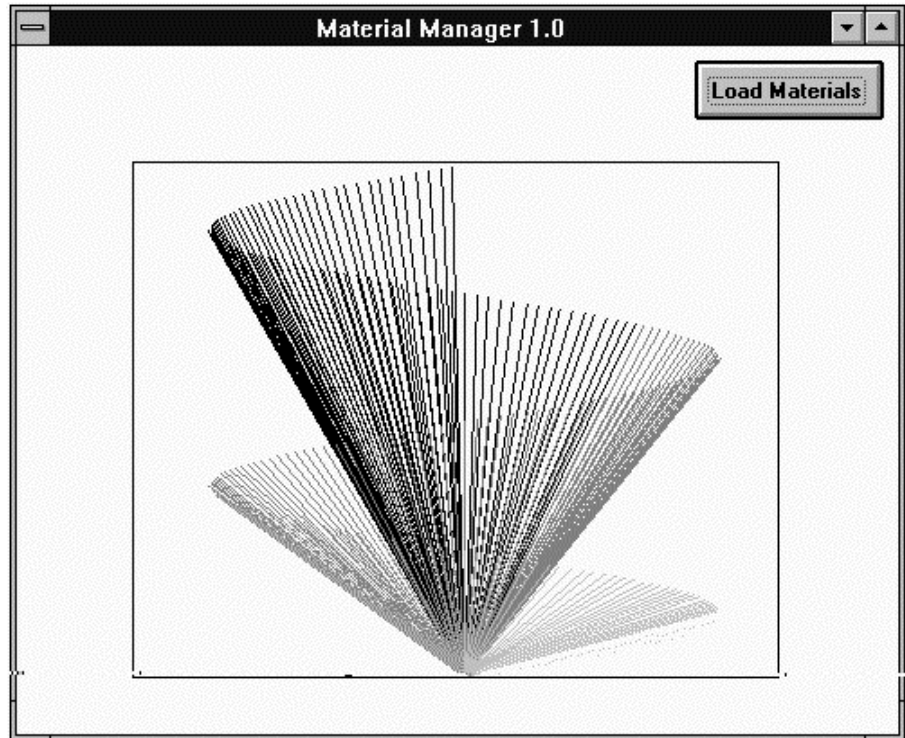
Standard This commands activates the four standard views of the model and tiles them on the screen:



Redraw (F2) This command will redraw the whole main window in order to remove undesired selection spots.

6. Material Manager

This program starts with the following window:



clicking on "Load Materials" a new window will pop up:

N.	Frequency (Hz)	31.5	63	125	250	500	1k	2k
0	Nessuno	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	intonaco calce (s.r.)	0.03	0.06	0.06	0.06	0.06	0.07	0.09
2	intonaco ruvido	0.01	0.01	0.02	0.03	0.04	0.05	0.04
3	intonaco liscio	0.01	0.02	0.02	0.02	0.03	0.04	0.04
4	int. calce fresco (T.R.)	0.01	0.02	0.03	0.04	0.04	0.05	0.06
5	int. calce maturo (T.R.)	0.01	0.02	0.03	0.04	0.05	0.06	0.07
6	int. calce degrad.(T.R.)	0.03	0.05	0.06	0.07	0.07	0.07	0.09
7	int. gesso liscio legno (P)	0.02	0.03	0.04	0.05	0.06	0.07	0.07
8	int. gesso liscio ferro	0.01	0.01	0.02	0.03	0.03	0.04	0.02
9	piastrelle stuccate (g)	0.02	0.03	0.03	0.03	0.04	0.04	0.04
10	legno di pino (C)	0.05	0.1	0.1	0.1	0.1	0.09	0.1
11	legno verniciato (g)	0.06	0.11	0.11	0.12	0.12	0.12	0.1
12	legno compensato (C)	0.06	0.11	0.11	0.11	0.12	0.12	0.1
13	pavimento legno (B)	0.01	0.02	0.03	0.04	0.06	0.12	0.1
14	pavimento legno (C)	0.05	0.09	0.09	0.1	0.08	0.08	0.1
15	pavimento marmo (B)	0.01	0.01	0.01	0.01	0.02	0.03	0.03
16	pavimento moquette (B)	0.03	0.05	0.05	0.05	0.1	0.2	0.3

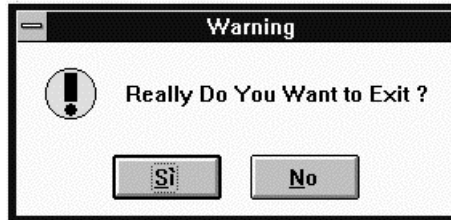
Here we can see the names of the materials and their coefficient α , for each octave. This window can be resized using the standard Windows procedures.

A Absorbing factor. Pressing this button every absorbing factors of each band will be displayed.

R Phonoinsulating coefficient. Pressing this button the coefficients of each band will be displayed.

Update File Saves the work done until this moment.

Quit Exits the program with the following dialog box:



If you want to insert a new material you should position the cursor on an empty line and press the left arrow (\leftarrow). Then you'll insert the material name and all of its parameters

7. Source Manager

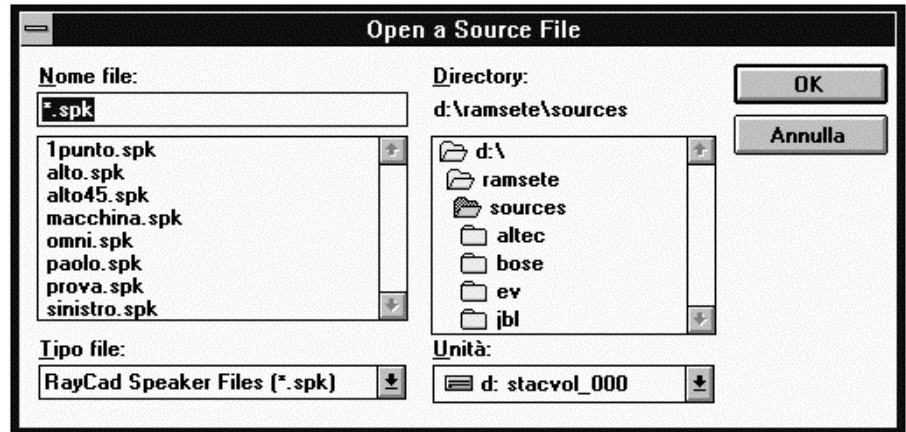
7.1. File Menu



New Creates a new source data file.



Open... This command opens the common open dialog:



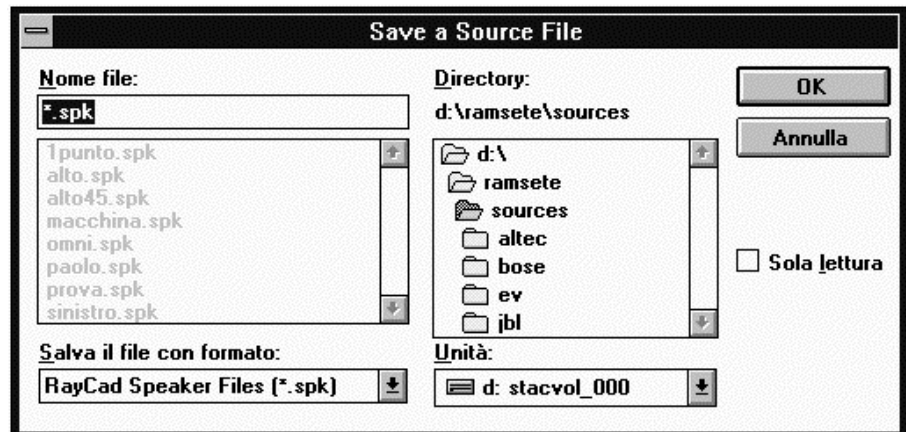
where you can load any .SPK file previously generated by Source Manager.



Save This item saves the work done, if you haven't saved it before you'll prompted for a new file name with the Save As... dialog box.

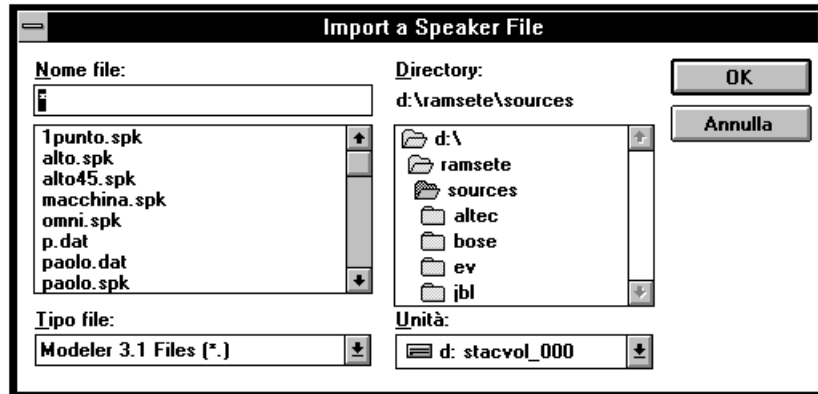


Save As This command allows you to save the file with a given name:

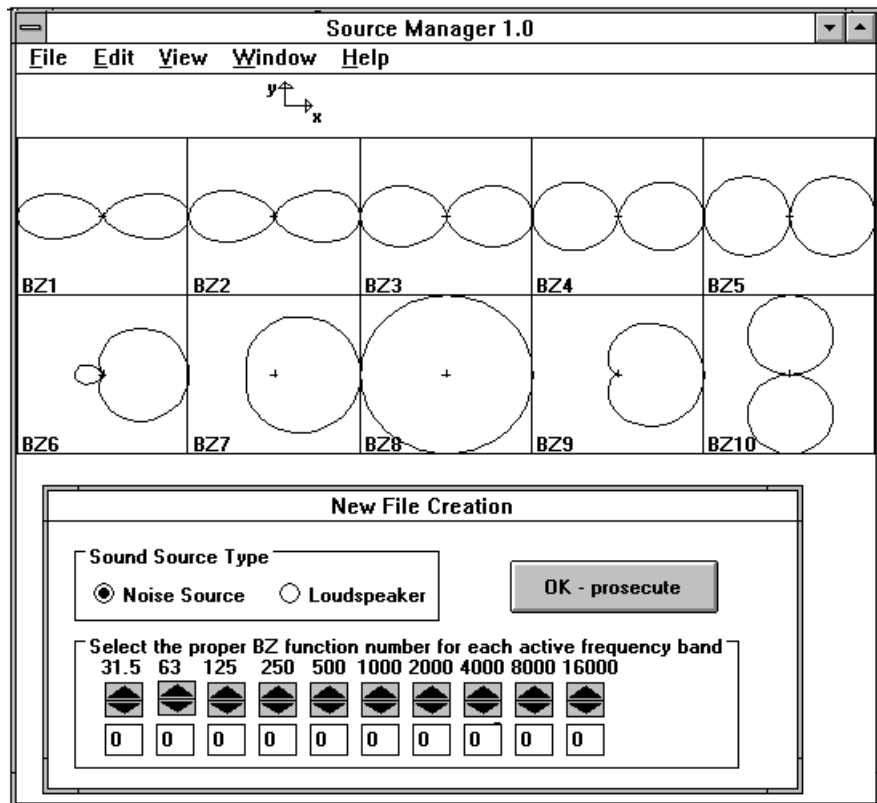




Import This command imports Modeler 3.0 or Modeler 3.1 speaker files:



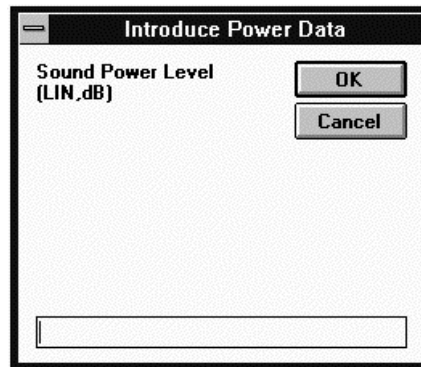
Source (BZ)... This item will pop up the following dialog box:



These BZ curves describe the directivity of a source. You should specify if you want to create a sound or noise source with the "Sound source type" radio button. Now you have to select a BZ curve for each band (BZ1, BZ2, ..., BZ10).

YOU CAN ASSIGN A "0" POWER VALUE ONLY TO THE FIRST BANDS OR TO THE LAST ONES. YOU CAN'T LEAVE POWER HOLES OTHERWISE THE PROGRAM WILL CRASH.

If you have selected a "Noise Source" you'll see this dialog box:



where you can specify the linear power level in dB of the source. If you have selected "Loudspeaker" you'll be asked for the electric power in Watt. The program will distribute the energy for each band automatically. Now you can press "OK" and save the work with the Save as... menu item.



Source ISO 3744... If you know the sound pressure level according to the ISO 3744 (3746) standard you can describe a source with the following dialog box:

ISO 3744 (3746) 1.0

Number of Microphones: 9

OK - proceed

Load from File

Save to File

Display Lw

Time Limit

length (2a) 2

width (2b) 1.5

height (c) 1

Test Room Volume 200

0

Freq.(Hz)	31.5	63	125	250	500	1000	2000	4000	8000	16k
Lp(1) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(2) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(3) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(4) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(5) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(6) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lp(7) - dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

You must insert the power levels for each band in dB, the dimensions of the parallelepipedal surface in meters and the room volume where the measures were taken. When you're done, click on the "OK" button to see the next dialog box:

Enter Heading Data

Noise Source Name:

Manufacturer :

OK - proceed

where you can specify the source name and manufacturer.

If you select the "Load from file" item you can load .DAT or .PRN files with this dialog box:

Load an ISO 3744 file

Nome file:

Directory:

Unità:

Tipo file:

Files:

Directory List:

- d:\
- ramsete
- sources
- altec
- bose
- ev
- jbl

OK
Annulla

"Save to File" button will show the common Save dialog box:

Save an ISO 3744 file

Nome file:

Directory:

Unità:

Salva il file con formato:

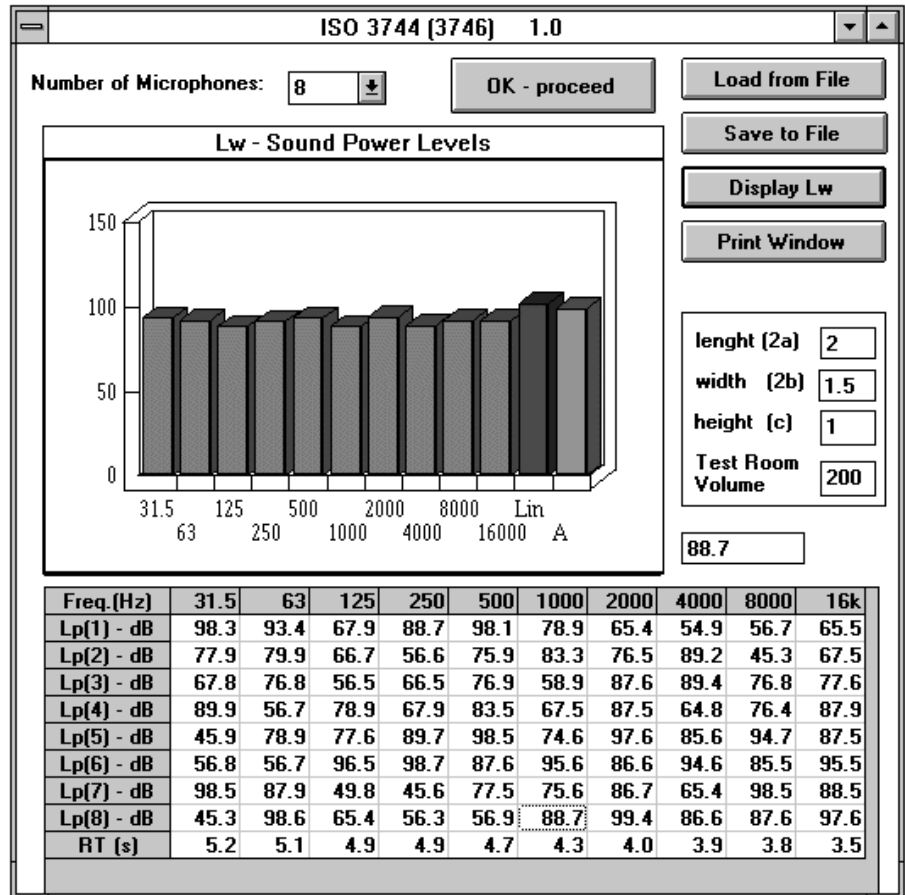
Files:

Directory List:

- d:\
- ramsete
- sources
- altec
- bose
- ev
- jbl

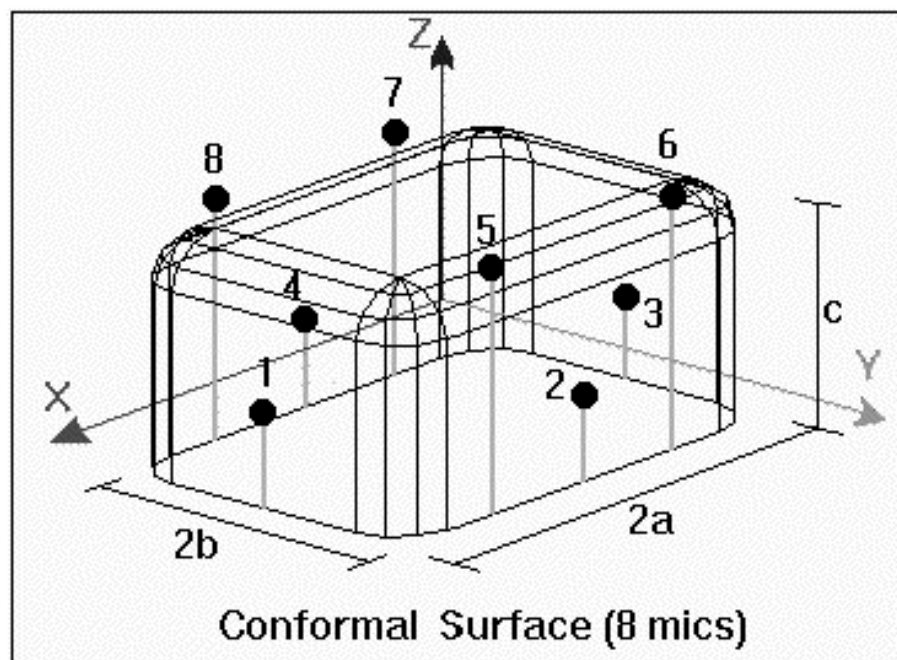
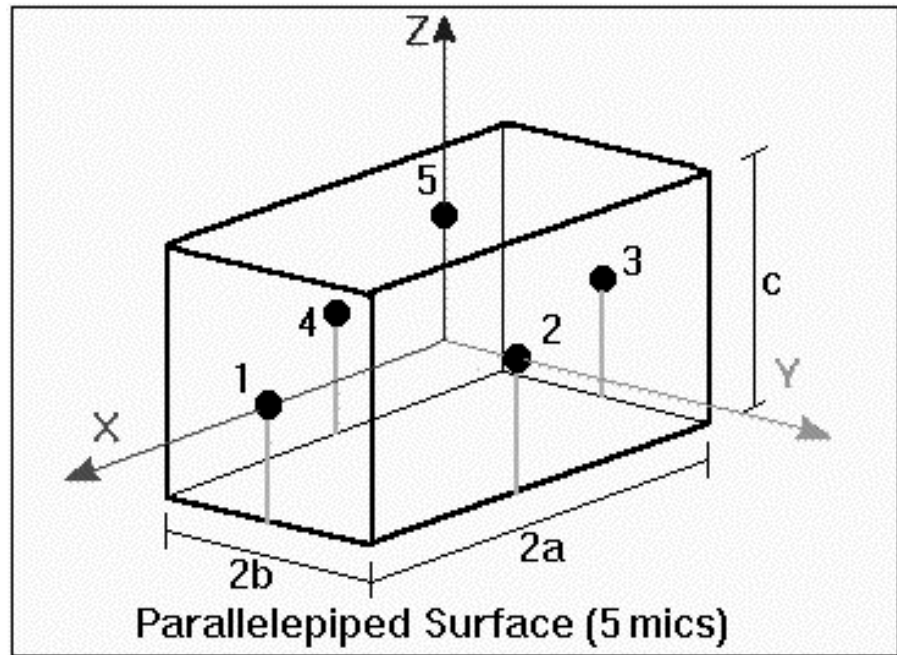
Sola lettura
OK
Annulla

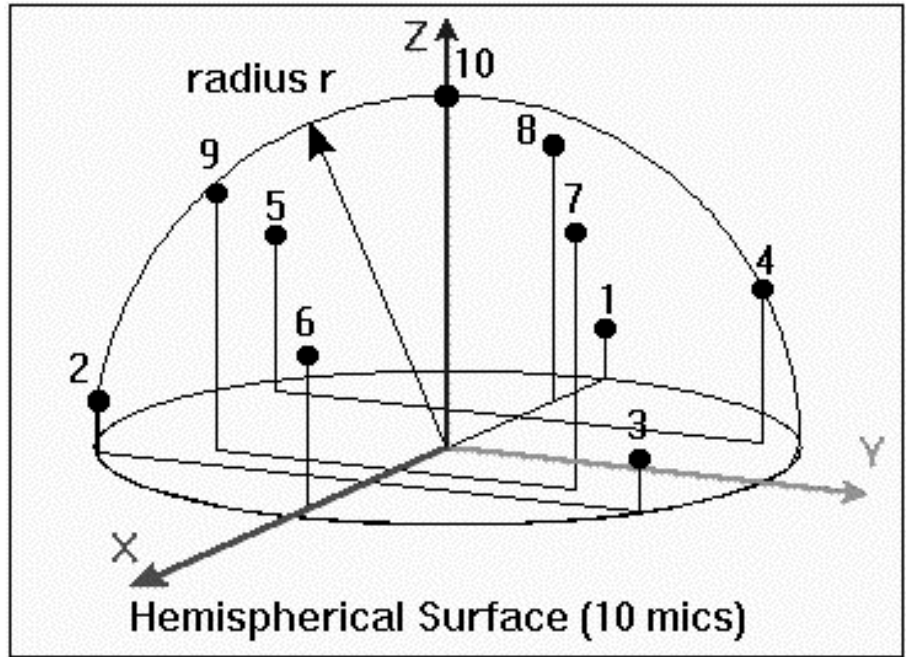
Clicking the "Display Lw" you can see the power level spectrum for each octave, linear and A weighted of the source you've just created.



Obviously "Print Window" will dump the window to the current printer.

There are also other methods to specify a source: parallelepipedal surface with 5 microphones, conformal surface with 8 microphones and hemispherical surface with 10 microphones.





In all these cases you can follow the same procedure described above, the only variation is the number of required parameters.



Auto_Print Screen This command prints the current window.



Printer Setup This item allows you to select and set the current Windows printer.



Exit This command exits the program.

7.2. Edit Menu



Cut This command puts in the clipboard the current selection and deletes it.



Copy This command puts into the clipboard the current selection.



Paste This command pastes in the current position the contents of the clipboard.

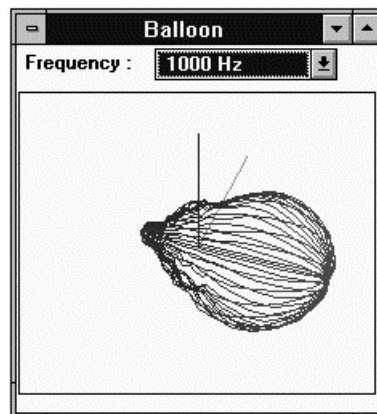


Delete This command deletes the current selection

7.3. View Menu



Balloon This command displays the following window:

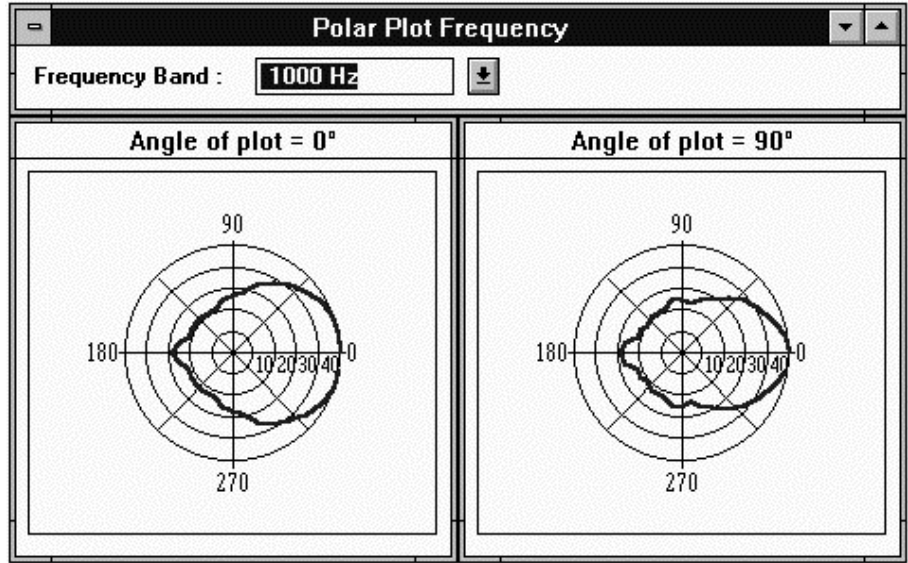


that shows the directivity balloon for the frequency selected in the listbox.

When you can't see any balloon the corresponding frequency has no power emission.



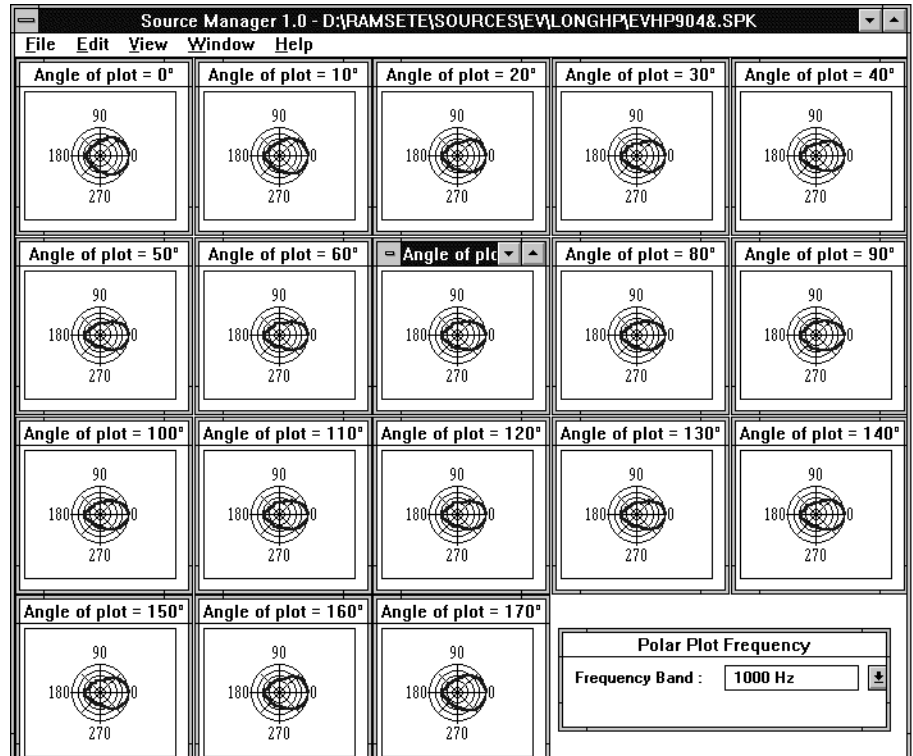
Curves (2) This command shows the following situation:



where the horizontal and vertical radiation diagram of the specified frequency are displayed.



Curves (All) This command fills the main window in this way:



These 18 windows show the planar radiation diagrams of the selected frequency with planes rotated with a step of 10° with respect to the horizontal plane.



Header Selecting this command you'll get the following dialog box:

where you can insert the source and manufacturer name, the first and last significant frequency.



Info Displays a window with general information about the current source:

Freq.	31.5	63	125	250	500	1000	2000	4000	8000	16000
Power Level (dB)	0.00	0.00	0.00	0.00	0.00	144.26	143.65	140.91	0.00	0.00
Directivity	0.00	0.00	0.00	0.00	0.00	19.39	17.70	16.60	0.00	0.00
Sensitivity (dB 1W,1m)	0.00	0.00	0.00	0.00	0.00	114.00	113.00	110.00	0.00	0.00
Electr. Impedance	0.00	0.00	0.00	0.00	0.00	8.00	8.00	8.00	0.00	0.00
Efficiency (%)	0.00	0.00	0.00	0.00	0.00	16.00	13.90	7.40	0.00	0.00

Here we can see the source type, the sound power level in dB, the directivity, the sensitivity, the electric impedance and the efficiency.

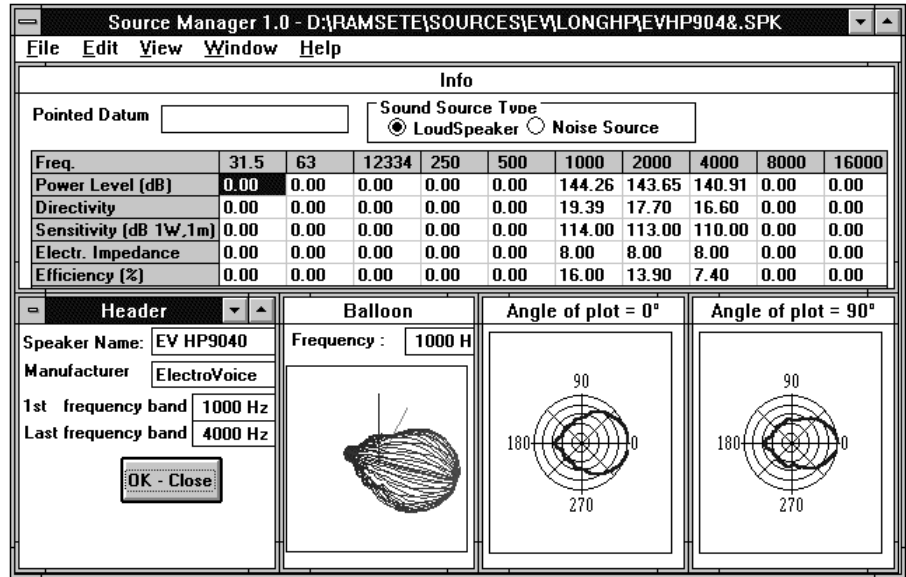


Data This command displays the directivity coefficients of each point of the balloon for the selected frequency:

Angles	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
0°	19.83	19.83	15.75	9.94	4.98	2.49	1.25	0.49	0.15	0.09	0.07
10°	19.83	19.83	12.51	7.89	4.98	1.98	0.78	0.31	0.09	0.07	0.06
20°	19.83	15.75	12.51	6.27	3.14	1.25	0.39	0.12	0.04	0.04	0.04
30°	19.83	15.75	9.94	4.98	1.98	0.78	0.24	0.07	0.03	0.03	0.03
40°	19.83	15.75	9.94	3.95	1.57	0.49	0.15	0.06	0.03	0.03	0.03
50°	19.83	15.75	7.89	3.14	1.25	0.39	0.12	0.04	0.03	0.03	0.03
60°	19.83	15.75	7.89	3.14	0.99	0.39	0.12	0.04	0.03	0.03	0.03
70°	19.83	15.75	6.27	2.49	1.25	0.39	0.12	0.06	0.03	0.04	0.03
80°	19.83	15.75	6.27	2.49	1.25	0.49	0.15	0.07	0.03	0.04	0.03
90°	19.83	15.75	6.27	2.49	1.25	0.49	0.15	0.09	0.04	0.06	0.06



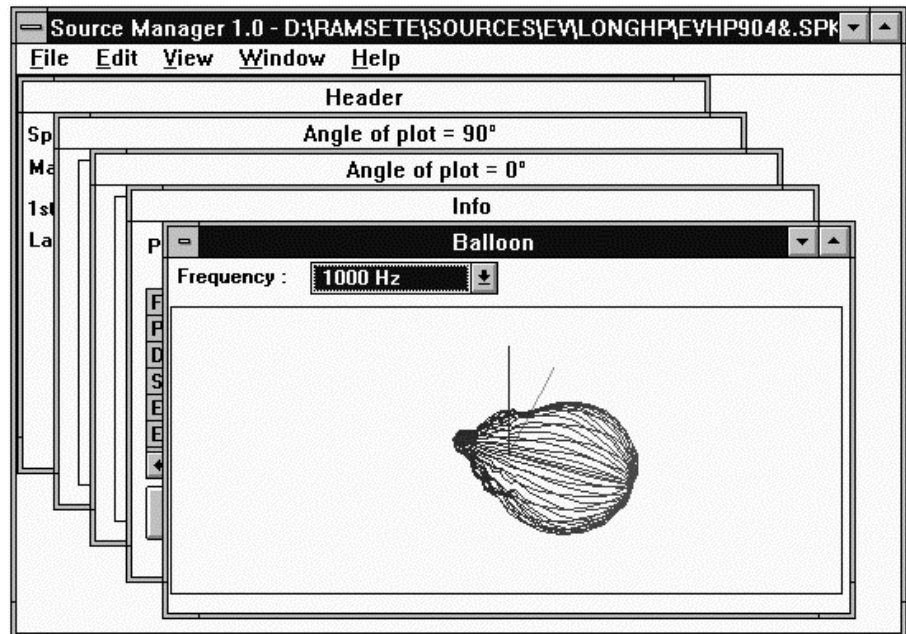
Standard This command opens the following 5 windows:



7.4. Window Menu

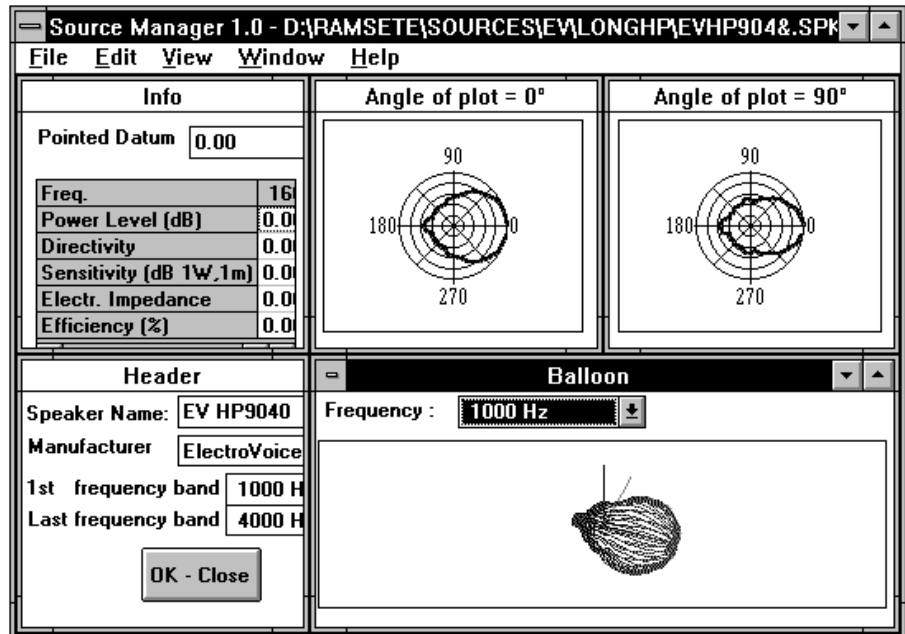


Cascade (Shift+F4) This command presents the typical Windows behavior:





Tile (Shift+F5) This command fills the main window with all the active child windows, as usual in Windows environment.



Arrange **I**cons Arranges all the iconized windows at the bottom of the main window.



Iconize **A**ll Iconizes all open windows.



Deiconize **A**ll Inverts the effect of the previous command.



Close **A**ll This command closes all the active windows.



Clear **S**creen Clears all the screen from previous messages.

7.5. Help Menu



Index... This commands displays the help index.

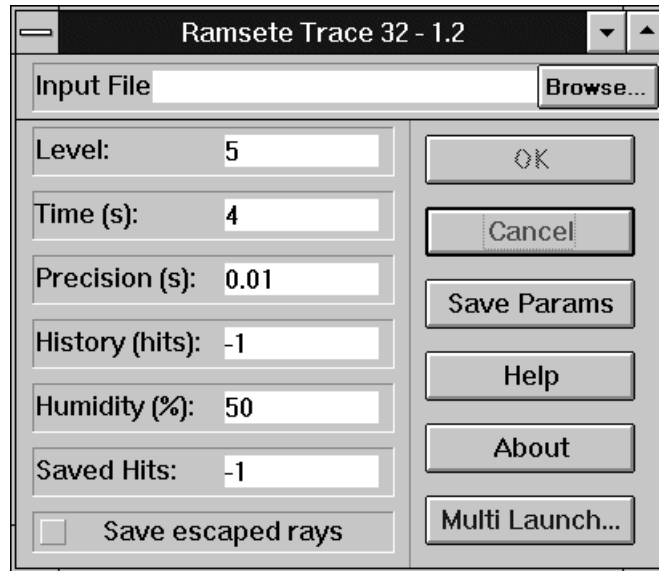


About... Displays the window containing information on the program and its authors.



8. Ramsete Trace

This program starts with the following dialog box:



Level It's the level of source balloon subdivision: the number of pyramids will be 8×2^N where N is our inserted value.

Time It's the duration of the tracer analysis: it should be as near as possible to the reverberation time in seconds.

Precision Is the width of each sample of the impulse response. It can assume any positive value but normally it ranges from 0.001 (theaters) to 0.1 (factories).

History Is the number of reflections before a pyramid is ignored: a zero value instructs the program to compute the direct wave only; a negative value tells the tracer to ignore this parameter and to follow the pyramids on a time basis.

Humidity It's the relative air humidity. The default value is 80%.

 THE LEVEL, TIME AND HISTORY VALUES HEAVILY INFLUENCE THE COMPUTATION TIMES:

- Level EXPONENTIALLY;
- Time LINEARLY;
- History LINEARLY.

WE HAVE ALREADY STATED THAT THE COMPUTATION TIME IS STRONGLY TIED UP TO THE NUMBER OF SURFACES IN THE GEOMETRIC MODEL AND THE NUMBER OF SOURCES AND RECEIVERS.

 THE TIME AND PRECISION PARAMETERS, THE NUMBER OF RECEIVERS INFLUENCES LINEARLY THE DIMENSION OF THE RESULTS FILE.

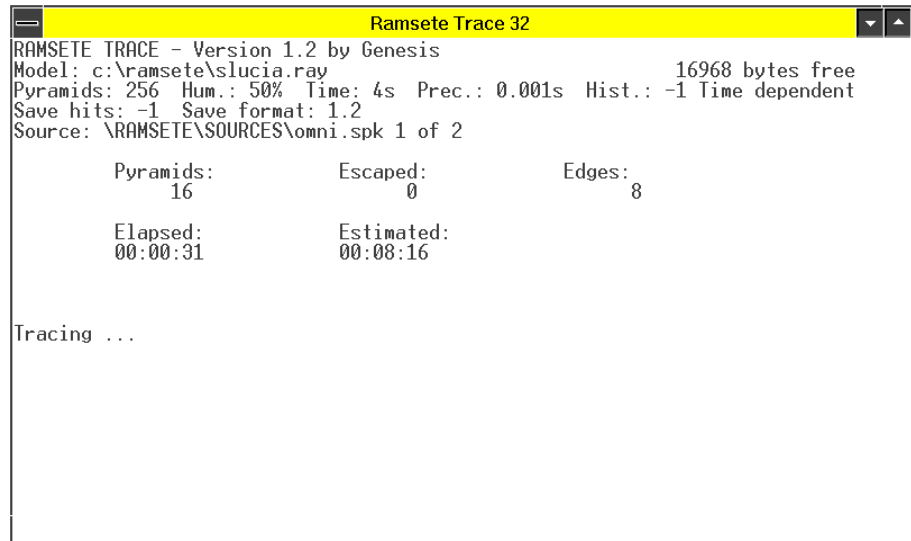
Save This button save the current values and uses them as a default in the next working session.

Cancel Will exit the program.

About Will display the following about box:




During the tracing process the following status window will be displayed:



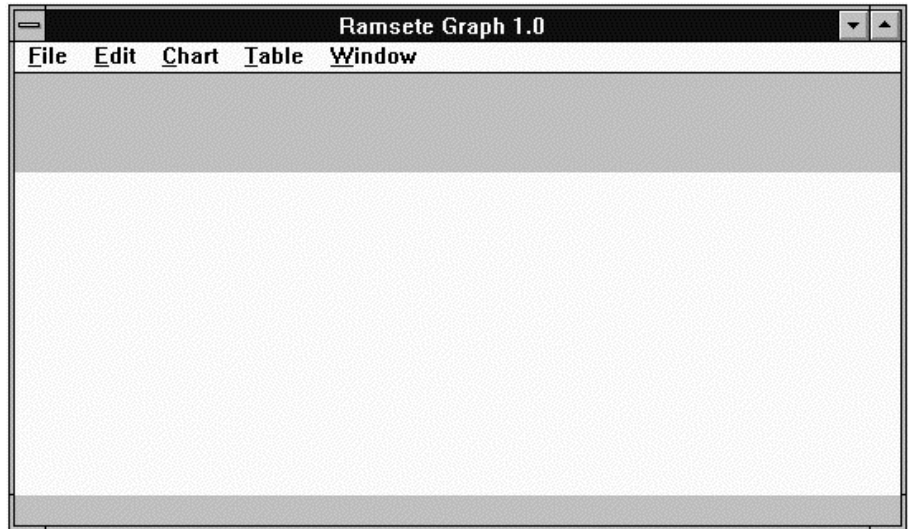
When the computation of a source has been completed the relative results will be saved in a file with an extension named after the letter associated to the source by Ramsete CAD: `._A` for the first source, `._B` for the second and so on.

Pressing "Cancel" you'll abort the computation of the current and subsequent sources but the result files of the preceding ones won't be deleted.

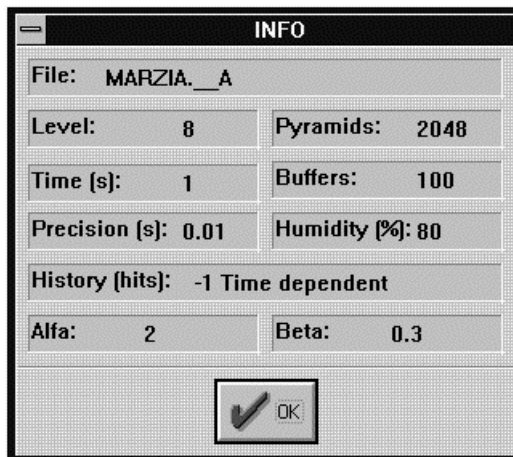
 BEFORE LAUNCHING A LONG ELABORATION GET SURE THAT ALL WINDOWS SCREEN SAVERS ARE DISABLED. THEY CAN HOG THE CPU FOR A WORTHLESS TASK SLOWING DOWN THE PYRAMID TRACE UNACCEPTABLY. IF YOU HAVE TO WAIT MANY HOURS, IT'S MUCH BETTER TOTURN THE MONITOR OFF

9. Ramsete Graph

This is the opening screen:



when you open a file with the standard Windows procedure you'll get this status window:



The Alfa and Beta constants are used for fine tuning the reverberation queue and shouldn't be changed. You can directly edit them in the ramsete.ini file but we don't recommend that, on the contrary we suggest to use more than 8 subdivisions in Ramsete Trace.

When you press "OK" you get a toolbar similar to this one:



In the first row you can see the list of the receivers and their mean labeled as "R" that stands for room data. The room receiver has not a real position in space, so it has only a symbolic meaning, not deterministic like other receivers.

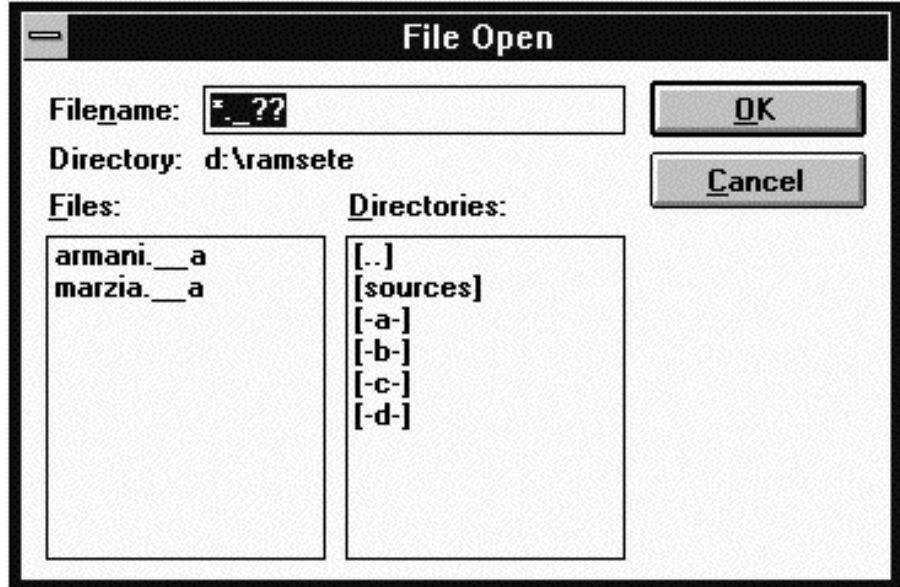
In the second buttons' row you can see all frequency bands and their linear and weighted A sum:

When you open the impulse response window, you'll get the information about the currently selected receiver and frequency.

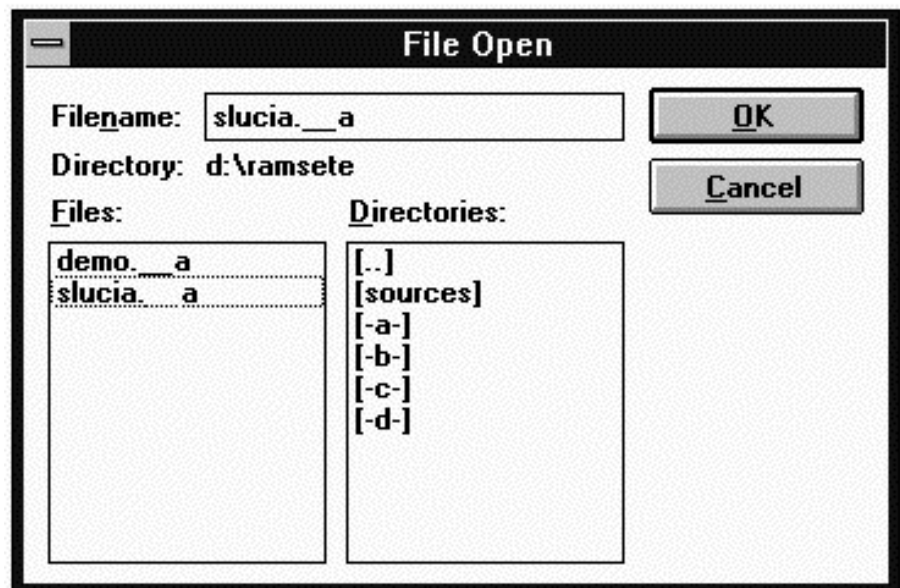
9.1. File Menu



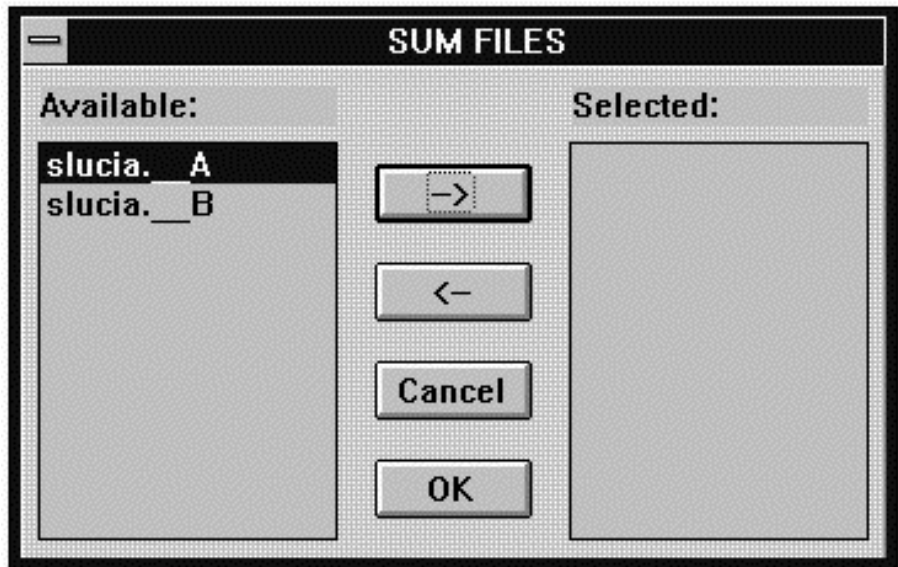
Open... This command allows you to select a file generated by Ramsete Trace and load it:



Sum... This commands allows the selection of more than one file generated by the same geometric model but from different sources. The first step consists of the selection of any data file in order to specify the name of the model:



In the second phase you should select the sources you want to add together:



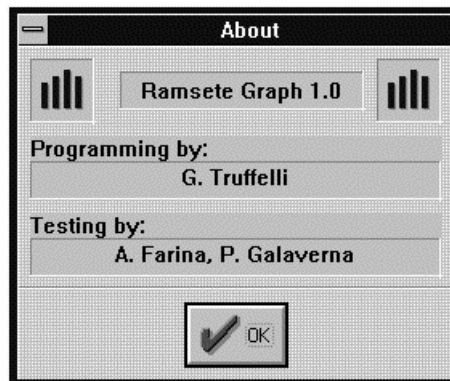
When you have done the selection, a new file with extension `.__` will be created. Later you can load this file alone or to sum it to other data files, in this case we suggest to rename it using the Windows File Manager as usual.



Print Will send to the printer the current window.



About... Will show some information about the program and its authors:





Exit Quits the program.

9.2. Edit Menu

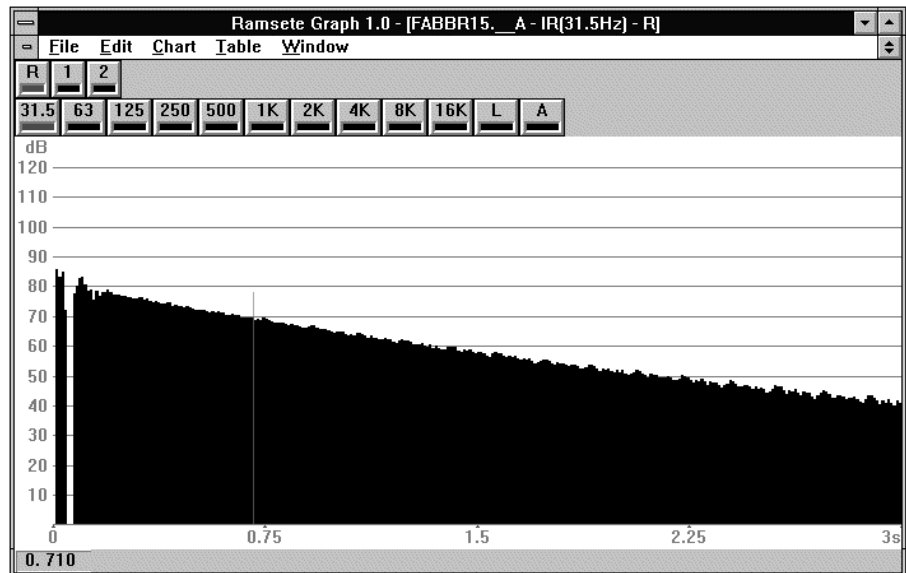


Copy Put in the clipboard the contents of the current window in text form, so that you can paste them into any spreadsheet application (such as Microsoft Excel or Borland Quattro Pro).

9.3. Chart Menu



Impulse Response This command displays the impulse response at specified frequency of the current receiver:



You can click anywhere in the window in order to move the cursor, represented by a vertical line, and display in the bottom left corner the level in that precise point. You can move the cursor using the arrow keys too.

If you keep the mouse button pressed you can draw a rectangular area and zoom the graphical representation of the curve. If you want to come back to the normal scale you have to press the right mouse button.



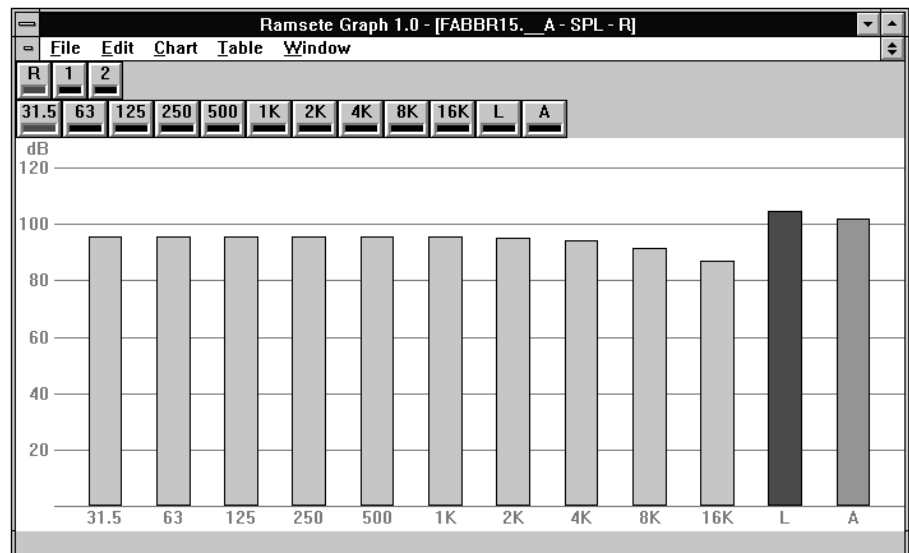
Schroeder This item will show the backward integration of the impulse response using a method developed by Schroeder:



The cursor can be moved in the same way as described above (↶ Impulse Response).



SPL This command will pop up a window with frequency response of the selected receiver for each octave, linear and weighted A:



THE CURRENTLY SELECTED FREQUENCY IS OBVIOUSLY IGNORED IN THIS CASE.



I10 This command displays the T_{10} decay time chart.



I15 This command displays the T_{15} decay time chart.



I20 This command displays the T_{20} decay time chart.



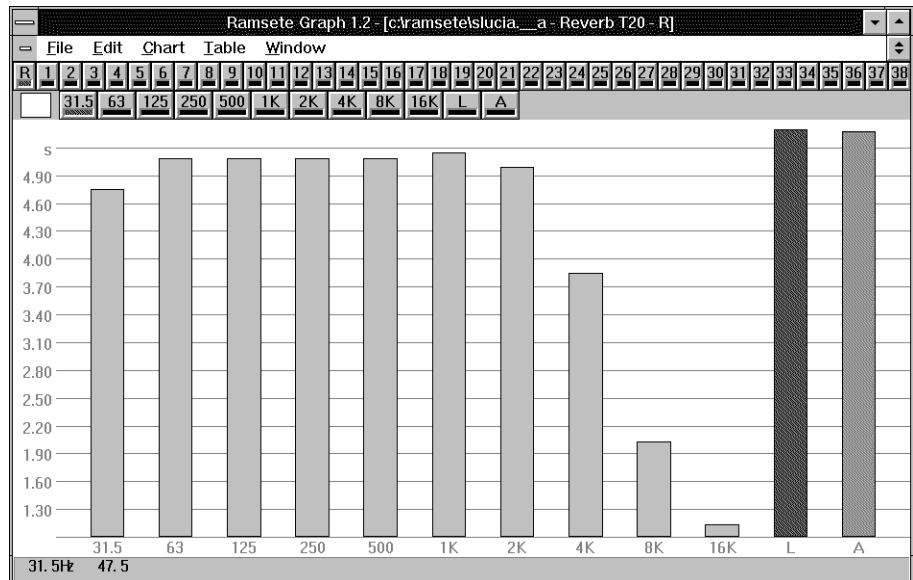
I25 This command displays the T_{25} decay time chart.



I30 This command displays the T_{30} decay time chart.



I60 This command displays the T_{60} decay time chart.



Autoresize This command enables or disables the automatic computation of the minimum and maximum values in charts in order to resize them accordingly.

9.4. Table Menu

In this menu all commands display a table containing data for each receiver and frequency, so the current selections are not influent.



SPL This command displays the SPL table.



I10 This command displays the T_{10} decay times table.



I15 This command displays the T_{15} decay times table.



I20 This command displays the T_{20} decay times table.



I25 This command displays the T_{25} decay times table.



I30 This command displays the T_{30} decay times table.



I60 This command displays the T_{60} decay times table.



EDT This command displays the Early Decay Times table.

SCANDIA. A - EDT												
	31.5Hz	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz	16KHz	L	A
R	18.925	18.921	18.904	18.834	18.688	18.070	15.517	7.612	2.211	0.732	18.426	17.153
1	18.888	18.884	18.867	18.798	18.659	17.953	15.562	7.652	2.136	0.949	18.417	17.095
2	18.826	18.822	18.805	18.736	18.718	17.986	15.519	7.549	2.071	0.850	18.340	17.156
3	18.878	18.873	18.856	18.919	18.768	18.031	15.612	7.586	2.152	1.935	18.500	17.275
4	19.147	19.142	19.124	19.054	18.902	18.254	15.785	7.668	2.472	-0.000	18.622	17.532
5	19.140	19.135	19.118	19.047	18.893	18.246	15.781	7.668	2.542	-0.000	18.727	17.526
6	19.005	19.001	18.983	18.914	18.764	18.135	15.611	7.603	2.166	2.254	18.493	17.276
7	18.818	18.814	18.797	18.728	18.582	17.972	15.520	7.569	2.145	1.208	18.325	17.156
8	18.742	18.738	18.721	18.787	18.517	18.038	15.555	7.665	2.185	1.155	18.394	17.167
9	18.889	18.885	18.868	18.799	18.658	17.953	15.509	7.662	2.132	0.759	18.419	17.099
10	18.825	18.821	18.804	18.867	18.718	17.987	15.524	7.554	2.077	0.767	18.341	17.161



LFC This command displays the LFC table.



LC This command displays the LC table.



LE This command displays the Lateral Efficiency table.

9.5. Window Menu



Cascade Will put all the open windows in a cascade:



Tile Will fill the main window with all the current charts and tables.



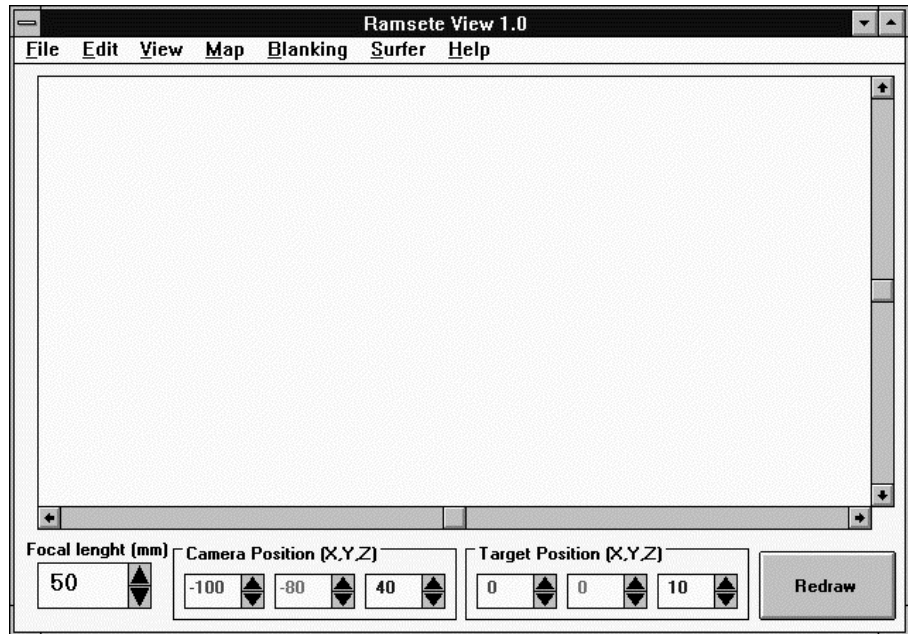
Arrange Icons Will align all the iconized windows at the bottom of the screen.



Close All Will close all the active windows.

10. Ramsete View

This is the opening window:



Let's describe the tools on the bottom line.

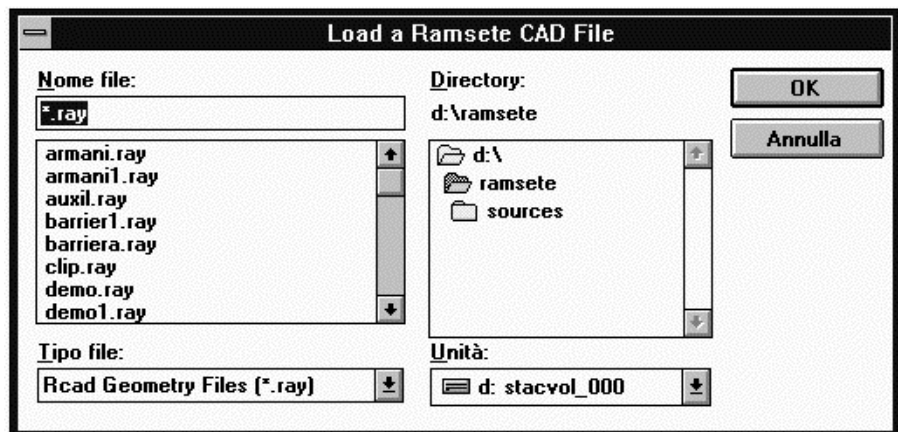
- Focal Length This spin button contains the focal length of the imaginary camera you are using to take a picture of the geometric model.
- Camera position It's the position in space of your camera.
- Target position It's the point you are aiming at.
- Redraw Updates the view (takes the photo).

You can also turn your camera left or right side using the horizontal scroll bar, on the contrary you can use the vertical scroll bar to move the camera up and down.

10.1. File Menu



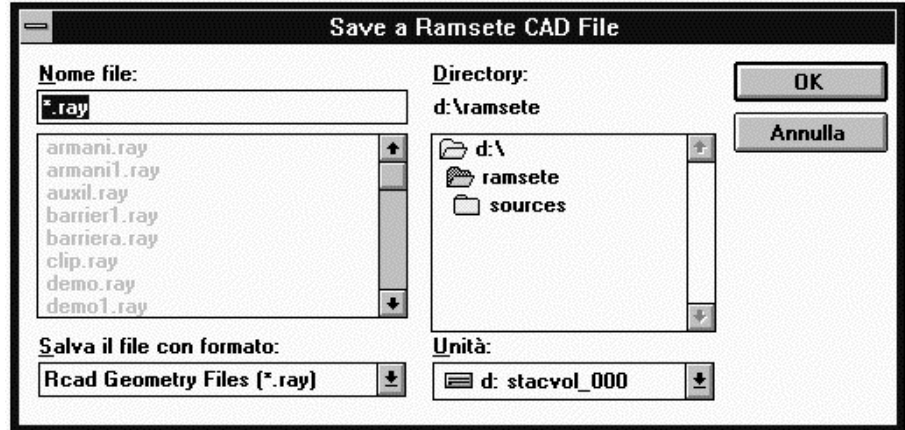
Open Geometry File This command opens the common Open file dialog box:



Here you can select any Ramsete CAD file in order to display it without computing any acoustic parameter.



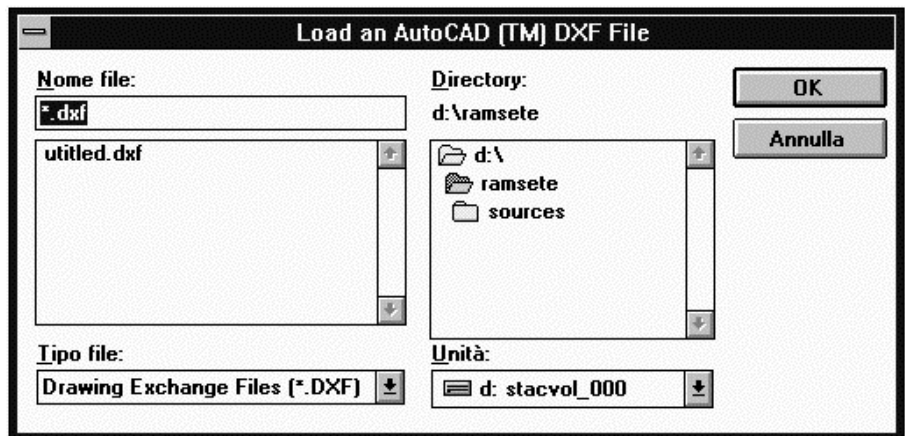
Save Geometry File This command opens the common Save file dialog box:



This option can be used to save geometric models in .RAY format when they have been loaded from a .DXF file.

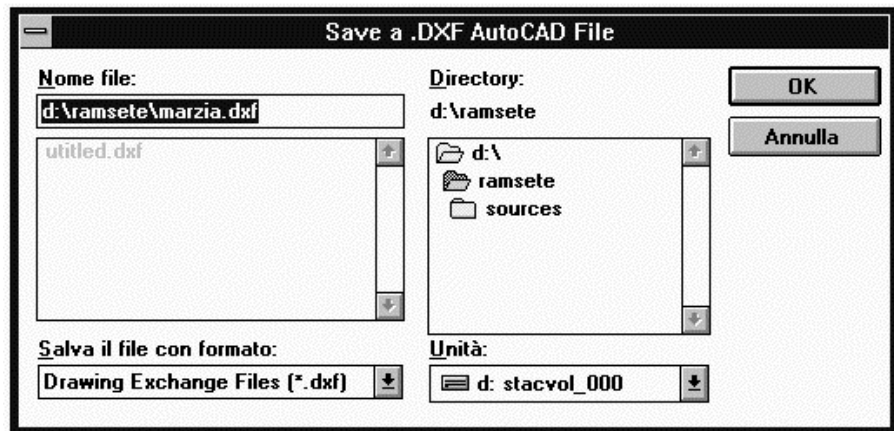


DXF In... This command imports .DXF files, so that you can convert them in .RAY files with the previous command.

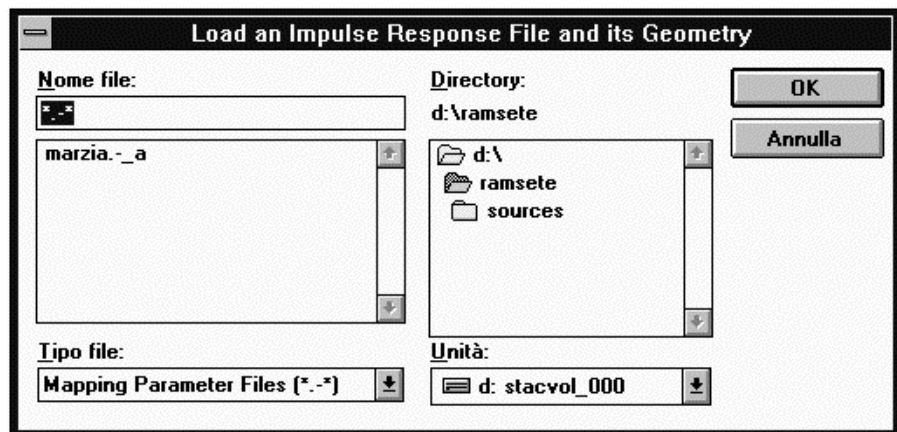




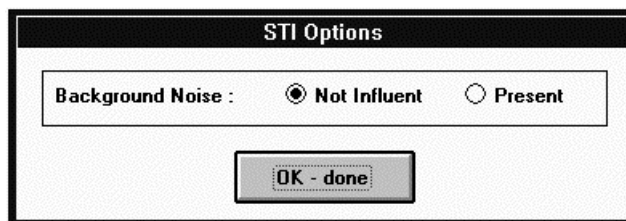
DXF Out... This option can be used to save geometric models in .DXF format when they have been loaded from a .RAY file.



Response+Geometry File This command opens the common Load file dialog box:



Ramsete view can handle two different file formats: Ramsete Trace ASCII text format or its binary format. When you load a Ramsete Trace file it'll be saved in binary format in order to speed up any subsequent processing. This command loads both the geometry and the impulse responses computed by Ramsete Trace in order to reach high quality graphic outputs such as perspective mappings of the room. When loading process has finished, you'll see the dialog box for the computation of the Speed Transmission Index (STI Options...):





Auto Print Screen... This command prints the current window.



Printer Setup... Will pop up the common printer setup window.



Exit Quits the program.

10.2. Edit Menu

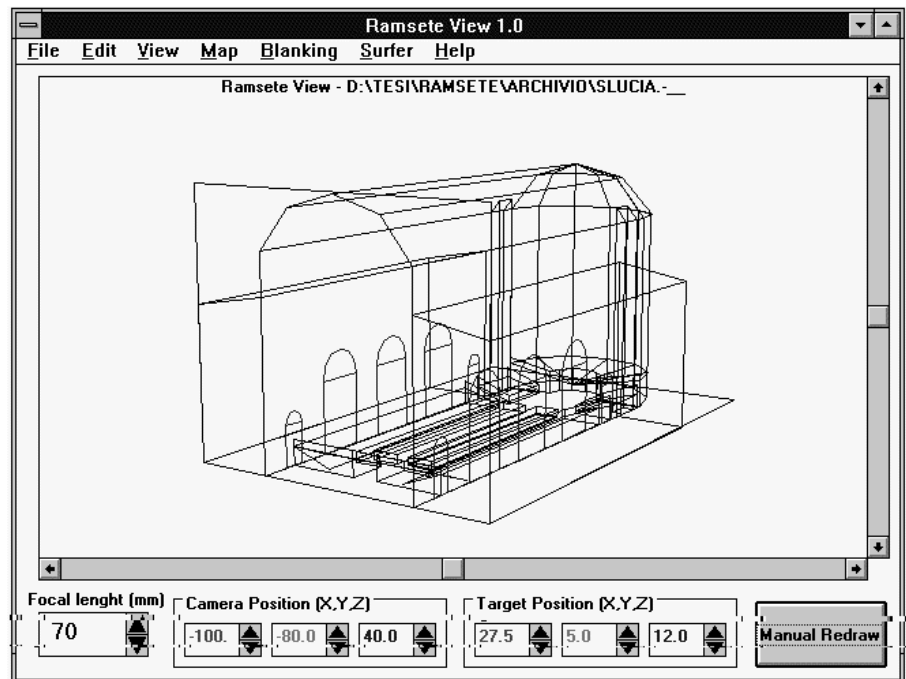


Copy to Clpbrd This command copies the current window into the Windows clipboard.

10.3. View Menu



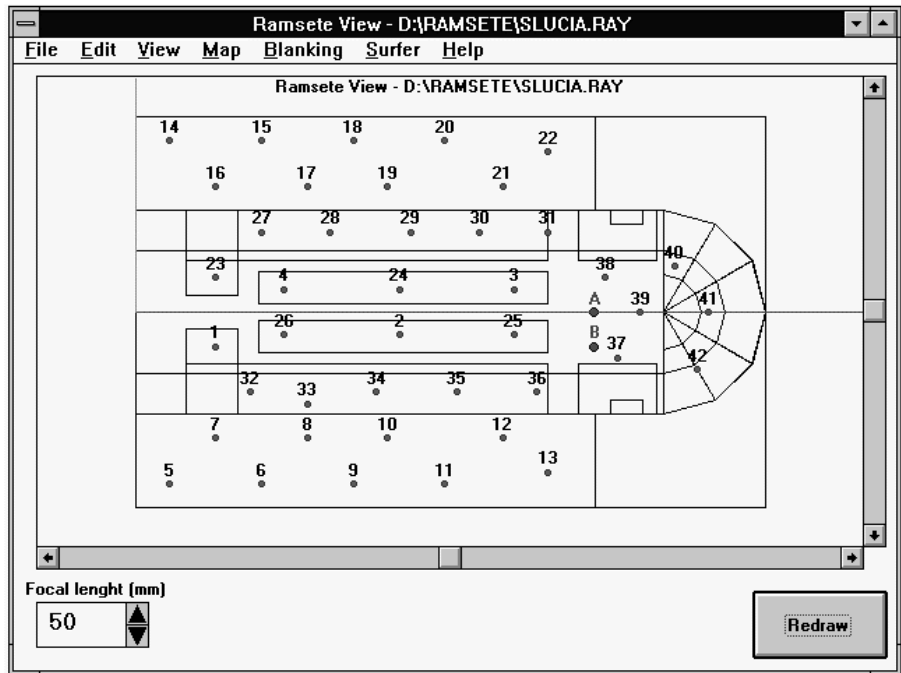
Draw 3D When you load a geometric model you get a window like this one:



where you can have a perspective view of the model from any point of view (see introduction of this chapter)




Draw 2D Displays a plant view of the model:



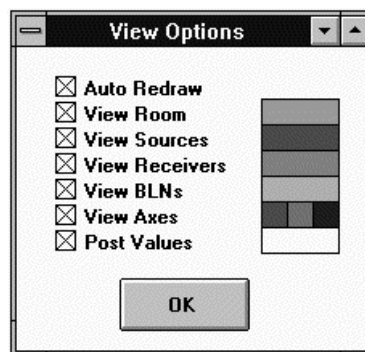
Here you can only change the focal length or panning the window using the horizontal or vertical scroll bars.



Render... Launches the Render program, described in the next chapter ( Render).

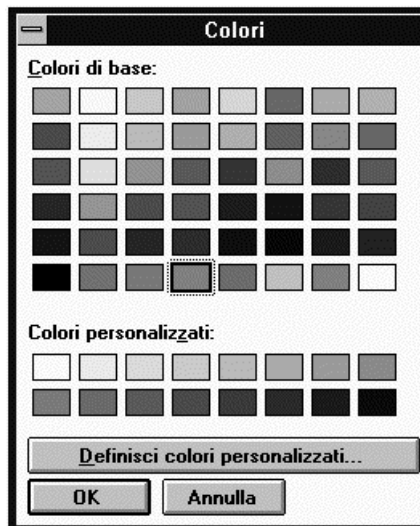


View Options... Opens a dialog box where you can select the entities to display or hide and their colors.

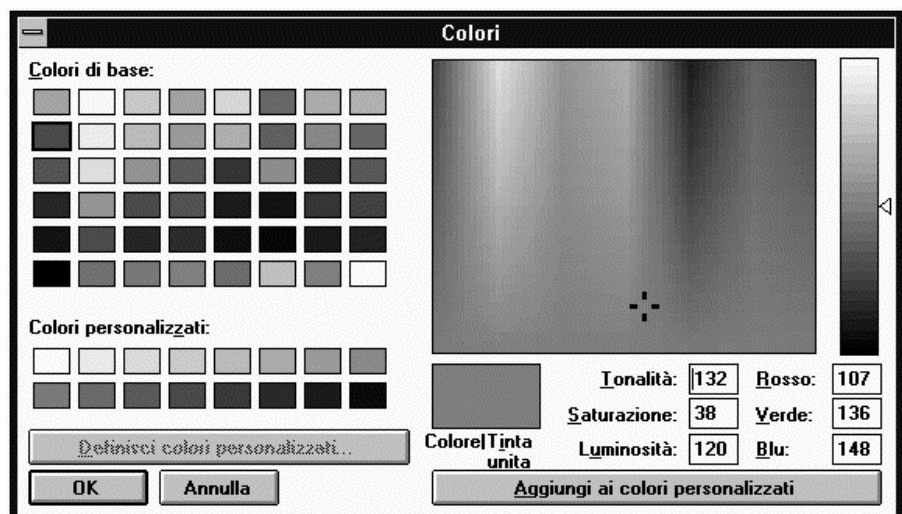


- Auto Redraw This check box toggles the status of the button on the right side of the main window. In "Auto Redraw" mode all changes to the "Focal length", "Camera Position" and "Target Point" cause an immediate update of the screen, otherwise you have to press "Redraw" each time you'd like to take the picture.
- View Room Shows or hides the room geometry.
- View Sources Shows or hides the sources.
- View Receivers Shows or hides the receivers.
- View BLNs Activates the blanking file if loaded.
- View Axes Shows or hides the axes.
- Post Values Displays the numeric value of the mapped parameter close to each receiver.

If you click on the colored region of each option, you can choose the color of the corresponding entity with this dialog box:



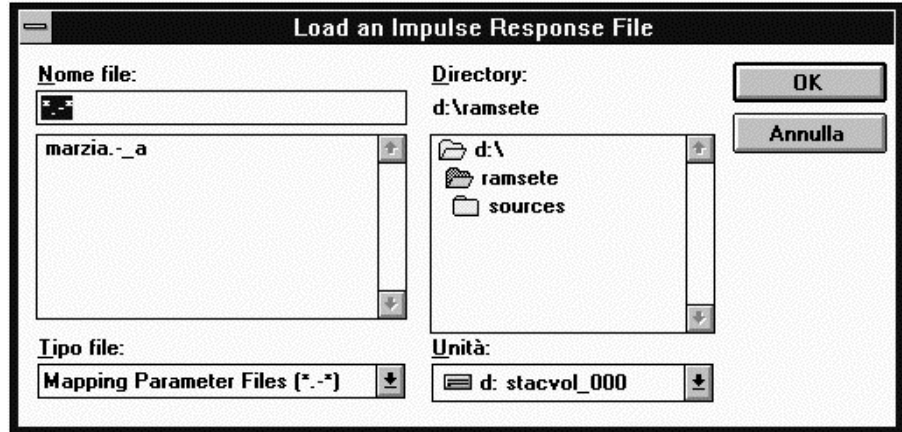
If you want to define a custom color you can press the proper button and open the common color selection dialog:



10.4. Map Menu

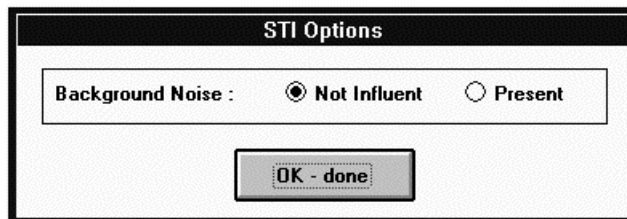


Load response file Opens the common open file dialog box:

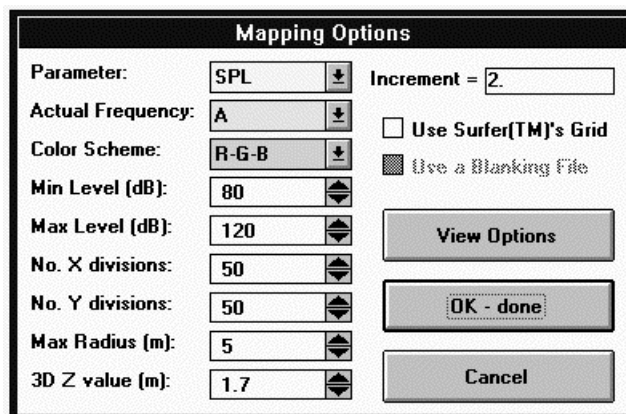


Here you can select an impulse response without the corresponding geometry (↻ Open Response+Geometry File).

When the loading process has been completed, you'll see the dialog box for the computation of the Speed Transmission Index (↻ STI Options...):



Mapping Options... Allows you to specify all mapping options in this dialog box:



Parameter This list box selects the parameter to map, it can assume the following values:

- SPL Sound Pressure Level
- L_{dir} Direct Wave Level
- L_{rev} Reverberated field level
- R/D

- L_p-L_w
- C_{50} Klarheitsmass Dresda Group
- C_{80} Klarheitsmass Dresda Group
- T_{bar} Barycentral Time Cremer, Kürer
- A_{eq} Equivalent Reflection Amplitude Ando
- STI Speech Transmission Index (RASTI is the A weighted of STI) Houtgast & C
- LE Lateral Efficiency Jordan
- A_{eq2}
- ITDG_{eq} Initial Time Delay Gap Beranek

Actual Frequency It's the frequency for the current parameter, it can assume these values:

- 31.5
- 63
- 125
- 250
- 500
- 1000
- 2000
- 4000
- 8000
- 16000
- Lin
- A

Color Scheme Selects a standard color combination:

- Blue-Red
- Green-Red
- White-Blue
- White-Black
- R-G-B
- Iris

Min. Level Defines the lowest value for the current parameter.

Max. Level Defines the maximum value for the current parameter.

These values are automatically computed, but you can change them manually in order to get a better dithering of a critical parameter value.

X divisions Defines the number of horizontal steps of the Surfer grid.

Y divisions Defines the number of vertical steps of the Surfer grid

This parameters are passed to the Surfer program that computes the mapping of the parameters. The higher they are the nicer the mapping will look like, but you can't exceed the limits of available DOS memory.

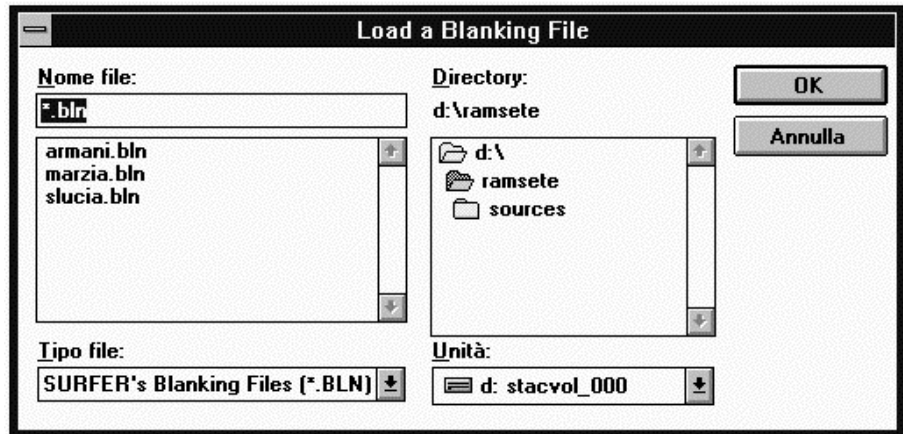
3D Z value Defines the Z coordinate of the perspective mapping plane (☞ Do Dither 3D...). This value should be equal to the height of the receivers, normally 1.7 m.

Increment It's the step between two isolevel curves.

Use Surfer If you purchased Surfer you can also check this box, otherwise you have to use a simpler mapping procedure.

Max. Radius The research radius of this latter algorithm can be specified in this edit box.

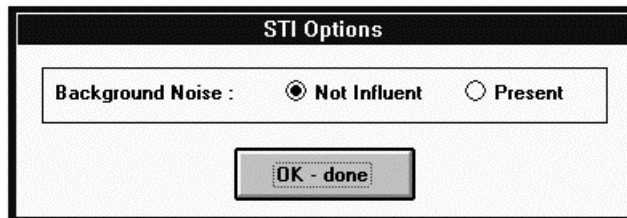
Use Blanking file This checkbox let you use a blanking file if you want to use the Surfer program (☞ Blanking menu), the file name can be specified in the following dialog box:



View Options Recalls the view options dialog (☞ View Options...).



STI Options... When you load an impulse response file you'll always see this dialog box:



where you are asked if the background noise can be ignored or not. If you click on the "Present" radio button, you need to specify the noise SPL for each band in the next dialog box:

STI Options

Background Noise : Not Influant Present

Level of Background Noise

Freq.(Hz)	125	250	500	1000	2000	4000	8000
SPL (dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Equalize for Standard Voice Spectrum : YES NO

Force Reference 60 dB(A) SPL at 1m : YES NO

OK - done




RGB Options... This commands allows you to specify one by one the colors used for the gradient mapping:

RGB Settings

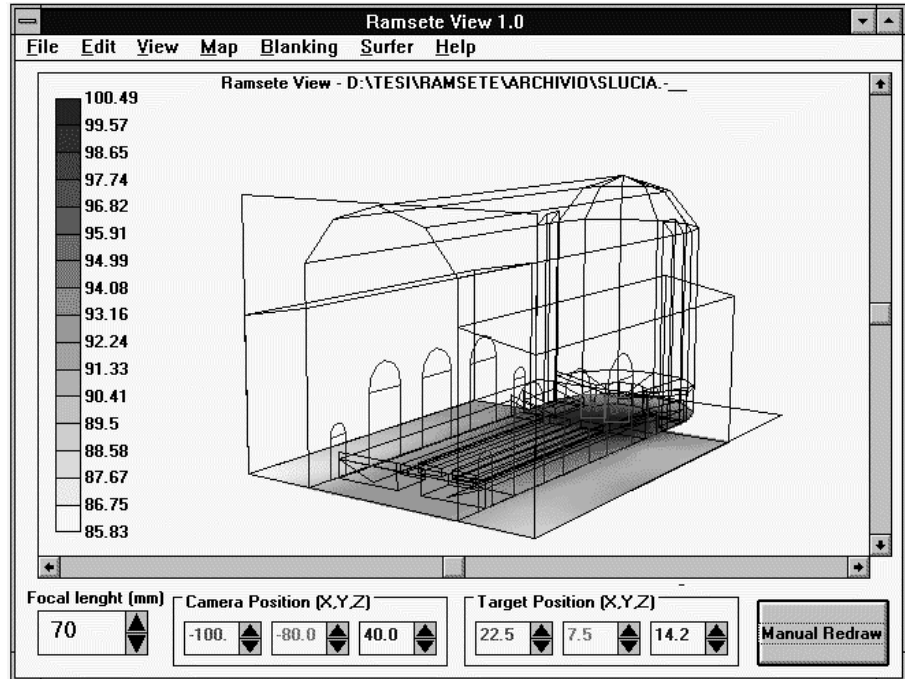
MAX	16	
	15	
	14	
	13	
	12	
	11	
	10	
	9	
	8	
	7	
	6	
	5	
	4	
	3	
	2	
	1	
MIN	0	

OK - exit

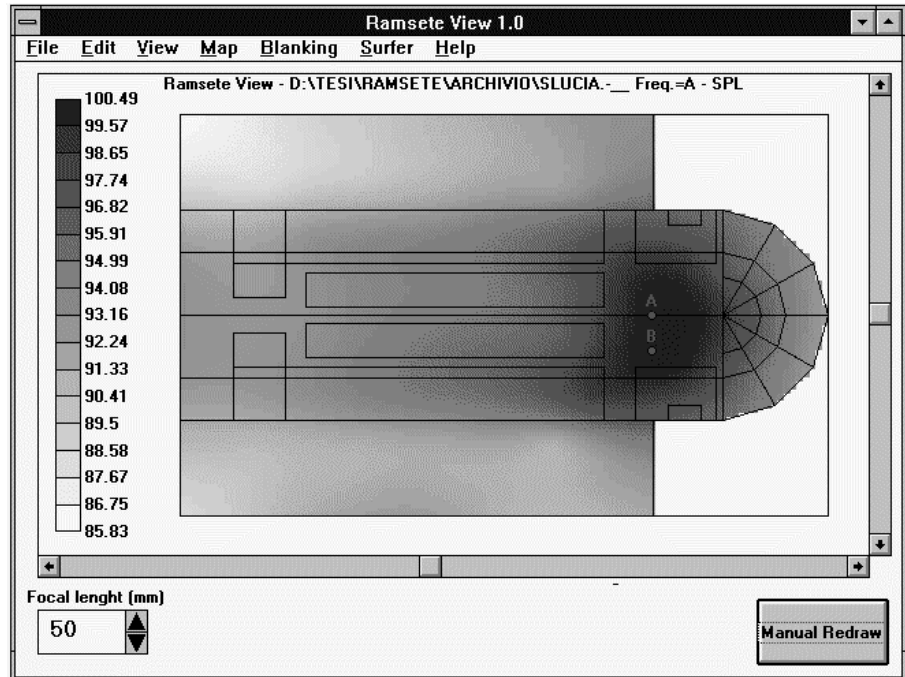
If you click onto a colored box you'll be prompted with the color selection dialog box ( View Options).



Do Dither 3D... This command shows the "Mapping options" dialog box (Mapping Options) and starts the Surfer program. When you can hear a beep you realize that the program has finished its computation and you will see a perspective mapping of the selected parameter using all options specified with the "View options" and "Mapping options" dialog boxes:

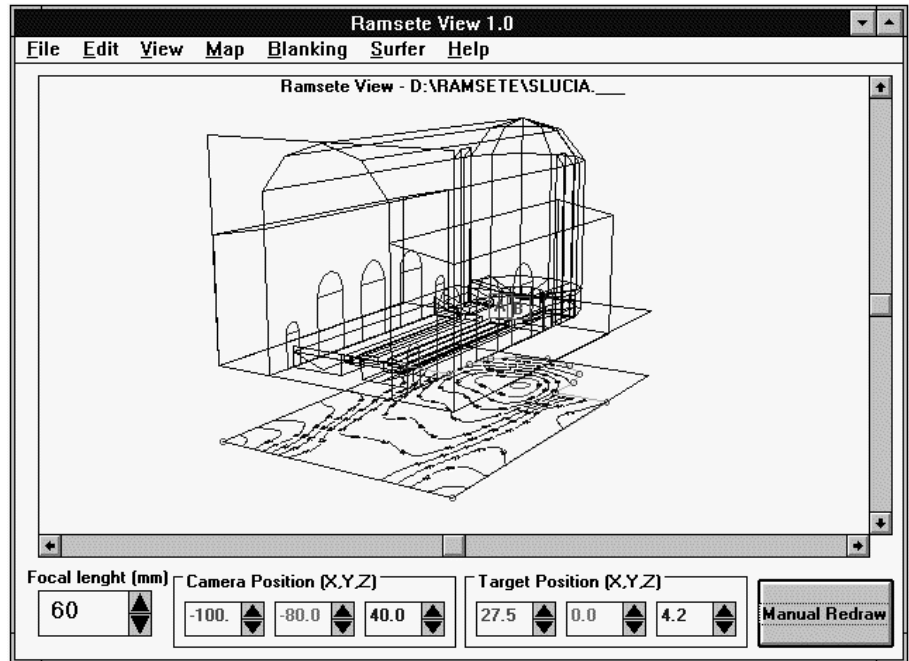


Do Dither 2D... This command is very similar to the former one in usage, obviously you'll get a bidimensional mapping of the selected parameter:

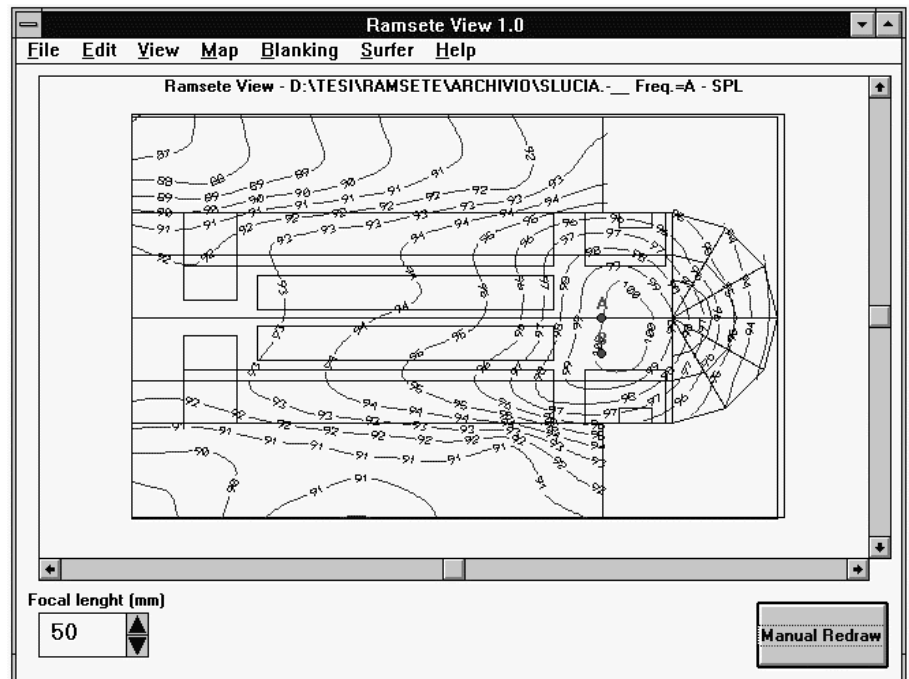




Do Contour 3D... This command performs the same steps of the previous commands and outputs a perspective mapping of isolevel curves of the selected parameter.



Do Contour 2D... This command is similar to the previous one, but it displays a bidimensional mapping like this:



10.5. Blanking Menu

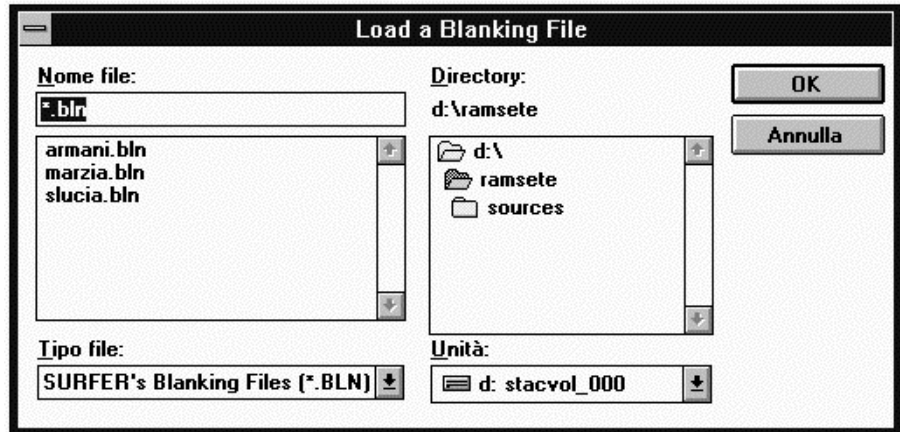
The blanking procedure defines the mapping area precisely in order to reach better graphical results also with a small number of grid subdivisions (↻ Mapping Options).



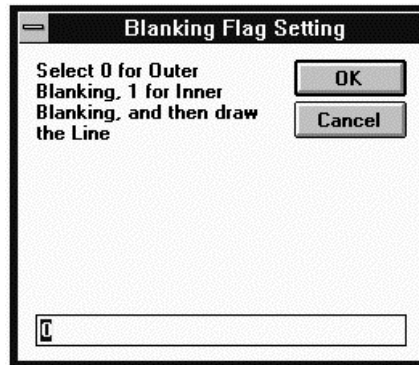
Clear Deletes the polygonal region from the screen.



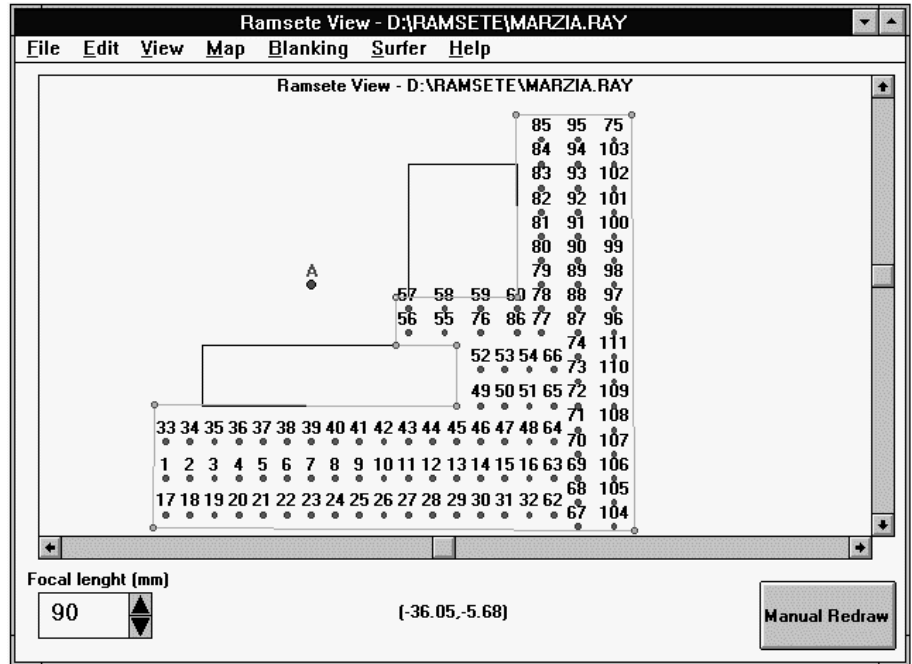
Load... Loads a previously saved blanking file with a .BLN extension:



Add Line... When you select this command you must insert the following value:



If your answer is "0" the mapping will take place inside the polygon that you'll draw, otherwise it will be blanked inside of it. At this point a small 2D CAD system will switch on to allow you to insert the polygon vertices. In the bottom line you can see the current cursor position.

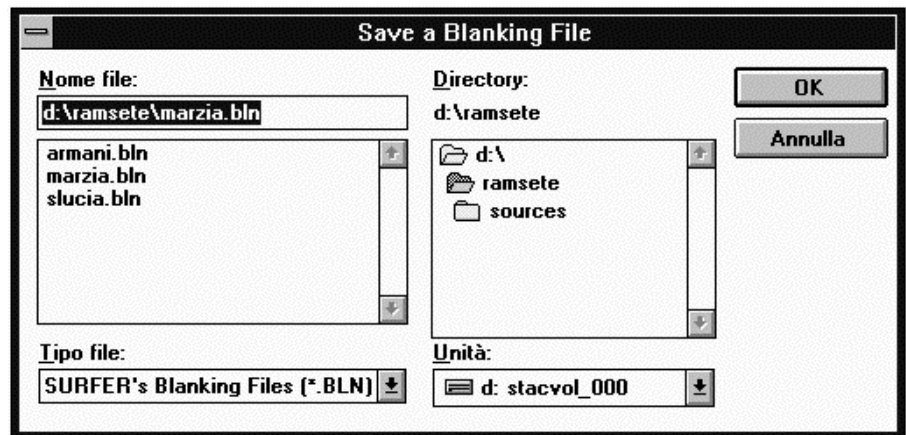



 YOU SHOULD BLANK ONLY AREAS THAT DON'T CONTAIN RECEIVERS.

 THE BLANKING POLYGON SHOULD ALWAYS BE CLOSED.



Save... This command saves the work performed with the common save dialog:



This file can now be used in the "Mapping Options" dialog box ( Mapping Options).

10.6. Surfer Menu



Grid... Activates the Grid subprogram of the Surfer package.



Topo... Activates the Topo subprogram of the Surfer package.



Plot... Activates the Plot subprogram of the Surfer package.



Set Plotter... Activates the Plotter subprogram of the Surfer package.

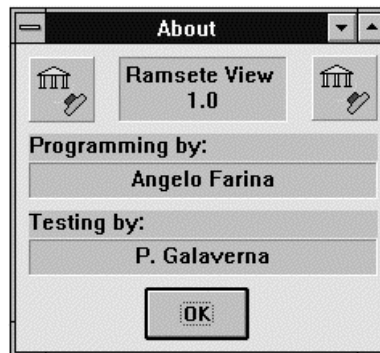
10.7. Help Menu



Help... Opens the help file.



About... Displays some information about the program version and its authors:



11. Render

11.1. File Menu



Exit Quits the program.

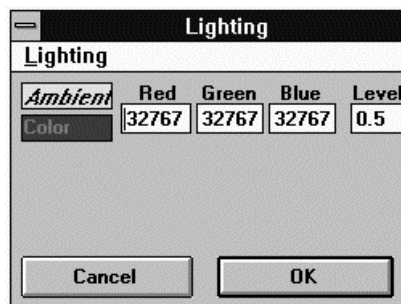
11.2. View Menu



Redraw This command redraws the entire screen.

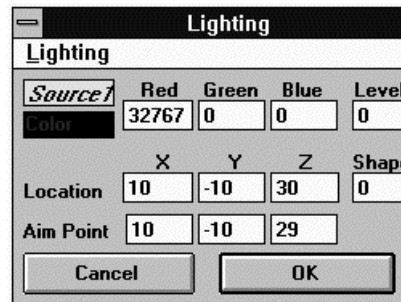


Set Lighting... This command opens the following dialog box:



where you can edit the RGB values of "ambient light". These values range from 0,0,0 (black) to 65535, 65535, 65535 (white), while the default values are 32767, 32767, 32767 (gray). The "Level" parameter represents the luminous intensity and can range from 0.0 to 1.0

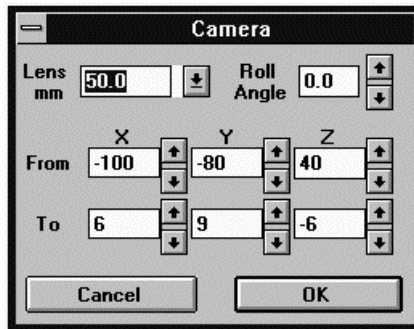
The "Lighting" menu allows you to specify the parameters of four spot lights with the following dialog box:



Here you can also point the location and the target point of the spot source. The "Shape" value can range from 0 to 1 and represents the concentration of the light beam.



Set Camera... Using this command you can set the camera parameters:



Lens It's the focal length.

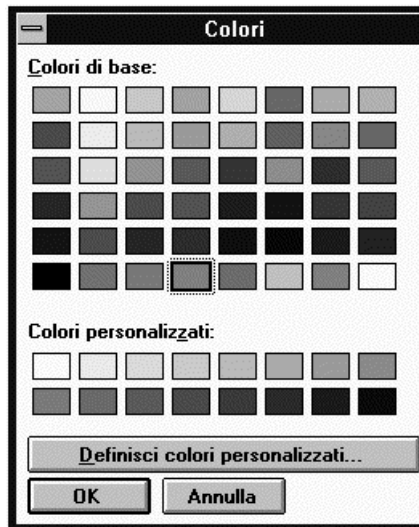
Roll Angle It's the angle of rotation of the camera with respect to the ground: 0.0 for landscape; 90.0 for portrait.

From It's the camera position.

To It's the target point.



Set Back Color... Allows you to specify the background color:

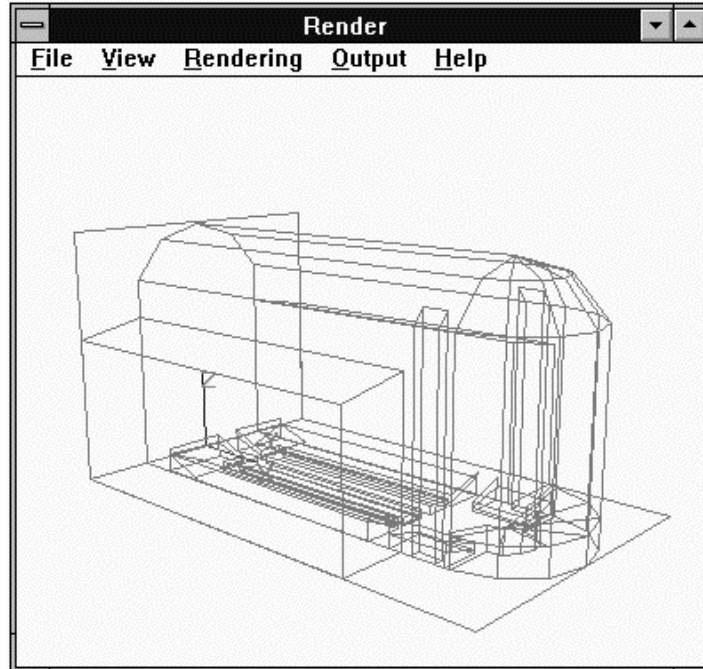


This dialog has been described in the View Options command ( View Options).

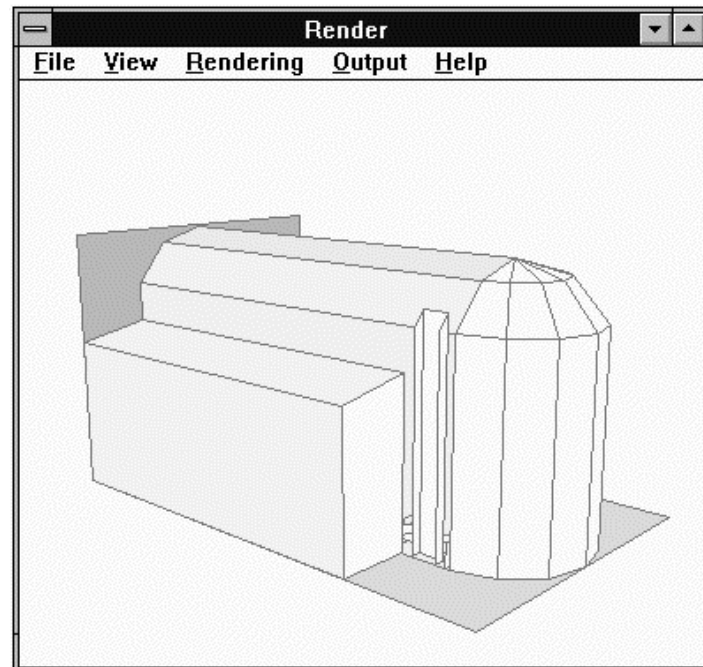
11.3. Rendering Menu



Wireframe Shows a wireframe representation of the model:

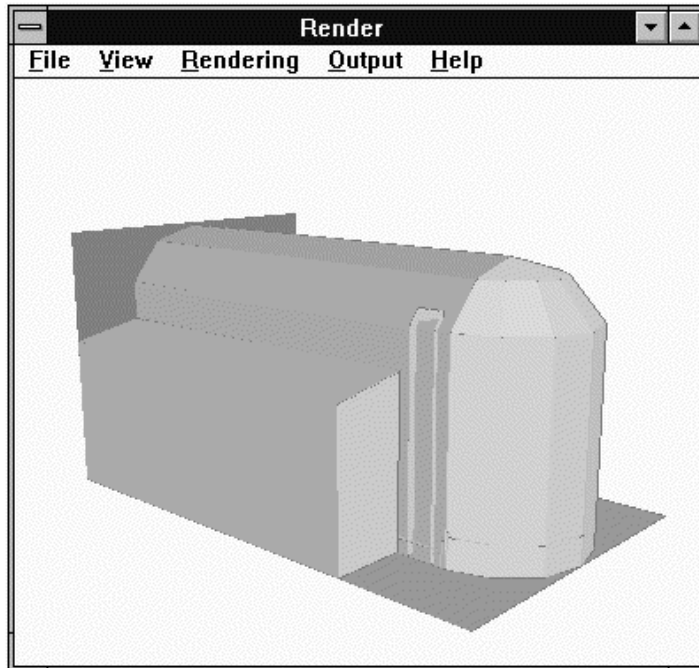


Painter Render This option shows a flat shade of the geometry using the painter algorithm:

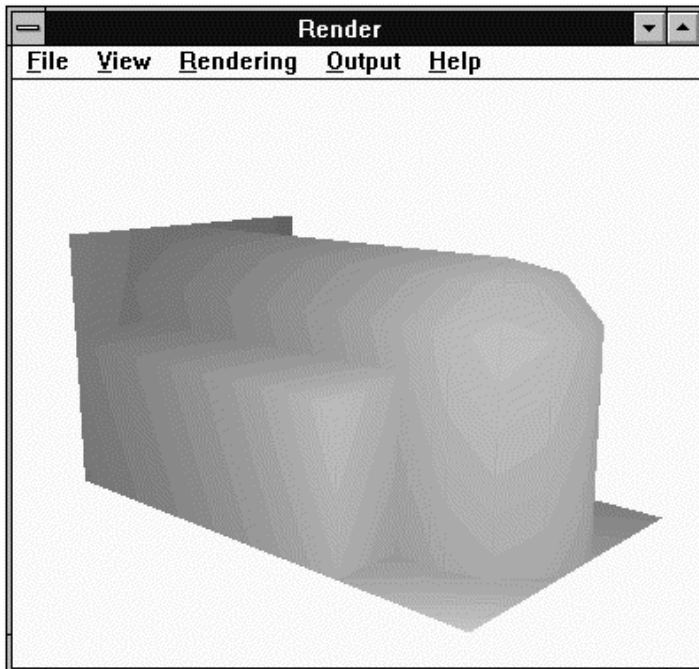




ZPoly Render This option computes also different color shades inside the same face:



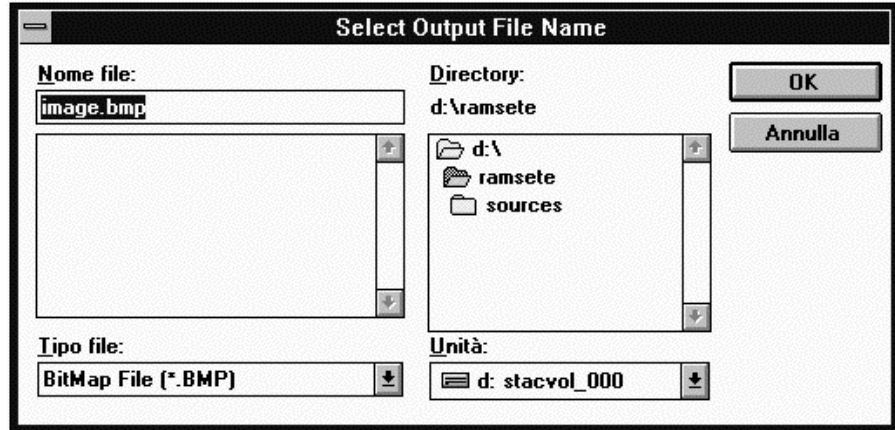
ZBuffer Render This algorithm is much slower but gives more realistic results:



11.4. Output Menu



File Name... Saves a file containing the current displayed image:



Metafile (Winword) .APM Selects a .APM Metafile.

Bitmap (Pbrush) .BMP Selects a standard Windows .BMP file.



Do File Output! This button creates the desired file.



Copy to Clpbrd Copies into the clipboard the current window.

11.5. Help Menu



Render Help... This option loads the Render help file.



About... This command opens Ramsete View about box:

12. Troubleshooting

When you get a warning box telling you "Hey you forgot to connect the dongle", you probably forgot to connect the hardware protection key to your computer. If you have properly connected the dongle and the problem still remains one of these assertions may be true:

The printer connected to the same parallel port is off;

There is a parallel cable without any printer at all on the other side

The hardware protection or the parallel port are faulty.

12.1. Ramsete Trace

If Ramsete Trace presents some escaped rays please check carefully the geometric model in order to verify that it is well closed.

When Ramsete Trace can't find a sound source you have to verify that it's still placed in the same directory where Ramsete CAD found it. In this case you have to edit the .RAY file manually or put the source in the original directory.

If the computation times are longer than usual check the specified tracing parameters and have a look at the "Turbo" indicator of your machine.

12.2. Ramsete Graph

If $L_p > L_w$ the receiver is too near to a sound source (less than 1 m).

If the program displays a sound pressure level that's half of the expected value you should check the position of the source, it could be exactly on a wall.

12.3. Ramsete View

For a correct mapping computation you should select the point as a decimal separator (not the comma!) in the Windows Control Panel.