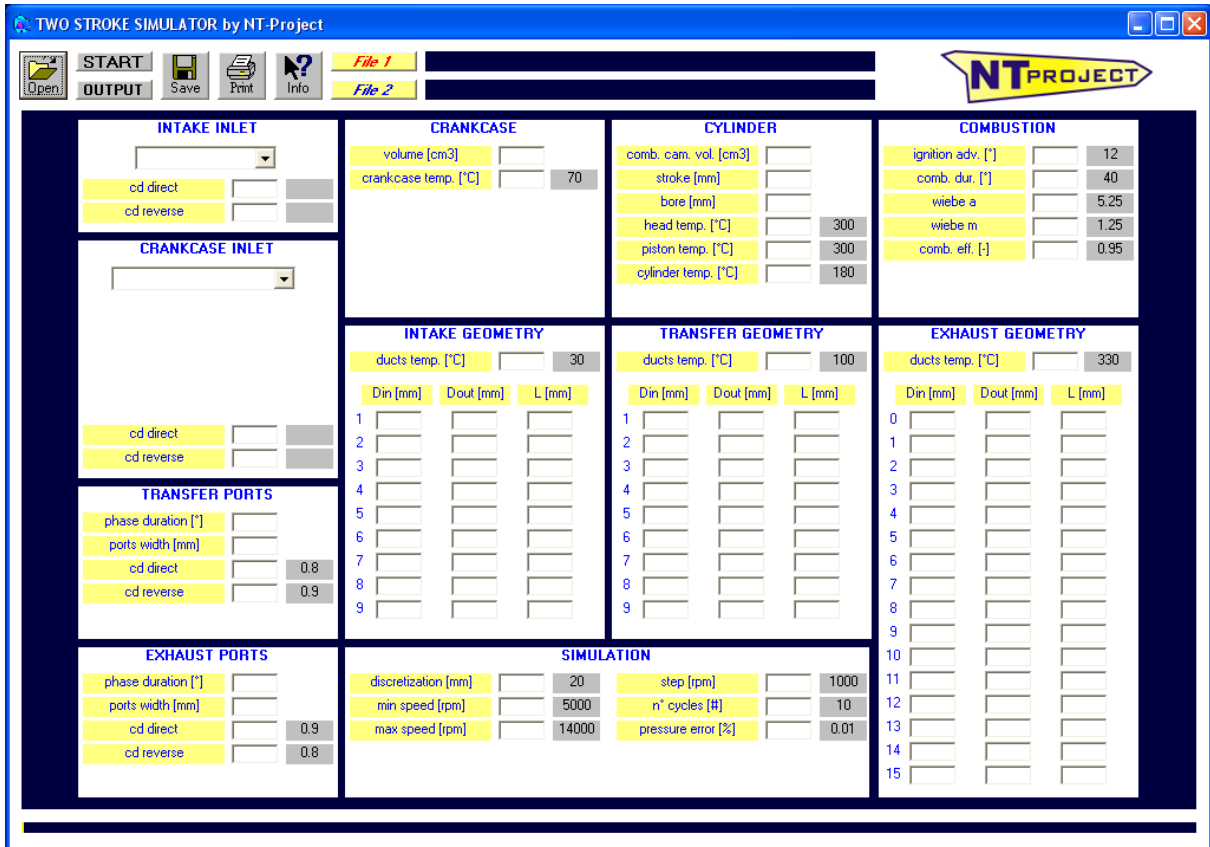


PRESENTATION SOFTWARE TWO STROKE SIMULATOR

When opening the software appears this screenshot:





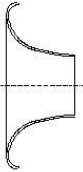
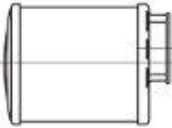
data entering

In the column on the left you must enter the features of the elements that define:

- air inlet in the intake system INTAKE INLET;
- air inlet in the crankcase CRANKCASE INLET;
- inlet and outlet of the air in the cylinder TRANSFER and EXHAUST PORTS.



You must select how the air enters in the intake system:

airbox	airbox-bellmouth	bellmouth	filter
			

The software has already pre-set the values of the direct and inverse flow coefficients for the different elements, anyway if specific flowbench tests are carried out, it is possible to enter manually the values obtained experimentally.

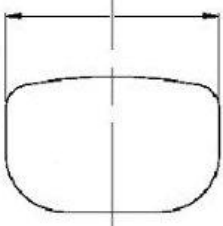
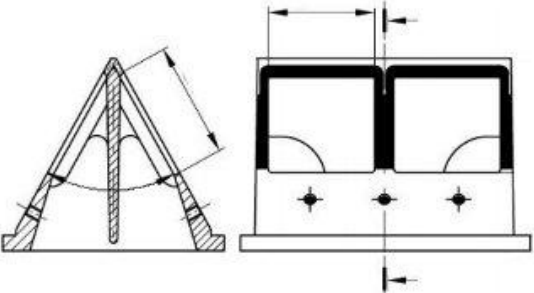
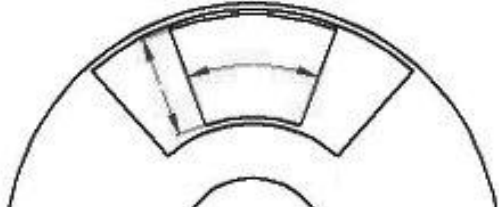
CRANKCASE INLET

piston port
reed valve
rotary valve

cd direct

cd reverse

2-stroke engines can have different intake systems in the crankcase, for this in the software is possible to enter the system of the engine that you want to simulate and to enter the relevant data.

<p><input type="text" value="piston port"/></p> <p>phase duration [°] <input type="text"/></p> <p>ports width [mm] <input type="text"/></p>	
<p><input type="text" value="reed valve"/></p> <p>n° ports [#] <input type="text"/></p> <p>reed angle [deg] <input type="text"/></p> <p>ports width [mm] <input type="text"/></p> <p>ports length [mm] <input type="text"/></p> <p>max opening delpap [bar] <input type="text"/></p>	
<p><input type="text" value="rotary valve"/></p> <p>port opening [°] <input type="text"/></p> <p>port closing [°] <input type="text"/></p> <p>port width [mm] <input type="text"/></p> <p>port length [mm] <input type="text"/></p>	

For piston port must be entered the phase duration in crank angle degree.

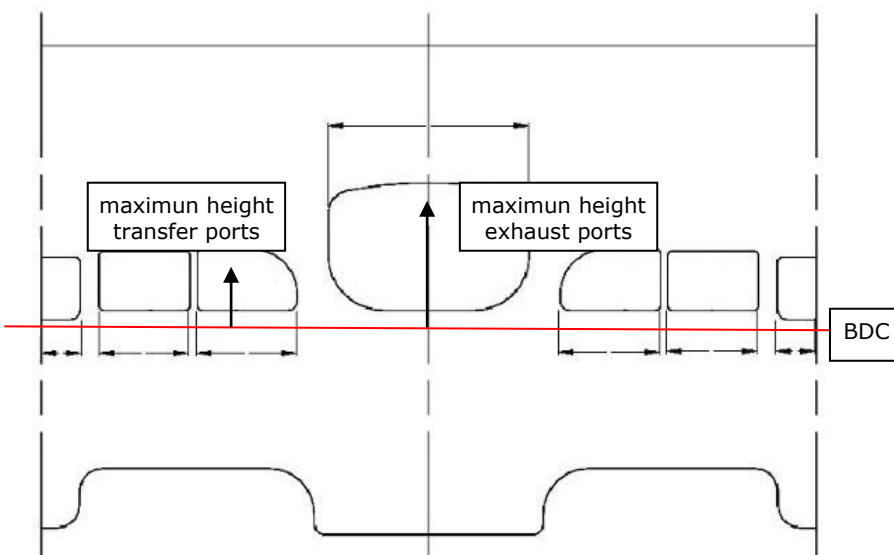
For rotary valve systems, opening and closing of the ports must be indicated in degrees considering the start of the engine cycle at bottom dead center (BDC), therefore:

the BDC will be to 0° and to 360°

the TDC will be to 180°

For reed valve system must be indicated which is the pressure difference that allows to open fully the reed windows. If you leave the value empty the software calculates automatically a value corresponding to reed petals suitable for the type of engine under study.

<p style="text-align: center;">TRANSFER PORTS</p> <table border="1"> <tr> <td>phase duration [°]</td> <td><input type="text"/></td> <td></td> </tr> <tr> <td>ports width [mm]</td> <td><input type="text"/></td> <td></td> </tr> <tr> <td>cd direct</td> <td><input type="text"/></td> <td>0.8</td> </tr> <tr> <td>cd reverse</td> <td><input type="text"/></td> <td>0.9</td> </tr> </table> <hr/> <p style="text-align: center;">EXHAUST PORTS</p> <table border="1"> <tr> <td>phase duration [°]</td> <td><input type="text"/></td> <td></td> </tr> <tr> <td>ports width [mm]</td> <td><input type="text"/></td> <td></td> </tr> <tr> <td>cd direct</td> <td><input type="text"/></td> <td>0.8</td> </tr> <tr> <td>cd reverse</td> <td><input type="text"/></td> <td>0.9</td> </tr> </table>	phase duration [°]	<input type="text"/>		ports width [mm]	<input type="text"/>		cd direct	<input type="text"/>	0.8	cd reverse	<input type="text"/>	0.9	phase duration [°]	<input type="text"/>		ports width [mm]	<input type="text"/>		cd direct	<input type="text"/>	0.8	cd reverse	<input type="text"/>	0.9	<p>For the transfer and exhaust ports, must be entered the phase duration in crank angle degree.</p> <p>In addition to this, the width of the ports must be entered. To calculate this value, if there are multiple rectangular shaped ports, simply enter the sum of the widths of the different ports; if the shape is different, the ideal would be to obtain the total area of the ports and divide it by the maximum height of the ports with respect to the bottom dead center.</p>
phase duration [°]	<input type="text"/>																								
ports width [mm]	<input type="text"/>																								
cd direct	<input type="text"/>	0.8																							
cd reverse	<input type="text"/>	0.9																							
phase duration [°]	<input type="text"/>																								
ports width [mm]	<input type="text"/>																								
cd direct	<input type="text"/>	0.8																							
cd reverse	<input type="text"/>	0.9																							

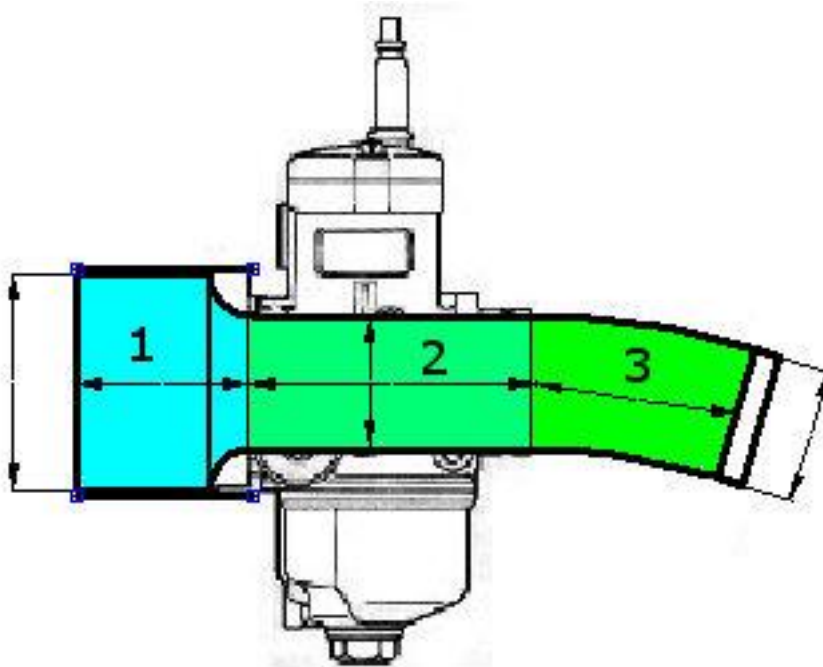


The software has already preset the direct and reverse flow coefficient values for the ports, anyway if specific flowbench tests are carried out, it is possible to enter manually the values obtained experimentally.

Then in the software must be entered the geometry of the ducts that go from:

- intake inlet to crankcase inlet INTAKE GEOMETRY;
- crankcase outlet to cylinder inlet TRANSFER GEOMETRY;
- cylinder outlet to exhaust outlet EXHAUST GEOMETRY;

INTAKE GEOMETRY



The geometry of the intake system must be inserted considering a series of sections that start from the filter side and which corresponds to section 1, until to the crankcase side.

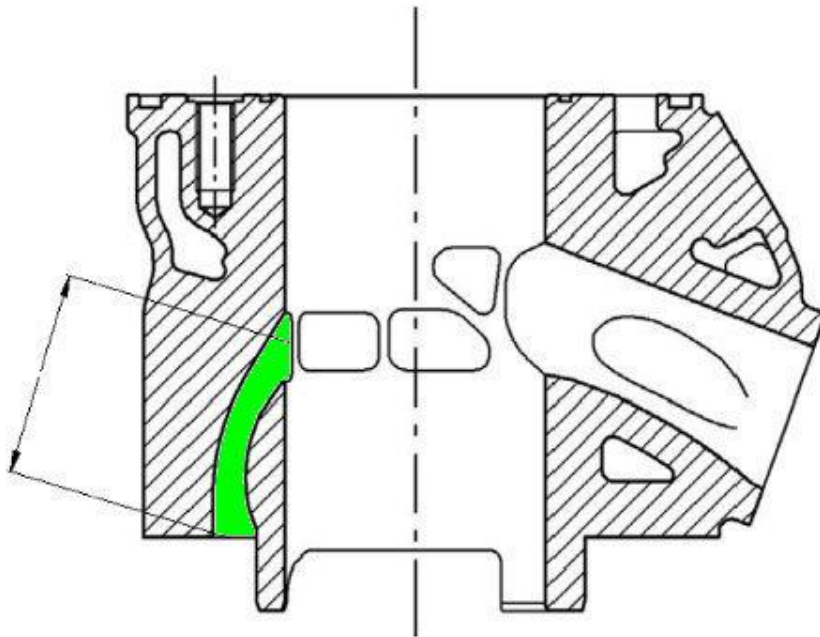
		INTAKE GEOMETRY		
<p>For each section must be entered:</p> <ul style="list-style-type: none"> - initial diameter D_{in} [mm]; - final diameter D_{out} [mm]; - length (considered on the axis of the duct) L [mm] <p>In addition to these data, it is possible to enter the value of the average wall temperature of the ducts; if you leave the field empty, the software will use the default value of 30 °C</p>		ducts temp. [°C]		30
		Din [mm]	Dout [mm]	L [mm]
1	<input type="text"/>	<input type="text"/>	<input type="text"/>	
2	<input type="text"/>	<input type="text"/>	<input type="text"/>	
3	<input type="text"/>	<input type="text"/>	<input type="text"/>	
4	<input type="text"/>	<input type="text"/>	<input type="text"/>	
5	<input type="text"/>	<input type="text"/>	<input type="text"/>	
6	<input type="text"/>	<input type="text"/>	<input type="text"/>	
7	<input type="text"/>	<input type="text"/>	<input type="text"/>	
8	<input type="text"/>	<input type="text"/>	<input type="text"/>	
9	<input type="text"/>	<input type="text"/>	<input type="text"/>	

A typical case, shown in the figure above, will have:

- section 1 – sleeve between airbox/filter and carburetor
- section 2 – carburetor
- section 3 – manifold between carburetor and crankcase/reed valve

TRANSFER GEOMETRY

The transfer ducts are inside the cylinder, and connect the crankcase to the cylinder itself.



Even if in reality there are more than one ducts, the data must be entered into the software as if there were a single duct with equivalent characteristics, therefore:

- as the initial diameter D_{in} [mm], must be calculated the equivalent diameter of the total passages area on the crankcase side;
- as final diameter D_{out} [mm], must be calculated the equivalent diameter of the transfer ports total area;
- as length L [mm], must be calculated the average length of the different transfer ducts (see figure above)

In addition to these data, it is possible to enter the value of the average wall temperature of the ducts; if you leave the field empty, the software will use the default value of 100 °C

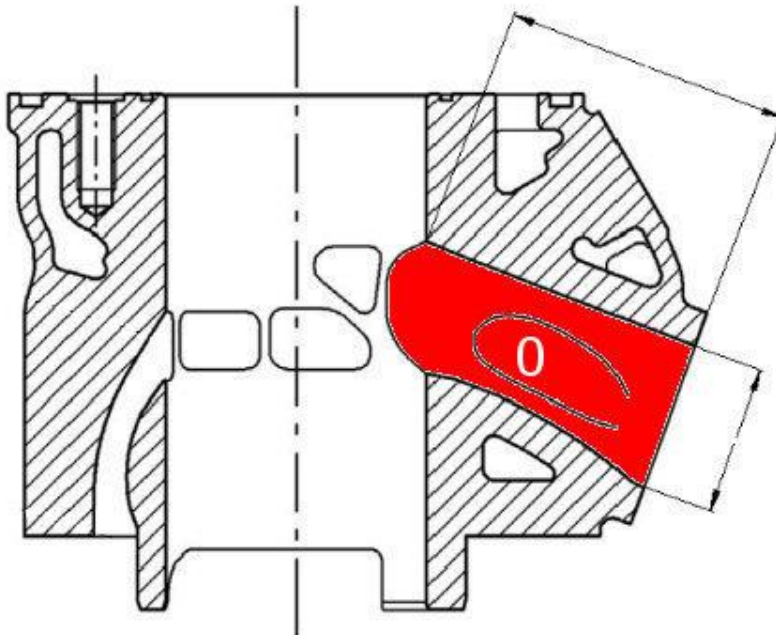
TRANSFER GEOMETRY

ducts temp. [°C] 100

	D_{in} [mm]	D_{out} [mm]	L [mm]
1	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>
4	<input type="text"/>	<input type="text"/>	<input type="text"/>
5	<input type="text"/>	<input type="text"/>	<input type="text"/>
6	<input type="text"/>	<input type="text"/>	<input type="text"/>
7	<input type="text"/>	<input type="text"/>	<input type="text"/>
8	<input type="text"/>	<input type="text"/>	<input type="text"/>
9	<input type="text"/>	<input type="text"/>	<input type="text"/>

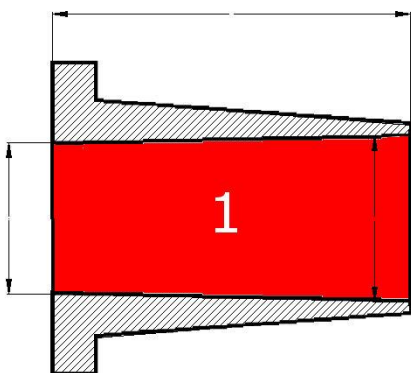
EXHAUST GEOMETRY

The geometry of the exhaust system includes several elements. The first, defined in the software as section 0, is the exhaust duct located inside the cylinder.

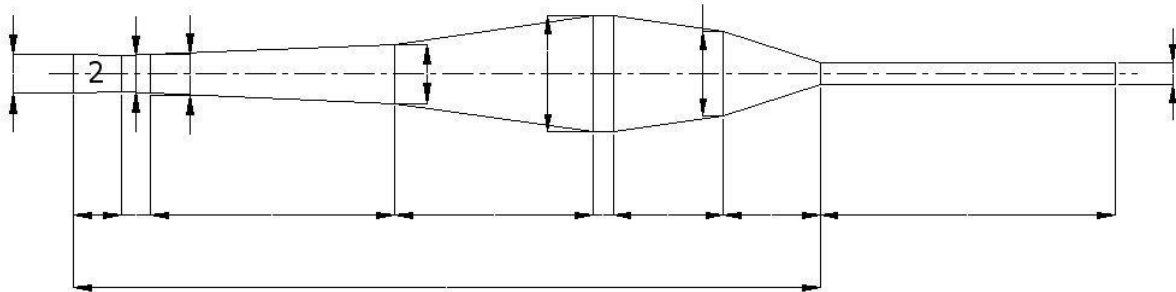


In this case, as D_{in} [mm] must be calculated the equivalent diameter of the total area of the exhaust ports, and as D_{out} [mm], the equivalent diameter of the exit area from the cylinder, where the exhaust manifold is to be applied.

The second element that makes up the exhaust system is the manifold that connects the cylinder to the exhaust muffler, and in the software it is defined as section 1



Finally, the geometry of the exhaust muffler must be entered with the data starting from section 2 considered the one connected to the exhaust manifold. The geometry of the exhaust muffler must be linearised, therefore for a curved muffler, for each section the length can be defined as the average between the short side and the long side, and for the diameters the circumference can be measured with a string and the diameter calculated accordingly.



For each section must be entered:

- initial diameter D_{in} [mm];
- final diameter D_{out} [mm];
- length (considered on the axis of the duct) L [mm]

In addition to these data, it is possible to enter the value of the average wall temperature of the ducts; if you leave the field empty, the software will use the default value of 330 °C

EXHAUST GEOMETRY

ducts temp. [°C]

	Din [mm]	Dout [mm]	L [mm]
0	<input type="text"/>	<input type="text"/>	<input type="text"/>
1	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>
4	<input type="text"/>	<input type="text"/>	<input type="text"/>
5	<input type="text"/>	<input type="text"/>	<input type="text"/>
6	<input type="text"/>	<input type="text"/>	<input type="text"/>
7	<input type="text"/>	<input type="text"/>	<input type="text"/>
8	<input type="text"/>	<input type="text"/>	<input type="text"/>
9	<input type="text"/>	<input type="text"/>	<input type="text"/>
10	<input type="text"/>	<input type="text"/>	<input type="text"/>
11	<input type="text"/>	<input type="text"/>	<input type="text"/>
12	<input type="text"/>	<input type="text"/>	<input type="text"/>
13	<input type="text"/>	<input type="text"/>	<input type="text"/>
14	<input type="text"/>	<input type="text"/>	<input type="text"/>
15	<input type="text"/>	<input type="text"/>	<input type="text"/>

At this point, only the data relating to the crankcase and cylinder remain to be entered.

<p>For the crankcase, the volume must be measured with the piston at bottom dead center BDC, and excluding the transfer ducts.</p> <p>In addition to these data, it is possible to enter the value of the average crankcase wall temperature; if you leave the field empty, the software will use the default value of 70 °C</p>	<div style="text-align: center;">CRANKCASE</div> <table border="1"> <tr> <td>volume [cm3]</td> <td><input type="text"/></td> <td></td> </tr> <tr> <td>crankcase temp. [°C]</td> <td><input type="text"/></td> <td>70</td> </tr> </table>	volume [cm3]	<input type="text"/>		crankcase temp. [°C]	<input type="text"/>	70
volume [cm3]	<input type="text"/>						
crankcase temp. [°C]	<input type="text"/>	70					

<p>For the cylinder you must enter the main specifications (displacement, stroke and bore), and the volume of the combustion chamber measured with the piston at top dead centre TDC, or calculated from the compression ratio: displacement / (compr.ratio-1)</p> <p>In addition to these data, it is possible to enter the value of the average wall temperature of:</p> <ul style="list-style-type: none"> - head (default 300 °C) - piston (default 300 °C) - cylinder (default 180 °C) 	<div style="text-align: center;">CYLINDER</div> <table border="1"> <tr> <td>comb. cham. vol. [cm3]</td> <td><input type="text"/></td> <td></td> </tr> <tr> <td>stroke [mm]</td> <td><input type="text"/></td> <td></td> </tr> <tr> <td>bore [mm]</td> <td><input type="text"/></td> <td></td> </tr> <tr> <td>head temp. [°C]</td> <td><input type="text"/></td> <td>300</td> </tr> <tr> <td>piston temp. [°C]</td> <td><input type="text"/></td> <td>300</td> </tr> <tr> <td>cylinder temp. [°C]</td> <td><input type="text"/></td> <td>180</td> </tr> </table>	comb. cham. vol. [cm3]	<input type="text"/>		stroke [mm]	<input type="text"/>		bore [mm]	<input type="text"/>		head temp. [°C]	<input type="text"/>	300	piston temp. [°C]	<input type="text"/>	300	cylinder temp. [°C]	<input type="text"/>	180
comb. cham. vol. [cm3]	<input type="text"/>																		
stroke [mm]	<input type="text"/>																		
bore [mm]	<input type="text"/>																		
head temp. [°C]	<input type="text"/>	300																	
piston temp. [°C]	<input type="text"/>	300																	
cylinder temp. [°C]	<input type="text"/>	180																	

Finally, in the software it is possible to manage the ignition and combustion parameters.

<p>For ignition you can enter the advance value considered as crank angle degrees before top dead centre TDC. The default value is 12 °.</p> <p>For combustion you can enter:</p> <ul style="list-style-type: none"> - duration (default 40 °); - efficiency (default 0.95) <p>and furthermore it is possible to manage two parameters that define the combustion trend according to a well-known law defined by Wiebe:</p> <ul style="list-style-type: none"> - parameter "a" which identifies the efficiency, higher is the value and greater will be the efficiency (default value 5.25); - parameter "m" which identifies the combustion speed (default value 1.25) 	<div style="text-align: center;">COMBUSTION</div> <table border="1"> <tr> <td>ignition adv. [°]</td> <td><input type="text"/></td> <td>12</td> </tr> <tr> <td>comb. dur. [°]</td> <td><input type="text"/></td> <td>40</td> </tr> <tr> <td>wiebe a</td> <td><input type="text"/></td> <td>5.25</td> </tr> <tr> <td>wiebe m</td> <td><input type="text"/></td> <td>1.25</td> </tr> <tr> <td>comb. eff. [-]</td> <td><input type="text"/></td> <td>0.95</td> </tr> </table>	ignition adv. [°]	<input type="text"/>	12	comb. dur. [°]	<input type="text"/>	40	wiebe a	<input type="text"/>	5.25	wiebe m	<input type="text"/>	1.25	comb. eff. [-]	<input type="text"/>	0.95
ignition adv. [°]	<input type="text"/>	12														
comb. dur. [°]	<input type="text"/>	40														
wiebe a	<input type="text"/>	5.25														
wiebe m	<input type="text"/>	1.25														
comb. eff. [-]	<input type="text"/>	0.95														

Before starting the calculation in the software it is possible to define the characteristics of the simulation.

The discretization, the number of cycles, and the pressure error allowed, values influence the precision and the speed of the calculation. For the discretization the default value is 20 mm. For the number of cycles defines the default value is 10. For the pressure error allowed between two cycles the default is 0.01%.

Finally, you must enter the engine speed values from which you want to start calculating torque and power (default 5000), and the final one (default 14000), indicating every how many revolutions (default 1000) you want to carry out the calculation between initial speed and final speed.

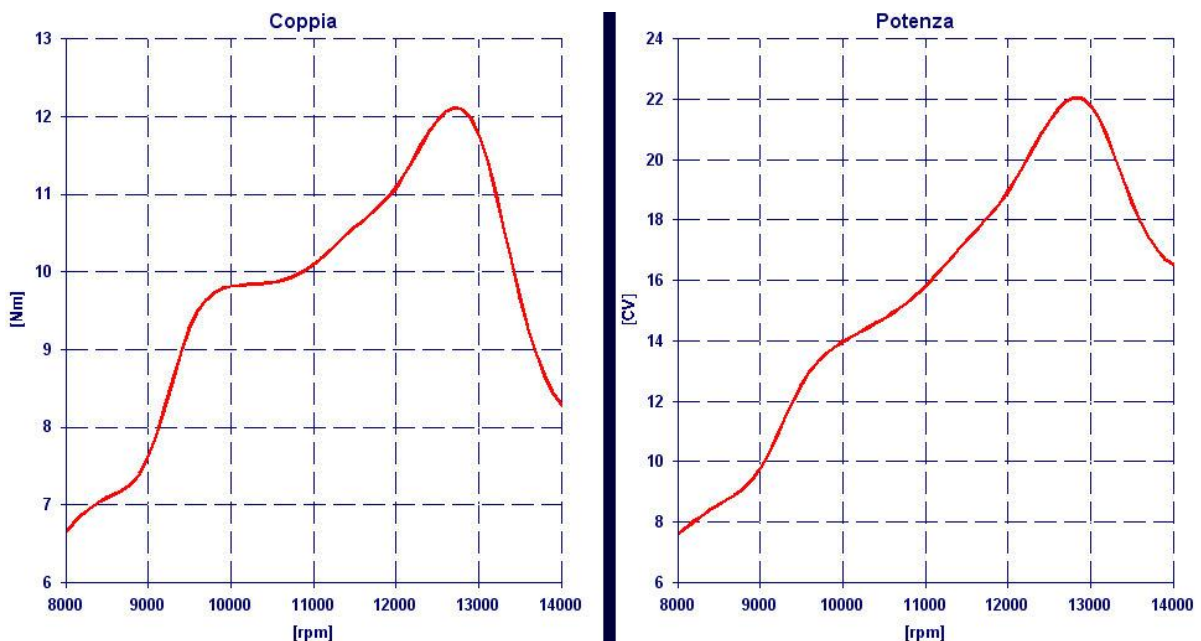
SIMULATION		
discretization [mm]	<input type="text"/>	20
min speed [rpm]	<input type="text"/>	5000
max speed [rpm]	<input type="text"/>	14000
step [rpm]	<input type="text"/>	1000
n° cycles [#]	<input type="text"/>	10
pressure error [%]	<input type="text"/>	0.01

After entering the data described above, you can start the calculation by pressing the START button. The software shows the progress of the calculation with a yellow bar at the bottom which indicates how much remain to be completed.



results

At the end of the calculation, pressing the OUTPUT button you can see the torque and power curves.

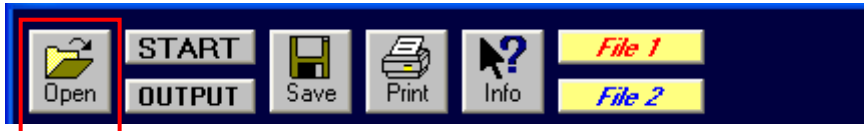


open and save data file

The data can be saved in a file * .tss through the "SAVE" button.



The stored data can be easily retrieved through the button "OPEN".



comparison results

The software allows you to compare the results with those of a previously saved solution.

To compare two results, after the calculation and saved the results, you must open the first file that you want compare from the button "Open" or the button "File1", and the second file from the button "File2".



The software will automatically show you the comparison (those of File1 in red, and those of File2 in blue). If you have loaded the File2, this will be maintained even when you perform a new calculation, so if you want to take a result as a reference, you can load it as File2, and then make the modifications on the File1, to start the calculation, and directly to compare the results.

print

At the end of the calculation you can print the input and output through the PRINT button.

