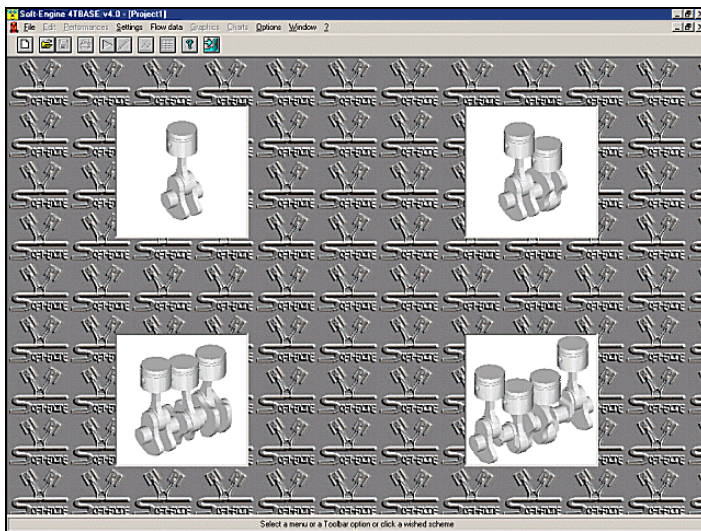


Soft-Engine - Software 4TBase

Main features

4TBASE is a **simulation software** by Soft-Engine for **4-stroke engines**, very easy to use. The software final purpose is to compute **horsepower**, **torque**, **specific consumption** and many other quantities. This product is the result of many years of research and experience in simulation codes. Data to be entered include **valve lift law**, timing, all **exhaust and inlet pipes diameters and lengths**, **compression ratio and fuel**, directly on the engine layout. The input of **experimental data** (flow test bench and **thermal** or **mechanical losses**) is not compulsory but help the expert to better study the engine behaviour and obtain more accurate results.



The main window

This software calculates inlet, exhaust pipes and cylinder pressure, it simulates **horsepower**, **torque** and **volumetric efficiency** performances. The most important function is the **variation of engine data**, as at a test bench. You can modify any values you want. After a further calculation process, you obtain new values which can be compared with the previous ones.

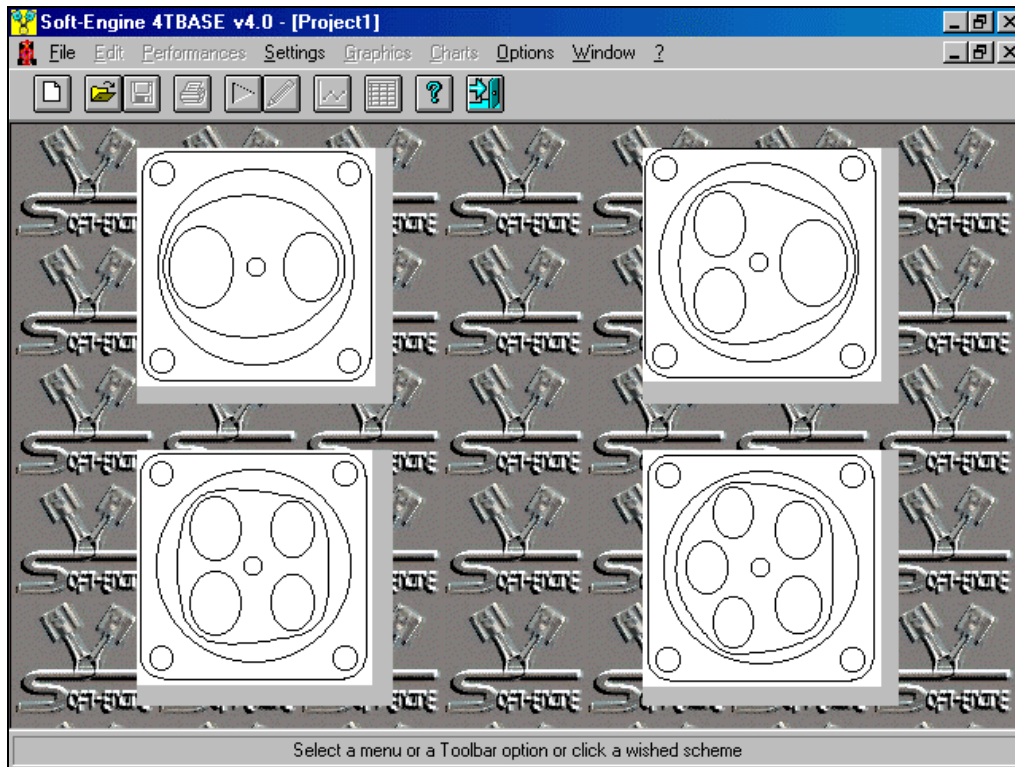
Fluid dynamics is simulated with equations of unsteady gas movement and by the method of the characteristics, combustion by **Wiebe laws**, friction losses are calculated by means of experimental relations to be customised. You can also enter all experimental data as you like. By 4TBASE the engine simulation is very powerful and professional.

Data input

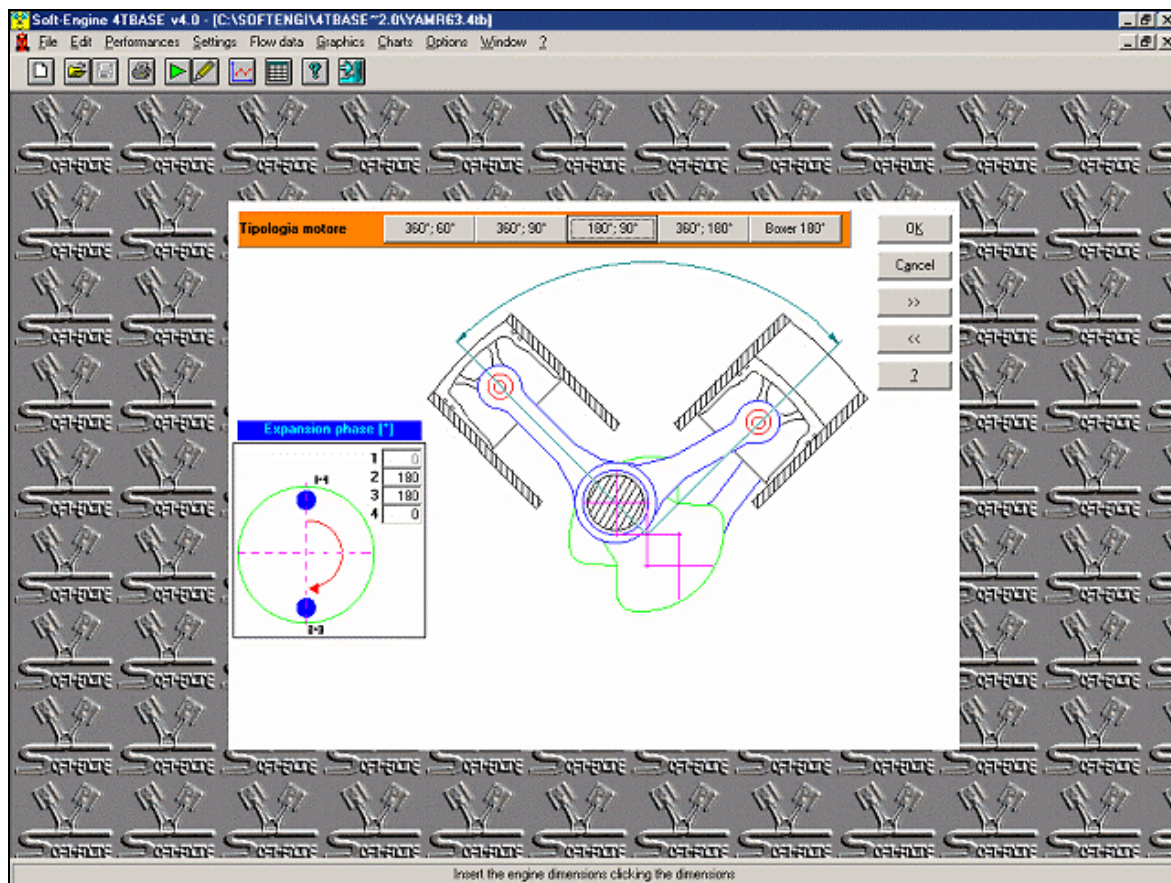
The data required by this program are:

- ☞ **cams** phase;
- ☞ **valves** lift law;
- ☞ valves diameter;
- ☞ exhaust and inlet **pipes** (any configuration and layout)
- ☞ **exhaust** and **inlet** flow coefficient;
- ☞ **compression ratio**;
- ☞ **combustion chamber** parameters;
- ☞ combustion angles;
- ☞ **mechanical losses** parameters;
- ☞ **experimental** data input and settings.

Soft-Engine engine simulation software – software “4Tbase”

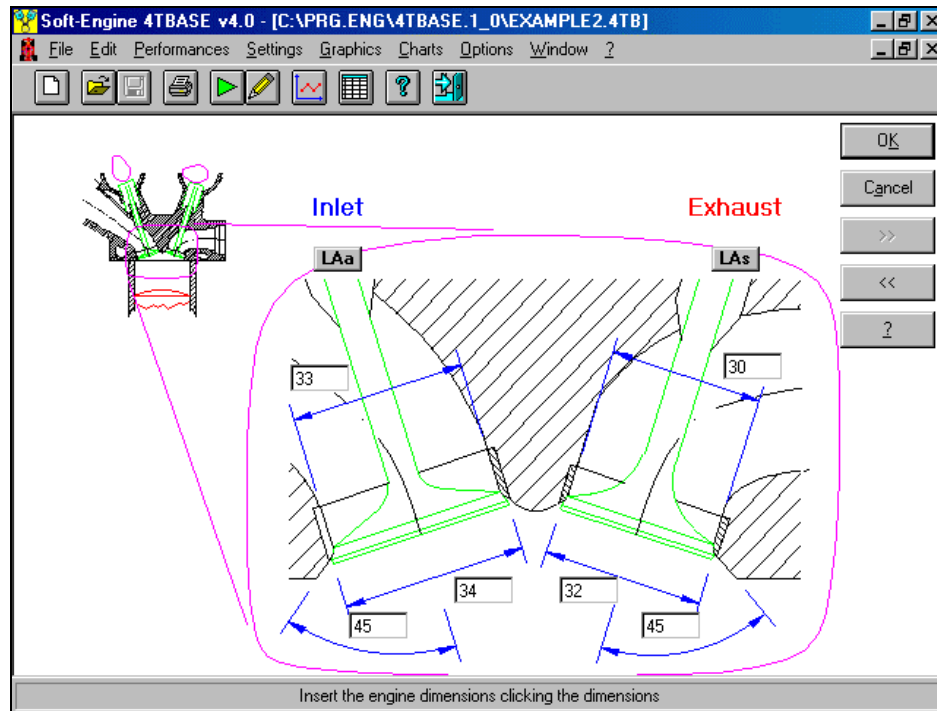


4TBase: valves arrangement choice



4TBase: cylinders arrangement choice

Soft-Engine engine simulation software – software “4Tbase”

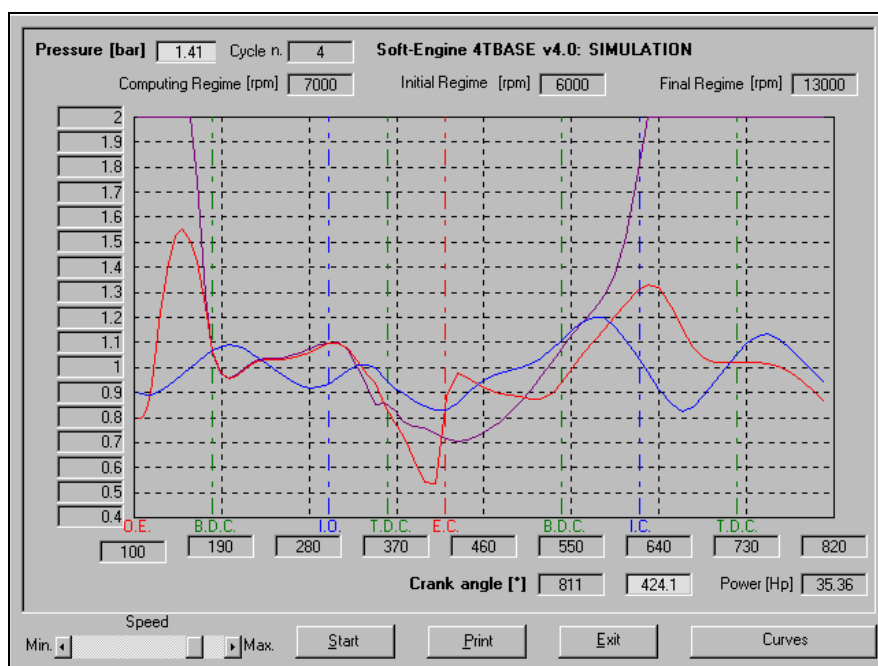


4TBase: data direct input by layouts with dimensions

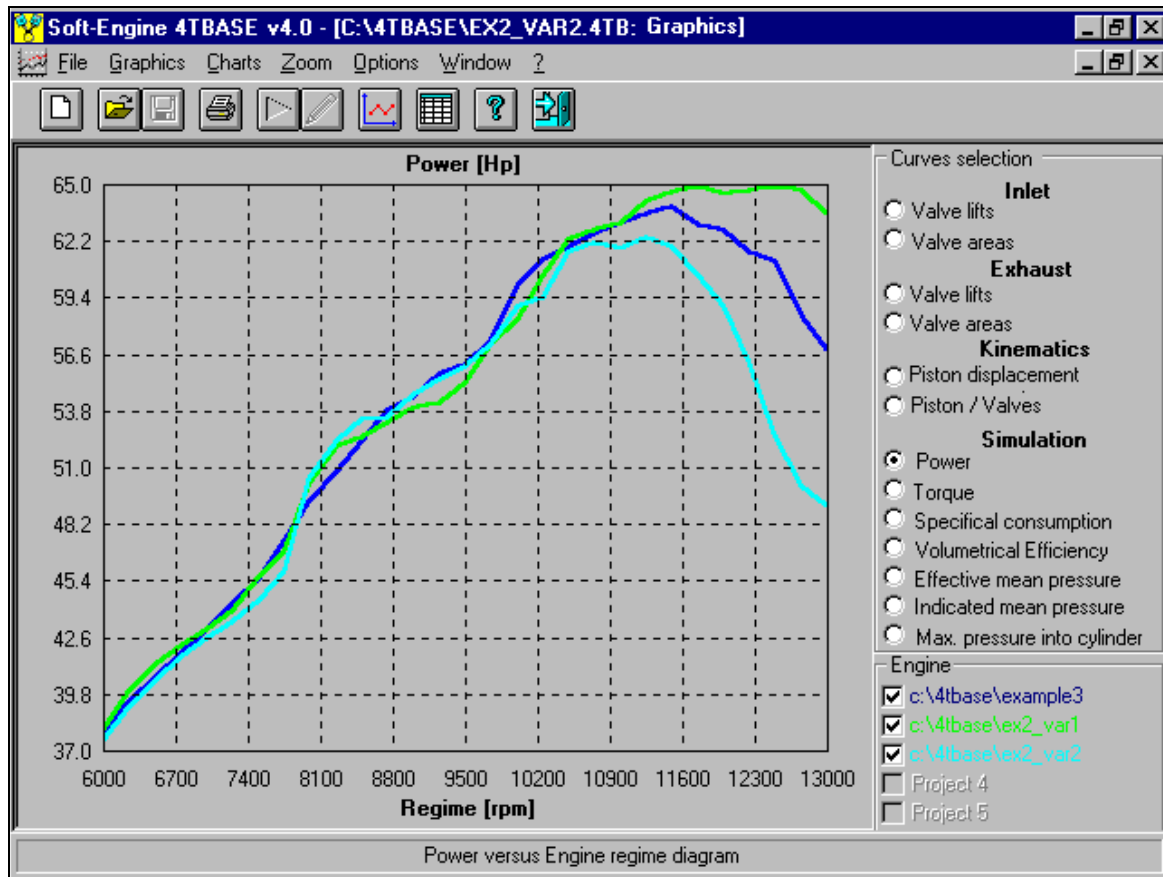
Results

The most important values calculated by this software at output vary according to the engine:

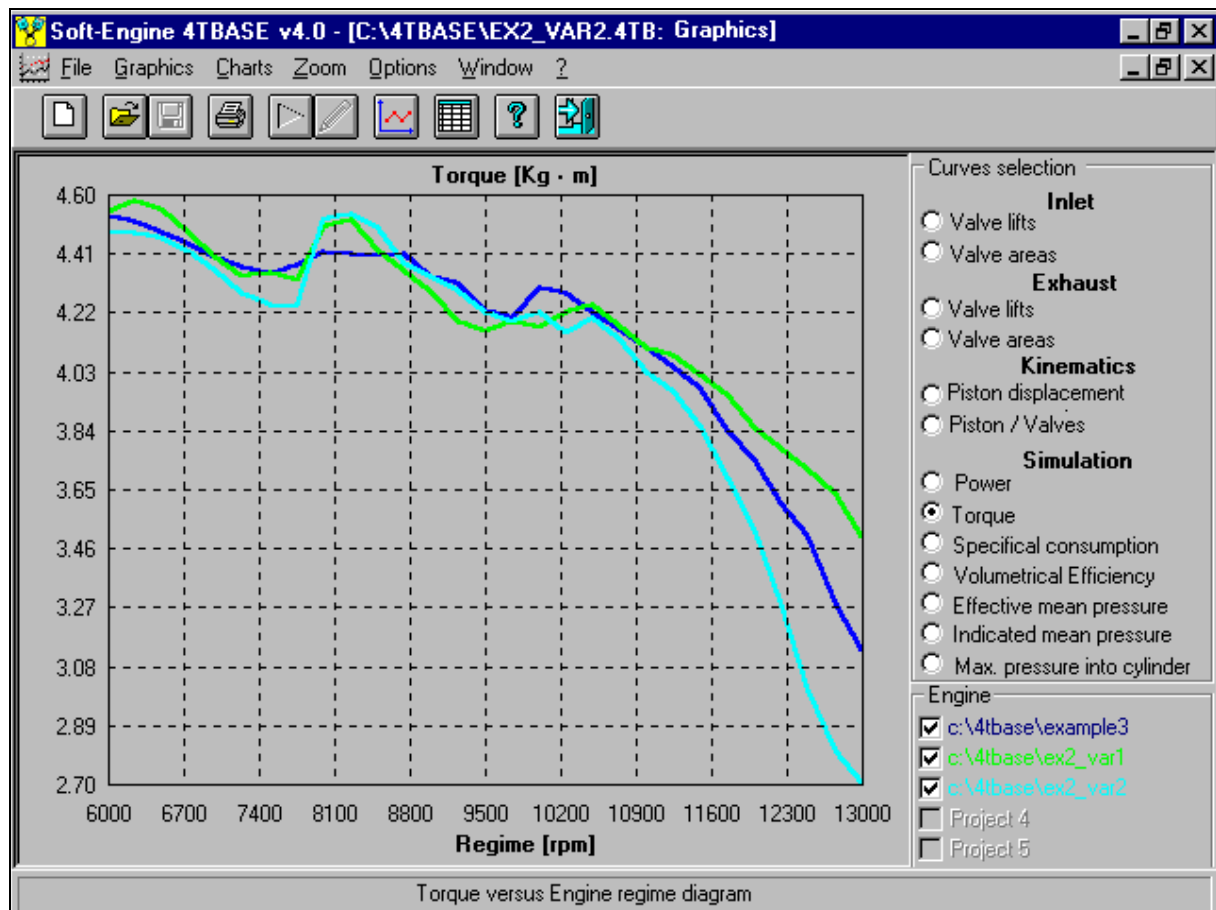
- ☞ **Horsepower**
- ☞ **Torque**
- ☞ **Specific consumption**
- ☞ **Volumetric efficiency**
- ☞ **Effective Mean Pressure**
- ☞ **Indicated Mean Pressure**
- ☞ **Cylinder Max. Pressure**



4TBASE: simulation, with cylinders pressures



4TBASE: simulation results - horsepower diagrams



4TBASE: simulation results - torque diagrams

Soft-Engine engine simulation software – software “4Tbase”

The followings results are specific for each cylinders:

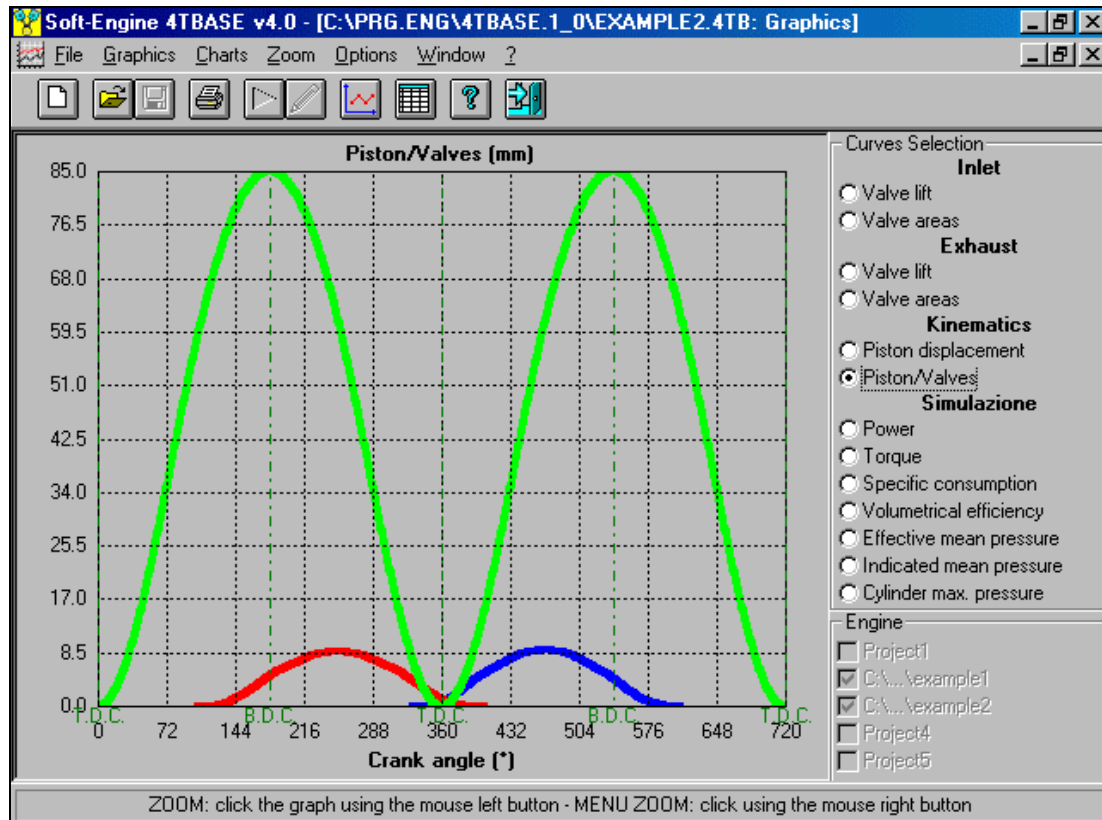
Valves areas

Valves lift

Piston displacement

During simulation procedure, it is possible to visualize the following quantities:

- cylinder pressure;
- intake pressure;
- exhaust pressure;
- intake and exhaust instantaneous masses.



4TBase: piston displacement and valve lift diagrams

Simulation result accuracy

The experimental thermodynamics and flow coefficient data are not compulsory for the computations, in-fact the software has some default truthful data for each kind of engine. Obviously, if default data are used, it is impossible to reach a perfect correspondance with the real engine behaviour. So, the software can be used in one of the following two ways:

1) VARIATING THE DATA: input of the only geometrical data, and default thermo-fluid dynamics coefficients use. In this way the simulation is well-accurate but there is a difference from the real engine performances. But it is possible to variate a geometric datum (example: the pipe lengths) and to evaluate if horsepower, torque and performances increases or decreases.

2) COMPUTING PERFORMANCES: input all thermo-fluid dynamics and lift valve law real coefficients if you like to make a best-accurate simulation. In this way the horsepower, torque and performances value are very accurate.

In conclusion, **the computing accuracy depends on the experimental thermo-fluid dynamics and flow coefficient data.** If they are truthful, the accuracy is optimal.

Single and multi cylinder engine management - Pipes layout draw

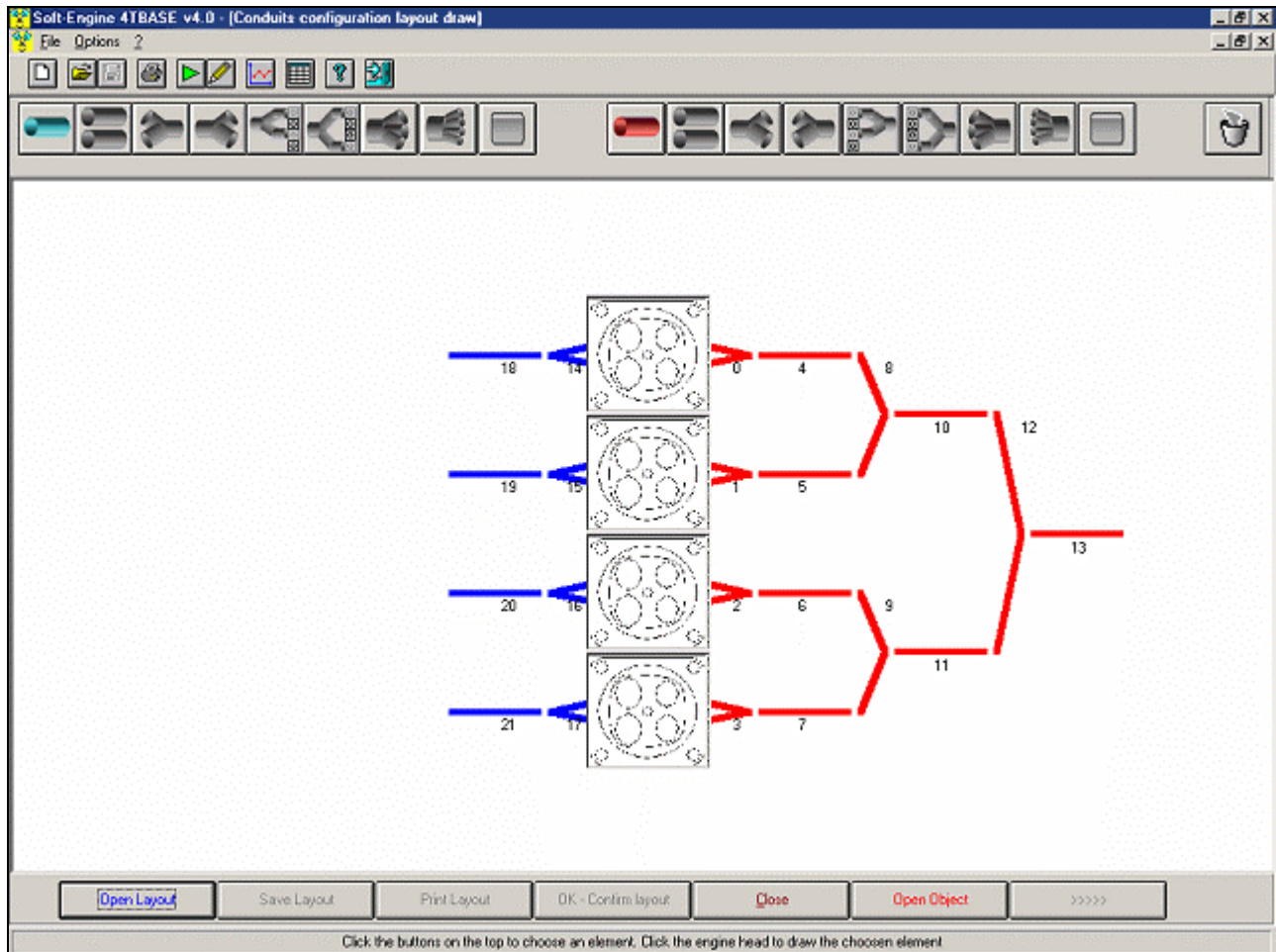
Soft-Engine engine simulation software – software “4Tbase”

In the single cylinder engines **the management of the ducts of intake and exhaust it is very intuitive**, because it is possible to **draw the pipes through a layout**. The pipes diameters and lengths can be input in a second moment, shaping them. General characteristic of the pipes layout insertion is that to draw a general simplified scheme; then is also possible to break every duct in more parts so that it is possible to manage, for each pipe cases as like join, curves, narrowings or sudden widening, conic variations of diameter, conducted to any section (not only circular), plenum etc...

In the motors to more than a cylinder it is possible, drawing its scheme with the formalities above you list, to make separate or convergent exhaust systems to sew together the ducts among them and many others...

However, **the real purpose of this software is to draw and simulate any exhaust and inlet pipes configuration**, for example **to calculate the effect of separate exhausts**, or **plenum box** on horsepower and torque. It is possible also **to change quickly pipes diameters and length after simulation** (see "Open object" function) and **compare the results, to find the effect of the variation**. Finally, **the pipes sections data** can be input by diameter, area or perimeter, **then widening, narrowings, discontinuity and other can be operated**.

The pipes configuration layout can be saved in a specific file, and it is possible to load it for different (but similar) engine, and the layout automatically "suits it" for the engine.



4TBase: the function to draw the pipes layout.

Click "Open object" to modify each drawn pipe lengths and diametres

Conduits layout sizes input

OBJECT N°09 CONNECTION EXH.

Quotes in mm

☒ Equivalent diameter
 ☐ Area
 ☐ Perimeter

Delete Chart
 Close
 >>>>>

4Tbase: pipes data input (connections)

Conduits layout sizes input

OBJECT N°13 CONDUIT EXH.

Object parts number:
4

It is possible to subdivide the object in 10 parts max.

☒ Equivalent diameter
 ☐ Area
 ☐ Perimeter

DATA PIPE	1	2	3	4
D Lft mm	60.0	60.0	64.0	64.0
D Rgh mm	60.0	60.0	64.0	64.0
L [mm]:	900.0	400.0	600.0	600.0

Delete Chart
 Close
 >>>>>

4Tbase: pipes data input (conic-cylindric parts with any section)

Compatibility with other software

In the most advanced versions the software is able to **import a cam made with our software "CAMS"** and to insert it in the simulation, so that is possible to appraise the performances of that cam. The communication with the "CAMS" it also happens to the inverse way: it is possible to directly introduce some data of this cam in 4TBase, to simulate its performances and then to export it, so **it is possible to make it indeed with the software "CAMS"**.

There is besides the possibility to also insert the real data coming from flow benches, to be able to **calculate even more the flow coefficients in realistic way** and therefore to be able to effect more accurate simulations. It is completely compatible with our flow bench "**FLUX**".

4TBASE can open or to export data in formed "VYB" for the compatibility with our software **VYBRO**, that analyzes the engine from the strengths and torsional vibrations point of view, and how to balance those vibrations.

The software can finally, open a file coming from the software **INERTIAL or BRAKER** that manages our HP **dynamometers**. In this way, it is possible to make a comparison among powers and couples of a simulated motor and the same one tested with dynamometers.

Versions

Version
Version 3.0 Single cylinder 4-stroke engine simulation. It is possible to import a valve lift law and the flow coefficient data from a text file, or to "copy and past" the values from data sheets.
Version 3.5 Like the 3.0 version but it allows the simulation for twin cylinders engine also, with the possibility to choose any cylinder arrangement. for example, it is possible to simulate engine with linear cylinders, or "V" type with any angle and light sequence. Dynamical drawing of intake and exhaust pipes, possibility to make any kind of pipe shaping , making narrowings or widening, conic variations of diameter, joints among different cylinders, plenum etc...
Version 4.0 Like the 3.5 version but the horsepower and torque simulation is suitable for engine from 1 to 4 cylinders , with any possible engine arrangement and conduits layout.
Version 5.0 Like the version 4.0 but it allows a total compatibility with other Soft-Engine software . For example, with this version it is possible: - to import and to export the valve lift law as a file of "CAMS"; in this case a projected cam with the software CAMS can be tested on 4TBASE to study its performances; vice versa, a cam used for the simulation in 4TBASE can be exported in CAMS and therefore made. - to directly import some tests made by Soft-Engine "FLUX" flow bench, to be able to calculate the flow coefficients on the base of real tests made by our flow bench. Truthful flow coefficients are essential for a best simulation of the engine; - to import and to export the data of the motor in formed "4TTOOL" to be able to make some added analyses on the engine, as for instance the calculation of the speed of squish or of the resonance resonance; - to care and to export the data of the motor in formed "VYBRO" so that to be able to effect dynamic analysis on the strengths in the engine, to analyze the vibrations and eventually to correct them (option "balancing"). - finally, to import real test made with our HP dynamometers, to be able to compare the results of the simulation with the a real test.

Soft-Engine engine simulation software – software “4Tbase”

PC mininum configuration

Feature	Description
Processor:	Any personal computer IBM compatible.
System:	Windows ME, NT, Xp, Vista, Seven, Eight, Ten - 32 or 64 bit systems.
Memory RAM and Hard Disk:	At least 512 MB RAM and 2 GB free in the hard disk (for best Windows performances).
CDrom or Dvdrom device:	Speed at least 52X.
Graphic card:	VGA, SVGA and compatible cards, set at least 32 bit, Min. resolution: 1024x768.
Miscellaneous:	Keyboard, mouse, at least 1 USB port free (to connect the printer).
Printer:	Any ink-jet printer. Total compatibility with laser printers.
Total compatibility with notebooks and cases minitower PC.	