# 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 purpouse is to compute **horsepower**, **torque**, **specifical 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.
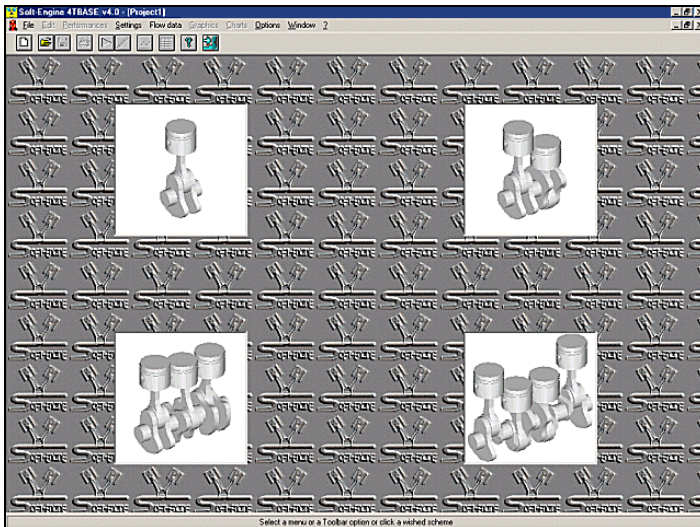
The main window

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 poverful 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.

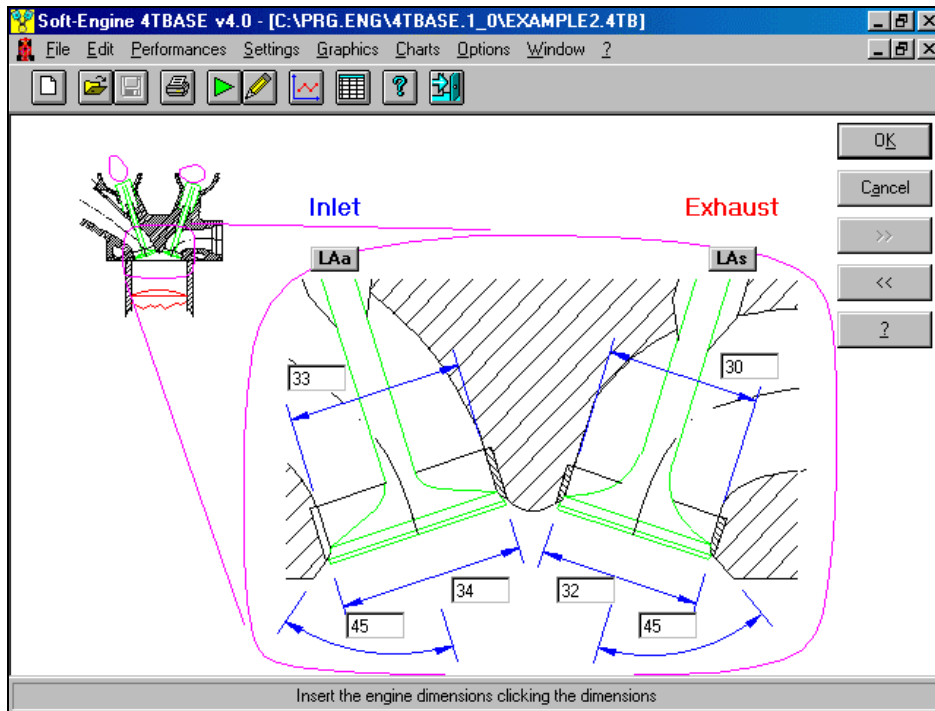# Soft-Engine engine simulation software – software "4Tbase"
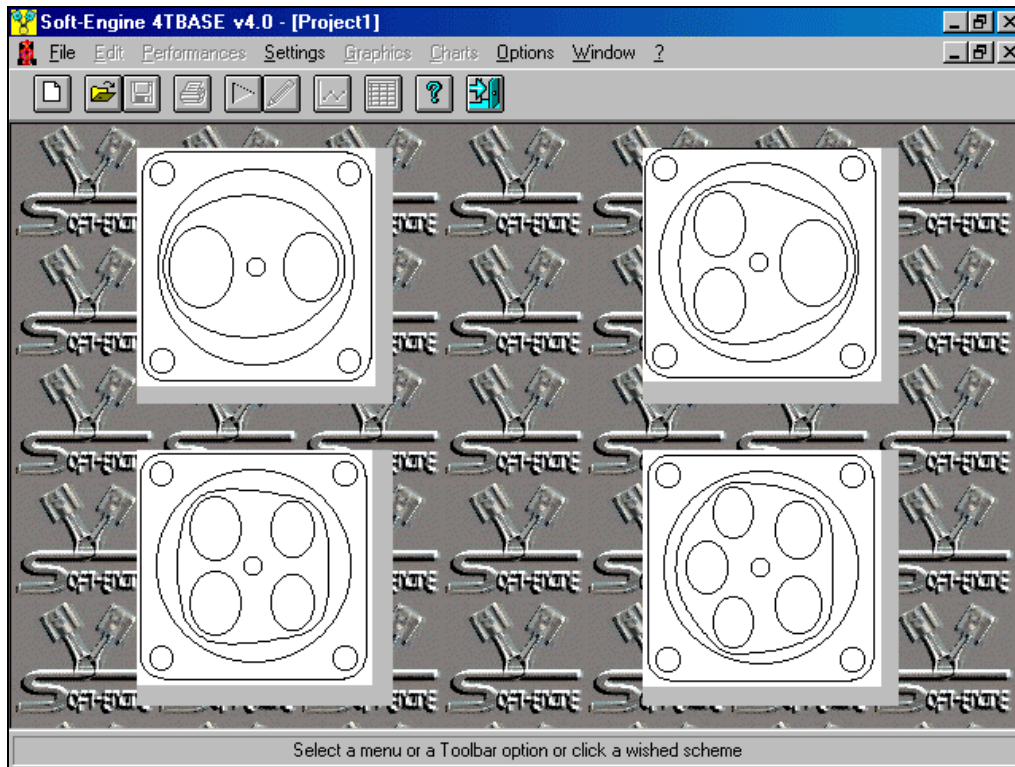
4TBase: valves arrangment choice
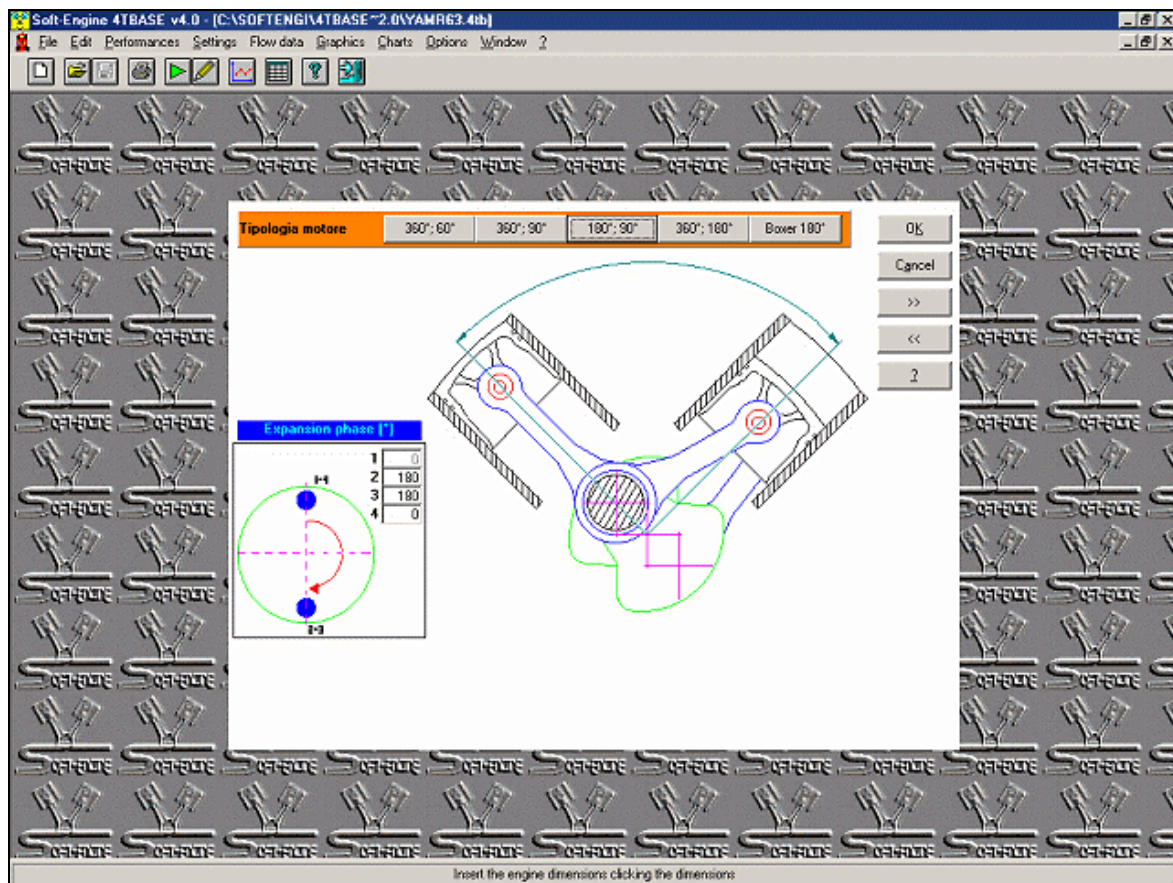
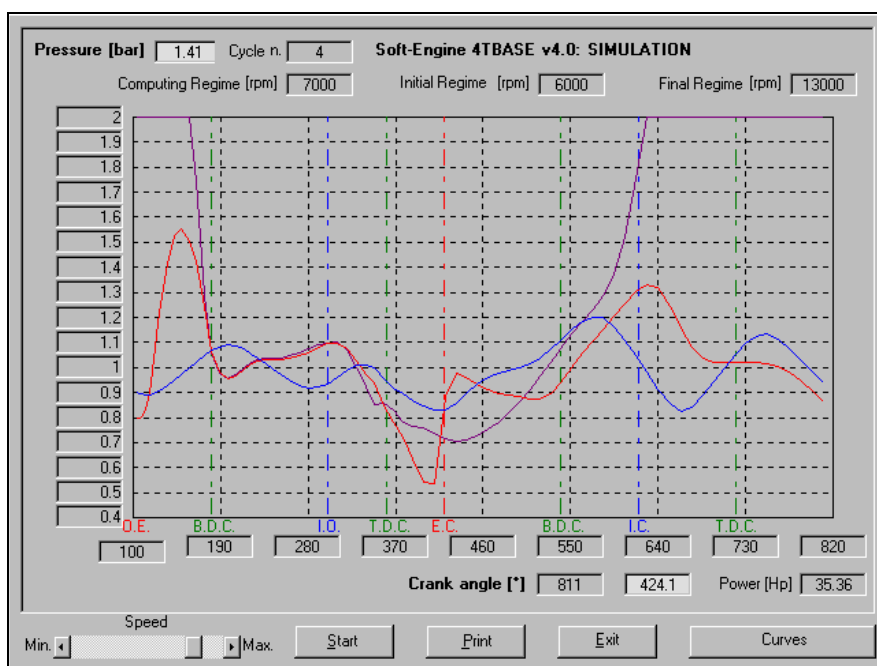*4TBase: cylinders arrangment choice*

*4TBase: data direct input by layouts with dimensions*

Results

The most important values calculated by this software at output vary according to the engine:
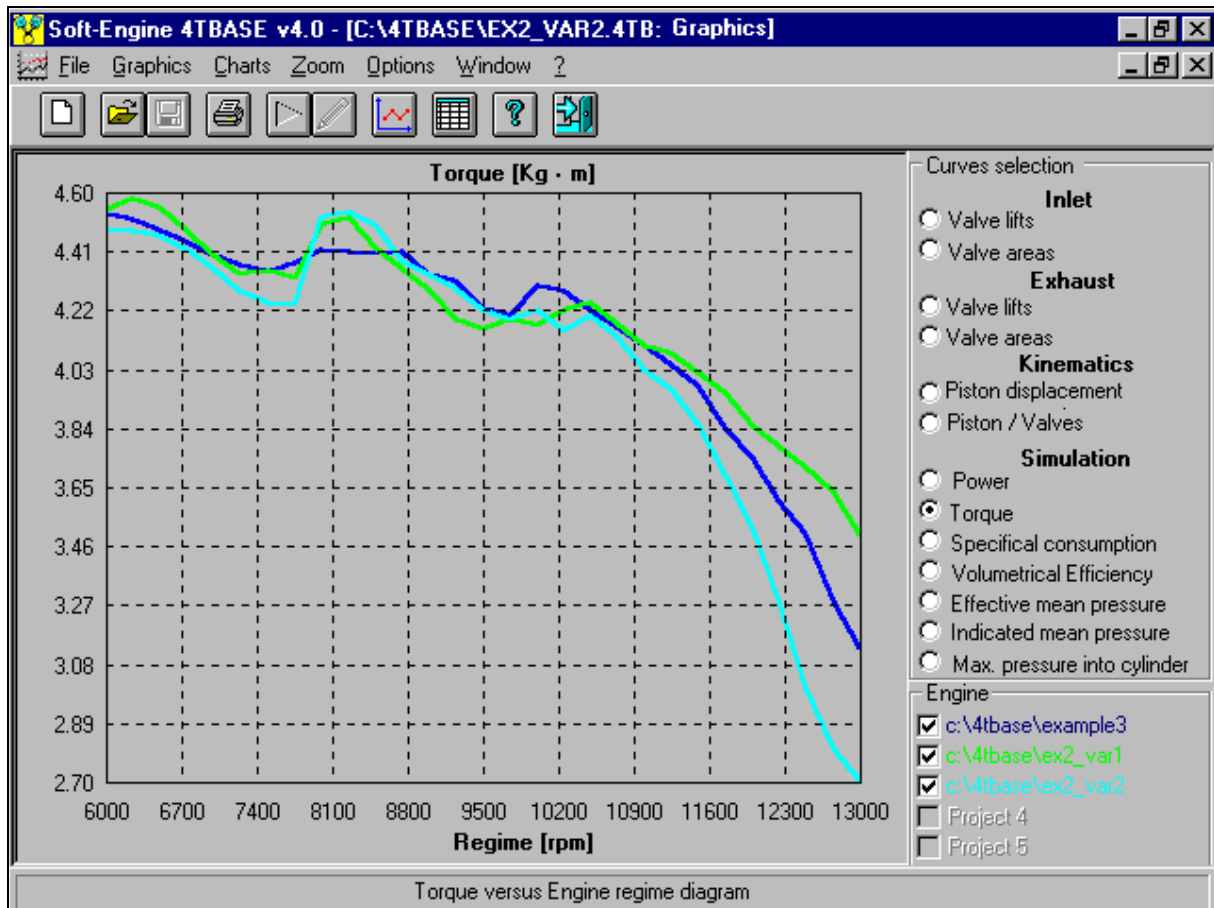
- **Horsepower**
- **Torque**
- **Specific consumption**
- **Volumetric efficiency**
- Effective Mean **Pressure**
- Indicated Mean Pressure
- Cylinder Max. Pressure

4TBASE: simulation, with cylinders pressures

Soft-Engine engine simulation software – software "4Tbase"
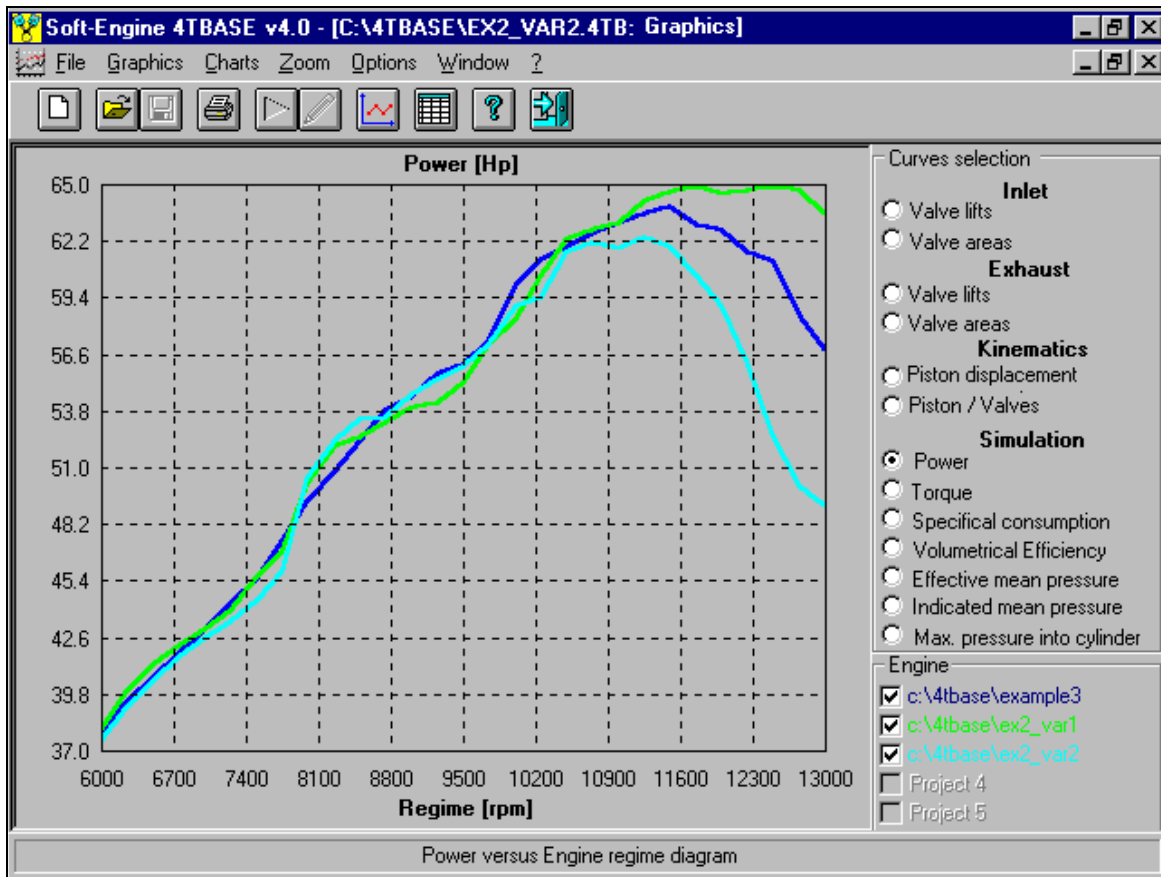
4TBASE: simulation results - horsepower diagrams

4TBASE: simulation results - torque diagrams

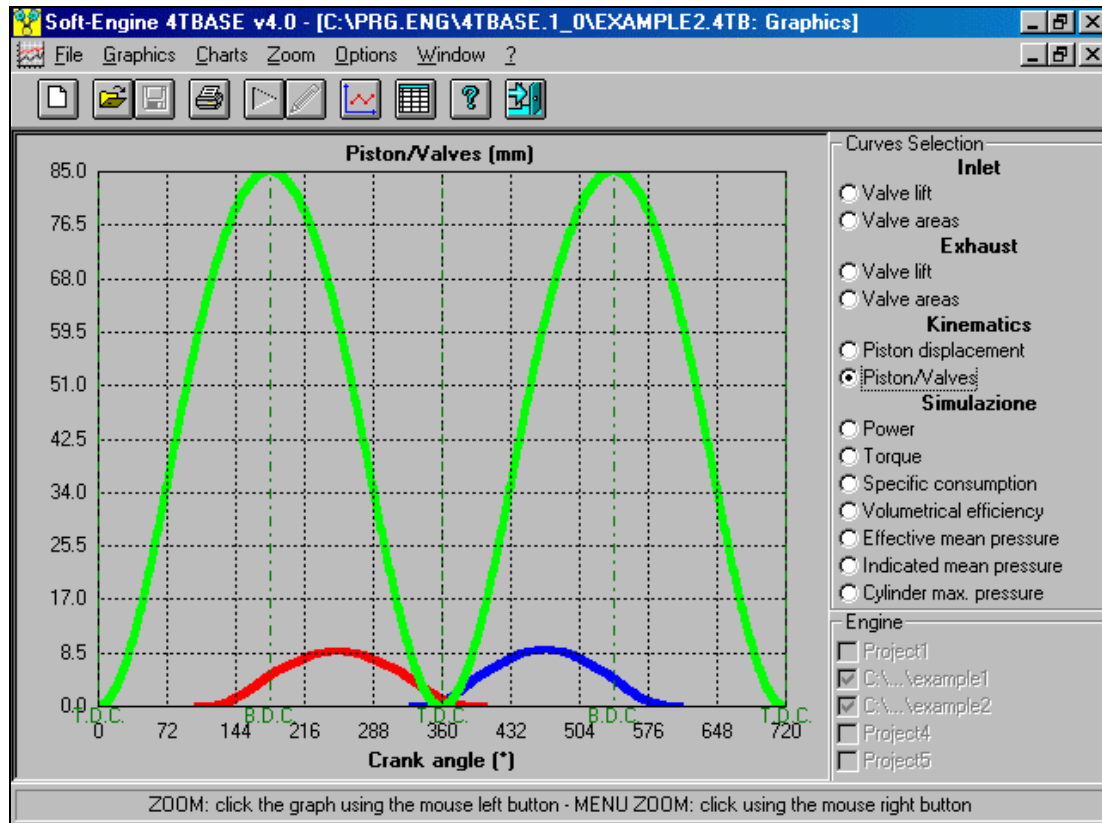The followings results are specifical for each cylinders:

🌀 **Valves areas**

🌀 Valves lift

🌀 **Piston** displacement

🌀 During simulation procerdure, 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 sperimental thermodinalmics and flow coeffienent data are not compusory for the computings, in-fact the software has some default thruthful data for each kind of engine. Obviously, if default data are used, it is impossible to reach a perfect conrespondance 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 lenghts) 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 esperimental themo-fluid dynamics and flow coefficent data.** If they are truthful, the accuracy is optimal.

### Single and multi cylinder engine management - Pipes layout draw

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 puropuse 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 lenght 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**.
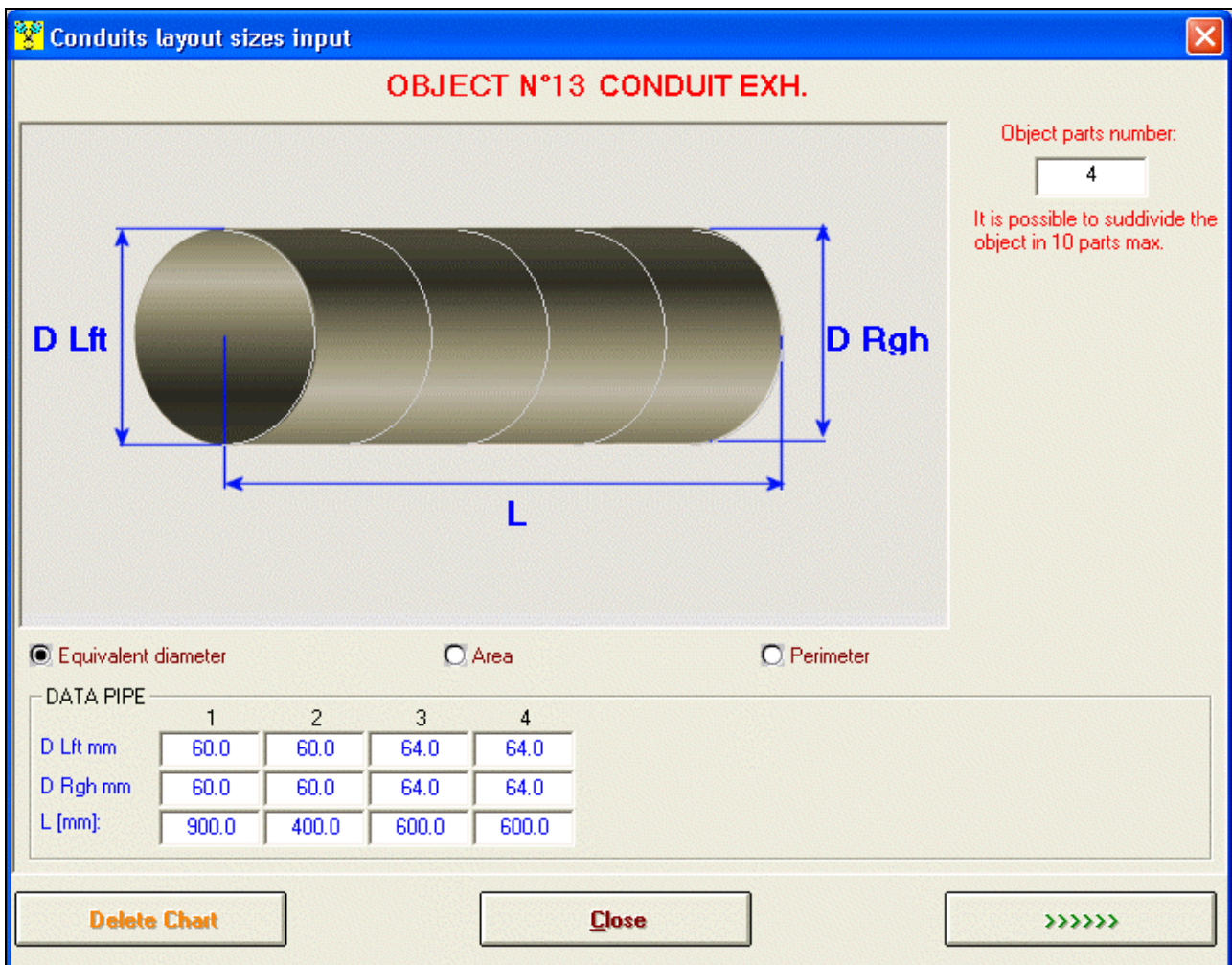
The pipes configuration layout can be saved in a specific file, and it is possible to load it for different (but similar) engine, and the layout automatically "suits it" for the engine.
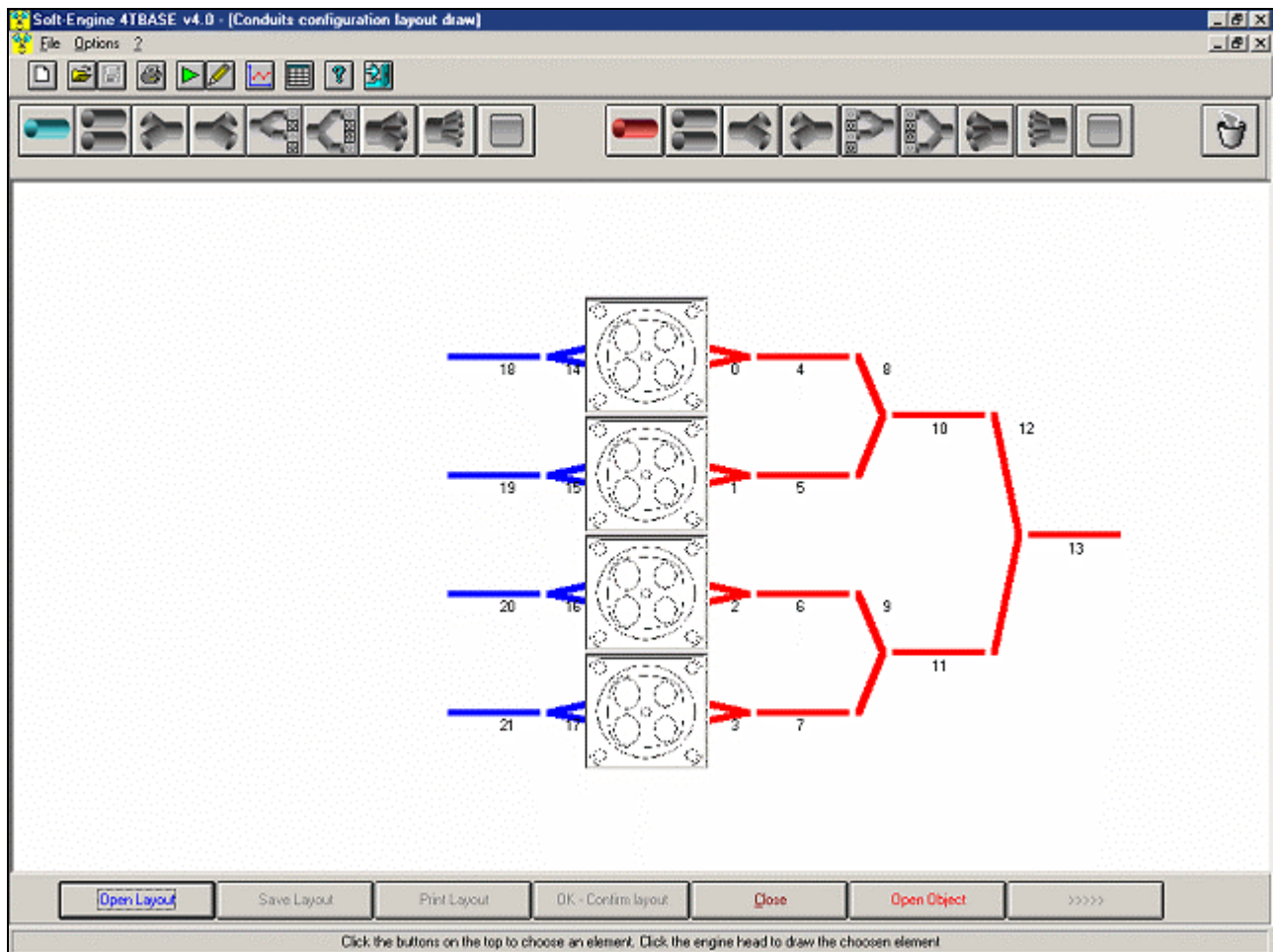
4TBase: the function to draw the pipes layout.
Click "Open object" to modify each drawn pipe lenghts and diametres
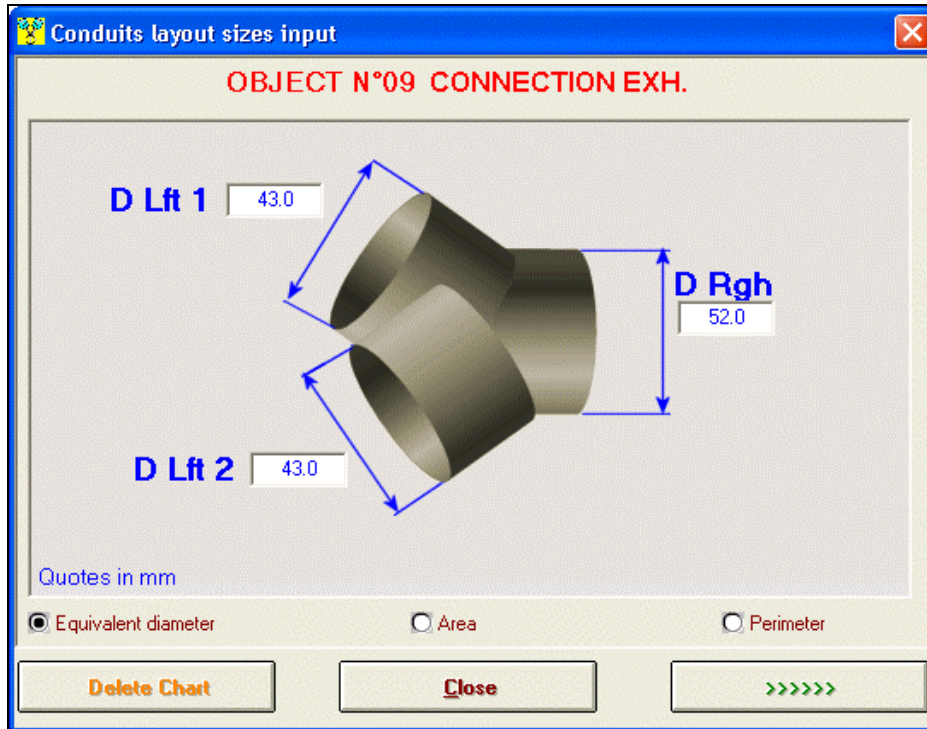
4Tbase: pipes data input (connections)

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

Compatibility with other software

In the most advanced versions the software is able to **inport 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 benchs, 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 vybrations.

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 and costs

Version	Cost

Soft-Engine engine simulation software – software "4Tbase"

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.	