

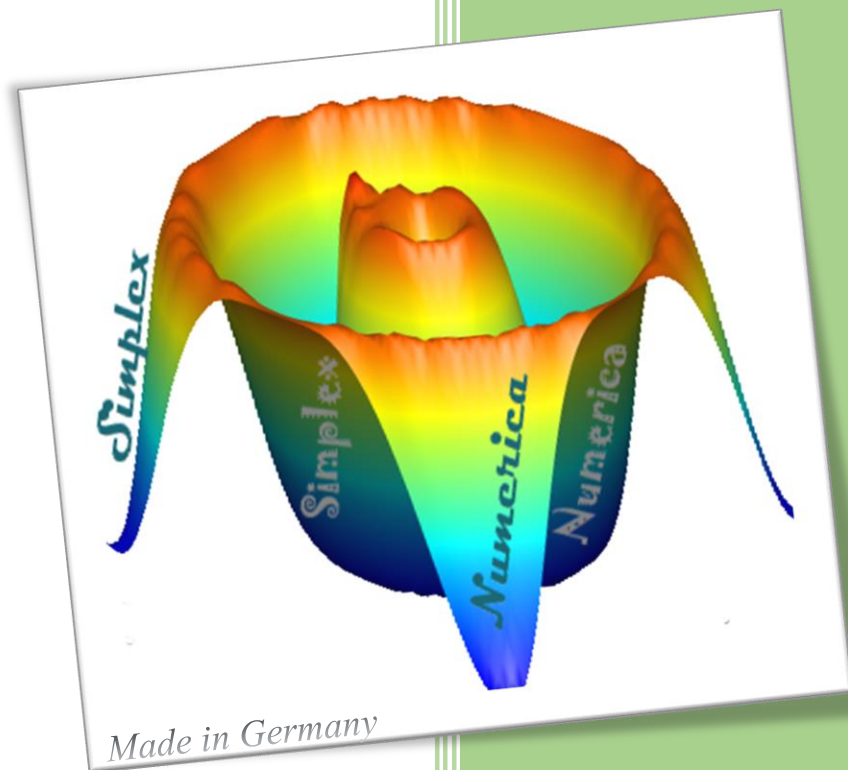
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SimplexNumerica

User Manual



SimplexNumerica is a comprehensive and powerful application that can be used in order to analyze data, 2D / 3D plotting, make complex calculations and develop programs in the C++ language on a Windows 10 Ribbonbar GUI.
www.SimplexNumerica.com

V24

Data Visualization

1 User Manual

Hint:

Be aware of the manuals "Programming *SimplexNumerica* with AngelScript" and "Excel-like SpreadSheet Module with FormulaEngine" from the developer and author of this document!

This documentation is provided to familiarize you with the fundamentals of *SimplexNumerica*.

For additional help using *SimplexNumerica*, review the sample files or visit the *SimplexNumerica* web site www.simplexnumerica.com

This manual helps you to navigate through the user interface. It contains a number of examples, which are designed to show some of the facilities available for creating charts/shapes, and professional presentations. There is an additional area for the numerical methods available. However, please refer to the internet if you require further details on a particular numerical algorithm. It is assumed that you are familiar with the use of Windows based packages.

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System Requirements

Hardware:

The minimum hardware requirements are:

- CPU: State-of-the-art Intel based processor.
- Memory: > 1GB
- Available disk space: > 300 MB

Software:

SimplexNumerica was tested on:

- *SimplexNumerica* will run on the Microsoft Windows Operating Systems (i86 or x64):
preferring Microsoft Windows 10 or 11
SimplexNumerica Setup program has already installed the Microsoft Visual C++ Redistribution Package for MFC C++ DLLs.

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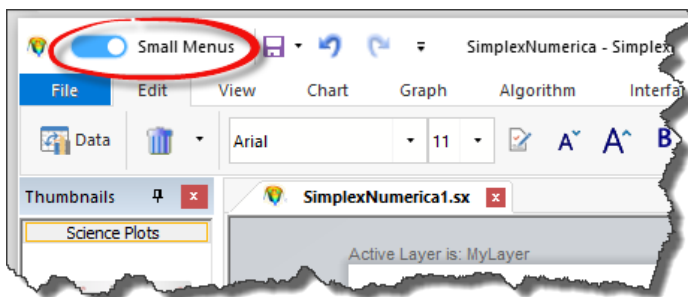
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3 What's new?

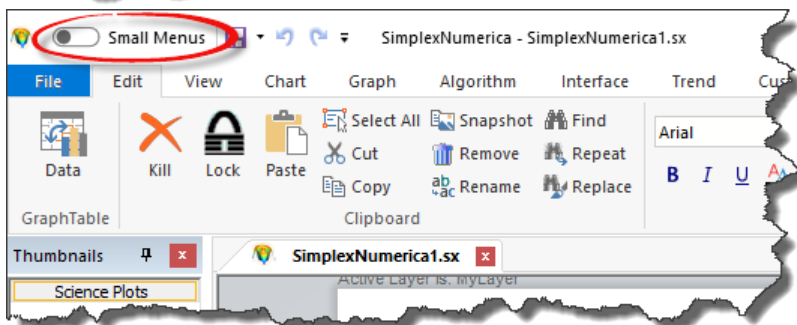
To provide you with the latest changes and improvements of *SimplexNumerica* we will extend this starter page and doc folder (see below) from time to time.

3.1 New Menus

Here the new user interface with *Small Toolbars* in addition to the *Standard Ribbonbars*. Now, you can switch between the small (Toolbars) and the standard Ribbonbars. There is a checkbox on top left of the windows title bar, see here:



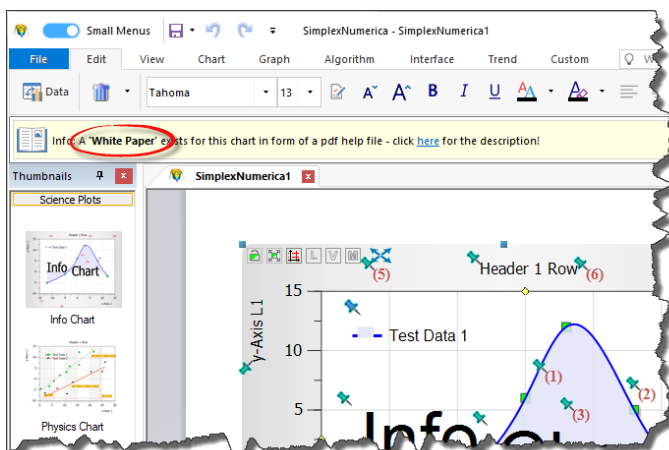
Small Menu (Toolbar)



Standard Ribbonbar

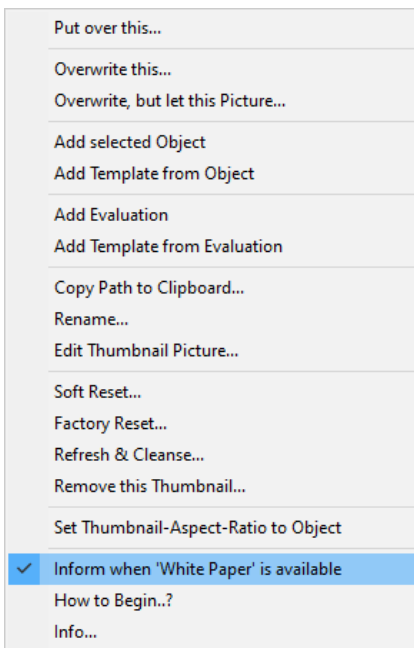
There are only a few menus (Icons) from the Standard Ribbonbar not available in the small one. If you miss one (like the font tools in the scripting editor), then switch to the Standard Ribbonbar, set it and go back to the small one...

Next, we have optimized the user interaction, so that you get more hints from the program. White Papers are introduced. They appear when you drag a chart from the Thumbnail Window into the Graphics window.

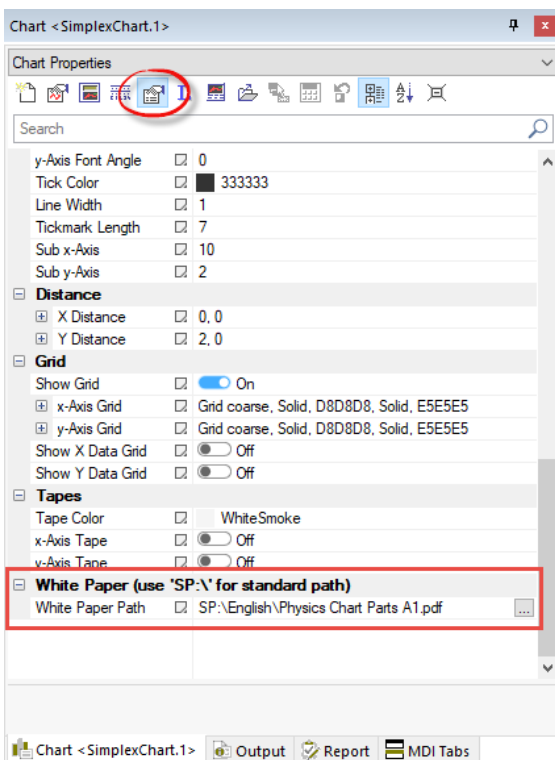


To de-activate this feature, right mouse click on the Thumbnail Window and select the menu point: Inform when "White Paper" is available (see next picture):

What's new?



Click on the entry [here](#) in that text line above to open a *.pdf file with more information. You can find the path to the file in the Chart Properties:



Certainly, you can make your own pdf files if you like...

Info:

Use SP:\ to the standard White Paper folder of the program.

We have made a short description for V21. See the folder

`C:\Program Files\SimplexNumerica64\Doc`

and the file

`Release Notes for Upgrade V21.pdf`

To avoid to blow up this manual too much, separate documentation for newer versions is written and placed inside the installation folder of *SimplexNumerica*. Please have a look at, e.g.:

`C:\Program Files\SimplexNumerica64\Doc`

A highlight is e.g. the white paper 'Text and Label Module.pdf' and the GPX Module.

3.2 DPI Awareness

Desktop applications that use older Windows programming technologies do not automatically handle DPI scaling and, as a result, will render blurry or be sized incorrectly in many common usage scenarios unless work is done by the developer to handle these scenarios.

As display technology has progressed, display panel manufacturers have packed an increasing number of pixels into each unit of physical space on their panels. This has resulted in the dots-per-inch (DPI) of modern display panels being much higher than they have historically been. In the past, most displays had 96 pixels per linear inch of physical space (96 DPI) but now (as of 2018) there are displays with nearly 300 DPI (or higher) on the market. Most legacy desktop UI frameworks have built-in assumptions that the display DPI is a constant value during the lifetime of the process.

Resolution independence is where elements on a computer screen are rendered at sizes independent from the pixel grid, resulting in a graphical user interface that is displayed at a consistent size, regardless of the size of the screen.

Since Windows XP, dots per inch (DPI) settings have been a component of the Windows development platform. For many years, high density displays did not consume a large percentage of the market. Now, due to the clear and perceivable user benefits, such as text legibility and image presentation, high density displays are becoming increasingly popular, particularly in mobile form factors. With the growing relevance of high DPI devices, it is important to enable each monitor of a system to run with optimal DPI settings to take full advantage of all display hardware. Windows 10 adds developer support that enables desktop applications to not only become aware of different monitor DPI settings, but to also respond to any dynamic DPI changes. This gives the user with the best possible experience on any display.

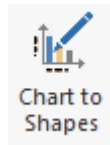
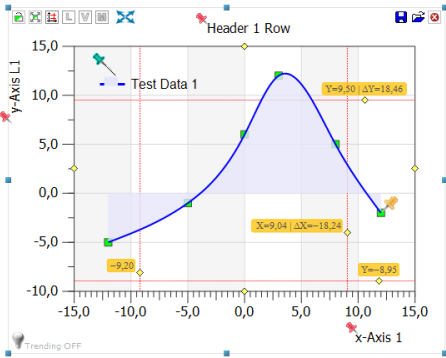
Writing a DPI-aware application is the key to making a UI look consistent across a wide variety of DPI display settings. An application that is not DPI-aware but is running on a high DPI display or across monitors of different DPIs will be scaled by the system to the appropriate size so that it is still usable, but can suffer from visual artifacts including incorrect scaling of UI elements, clipped text, and blurriness. By adding support in *SimplexNumerica* for DPI awareness level, we can present our application's UI in a predictable manner. By updating our app to respond to dynamic changes in DPI, we create an application that is crisp, making it more visually appealing to users.

What's new?

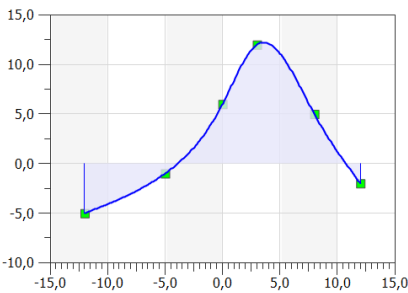
3.3 Physical Chart to Shapes

You can depacketize a Physical Chart into its text scaling, rectangles, lines and polygons. There is a new icon in the Ribbonbar Chart that can be used for this.

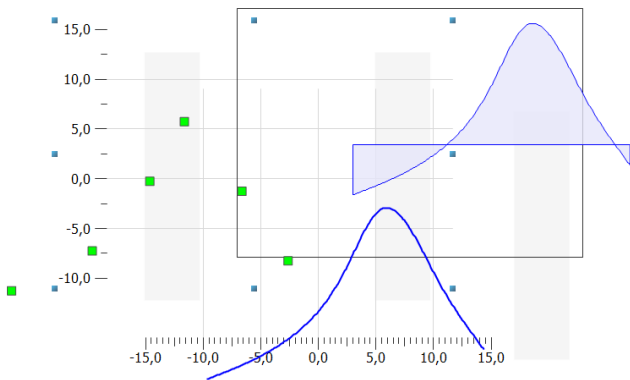
Start with a sample chart:



Please click on that icon.

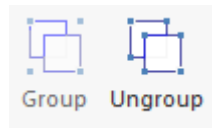


That results in this graphic. But that is not any longer a dynamic chart. They are individual elements.



You can see that, when you click on it and move the elements (shapes) away.

The most shapes are still grouped. Use that ungroup icon or use key <Ctrl> + U



Layer set hidden

The active chart layer >> MyLayer << was made hidden (checkmark Visible) here in the Layout window to see the shapes in the new Layout >> Shaped Chart Layer << much better.

Name	Visible	Select...	Inhibit	Charts, Shapes and
Shaped Chart Layer.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	FillRectangle, FillRe
MyLayer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SimplexChart.1

So that the original chart is not covered, it is simply made hidden. The shapes are on the Layer named like

>>> Shaped Layer <<<

Here in this example, the original chart is still on Layer

>>> MyLayer <<<

In the next SimplexNumerica updates we will extend to other charts.

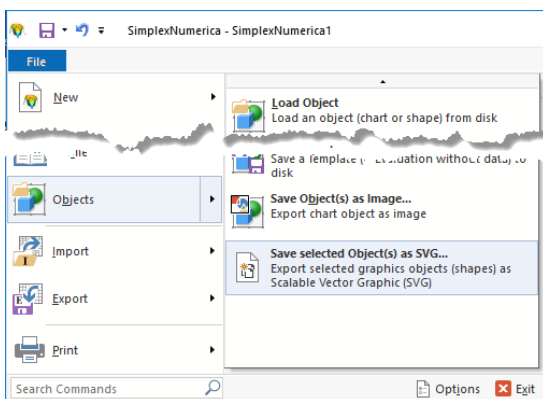
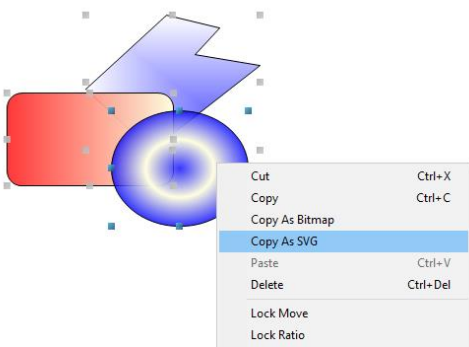
3.4 SVG Graphic

Definition:

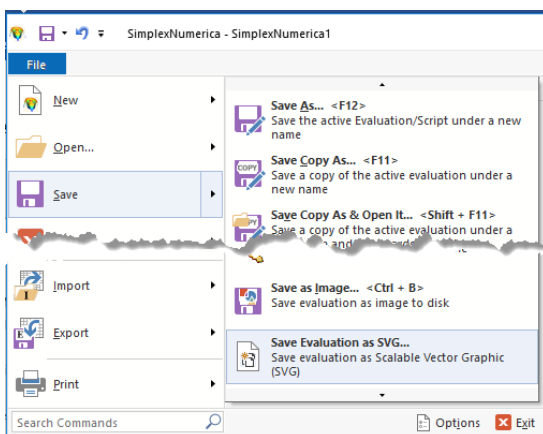
Scalable Vector Graphics (SVG) is an XML-based vector image format for two-dimensional graphics with support for interactivity and animation. The SVG specification is an open standard developed by the World Wide Web Consortium (W3C) since 1999. SVG images and their behaviors are defined in XML text files.

Object-oriented shapes in SimplexNumerica can now be saved in SVG vector graphic files. If you want to save a Physics Chart, then you must convert it before in a bunch of shapes (see previous chapter). Types of 2D/3D Business charts cannot be converted and not be saved as SVG.

If you want to save individual shapes, then use the right mouse click for the selected shapes, that opens the popup menu with the entry **Copy As SVG**



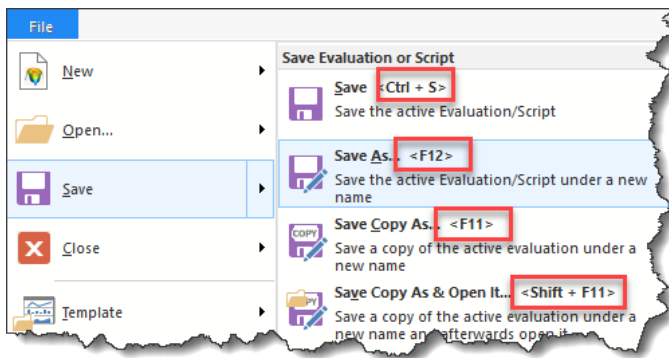
...or you can use the **File** menu **Save selected Object(s) as SVG...**



If you want to save everything, then use the **File** menu **Save Evaluation as SVG...**

Again: Use description in previous chapter to save a Physics chart as SVG.

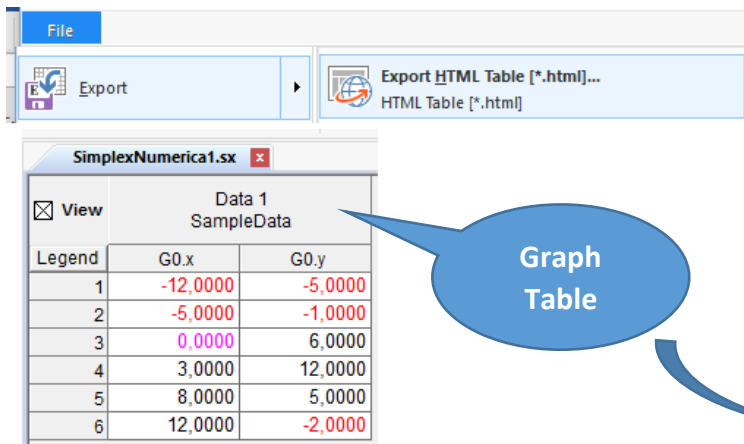
3.5 Shortcuts on File Menu



Still available but not identified the standard shortcuts in the file menu after the change from Pulldownmenu to Ribbonbars.

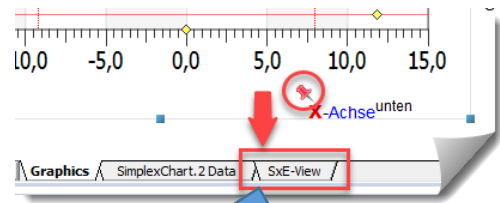
3.6 Export HTML Table

Already available in previous versions but now **optimized** for the new editable *SimplexEditor*-View (SxE-View).



Data 1 SampleData		
Legend	G0.x	G0.y
1	-12,0000	-5,0000
2	-5,0000	-1,0000
3	0,0000	6,0000
4	3,0000	12,0000
5	8,0000	5,0000
6	12,0000	-2,0000

Graph Table



If you like to export a GraphTable (DataSheet) as a HTML file for an external browser program or word processor, then swap to the *GraphTable* view (maybe select an area) and use this export menu...

But, for instance, if you want to show the table (or parts of it) as a HTML label around its chart, then you can either import the previous saved file in *SimplexEditor* (SxE) or you can use direct the **new** function **Add Grid Label** (see Ribbonbar icon) or the **new** Ribbonbar icon **Add Label**.

- Please have also a look at the chapters:
- How to edit a HTML file in SxE? (see 7.7) and
 - How to import a HTML file in SxE? (see 7.8)

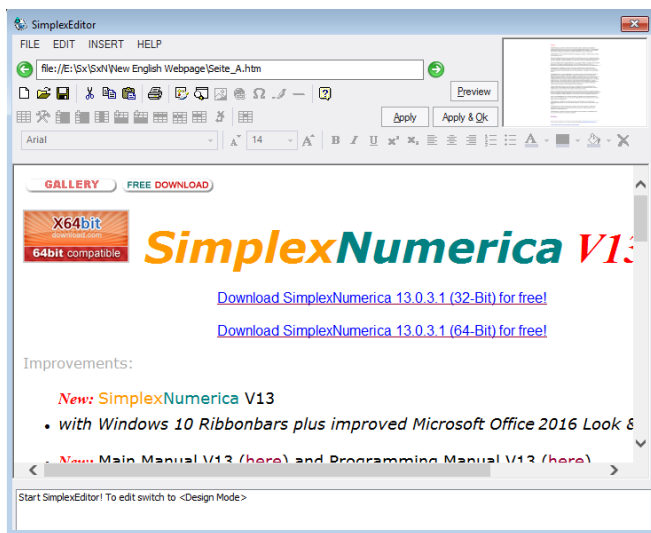
What's new?

3.7 SxE-View

SxE is the abbreviation of **SimplexEditor**. **SxE** and **SxE-View** are only simplified clones of the **Microsoft Internet Explorer Browser**. The HTML editor views of **SxE** and **SxE-View** have the same functionality, but **SxE** is a separate application.

If the **SxE-View** is hidden, the view runs in **Runtime Mode**. If you click on the **SxE-View-Tab**, then it will change automatically to the **Design Mode** (see **SxE** for different modes) of the **Internet Explorer**.

Info
The **SxE-View** is a simple browser that can be used to modify existing HTML labels. New labels can be made by the **SimplexEditor** or any other external HTML Editor. **SimplexEditor** can be called directly from the label dialogbox.

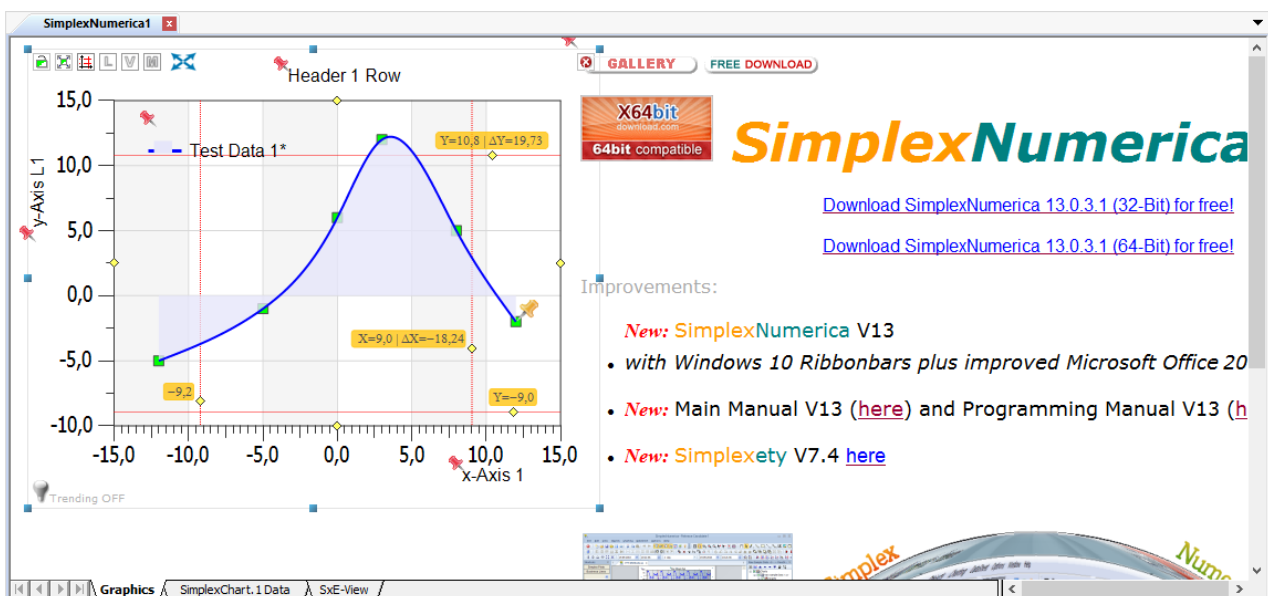


Webpage inside **SimplexEditor**.

You can load and display a standard webpage from file or internet (without frames) - but not always transferring it to **SimplexNumerica**, because the internal conversation tool removes unsupported HTML tags from such a webpage.

Look in Graphics page:

The webpage is getting a HTML label inside the Graphics page.



What's new?

The next screendump shows the *SxE-View* of the webpage:

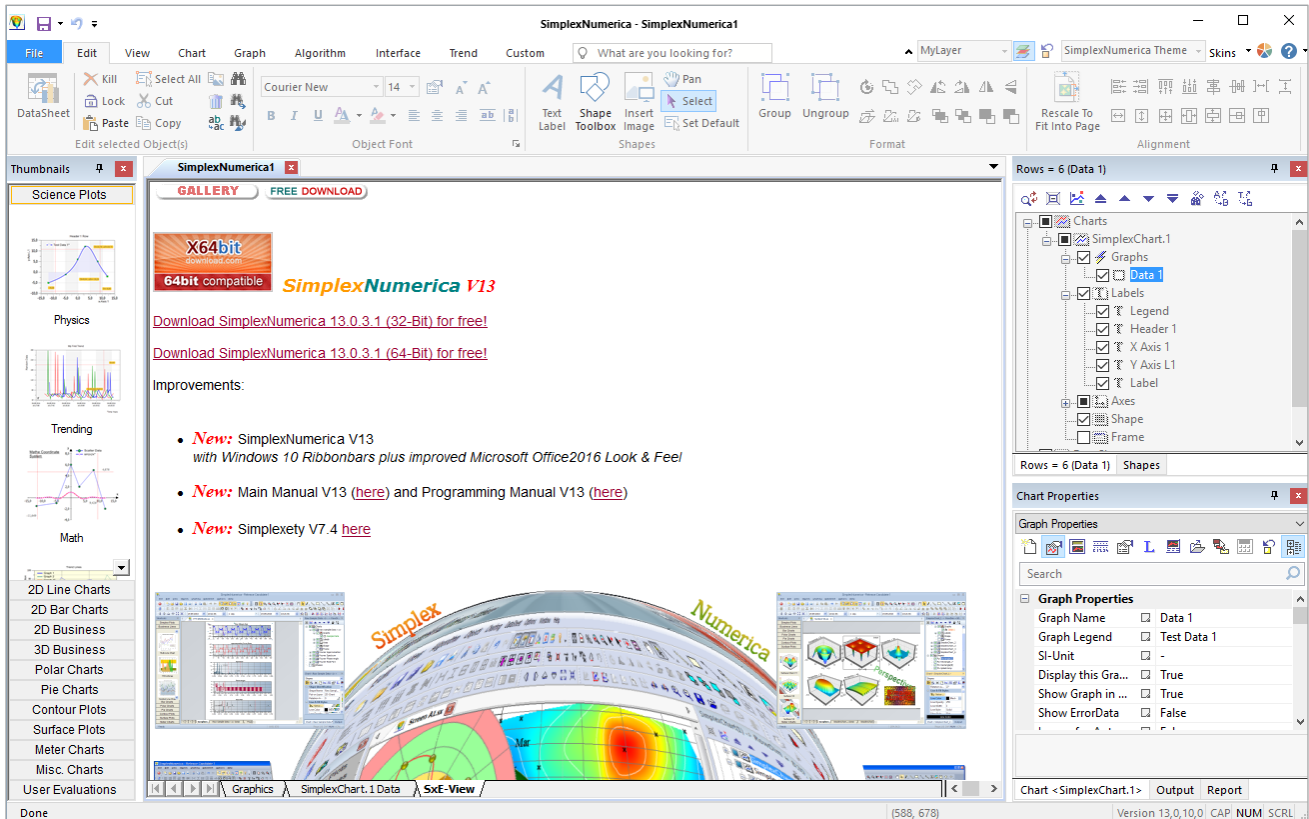


Fig.3-1: *SxE-View* of a webpage

Now, you can *edit* the webpage inside *SxE-View* similar to the SimplexEditor (SxE). In this version of SimplexNumerica there are no toolbars or menus to support this editor. But you can use copy & pasted, undo, redo, etc. or size changings, e.g. of a table.

When you are finishing your redacting, then swap back to the *Graphics Tab*. That applies the changings to the HTML text label.

Hint

Please have a short look at chapter 7.9 to see another example for the use of the *SxE-View*.

What's new?

3.8 Graph Statistics View

The Graph Statistics View displays a hierarchically arranged view of the graphs on the chart, in an objected tree column table. The Graph Statistics View lists information about each graph. When first displayed, the Graph Statistics View is located under the MDI window.

The Graph Statistics View (as it appears in a default configuration) is shown below; your Graph Statistics View might look different depending on how it has been customized in your system.

As you may know, the most SCADA systems or process analysts have such a view underneath their trend view. Consequently, you can use this view in the same way here in *SimplexNumerica*. It will be automatically refreshed during trending the graphs of all the available charts.

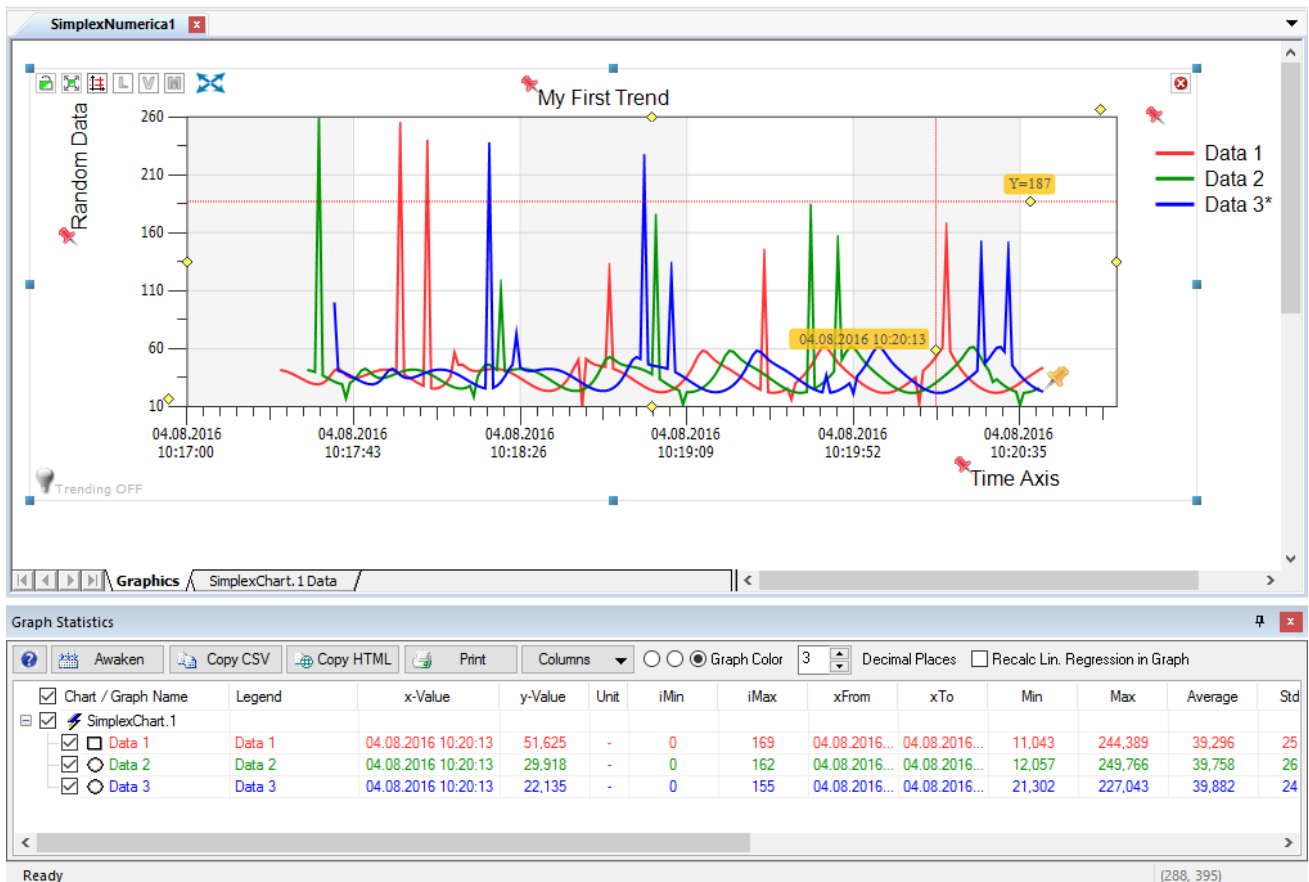


Fig.3-2: MDI window and Graph Statistics View

As you can see, there is a button row and a white table-like display for each of the charts graphs. The chart name entries of the table can be collapsed, so that its graph entries are hidden.

You can use the mouse for checking, double-clicking or dragging. Use the Ribbonbar View to hide/show the view.

Info

Before you start, please read the info text behind the question button:



It explains also the x-Position and Interval Range for the values!

What's new?

Here is the content of this messagebox that answers FAQs:

Button Awaken

If the table is not updating for any reason, then press this button once. After the first knock-on, the system should automatically update the table.

Which data are shown?

If the Ribbonbar <Graph> "Show Curve" is selected, then the *CurveData* is used for calculation, else the *SampleData*.

At which x-Position in the Chart?

For "Science Plots" use right vertical cursor line, then the first available data point to the left will be shown in this table. For all other charts the last data point will be used.

And in which x-Range?

For "Science Plots" use left and right vertical cursor lines, then from the left cursor the first available data point to the right and the first available data point to the left from the right cursor will make the range (inclusive) and used for calculations. For all other charts the first and last data point will be used.

Linear Regression?

If checked, then all available graphs are overwritten by the linear regression line (Line between left and right cursor in the chart).

Drag & Drop?

Can be used to move columns.

Button Columns?

Use this button menu to select which columns are shown!

You can use the Ribbonbar *View* and the icon *Graph Statistics* to show and hide the view.

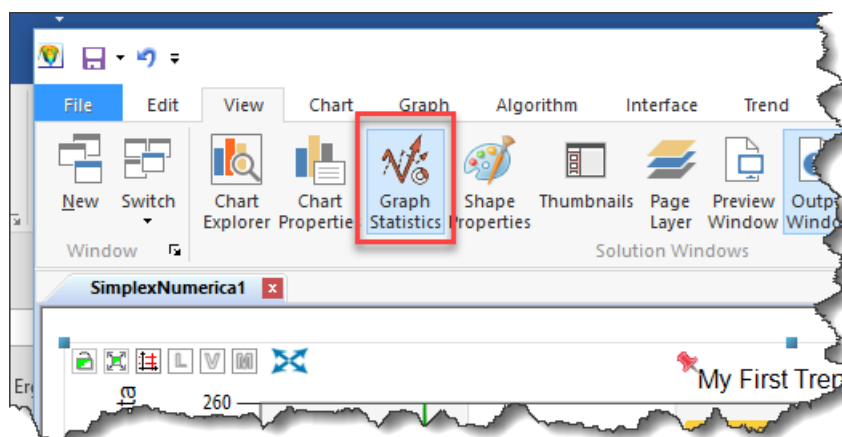

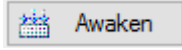
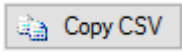
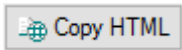
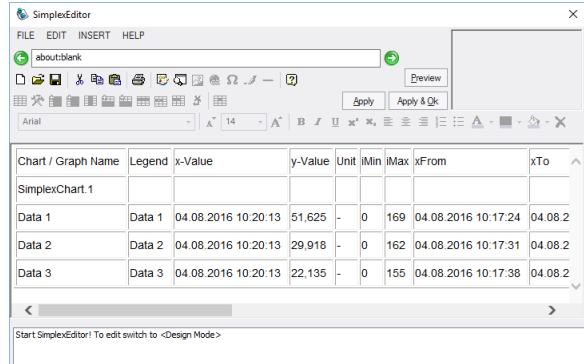

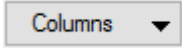
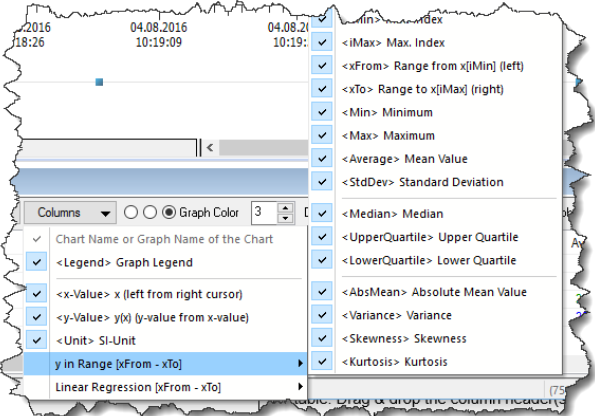

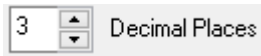



Fig.3-3: Show and hide the Graph Statistics View

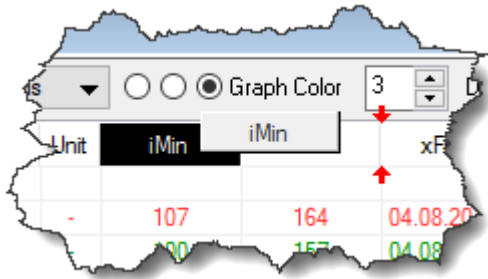
The table below shows the functionalities of the button row.

Symbol	Function
	Info Messagebox See above the text in the info box.
	Button Awaken If the table is not updating for any reason, then press this button once. After the first knock-on, the system should automatically update the table.
	Button Copy CSV Content of the grid will be copied to the clipboard as Comma Separated Values (CSV). From there you can simply pasted (Ctrl + V) it into any other program that supports this format.
	Button Copy HTML Content of the grid will be copied to the clipboard as HTML. Paste it afterwards into a HTML editor – like SimplexEditor (SxE). 
	Button Print Print the table out to a printer device.
 <i>Please look to the internet for explanations of the statistic functions.</i>	Button Columns Select and check the columns that you want to see in the table. Drag & drop the column header(s) to another position (if you like to do so). 

Symbol	Function
	<p>Radio Button Graph Color It shows the color of the graphs.</p> <p>Please toggle around:</p> <ul style="list-style-type: none"> • No Color • First Column • All Columns <p>for each of the graph rows.</p>
	<p>Edit the Decimal Places ...of the values in the table cells.</p>
	<p>Button Recalc Linear Regression in Graph What it does, it exchanged the existing graph of each available chart against a fresh calculated linear regression line in the above described interval.</p>

Mouse Activities

You can use the mouse on the table as follows:

Mouse Action	Function
Double-click on a graph row in any cell.	<p>Select Graph</p> <ul style="list-style-type: none"> • Activates the associated chart and highlights the graph of the clicked row. • Selects the graph in the <i>Chart Explorer</i> and its properties in the <i>Property Window</i>.
Check and uncheck the boxes on the first column	<p>Hide/Show Graph Hides or shows the appropriated graph in the chart.</p>
Click on any statistic value cell.	<p>No Function implemented.</p>
Drag & Drop	<p>Exchange columns</p>  <p>Hold down left mouse button on the column header and drag it on another position. The red arrows are showing the position.</p>

4 Development

The idea for *SimplexNumerica* sprung out of my own desires to create a relatively simple data plotter. Thus, *SimplexNumerica* started out as a small side project of mine in 1986. I have previously worked on other programs and something I noticed early on was the benefits of having a good base layer. In fact, a lot of my work with the *Simplex* series has been revolved around building programs like *SimplexParser*, *SimplexIPC*, *SimplexGraphics*, *Simplexety* and *SimplexEditor* as the base layer.

SimplexNumerica is designed to provide the power and functionality to satisfy the most demanding data plotting requirements. It can handle arrays up to the limits of virtual memory, and will work with 32 and 64-bit editions of Microsoft Windows™ Vista, Windows 7, Windows 8, Windows 10 and beyond.

SimplexNumerica has a wide-ranging library of 2D and 3D charts with a large section based on approximation and interpolation algorithms. Additional charts are from the libraries *ChartDirector* and *BCGControlBarPro*.

SimplexNumerica is equipped with genuine object-oriented vector diagrams with context sensitive pull down menus, e.g. the report and layout windows facilitate the ease-of-use and operation of the program. Likewise, the chart module integrated into the user interface places its elements (lines, polygons, ellipses etc.) in an object-oriented manner. Icons and menu options for selecting, increasing, grouping etc. are also intuitively present. The diagram types and numeric functions can be checked in separate data sheets. The tool windows are dynamically updated to show the most important functions; mouse-clicks are the only action necessary for most operations.

The integrated scripting language *AngelScript* with its colored C++ editor can be used to write simple but complex sequences. Likewise, complex operational sequences are taken care of automatically as far as possible by the program.

Auto-scale routines permit the highest automation. The interactive nature of data analysis limits your user-inputs to that which are only necessary. When just getting the job done is work enough, the last thing you need is to waste time having to learn yet another computer application. Your experience with other tools should be relevant to each new application, making it possible to sit down and use that new application right away. That is why *SimplexNumerica* is so popular. Whether you simply need a powerful extension for Excel™, a tool for plotting row data, or whatever, *SimplexNumerica* does hopefully what you want and the way you would expect. Because *SimplexNumerica* is designed to provide the power and functionality to satisfy the most demanding plotting needs.

SimplexNumerica has been implemented according to the *Microsoft Windows Guidelines for Accessible Software Design*, so great attention has been paid to making it easy for both beginners and experienced users.



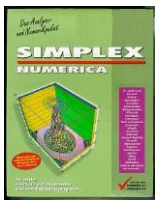
If you still have further questions, please do not hesitate to contact me.

Dipl.-Phys.-Ing. Ralf Wirtz, Software Engineer and Developer

Email: simplexnumerica@gmail.com

Web: www.SimplexNumerica.com

5 SimplexNumerica References in German



SimplexNumerica bietet objektorientierte numerische Algorithmen und Datenanalysen sowie vektorisierte Visualisierungen mit einer hochauflösenden Grafik-Engine. Das Programm hat bereits eine lange Geschichte hinter sich, die im Jahr 1986 beim deutschen Fraunhofer-Institut für Lasertechnik in Aachen begann. Das Programm ist sicherlich manchen Wissenschaftlern in der Vorgängerversion noch unter dem Namen *Data Professional* für PC und Atari bekannt.

- ❖ Das Programm lässt sich jederzeit von Englisch in Deutsch (und umgekehrt) umschalten.

Falls jemand die Meinung zu dem Programm interessiert, der kann in den folgenden Berichten die Beurteilung lesen:

- **c't** Magazin für Computer Technik, Ausgabe 6 vom März 2013, Seite 140 – 146
Untertitel: *Software für Wissenschaft und Technik*, (mehrere Programme im Bericht)
- **c't** Magazin für Computer Technik, Ausgabe 14 von 2001, Seite 124
Titel: *Kapieren mit Spaß, Lern- und Trainingshelfer aus Free- und Shareware*
- **c't** Magazin für Computer Technik, Ausgabe 7 vom Juli 1990, Seite 150 – 156
Titel: *Annäherungen von Frau Dr. Nicoletta Adams*, (nur *Data Professional* im Bericht)
- ST Computer, Ausgabe 4 vom April 1989, Seite 26 - 31
Titel: *Ein Messwert kommt selten allein*, (nur *Data Professional* im Bericht)
- ST Computer, Ausgabe 6 vom Juni 1992, Seite 50 - 55
Titel: *Was eine Auswertung ausmacht*, (nur *Data Professional* im Bericht)
- <http://www.heise.de/download/simplex-numerica-115924.html>

In der **c't** vom März 2013 wurden mehrere Programme aus verschiedenen Bereichen von Wissenschaft und Technik beschrieben. Als Auswerte-Programme wurden nur *Origin*, *Simplexety* und *SimplexNumerica* aufgeführt. *Simplexety* und *SimplexNumerica* wurden vom Ersteller dieses Dokuments entwickelt.

Hier ein Auszug aus dieser Ausgabe:

Die Auswertung und die Präsentation wissenschaftlicher Daten gehören zu den eher lästigen Forscherpflichten. Abhilfe schafft hier SimplexNumerica, ein leicht zu bedienendes Plot-Programm. Neben einer großen Anzahl von vordefinierten 2D- und 3D-Diagrammen glänzt die Software mit Funktionen zum Importieren und Editieren von Messdaten. Der objektorientierte Aufbau der grafischen Darstellung und eine C++ Scriptsprache sorgen dafür, dass beim Anpassen an eigene Bedürfnisse kaum Wünsche offen bleiben.

c't Magazin für Computer Technik, Ausgabe 6 vom März 2013, Seite 140 – 146

Hier ein Auszug aus Artikel aus c't 14/2001 speziell zu SimplexNumerica:

Wo numerische Werte anfallen, etwa bei Messungen im Physikunterricht, bei Klimabeobachtungen für Geografie oder im Rahmen beliebiger statistischer Untersuchungen, will man sie aussagekräftig darstellen. Ein sehr komplexes und leistungsfähiges Visualisierungswerkzeug, das als bloße Unterrichtshilfe schon fast zu schade ist, heißt SimplexNumerica. Das Programm hat einen ehrwürdigen Stammbaum: Für den Atari ST wurde sein Vorgänger vor Jahren unter dem Namen `Data Professional` verkauft. Es beherrscht spezielle Darstellungen für die verschiedensten Bereiche in Schule und Studium: Geografen, Biologen, Chemiker und Elektrotechniker können es gleichermaßen sinnvoll nutzen. Algorithmen- und Funktionenliste, Diagrammtypen und Beschriftungsmöglichkeiten lassen ebenso wenige Wünsche offen wie die Optionen zur optischen Ausgestaltung der Ergebnisse.

c't Magazin für Computer Technik , Ausgabe 14/2001

6 Installation

The installation of *SimplexNumerica* is a standard windows procedure. Download the program in form of a *.zip file; extract and start the setup executable. Then follow the dialogs...

Once installed, *SimplexNumerica* is added to the start menu, and a *SimplexNumerica* icon is added to the desktop.

Next, put the license file¹ into the *SimplexNumerica* install folder. To run the program, double-click on the *Windows Explorer* icon, or run it in the same way that you run your other applications from the start menu or desktop.

After *SimplexNumerica* runs, you will see a start-up dialog and after that the program environment.

Here the steps again:

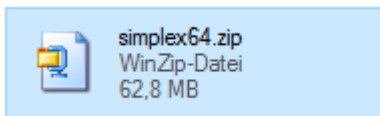
Step 1 - Download the program from www.SimplexNumerica.com

32-Bit-Version: simplex.zip

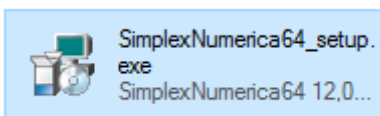
64-Bit-Version: simplex64.zip

Tip:

Anyone can freely download the *SimplexNumerica* Professional Edition. If you do not have a license file, then you will see some hints for upgrading, but you can use the whole range of functions!



Please unzip the compressed version (*.zip), first...



Before you can run *SimplexNumerica*, you must install it by running the setup program. Simply double click on the icon <*SimplexNumerica_setup.exe*> for 32-Bit or <*SimplexNumerica64_setup.exe*> for 64-Bit version, respectively, or use the *Run* command, found by pressing the Windows Start button. You will be prompted for the name of the program you want to run.

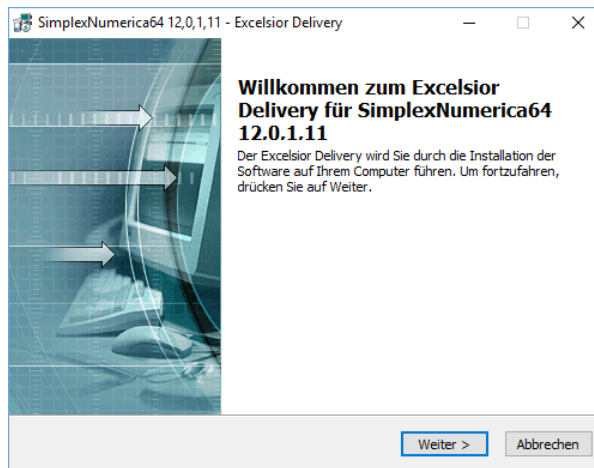
Installation on the network

To install *SimplexNumerica* on a network, simply install it on the server in the normal way described above.

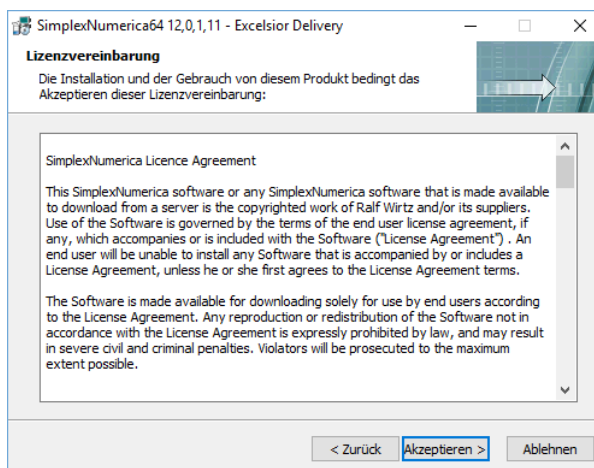
¹ You will get the license file via email after the order of the program from the developer. Please await it among three days.

For each client that will have access to the server, create a shortcut (or icon) for *SimplexNumerica* on the client system and run the program once. *SimplexNumerica* will install itself properly on the client system.

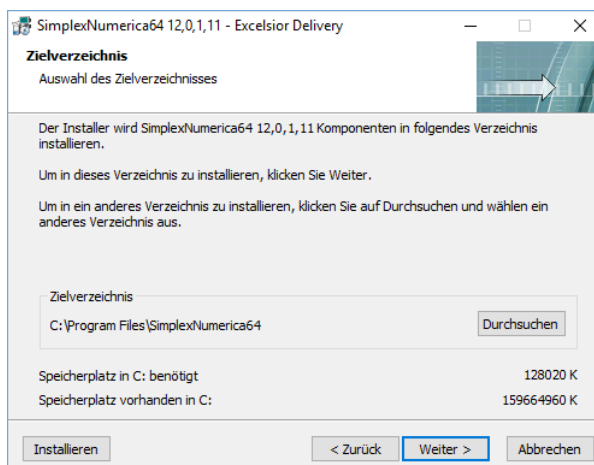
Step 2 - Follow the dialogs...



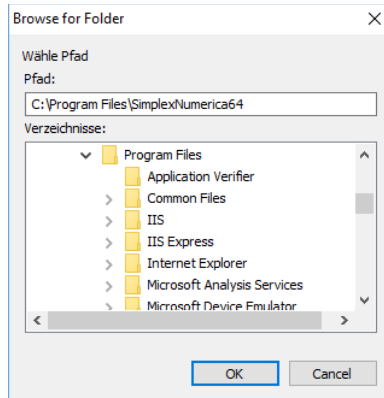
Accept the license agreement...



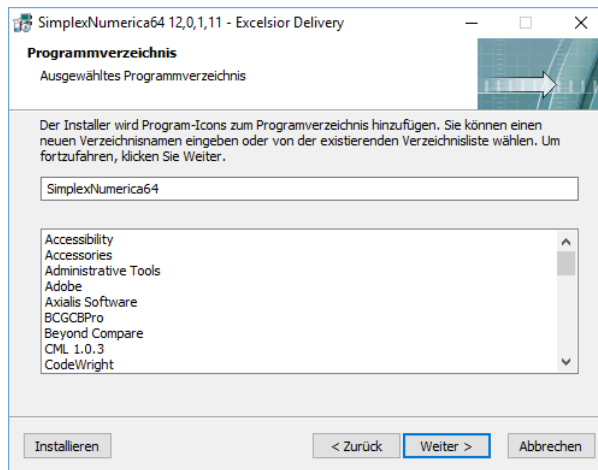
...be aware of a good place to install...



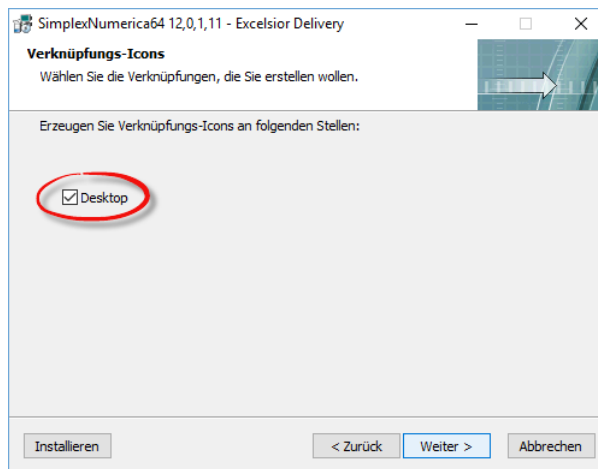
Choose an installation folder or let the default path...



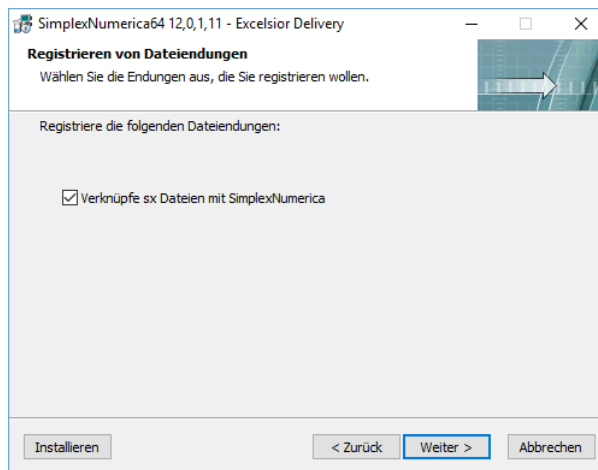
...we let the name...



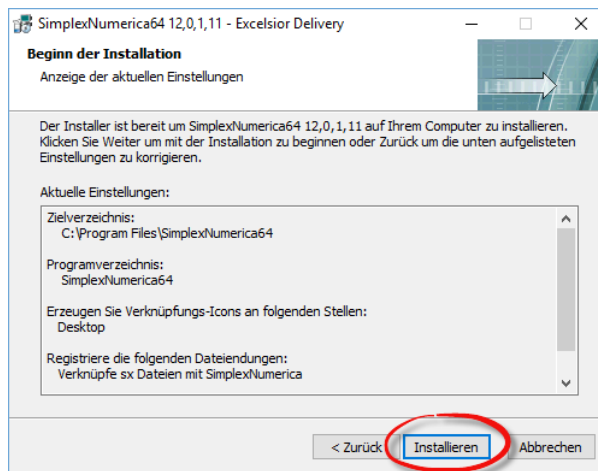
..a shortcut to the desktop...



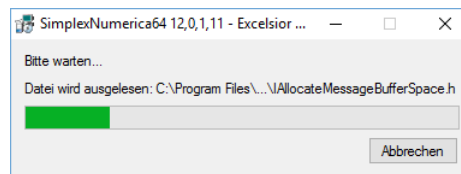
Evaluations have the file extension *.sx in *SimplexNumerica...* Except the link to its extension, so that a double click can open a new instance of *SimplexNumerica*.



Now, start the installation...

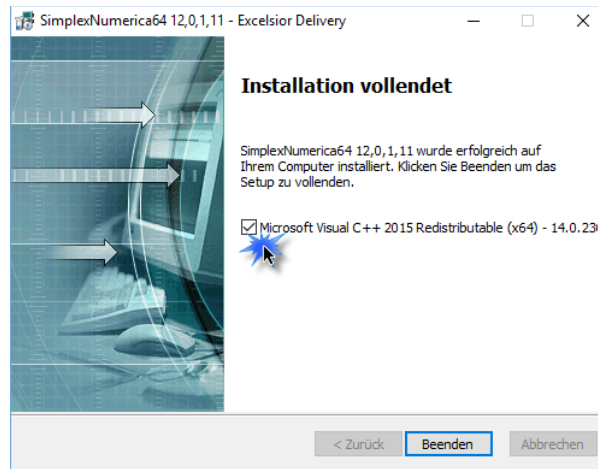


Installation runs...



SimplexNumerica is developed in C++ based on Microsoft Foundation Classes (MFC).
It needs their Redistribution Compiler Package (DLLs etc.).

Microsoft Visual C++ Redistribution Package for MFC C++ DLLs:



The installation is all over now! The program icon can be found e.g. on the desktop. Start the program from here (see next chapter) ...

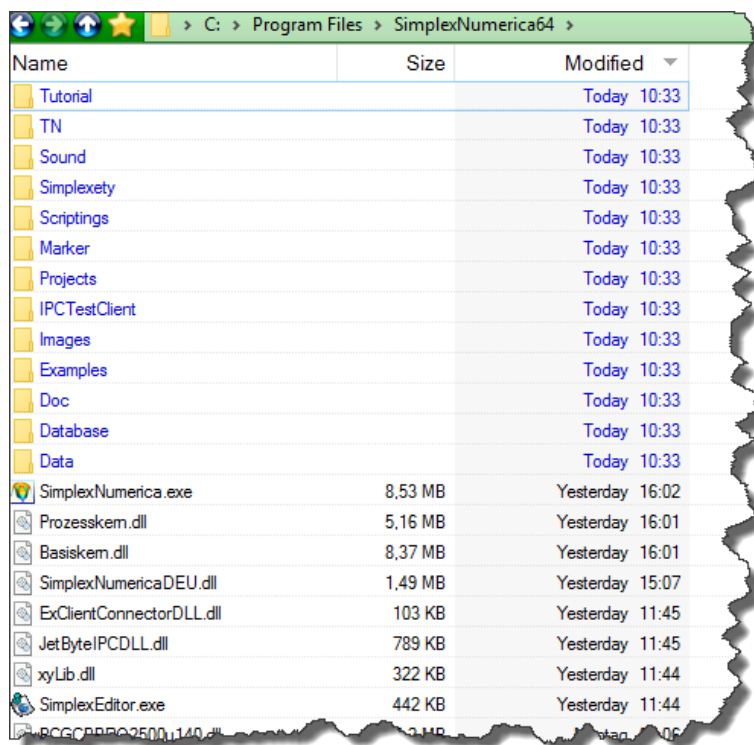


Fig.6-1: SimplexNumerica Installation Folder

Certainly, the place to find the installation folder depends on the 32-Bit or 64-Bit setup (and not to forget your choice in above dialog no. 3).

Hint:

Later, you can switch the program language between English and German, and vice versa. Please have a look at chapter 0.

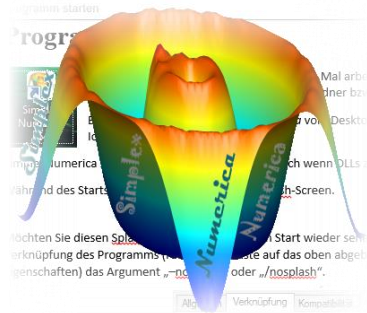
7 Start-up



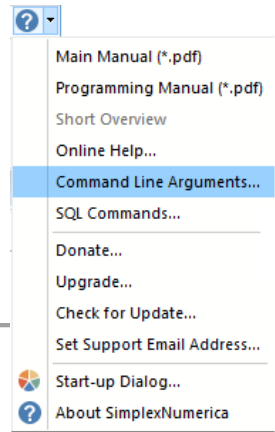
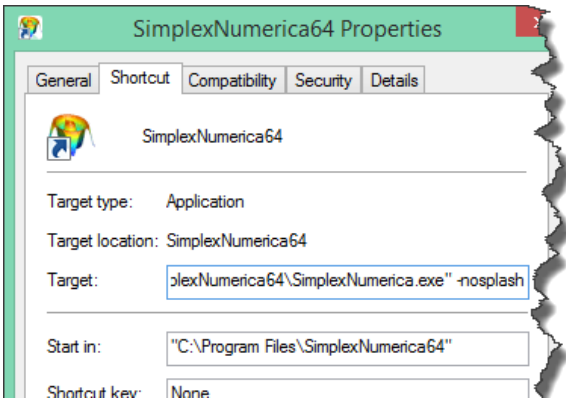
Please start *SimplexNumerica* from the desktop, double-click on the program icon.

→ SimplexNumerica starts very quickly, as a rule, also because only a few DLLs are loaded at start time.

During startup, a so-called splash screen appears.



If you do not like to see the splash-screen anymore, then add to the shortcut target path of the program the argument „-nosplash“ or „/nosplash“.



The available command-line commands can be interrogated in the program under the Pull-down menu Help.

When you have started-up *SimplexNumerica* for the very first time, then you should see the next, so-called Start-up Dialog.

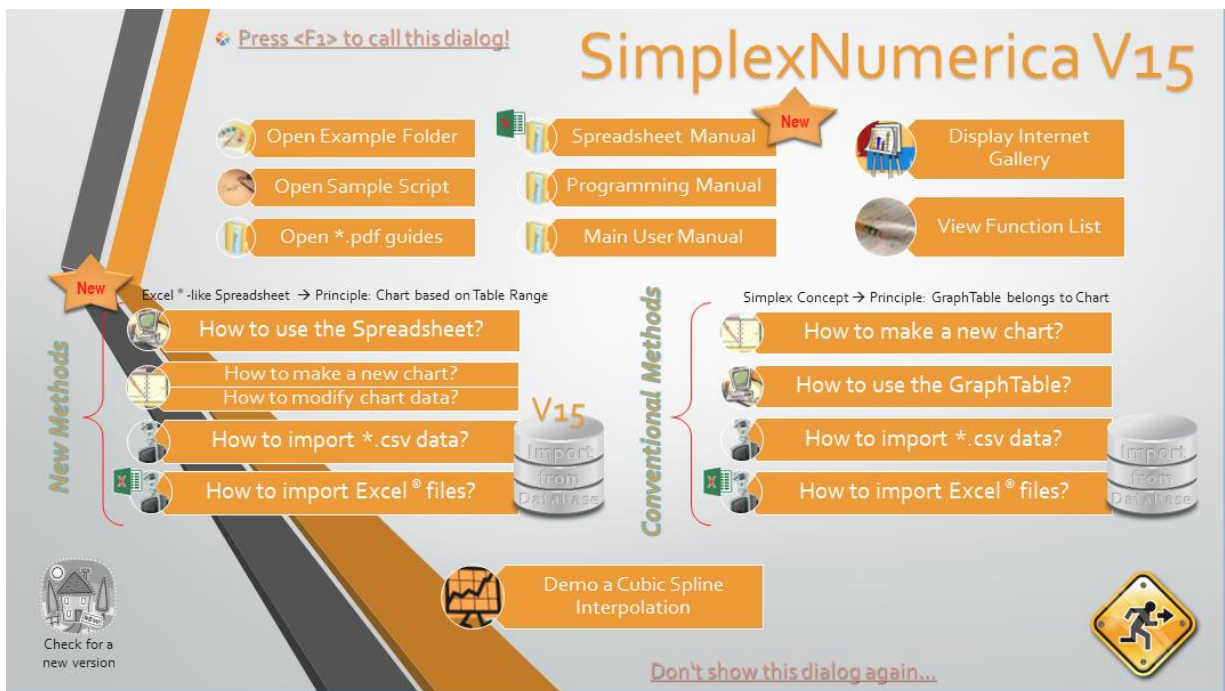


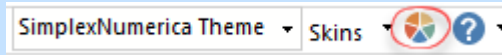
Fig.7-1: Start-up Dialog to find the right way

Start-up

The start-up dialog makes it easy to deep into the main program parts and to see the program life, step-by-step, in action. Play a little bit around the entries of the start-up dialog.

Info:

Recall the Start-up dialog again, use key <F1> or use the toolbar icon left from question mark to recall the Start-up Dialog!



The dialog is primarily an introduction to the program. When you click on one of the colored rectangles, then the dialog will be closed and a sequence of instructions will guide you through a more or less extensive instruction to the program. If you do not want to see, each time, again this dialog, then click on the text: *Don't show this dialog again...*



If you click on the left symbol, nothing happens more than the program starts up and shows you its main (default) desktop. If the program starts not for the first time, then the desktop may be look different – like the next screenshot in *Microsoft Windows 10*:

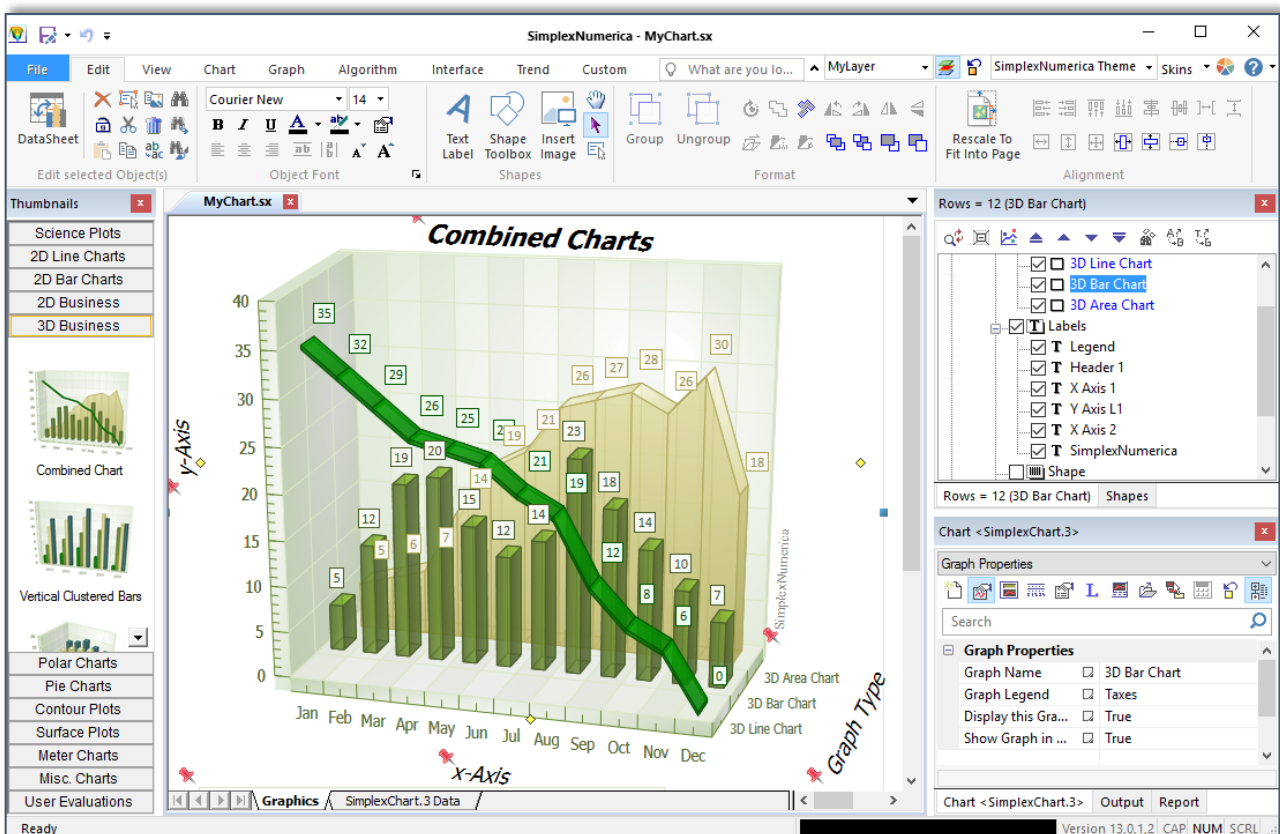
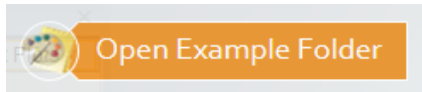


Fig.7-2: Evaluations are organized in MDI-Tab-Views

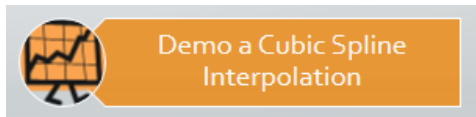
Please call again the Start-up dialog again (key F1)...

Start-up

Before you begin working with *SimplexNumerica*, please open some example evaluations.



Use this button in the start-up dialog. Then the program opens the Fileselectbox, it shows you the path to the example folder and sub-folders.



You can also try to evaluate sample data with a Cubic Spline function, when you press this button.

Now, go to the main environment of the program...

SimplexNumerica is primarily a Microsoft MDI² application, ordered by the popularly tabs within the parent mainframe window. MDI applications consist of a single parent window (like a desktop), and the application's client windows that are contained within or float on top of the parent window.

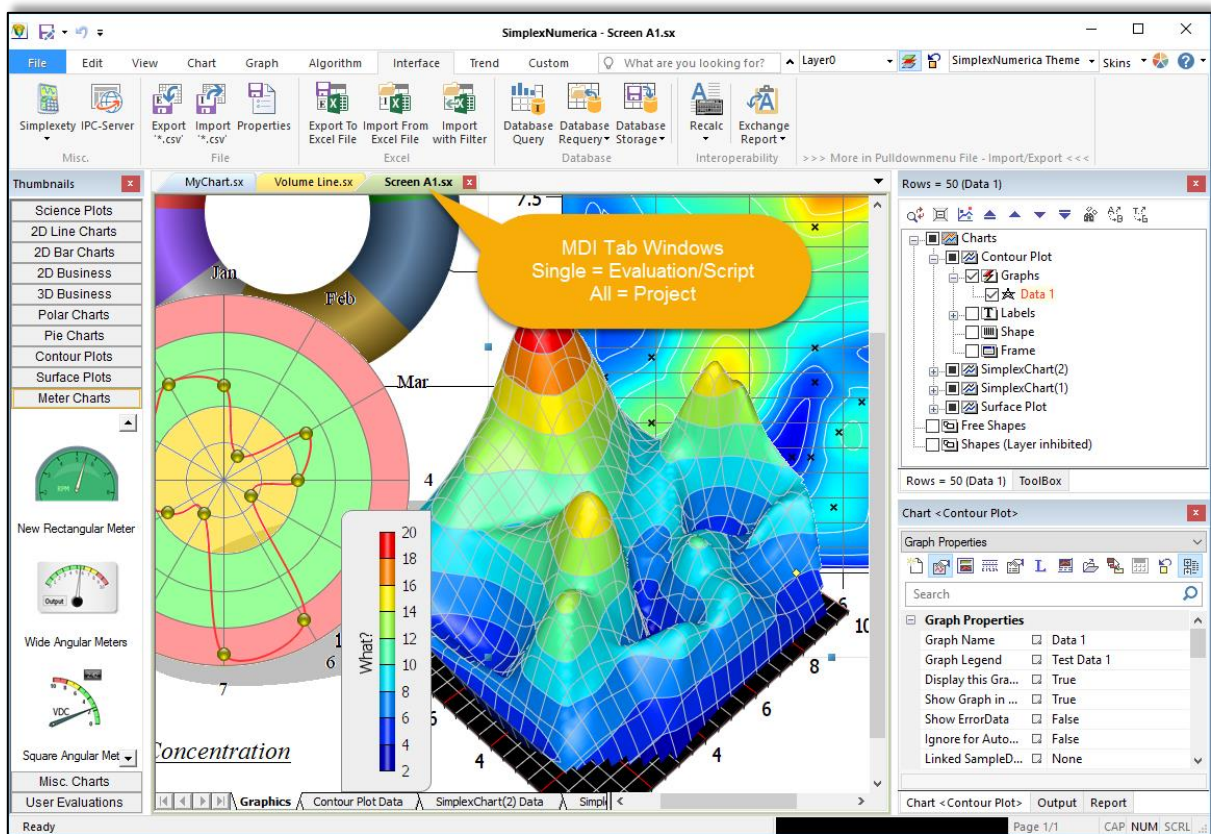


Fig.7-3: SimplexNumerica Environment

Note

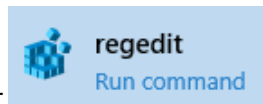
To change the environmental look of the application, use Toolbar → Skins. Default is the Windows 10 Skin with the name "Windows 10 Style".

² MDI → Multiple Document Interface

Start-up

If you start the *program* the very first time, then the default environment will be shown. The next start will have exactly the same look as when you have quit the program. All environment settings will be stored into the Microsoft Windows registry.

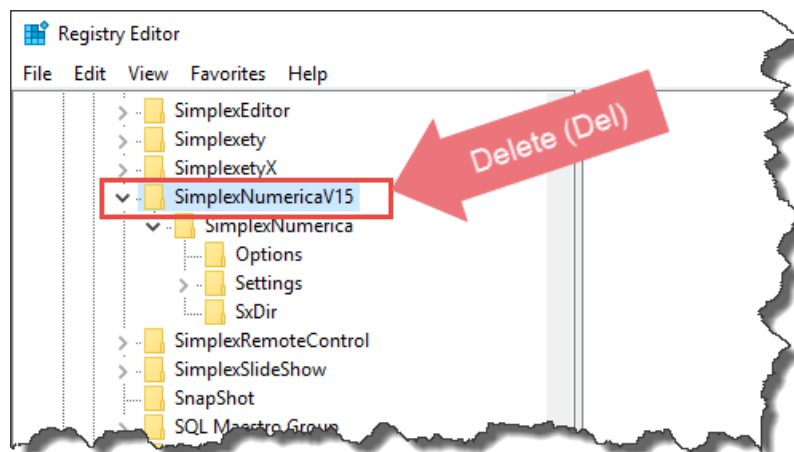
If you have an installed *SimplexNumerica* version (or copied the installed folder to another PC), please delete this key manually, if you want to remove *SimplexNumerica* from your harddisk or if you like to set the look to default, too. That's because all your user settings are not been lost, if you make an update.



Here is the extract from the *Registry Editor*

Follow the steps to reset the *SimplexNumerica* settings:

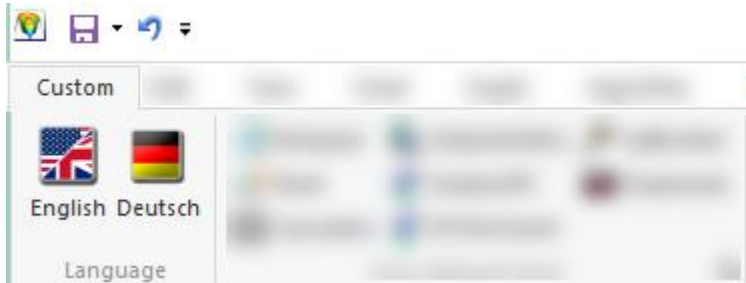
1. Quit the program
2. Run `regedit.exe`
3. Look for the key `Computer\HKEY_CURRENT_USER\SOFTWARE\SimplexNumericaV15`
4. Delete the entry "*SimplexNumericaV15*" and
5. Re-start the program again.



After the re-start of the program, you will see the default window GUI, settings and skin of the program.

7.1 Switching the Language

At present, only two languages are supported, English and German. The program used English as the main language. German phrases have to be translated after parts of the program were getting finish.



Use the Ribbonbar tab **Custom** to switch between the languages during runtime. Disadvantage is the reset of the environment, because we have to clean the registry, so that the new (default) menu entries can be replaced.

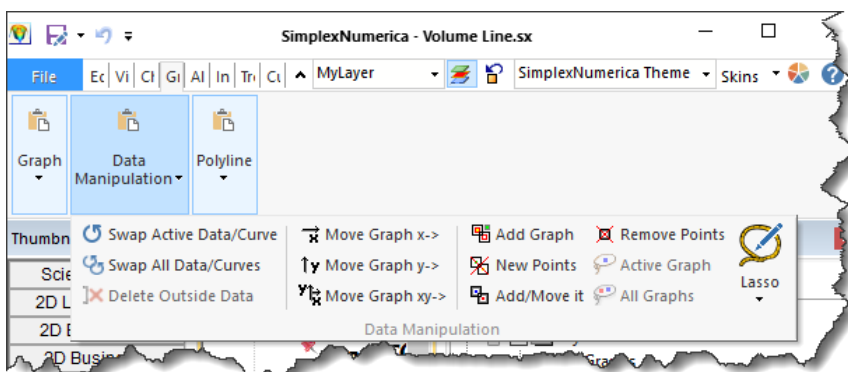
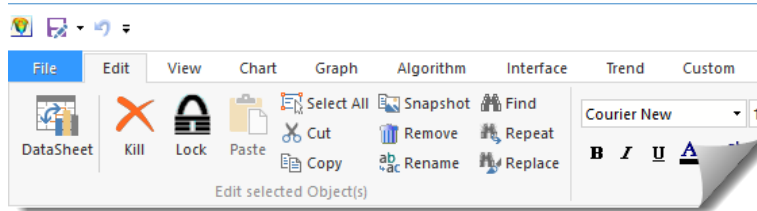
Hint:

If there is a function not working well in German, then please try the English language until the bug is fixed by the developer.

Please send also a message to the developer email address:
simplexnumerica@gmail.com

7.2 New User Interface (Ribbonbar)

The "Ribbonbar" control was introduced by Microsoft in Office 2007. It's not just a new control - it's a new user interface ideology.



Ribbon control replaces traditional toolbars and Pulldownmenus with tabbed groups (Categories). Each tab is logically split into Panels and each panel may contain various controls and command buttons. In addition, Ribbon control provides smart layout maximally utilizing the available space. For example, if a Panel has been

stretched and has no place to display all available controls, it becomes a menu button which can display sub-items on a pop up menu. Here are some elements from another program.

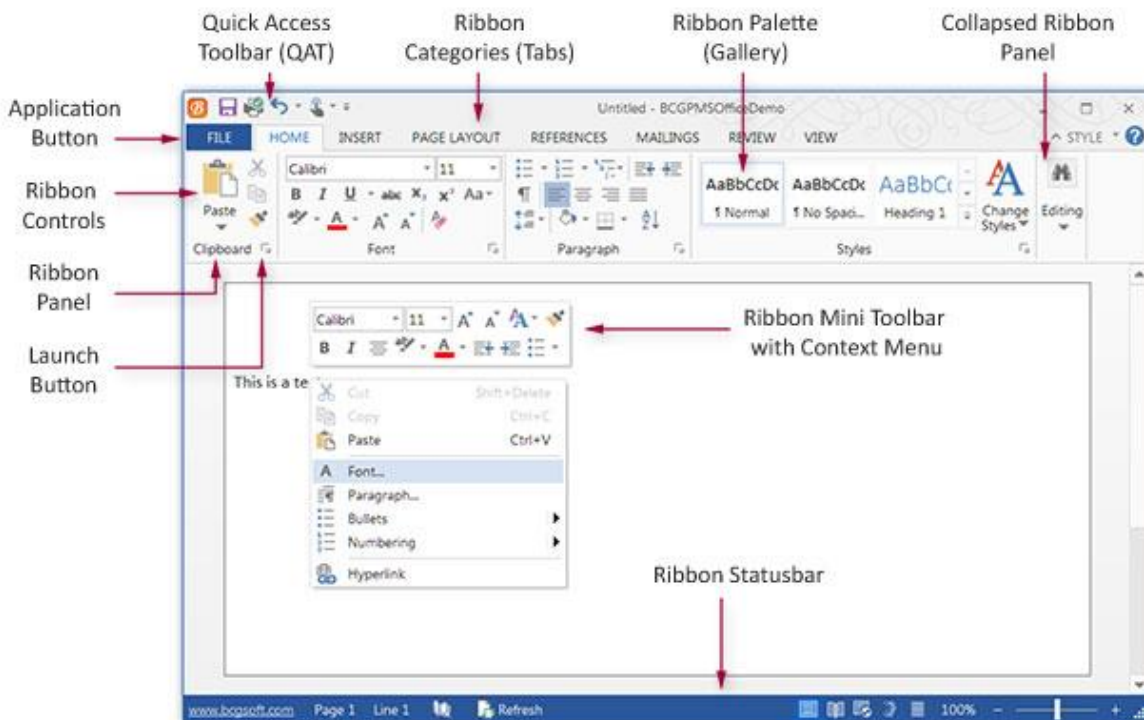
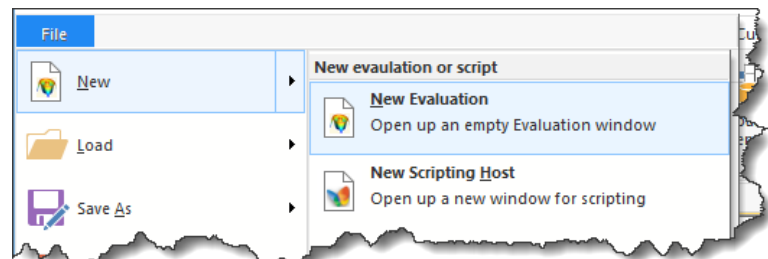
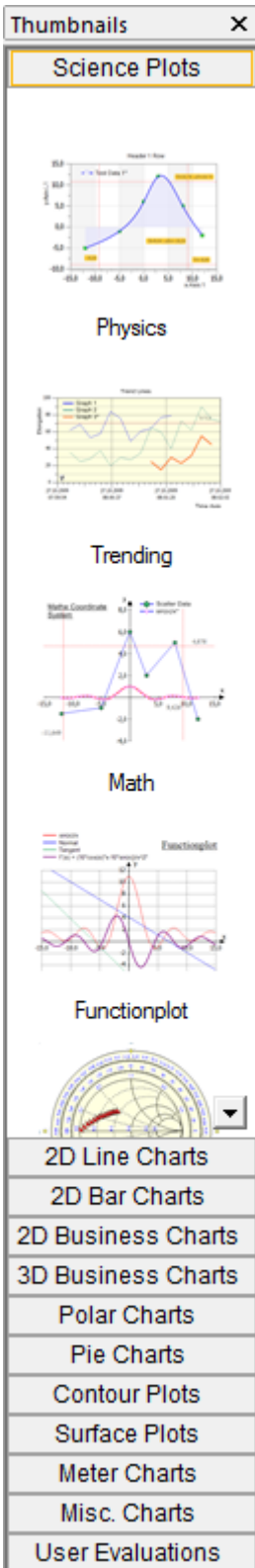


Fig.7-4: Ribbonbar Controls

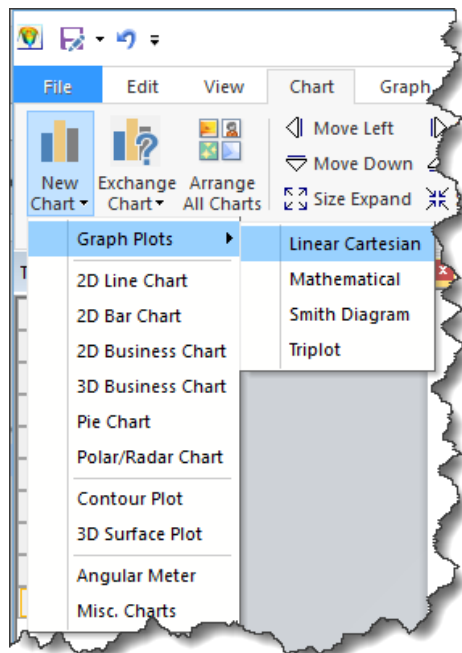
7.3 Add a new Evaluation & Chart

To add a new chart (and an evaluation), you can click on any chart in the left Thumbnail bar (Nevertheless, a MDI window is available or not). → That's it!

Nevertheless, here we will call the Pulldownmenu **File** → **New** → **New Evaluation** or simple use the key <Ctrl + N> to invoke our first empty *Graphics MDI window with a Tab-view on top of the page*. That page is called an **Evaluation**. The file has always the extension `*.sx'`.



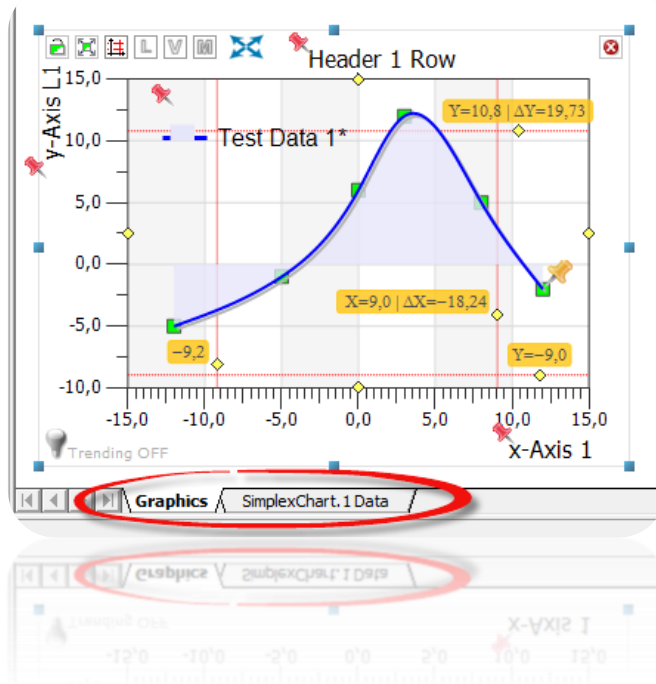
→ Next, use the Ribbonbar category *Chart* to select a chart in their basic form (without any setups).



→ To follow the description, please choose the *Physics* chart (Linear Cartesian).

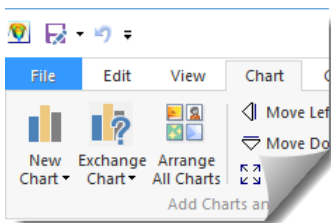
Below the window, there is a new Tab, right next to the Graphics tab especially for the data of the new *Physics* chart (*GraphTable*).

→ Click on that tab or use key <F3> to swap between the Graphics or Table (*GraphTable*)



The chart and table are in relation to each other. The table tab name is equal to the chart name plus the word "Data". You can change the name in the chart properties (see chapter 10.8). Swap back to the *Graphics View*; use key <F3> again.

For instance, if you copy and paste more charts, then more table tabs appearing with connections to their charts.



Hint:

If you have more than one chart on your evaluation page, then you can arrange those with the help of the icon in the Ribbonbar *Edit*, panel *Alignment Toolbar* or use the icon *Arrange All Charts* from the Ribbonbar *Chart*.

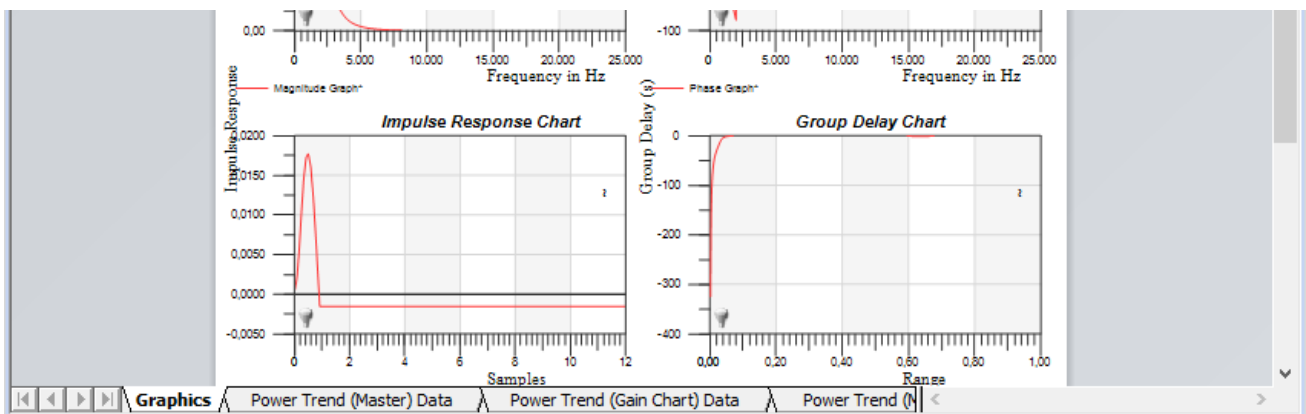
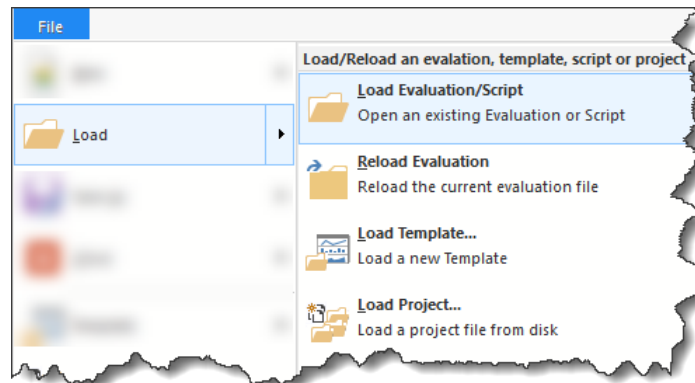


Fig.7-5: Arrange Charts automatically (Arrange All Charts)

7.4 Load Evaluations

To load (or open) an evaluation, please choose the key <Ctrl + O> or use the Pulldownmenu File:

■ Load Evaluation:

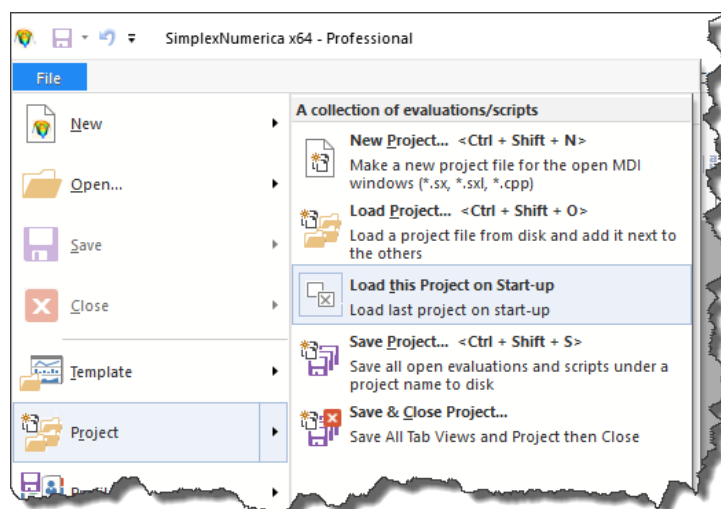


- Pulldownmenu File
- Menu Load... (Strg + O)
- Choose e.g. the path <x:\SimplexNumerica\Examples>
- Search for an appropriated '*.sx' file and load it...

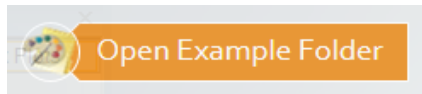
You can also load multiple evaluations at once. This is called a **Project** in *SimplexNumerica*.

■ Load Project:

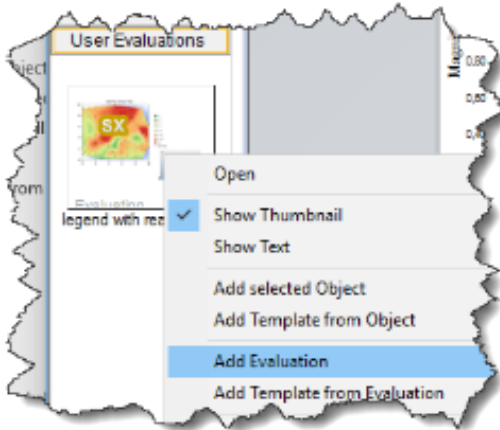
1. Choose Pulldownmenu "File | Load | Load Project...".
↳ Use the Fileselectbox.
2. Choose path and file with the extension '*.sxw'.
3. Open the project....
4. To ensure that the project is automatically loaded at the next program start, please select the menu item:
"File | Project | Load this Project on Start-up".



You can also use the start-up dialog to load a sample evaluation.

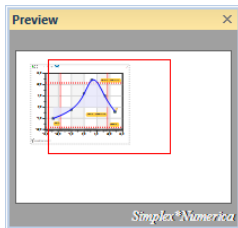


Use the left button in the start-up dialog. Then it opens the Fileselectbox, it shows you the path to the example folder and sub-folders.



Tip
Often used evaluations can be saved into the Thumbnail window, category "User Evaluations".
Click with the right mouse button into the white empty space of the window. Then opens a popumenu as shown to the left...
To load it, simply click on its thumbnail

By the way:



There is also a Preview Window available to move and show parts of the view. The red rectangle is the dimension of the main display. It can be moved and the main display will be moved, too.

You will find it in the Ribbonbar *View*.

...

7.5 What is a Graph?

A graph consists of input (measurement) data (shown by *Data Marker*); the data behind are called **SampleData** plus a (approximation/interpolation) curve; the data behind are called **CurveData**.

SampleData and *CurveData*, together they are called **GraphData**

$$\text{GraphData} = \text{SampleData} + \text{CurveData}$$

(GraphData are data arrays behind a graph)

Info:

Each graph can have its own properties for line colors, shadings, math parameters, etc.

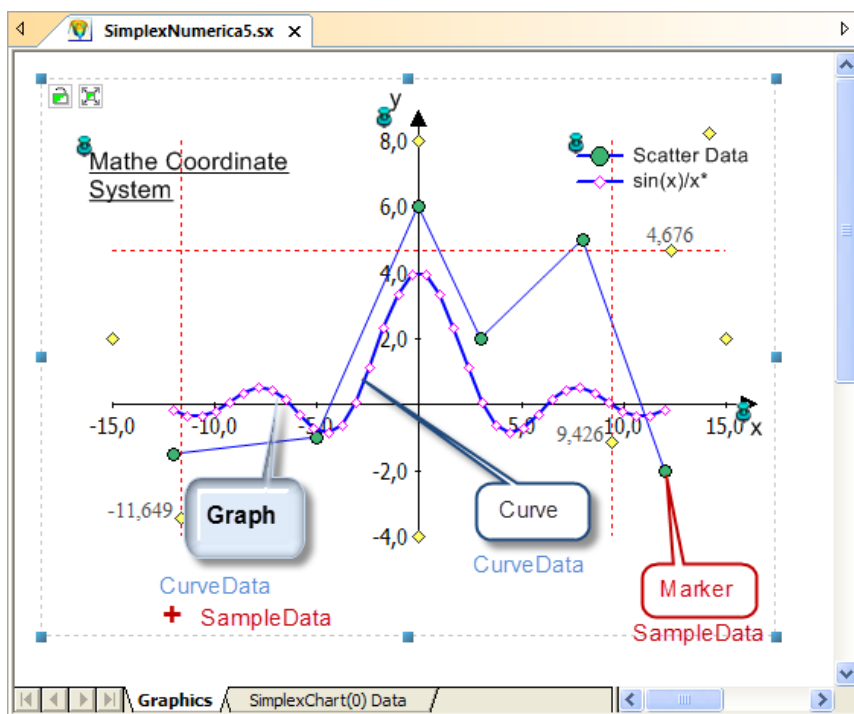


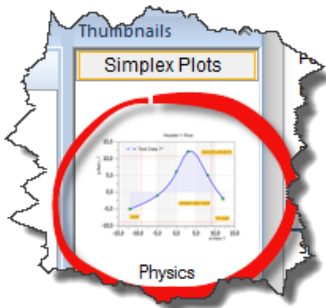
Fig.7-6: Chart with two graphs

- A Graph is not a chart!
- A Chart can have more than one Graph.
- *SampleData* are shown in form of *Data Markers*.
- One marker represents each measurement point.
- A *Graph* is called a *Series* in several other programs (Graph or Series, it is the same term)!

$$\text{Series} = \text{Graph} = \text{Sample Points} + \text{Curve Points}$$

- A curve consists on calculated sample data called *CurveData*.
- Is there more than one graph in a chart than there is a current (active) one (highlighted).
- Is there only one graph in a chart than the current one is this.

7.6 Add a new Graph



Let's add again a chart from the thumbnail window and then add one or more graph(s) to this chart.

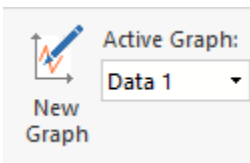
→ Please close all evaluations (pages).

→ Please click on this symbol *Physics* or move it to an empty page.



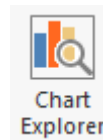
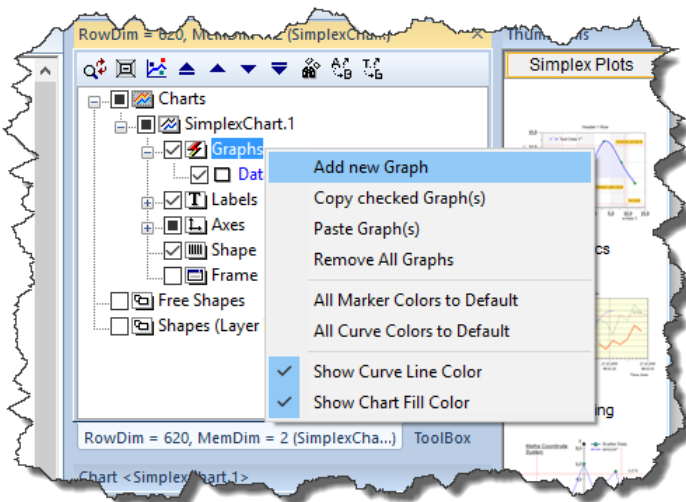
Then click on the Ribbonbar *Graph* icon *Fill Curve*

to let the curve unfilled.

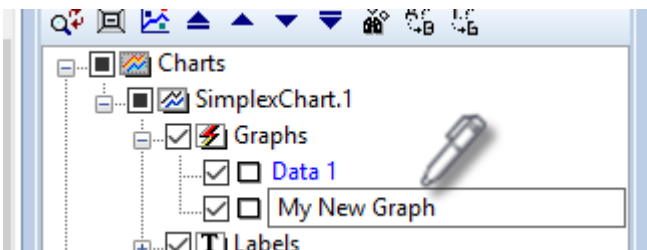


Add a new graph to the chart:

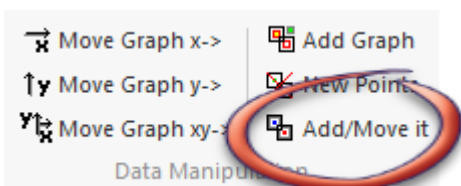
Either use the Ribbonbar *Graph*, icon *New Graph* or right-click in the **Chart Explorer** on *Graphs...*



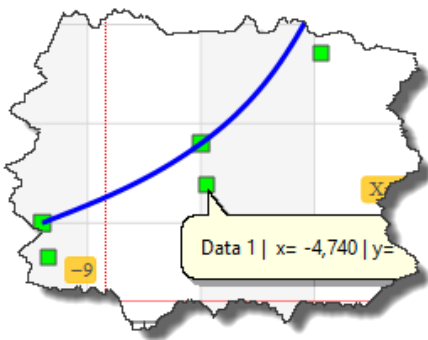
Add a new Graph in the *Chart Explorer...*



Edit a new graph name...

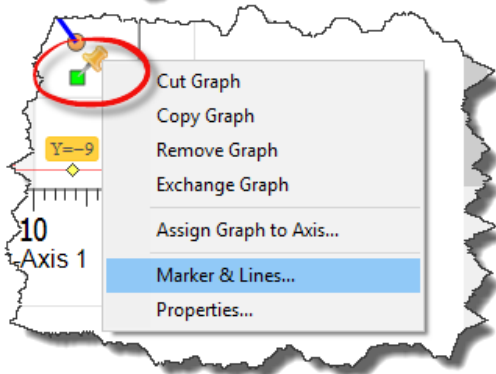


Use this icon here (Ribbonbar *Graph*) to modify the active graph inside the chart.



Drop the mouse over the chart and...

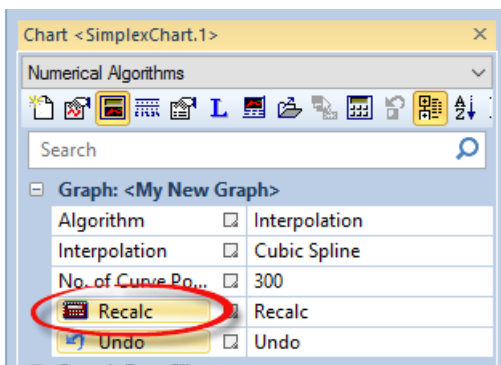
...hold down the left mouse button on a marker, hold it and move the marker around.



Left click on the Gold Pin and choose *Properties* to see where they are, or

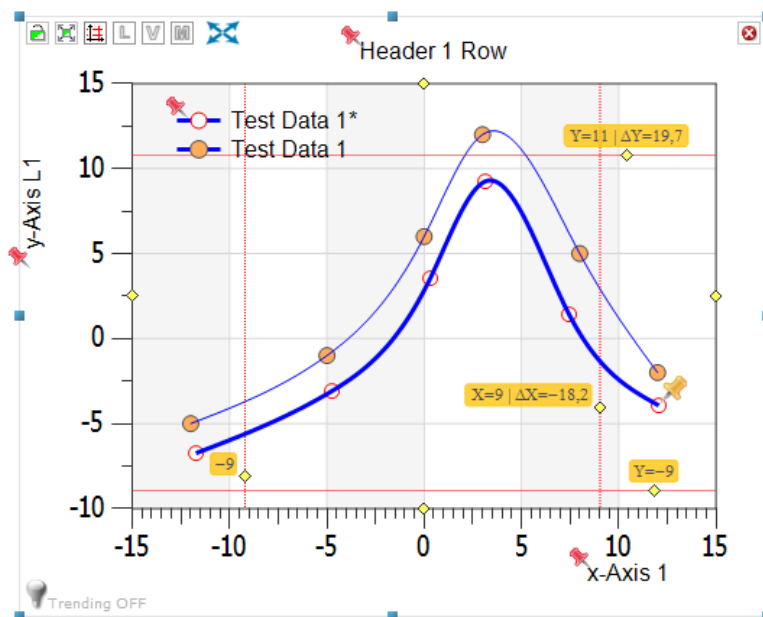
Left click on the Gold Pin and choose *Marker & Lines*, directly.

After making some style changings in the *Properties* you can select the graph in the *Chart Explorer*.



Select *Numerical Algorithm Properties* and choose a *Cubic Spline* to fit the new data values.

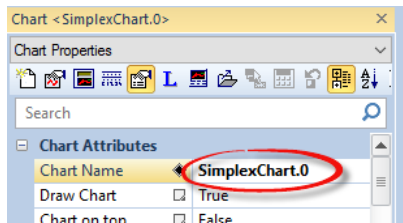
To get something like this...



Start-up

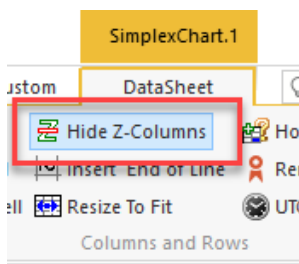
Next, we will add a third graph to the chart, but this time with the help of the *GraphTable* Editor.

To show the data, please press key <F3> or click on the tab. **SimplexChart(0) Data** , but before...

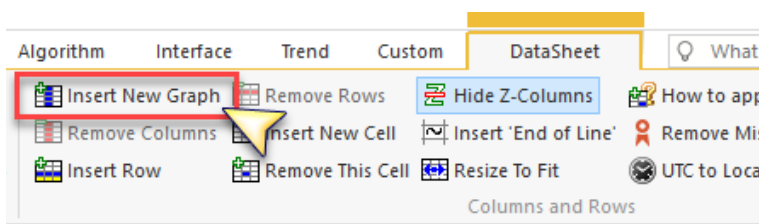


Info
 The name of the chart can be different.
 If you like, then you can change the name here in the Properties.

Now, please press <F3>...



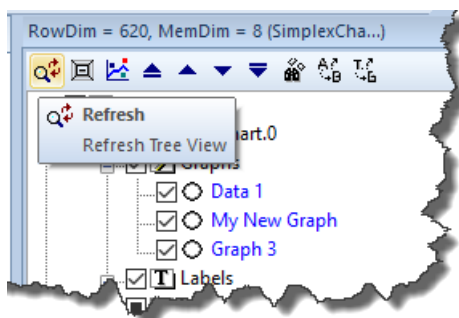
After swapping to the *GraphTable*, please switch off the z-Column for now...



Now, insert a new graph from the *GraphTable* Ribbonbar.

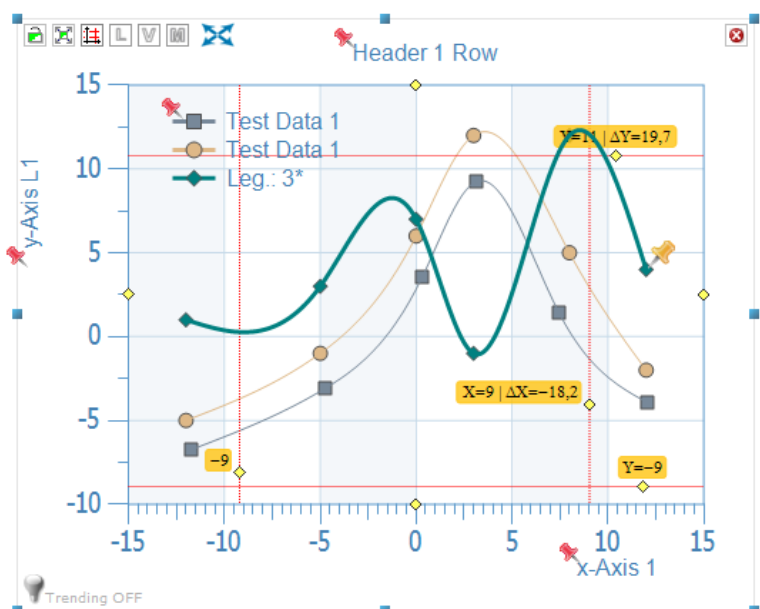
Data 1 SampleData	Data 2 SampleData	
G0.y	G1.x	G1.y
-5,0000	-12,1748	-7,6781

→ Edit the new data columns with dummy values and then switch back to the Graphics <F3>...



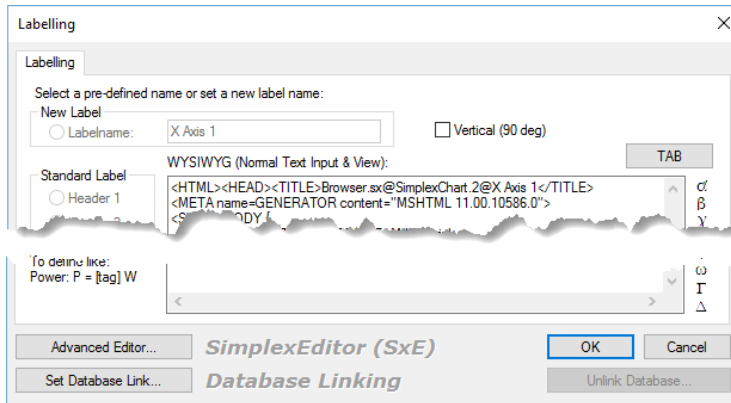
If the *Chart Explorer* does not show the new added graph, then try to refresh the entries...

Again a Cubic Spline and change the chart theme...

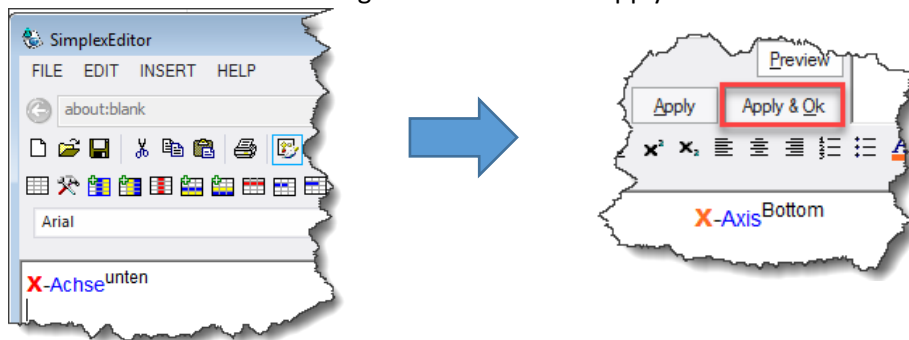


7.7 How to edit a HTML file in SxE?

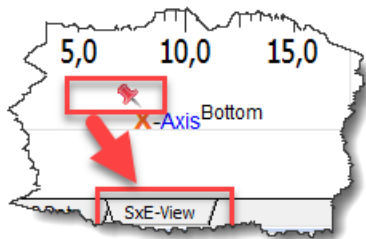
1. Double-click on the red pin  **X-Achse unten** from a (chart) text label.
2. Click on the button **Advanced Editor** – SimplexEditor (SxE)



3. Edit the HTML text in the Design Mode of SxE and apply.



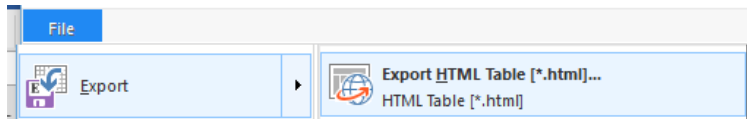
4. Double-click afterwards again on the pin to see the HTML text.



5. ...and click on the Tab **SxE-View**
6. Here you can edit the text again but always after the first definition in SxE (without to call SxE explicitly again).

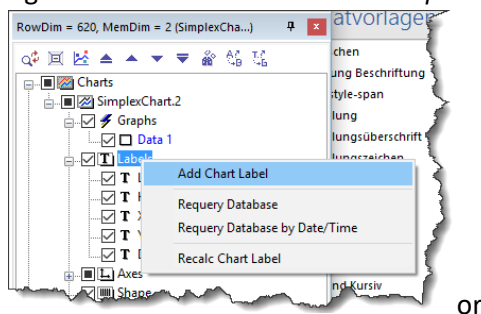
7.8 How to import a HTML file in SxE?

You can export, for instance, a GraphTable (table) as an HTML file from the *SimplexNumerica* File menu (as described within chapter 13.1.12).

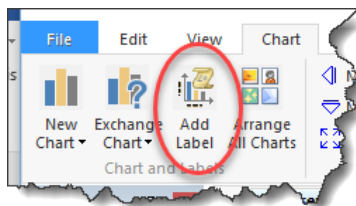


Now, for instance, if you want to show the table (or parts of it) as a HTML label around its chart, then you can either import the previous saved file in *SimplexEditor* (SxE) or you can use the new function **Add Grid Label** (see next chapter). First, we will show how to import a HTML file with the help of SxE.

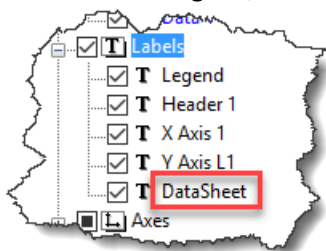
1. Right-click on **Labels** in the *Chart Explorer*.



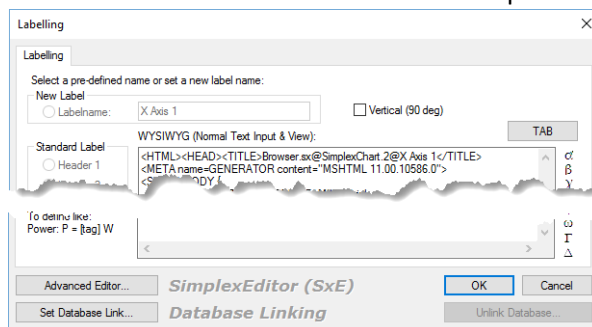
2. use the Ribbonbar Chart



3. Choose **Add Chart Label**
4. In the next dialogbox, use e.g. GraphTable (or “My nice Table”) as label name.

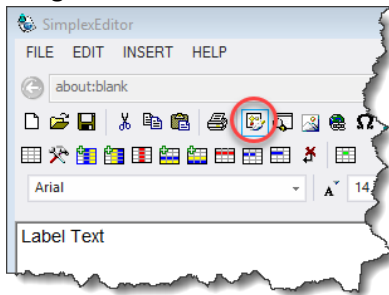


5. Click on the button **Advanced Editor** – SimplexEditor (SxE)

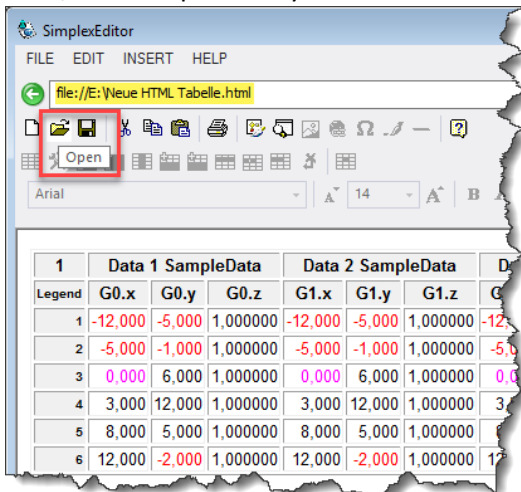


Start-up

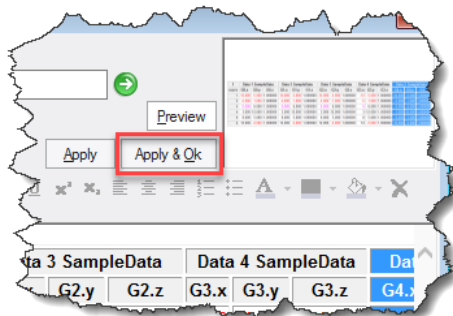
- 6. SxE should open...
- 7. Design Mode in SxE should be activated...




- 8. Now, load the previously saved HTML file.



- 9. And press Button *Apply* or *Apply & Ok*



- 10. Click on the label pin  or select the label in the *Chart Explorer*
- 11. and click on the Tab *SxE-View* at the bottom of the page.
- 12. Use the *SxE-View* to format or edit the table as you like...

These steps are too fiddly for a normal usage. You can use the Ribbonbar icon Add Grid Label (see next chapter) to do that in one step.

7.9 Add Grid Label

Use this menu to add a table (= grid) from the *GraphTable* to its related chart.

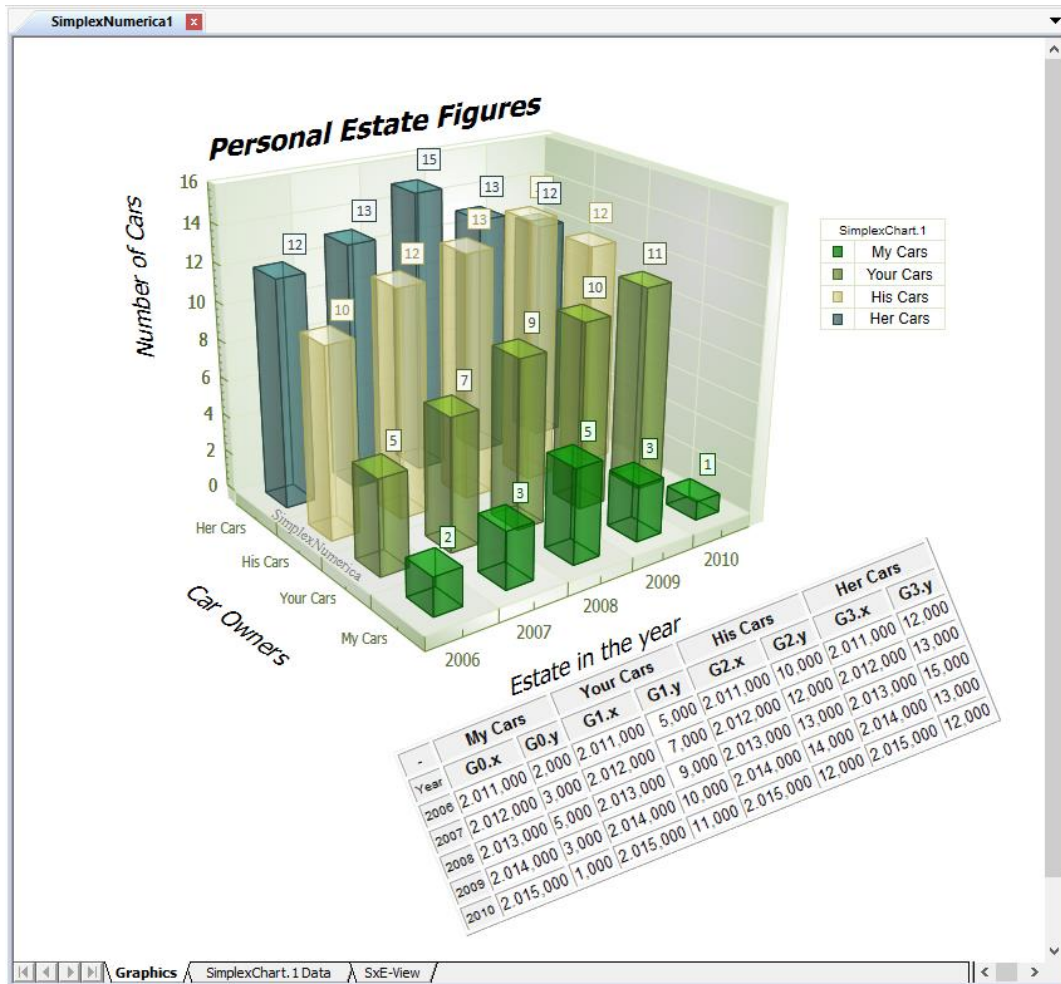
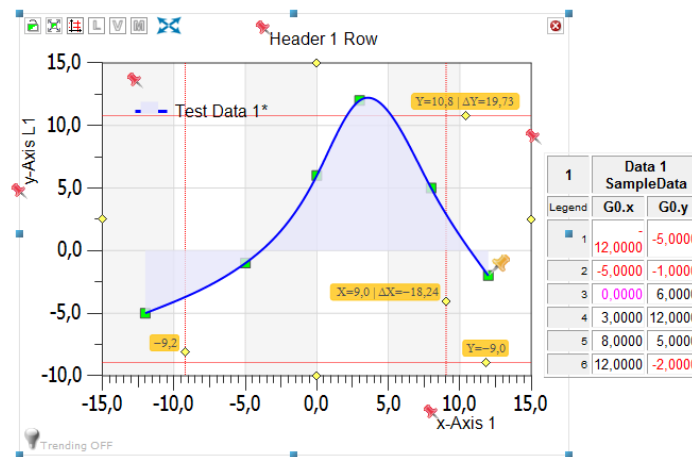


Fig.7-7: Label made by Table

- ➔ To do that, please select a chart, then press <F3> to swap to the *GraphTable* and then select or do not select a data range in the table and afterwards press the icon **Add Grid Label** in the GraphTable-Ribbonbar.
- ➔ If the layout of the table does not fit your needs, then you can use the **SxE-View** or **SimplexEditor (SxE)** to modify its format, size and content.

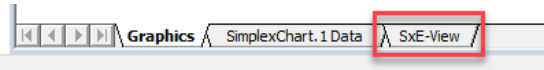
Here we will demonstrate this in the *SxE-View*.

1. Use the **Physics** plot from the Thumbnail-Window.
2. Press <F3>, hide the z-Columns and use icon <Add Grid Label>



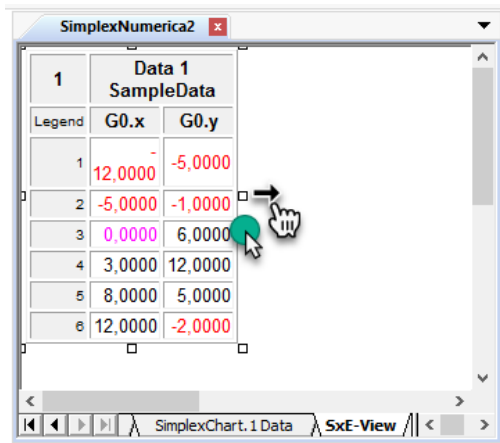
3. You will see this: and maybe find, that -12 is not well formatted. The dash is in the line above. → Change that in the *SxE-View*:

4. Click on the table pin (means select the table label)

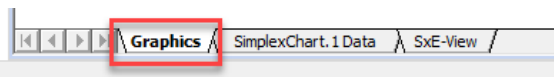


5. Click on the *SxE-View-Tab* at the bottom of the page.

6. Click on the right side of the table (Activates the border of it).

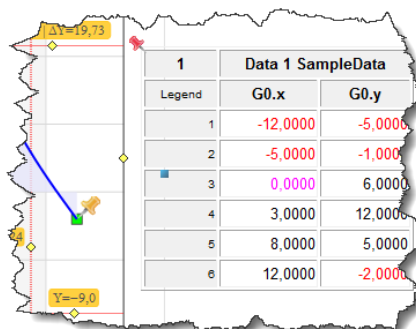


7. Move the size of the table...



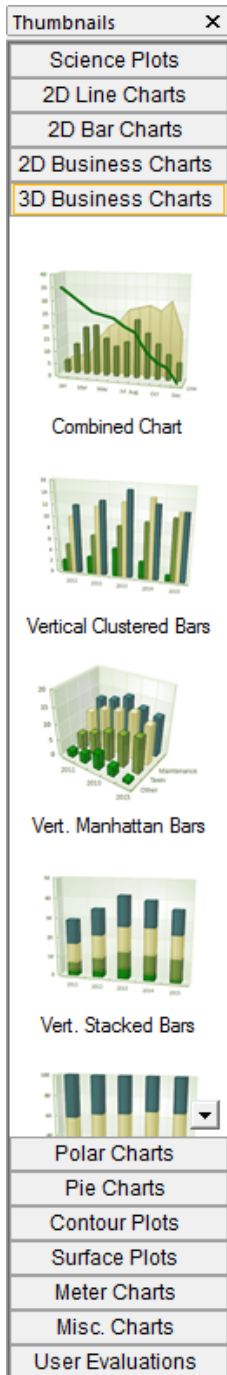
8. To apply, please click on the Graphics Tab.

The result looks like:



8 Chart Impression

8.1 Chart Architecture



SimplexNumerica uses a component-based drawing architecture - especially for charts. Components are display-panel primitives (like lines, rectangle, etc.) that include attributes that manage background, border, and foreground appearance. Available components provide background panels, titles, labels, legends, and graph displays. Charts are constructed by allocating components of various types, setting desired attributes, and adding the configured components to a list of properties. Data objects are stored in another list. A serviceable chart can be produced by a few lines manually or via script code that create display components. *SimplexNumerica* automatically configures the chart to fit the data. The axes are properly scaled. Lines, bars, and other filled polygons are drawn in various colors and styles according to the amount of data displayed. This configuration is done for each draw cycle, so that the chart responds instantly to changing data and style settings. More complex, presentation-style charts or *Business Charts* can be produced by creating additional components. You can specify various style settings to enhance the appearance of the chart. Several samples are provided to demonstrate the various ways to enhance charts.

SimplexNumerica supports a few main basic chart and axes types optimized for speed and performance. They are called *Science Plots* and can be found in the Thumbnail Window, too. To select one of these basic charts, click on any picture in the Thumbnail Window.

Each chart type may support a limited subset of the available axes types. The more advanced axes type is the *Physics Chart*. This is also called a Cartesian-coordinate-system.

Some chart types require data supplied in a specific format. Furthermore, the chart type determines what effect the various style objects contained in the display component, the data lists, and the individual data items have on the graphic elements.

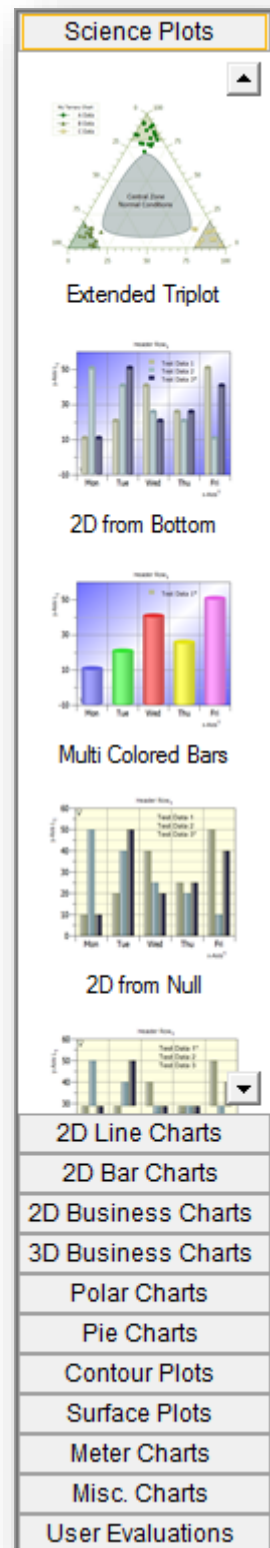
The following topics describe the supported chart types and present some implementation details. It is convenient to organize the chart types according to the axes types supported.

The thumbnails images (see left picture) show how data are represented in the basic chart types. These small pictures do accurately represent the visual quality of normal-sized charts produced by *SimplexNumerica*.

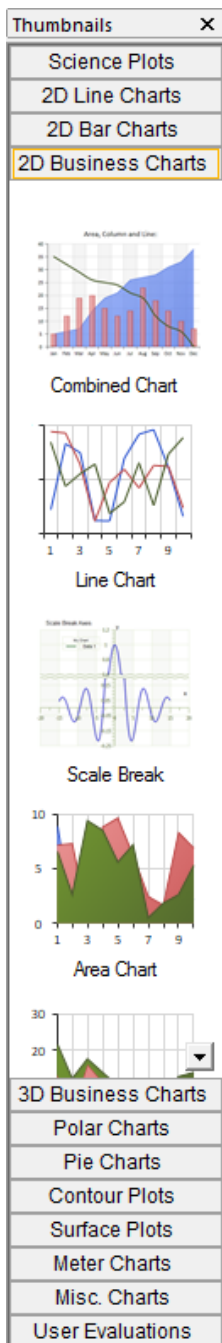
Hint
Be aware that the inbuilt cursor function are made for Cartesian Coordinate Systems like the *Physics charts*, only.

SimplexNumerica supports the following Chart features:

- ❖ 2D and 3D charts
- ❖ Unlimited number of charts and graphs
- ❖ Unlimited number of Data Points (*SampleData* and *CurveData*)
- ❖ Conversion between compatible charts on the fly
- ❖ Conversion without clearing and adding new data
- ❖ Ability to display different graph types on the same chart area
- ❖ Customizable Data Markers for Data Points
- ❖ Customizable Data Labels for Data Points
- ❖ Inclusion of individual Data Points to Legend
- ❖ Tooltip support
- ❖ New Labels support
- ❖ Missing Data support
- ❖ Nearly Real Time Charting
- ❖ Data Point values can be modified on the fly
- ❖ A graph series can automatically remove data points when the specified history depth is reached
- ❖ Automatic Coloring of Curves and Data Points
- ❖ Some charts with its properties like outline, fill and text colors are automatically colored according to the currently selected color theme
- ❖ etc.



8.2 Chart Thumbnails



The Thumbnail window shows you a chosen part of the chart object library. Everyone can extend the library. You can put your own objects into the Thumbnail window (→use right mouse click inside).

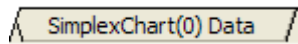
To test it, click on the *Physics* picture of the *Science Plots* register to activate a new evaluation view (if not already there) and to put this chart object on top of the view.

The program selects the chart object and you can change the associated properties inside the Property Window.

Info:

Against other programs like MS Excel, a chart is the main object; data are only part of it.

To show the data, please press key <F3> or click on the tab.

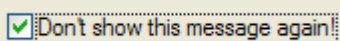


Legend	G0.x	G0.y	G0.z
1	-12,0000	-5,0000	1,000000
2	-5,0000	-1,0000	1,000000
3	0,0000	6,0000	1,000000
4	3,0000	12,0000	1,000000
5	8,0000	5,0000	1,000000
6	12,0000	-2,0000	1,000000

Click on the tab Graphics Graphics **SimplexChart(0) Data** to go back to the chart. The chart is still selected. Now, if you click on another thumbnail picture, then two possibilities of viewing this new chart are available. First, the new one is going to exchange the old one or the new one will be put beside the old one. *SimplexNumerica* has the following rule: If the old chart is selected, then the new one will remove it and will be placed on the same position. However, the data will be used from the old one. If there is no chart selected, then the new one will be placed beside the old one and have its own (default) data.

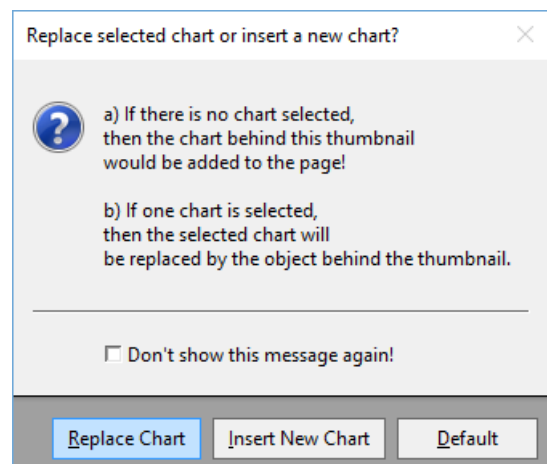
By the very first time of clicking a second chart, *SimplexNumerica* will show the following dialog, so that the user can decide what to do.

Before you press the Default button, please select



so that *SimplexNumerica*

can make its default rule or let it and press what you want to do.



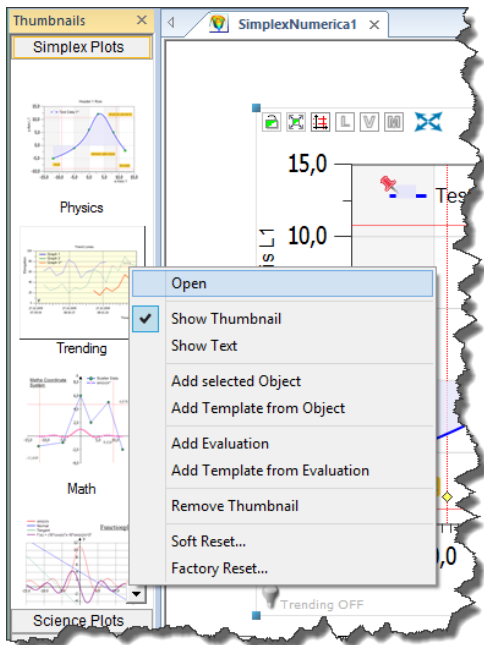
Here are the rules:

Question: Replace selected chart or insert a new chart?

- a) If there is no chart selected, then the chart behind this thumbnail would be added to the page!
- b) If one chart is selected, then the selected chart will be replaced by the object behind the thumbnail!
- c) If you drag and drop a chart from the thumbnail window to the Graphics View, then always the new chart will be placed without to replace the possibly selected chart on the page!

Use right mouse button!

When you click with the right mouse button inside the thumbnail window, then a popup menu - as shown in the next picture - appears:

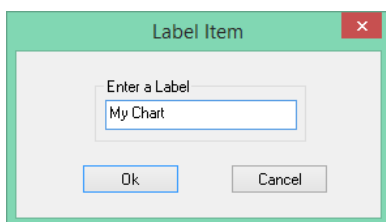


The menu item *Open* does the same as above described.
Show Thumbnail and *Show Text* do what they describe.

8.2.1 Add selected Object

Adds a selected chart to the Thumbnail window.

Please select a chart and call this popup menu. Then enter a name for the new thumbnail object:



Now you can see the chart add to the thumbnail window:

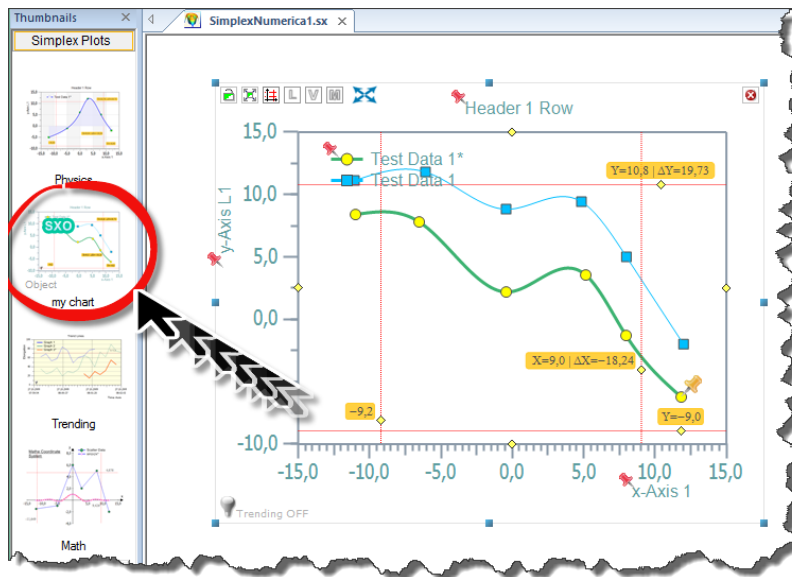


Fig.8-1: Chart added to Thumbnail Window

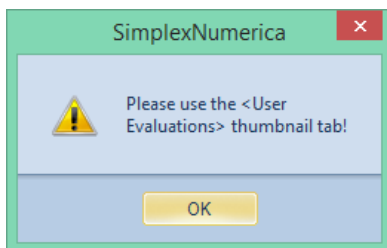
8.2.2 Add Template Object

Adds the selected chart as a template (without data) to the Thumbnail window. It is the same procedure as before.

8.2.3 Remove Thumbnail

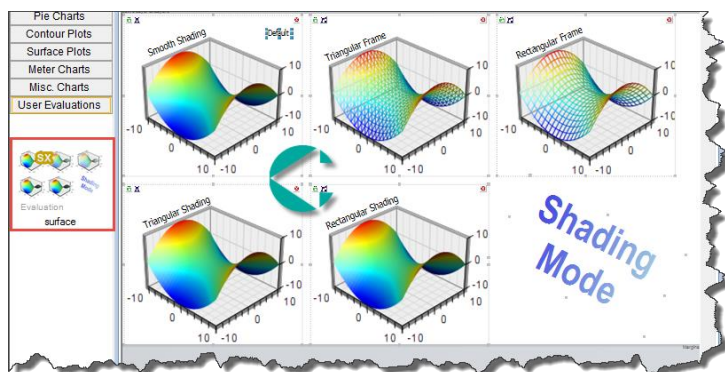
Removes the object from the Thumbnail window.

8.2.4 Add Evaluation



Adds the evaluation (the whole page) to the Thumbnail window.

You can put that to the thumbnail tab, only.



8.2.5 Add Template from Evaluation

Adds the evaluation (but without data) to the Thumbnail window.

8.2.6 Soft Reset

Make a Soft Reset. Copy original factory thumbnails back to here. However, it does not remove the user-designed thumbnails!

8.2.7 Factory Reset

Make a Factory Reset. Remove all thumbnails and copy the original factory thumbnails back to here. Removes the user thumbnails completely from here.

8.3 Chart Parts

The following picture shows the main chart parts of a chart.

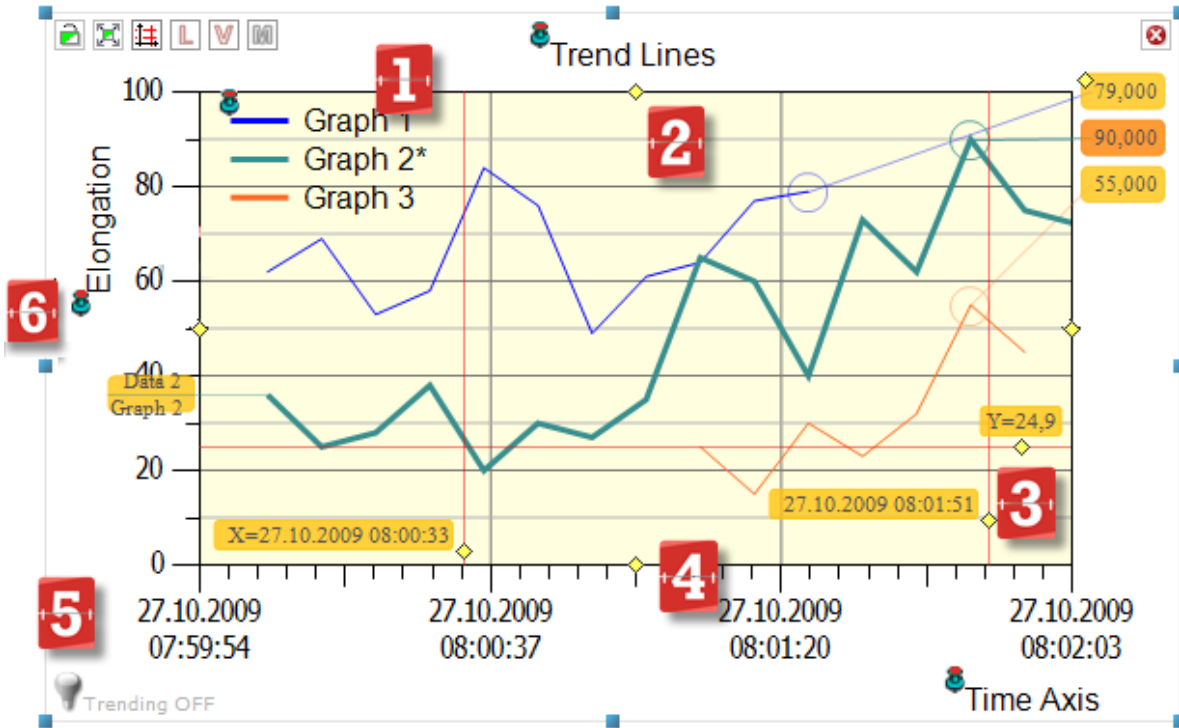
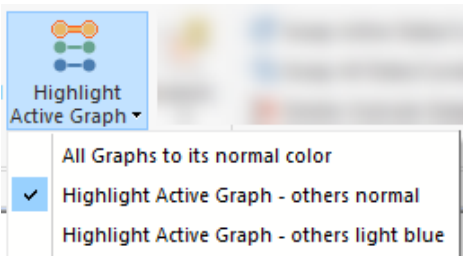


Fig.8-2: Main chart parts

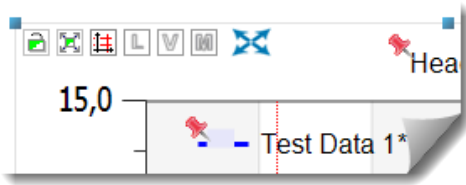
The following table describes the areas:

Pos.	Description
1	<p>Chart Legend</p> <p>The legend shows the names and colors of the curves. By clicking on an item in the legend, you can select the corresponding curve.</p> <p>The legend entry is marked out with an asterisk "*".</p> <p>The highlighted entry is selected, the corresponding curve, too. The curve is then highlighted in bold (but, see picture to the left, it depends on the checkmark).</p> <p>The highlighted curve is now the active one!</p> <p>⇒ <i>Orientation and position of the legend can be changed using the mouse or the properties.</i></p>











Pos.	Description
2	<p>Chart Background</p> <p>These can be changed by the shape properties.</p> <p><u>Hint:</u> The yellow background in the above picture is from a shape object, lying behind the chart!</p>
3	<p>Cursor Line</p> <p>The cursor line marks the point of the curve or the sample data.</p>
4	<p>Chart Main Axis (x/y)</p> <p>The x-axis can have a trend timeline. The start and end times of the trend can be entered by double-click with the left mouse button. Do it, double-click on y_{\min} (in picture value 0) or y_{\max} (in picture value 100). ...x_{\min} and x_{\max} can also set by double-clicking on the corresponding values.</p>
5	<p>Life Sign</p> <p>Only for Trending: Indicates the status of the trend:</p> <ul style="list-style-type: none"> • Yellow → Trend is started • Gray → Trend is stopped • Red → Trend being refreshed
6	<p>Labels</p> <p>Chart Labels are glued on its chart by red pins. Click on such a pin, hold down the mouse button and move the label around. Double-click to open its properties.</p>

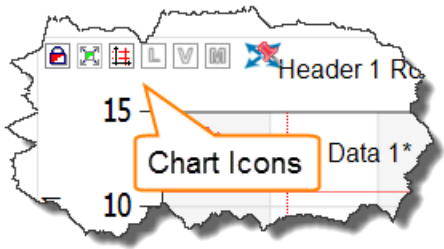
8.4 Chart Toolbar



As you may have already noticed the small toolbar on the top left corner of the chart and you have wondered what functions are attached to it. These symbols are used to analyze graphs, but they also offer functions that can be of interest for the determination of graphs.

The following table explains the features:

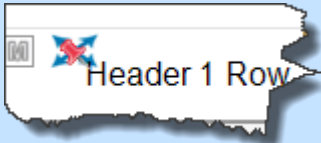
Symbol	Function
 	<p>Lock Move Controls whether the chart can be moved.</p> <p>Enabled: Chart is prevented from moving. Disabled: Chart can be moved.</p>
 	<p>Lock Ratio Controls whether the aspect ratio during scaling of a chart remains the same.</p> <p>Enabled: Aspect ratio is preserved. Disabled: Chart can be scaled unevenly.</p>
	<p>Show Cursor Lines Controls whether cursor lines can be drawn inside the chart.</p> <p>Enabled: Cursor lines are available. Disabled: Cursor lines are not available.</p>
	<p>Show Graph Legend Controls whether an additional legend is displayed to the selected trend curve.</p> <p>Enabled: Legend is displayed. Disabled: Legend is not displayed. Use <Ctrl> to set it on the right side</p>
	<p>Show Active Controls whether additional text labels are displayed.</p> <p>Enabled: Additional labels are displayed. Disabled: Labels are not displayed. Use <Ctrl> for all graphs</p>
	<p>Move Graph Labels Positions the label.</p> <p>Enabled: Labels located to the right side. Disabled: Labels turning around.</p>



Show/Hide the icons on top of the primary *Physics* chart.

→ Useful if you overlap a label with such an icon.

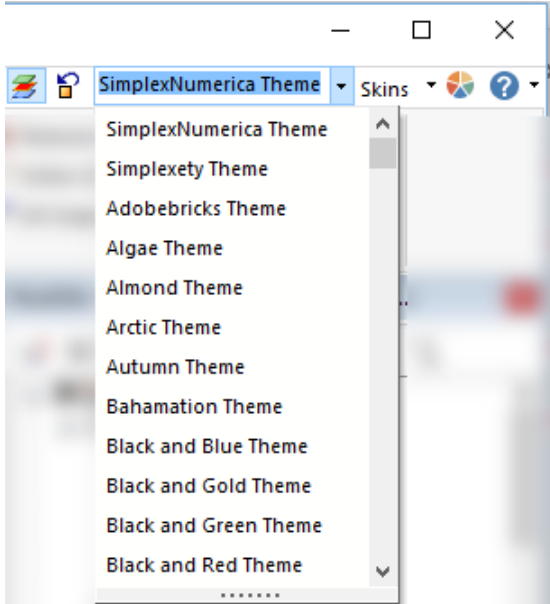
Tip



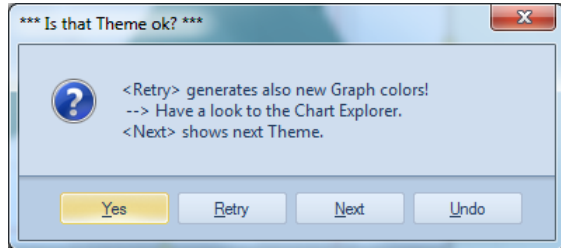
Hold down the shift key <Shift> and click on a Red Pin to move an overlapped label.

8.5 Chart Themes

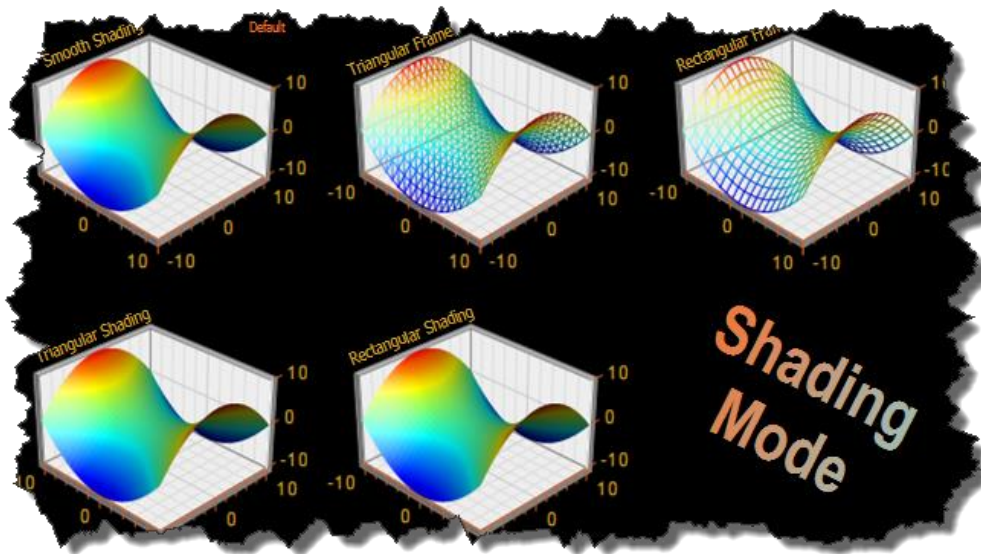
After you have placed a new chart on the view, you can change the theme, if you like.



Click on the left combobox and select another theme. The program will change the charts (graph colors, text, labels, etc.) and the background of the page.



Click on the button *Next* to see again another theme or click on *Yes* to except the chosen one. Some themes have more than one constellation. Use the button *Retry* to click through the possibilities...



Black and Gold Theme

SimplexNumerica provides two different chart theme settings. The charts up to *SimplexNumerica* version 11 can be set as described above in this chapter. The new extended *BCGControlBarPro* chart have their own theme property entry.

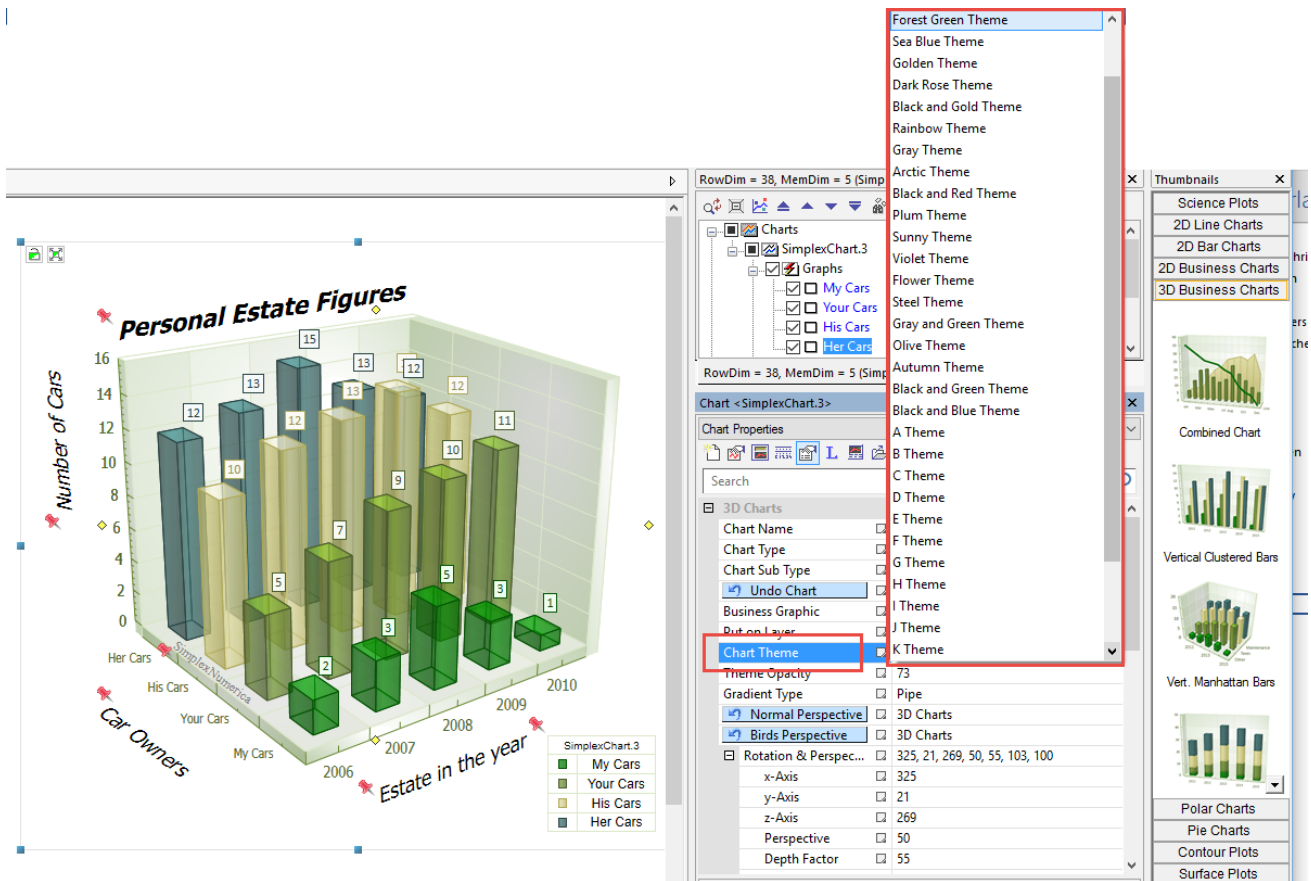


Fig.8-3: Chart Themes select in properties for new chart types, only

Which chart which theme setting?

To see which chart used which theme, please select the chart and have a look to the property entry Chart Theme. If it is available, then use it, else use the toolbar above.

→ If the *Chart Theme* is available, then e.g. the graph color is set by the theme and not any longer manually in the properties.

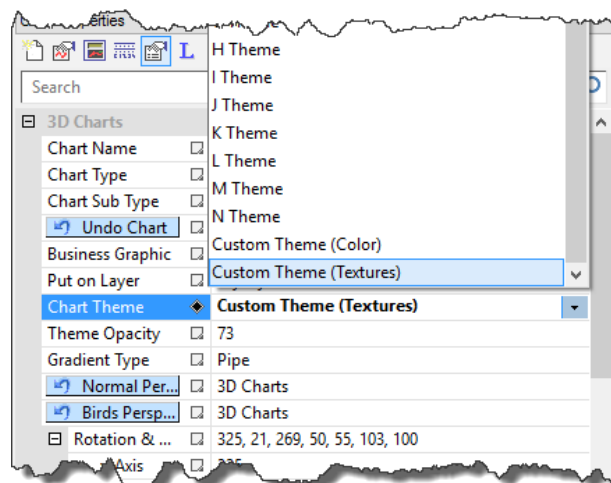
8.6 Chart Textures

SimplexNumerica supports for each new chart type (BCGControlBarPro ones) chart textures as one of the themes.



Fig.8-4: Manhattan Bar Chart with Textures

→ Select the corresponding chart and choose the texture theme in the chart properties.



Hint:

Do not forget to set the right Theme Opacity (transparent elements) between 0 and

100 %. Theme Opacity

8.7 Chart Labels

Chart Labels are glued on its chart by red pins.

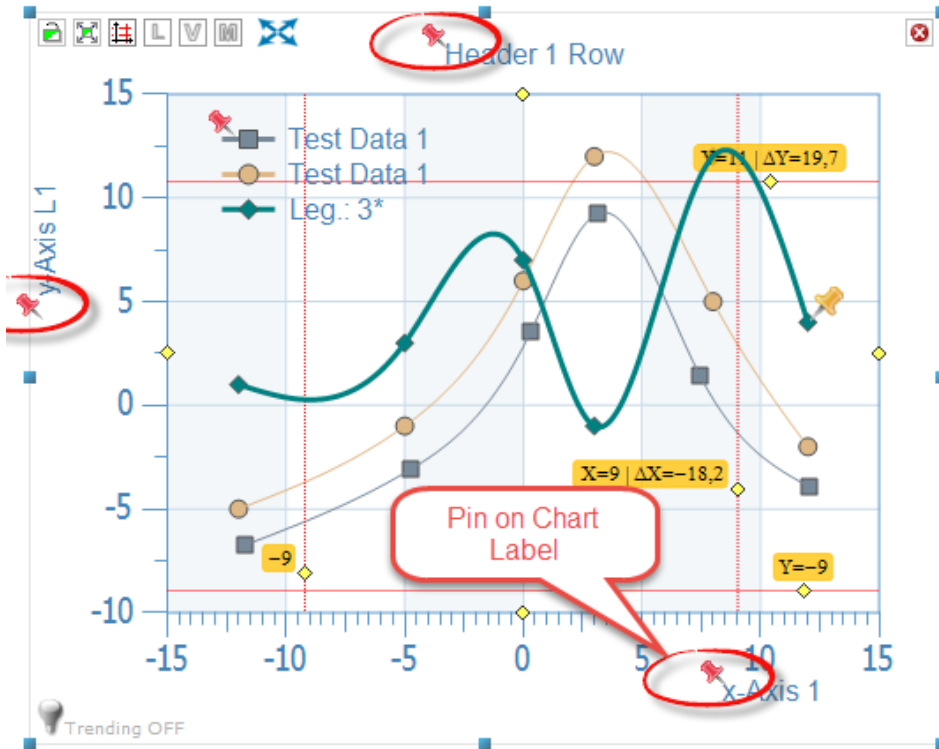
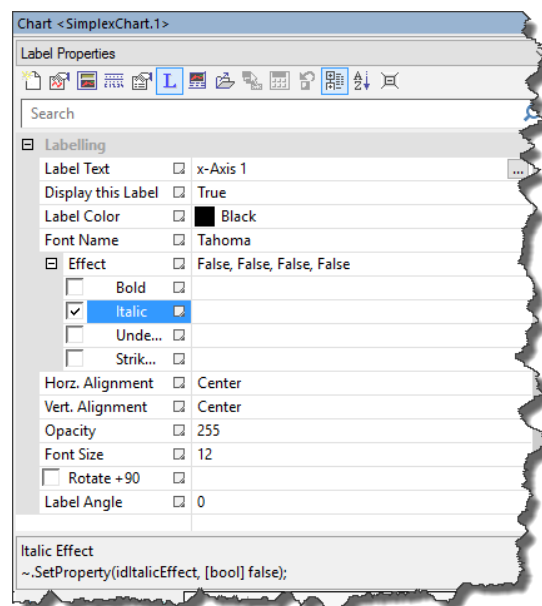


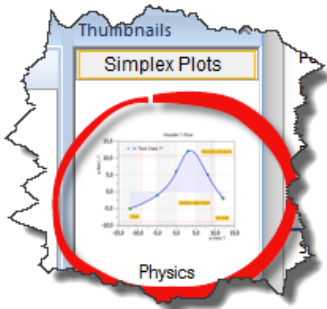
Fig.8-5: Chart Labels pinned by red pins

Let's do:

- Move a chart and the *Chart Labels* moving automatically, too!
- Click on a red pin and move by hand!
- Double-click to call the *Editbox*.
- Simply click on a red pin to show its properties.



8.7.1 Add a new Chart Label

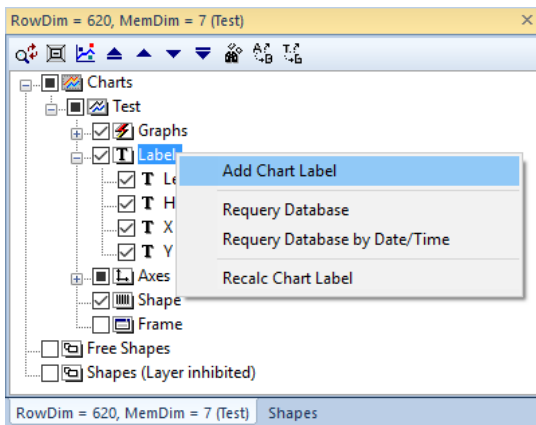


Let's add a chart from the thumbnail window and then add one or more chart labels to this chart.

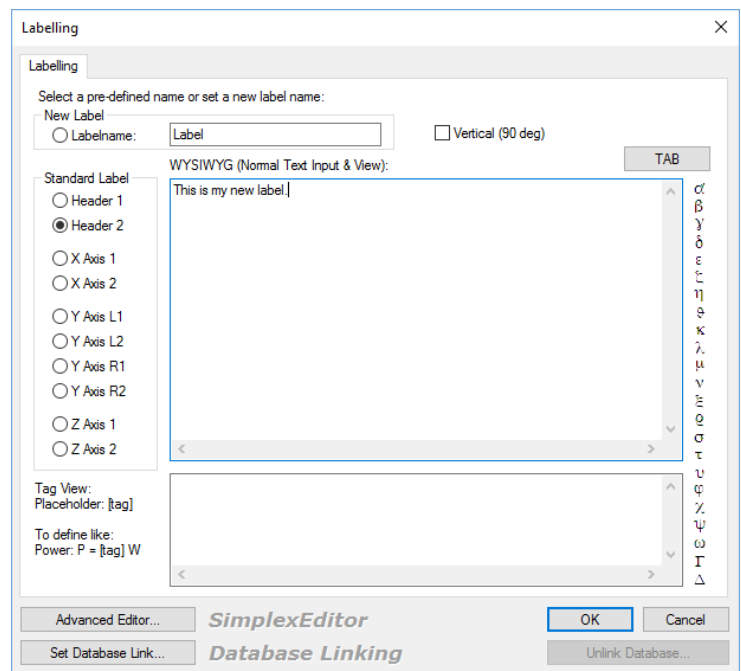
→ Please close all evaluations (tab windows).

→ Please click on this symbol or move it to an empty page.

→ Please have in mind, that a chart label is always related to a chart, whereby a text label is independent and not fixed on that.



To add a label to a chart, please right click on the **Chart Explorer** list on item **Labels** and choose the menu item **Add Chart Label** to open the following dialogbox:



Follow the steps:

→ Select a pre-defined name (**Standard Label**) or set a new label name, like "My Label". The dialogbox below shows a Standard Label "**Header 2**" with an edited text...

→ Place the cursor in the edit field and choose a Greek symbol on the right list.

→ Define a tag as placeholder.

→ Use the **Advanced Editor...** for extra word processing (see chapter 17).

→ Set a **Database Link** ... dedicated to this chart label (see chapter 16.3.4).

→ Click on **OK** to leave the dialogbox.



→ Click on the **Red Pin**, hold down the left mouse button and drag the label around.

8.8 Chart Axes

Hint:

Please have a look at chapter 13.4.3 ff.

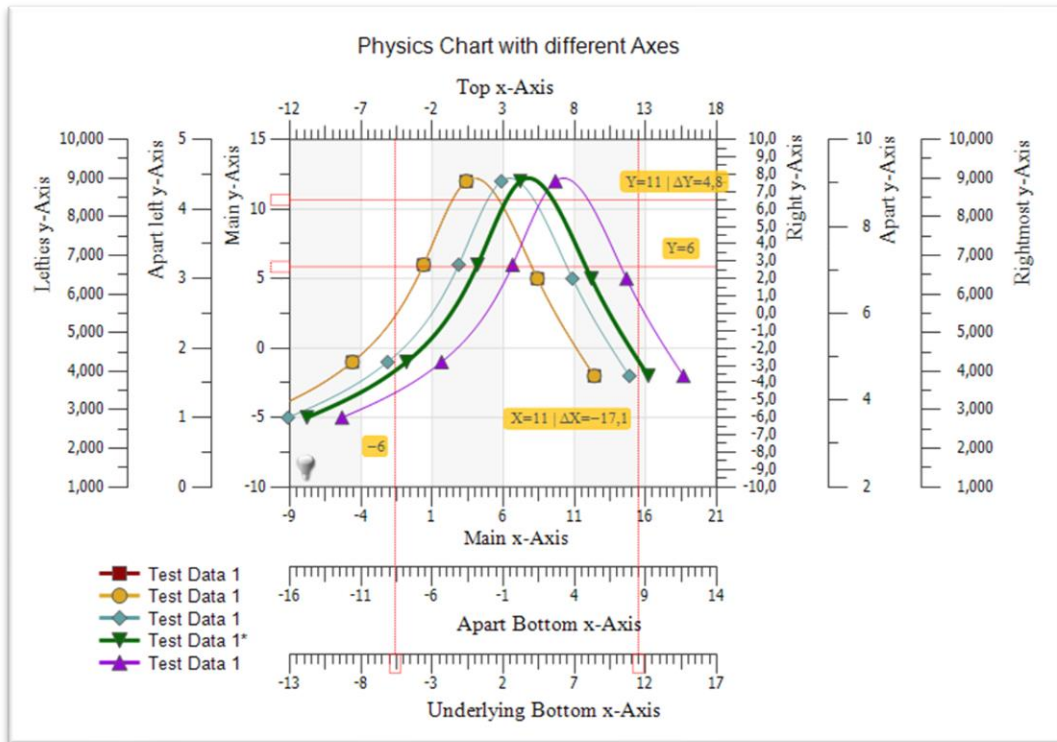


Fig.8-6: Different Chart Axes around the Physics Chart, only

- An axis can display or hide at its place.
- You can customize the range of each axis or by AutoScale.
- You can assign each axis to a Graph.
- Cursor have small indicators on the assigned axis. You can see which graph belongs to which axis.
- Customizable Major and Minor Tick Mark size.
- Major and Minor Tick Marks can be hidden.
- Cross the Axis.
- Display outside the Axis.
- Display inside the Axis.
- The outline color, size and stroke style of each Axis Line and Tick Marks can be customized

Date/Time Mode

The X axis can be set to the date mode. In this mode it treats the X component from related graph series as date/time values, calculates the Major Unit and formats the labels accordingly.

AutoScale - Automatic and Manual Scaling

- Use AutoScale to calculate min/max range and the required scale.
- You can specify a fixed display range for an axis and it will automatically calculate the required scale.
- You can specify a fixed Maximum Display Value separately.

Chart Impression

- You can specify a fixe Minimum Display Value separately.

Cross Type

- It is possible to specify where an Axis crosses its perpendicular axis.

Logarithmic Scales

- Any axis can be set to logarithmic scale.

Reverse Order

- Any Axis can display values in reverse order

Axis Rotation

- Any series type can be displayed correctly when X axis is vertical and Y axis is horizontal.

Axis scale breaks.

- Scale breaks can be generated automatically or added manually.

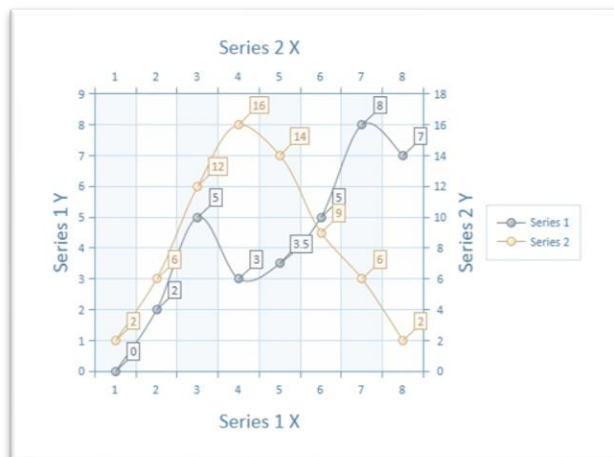


Fig.8-7: Top and right axis for new charts, only

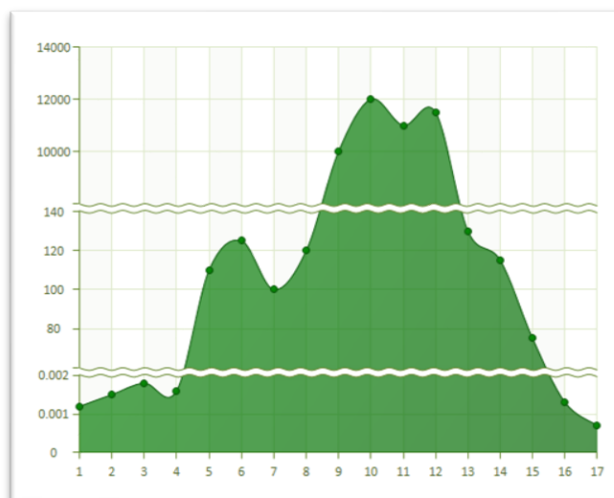
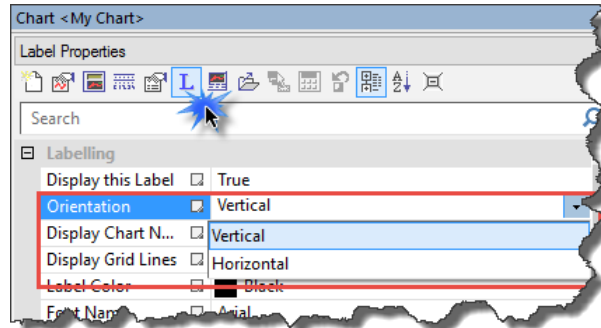


Fig.8-8: Axes Scale Breaks

8.9 Chart Legend

SimplexNumerica supports two legend layouts: Horizontal and Vertical.



The Legend formatting includes the following customizable elements:

- ❖ Legend Position and Visibility
- ❖ A Legend takes left, right, top, top-right and bottom positions
- ❖ A Legend can overlap the plot area, or take place outside of the plot area
- ❖ Legend appearance, which includes outline and fill colors, border width and stroke style, text color, font family and size for legend entries.
- ❖ A graph series can specify what content should be included into legend entry
- ❖ It is possible to specify a custom string to be displayed in the legend entry for each Data Point.
- ❖ Mouse event support.

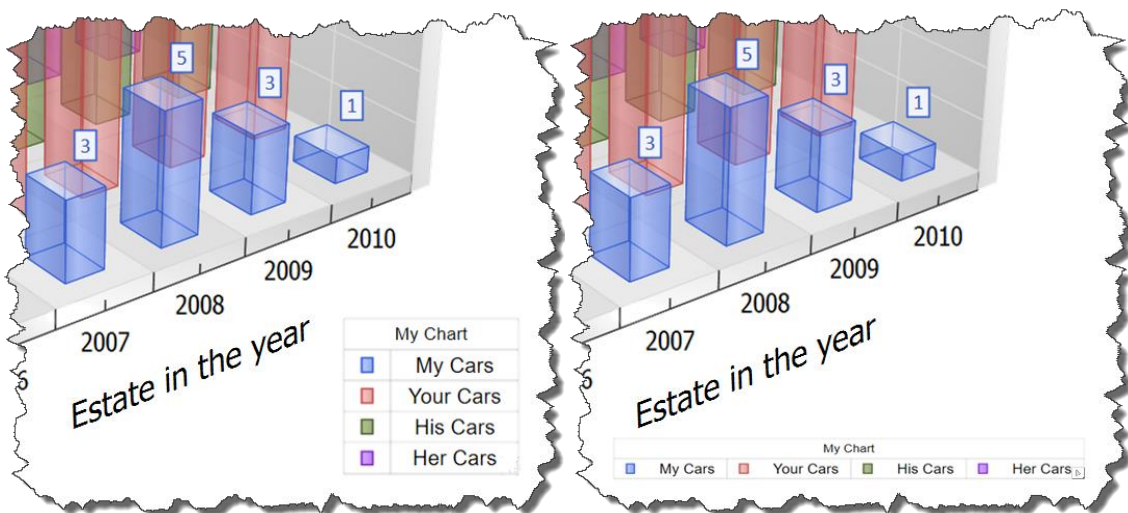
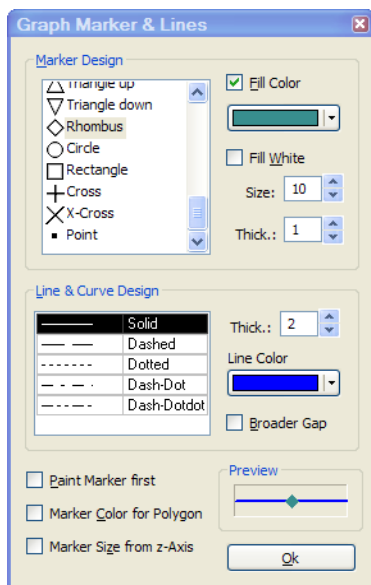
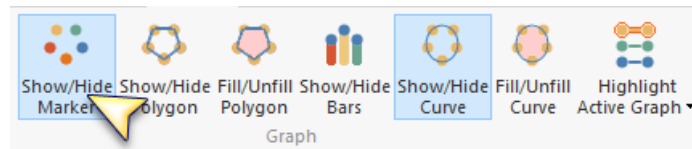



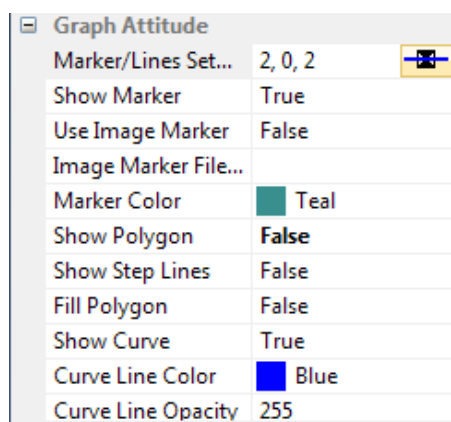
Fig.8-9: Vertical and Horizontal orientation

8.10 Graph Data Marker

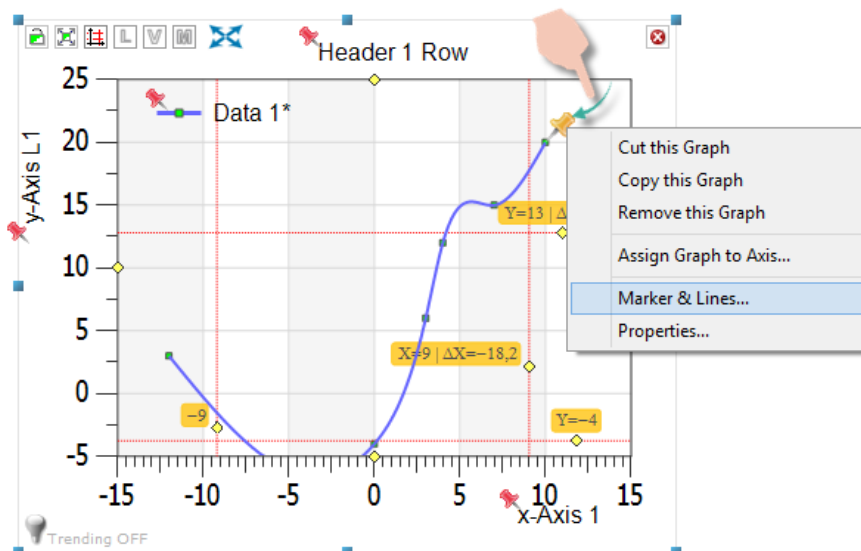
Data Marker representing the position of the data points of a Graph (Series). Data Marker are on top or behind a curve. Please use the next toolbar to switch on and off the marker and some other graph settings.



Use the *Chart Properties* and click on button  right to Marker/Lines to change the marker type (or something else).



You can also click on the pin on the right side of the graph...



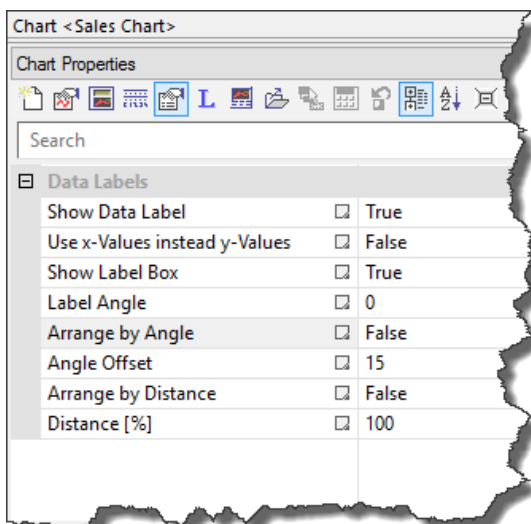
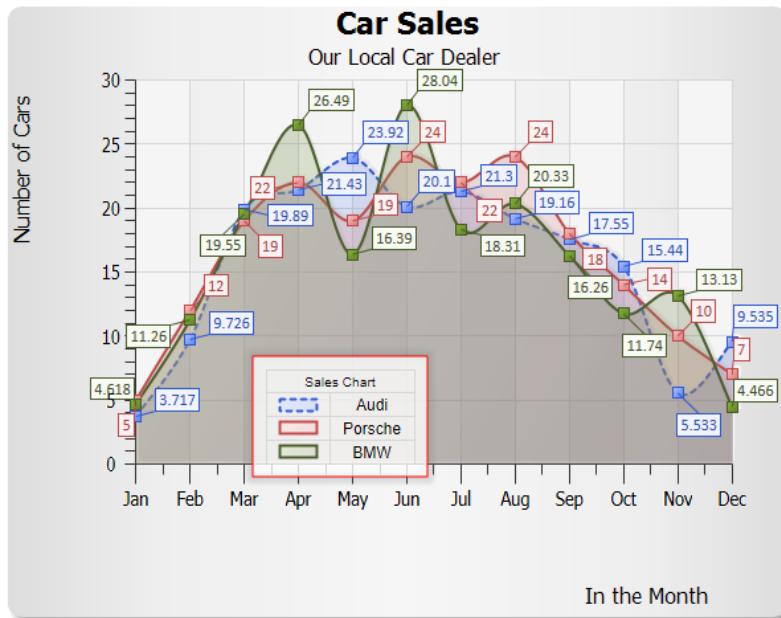
Use the checkboxes in the dialog to set its style.

8.11 Graph Data Labels

Data Labels are on top on a Graph.

Its formatting includes the following customizable elements:

- Visibility
- Fill color (set by *Chart Theme*)
- Line color, width and stroke style (set by *Chart Theme*)
- Text color, font size and rotation (set by *Chart Theme*)
- Data Label Position (set in properties)
- Drop Line to Data Marker. The Data Label's box is connected with a Data Marker by line.
- Draw Data Label Border Box. If this option is turned off, the border around Data Label content is not drawn and the bounding rectangle is not filled.



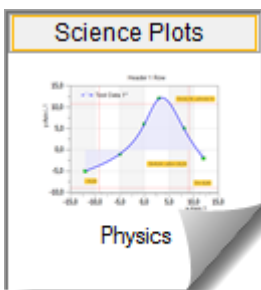
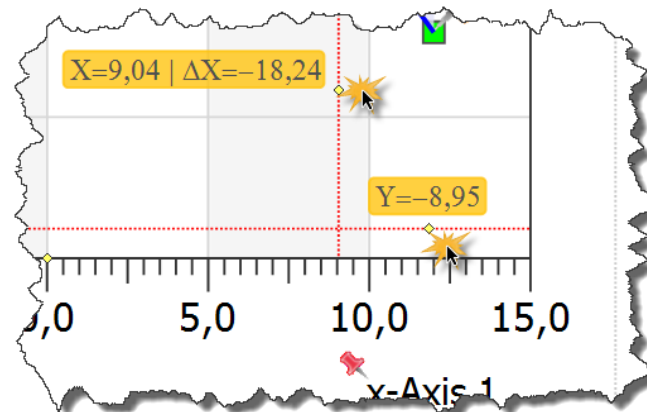
The Data Label position is defined by an angle and distance from Data Marker.

Set the corresponding parameter of the *Data Labels* in the *Chart Properties*.

Hint:

In addition to this, please have a look on chapter 13.4.16.

8.12 Cursors



Let's have a look to the thumbnail window with the name *Science Plots*. There are the native 2D charts, which have been optimized over time for both functionality as well as performance.

The topmost is the **Physics** Cartesian Coordinate System (see left picture). The **Physics** Chart has been optimized with the most advanced functions, especially the cursor functions.

→ Cursors are only inside the *Physics Charts*!

→ *The other charts have tooltips, only.*

8.12.1 Position Cursor Marking Lines

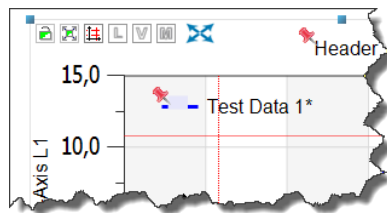
You can position the horizontal and vertical marker lines only in the *Physics Coordinate System*. The marker lines are provided with a label indicating the respective X and Y value. This setting is stored in the evaluation. The marking lines can be moved using its **yellow rhombus handles**.

The marking lines can be shown like this:

■ Procedure:

1. Choose a chart.
 - ↳ On top of the chart a Toolbar³ appears.

³ Use the Pulldownmenu "View | Chart Icons" to make this toolbar visible or invisible.



2. Click on the symbol "Show Cursor Lines"



↳ On each side of the chart appearing yellow dots (handles).

3. Click on one of the yellow dots and slide it down on the chart.

↳ The tag line is getting visible and it appearing labels on the handles. The respective X and Y value of the line is displayed.

8.12.2 Show Additional Cursor Legend

You can display an additional legend at the left edge of the diagram. That shows the name of a graph or trend curve. It displays the name of the (trend) graph, selected by the *Chart Explorer*.

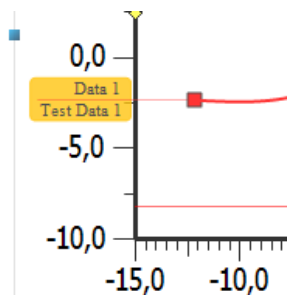


Fig.8-10: Additional Legend appears.

■ Procedure:

1. Select a chart.

↳ On top of the chart, a toolbar is displayed.



2. Click on the symbol "Show Graph Legend".



↳ The Legend appears next to the Y-axis.

It shows the name of the currently selected curve (the active one).

8.12.3 Show Cursor Label and Position

You can display additional labels to the active graph or to all graphs. The labels indicate the value of the curve at the cursor position.

The labels can be positioned on the right side or can be distributed over the whole chart.

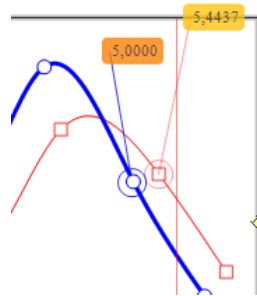


Fig.8-11: Additional distributed Labelling

When you move the line of the right label, then the text label jumps to the next marker.

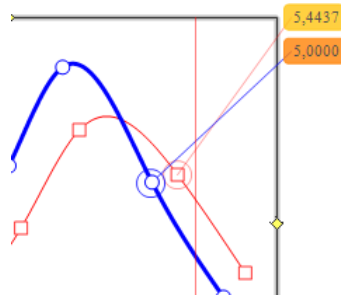


Fig.8-12: Additional label positioned flush right.

Clicking with the left mouse button on a label, so that this graph is getting the active graph (or remains the one).

Procedure:

1. Select a Chart.
 - ↳ On top of the chart, a toolbar is displayed.



2. To show or hide a label for one or all graphs, do one of the following.

▶ **Label to one graph**

- Click on the Symbol "Show active Graph Label".



↳ The active label is displayed.

▶ **Label to all Graphs**

- Click on the Symbol "Show active Graph Label" and press Control key



↳ All the labels are displayed in the chart.



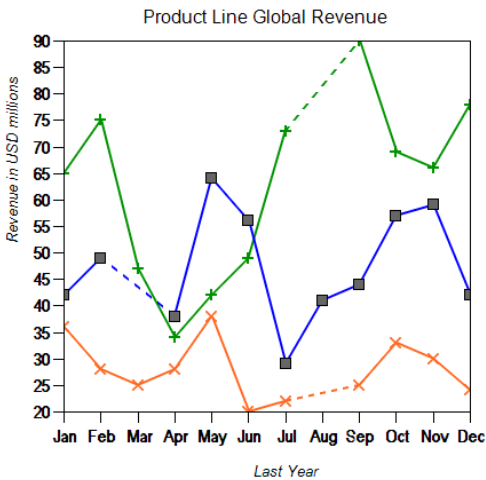
3. To distribute the labels inside the chart, click on the symbol "Move Graph Labels".

8.13 Missing Values

A so called *Missing Value* or *Missing Data Point* is marked with a question mark (?) in *SimplexNumerica*. The data point can be set as such in the *GraphTable*.

Hint to Files from older Program-Versions:

If you will see in your tabble a huge value in a cell, then maybe this is the referecevalue behind the question mark. Change that value in a question mark.

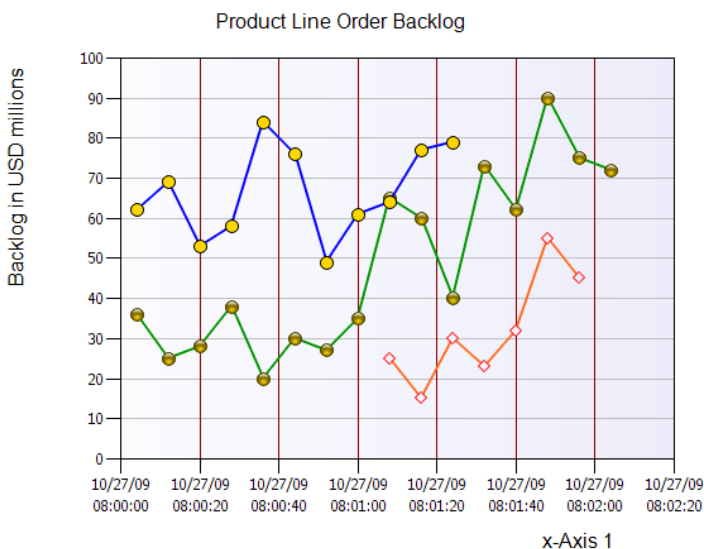
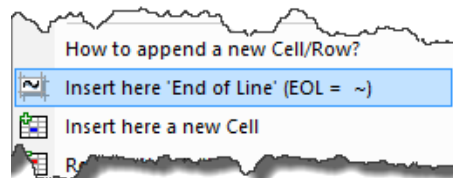


View	Graph 1 SampleData		Graph 2 SampleData		Graph 3 SampleData	
Legend	G0.x	G0.y	G1.x	G1.y	G2.x	G2.y
Jan	1,000	42,000	1,000	65,000	1,000	36,000
Feb	2,000	49,000	2,000	75,000	2,000	28,000
Mar	3,000	?	3,000	47,000	3,000	25,000
Apr	4,000	38,000	4,000	34,000	4,000	28,000
May	5,000	64,000	5,000	42,000	5,000	38,000
Jun	6,000	56,000	6,000	49,000	6,000	20,000
Jul	7,000	29,000	7,000	73,000	7,000	22,000
Aug	8,000	41,000	8,000	?	8,000	?
Sep	9,000	44,000	9,000	90,000	9,000	25,000
Oct	10,000	57,000	10,000	69,000	10,000	33,000
Nov	11,000	59,000	11,000	66,000	11,000	30,000
Dec	12,000	42,000	12,000	78,000	12,000	24,000

Some charts shown an interrupted graph line (like above) to exhibit the missing ones.

8.14 Uneven Data Points

That means graph columns with different numbers of data points.



2 data	Graph 3 SampleData	
G1.y	G2.x	G2.y
36,000	27.10.2009 08	25,000
25,000	27.10.2009 08	15,000
28,000	27.10.2009 08	30,000
38,000	27.10.2009 08	23,000
20,000	27.10.2009 08	32,000
30,000	27.10.2009 08	55,000
27,000	27.10.2009 08	45,000
35,000	~	~
65,000	~	~
60,000	~	~

Use the character ~ to mark the end of the graph data column.

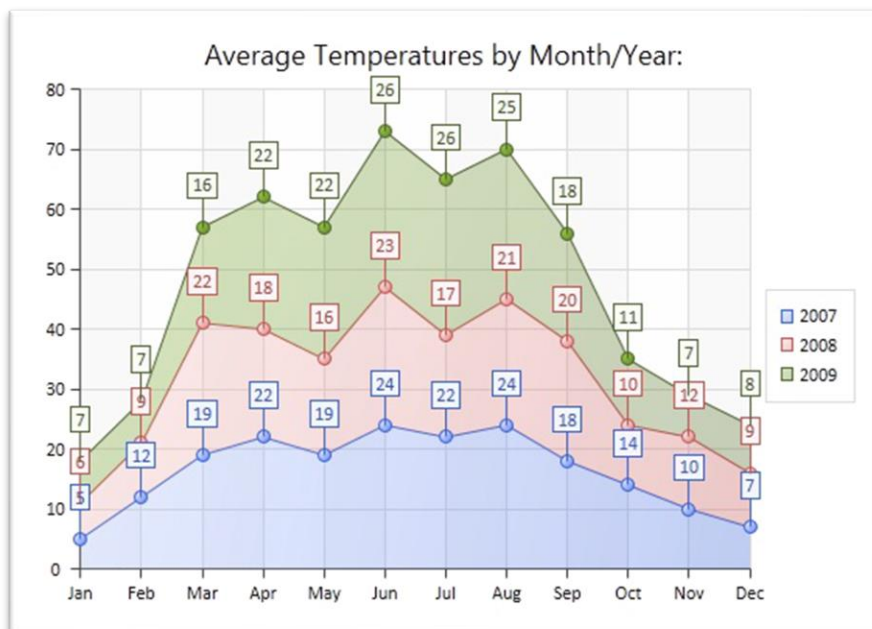
→ You can set that character everywhere.

→ Please have a look at chapter 12.11.6.

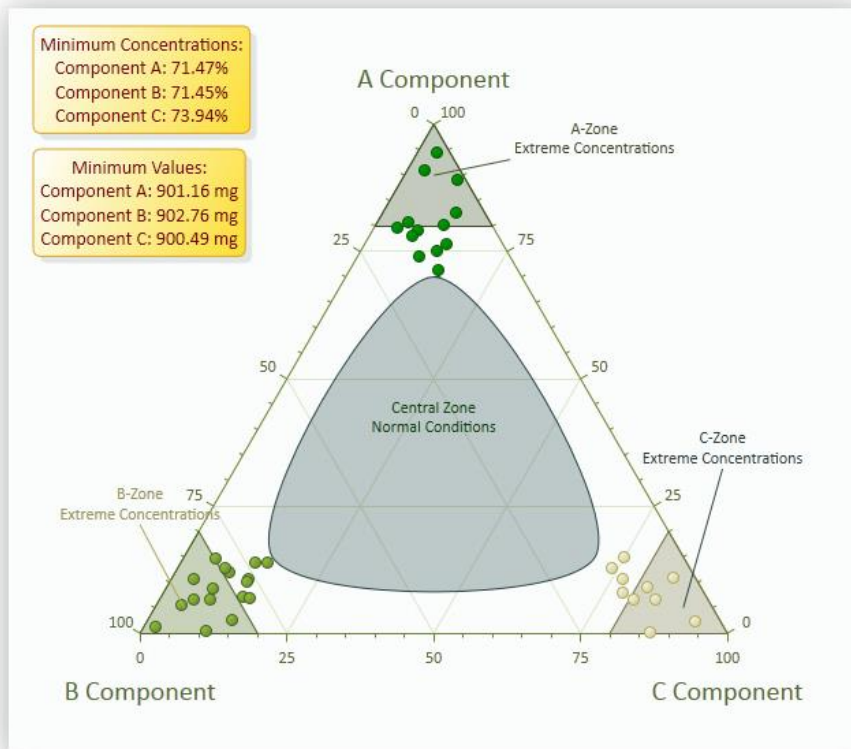
9 Chart Types

Next chapters are only an extract from the huge diversity of the *SimplexNumerica* chart gallery (see Thumbnail-Window)!

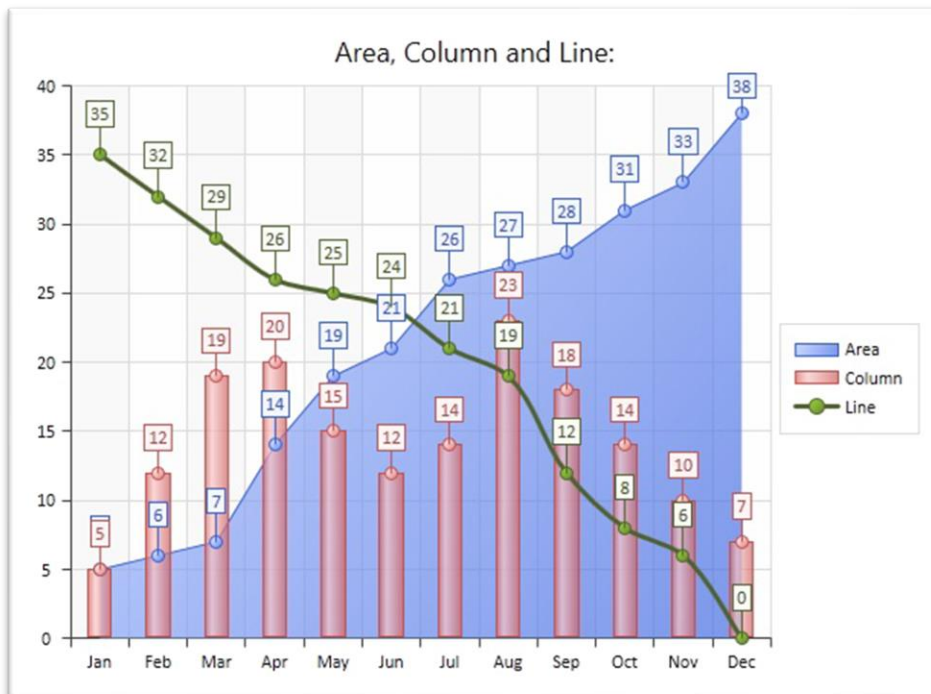
9.1 2D Business Charts



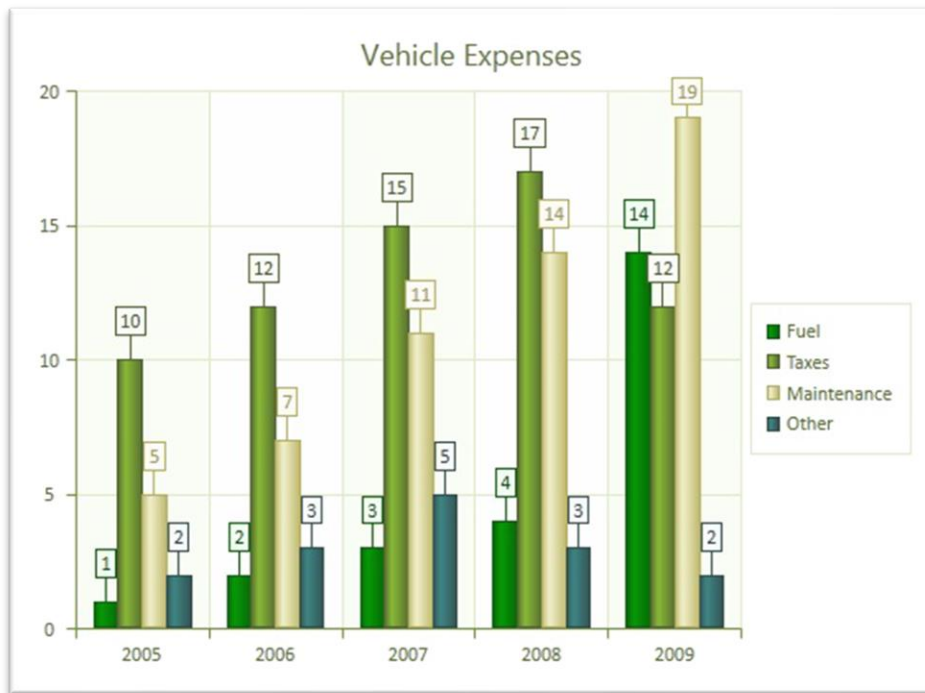
2D Area Chart



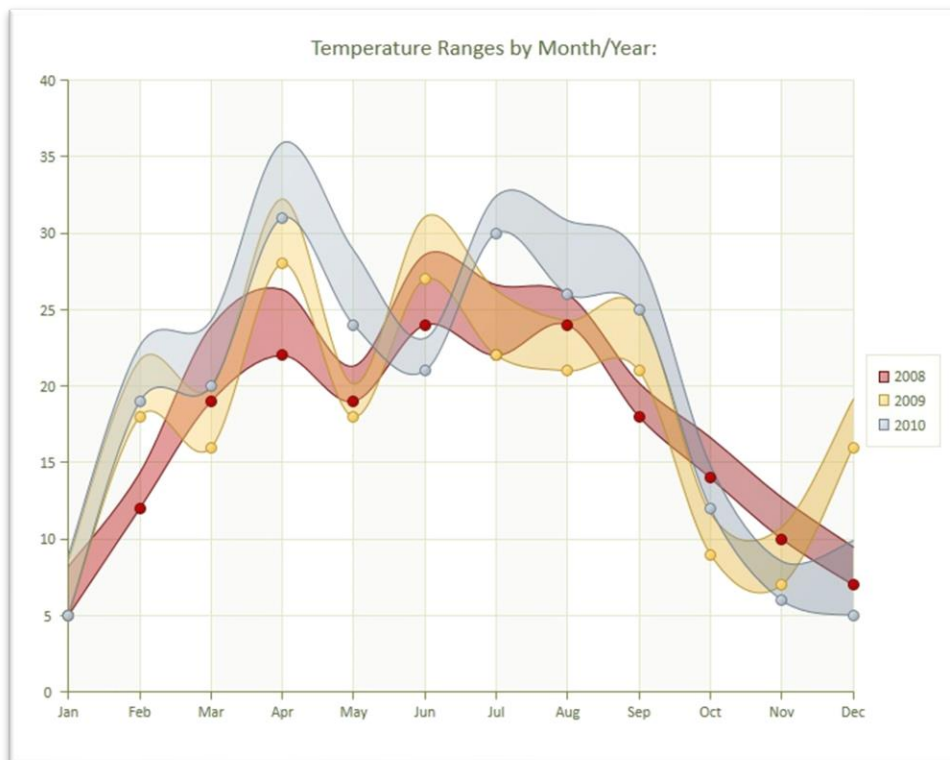
Ternary Chart (Triplot)



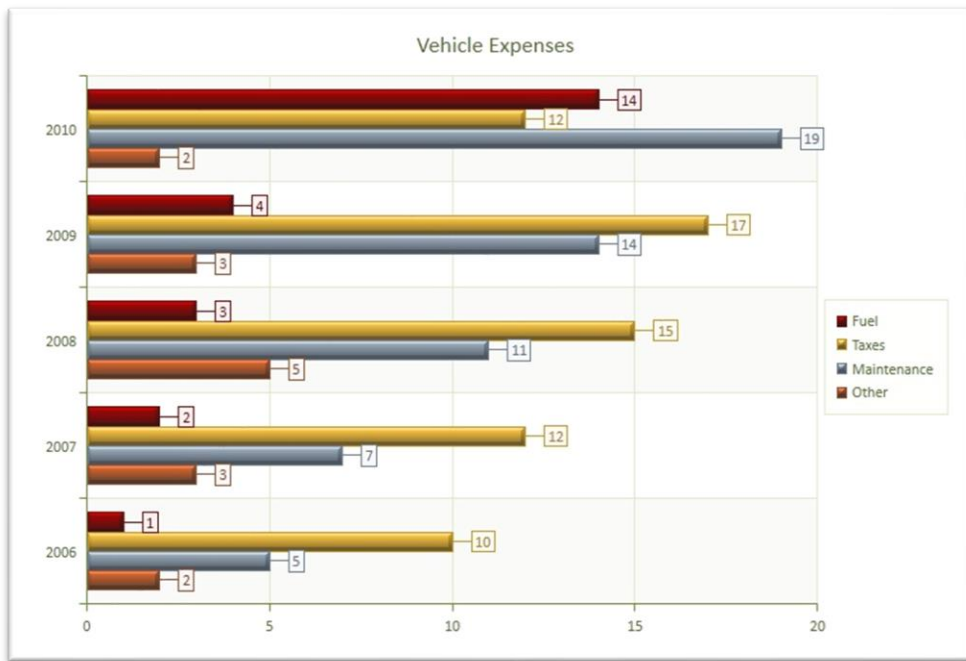
2D Combined Chart



2D Business Bar Chart



2D Range Area Plot with the help of the z-Axis



2D Horizontal Clustered Bar

9.2 What are Business Charts?

What are Business Charts? I do not know whether this is a fix term. In *SimplexNumerica* it is simply a chart without to use the x-columns. Instead it used the (left) Legend column from the *GraphTable*. Here an example:

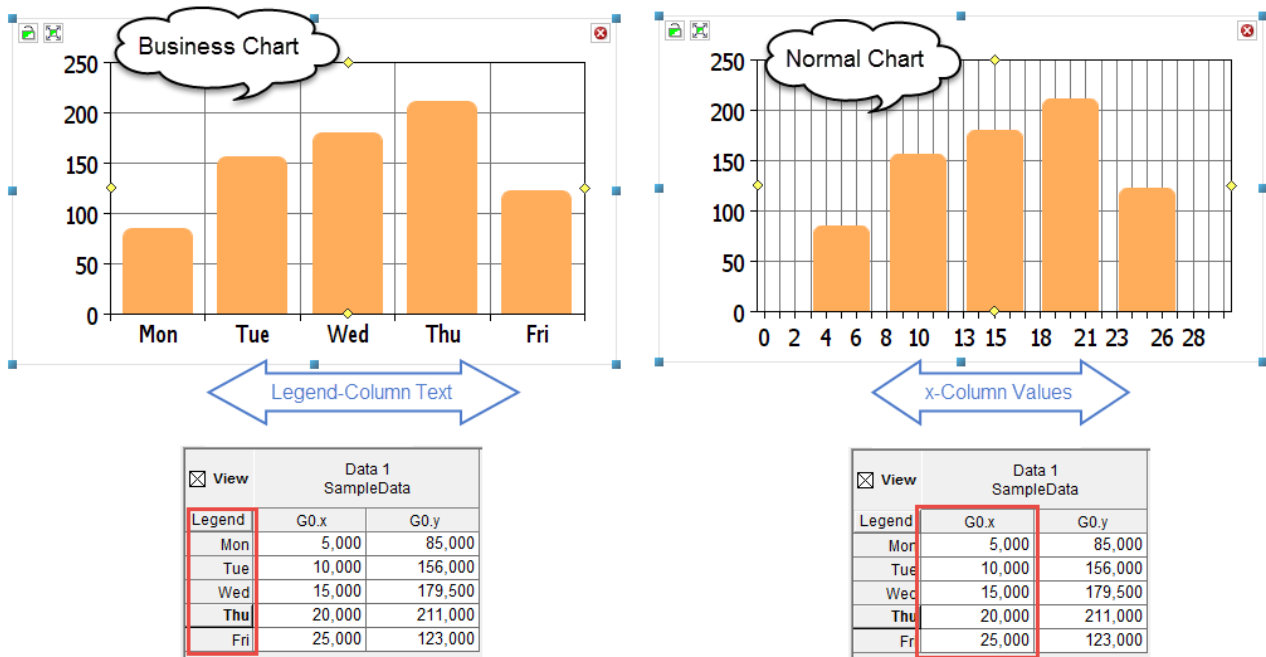
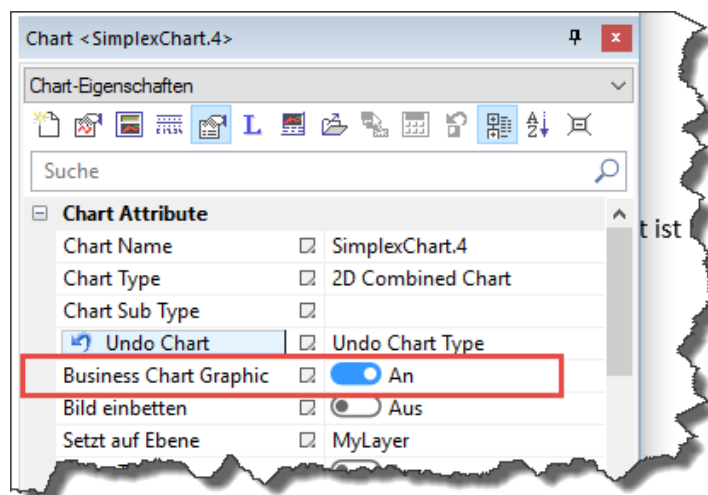


Fig.9-1: Business and Normal Chart

Please use the chart properties to set a diagram to a *Business Chart* so that *SimplexNumerica* can use its *Business Graphic* routines.



→ Set item *Business Chart Graphic* to **On**: Business Chart

→ Set item *Business Chart Graphic* to **Off**: Normal Chart

9.3 3D Business Charts

Since *SimplexNumerica V12* many new charts were implemented. In particular, the *BCGControlBarPro* chart library with its Business Charts in 2D and real 3D form is worth mentioning.

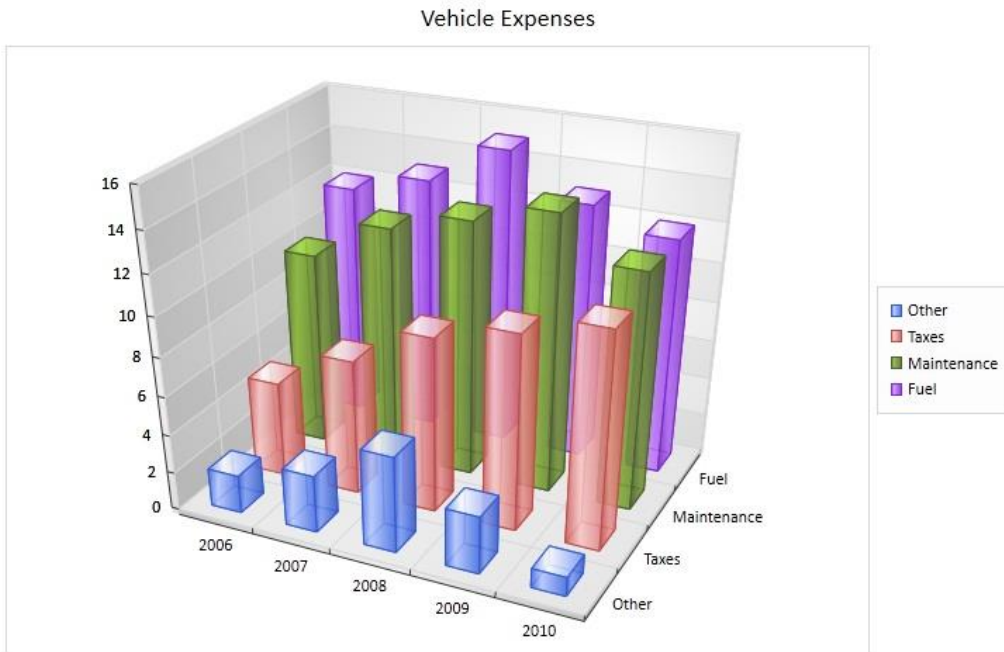


Fig.9-2: Manhattan Bar Chart

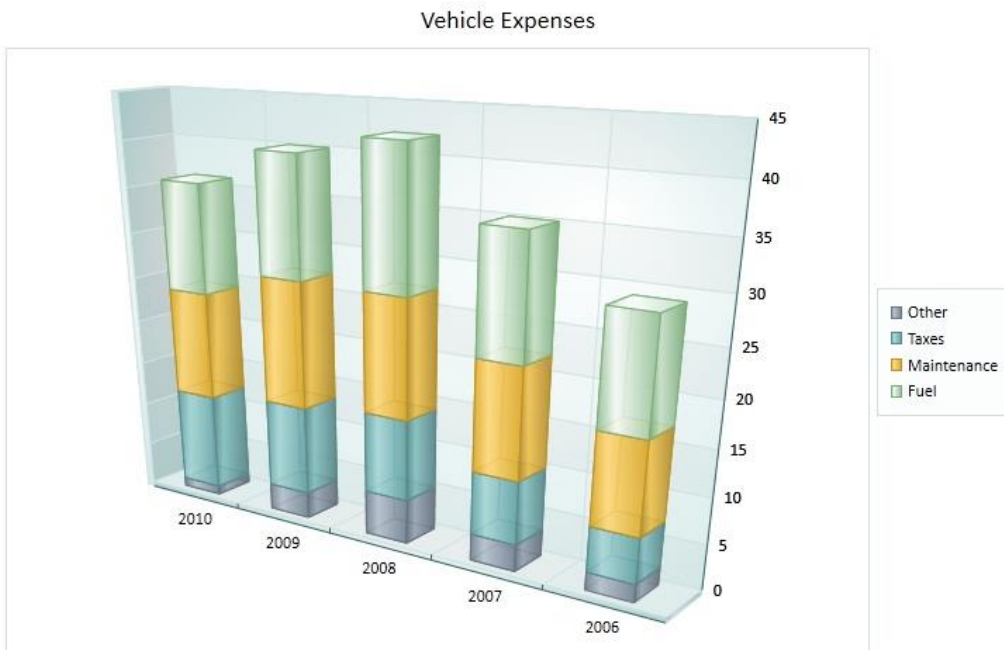


Fig.9-3: Stacked Column Chart



Fig.9-4: Horizontal Stacked Bar Chart



Fig.9-5: Horizontal Manhattan Bar Chart

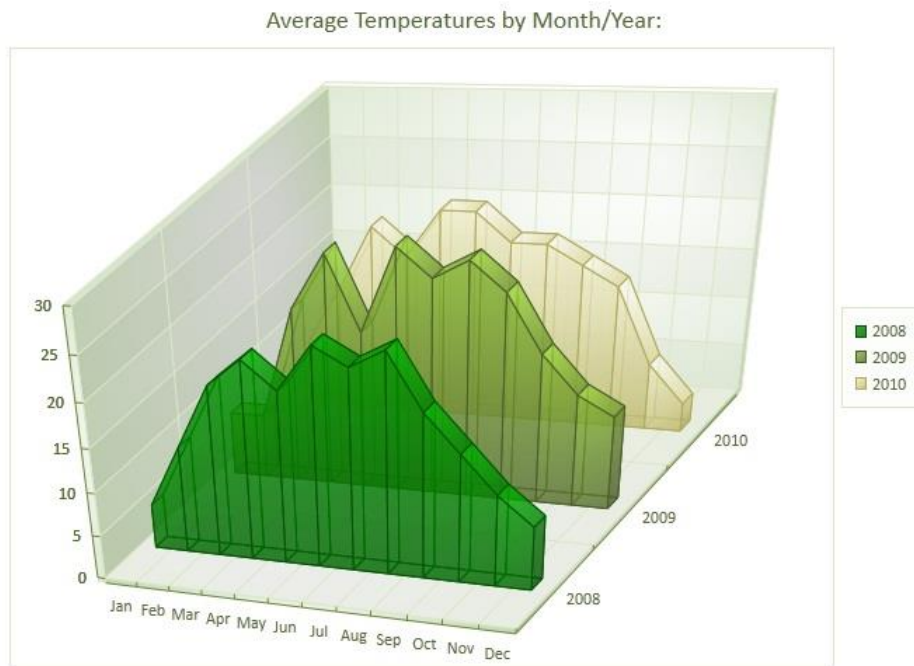


Fig.9-6: 3D Area Chart

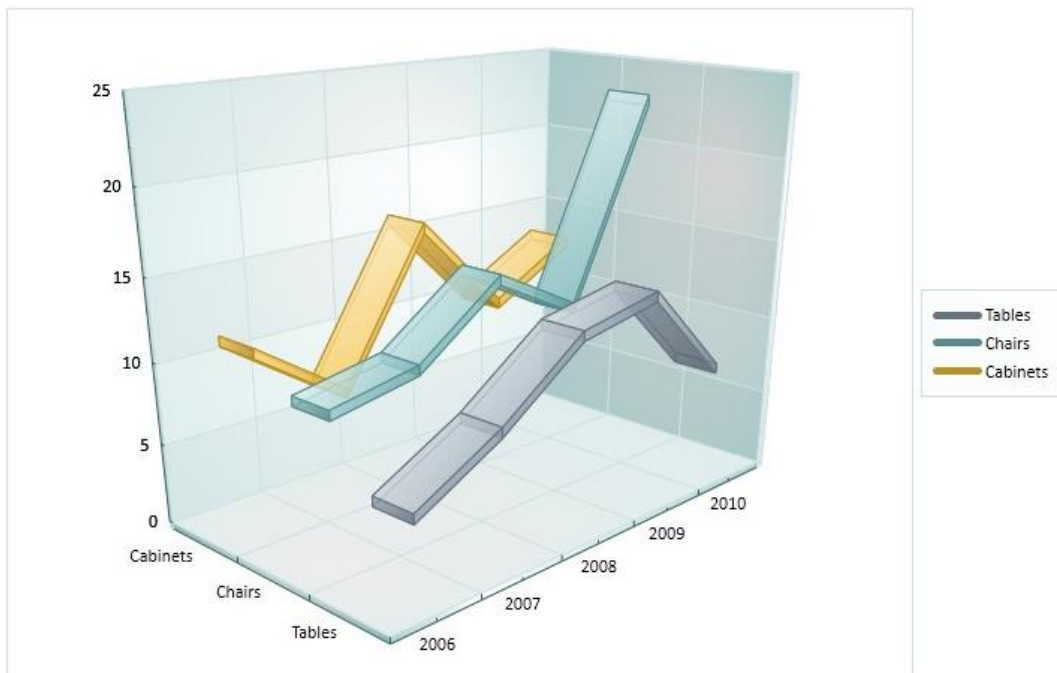


Fig.9-7: 3D Line Chart

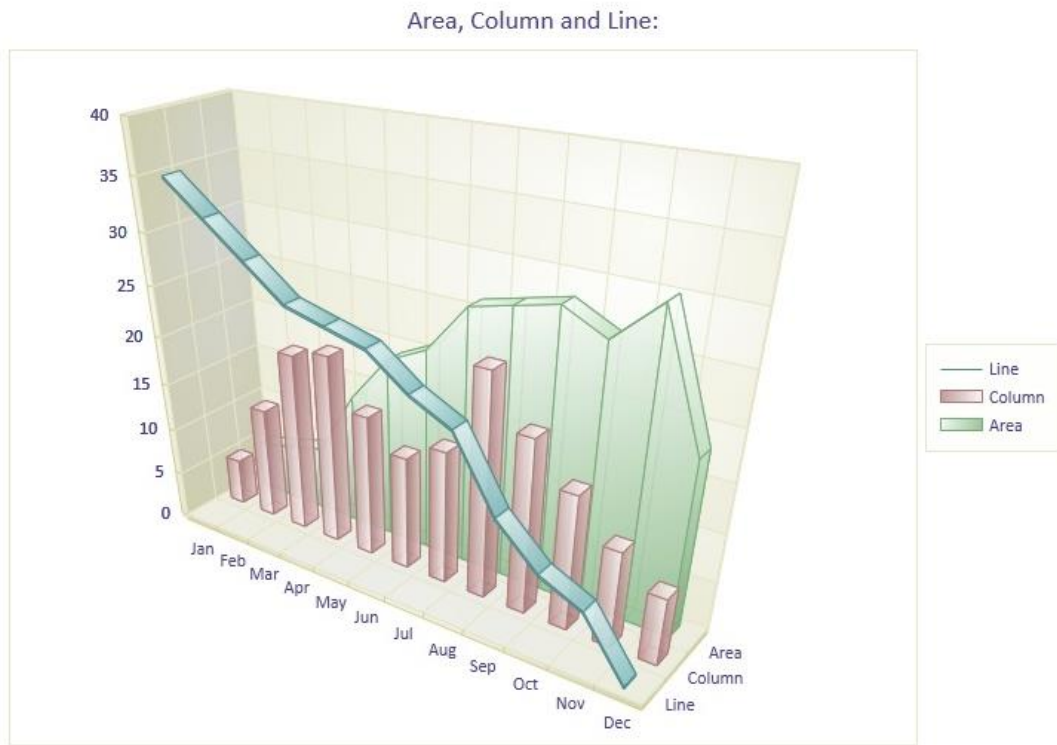


Fig.9-8: 3D Combined Chart

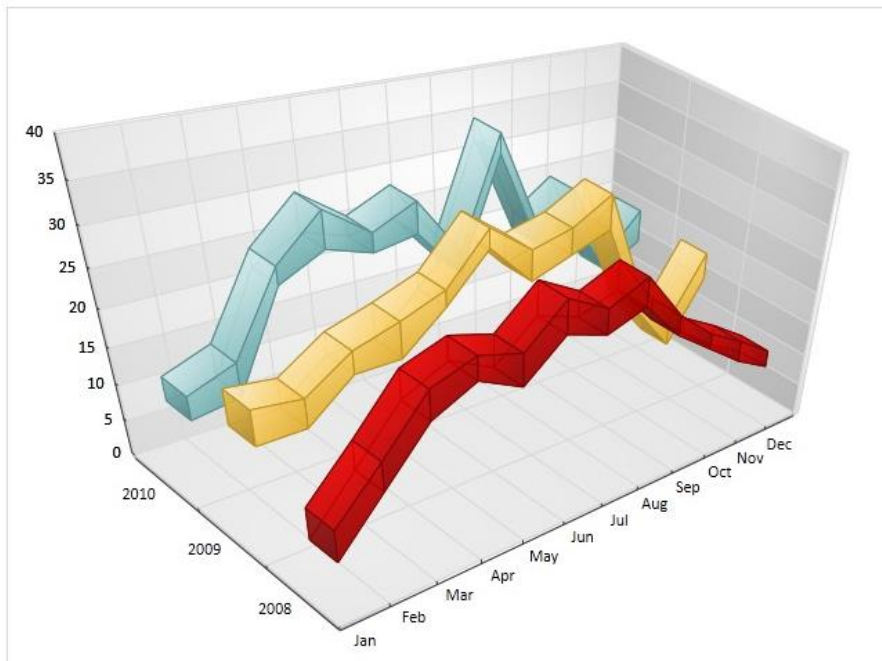
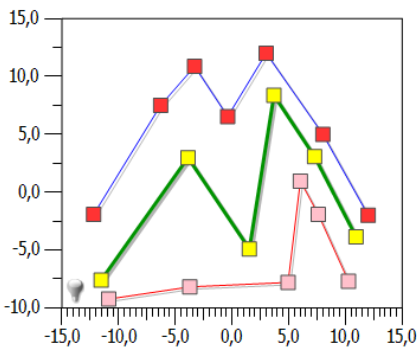


Fig.9-9: Range Area in 3D

9.4 Physics Cartesian Coordinate System



The in *SimplexNumerica* so called *Physics Chart* is a Cartesian Coordinate System. It shows you a chart with classic axes. It is divided into the following axes types:

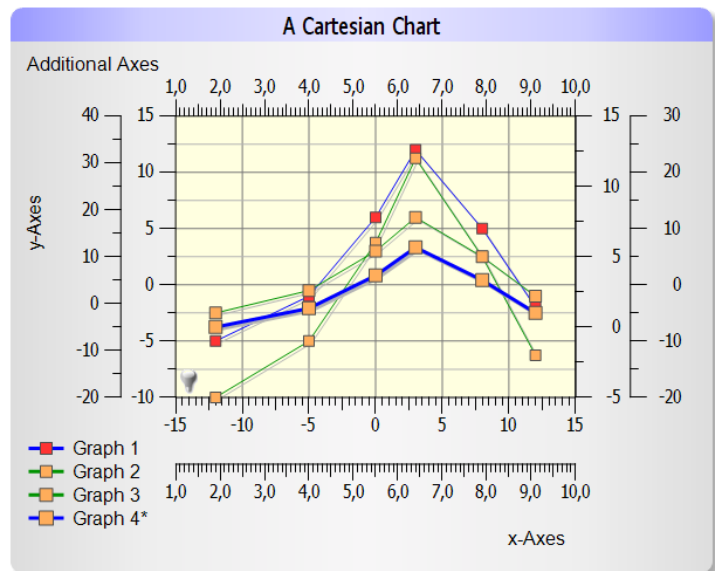
- x-linear/y-linear
- x-logarithmically/y-logarithmically
- x-linear/y-logarithmically
- x-logarithmically/y-linear

Hint:

To get more information, please have a look at chapter 0

In addition, the following axes can be displayed:

- 2D Bottom x-Axis {Abcissa}
- 2D Left y-Axis {Ordinate}
- 2D Bottom x- & Left y-Axis
- 2D Top x-Axis {Abcissa}
- 2D Right y-Axis {Ordinate}
- 2D Apart Bottom x-Axis {Abcissa}
- 2D Apart Left y-Axis {Ordinate}
- 2D Apart Right y-Axis {Ordinate}



The classic axes types are used to plot data along the scaled vertical and horizontal axes. Sometimes they are called Scatterplot. The Scatterplot ordered pairs of data values against appropriately scaled x and y-axes. The data from one or more records are plotted as a series (in *SimplexNumerica* called Graph).

Info:

Series = Graph in *SimplexNumerica*

In *SimplexNumerica*, there are special *Business Diagrams* only for y-axes columns.

A Contour Plot or a Contour Map like the next figure use the *Cartesian axes* with color shading.

The axes can be automatically scaled with the *AutoScale* function to fit the data values on the coordinate system. The axes limits can be set to specific values in the properties window. In addition, the appearance of

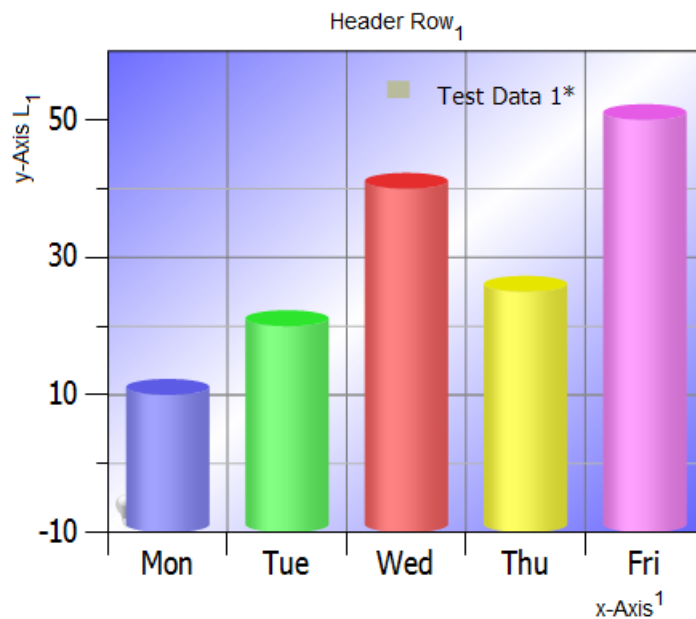
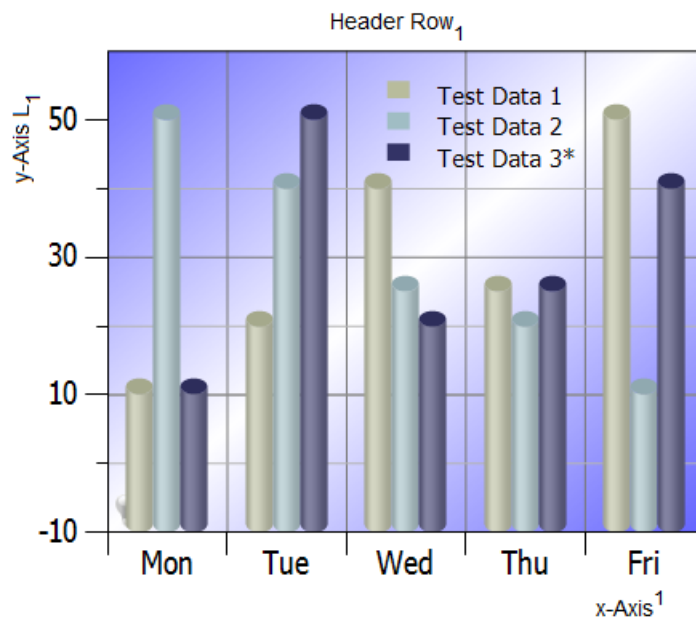
Chart Types

the axes can be modified using properties. All axes can completely set to hidden by setting this in the properties.

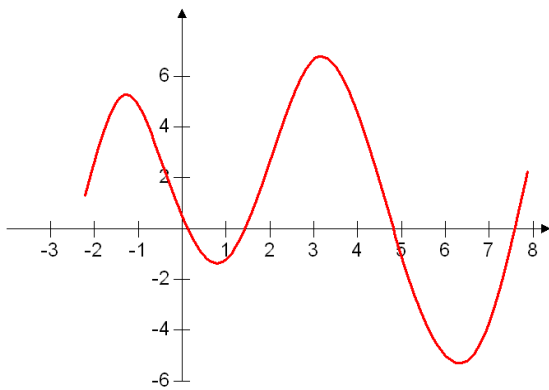
The Line graph draws a line connecting the data points of a *SampleData* record in form of a polyline curve, or polygon to a closed curve. The data points can be optionally covered by marker or point objects.

Also *Vertical Bar Graphs* belonging to the physical charts. Their axes types are used to plot data values as bars, which extend vertically. The bars are spaced evenly across the horizontal axis.

You can show also an isographic pseudo three-dimensional look to the bars in the 2D-Window like these two *Business Charts*:



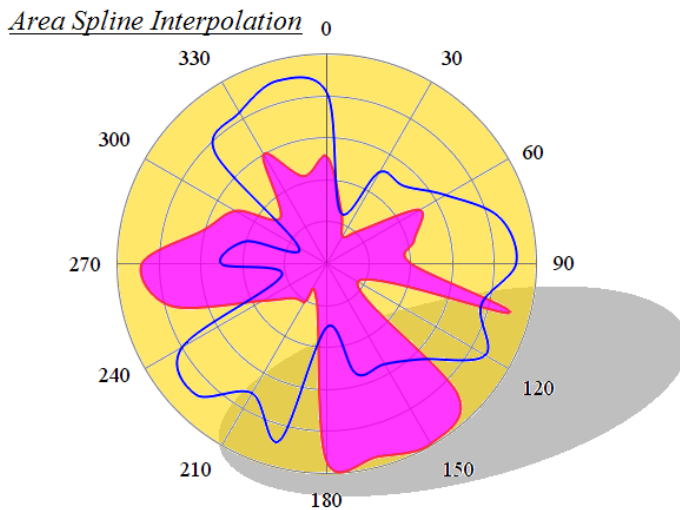
9.5 Math Chart (Mathematical Chart)



A *Mathematical Chart* is also based on a Cartesian-coordinate-system. In distinction to the *Physics Chart*, the axes cross go always through the zero point.

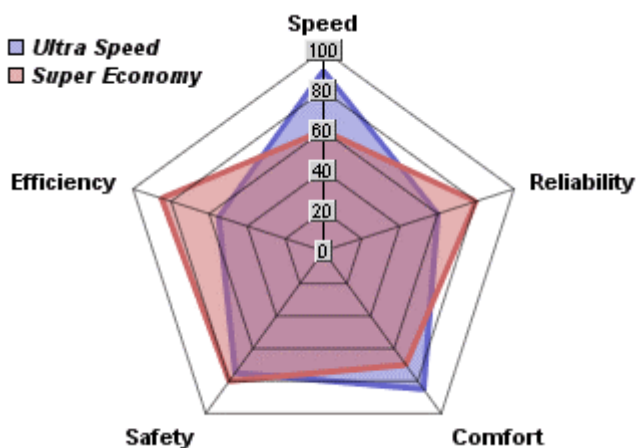
Some graphical and interactive functions are not supported for this chart. For manipulation of a chart use the *Physics Chart* and afterwards go back to this one.

9.6 Polar Chart



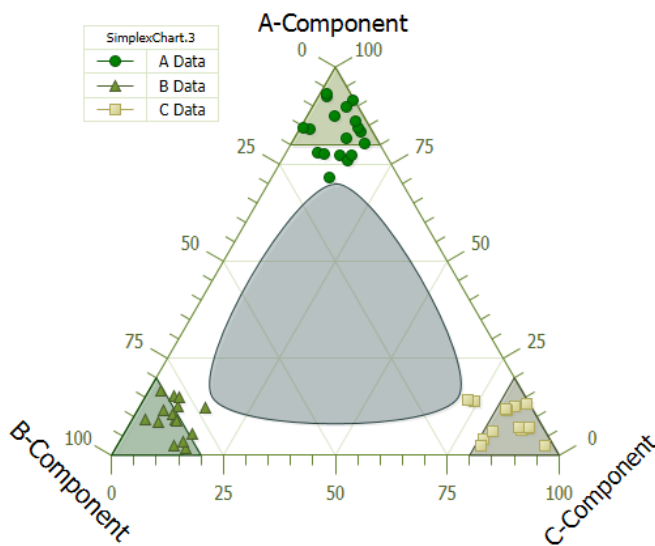
The Polar Chart is a special form of the mathematical coordinate system. The Polar chart type is a circular graph on which data points are displayed using the angle, and the distance from the center point. The X-axis is located on the boundaries of the circle and the Y-axis connects the center of the circle with the X-axis.

9.7 Radar Chart



A radar chart is a graphical method of displaying multivariate data in the form of a two-dimensional chart of three or more quantitative variables, represented on axes starting from the same point. The relative position and angle of the axes is typically uninformative.

9.8 Ternary Chart (Triplot)



The *Ternary Chart* is e.g. used if one has a mixture of three chemical components and likes to see the coherencies in only two dimensions.

A *Ternary Chart* can be called Triplot; it is a triangular coordinate system, in which three different axes are available. These axes are however not completely independent from each other. The following relation applies to it (with format of numbers in percent):

1. If the third axes are given, then the sum of the 3 axes corresponds to 100%
2. If only 2 axes are given, then results the third from $x_C = 100 - x_A - x_B$

In the properties you can set the specific parameter of a Ternary Chart.

To Pt. 1:

SimplexNumerica calculates the sum and divides these afterwards by 100 from the 3 columns:

$$\text{Value\%} = \{ \text{Column1}(i) + \text{Column2}(i) + \text{Column3}(i) \} / 100$$

Then each column is set to:

$$\text{Column 1 \% (i)} = \text{Column 1 (i)} / \text{Value\%}$$

$$\text{Column 2 \% (i)} = \text{Column 2 (i)} / \text{Value\%}$$

$$\text{Column 3 \% (i)} = \text{Column 3 (i)} / \text{Value\%}$$

To Pt. 2:

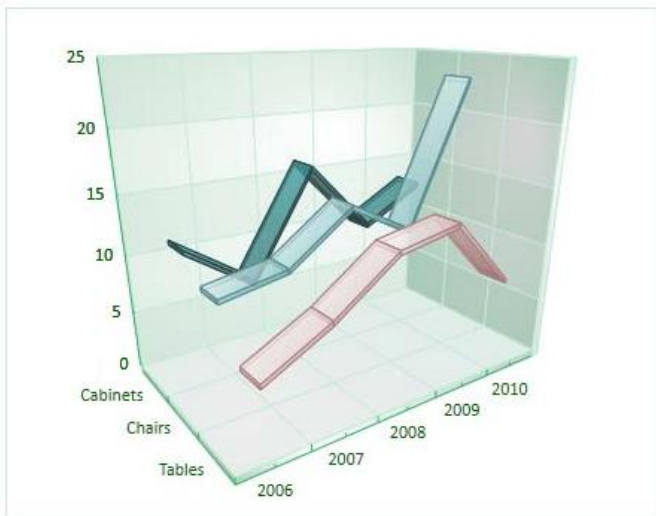
SimplexNumerica calculates the third column and from 2 columns:

$$\text{Column 3 (i)} = 1 - \text{Column 2 (i)} - \text{Column 1 (i)}$$

To Pt. 1 and 2:

- Column 1 is equal to x-Axis.
- Column 2 is equal to y-Axis.
- Column 3 is equal to z-Axis.

9.9 Line Chart



A *Line Chart* has the following features:

- 2D and 3D modes
- Simple Line
- Stacked Line
- 100% Stacked Line
- Stacked groups
- Curve Lines
- Step Line
- Reversed Step Line
- Auto Coloring of individual lines
- Closed Shape with fill
- Theme Support

Fig.9-10: 3D Line Chart

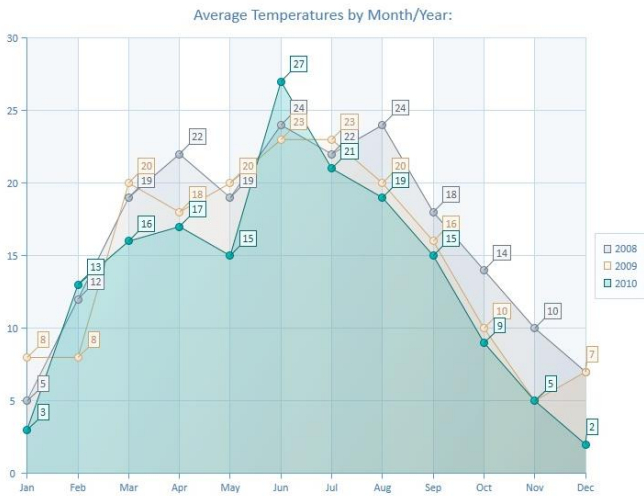


Fig.9-11: Step Line Chart

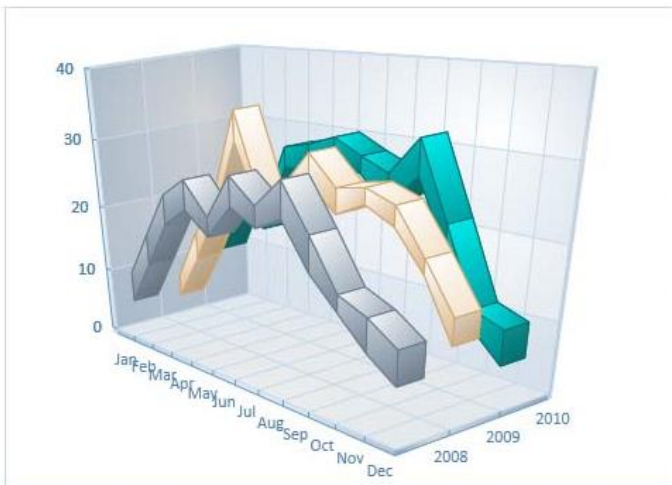


Fig.9-12: Stacked Line Chart

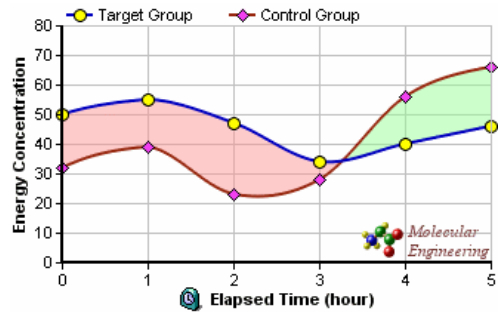
9.10 Area Chart



to indicate volume. When multiple attributes are included, the first attribute is plotted as a line with color fill followed by the second attribute, and so on.



An Area Chart or area graph displays graphically quantitative data. It is based on the line chart. The area between axis and line are commonly emphasized with colors, textures and hatchings. Commonly one compares with an area chart two or more quantities. Area charts are used to represent cumulated totals using numbers or percentages (stacked area charts in this case) over time. Use the area chart for showing trends over time among related attributes. The area chart is like the plot chart except that the area below the plotted line is filled in with color



An Area Chart has the following features:

- 2D and 3D modes
- Simple Area
- Stacked Area
- 100% Staked Area
- Range Area
- Stacked Groups
- Curve Area
- Auto Coloring of individual Data Markers
- Area Origin (area base line differs from zero)
- Theme Support

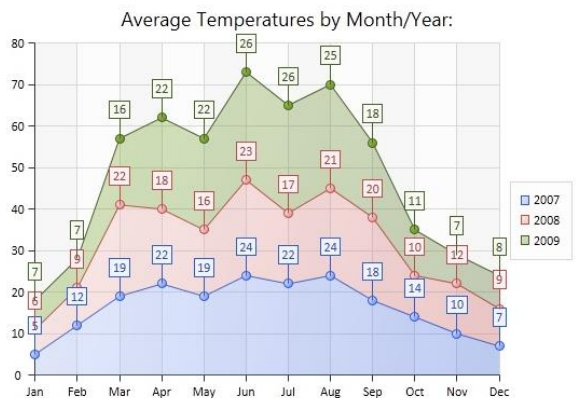
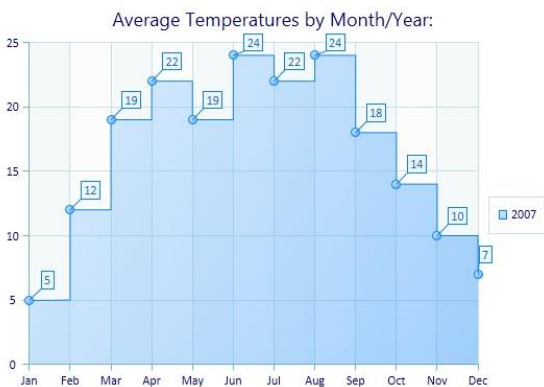
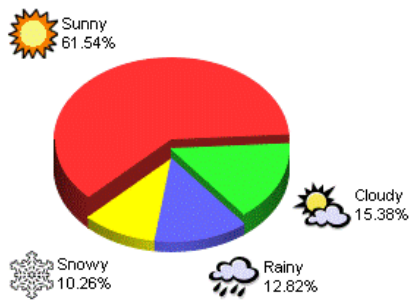


Fig.9-13: Different Area Charts

9.11 Pie Chart



A *Pie Chart* (Circle, Doughnut or Torus Charts) is a circular statistical graphic, which is divided into slices to illustrate numerical proportion.

In a *Pie Chart*, the arc length of each slice is proportional to the quantity it represents. While it is named for its resemblance to a pie that has been sliced, there are variations on the way it can be presented.

Pie Charts have the following features:

- Chart rotation (ability to specify starting position of the first pie in 0-360 degrees range)
- Pie explosion
- Individual explosion for each Data Point
- Customizable height of pie (for 3D Charts)
- Customizable angle
- etc.

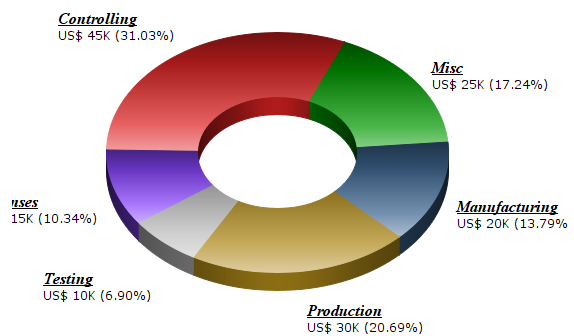
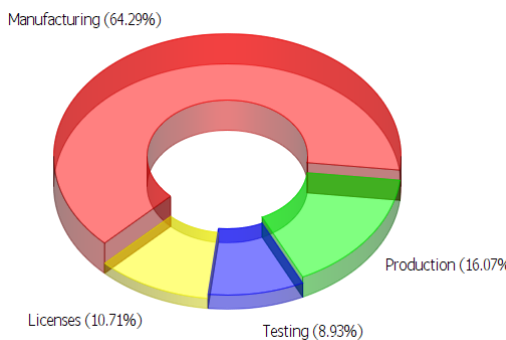
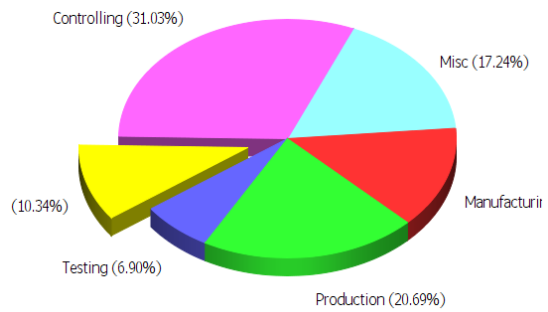
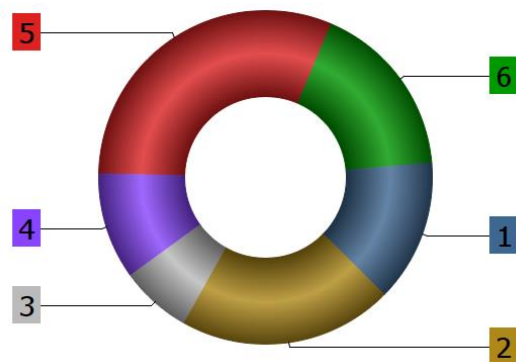
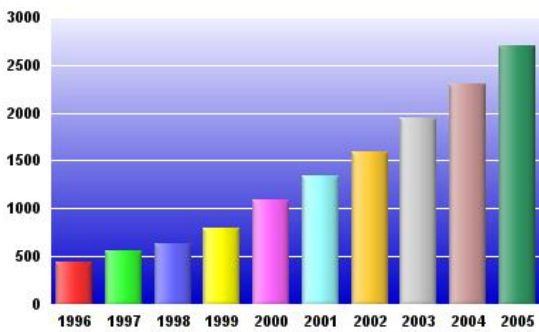


Fig.9-14: Different Pie Charts

9.12 Bar Chart



A Bar Chart or bar graph is a chart with rectangular bars with lengths proportional to the values that they represent. The bars can be plotted vertically or horizontally. A vertical bar chart is sometimes called a column bar chart.

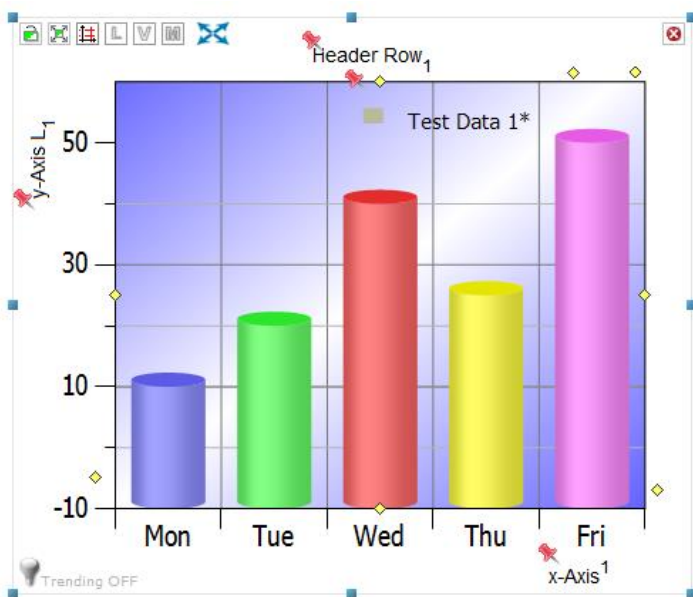
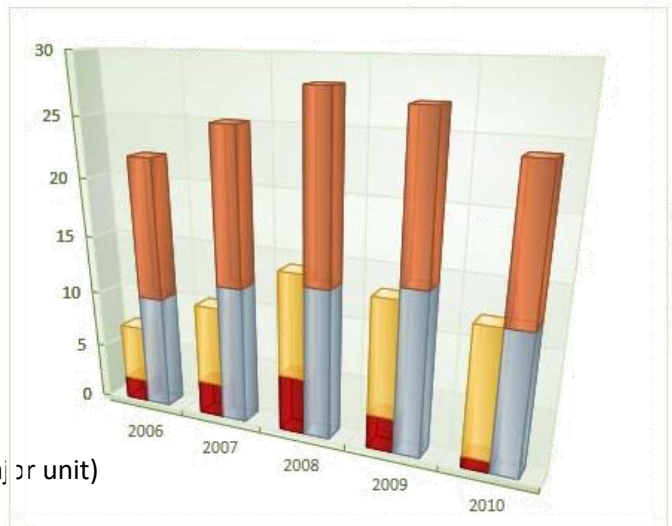
A Bar Graph is a chart that uses either horizontal or vertical bars to show comparisons among categories. One axis of the chart shows the specific categories being compared, and the other axis represents a discrete value. Some bar graphs present bars clustered in groups of more than one (grouped bar graphs), and others show the bars divided into subparts to show cumulative effect (stacked bar graphs).

Bar Charts have many advanced variations:

- 2D and 3D modes (incl. **Manhattan Charts**)
- Simple Bar Chart
- Stacked Bar Chart
- 100% Stacked Bar Chart
- Range Bar Chart
- Side-by-side stacked (stack groups)
- Side-by-side 100% stacked (stack groups)

Settings

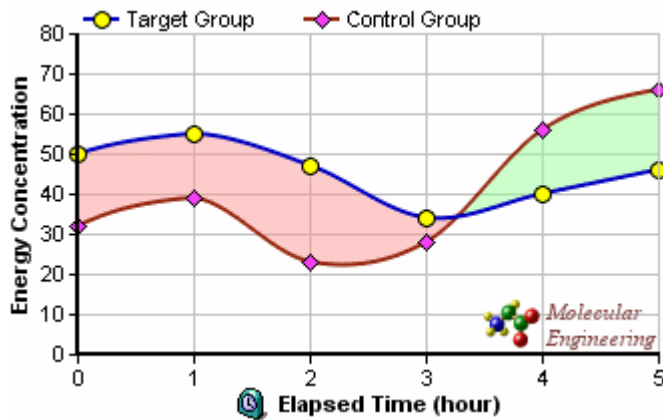
- Set the Column and Bar distance (specifies how the columns or bars fit the major unit)
- Column and Bar separation and overlap
- ...and much more properties to set...



Science Bar Chart

Fig.9-15: Different Bar Charts

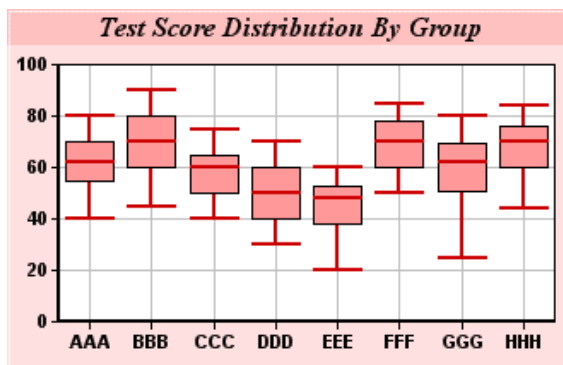
9.13 Trending Charts



A *Trending Chart* is a graphical representation of time series data (information in sequence over time) showing the trend line or curve that reveals a general pattern of change.

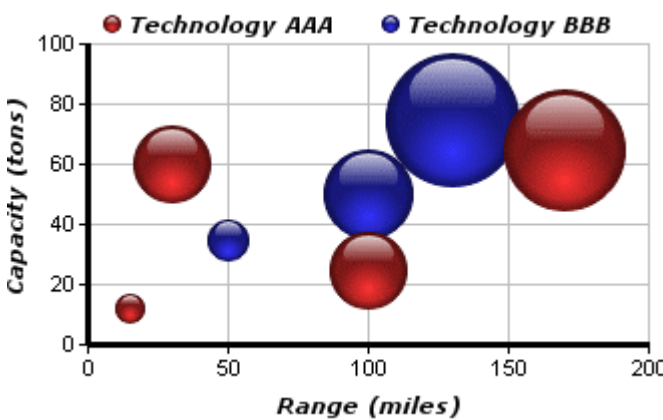
Fig.9-16: Trending Chart

9.14 Box-Whisker Charts



A *Box Plot* or *Boxplot* is a way of graphically depicting groups of numerical data through their quartiles. Box plots may also have lines extending vertically from the boxes (whiskers) indicating variability outside the upper and lower quartiles, hence the terms box-and-whisker plot and box-and-whisker diagram. Outliers may be plotted as individual points. Box plots are non-parametric: they display variation in samples of a statistical population without making any assumptions of the underlying statistical distribution. The spacings between the different parts of the box indicate the degree of dispersion (spread) and skewness in the data, and show outliers.

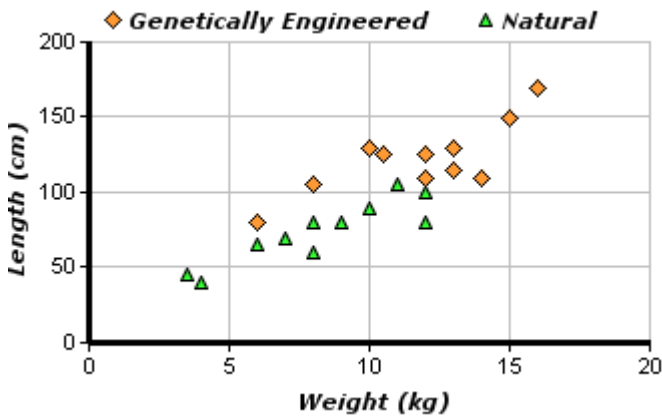
9.15 Bubble Charts



A *Bubble Chart* is a type of chart that displays three dimensions of data. Each entity with its triplet (v1, v2, v3) of associated data is plotted as a disk that expresses two of the v_i values through the disk's xy location and the third through its size. Bubble charts can facilitate the understanding of social, economic, medical, and other scientific relationships. Bubble charts can be considered a variation of the scatter plot, in which the data points are replaced with bubbles. This type of chart can be used instead of a Scatterplot if your data

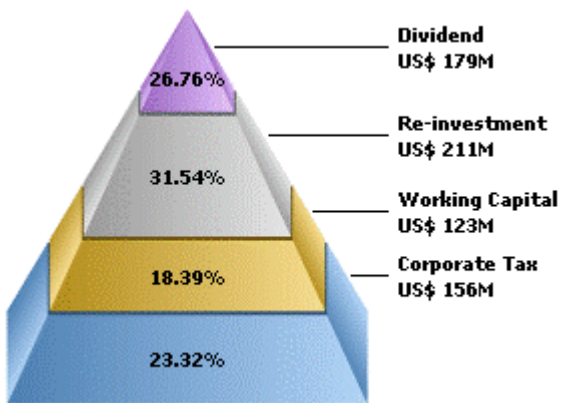
has three data series, each of which contains a set of values.

9.16 Scatterplots



A *Scatterplot* (or *Scatter Graph*) is a type of mathematical diagram using Cartesian coordinates to display values for two variables for a set of data. The data is displayed as a collection of points, each having the value of one variable determining the position on the horizontal axis and the value of the other variable determining the position on the vertical axis.

9.17 Pyramid, Cone & Funnel Charts



These charts are often used to represent stages in a sales process and show the amount of potential revenue for each stage. This type of chart can also be useful in identifying potential problem areas in an organization's sales processes. A funnel chart is similar to a stacked percent bar chart.

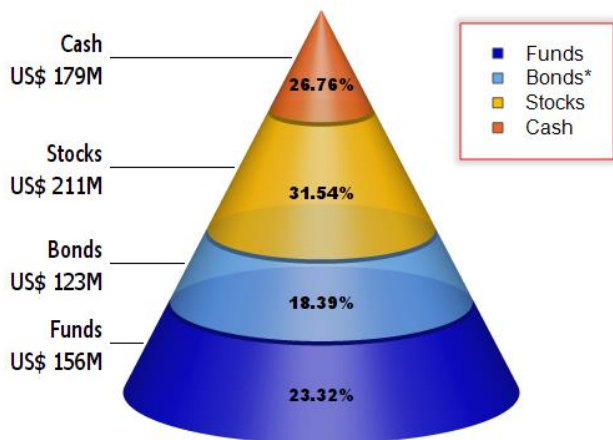
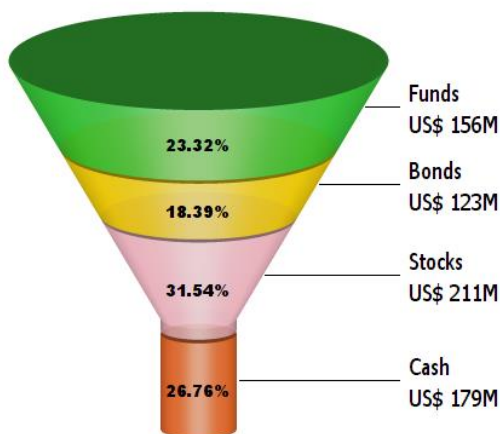
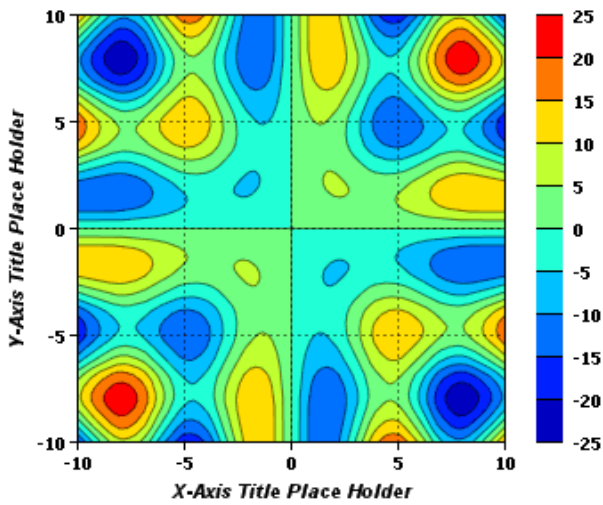


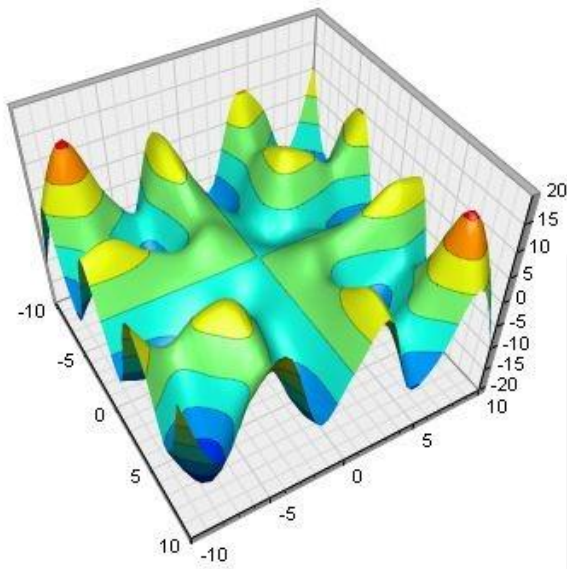
Fig.9-17: Pyramid, Cone & Funnel Charts

9.18 Contour Plots/Maps



A Contour Plot of a function of two variables is a curve along which the function has a constant value. It is a cross-section of the three-dimensional graph of the function $f(x, y)$ parallel to the x, y plane. In cartography, a contour joins points of equal elevation above a given level, such as mean sea level. A contour map is a map illustrated with contour lines, for example a topographic map, which thus shows valleys and hills, and the steepness of slopes. The contour interval of a contour map is the difference in elevation between successive contour lines.

9.19 Surface Plot



Surface Plots are used to visualize arbitrary rectangular grids of points in 3D space. Each element in the grid gets a point in 3D space assigned. In the simplest case, only the Z coordinates of the points are defined.

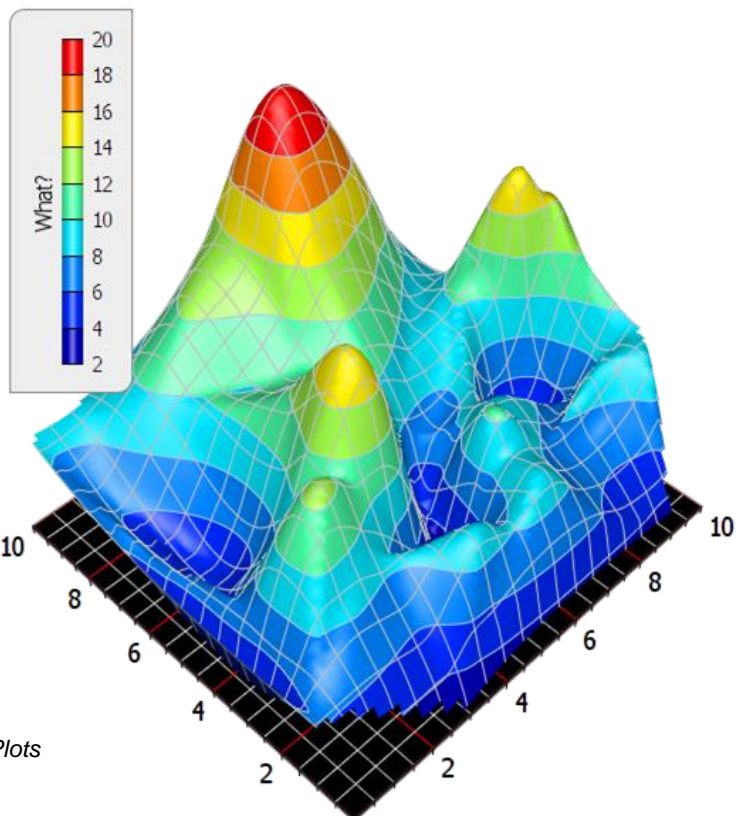


Fig.9-18: Surface Plots

9.20 Smith Diagram

In electro-technology, particularly in the high frequency and microwave engineering, the Smith diagram is very often used.

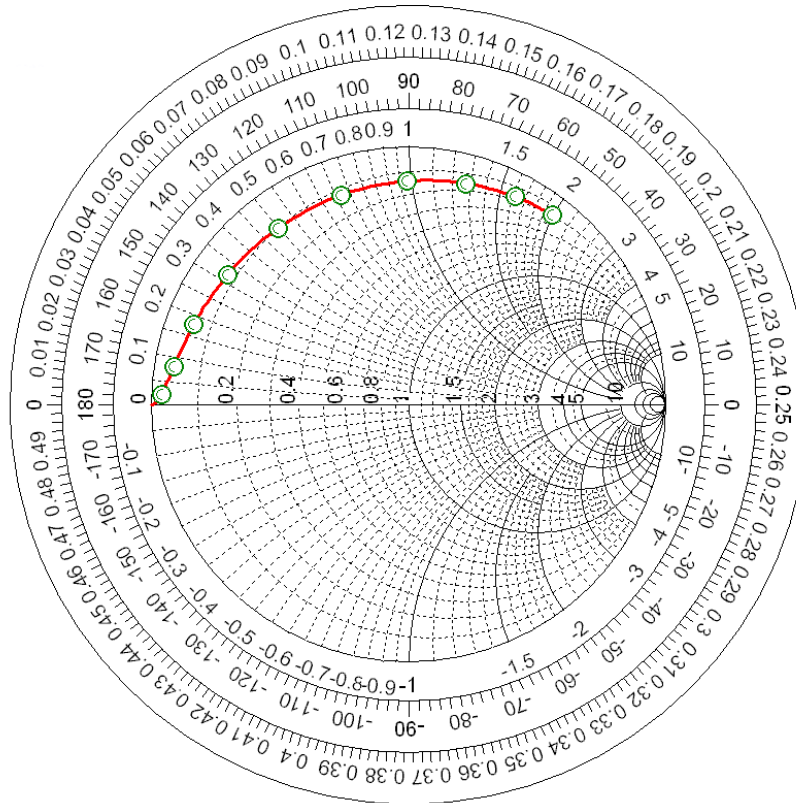


Fig.9-19: Smith Diagram

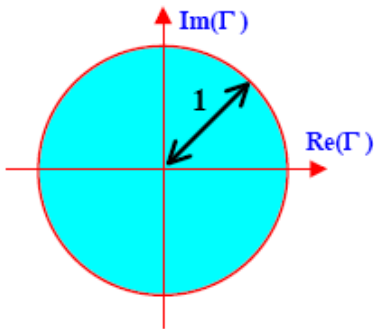
The Smith diagram is the result of the mapping of the right Gauss' number level into a circle area.

The input of the data is automatically standardized on the reference resistance (e.g. 50 ohms). Therefore, for the point (1,0) an input of $x = 50$ and $y = 0$ are necessary. The points are marked by the markers in the Smith diagram. The point (50,0) corresponds to the origin of the coordinate system in the w-level. They can represent all points of the right z-half plane in the Smith diagram.

The Smith diagram is one of the most useful graphical tools for high frequency circuit applications. The chart provides a clever way to visualize complex functions and it continues to endure popularity decades after its original conception.

Additional information can be found here: http://en.wikipedia.org/wiki/Smith_chart

Specific information follows next...



From a mathematical point of view, the Smith diagram is simply a representation of all possible complex impedances with respect to coordinates defined by the reflection coefficient.

The domain of definition of the reflection coefficient is a circle of radius 1 in the complex plane. This is also the domain of the Smith diagram.

The goal of the Smith diagram is to identify all possible impedances on the domain of existence of the reflection coefficient. To do so, we start from the general definition of line impedance (which is equally applicable to the load impedance)

$$Z(d) = \frac{V(d)}{I(d)} = Z_0 \frac{1 + \Gamma(d)}{1 - \Gamma(d)}$$

This provides the complex function

$$Z(d) = f\{\text{Re}(\Gamma), \text{Im}(\Gamma)\}$$

we want to graph. It is obvious that the result would be applicable only to lines with exactly characteristic impedance Z_0 .

In order to obtain universal curves, we introduce the concept of normalized impedance

$$z(d) = \frac{Z(d)}{Z_0} = \frac{1 + \Gamma(d)}{1 - \Gamma(d)}$$

The normalized impedance is represented on the Smith diagram by using families of curves that identify the normalized resistance r (real part) and the normalized reactance x (imaginary part)

$$z(d) = \text{Re}(z) + j\text{Im}(z) = r + jx$$

Let's represent the reflection coefficient in terms of its coordinates

$$\Gamma(d) = \text{Re}(\Gamma) + j \text{Im}(\Gamma)$$

Now we can write

$$\begin{aligned} r + jx &= \frac{1 + \text{Re}(\Gamma) + j \text{Im}(\Gamma)}{1 - \text{Re}(\Gamma) - j \text{Im}(\Gamma)} \\ &= \frac{1 - \text{Re}^2(\Gamma) - \text{Im}^2(\Gamma) + j2 \text{Im}(\Gamma)}{(1 - \text{Re}(\Gamma))^2 + \text{Im}^2(\Gamma)} \end{aligned}$$

The real part gives

$$\begin{aligned} r &= \frac{1 - \text{Re}^2(\Gamma) - \text{Im}^2(\Gamma)}{(1 - \text{Re}(\Gamma))^2 + \text{Im}^2(\Gamma)} \\ r(\text{Re}(\Gamma) - 1)^2 + (\text{Re}^2(\Gamma) - 1) + r \text{Im}^2(\Gamma) + \text{Im}^2(\Gamma) + \underbrace{\frac{1}{1+r} - \frac{1}{1+r}}_{=0} &= 0 \\ \left[r(\text{Re}(\Gamma) - 1)^2 + (\text{Re}^2(\Gamma) - 1) + \frac{1}{1+r} \right] + (1+r) \text{Im}^2(\Gamma) &= \frac{1}{1+r} \\ (1+r) \left[\text{Re}^2(\Gamma) - 2 \text{Re}(\Gamma) \frac{r}{1+r} + \frac{r^2}{(1+r)^2} \right] + (1+r) \text{Im}^2(\Gamma) &= \frac{1}{1+r} \\ \Rightarrow \left[\text{Re}(\Gamma) - \frac{r}{1+r} \right]^2 + \text{Im}^2(\Gamma) &= \left(\frac{1}{1+r} \right)^2 \end{aligned}$$

Add a quantity equal to zero

Equation of a circle

The imaginary part gives

$$\begin{aligned} x &= \frac{2 \text{Im}(\Gamma)}{(1 - \text{Re}(\Gamma))^2 + \text{Im}^2(\Gamma)} \\ x^2 \left[(1 - \text{Re}(\Gamma))^2 + \text{Im}^2(\Gamma) \right] - 2x \text{Im}(\Gamma) + \underbrace{1 - 1}_{=0} &= 0 \\ \left[(1 - \text{Re}(\Gamma))^2 + \text{Im}^2(\Gamma) \right] - \frac{2}{x} \text{Im}(\Gamma) + \frac{1}{x^2} &= \frac{1}{x^2} \\ (1 - \text{Re}(\Gamma))^2 + \left[\text{Im}^2(\Gamma) - \frac{2}{x} \text{Im}(\Gamma) + \frac{1}{x^2} \right] &= \frac{1}{x^2} \\ \Rightarrow (\text{Re}(\Gamma) - 1)^2 + \left[\text{Im}(\Gamma) - \frac{1}{x} \right]^2 &= \frac{1}{x^2} \end{aligned}$$

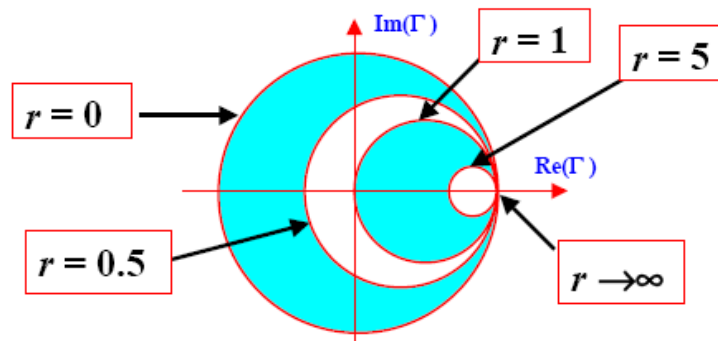
Multiply by x and add a quantity equal to zero

Equation of a circle

The result for the real part indicates that on the complex plane with coordinates (Re(Γ), Im(Γ)) all the possible impedances with a given normalized resistance r are found on a circle with

$$\text{Center} = \left\{ \frac{r}{1+r}, 0 \right\} \qquad \text{Radius} = \frac{1}{1+r}$$

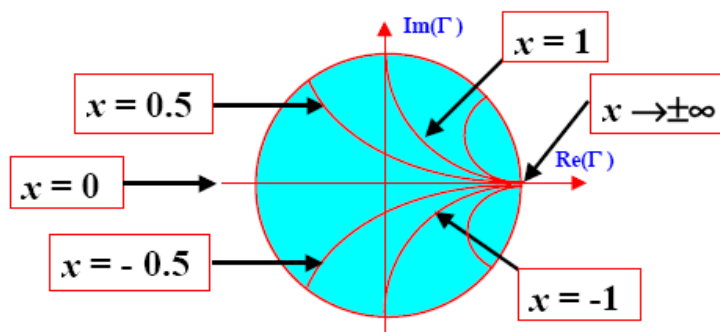
As the normalized resistance r varies from 0 to ∞ , we obtain a family of circles completely contained inside the domain of the reflection coefficient $|\Gamma| = 1$.



The result for the imaginary part indicates that on the complex plane with coordinates $(\text{Re}(\Gamma), \text{Im}(\Gamma))$ all the possible impedances with a given normalized reactance x are found on a circle with

$$\text{Center} = \left\{ 1, \frac{1}{x} \right\} \qquad \text{Radius} = \frac{1}{x}$$

As the normalized reactance x varies from -8 to 8 , we obtain a family of arcs contained inside the domain of the reflection coefficient $|\Gamma| = 1$.



The Smith diagram can be used for line admittances, by shifting the space reference to the admittance location. After that, one can move on the chart just reading the numerical values as representing admittances. Let's review the impedance-admittance terminology:

$$\text{Impedance} = \text{Resistance} + j \text{ Reactance}$$

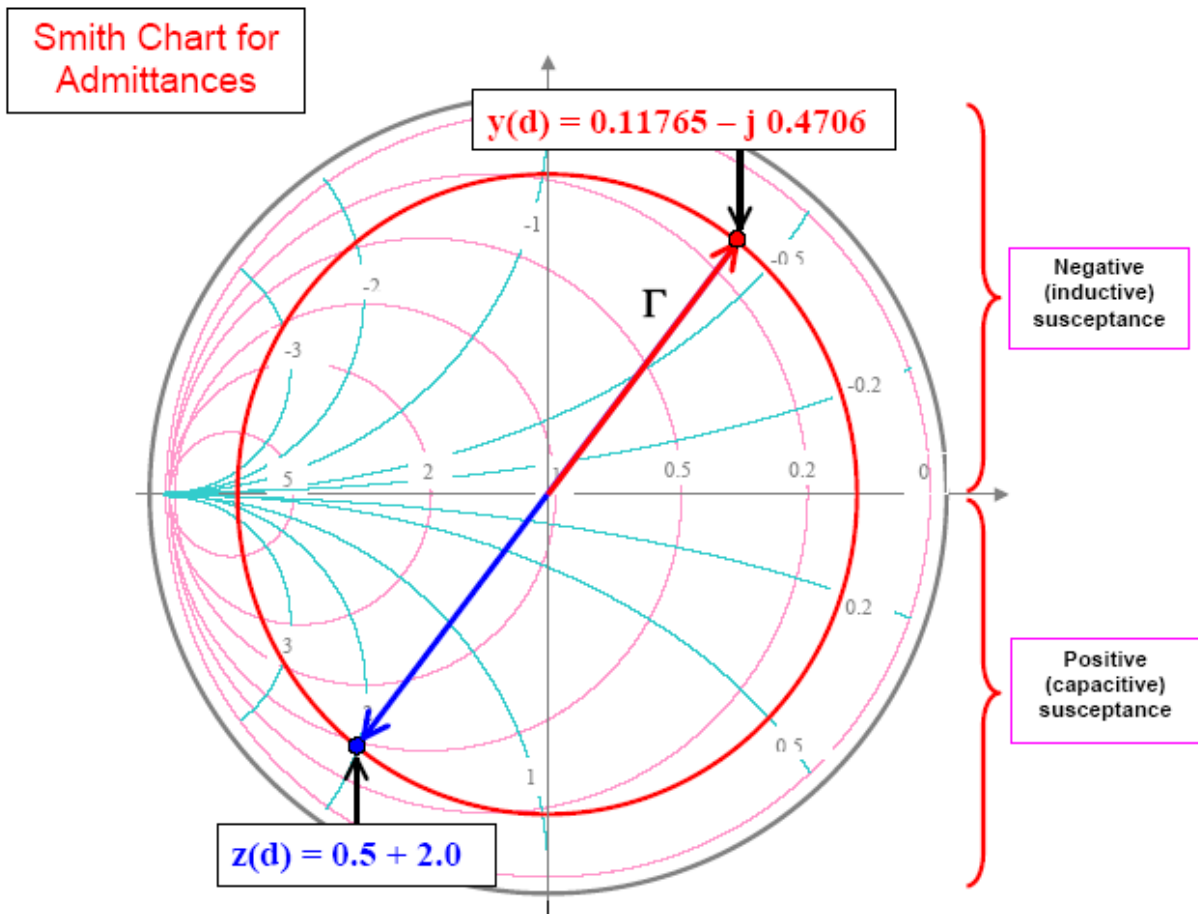
$$Z = R + jX$$

Impedance, denoted by Z, is an expression of the opposition that an electronic component, circuit, or system offers to AC (alternating current). Impedance is comprised of two independent scalar (one-dimensional) phenomena: resistance and reactance. Both of these quantities are expressed in ohms.

Admittance = Conductance + j Susceptance

$$Y = G + jB$$

On the impedance chart, the correct reflection coefficient is always represented by the vector corresponding to the normalized impedance. Charts specifically prepared for admittances are modified to give the correct reflection coefficient in correspondence of admittance.



$$z = r + jx \quad y = g + jb = \frac{1}{r + jx}$$

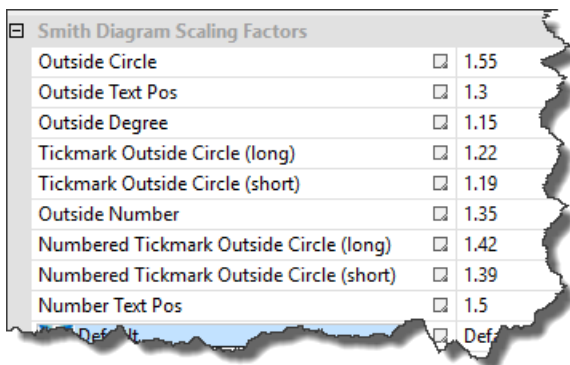
$$y = \frac{r - jx}{(r + jx)(r - jx)} = \frac{r - jx}{r^2 + x^2}$$

$$\Rightarrow \quad g = \frac{r}{r^2 + x^2} \quad b = -\frac{x}{r^2 + x^2}$$

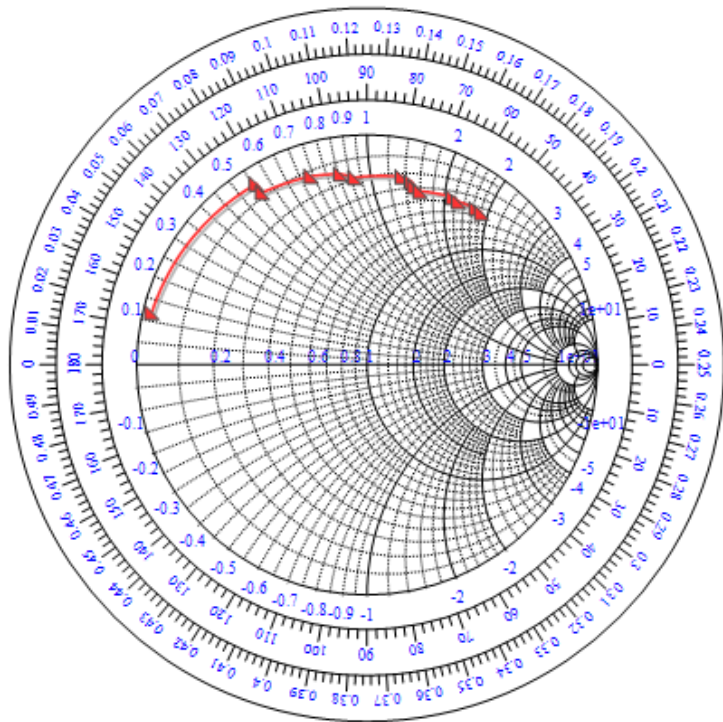
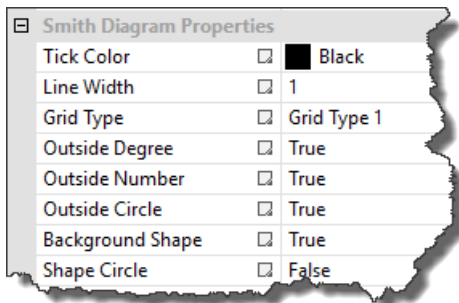
Since related impedance and admittance are on opposite sides of the same Smith diagram, the imaginary parts always have different sign. Therefore, a positive (inductive) reactance corresponds to a negative (inductive) susceptance, while a negative (capacitive) reactance corresponds to a positive (capacitive) susceptance. Numerically, we have the left relationship.

9.20.1 Program Parameter

Please use the program properties to setup the right *Smith Diagram* parameters.



The scaling factors are used for multiplying the geometry with a real value.



The diagram properties are used to change the look of the chart.

10 User Interface

The following figure shows the typical structure of the user interface of *SimplexNumerica*. In the example, the toolbars and windows are arranged highhanded. After that, it was clicked on the left thumbnail picture with the name *Functionplot* (see no. 4).

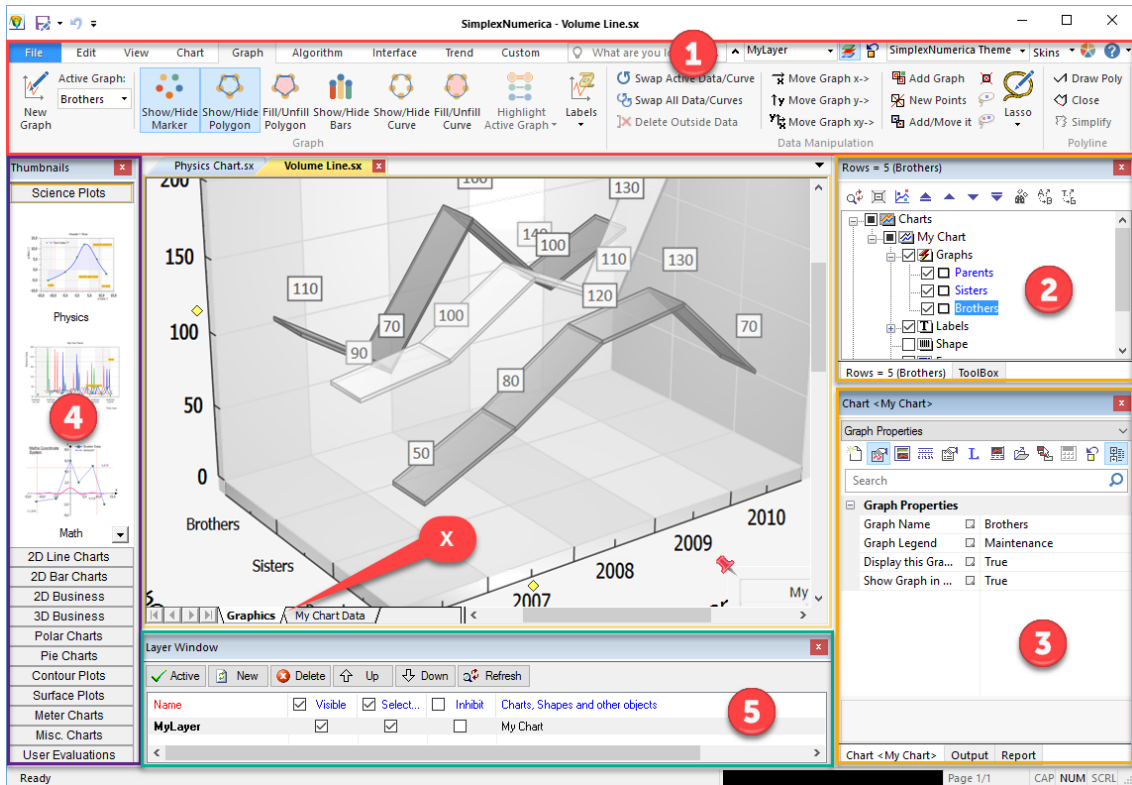


Fig.10-1: User Interface with different areas

The program is divided into the following areas:

No.	Description
1	Ribbonbar with its Toolbar This area shows the Ribbonbar Tabs and their toolbars.
2	Chart Explorer The Chart Explorer displays the name of the graphs and the other elements of the diagram. It offers the possibility to hide individual graphs or components.
3	Chart Properties / Output Window In this area, there is a window "Chart Properties" and "Output window". Between these windows, you can switch the tabs at the bottom of the window.
4	Thumbnails Thumbnails are sample objects, mostly charts, but also evaluations, templates and template objects that were stored.
5	Layer Window Use that window to handle the layer properties.

No.	Description
x	Tab-view (Graphics View or GraphTable) This is the main output window of an evaluation. An evaluation can contain several charts or shapes, and text objects. In the lower part of the window, you can switch between chart and table. Between these windows, you can switch either with the tabs at the bottom of the window (where x is pointing) or by pressing <F3>.

10.1 Evaluations

An evaluation is the sum of the content of all layers within a page inside a MDI window with its bottom tabs.

The left Ribbonbar Pulldownmenu File can be used to

- Make a new evaluation
- Load an existing evaluation
- Reload an existing evaluation
- Save, open and close evaluations
- Store reports in the thumbnail window (use <F7> to show)

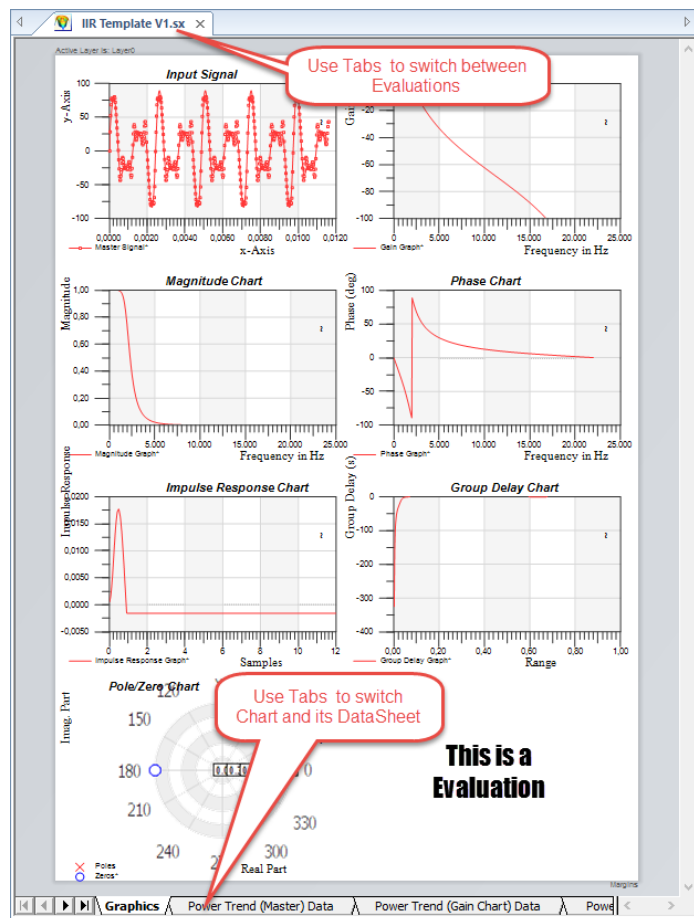



Fig.10-2: Evaluation Page

10.1.1 Sample Folder

Please have a look to the sample folder (e.g. path for x64):

`C:\Program Files\SimplexNumerica64\Examples`

There are many simple examples for different purposes.

You can use the key <F1> or the toolbar icon  to call the start-up dialog with a button to the example path.

10.1.2 Load an existing Evaluation

You can always load (open) another evaluation. It will be loaded and added right to the other tabs.

■ **Procedure:**

1. Select the menu item "File | Open..." (Key: <Strg + O>)
 - ↳ The "Open" Fileselectbox will appear.
Evaluations have the extension *.sx.
2. Enter the path and file name in the Fileselectbox.
3. Click the "Open" button.

10.1.3 Reload Evaluation

You can load an already open evaluation again. This can be useful for example, if you have made any accidental changes and want to restore the original state in a simple manner.

■ **Procedure:**

1. Select the menu item "File | Open | Reload" or press the key combination <Ctrl + R>.

10.1.4 Save and Close Evaluations

SimplexNumerica offers you a number of clever ways for saving and closing evaluations.

- **Save**
Saves the evaluation under its name.
- **Save As...**
Saves the evaluation with a different name.
- **Backup (Save Copy As...)**
Saves a backup of the evaluation with a different name.
- **dto., but opens it in a new Tab.**
- **Save All**
Save all evaluations.
- **Save and Close All**
Save and Close all evaluations.

- Save and Close All but this
Saves all evaluations except for the active one.
- Close
Close the active evaluation.
- Close All
Close all evaluations
- Close All but this
Close all evaluations except for the active one.

10.2 Evaluation Window

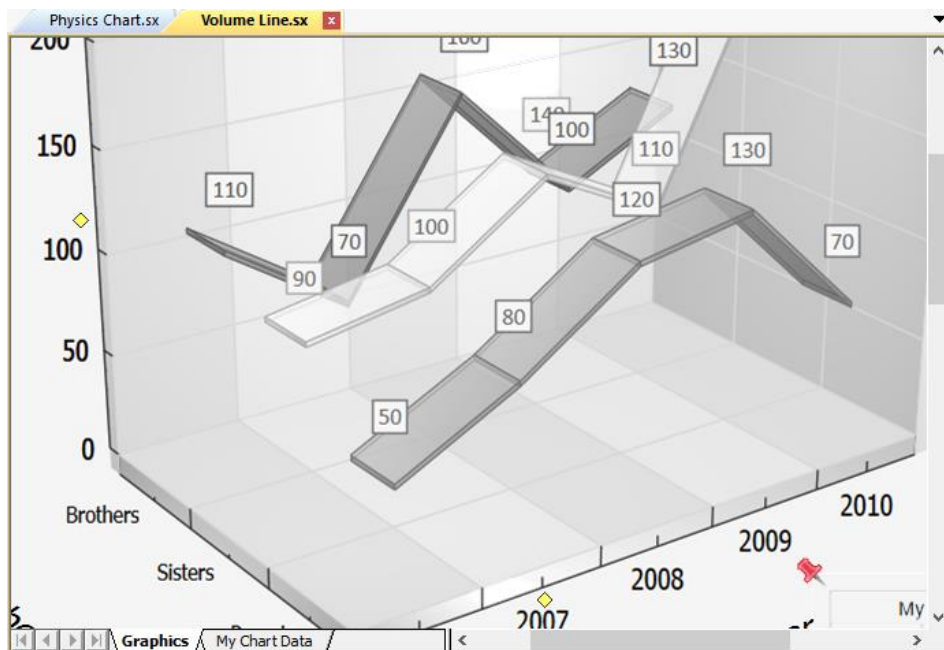
The evaluation page shows the content of an evaluation (charts, shapes, text, etc.) in the **Graphics View** and the data table in the **GraphTable View**.

Between the two views of representation - Graphics and *GraphTable* - can be switched with the function key <F3> or the tabs at the bottom of the window.

The name of the *GraphTable* tab is equal to the **chart name** plus the word **Data**.



- Tab "Graphics"
Shows the graphical representation of the evaluation.
- Tab <Name of the Chart> plus the word Data
Invokes the data representation of the corresponding chart in form of a table with arrays, so called *GraphData*.



10.2.1 Graphics View

In the evaluation window, several charts can be available, simultaneously. An evaluation can also consist of a rectangular shape without any data, e.g. only a simple rectangle.

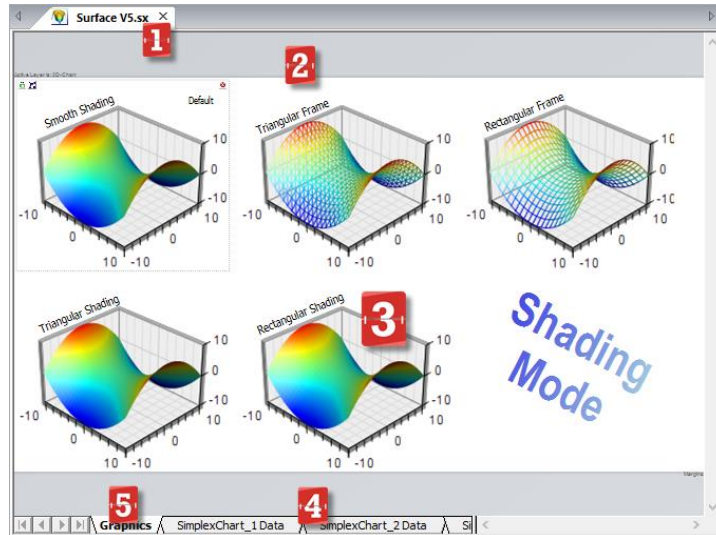
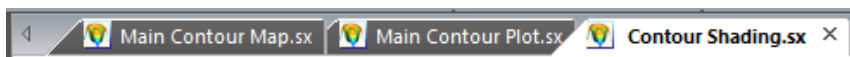


Fig.10-3: Main Window and Tabs for the Evaluation

The following table describes the areas:

No.	Description
1	<p>Tabs for open evaluations → Project</p> <p>With these tabs, you can switch between the evaluations. The sum of all available evaluations is a project. → However, if it is just being stored as such. → If it has been stored, it can (of course) be used as such and also reloaded.</p> <p>⇒ <i>Several evaluations can be saved together as a project.</i></p>
2	<p>Evaluation</p> <p>Graphical representation of an evaluation. An evaluation can contain different numbers and other types of charts and shapes (rectangles, images, etc.).</p>
3	<p>Different Charts</p> <p>Inside the charts, the data is displayed as each individual graph. A graph consists of measurement data (SampleData) and curves (CurveData).</p>
4	<p>Tab of the GraphTable(s)</p> <p>With these tabs, you call the tables and switch between them in order. An evaluation owns for each chart a table of data.</p>
5	<p>Tab of the Graphic</p> <p>With the tab "Graphics", you get the Graphics View in the foreground.</p>

Use the tabs above to change between the evaluations:



The next chapter shows some parts of an evaluation window.

10.2.2 GraphTable View

In this view, you can edit the table data related to just one chart. Use the icons of the Ribbonbar **GraphTable**. Remember: In early program versions was the table called *DataSheet*.

Hint

Has an evaluation several charts included, then there is a GraphTable (view) for each chart.

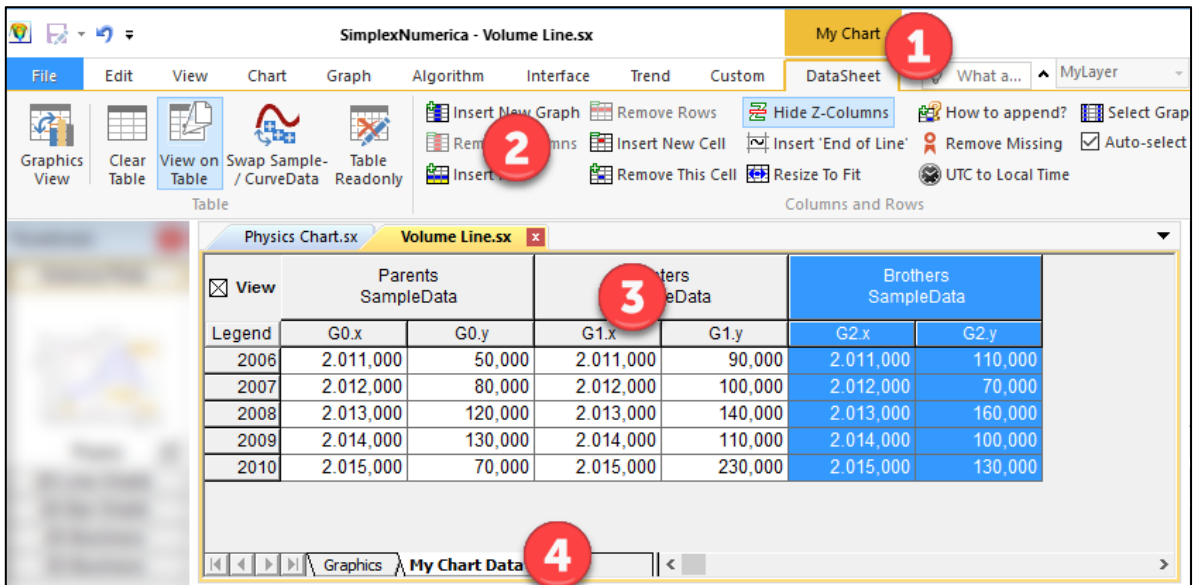
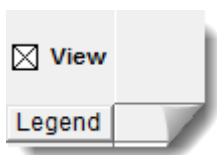


Fig.10-4: GraphTable View.

The current graph data (in this case, the measurement data) by default, when switching from the graphics to the table, will be selected (highlighted in blue).



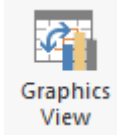
If the box is checked on **View** (→Data View Mode), the table shows only a view (you maybe knows that from a database) to the actual data. This means that the data displayed (and only the displayed ones) were quickly brought out of a large buffer. However, in the view mode, the tables can be edited only limited compared to the actual tables mode (View is unchecked).

In *TableMode* (no cross in front of **View**), the data can be processed similarly as in Excel. For example, the cursor is in the last line, a new line can be inserted below with simply pressing the return/enter key.

Info

SimplexNumerica has two modes for entering data within the same worksheet. The *TableMode* as an easy editing mode compliant with Excel and the *ViewMode* for fast presentation (especially with many measuring data) and for easy data entry.

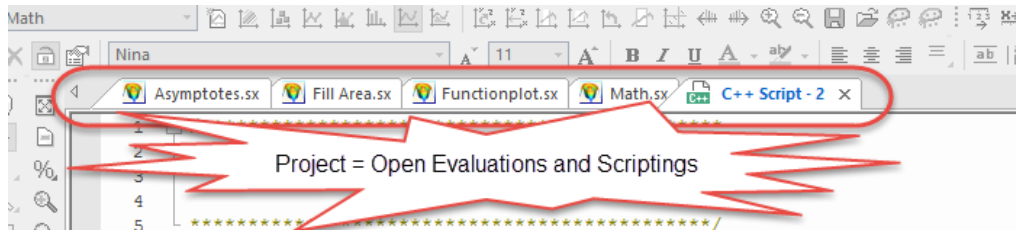
The following table describes the fields marked with numbers in the above image:

Pos	Description
1 Ribbonbar GraphTable	The name of the chart is on top (here "My Chart").
2	Ribbonbar Entries Provides functionality to edit the table.
3	Table ⇒ See different chapters for this ⇒ The Z-table columns can be hidden.
4	Tabs With these tabs you can switch between: <ul style="list-style-type: none">• GraphTable and Graphic• Other tables of the same evaluation.• Use key <F3>  <ul style="list-style-type: none">• Use Icon

➔ Please switch back to the Graphics display → Press <F3>

10.3 Projects

A project is defined as the sum of all open evaluation and script Tab-views. Tab-views can only be added to a project if they are open, and removed if they are not available when you save the project, again.



A project can only be created by giving it a file name. Projects are saved into the file that you specify which may be located anywhere on your hard drive. Project files use the extension ".sxw" (w: workspace).

Once you have created a project, you may open it later using the command on the File menu. There is also an option to reload the last project when *SimplexNumerica* starts.

Other commands, on the Project submenu of the File menu, allow you to close a project or to save it under a different name.

When you close a project using the Close command, you will be asked if you want to save any changes. If you open another project without closing the current one, it will be added to the others.

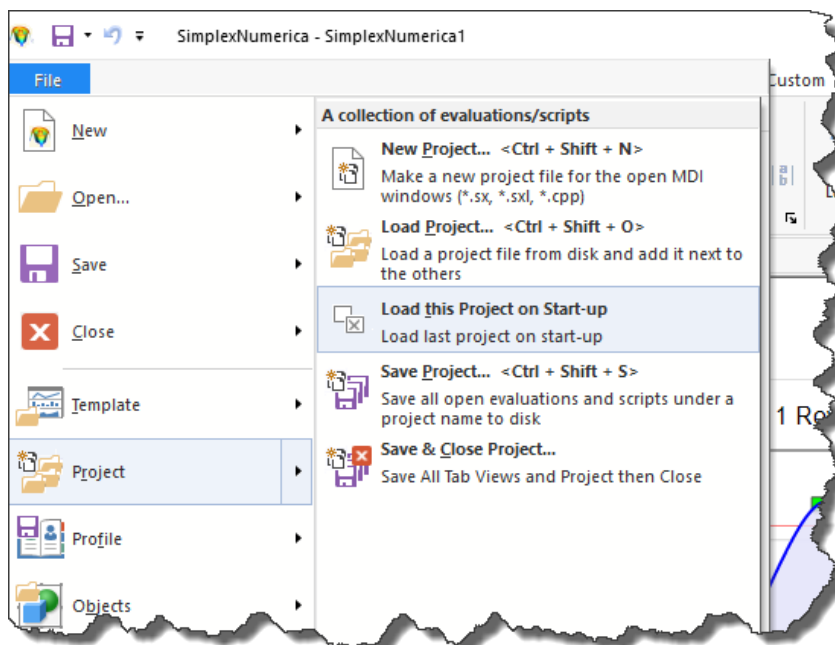
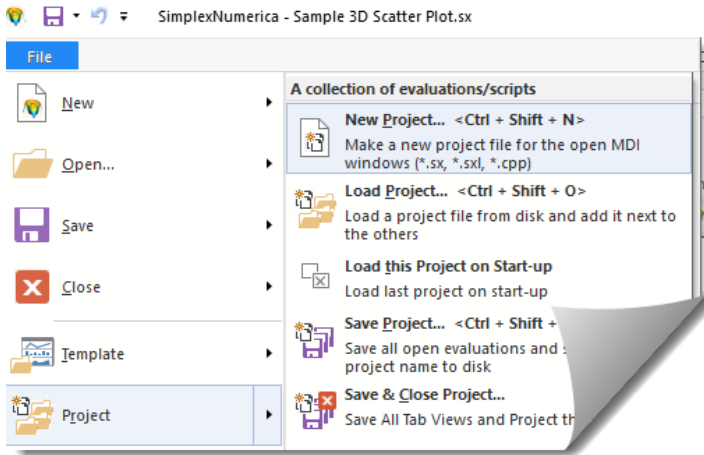


Fig. 10-5: Project Menus.

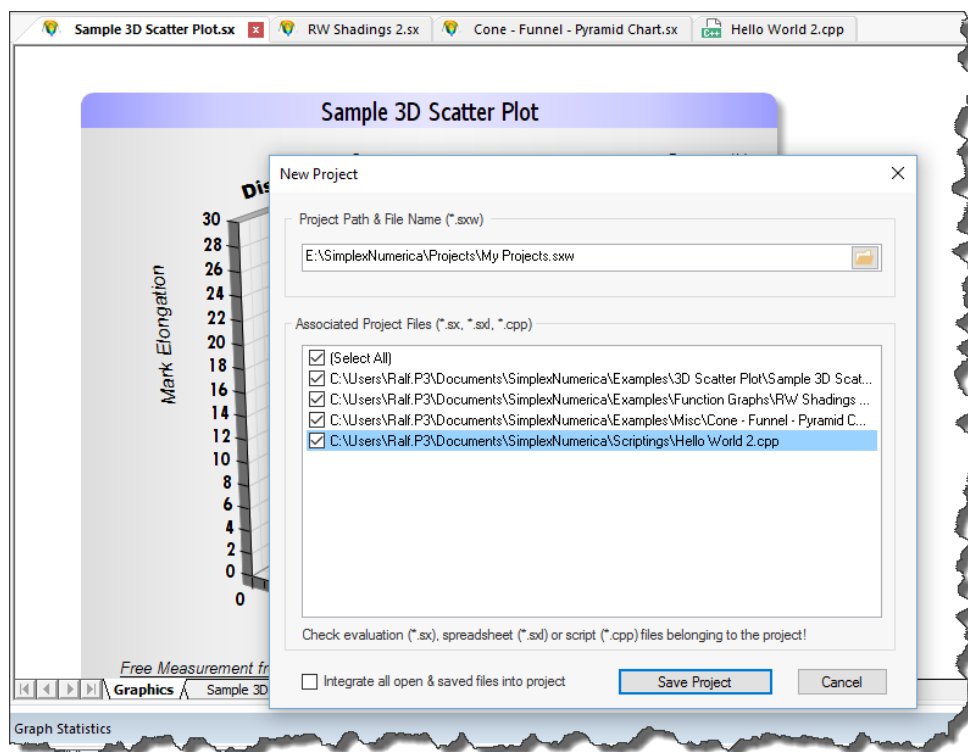
10.3.1 New Project

Before we want to explain the Projects in SimplexNumerica, we need to load some evaluations, e.g. from the Example folder. Press key <F1> and choose some examples and a few scripts in the Start-up dialog.

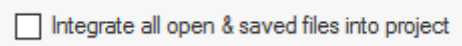


Then use the menu from the Ribbonbar →File, →Project, →New Project...

Now, select (set checkmark) in the upcoming dialog...



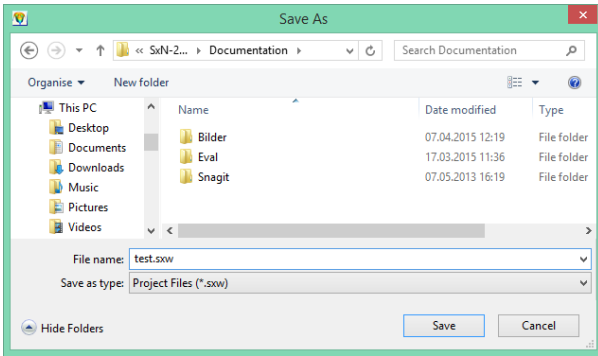
...all evaluations and scripts that you want to put into the Project file; or use to do that what it says.



Enter a path and filename for the Project. Press *Save Project*.

That was one possibility to make a project file. If you always want to put all open evaluations/scripts into a project file, then you can use simply the next chapter...

10.3.2 Create a Project



From the File menu, choose Project, Save Project.... The Save As dialog box will be displayed, with the project name with extension [* .sxw], initialized to the current folder.

If necessary, change the name to something more appropriate, and browse for the folder you want to save it.

Click Save.

Hint

When you choose Save & Close Project, then all the evaluation files will be closed, after saving.

10.3.3 Load Project

It loads all previously saved evaluation files (as a new project) into the workspace.

To open a project:

1. From the File menu, choose Project, Load Project... The Open File dialog box will be displayed.
2. Browse for the project file you want to open.
3. Click Open.

Note:

If you have already evaluations tabbed, then the program will add the new files to the Tab rows.

If the program cannot find the absolute path from each evaluation, as specified by the project, then it starts searching from the root folder downwards.

10.3.4 Save Project

It saves all evaluation files as a new project. To save an existing project, choose the Project → Save Project... command from the File menu.

Note:

The program will save the absolute path from each evaluation inside the project file.

10.3.5 Save & Close Project

Use this menu item to save all evaluation and script files as a new project and to close all windows.

⇒ To close a project, choose this command from the File menu. You will be asked if you want to save any changes, then the project and all evaluations in it will be closed.

10.3.6 Load this Project on Start-up

It loads all previously saved evaluation and script files during the start-up of the application.

10.4 Extended Keyboard Navigation

There is a new function to switch between MDI windows in *SimplexNumerica*:

→The extended application keyboard navigation.

Implemented in *SimplexNumerica* is a Microsoft Visual Studio-like MDI Windows Navigator.

The keyboard shortcuts <Ctrl + Tab> and <Ctrl + Shift + Tab> can be used to invoke the left menu.

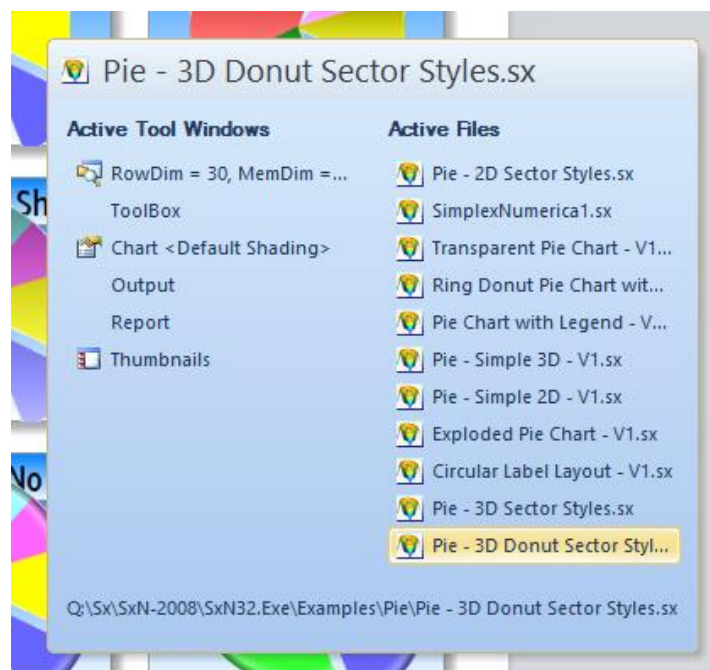


Fig.10-6: Extended Keyboard Navigation

Click on an item will open the corresponding window.

10.5 Layers

You can separate your canvas (→ content of the evaluation page) in several layers. You can think of a layer as a stack of transparent sheets of paper, to which you can attach charts, shapes and drawings. Then, you can change the order of the “stack” to view and work with a different set of items. Layers provide a way to keep items separated so that they cannot interact with each other, and so that you can hide an entire set of items from view with a single click. Although most visuals do not require the use of layers, there are several common applications. For more than one chart on screen, it may be desirable to place each on a different layer.

10.5.1 What is a Layer?

Another example to above: You can imagine the Graphics View consisting of transparent foils lying over each other, but here the foils are called layer. Each object (chart, shape, etc.) can be set on different layers. To show that, invoke the Layer Window (key <F8>):

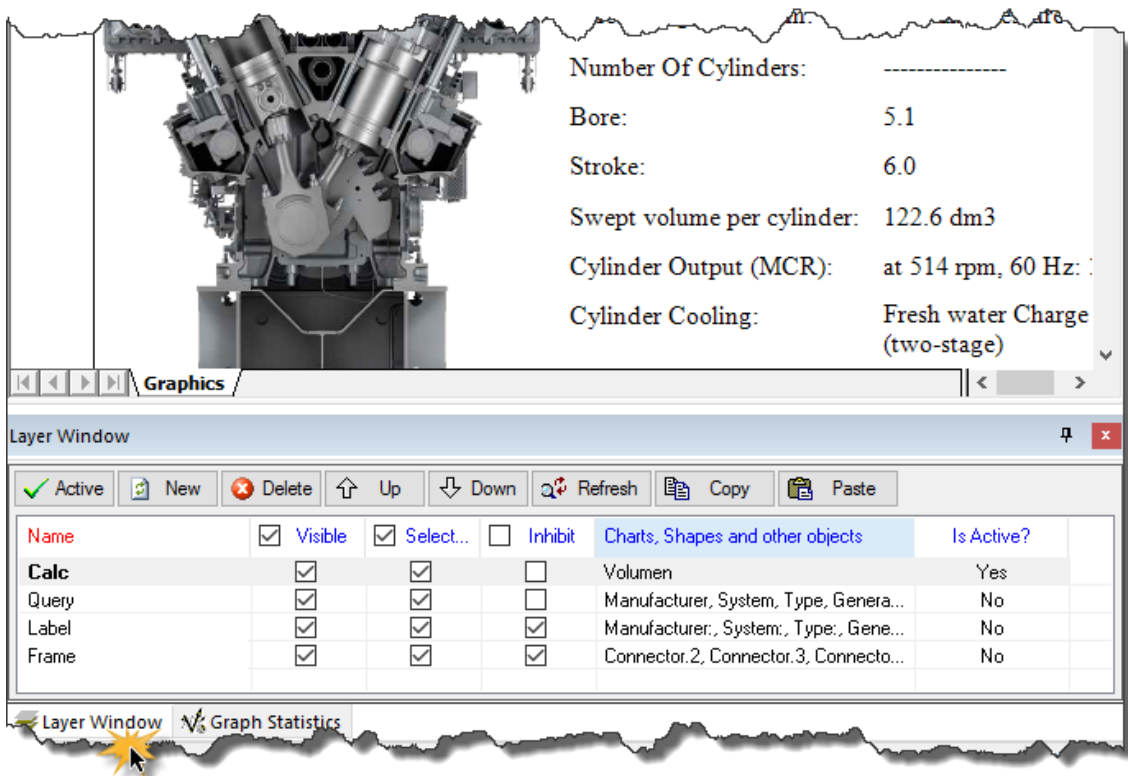


Fig.10-7: Layer Window beneath the evaluation page

Here, in the picture above, the cylinder shape lies on layer “Frame” and the text shapes are lying on the so called “Calc” layer. The names can be renamed in the Layer Window itself or in the shape properties. To place a chart/shape on a different layer, use the properties or related toolbar.

Use the buttons in the *Layer Window* to Activate/Delete/Move (Up/Down) or to make a New Layer. The appropriated layer has to be selected. Do not use the name cell for selection, because it is for renaming a layer.

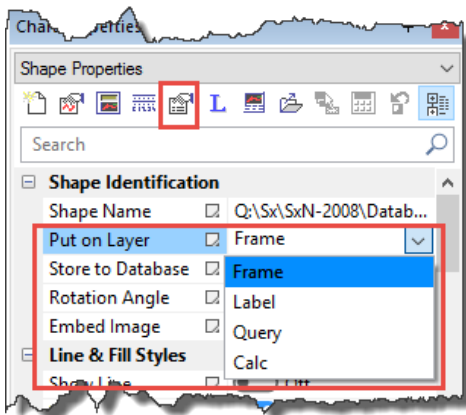
Hint:

Parallel to the movements here in the layer, certainly objects can be set in position with the Ribbonbar Edit, Toolbar Format. You can set objects (= charts & shapes) in different z-order

Note:

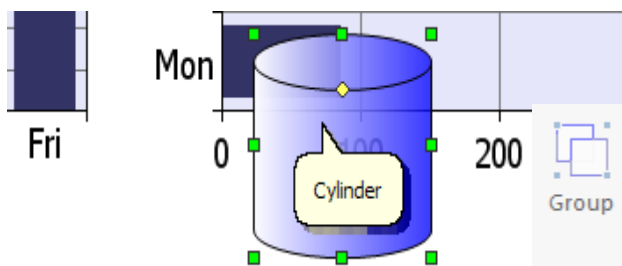
Only shapes or free text can be rotated. To rotate labels inside charts, please use their properties.

Use the Zooming toolbar to zoom the display inside the view or the magnifier for details.

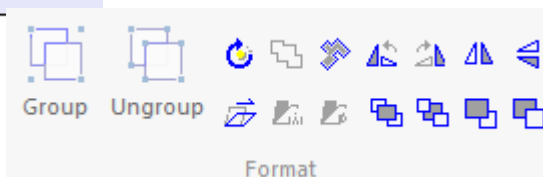


Use the properties to put a shape on another layer.

Please have a look to next chapter for more information...



Click on an object and change its z-order with the help of the *Edit* Ribbonbar toolbar.



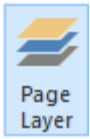
Note:

You can set the z-order via the Format toolbar, but always on the same layer, only.

Please have a look to the Selection Toolbar (next chapter). You can display either the layer from the selected shape or the active layer, respectively. Use the next icon to swap its functionality.



10.5.2 Ribbonbar with Layer Icons



Two toolbars are helpful when working with layers. The first is the *View Toolbar*, where you can find the icon to display the layer window.



The second is the *Selection Toolbar*. It has two icons for switching between the currently 'Active Layer' and the associated 'Layer of selected object(s)'. In addition, it has a combobox to switch between the available layers (and set this layer to the selected object).

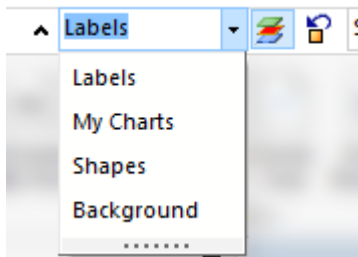


If this Icon is selected, then it shows the layer name of the selected chart/shape in the combobox. Change the name in the combobox will move the selected shape in another layer.

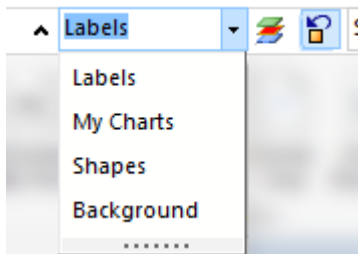


If this icon is selected, then it shows the active layer name in the combobox. Change this name will activate the other layer.

Info:
A shape cannot be assigned to multiple layers.



Left icon selected. Use this combobox to select the active layer.

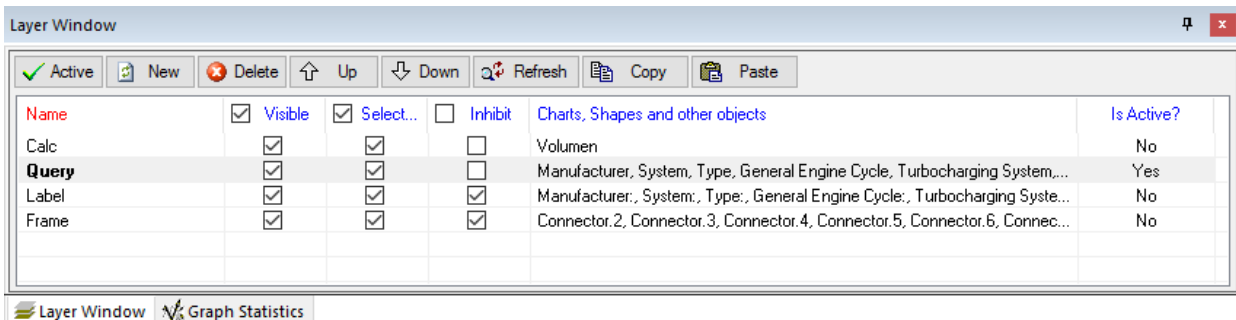


Right icon selected. Use this combobox to place the selected shape to this layer.

10.5.3 Layer Window



You can open/close the layer window with the icon from the *Main Toolbar* or use key <F8>.



When you select a shape in a drawing, the layer, to which that shape is assigned, appears in the combobox of the above-described toolbar. You can see the name of the shape also in the right column of the layer window.

Adding a Layer



When the page you are using does not include the layers you want, you can create layers of your own. Suppose your drawing contains a layer called *AroundChart1*. You might want to refine that further by creating a layer called *AroundChart2*. That way, you could easily distinguish chart1 related objects from chart2. The following steps describe how to add a layer:

1. Show the Layer Window (use <F8>)
2. Choose *New* in the Layer Window.
3. Double-click on the name to rename it.

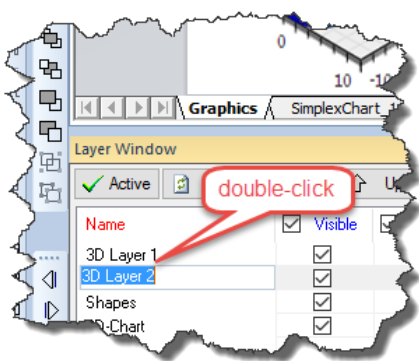
Activate a Layer

SimplexNumerica puts new objects always on the active layer!

To activate a layer

1. Select the layer in the toolbar  or
2. Click in the corresponding row in the Layer Window
3. Click on the button  in the Layer Window.

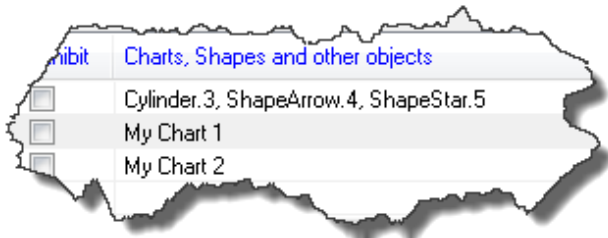
Rename a Layer



You may want to change the name of a layer that you create to something that better describes the shapes or charts that it contains. Even though *SimplexNumerica* lets you rename predefined layers, it is best to use this option when you are working with layers that you create.

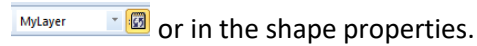
→ Simply double-click on the name in the left column in a cell of the layer window.

Assigning Shapes to Layers

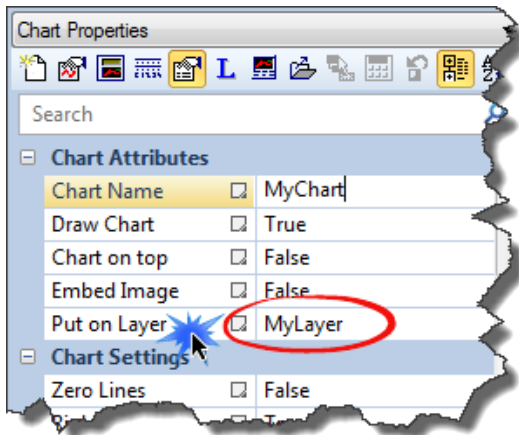


The Layer Window will show you which shapes/charts are belonging to the different layers.

Now, if you like to change the layer for a shape, then you can do it as described above in the toolbar



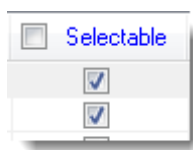
You can see in the left picture the entry "Put on Layer". To the right is a combobox where you can see the actually layer of this selected shape and where you can change it to another layer.



Protecting Layers from Changes

After you go to all the trouble of defining layers and adding shapes to them, nothing is worse than another user (or yourself) accidentally deleting or changing them. You can protect a layer from changes by locking it. After you lock a layer, you cannot move, change, or delete shapes — you cannot even select them. You also cannot add shapes to a locked layer.

The following step describes how to lock a layer:

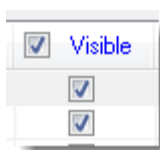


→ Simply uncheck the column *Selectable* in the row of the layer that has to be deactivated.

Hiding a Layer

One of the big advantages of using layers in a drawing is that you can turn them off when you do not want to display their shapes. Suppose that you want to work on the placement of movable charts in your layout. You will want to display the layers that contain the legends or arrows to data points or in another scenario; you might know that some shapes are covering other shapes.

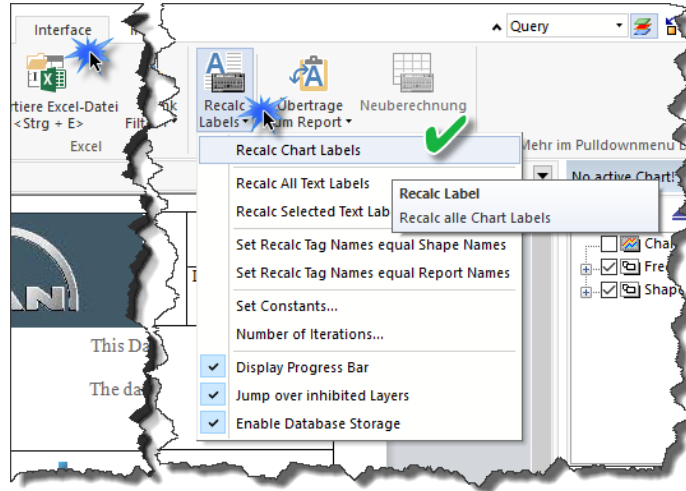
The following step describes how to hide a layer:



→ Simply uncheck the column *Visible* in the row of the layer that has to be hidden.

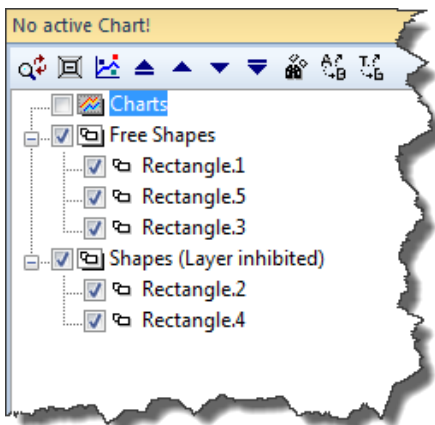
Inhibit a layer

Text Shapes placed on inhibit layers will be ignored during calculation (see Ribbonbar **Interface, Recalc Labels**).



They will be also separated inside the **Chart Explorer**.

In this example, *Rectangle.2* and *Rectangle.4* are lying on an inhibited layer (not necessarily the same layer).



Tip
If you have a lot of shapes lying on different layers on a page and some of the shapes (like lines, legends) are not used for recalculations or database queries, then it is better to separate these from the essential ones.

Move Up/Down

Use the layer window buttons up and down to bring individual shapes on top or behind other ones.

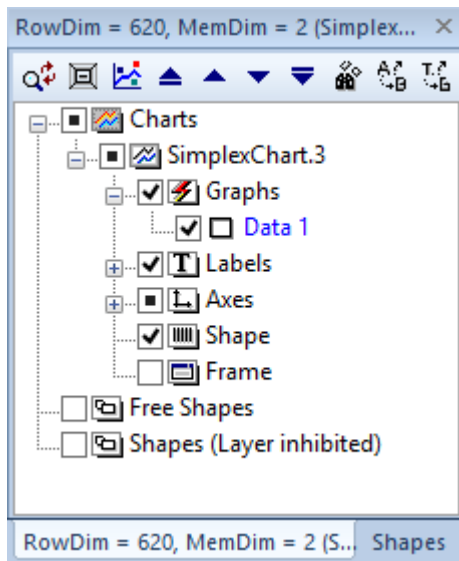
Tip:

To change the order of shapes you should use this toolbar, first:



With these icons, you cannot move to another layer!

10.7 Chart Explorer



The **Chart Explorer** lists the charts and shapes (rectangles, connectors or others), labels, axes and frames.

The left picture shows two main notes: Charts and Shapes. Here in this picture, the shape note is empty (nothing in there), but chart note is filled with one chart (SimplexChart.3) and this with one graph (Data 1).

→ You can change the name of the chart also in the properties, e.g. in "My Chart".

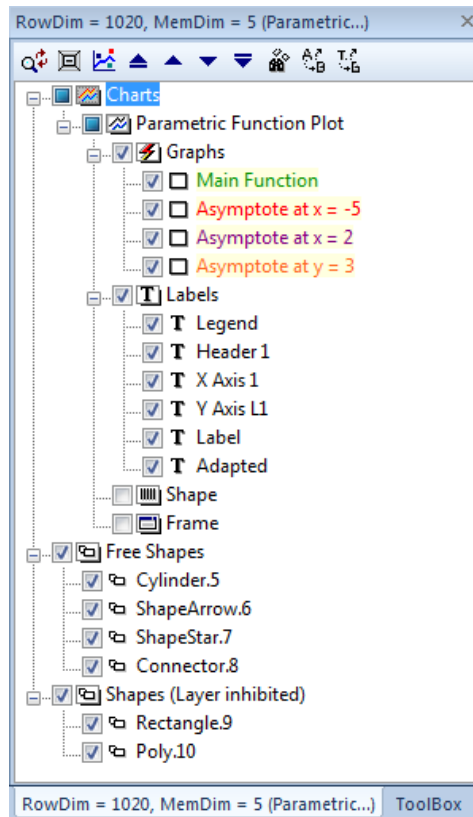
Then "My Chart" has Graphs, Labels, Shapes and Frames as knots.

Each Graph has data points (Marker) and one curve. Both can be hidden, too.











The left picture shows only one Graph: "Data 1".

You can open the **Chart Explorer** window with the menu item Ribbonbar View / **Chart Explorer**" or the function key <F4>.

Here another example:

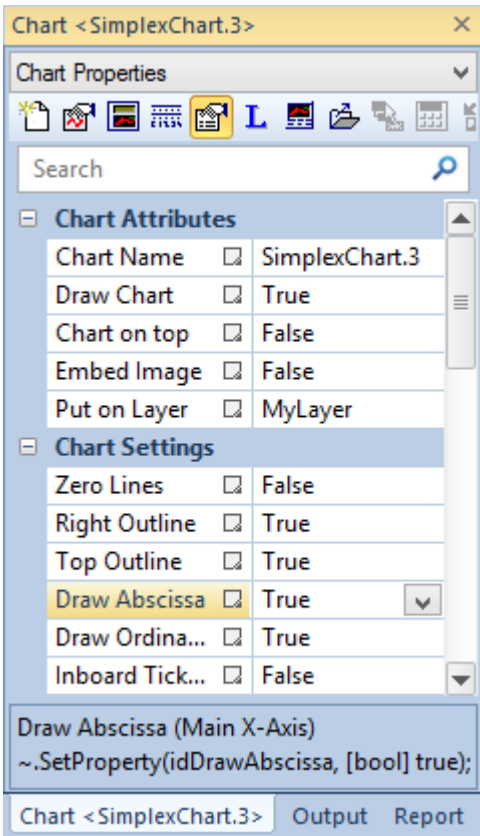


In the upper part of the **Chart Explorer** is a toolbar with the following functions:

Symbol	Funktion
	Refresh of the Tree-control If it happens that the program does not automatically update the content of the tree control, then you can do it manually with the help of this icon.
	Expand all trees below.
	Adds a new graph. Makes a new graph inside the active chart. You can edit the name of the new graph in an in-place opening edit field.
	Bring active graph on top.
	Moves the graph to a next higher level.
	Moves the graph on the next lower level.
	Bring active graph behind.
	Search Graph or Shape Entry.
	Rename all Graph entries.
	Rename all Shape entries.

10.8 Chart Properties

You can open the *Chart Property* window with the menu item "View | Chart Properties" or the function key <F5>.

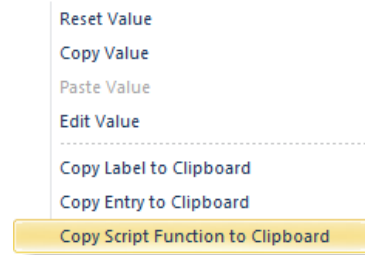


The above *Chart Explorer* shows the name of the charts (like SimplexChart.3). Click on this and activate the *Chart Properties* in the window beneath to it. Here is also a good place to rename the chart.

The properties are separated into categories. Each category has its own attributes, settings and user actions.

Only for Experts:

To change the name of the chart via script, write SetProperty(). Left mouse click on den box right to *Chart Name* opens a popup menu



Use this and write a small script:

```

/*****
    SimplexNumerica - Sample Script
    *****/
#pragma extension "corelib"

void main()
{
    Application app("Simple App");
    app.NewEval();
    Chart ch = app.MakeChart("My Chart",idChartTypePhysics,100,100,400,300);
    ch.SelectPropertyGroup("Chart Properties");
    ch.SetProperty(idChartName, "My Chart");
    app.SelectChart("My Chart");
}

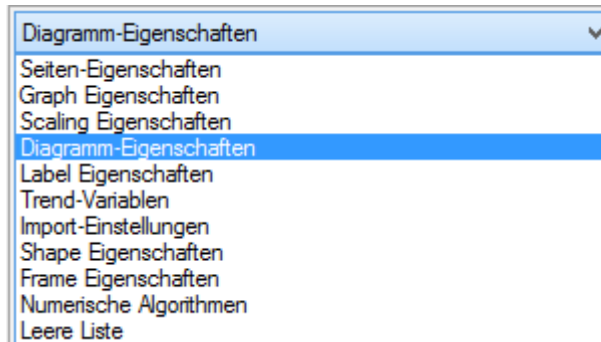
```

We cannot describe all properties here. You can click on it and can see below a short description and the name of the script function.

Use the icons in the toolbar to invoke the categories and other functions. The corresponding properties are displayed and can be edited.
















The categories can also be accessed from the combo box above the toolbar:




Are too many properties available, so you can search for...

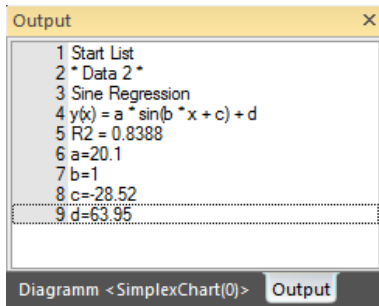


The following table explains the functions of the Property toolbar:

Symbol	Funktion
	Categorize Sorts the properties by category.
	Browse Alphabetically Sorts the properties alphabetically.
	Expand All Minimized or maximized the list of properties.
	Page Format Shows some properties around the page (canvas).
	Graphs Displays the category "Graph Properties".
	Algorithm Calculations and algorithms especially for this active graph.
	Scaling Shows the category "Scaling and Interval".
	Charts Shows the category "Chart Properties".
	Label Shows the category "Label & Text".
	Trending Shows the category "Trend Properties".
	Import Shows the category "Import Properties".
	(Repeat) Last Edit (for all others) Transmits last settings on all other graphs.
	Recalculation of all graphs

Symbol	Funktion
	<p>Swap between SampleData and CurveData Swaps the SampleData with the CurveData for the current graph. <i>SampleData</i>: Measuring data represented as marker. <i>CurveData</i>: In general, the real data of the calculated curve points.</p>

10.9 Output Window



The Output window displays the program outputs. For example, the information on the communication with a data source or the calculation results of an algorithm.

This window is usually in the background of the window "Chart Properties". It is displayed by clicking on the tab "Output". If the window is fully closed, then use the menu item [View | Output Window] or press <F10>.

Fig.10-8: Output Window

10.9.1 Output from Scripting Engine

If a fault has occurred, then the Output Window will be opened by the program and shows you the relevant row in the text editor. Double click on this line in the Output Window to select the line in the code editor. You can use the Output Window also via script:

```
app.Output ([string]);  
app.Error ([string]);  
app.Print ([string]);
```

Please have a look to the scripting engine reference for more details about scripting.

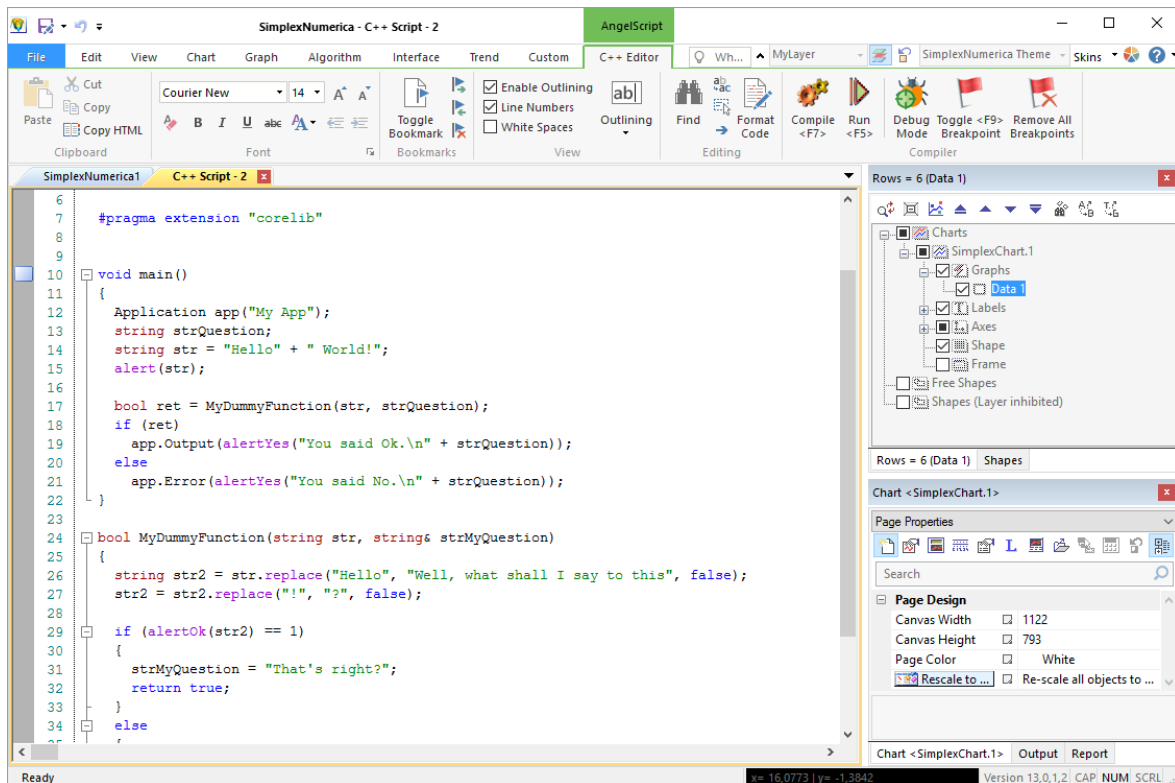
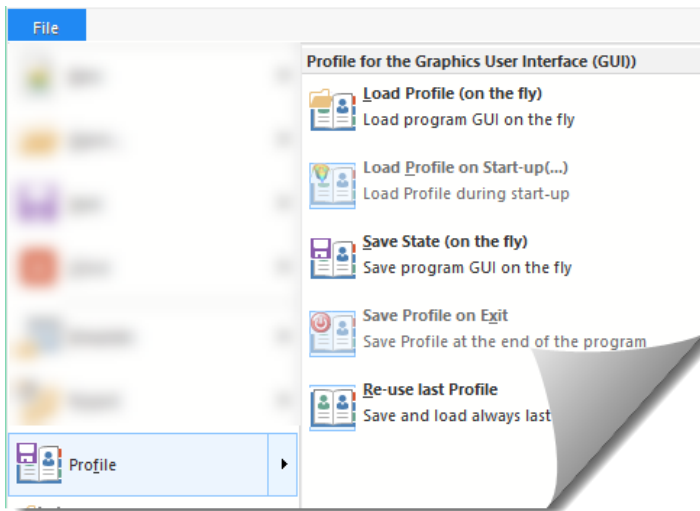


Fig.10-9: Script Editor in SimplexNumerica

10.10 Profiles



A profile is a snapshot of the actual workspace (environment) of the application. You can save such a snapshot each time (on the fly) or when you quit the program (on exit). Last state, made on the fly, would be load again. A profile that was saved at the end of the program can only be loaded during the start-up of the application.

The next chapters describe some work cases appropriated to profiles.

Info

Be aware that the content of the profile is saved to the registry. Depending on your windows operating system security levels, a dialog, to ask for an administrator password, appears.

10.10.1 Load State (on the fly)

Loads the previously saved state of the program environment.

10.10.2 Save State (on the fly)

Saves the actually state of the program environment.

10.10.3 Save Profile on Exit

Before you can use this menu, uncheck "Auto load/save Profiles" and check the others. To test this menu, please save everything important to disk and quit the program.

In profiles, the dimension, arrangement of windows and toolbars are saved.

You can do with profiles:

- Load profile at startup.
- Automatically load profile.
- Save profile during the lifetime of the program.
- Save profile when you exit the program.
- Replace profile at runtime.

10.10.4 Load Profile on Start-up

You can select a profile when you start *SimplexNumerica*. The precondition for this is that you have already stored a profile and have not hidden the associated selection dialog.

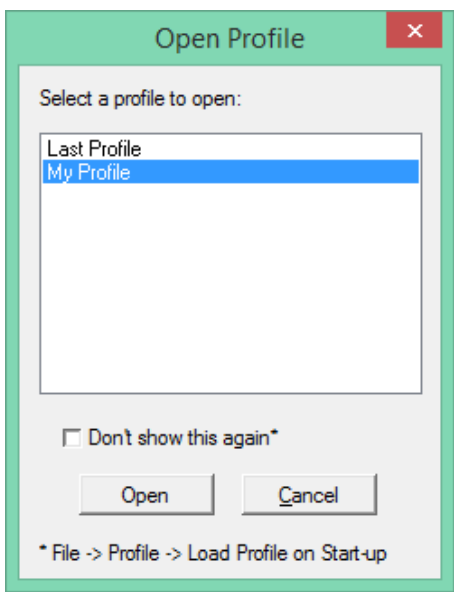
To test the profiles, please check this menu item and re-start the program.

During re-start, the dialog *Open Profile* appears.

Tip:

If you do not want to be prompted each time the program is started by the profile dialog, then you can hide the dialog.

→ Check the entry: Don't show this again.



Procedure:

1. Please (re-)start *SimplexNumerica*.
2. Dialog "Open Profile" appears (only if you saved a profile in previous session).
3. Select a profile from the listbox.
4. Click the "Open" button.
5. *SimplexNumerica* starts and selects the environment with the profile settings.

10.10.5 Automatically load specific Profile

You can also specify that a specific profile is automatically loaded at startup and saved when you quit the program.

Procedure:

1. Load the profile that you want to.
2. Select the menu item "File | Profile | Save Profile on Exit".
3. Select the menu item "File | Profile | Auto load/save Profiles".

10.10.6 Manually load specific Profile

You can also specify that a specific profile should be manually loaded at startup and automatically saved when you quit the program.

■ Procedure:

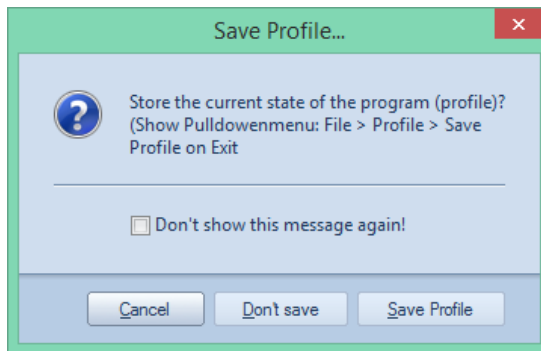
1. Load the profile that you want to.
2. Do not select the menu item "File | Profile | Auto load/save Profiles".
3. Select the menu item "File | Profile | Save Profile on Exit".
4. Select the menu item "File | Profile | Load Profile on Start-up"

10.10.7 Keep Profile up-to-date

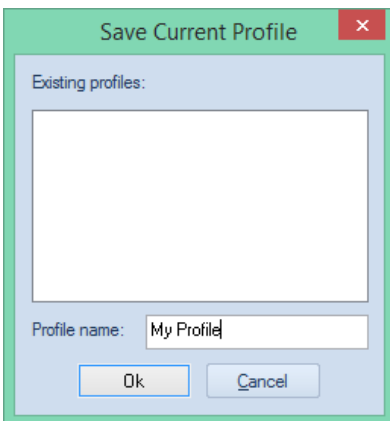
To help you remember to save the final adjustments, let *SimplexNumerica* remind yourself. Then you will be asked if you want to save the profile.

■ Procedure

1. Select the menu item "File | Profile | Save Profile on Exit".
2. When you close the application, a message box will appear.



3. Follow one of the three statements:



- Save Profile: Profile will be saved into the registry.
- Quit Program: Nothing will be saved.
- Cancel: Stop the action.

Hint

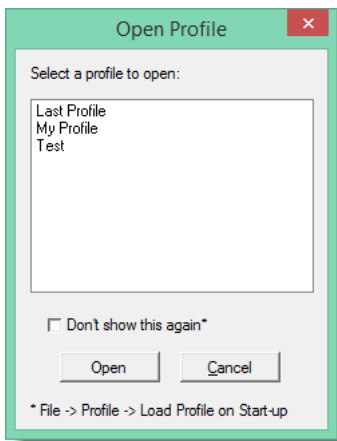
Depending on your security levels, a dialog, to ask for an administrator password, appears, because *SimplexNumerica* writes the info into the windows registry database.

10.10.8 Replace Profile at Runtime

SimplexNumerica has loaded a profile, but you will want to use another one. As far as no project or evaluation is open, you can load a different profile.

■ Procedure:

1. Select the menu item "File | Profile | Load Profile..."



- ↳ It appears the dialog "Open Profile".
- 2. Chose a Profile.
- 3. Click on the button "Open".
 - ↳ The profile is loaded.

10.10.9 Show dialog "Open Profile" again

As already mentioned, there is a possibility to permanently dismiss the dialog by selecting "Do not show this (dialog) again" in the above dialog. → Bring it back with File | Profile | Load Profile on Start-up.

11 SimplexGraphics Framework

You can learn here the basics of *SimplexNumerica's* graphical framework called *SimplexGraphics (SxG)*.

It provides basic elements like line, rectangle, circle and their Properties like pen, brush, font, arrow, shadow, etc.

Here,

- you can learn the shape types of *SimplexGraphics...*
- use (HTML) Text, Labels, Legends and more...
- All about Connectors...
- All about Groups...

11.1 What is SimplexGraphics?

SimplexNumerica based on the new sophisticated rendering engine called *SimplexGraphics (SxG)*, which produced astonishing graphics and layouts.

SimplexNumerica is also based on the scientific part of the visualization library *SimplexGraphics*, a C++ library for 2D graphics objects management (creating, editing, and viewing) and vector image publication.

The *SimplexGraphics* library is designed as a framework to develop vector based application. It offers a set of classes that abstract most commonly used shapes and allow user to define/add new building blocks as shapes. These shapes can be as complicated as a connector (link) that knows how to layout itself when connecting different components. It can also be as simple as a rectangle or ellipse shape.

SimplexGraphics library also offers many different GUI components to access graphics object's properties, such as size, rotation angle. It also offers an unlimited redo-undo framework that allows creating a user-friendly application. *SimplexGraphics* abstracts 2D graphic objects or its derivatives. *SimplexGraphics* components support serialization in binary form.



SimplexGraphics allows user to move, resize and rotate components through mouse actions. It also allows user to nudge (change the position by finite step) using keyboard. All these operations are abstracted as actions with undo/redo support.

To visualize the process of moving, sizing and rotation smoothly, these processes are decomposed to a serial of smaller process. The smoothness of the visualization is decided on the interval

between two mouse move events. If user drags the handle more slowly, the component will be sized or moved more smoothly.

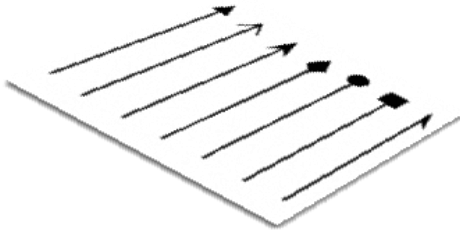
SimplexGraphics redraws components at the same time user moves/size/rotate the components. This redraw request is send to all components intersecting with this component under modification.

11.2 Shape Styles

There are standard shape properties similar to the Microsoft Office packet. We do not like to blow up this manual with all shape variations and properties. Please feel free to find out what is available...

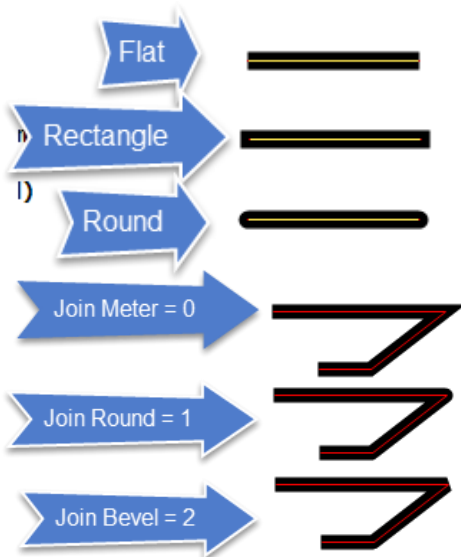
Here some of the styles:

Arrow Styles



Adding arrow to both or one end of a line or curve is easy to implement. The library has predefined eight type different arrows.

Pen Styles



Line Cap

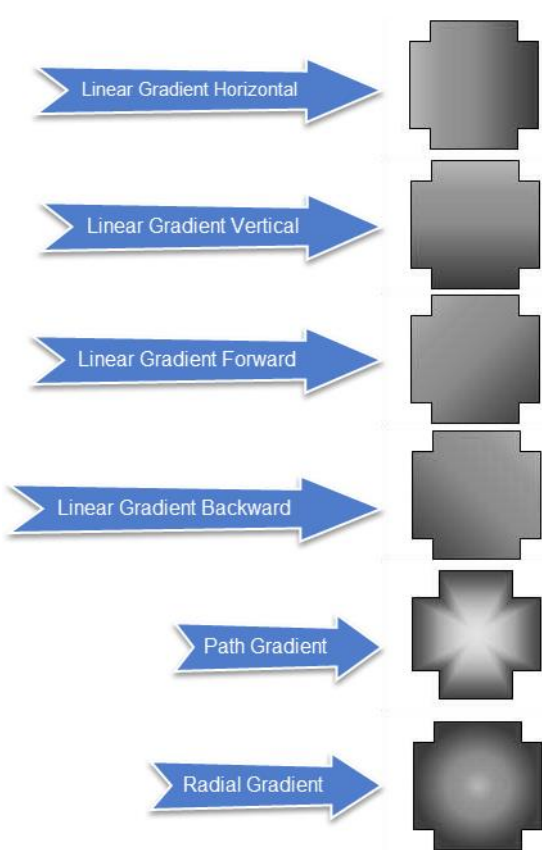
Line cap defines all the cap of a line is drew.

Line Join

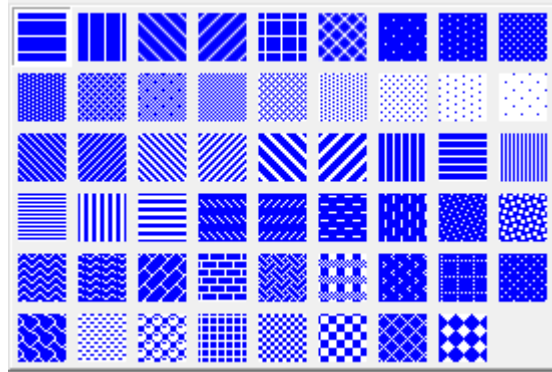
Line join defines all the join of a poly line/curve is drew.

Brush Styles and Hatch Pattern

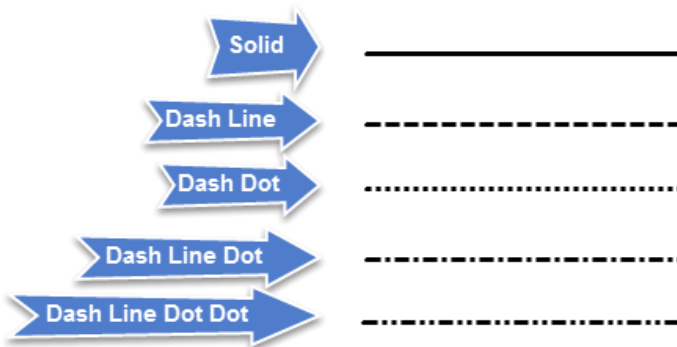
Brush property stores all the data that describe brush object or fill property. Use complex gradient and hatch pattern for filling or simpler pattern to store solid brush, which has one color. This basic brush is



suitable for cases that thousands or even more objects are visualized at real time, because gradient fill and hatch fill are time consuming.

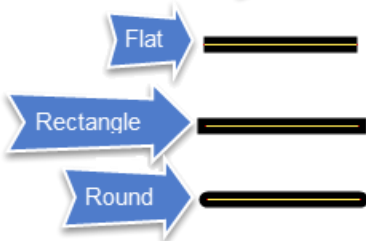


Dash Style

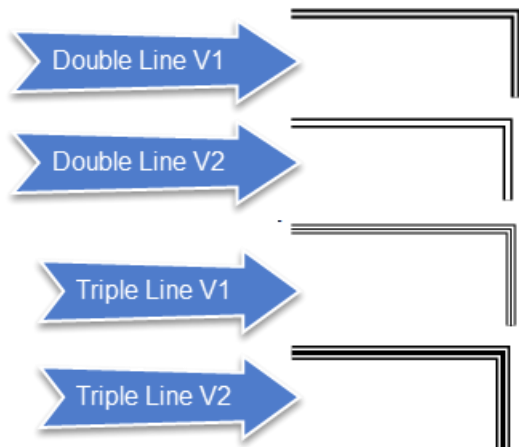


SimplexGraphics supports five dash style and also allow user to define its own dash pattern.

Dash Cap

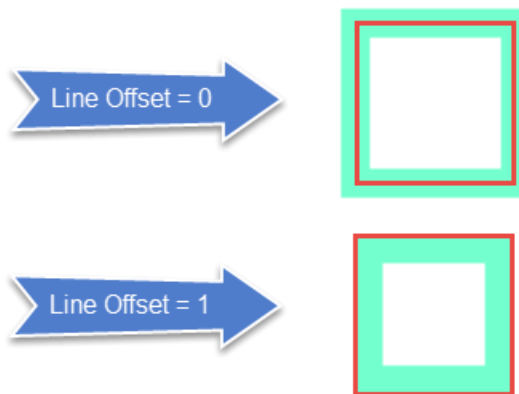


Dash cap defines the line's cap in the dash line.



Compound Pen Style

SimplexGraphics addresses the needs of compound pen style. It has defined the following special line style.



Line Offset

When drawing a polygon, if using pen width more than 1 pixel, user can choose different inset value (0, 1). If inset offset is set to be 1, the poly line will be inset. See following example of a rectangle, which the red dash line is the logical path of this rectangle.

Using brush in a pen

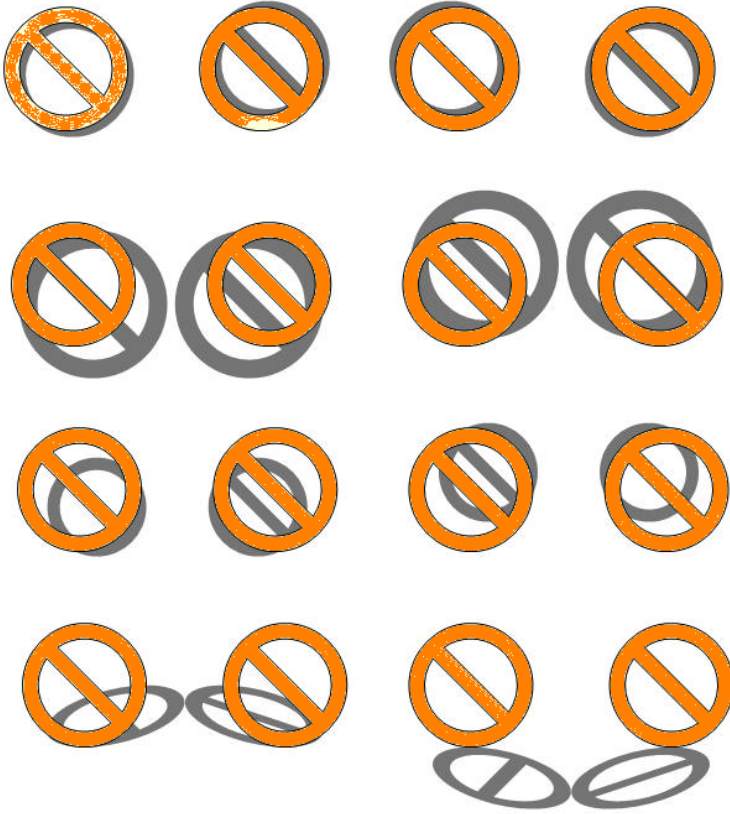
Default pen use a solid brush to rend the path. It is possible to use any sophisticated rendering brush (gradient, hatch or texture) brush in rendering a curve. Following examples are simply a rectangle and ellipse component, we use different gradient brush to rend the path (the rectangle) and the inner region. It gives a visual effect of button.

Using Arrow/Anchor

An arrow property can be attached to pen property to define the arrowhead in both end. A pen property can create the pen without arrow in both end. The brush to fill the arrowhead will be inherited from the pen property, so the arrowhead and the line/curve are uniform.

Shadow Property

The rendering engine allow different style of shadow effect. A shade is the projection of the region that component occupies. Since *SimplexGraphics* library is a 2D vector-drawing package, the projection is not a perspective transformation but an affine transformation. Although, there is not limitation of the brush used to fill shadow, gray solid brush (50% percent transparency) is default shadow brush. Following are the shadow type that *SimplexGraphics* currently support. User can set the transformation matrix to create different shadow effect. A filter property can also be applying to Shadow property to transform the color or visual effect.



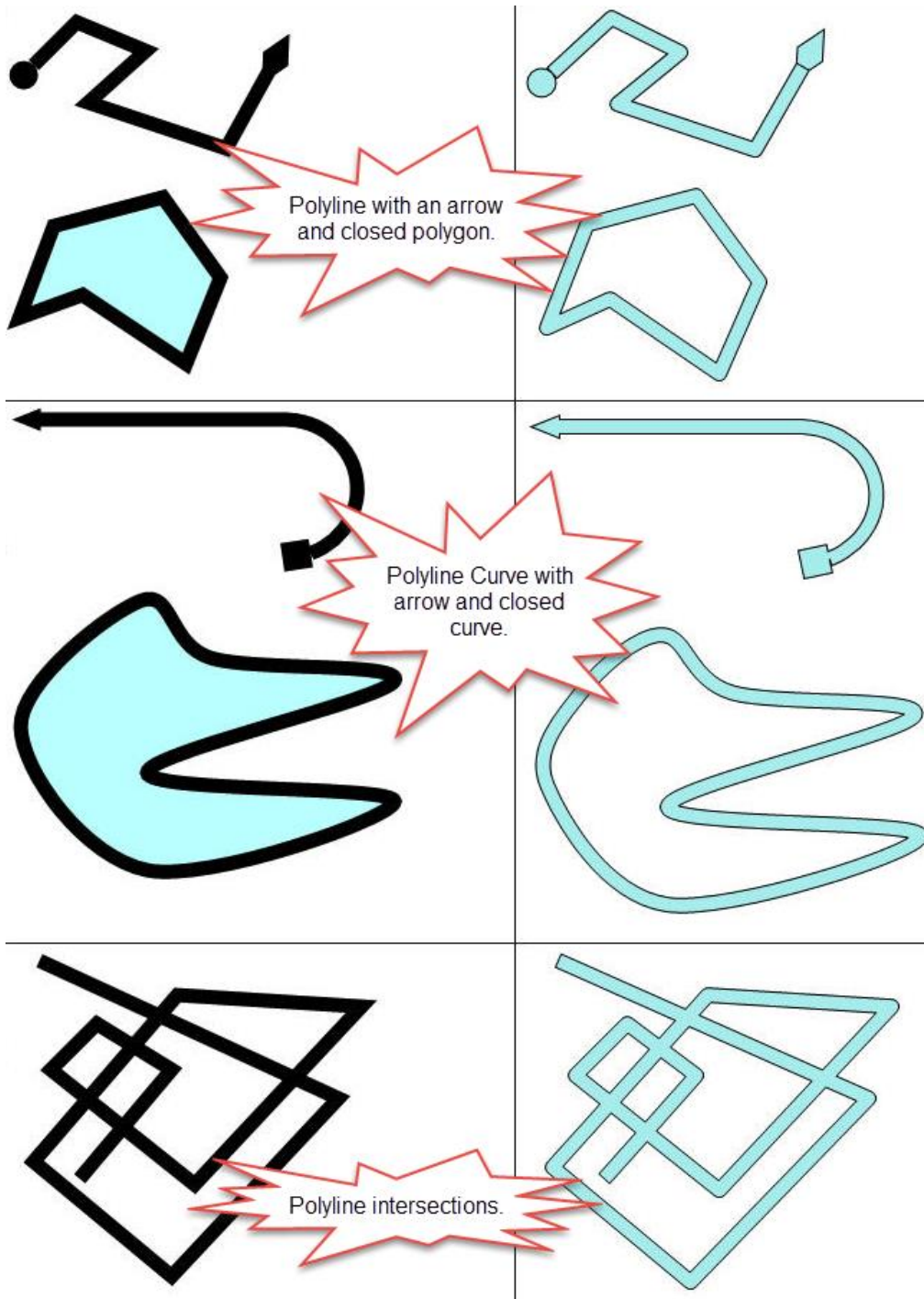
Shadow Offset

You can offset the shadow by setting the X-offset and Y-offset of the shadow. Shadow Fill can be filled by any brush and property, which will used create the brush property to fill the shadow.

A component finds the outline (boundary) of the shape, so that different pen and fill style could apply.

Outline Property

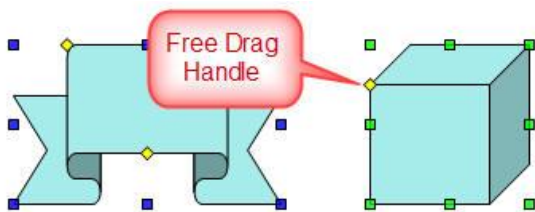
An outline property brings interesting effects to *SimplexGraphics* objects. Outline property will force



Edit/Add/Remove Points from Polygon

It is convenient that end user can add edit/point/remove using graphics user interface. *SimplexGraphics* gives the end users the capability to edit a poly object using mouse. When the tool is activated, use can choose either adding/moving a point or deleting a point. If user chooses to delete the point, and mouse is clicked on one current point, this point will be removed. If user choose to add/move point, and user click the mouse on a point that currently exists, then user can drag the point to another location. If the mouse is not clicked on a current existed point, but on the straight line connecting two existed points, then a new point will be added between these two points.

11.3 Inbuilt Shapes



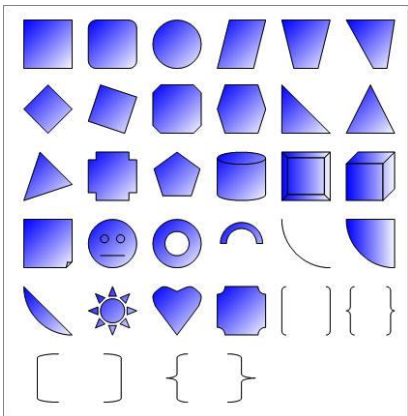
Shapes in *SimplexGraphics* are extended objects from the basis forms like lines, rectangles, etc. The difference between basis objects and general shapes is that shape typically has one or more free drag handle. A free drag handle (shown as yellow diamond) is a handle that user can use to

adjust the shape, like the roundness of a round rectangle. Some objects only use its handle for resizing.

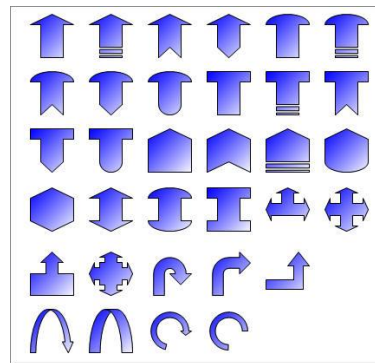
Basic shapes

Most basic shapes has 1-3 free handles that allows user to adjust the shape with mouse.

Block Arrows

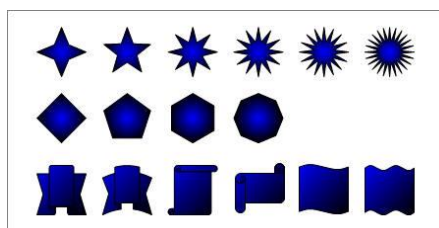


All the block arrow has 1-3 free handles that allows user to adjust the arrow shape with mouse.



Star and Banners

The number of vertices of a star or normal polygon could be any integer greater than 3.



11.4 Connectors

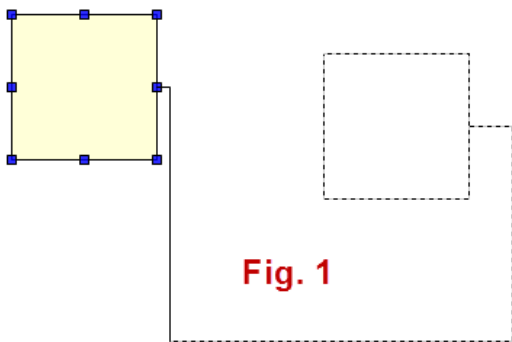
Connector is a line (curve) object that links two or multiple components or shapes. The most important feature of connector is that a connector is aware of the position change of the component it connects and it can automatically adjust its position to fit the new location of those components. A connector automatically re-compute its path to make the layout have optimized visualization effect.

Important note:

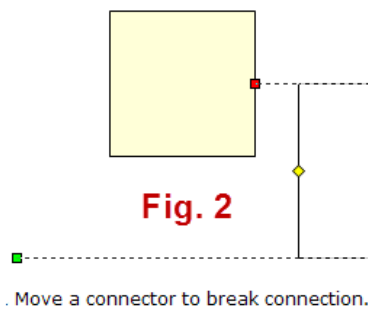
SimplexGraphics' connectors does not allow self-connecting. It does not connect another objects either.

When a connector is not in group, it doesn't allow rotation or flipping. However, if a connector is grouped with other components, rotating or flipping group will rotate or flip the connector correspondingly. Ungroup a group which has connector inside will trigger the layout (if the connector should be automatically layout) and normalization (if the connector is not normal) of that connector.

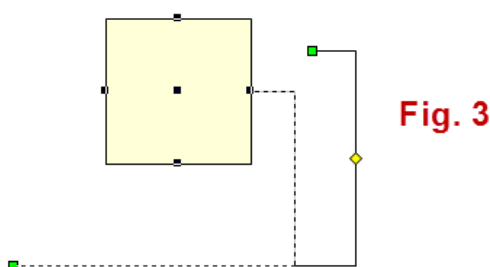
When a connector is connected to a component, move the component will update the connector (Fig. 1). Move the connector will break the connection (Fig 2). Drag the ends of connector can create or break connection (Fig. 3). Drag the free handle (not the ends) will adjust the path (Fig. 4).



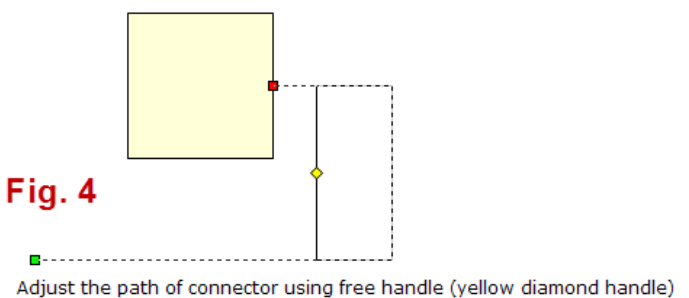
Move a component will cause the connector to change the path



Move a connector to break connection.



Move then end of connector to break connection



Adjust the path of connector using free handle (yellow diamond handle)

Connector and Layer Components

Connector and Layer Components can be located on different layer. A connector, as a component, can be located on different layer where the components it connects are. The components that are linked with a connector can also on different layer. If all components for connecting are on layer 1, and all the connectors are on layer2, change the z-order of layers will cause all the component are draw before connector or vise-versor, and if the component are not transparent, it can easily hide the part of connectors that is inside the components it links. Of cause, if the component is not transparent, this way does not work, but *SimplexGraphics* allow to only showing the connector outside the component. It is not simply clipping, but

recalculate the endpoint of connector based on the component's region, and it will draw the arrows near the edge of component. Connector does not support cross-canvas link.

Connector with Two Ends

In many cases, a connector with two ends satisfies user's requirement well. The current mouse cursor position will query the document to find the component that can be connected. User can introduce different logic to choose the connectable component. *SimplexGraphics* support automatically layout, if a style bit of component is set to be one. It also has a parameter to adjust the roundness of the corner. It also allowed user to edit the path of connector in the same way. Those editing effect will be lost if style layout bit is set to be true.

Anchor Point

By default a component has five preferred points that can be used for connection. These points are called anchor point. For symbols, user can define any numbers of default anchor points in *SimplexGraphics*. For example, a pump component may have two anchor point to represent the inlet and outlet. A component could be connected to any point.

Auto Layout

SimplexGraphics supports auto layout. Once the anchor point position is changed, connector will be recomputed with the best route to connect the objects. The relative position of components and the size of the component all affect the layout output. If a connector is in a group, it will be prohibited for auto layout. User has the following option to adjust the layout effect.

1. Preferred Initial direction
For the anchor point, it has a preferred the direction (left, right, up and down) to connect a connector object. For the center anchor point, the preferred direction could be any direction.
2. Initial Minimum Distance
Defines the initial distance that connector has to extend along the preferred initial direction. Default value is 10.
3. Connect edge instead of anchor point
Connector usually connects to the anchor point. *SimplexGraphics* allows to hide the part of connector that is inside the component it connects. The effect will be connecting to the edge instead of an anchor point, if it is inside the shape.
4. Adjust Path Using Free Handle
Connector supply drag handle that allows user to adjust the layout after the automatically layout is done. Once auto layout is redo, the effect of adjusting will be lost. *SimplexGraphics* maintains the pointer to connector and component, as well as the index and position of anchor point on which they are connected.

11.5 Text, Labels and Legends

SimplexNumerica has three levels of text support. The first option is using *SimplexGraphics* normal text objects, the second option is the label and legend support connected to a chart. Both using the *SimplexGraphics* text formatting and drawing functions. The third option is using *SimplexEditor* as an In-process Server for HTML text support, which needs *SimplexEditor* to be installed in the same machine and directory of *SimplexNumerica* executable.

There are different advantages for these three ways. HTML text support is very simple to use because *SimplexEditor* takes care of almost everything. There is no shortcoming at all. However, the most native way in *SimplexGraphics* for text support is using standard text boxes like rectangles and lines and the labels connected to a chart. Text or label components are treated as a property of components in *SimplexGraphics*. The difference of text property and label property is:

1. Absolute position to a component like a chart cannot be changed by the user. *SimplexNumerica* implements a drag handle (Pin) to allow user change label position by mouse dragging and dropping only relative to the chart.
2. Text will transform with the component. If you rotate/flip/shear components, text will rotate/flip/shear with it. *SimplexGraphics* Label property will not transform with component. Use text with different style of text trimming, wrap and alignment.

SimplexGraphics also supports fitting the boundary to the text so it tightly bounds the text and drawing text with gradient/hatch/texture brush.



11.6 Groups

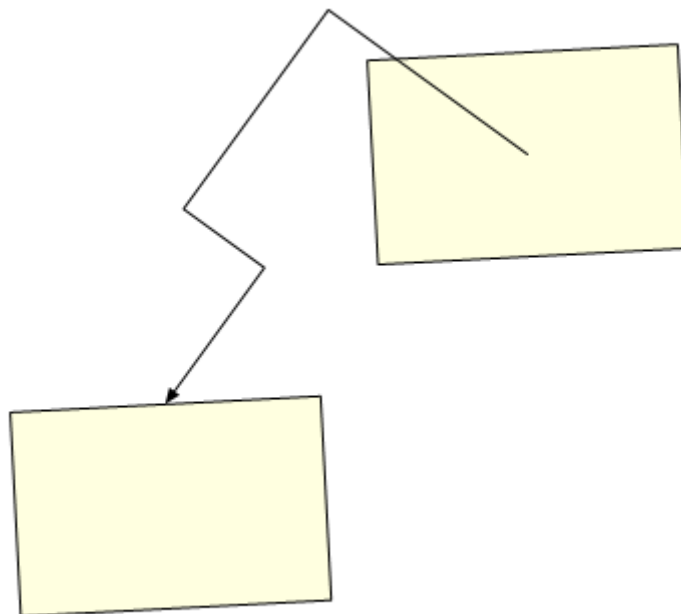
It is convenient to select multiple components (Shapes, Charts, etc.) and change the properties simultaneously. The Group mechanism gives user also the possibility to manipulate multiple properties in the similar way user does with a single component. *SimplexGraphics* allows multiple components in the same layer are grouped. It is enforced in *SimplexGraphics* that one component can only belong to one group, while a group, as can belong to another group. *SimplexGraphics* allows multiple level grouping.

It is different to rotate a group object comparing to rotate multiple component at a time. In the latter case, all components rotate with its own center and will not change the position. A group object will rotate with its center, then the components in this group are actually changing its position.

Components can be located on different layer for grouping. A group, as a component, can also be located on different layer.

If you change the group's layer location, the components inside of the group are not changed. However, developer can explicitly change the location of all components to the layer where group is located, if this is desired.

SimplexGraphics implements two action related to grouping and ungrouping. If ungrouping a group, which includes connector, the up group action will trigger the normalization of this connector (if it is rotated or flipped) or automatically layout this connector.



11.7 Use of the Shapes

SimplexNumerica has a Shape Explorer (→ **Chart Explorer**) to list all shapes and a property list window which allows to set the properties for each individual object (shape).

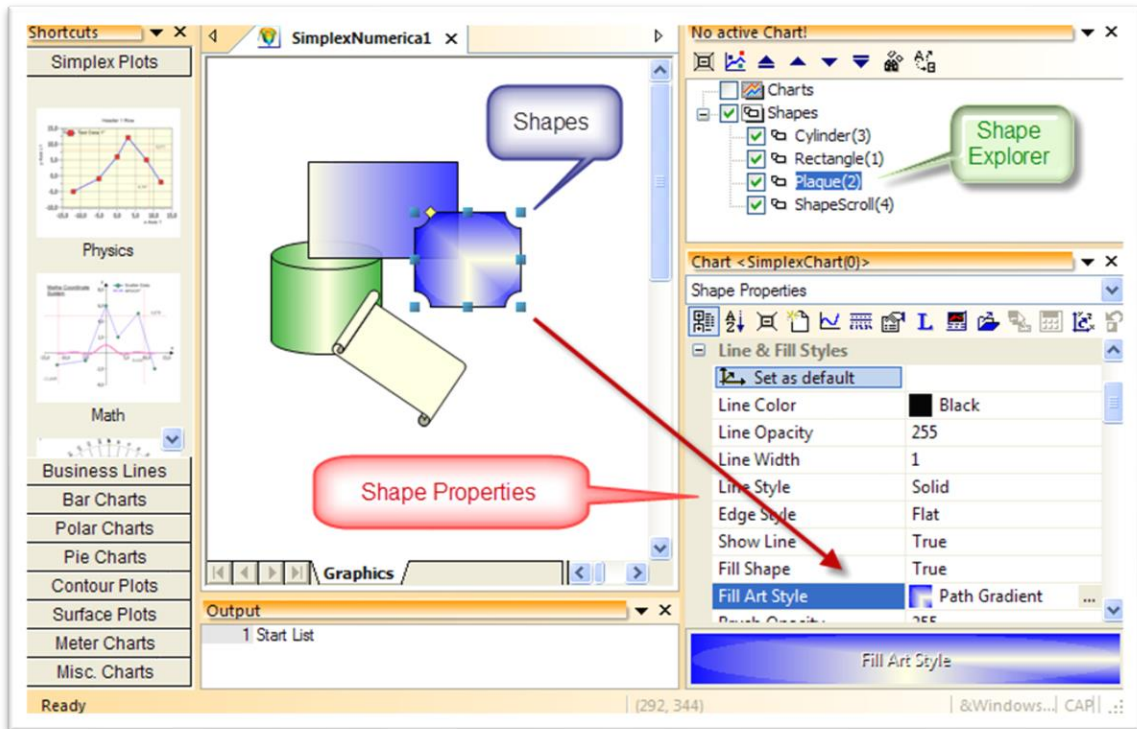


Fig.11-1: User-Interface for Shapes

Info

- Each shape is placed by its name into the hierarchy of the *Chart Explorer* under the rubric **Shapes**.
- Click on one of this shape names opens the related properties in the window called **Shape Properties**

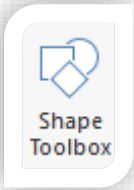
Tip

The color control inside the property window has more options as it look like... Change a shape to its appropriated color and style, and then set it as default for the next drawings.

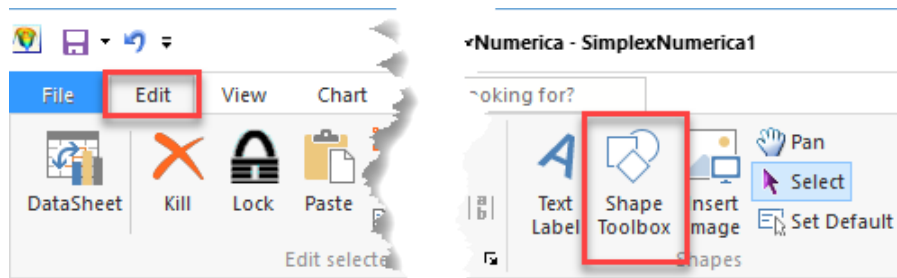
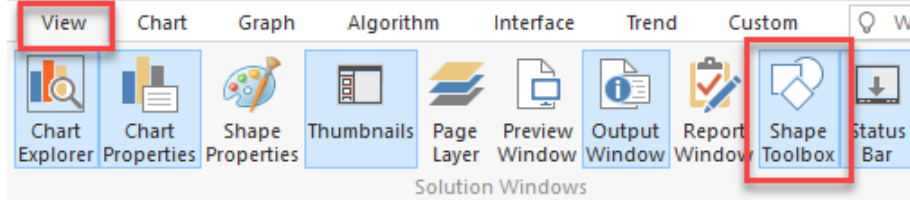
As already told before, lines are snapping like a magnet if they see another...

11.7.1 Shape Toolbox

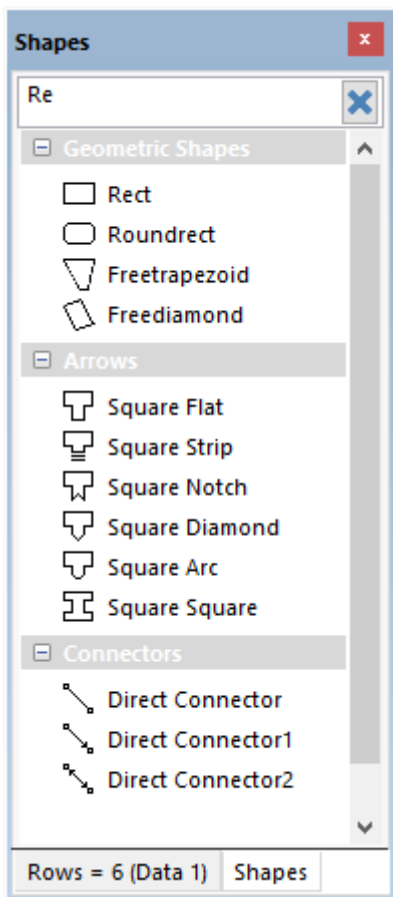
Activate the Shape Toolbox with the help of the Ribbonbar Icon to the left.



You can find it here:



Or you can find it here:






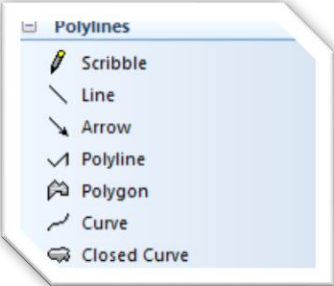

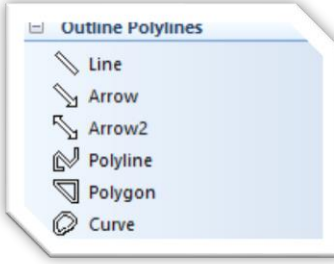

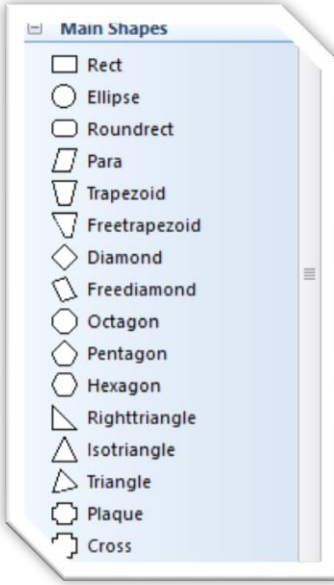
To find fix a shape, please use the search field on top of the list.

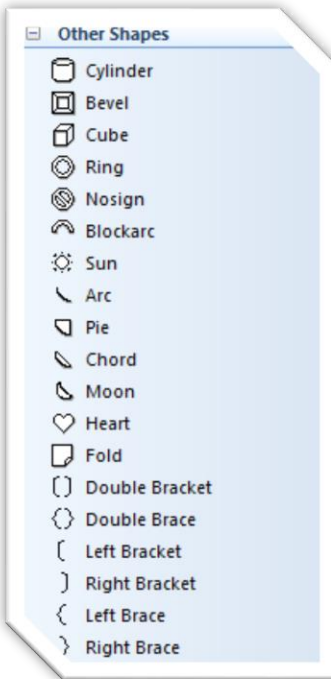
To use it, please select a shape, then click on the page to expand it.

Or, drag and drop a shape from the list to the page and expand it afterwards.

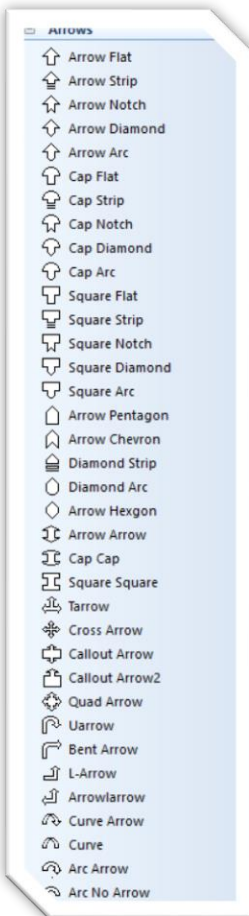
Tip
Hold down the <Ctrl> key to repeat the selected drawing shape inside the page.
When you have pressed the <Ctrl> inside the page, then you can paint the same shape multiple times around. Press right mouse to stop.

The following table explains the functions of the *Ribbonbar Edit*, panel *Shapes* and the Toolbox.




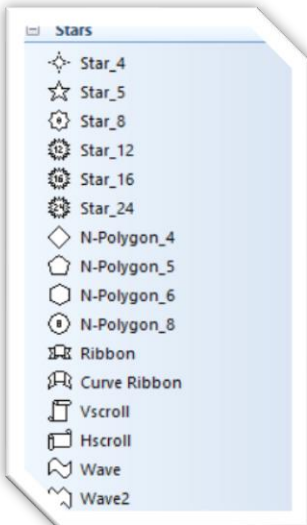

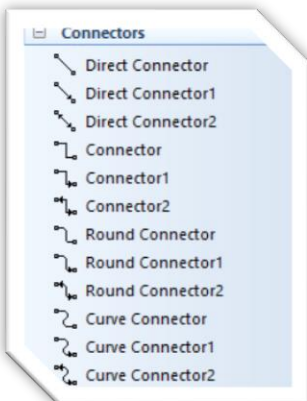

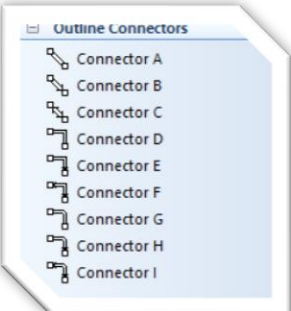
Symbol	Function
	Pan Page Content Pan or move the content of the page inside the scrolled window.
	Select Object Select an object (or more) and use the properties to modify it. Or select in the <i>Chart Explorer</i> a name of an object. The object on screen will be selected, too.
	 <p>Polylines</p>
	 <p>. Outline Polygons</p>
	 <p>Geometric Shapes</p>



Other Shapes



Arrows

 Text Label	Insert Text Label* Edit on screen: Double-click > Edit directly in Text field, Ctrl + Double-click > Call Text dialog
 Insert Image	Insert Image. Insert picture/image/bitmap from disk. Use the Fileselectbox to choose the right format in its integrated combobox
	 Stars
	 Connectors
	 Outline Connectors

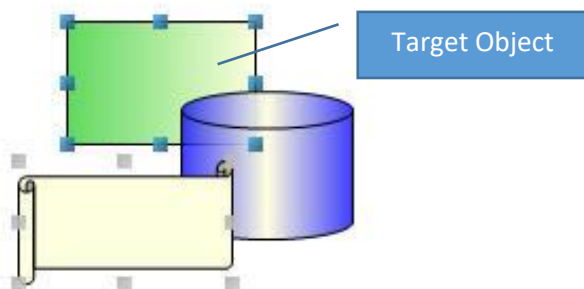
11.7.2 Shape Objects

The focus on this category is concentrating on shape objects. Charts and shapes, they have the same object oriented graphics framework, called *SimplexGraphics (SxG)*. Please have a look at last chapter for more information.

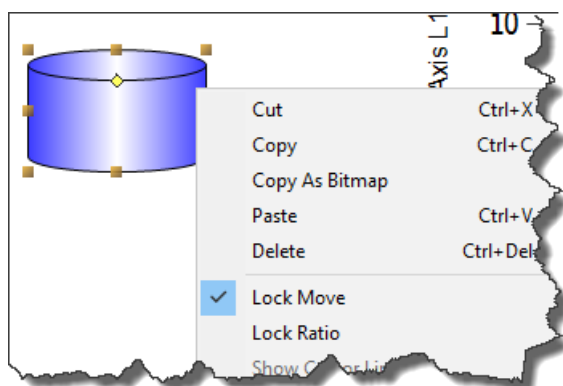
- Def.: Object = Single Shape (like Rectangle, Circle, etc.).
- Object = Shape behind a Chart.
- Chart = Shape + Chart Form, Scaling, Graphs, etc.

Selecting Objects

Before any operations, such as resizing and color changing, the objects must be selected. The **Handles** of the selected objects will be shown as the following figure, where the most recently selected object has the **Blue** handles and other objects have **Gray** handles. The object with **Blue** handles is also called **Target** object, which is used by some operations (i.e., **Align** and **Same Height**) as the reference object.

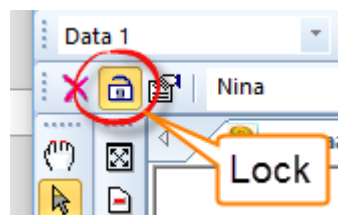


Lock an Object



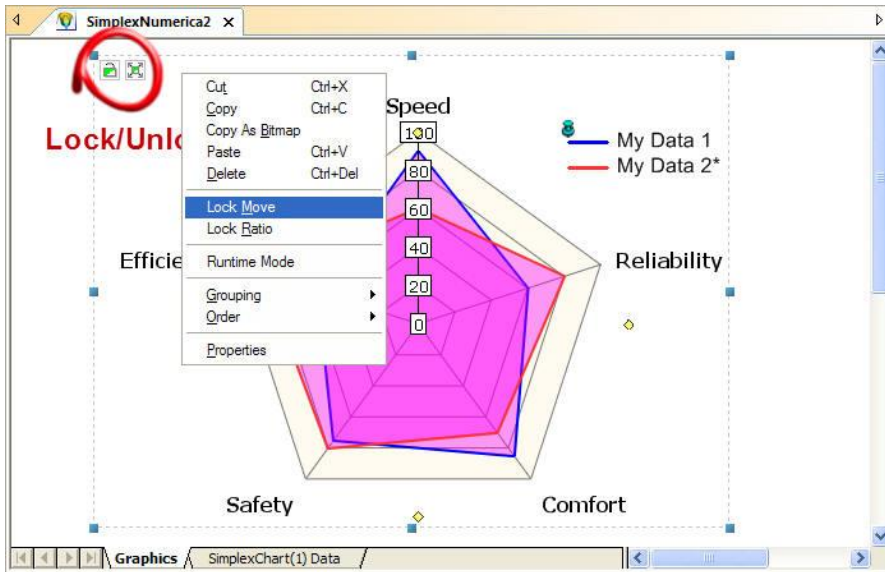
You can lock an object so that it cannot be moved around. It is fixed on the locked place.

→ Right mouse click on an object opens the Popupmenu where you can select this menu item,



or use the toolbar icon to lock/unlock an object.

Lock/Unlock Chart




Click with the right mouse on a chart to open the same Popumenu as before

or

click on the Lock/Unlock symbols as shown in the left picture to select either **Lock Move** (checked) or **Unlock Move** (unchecked) or **Lock Resizing** (checked) and **Unlock Resizing** (unchecked).

Select an Object

To select an object, first press the **Select Tool** button  (if not the default button) on the Ribbonbar **Edit**, then click the object. For the objects filled with the transparent color, their borders should be clicked instead.

To select multiple objects, after selecting an object, hold down **Ctrl** key and click on other objects, one by one. Click the selected object with **Ctrl** key held down would de-select the object, again.

You can also use the mouse to drag a region to select all the objects in that region. To drag the mouse, hold the left mouse button down and move the mouse. When the mouse is moving, a temporary dotted rectangle is used to represent the region. When the left mouse button is up, all the objects that are completely enclosed by the rectangle region will be selected. To add the dragging selection to an existing selection, drag the mouse while **Ctrl** key is held down.

To select all objects, use the **Select All** (or **Ctrl + A**) command from the Pulldownmenu **Edit**.

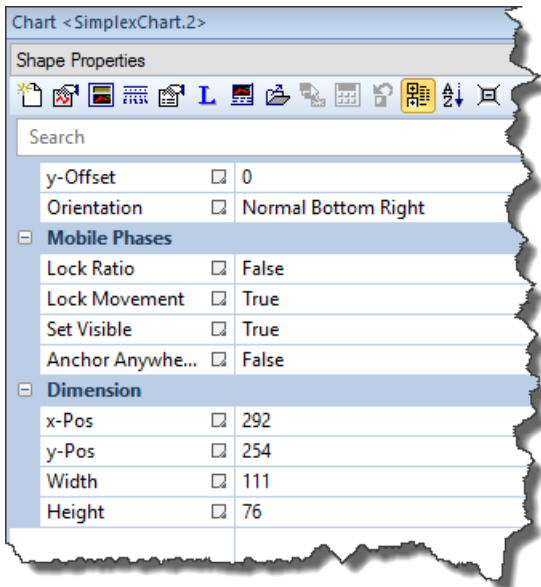
Moving Objects

To move an object (or several objects) to a new position, you need to select it, first. See previous chapter **Selecting Objects** on how to select objects.

Move the mouse on the selected object, the mouse cursor changes to a four-directional cross and you can **click and drag** the selected object to a new position as illustrate below.

You can also change the position of the selected object by changing its X and Y coordination within the **Property Window**.

Resizing Objects




To change the size of an object, you need to select it first. See previous chapter *Selecting Objects* on how to select objects.

Move the mouse over the **selection handles** of the selected object, then **click and drag** the mouse to an appropriate size you wanted as illustrated below.

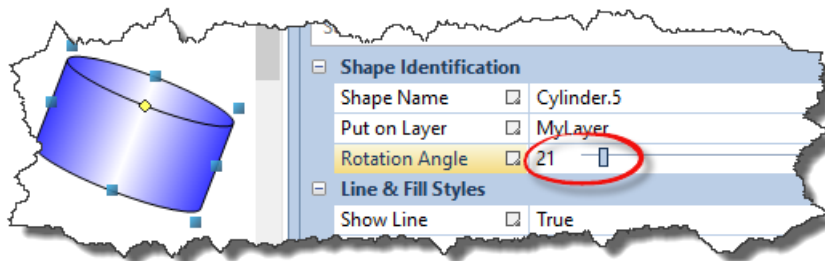
You can also resize the selected object by changing its **X** and **Y** coordination as well as its **Width** and **Height** within the **Property Window**.

Rotating Objects

To rotate an object (or several objects), you need to select it, first. See *Selecting Objects* on how to select objects. Unfortunately, you cannot rotate a chart.

Click the Rotate Button  in the toolbar, then move the mouse over the **selection handles** of the selected object, then **click and drag** the mouse. The select object (charts are not possible to rotate, yet) will rotate according to its center with an appropriate angle as illustrated below.

You can also rotate the selected object by changing its **rotation angle** within the *Property Window*.



Flipping Objects

To flip an object (or several objects), you need to select it first. See *Selecting Objects* on how to select objects.

After selecting the object (s), click the **Flip Buttons** in the toolbar to flip it (them).

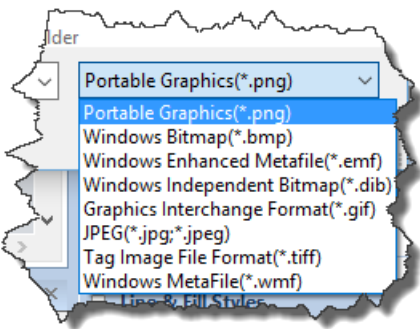


The effect of flipping corresponding to rotation with specific angle (90, 180, 270 etc.). Therefore, you can also specify the selected object's **rotation angle** within the Property Window.

Most of these menus are standard on Windows so please refer e.g. to *Microsoft Office* package help.

Insert Image

You can import any bitmap from disk to insert into the evaluation page as a single shape object. The most popular formats that can be used inside *SimplexNumerica* are:



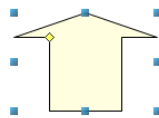
- Portable Graphics(*.png)
- Windows Bitmap(*.bmp)
- Windows Enhanced Metafile(*.emf)
- Windows Independent Bitmap(*.dib)
- Graphics Interchange Format(*.gif)
- JPEG(*.jpg;*.jpeg)
- Tag Image File Format(*.tiff)
- Windows MetaFile(*.wmf)

Select the format in the combobox of the Fileselectbox.

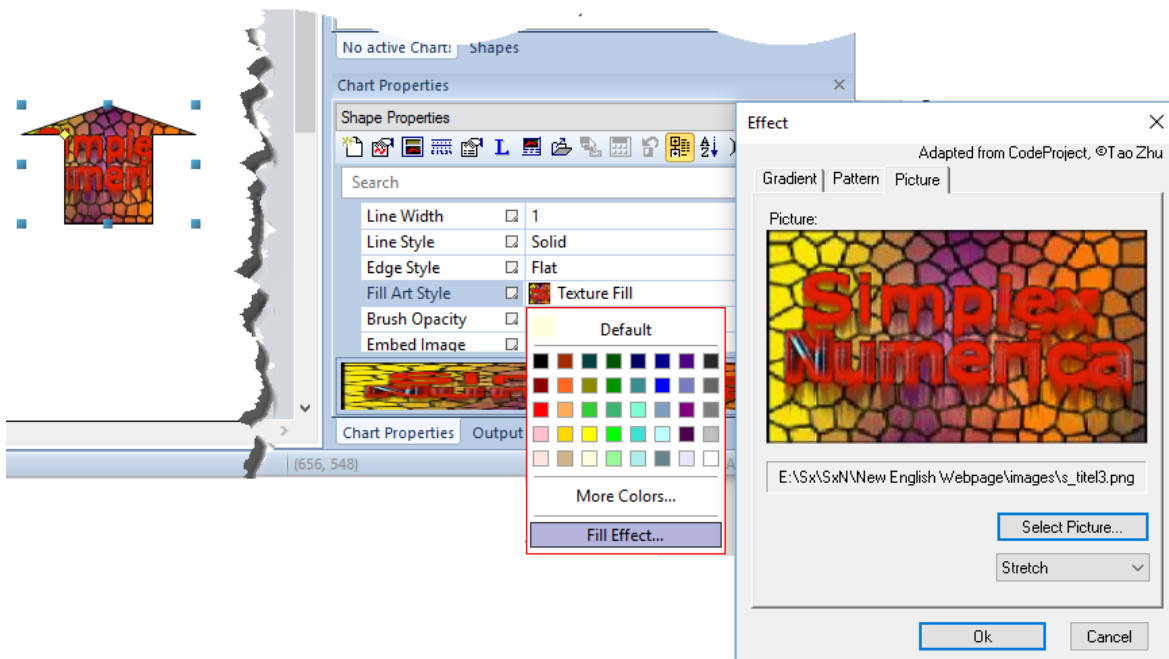
Another possibility to insert a picture is to use the shape properties, instead.

Fill a Shape with an Image

→ Please draw or select a shape.

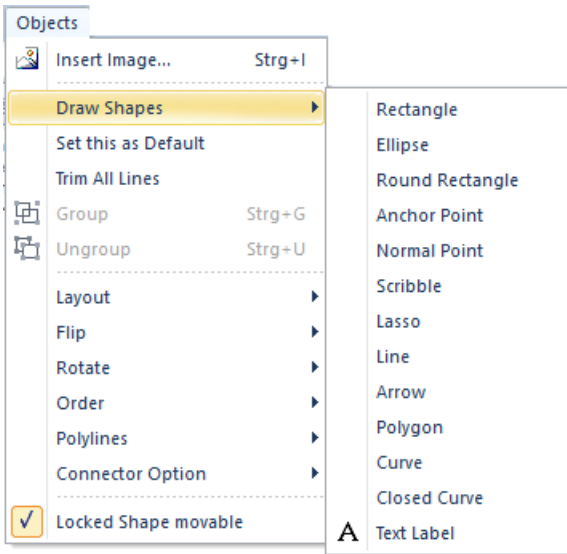


As far as you select a shape, its properties will be listed in the **Property Window**.



Scroll down to **Fill Art Style** and click on **Fill Effect...** to open an Effect dialogbox. Change to Tab **Picture** and select your choice on disk...

Draw Shapes



These here are the normal geometric shapes.

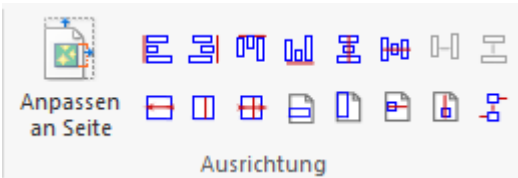
Hint

If you need more shapes, then please have a look at chapter 0.

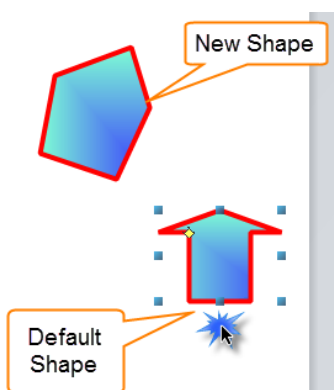
- Draw a shape and use the properties to set its style.
- The **Text Label** has more functionality. Please have a look at chapter 16.3.4.
- Exit a **Polygon** or **Closed Curve** line chain with **Right Mouse Button** or **double-click with the left button**.

Locked Shape movable

Use this menu item to activate some icons in the **Alignment Toolbar**, so that you can also move locked shapes.

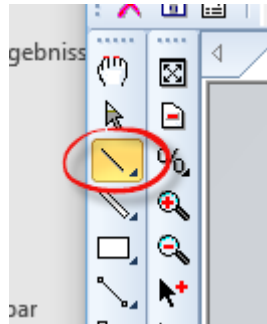
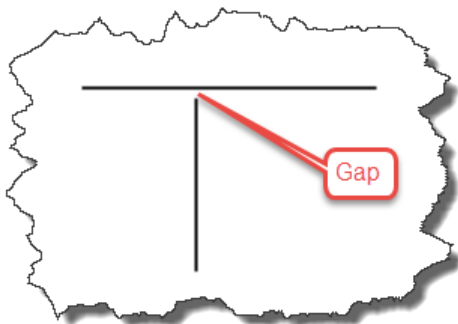


Set this as Default



Sets the style of the selected shape as the default style for all next new shapes until you set another shape to the default.

Trim all Lines



This menu works only for **Straight Lines**.

It can close **all near gaps** between orthogonal lines.

Hint

→ When you draw a **Straight Line** and this line comes near to another line, then it automatically extends its length, so that it touched the other. To avoid that behavior, please press the key **<Shift>** in that zone.

→ Holding down the **<Ctrl>** key during drawing a line will snap-in the line at practical angles.

Group/Ungroup

Objects can be grouped as you know it from a lot of drawing programs...

Merge Objects

Use this menu item to make from selected shapes one single shape.

Info


Please use group/ungroup to merge shapes temporarily together.


If you have done this, then you cannot undo it to a later time.


Objects z-Order




These are standard icons in a vector editing program. You can bring objects (charts & shapes) in front of another or look to the tooltips:

 **Bring to the Front**
Bring Object to the front on the same Layer

 **Bring to the Back**
Bring Object to the back on the same Layer

 **One Step Forward**
Bring Object one step forwards on the same Layer

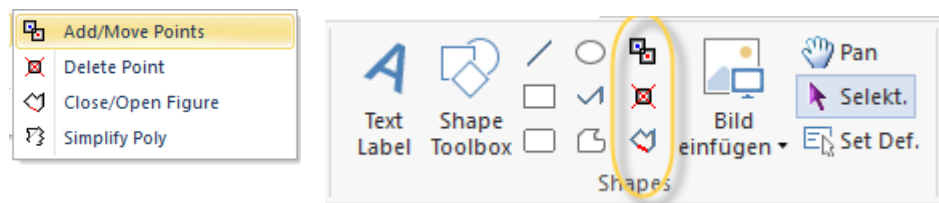
 **One Step Backward**
Bring Object one step backwards on the same Layer

Polylines

A **Polyline** is a chain of single straight lines. A **Polygon** is a closed **Polyline**.

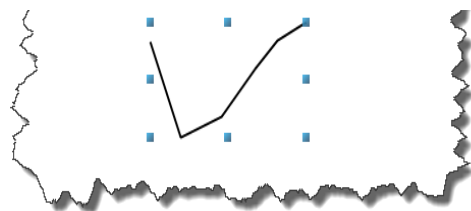
Use this menu items to **Add/Move/Delete** points among this chain links.

If the polyline has a lot of knots, then it makes sense to simplify it.



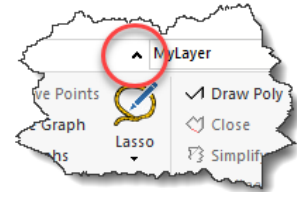
Convert to Path

Herewith you can convert e.g. a polygon into an integral whole that can be filled.



12 Ribbonbar Overview

Please take a short look at chapter 7.2 for the elements of a Ribbonbar.



A Ribbonbar cannot be moved around the main frame of the application like toolbars. But it can be set hidden and shown again, use that symbol here:

Unfortunately, like in Microsoft Office, the panels and icons of a Ribbonbar cannot be changed by the user.

But on top, there is a small toolbar called **Quick Access Toolbar**, that can be modified by the user with the help of an option dialog.

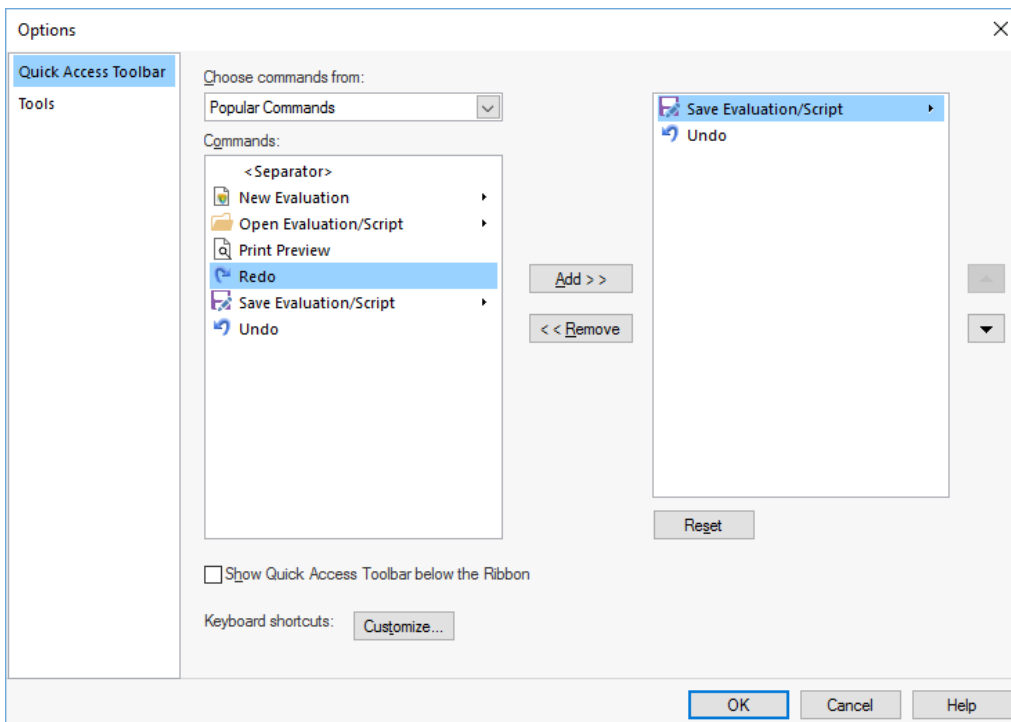
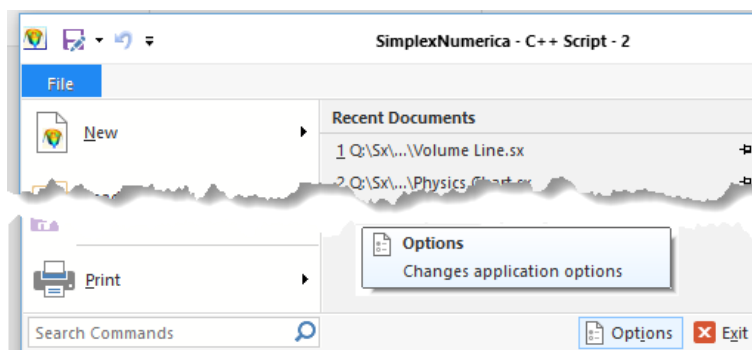


Fig.12-1: Option Dialog to modify the Quick Access Toolbar

You can find this dialog here:



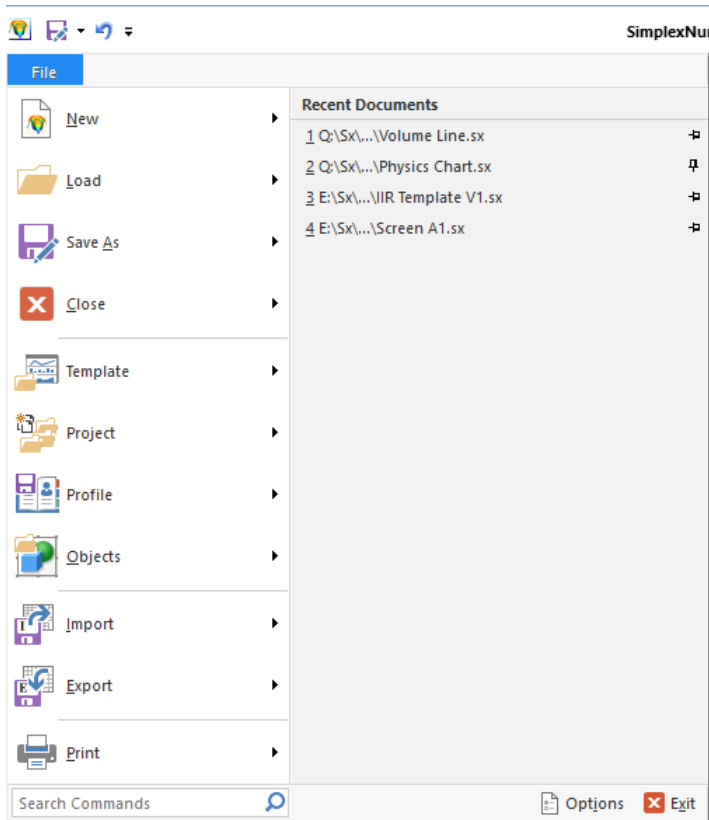
Go to File, Button Options.

Tip

Use edit field "Search Commands" to list the functional Ribbonbar entries.

12.1 Ribbonbar File

The *Ribbonbar File* appears underneath the left upper corner of the program mainframe. It behaves like a Pulldownmenu - but sure if you click on it.
































Right to the menu, you can see the most recent document list. If you like to have entries permanently, then use the pin on the right side.

























The following table explains the commands and functions of the Ribbonbar *File* with the larger Ribbonbar Icons.

These are the commands inside the Ribbonbar *File*:

Icon	Key	Function	Description
Menu Item New			
	Ctrl + N	New Evaluation	Open up an empty Evaluation window
	Ctrl + M	New Scripting Host	Open up a new window for scripting
	Ctrl + K	New Spreadsheet (short Table)	Open up a new table window
Menu Item Load			
	Ctrl + O	Load Evaluation/Table/Script	Open an existing Evaluation, Table or Script
	Ctrl + R	Reload Evaluation	Reload the current evaluation file
	Ctrl + T	Load Template	Load a new Template
	Ctrl + Shift + O	Load Project	Load a project file from disk

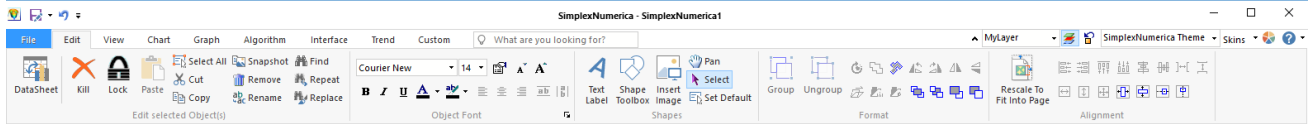
Menu Item Save			
	Ctrl + S	Save Evaluation/Table/Script	Save the active Evaluation/Table/Script
	-	Save As	Save the active EvaluationTable//Script under a new name
	-	Save Copy As	Save a copy of the active document with a new name
	-	Save Copy As Open It	Save a copy of the active evaluation under a new name and open it
	-	Save All	Save all open evaluation windows
	-	Save Close All	Save All and Close
	-	Save Close All but this	Save ALL Tab windows and Close it, except this one
	-	Encrypt before saving	Use secure password for evaluation
	-	Save Evaluation as Image	Export Chart as Bitmap
	-	Save Evaluation as Template	Save a Template (= Evaluation without data) to disk
	-	Save All Evaluations as Project	Save all Tab windows (evaluation and scripts) to disk
Menu Item Close			
	-	Close Window	Close the active Evaluation/Script window
	-	Close All	Close all evaluations/scripts
	-	Close All but this	Close all windows - but not the active one
Menu Item Project			
	-	Load last project on start-up	Load last project on start-up
	-	Save All Views Project then Close	Save All Tab Views and Project then Close
Menu Item Profile			
	-	Load Profile (on the fly)	Load program GUI on the fly
	-	Load Profile on Start-up()	Load Profile on Start-up
	-	Save State (on the fly)	Save program GUI on the fly
	-	Save Profile on Exit()	Save Profile on Exit\
	-	Auto save Profiles	Load always last profile
Menu Item Object			
	-	Load Object	Load an object (chart or shape) from disk

	-	Load Template Object	Load a Template from disk. The data and labelling will be used from the active evaluation!
	-	Change Chart Dimensions	Open a dialog to change the chart dimensions, too
	-	Change Page Size	Open a dialog to change the page size
	-	Save Object	Save the selected object (chart or shape) to disk
	-	Save Object(s) as Image	Export Chart Object as Bitmap
	-	Save Template Object	Save a Template (= Evaluation without data) to disk
Menu Item Import			
	Ctrl + L	Import Table Format [*.csv]	Import Comma Separated Table Data (*.csv)
	-	Import Table Layout File [*.tbl]	Load Table Layout File [*.tbl]
	Ctrl + 9	Import Table Default Layout File [Default.tbl]	Load Default Table Layout File [*.tbl]
	-	Format Properties	Import/Export Format Properties
	-	Import Excel [*.xls] or [*.xlsx]	Import Table from Excel (*.xls)
	Ctrl + E	Import Excel with Filter [*.xls] or [*.xlsx]	Import Table from Excel (*.xls)
	Ctrl + D	Import Database	Import Database
	-	Import DBase III Format [*.dbf]	Import Table from DBase (*.dbf)
	-	Import CitectScada [Tr}.dbf]	Import Table from Citect
	-	Import DSP File	Import Table from DSP File
	-	Import Short Wave File [*.wav]	Import Table from Wave File
	-	Import ASCII Text, Import Comma-separated values	
	-	Import Comma-separated values	
	-	Import Sietronics Sieray '*.CPI'	
	-	Import Siemens/Bruker Diffraction '*.UXD'	
	-	Import Rigaku '*.DAT'	
	-	Import Siemens/Bruker '*.RAW'	
	-	Import VAMAS ISO-14976	
	-	Import Philips '*.UDF'	
	-	Import Princeton Instruments WinSpec	
	-	Import Powder Diffraction '*.CIF'	





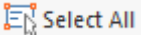

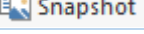
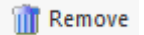
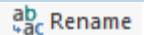
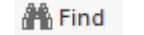

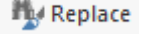
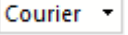










	-	Import Philips RD Raw Scan '*.V3'	
	-	Import Canberra '*.MCA'	
	-	Import Canberra '*.CNF'	
	-	Import XFIT '*.XDD'	
	-	Import RIET7/ILL_D1A5/PSI_DMC '*.DAT'	
	-	Import DBWS data file	
	-	Import ChiPLOT data	
	-	Import Spectra Omicron/Leybold	
	-	Import Weisang RingBuffer	
	-	Import Weisang RingBuffer Extended	
Menu Item Export			
	-	Export Table [*.csv]	Export Table Data (*.csv)
	-	Export Excel [*.xls] or [*.xlsx] File	Export Table to Excel (*.xls)
	-	Export HTML Table [*.html]	HTML Table [*.html]
	-	Export Table Layout File [*.tbl]	Save Table Layout File [*.tbl]
	-	Default Table Layout File [Default.tbl]	Save Default Table Layout File [Default.tbl]
	-	Export Wave File [*.wav]	Export Table in Wave File
Menu Item Print			
	Ctrl + P	Print	Print the active page
	-	Print Setup	Change the printer and printing options
	-	Print Preview	Displays the page to prepared for printing
	-	Page Setup	Change the page dimensions and margins of the page
	-	Page Units	Setup the Page Units
	-	Canvas Size	Setup the Canvas (page content) Size
	-	Copy the Evaluation, then set e.g. DIN-A4, adjust (rescale) and print it	
Bottom Band			
	-	Options	Changes application options
	Ctrl + Q	Exit Program	Exit SimplexNumerica Program








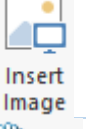

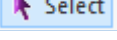















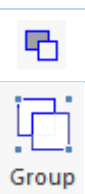
12.2 Ribbonbar Edit


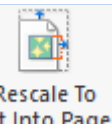
The *Ribbonbar Edit* is a fix tape, sorted by the Tab with the name “Edit”.


















These are the commands inside the Ribbonbar *Edit*:

Icon	Key	Function	Description
	F3	Swap Graphics/GraphTable	Swap between Graphics and GraphTable (Grid) page
	-	Kill Top Object	Remove and delete topmost selected Chart/Shape and its data from memory (No Undo!).
	-	Lock/Unlock	Lock/Unlock movement of a chart/shape
	Ctrl + V	Paste	Insert Clipboard contents
	Ctrl + A	Select All	Select the entire document
	Ctrl + X	Cut	Cut the selection and put it on the Clipboard
	Ctrl + C	Copy	Copy the selection and put it on the Clipboard
	-	Copy As Bitmap To Clipboard	Copy selection as bitmap to clipboard
	Ctrl + Entf	Remove selected Objects	Remove all selected Charts/Shapes and put them into an Undo buffer (at the expense of memory).
	-	Rename Graph	Rename specific graph text with different text
	Ctrl + F	Find	Find Text
	Ctrl + Shift + F	Repeat	Repeat the last action
	-	Replace	Replace specific text with different text
	-	Fontname	Fontname of the selected text
	-	Fontsize	Fontname of the selected text
	-	Properties	Text Format Properties
	-	Shrink Text	Shrink the selected text
	-	Grow Text	Grow the selected text
	-	Bold	Makes the selection bold (toggle).
	-	Italic	Makes the selection italic (toggle)
	-	Underline	Formats the selection with a underline (toggle)
	-	Foreground Color	Formats the selection with a foreground color
	-	Background Color	Formats the selection with a background color.
	-	Align Left	Left-justifies paragraph

	-	Center	Center-justifies paragraph
	-	Align Right	Right-justifies paragraph
	-	Fit Horiz. Text	Fit the Shape to bound horizontal text
	-	Fit Vert. Text	Fit the Shape to bound vertical text
	-	Font Dialog	Show the Font dialog box.
	-	Insert Text Label	<u>Click on entry:</u> Doubleclick → Edit, Ctrl + Doubleclick → Dialog
	-	ID_VIEW_ALWAYS_TOOLBOX	Shape Toolbox
	Ctrl + I	Insert Picture	Insert picture/image/bitmap from disk
	-	Pan	Pan the current page
	-	Select Object	Select an object. Have a look to its properties!
	-	Set default fill and pen effect	Set the fill and pen property of select component as default
	-	Rotate Objects	Rotate (all) selected object(s). Drag the mouse on any object handle!
	-	Merge Objects	Merged two or more selected objects (but no Chart) to one object
	-	Unify Object	Unify selected object (polygon preferred) to one object path
	-	Rotate -90	Rotate Selection by -90 Degree
	-	Rotate +90	Rotate Selection by +90 Degree
	-	Horizontal Flip	Horizontal Flip
	-	Vertical Flip	Vertical Flip
	-	Shear Tool	Apply shear transformation
	-	Transform	Apply warp transform to path.
	-	Perspective Transform	Apply perspective transform to path.
	-	Bring to the Front	Bring Object to the front on the same Layer
	-	Bring to the Back	Bring Object to the back on the same Layer
	-	One Step Forward	Bring Object one step forwards on the same Layer
	-	One Step Backward	Bring Object one step backwards on the same Layer
	Ctrl + G	Group	Group the selection

 Ungroup	Ctrl + U	Ungroup	Ungroup the selected group
 Rescale To Fit Into Page	-	Rescale to page	Rescale to fit into page

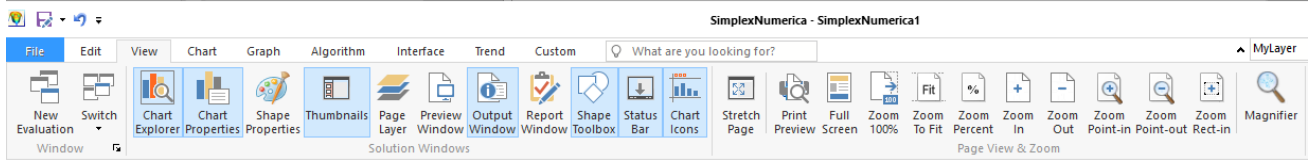
The following table explains the functions of the alignment toolbar*.

Symbol	Function*
	Align to Left Align objects to the left side
	Align to Right Align objects to the right side
	Align to Top Align objects to the top side
	Align to Bottom Align objects to the bottom side
	Align Center Vertical Align object to center on a vertical line.
	Align Center Horizontal Align object to center on a horizontal line.
	Even Horizontal Evenly Space between Objects
	Even Vertical Evenly Space between Objects
	Same Width Make objects same width
	Same Height Make objects same height
	Same Width and Height Make objects same width and height
	Page Width Make object same width as page
	Page Height Make object same height as page
	Center Object Vertical Vertically center object in page
	Center Object Horizontal Horizontally center object in page











*Use key Shift to move objects proportional.
















12.3 Ribbonbar View

The *Ribbonbar View* is a fix tape, sorted by the Tab with the name “View”.



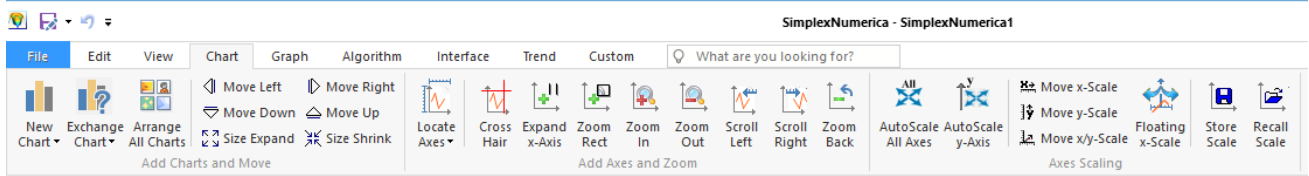
These are the commands inside the Ribbonbar **View**:

Icon	Key	Function	Description
 New Evaluation	Ctrl + N	New Evaluation	Open up an empty Evaluation window
 Switch	-	Switch Windows	Switch to a different currently open window
 Chart Explorer	F4	Show/Hide Graph Explorer	Contents Charts, Graphs (= SampleData + CurveData), Labels and Legends, Shapes and Frames
 Chart Properties	F5	Show/Hide Properties	Please use the Chart Explorer to work with the Properties
 Shape Properties	F6	Show Shape Properties	A shape can be a rectangle/circle or other graphic object. Each chart was also based on a shape. These shape(s) can be modified here
 Thumbnails	F7	Show/Hide Thumbnail Viewer	The Thumbnail Viewer contains objects and evaluations. Right mouse click on the viewer to extent it..
 Page Layer	F8	Show/Hide Layer Window	Try to use the Layer. It will help you to organize your objects (like charts and shapes) among the others..
 Preview Window	F9	Show/hide Navigation Window	It shows you the whole page (evaluation) with a red rectangle. That is the actual area of the main window
 Output Window	F10	Output	View Output Window
 Report Window	Ctrl + F10	Report-Editor	Open/Close the window of the Report-Editor

 Shape Toolbox	Ctrl + F3	View Shape Toolbox	View Shape Toolbox
 Status Bar	-	Toggle StatusBar	Show or hide the status bar
 Chart Icons	-	Show Chart Icons	Show Chart Icons
	-	Print Preview	Copy the Evaluation, then set e.g. DIN-A4, adjust (rescale) and print it
 Stretch Page	-	Stretch Full Page	Stretch page to see the whole content
 Full Screen	Ctrl + F11	Toggles Full Screen	Toggles full screen mode On and Off
 Zoom 100%	-	Zoom-in 100%	Zoom in by 100 %
 Zoom To Fit	-	Zoom Full Page	Zoom to fit the full page
 Zoom Percent	-	Zoom Percent	Set the percentage in the popupmenu
 Zoom In	-	Zoom In	Zoom in page
 Zoom Out	-	Zoom Out	Zoom out the page
 Zoom Point-in	-	Zoom Point In	Zoom Point in the page
 Zoom Point-out	-	Zoom Point Out	Zoom Point out of the page
 Zoom Rect-in	-	Zoom by Rectangle	Zoom with the help of a rectangle
 Magnifier	-	Use Magnifier	Use Magnifier and keep the left mouse button pressed and move the mouse

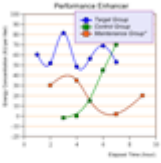
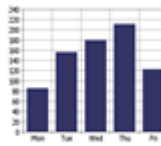

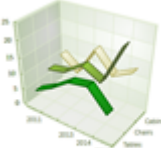

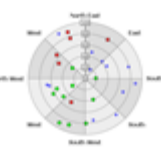
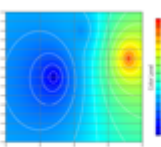
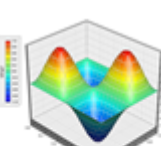
12.4 Ribbonbar Chart



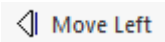
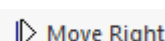
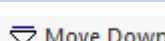
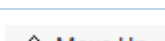
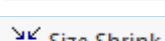
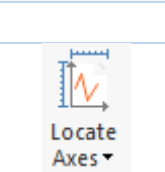
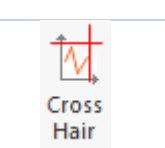
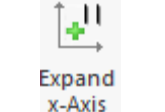
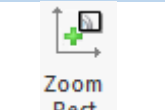
The *Ribbonbar Chart* is a fix tape, sorted by the Tab with the name “Chart”.



These are the commands inside the Ribbonbar **Chart**:

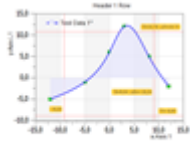
Icon	Key	Function	Description
	-	New Chart	Add a new chart (but use Thumbnails instead)
	-	Exchange Chart	Exchange selected chart type (use Thumbnails instead)
Default Charts:			
 Physics	-	Linear Cartesian	
 Math	-	Mathematical	
 Smith Diagram	-	Smith Diagram	
 Triplot	-	Ternary (Triplot)	

	-	2D Line Chart	
Spline Line Chart			
	-	2D Bar Chart	
Simple Bar Chart			
	-	2D Business Chart	
Combined Chart			
	-	3D Business Chart	
Volume Line			
	-	Pie Chart	
Simple 2D Pie Chart 2			
	-	Polar/Radar Chart	
Polar Scatter Chart			
	-	Contour Plot	
Scatter Plot - No Marker			
	-	3D Surface Plot	
Surface Chart V1			

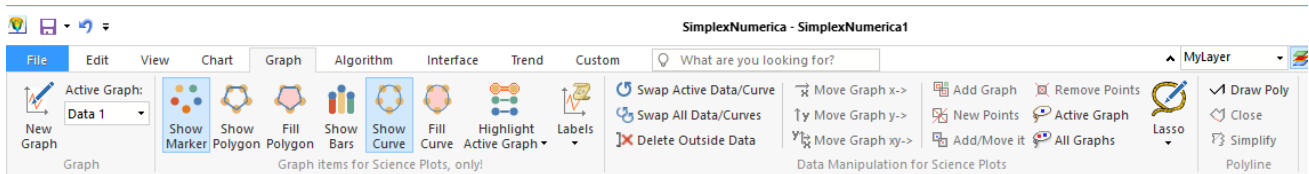
	-	Angular Meter	
Round Meter			
	-	Misc. Chart	
Simple Pyramid			
		Move Left	Move chart inside frame to the left (Use Ctrl/Shift)
	-	Move Right	Move chart inside frame to the right (Use Ctrl/Shift)
	-	Move Down	Move chart inside frame downwards (Use Ctrl/Shift)
	-	Move Up	Move chart inside frame upwards (Use Ctrl/Shift)
	-	Shrink	Shrink the chart (Use Ctrl/Shift)
	-	Locate Axes	Locate axes on a Physics Chart, only
	-	Main Bottom x-Axis,	
	-	Top x-Axis,	
	-	Apart Bottom x-Axis,	
	-	Underlying Bottom x-Axis,	
	-	Main Left y-Axis,	
	-	Right y-Axis,	
	-	Apart Left y-Axis,	
	-	Leftist y-Axis,	
	-	Apart Right y-Axis,	
	-	Rightmost y-Axis,	
	-	Axes Properties	
	-	Cross Hair	Show the Cross Hair
	Ctrl + 3	Expand Scaling	Expand Scaling in chart
	Ctrl + 4	Zoom Scaling	Zoom chart scaling

 Zoom In	Ctrl + 5	Zoom In	Zoom in page
 Zoom Out	Ctrl + 6	Zoom Out	Zoom out the page
 Scroll Left	-	Scroll Left	Scroll Left (Ctrl: Scroll Up)
 Scroll Right	-	Scroll Right	Scroll Right (Ctrl: Scroll Down)
 Zoom Back	-	Zoom Scaling Back	Zoom scaling back to previous scale
 AutoScale All Axes	Ctrl + 1	AutoScale	AutoScale all Chart Axes
 AutoScale y-Axis	Ctrl + 2	AutoScale Main Y Axis	AutoScale only the main Y Axis on the left side of the chart
 Move x-Scale	-	Move Graph/Scale X->	Move Graph/Scale in X->Direction
 Move y-Scale	-	Move Graph/Scale Y->	Move Graph/Scale in Y->Direction
 Move x/y-Scale	-	Move Graph/Scale XY->	Move Graph/Scale in XY->Direction
 Floating x-Scale	-	Floating Scaling	Move x-Axis-Scaling during movement of a Graph
 Store Scale	Ctrl + 7	Save Chart Scaling	Save scaling of the active chart
 Recall Scale	Ctrl + 8	Load Chart Scaling	Load scaling from (any) last saved chart


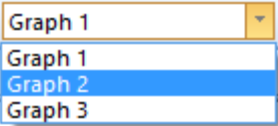



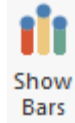
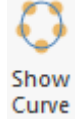
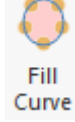
12.5 Ribbonbar Graph



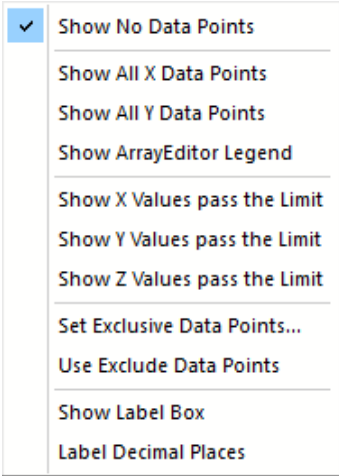
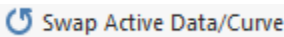

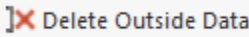
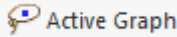


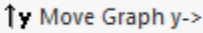



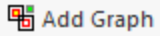
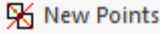

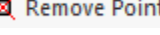
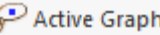
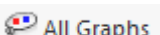
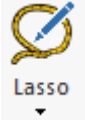
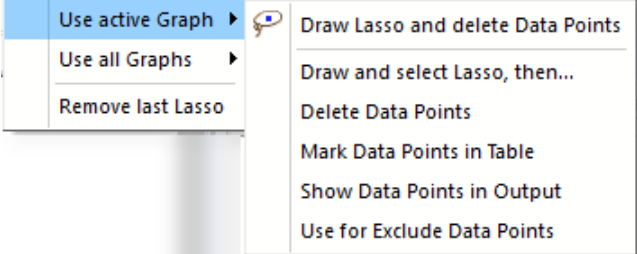
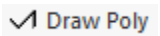
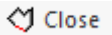

Here you can do everything around graphs, like activate, highlight or set its properties. The most of the menu points are make sense for 2D *Cartesian Coordinate Systems*, only, like Science Charts, mainly the *Physics* chart.



The following table explains the features of the *Graph* Ribbonbar:

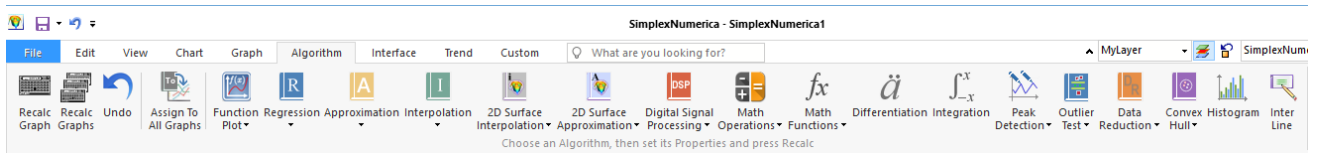
Symbol	Function
	New Graph Add a new Graph to the active chart
	Select the active Graph from a combobox The program sets the name of the active graph into the edit field of the combobox. You can change the active graph if you like.
	Show/Hide Marker Switch on and off the data marker of the selected chart's active graph.
	Show/Hide Polygon/Polyline Switch on and off the polygon (closed) or polyline (open) of the selected chart's active graph's data points.
	Fill or Unfill Polygon It closed the polyline, if the last data point is not the same as the first.
	Show/Hide Bars It shows the bars from the data points of the active graph.
	Show/Hide Curve It shows the curve from the curve points of the active graph.
	Fill/Unfill Curve It closed the curve, if the last curve point is not the same as the first.

Symbol	Function
 <p>Highlight Active Graph ▾</p>	<p>Highlight Graph Highlights the selected trend curve - shown in color.</p> <p>There are three conditions for a graph:</p> <ol style="list-style-type: none"> 1. Original thickness and color of all graphs. 2. Fatter to see which graph is active. 3. Non-active graph attenuated in gray.
 <p>Labels ▾</p>	
 <p>Swap Active Data/Curve</p>	<p>Swap Active Data Points with Curve Points This menu is to swap the <i>SampleData</i> and the <i>CurveData</i> of the Active Graph.</p>
 <p>Swap All Data/Curves</p>	<p>Swap All Data and Curve Points</p>
 <p>Delete Outside Data</p>	<p>Delete data outside the marked region Use the mouse to expand a range on the x-axis. The data outside this range will be removed.</p> <p>⇒ <i>Undo is not possible.</i></p>
 <p>Active Graph</p>	<p>Capture data from the active Graph with the Lasso Let's define a round portion of the active graph with the mouse. Immediately the data inside the lasso will be deleted. Only the data from the active graph in this region will be deleted.</p>
 <p>All Graphs</p>	<p>Capture data from all Graphs with the Lasso Let's define a portion around the graph with the mouse. Immediately the data inside the lasso will be deleted. The data from all graphs lying in this region will be deleted.</p>
 <p>Move Graph x-></p>	<p>Move Graph in X-Direction (Scala is ossified)</p>
 <p>Move Graph y-></p>	<p>...ditto in Y-Direction</p>
 <p>Move Graph xy-></p>	<p>...ditto in both direction</p>

Symbol	Function
 Add Graph	Add Graph Make a new Graph, then add or move marker points.
 New Points	New Data Points (Marker) Clear the active graph's data points and put with the help of the mouse new ones into the chart.
 Add/Move it	Add/Move it Add or move existing data points from any graph in the selected chart
 Remove Points	Remove Data Points (Marker) Click on a data point (Marker) to remove it.
 Active Graph	Remove Data Points from Active Graph Draw, with the help of the mouse, a polygon around the data points. Then afterwards the points are removed by the program. Does not matter to draw over not active (other graphs) data points. They will not be registered!
 All Graphs	Remove Data Points from All Graph ...ditto, for all Data Points
 Lasso	
 Draw Poly	Draw a Polyline Draw an independent poly segment line.
 Close	Close it to a Polygon Close or open polyline.
 Simplify	Simplify the number of data Reduce polyline with less point.

12.6 Ribbonbar Algorithm

The *Ribbonbar Algorithm* is a fix tape, sorted by the Tab with the name “Algorithm”. In version *SimplexNumerica V13* it has exchanged the previous Pulldownmenu Algorithm completely.



The most of the mathematical and numerical functions are to find in this Pulldownmenu.

Note:

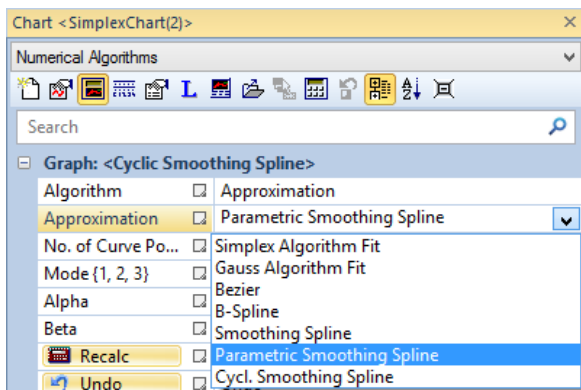
You need to have a chart selected to use one of this functions.

Please use e.g. Wikipedia for explanations of *SimplexNumerica's* enhanced algorithms.

The previous versions of *SimplexNumerica* had a separate manual for the algorithm. But in the internet ages, it makes no sense anymore to maintain such a document.

Nevertheless, for more or less detailed information, please go to chapter **19 Algorithm in SimplexNumerica**

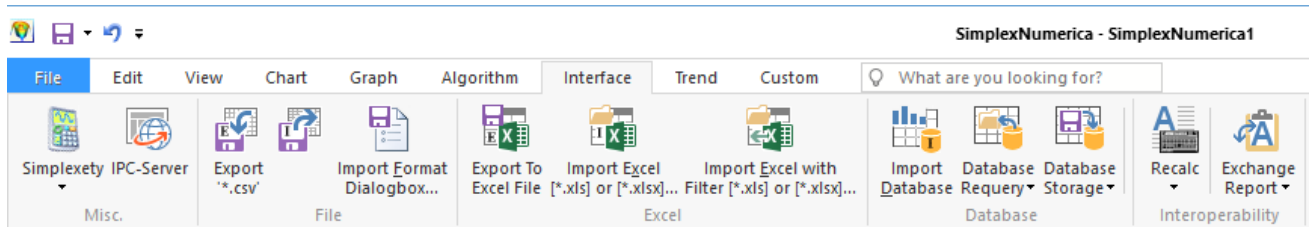
Please do not forget that the **Algorithm** are also accessible from the properties.



To start learning: Please use the Start-up dialog to test a **Cubic Spline** function with your data.

12.7 Ribbonbar Interface

The *Ribbonbar Interface* is a fix tape, sorted by the Tab with the name “Interface”. In version *SimplexNumerica V13* it has exchanged the previous Pulldownmenu Interface or Reload, respectively.



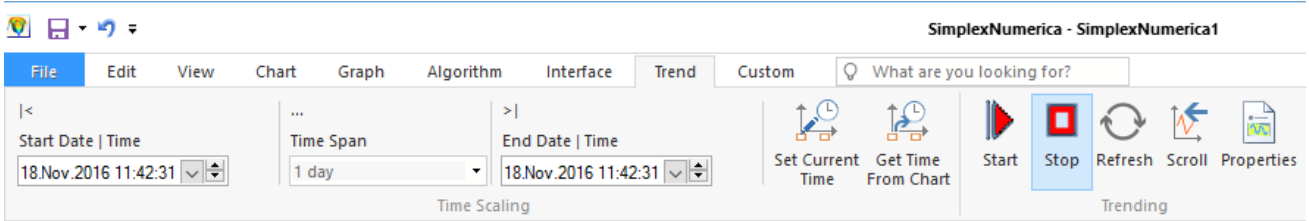
The wording **Interface** means interfacing of data, re-calculation of information, trending of measurement data, database exchange, reporting and so on...

The following table is only an extract of some functions. For more, please look at chapter

Symbol	Function
	Requery Text Label Database Requery of all Text Labels.
	Constants Dialog Call Constants Dialog for this recalculations.
	Recalc Text Recalc all Text Labels.
	Exchange Text Label Tags Exchange all Text Label Tags in Report Window.

12.8 Ribbonbar Trend



The *Ribbonbar Trend* is a fix tape, sorted by the Tab with the name “Trend”. It shows only a few icons and controls especially for trending purposes.



Inside this manual you will find a lot of topics related to trending data from external sources. Please have a look...

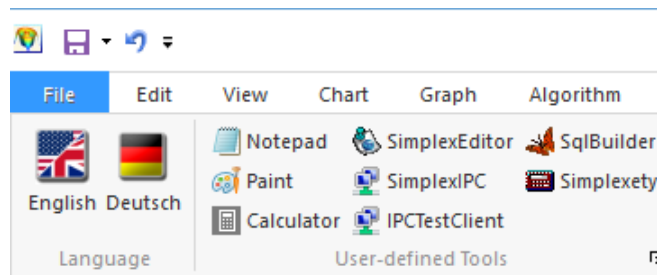
The following table explains shortly the functions of the *Trend* Ribbonbar.


Symbol	Function
	Start Date and Time
	Time Span
	End Date
	Set Actual Time Now Set actual date and time to the comboboxes.
	Get Time from Chart Get date and time from chart x-axis scaling and put it into the comboboxes.
	Start Trending Start Trending for all charts.
	Stop Trending Stop Trending for all charts.
	Refresh Trending Refresh Trending means continually gathering data from source.

Symbol	Function
 Scroll	Scroll Trend Curve Scroll all trend curves in the active chart.
 Properties	Trend Properties

12.9 Ribbonbar Custom

The *Ribbonbar Custom* is a fix tape, but can be extended by user defined programs. Here you can change the program language between German and English. Maybe others in future...



Please have a look to the bottom right corner, you will see the symbol . Click on it and call the configuration dialogbox for the external programs.

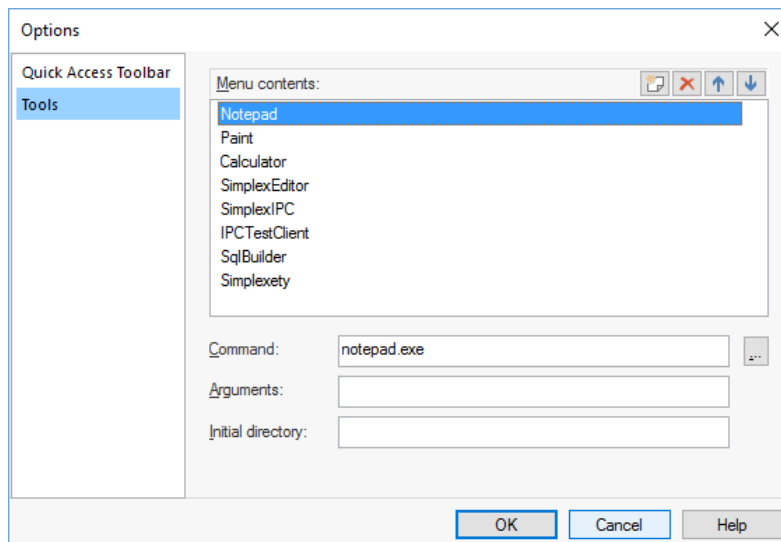
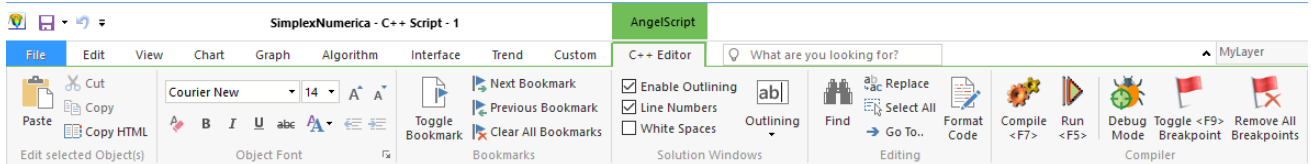


Fig.12-2: Dialogbox for User defined Tools







12.10 Ribbonbar C++ Editor

Hint

This toolbar can only be used for the *SimplexNumerica Scripting Host*! It only appears when a script MDI window is on top.



The following table explains the functions of the compiler panel.

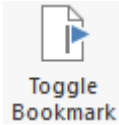
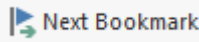
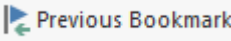
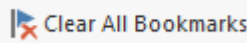


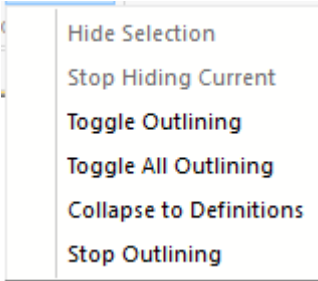
Symbol	Function
 Compile <F7>	Compile Script Compile the active script.
 Run <F5>	Run Script Run the active script.
 Debug Mode	Debug Mode Switch into Debug Mode.
 Toggle <F9> Breakpoint	Toggle Breakpoint* Mark a line in the editor with a breakpoint or remove it.
 Remove All Breakpoints	Remove All breakpoints
 Format Code	Format Code Try to format the existing code (without to save it)*.

*Formatting the C++ code with the help of a modified version of Artistic Style conform to the Microsoft Foundation Classes (MFC).

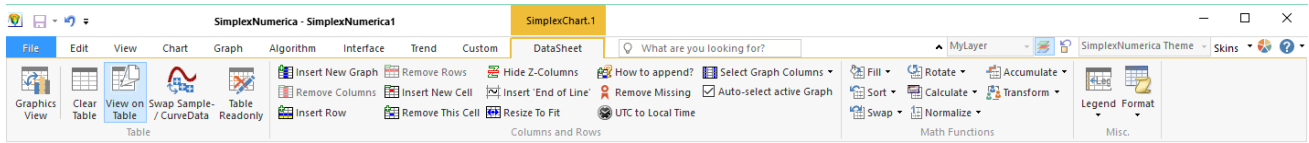
The following table explains the functions of the editor related panels of the Ribbonbar **C++ Editor**.

Please open a *SimplexNumerica Script* (key: Ctrl + M) and use this panel of the Ribbonbar to edit the source code of the script.

The following table explains the functions of the editor panel.

Symbol	Function
 <p>Toggle Bookmark</p>	<p>Toggle Bookmark Inserts or removes a Bookmark</p>
 <p>Next Bookmark</p>	<p>Next Bookmark Go to the next temporary bookmark</p>
 <p>Previous Bookmark</p>	<p>Previous Bookmark Go to the previous temporary bookmark</p>
 <p>Clear All Bookmarks</p>	<p>Clear All Bookmarks Clear all bookmarks in the editor window</p>
 <p>Find</p>	<p>Find Text Search for a text passage.</p>
 <p>Outlining</p>	

12.11 Ribbonbar GraphTable



These menu items are for editing and calculating the *SampleData* from all graphs but of only one (selected) chart.

Important Information


→ *SimplexNumerica's GraphTable* is more an *Array Editor* than a *Spreadsheet*. It is organized in fix x/y/z columns and a number of *Sample Data* rows.

Hint

The *GraphTable*, integrated in *SimplexNumerica*, is not intended to be a competitor to Microsoft Excel® or other Spreadsheet programs.

Certainly, you can use your preferred spreadsheet program to copy and paste the data.

View	Data 1 SampleData			Data 2 SampleData			Data 3 SampleData		
Legend	G0.x	G0.y	G0.z	G1.x	G1.y	G1.z	G2.x	G2.y	G2.z
1	-12,000	-5,000	1,000000	-12,000	-5,000	1,000000	-12,000	-5,000	1,000000
2	-5,000	-1,000	1,000000	-5,000	-1,000	1,000000	-5,000	-1,000	1,000000
3	0,000	6,000	1,000000	0,000	6,000	1,000000	0,000	6,000	1,000000
4	3,000	12,000	1,000000	3,000	12,000	1,000000	3,000	12,000	1,000000
5	8,000	5,000	1,000000	8,000	5,000	1,000000	8,000	5,000	1,000000
6	12,000	-2,000	1,000000	12,000	-2,000	1,000000	12,000	-2,000	1,000000

Click on the toolbar icon  or the Pulldownmenu *File, New...* or press key <Ctrl + N> to clear the content of the sheet.

Note

A *GraphTable* is always dedicated to one Chart, only!

12.11.1 Swap Graphics / Data Sheet

Change between Graphics and GraphTable View either use:

→ Pulldownmenu *GraphTable, Swap Graphics / Data Sheet*.

→ Use the toolbar icon .

→ Use the key <F3> .

→ Click on the related bottom tab of the view  .

12.11.2 Clear Table

Toolbar Icon  (New) or .

Use the key <Ctrl + N> .

Cleans the table and the graph structure behind the chart.

12.11.3 Table Mode / View Mode

As already described above, *SimplexNumerica* has two modes for data editing inside the same GraphTable,

Table Mode View for comfortable editing like Excel and the View Mode View for real time display, but limited editing capabilities.

If you have loaded many data rows, then the View Mode shows you only an extract (exactly the range in the display) of that data arrays and hence it is much faster as in Table Mode. On the other hand, Copy & Paste should be used in Table Mode, only.

Note:

Some menus are not available in View Mode.

12.11.4 Make Table Read-only

You cannot edit the table if it is read only.


12.11.5 Math Function

This menu shows you all the math function in relation with the *GraphTable*. Description is underneath this main chapters at chapter [12.11.19 Popupmenu Math Functions](#), because it blows to much up here.

12.11.6 Insert here End of Line (EOL = ~)

As already described above:

Ribbonbar Overview

If you need fewer rows, then swap to the **View Mode** and put the character ~ in any cell row (or use toolbar icon ).

SM	Data 1			Data 2			
Legend	G0.x	G0.y	G0.z	G1.x	G1.y	G1.z	G2.x
1	-12.000000	-5.0000	0.000000	0.000000	-5.0000	0.000000	-3.00
2	-11.807615	-4.5564	0.000000	5.000000	-1.0000	0.000000	-1.76
3	-11.567134	-4.0660	0.000000	8.000000	6.0000	0.000000	-0.94
5	-11.326653	-3.6411	0.000000	10.000000	12.0000	0.000000	-0.11
5	-11.086172	-3.2759	0.000000	12.000000	5.0000	0.000000	0.83
6	-10.845691	-2.9647	0.000000	15.000000	-2.0000	0.000000	1.54
7	-10.557114	-2.6552	0.000000	~	~	~	2.30
8	-10.316633	-2.4446	0.000000	~	~	~	3.31
9	-10.028056	-2.2412	0.000000	~	~	~	3.96
10	-9.787575	-2.1075	0.000000	~	~	~	4.55
11	1.304442	8.6755	0.000000	~	~	~	6.00
12	-9.306613	-1.9198	0.000000	~	~	~	6.44
13	0.831850	7.6914	0.000000	~	~	~	6.56

Table Mode (View unchecked):
Not available! Only for display, see next picture Data 2.

View Mode (View checked):
SimplexNumerica cuts the rest of the x/y/z rows instantaneous after Return/Enter.

12.11.7 Insert here a new Cell

Table Mode (View checked):

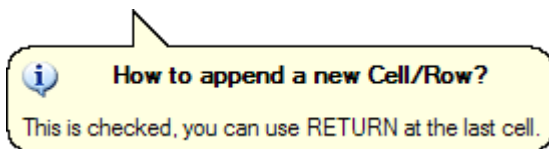
→ If you need more rows, then press **Return/Enter** key in the last row.

View Mode (View unchecked):


Not available!

If you use this menu here, then a new cell will be adding at the cursor position and all values in this column are shifted up.


12.11.8 How to append a new Cell/Row?



Shows you how to append a new Cell/Row.


Toolbar icon 

12.11.9 Remove this Cell

Toolbar icon 

Removes the actual cell. The program shrinks the size of the x/y/z arrays, too.

12.11.10 Resize selected Column(s) To Fit

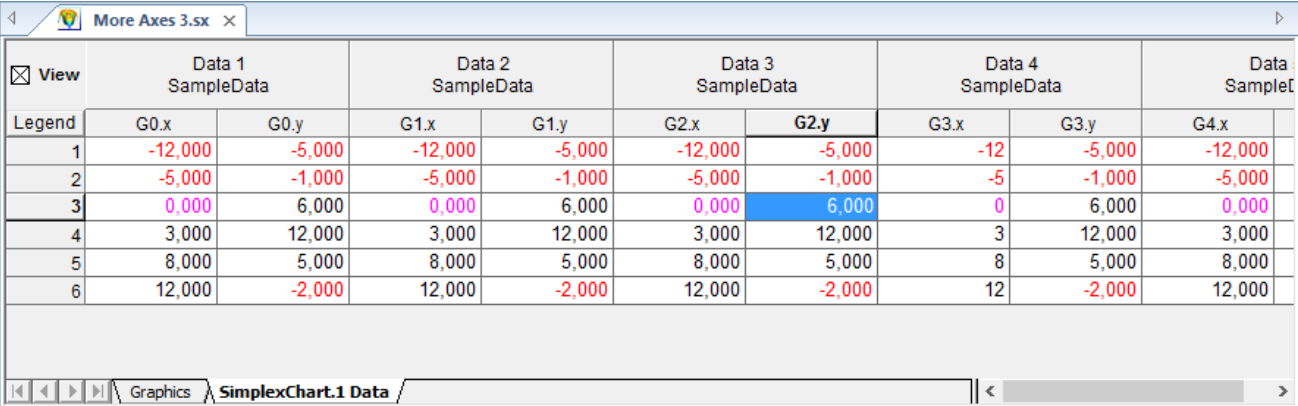
Toolbar icon 

Resize the column with to fit the text length of the entries.

12.11.11 Hide Z-Columns


Toolbar icon 

Hides all z columns.



<input checked="" type="checkbox"/> View	Data 1 SampleData		Data 2 SampleData		Data 3 SampleData		Data 4 SampleData		Data Sample
Legend	G0.x	G0.y	G1.x	G1.y	G2.x	G2.y	G3.x	G3.y	G4.x
1	-12,000	-5,000	-12,000	-5,000	-12,000	-5,000	-12	-5,000	-12,000
2	-5,000	-1,000	-5,000	-1,000	-5,000	-1,000	-5	-1,000	-5,000
3	0,000	6,000	0,000	6,000	0,000	6,000	0	6,000	0,000
4	3,000	12,000	3,000	12,000	3,000	12,000	3	12,000	3,000
5	8,000	5,000	8,000	5,000	8,000	5,000	8	5,000	8,000
6	12,000	-2,000	12,000	-2,000	12,000	-2,000	12	-2,000	12,000

12.11.12 Insert new Graph Columns

Toolbar icon 

Insert new graph columns

12.11.13 Select Graph Columns for x/y/z Axis


Use this menu to select either x, y or z columns.

<input type="checkbox"/> SM	Data 1		Graph 2	
Legend	G0.x	G0.y	G1.x	G1.y
1	-12,0000	-5,0000	-12,0000	-5,0000
2	-5,0000	-1,0000	-5,0000	-1,0000
3	0,0000	6,0000	0,0000	6,0000
4	3,0000	12,0000	3,0000	12,0000

12.11.14 Auto-select active Graph Columns

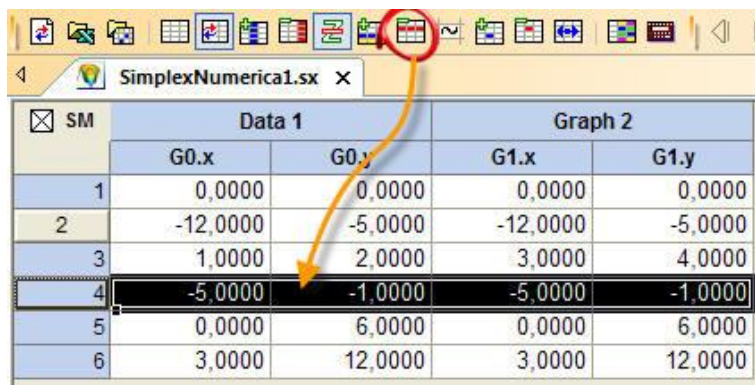
If you have more than on graph in a chart, then only one can be the active Chart. To show this active graph automatically when you swap to the GraphTable, then check this menu here.


12.11.15 Insert Row

Toolbar icon 

To insert a row, first place the cursor in a cell where you want to insert the row underneath.

12.11.16 Remove Rows



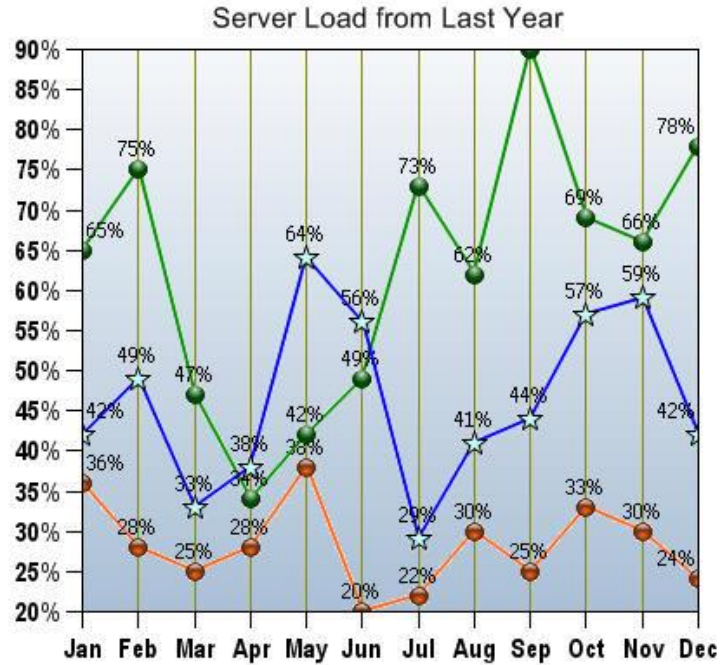
Toolbar icon 

Removes a whole row.

12.11.17 Popmenu Table Legend

Data 1		
Legend	G0.x	G0.y
Leg. 01	-12,0000	-5,0000
Leg. 02	-5,0000	-1,0000
Leg. 03	0,0000	6,0000
Leg. 04		00
Leg. 05		00
Leg. 06	12,0000	-2,0000

Each chart has only one Legend column in its GraphTable, on



the left side of the table.

Data row legends can be used e.g. for the x-axis labeling of a chart.

There is a button above the legend rows to edit the Legend. Click on that and edit the cells.

SimplexNumerica1.sx					
Graph 1			Graph 2		Gra
Legend	G0.x	G0.y	G1.x	G1.y	G2.x
Jan	1,000	42,000	1,000	65,000	1,000
Feb	2,000	49,000	2,000	75,000	2,000
Mar	3,000	33,000	3,000	47,000	3,000
Apr	4,000	38,000	4,000	34,000	4,000
May	5,000	64,000	5,000	42,000	5,000
Jun	6,000	56,000	6,000	49,000	6,000
Jul	7,000	29,000	7,000	73,000	7,000
Aug	8,000	41,000	8,000	62,000	8,000
Sep	9,000	44,000	9,000	90,000	9,000
Oct	10,000	57,000	10,000	69,000	10,000
Nov	11,000	59,000	11,000	66,000	11,000
Dec	12,000	42,000	12,000	78,000	12,000

The color column can be used for certain charts. Please edit the color values in hexadecimal format.

Legend		
	Legend	Color
1	Jan	#0000FF
2	Feb	#0000FF
3	Mar	#0000FF
4	Apr	#0000FF
5	May	#0000FF
6	Jun	#0000FF
7	Jul	#0000FF
8	Aug	#0000FF
9	Sep	#0000FF
10	Oct	#0000FF
11	Nov	#0000FF
12	Dec	#0000FF

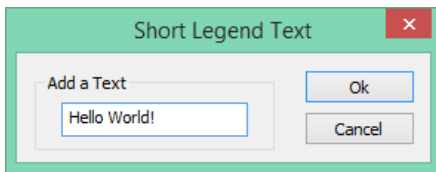
Leg Column from 1...n

Sets the numbering in the legend column from 1 to n.

Individual Text to Legend Column

See above dialog for individual text in the legend column.

Global Text to Leg Column



Puts the same text in the legend column.

12.11.18 Popupmenu Format

Next menus are specific to the grid in table mode, only.

Most of the formats are not suitable for the related chart.

Please set the following properties in the chart properties on the Graphics View.

- Number of Decimal places
- Format Cells
- Lookup Cells
- Resize Rows
- Resize Columns
- Styles
- Alignment
- Style

12.11.19 Popupmenu Math Functions

Popupmenu Fill

Select in the Popupmenu the following menu items:

- Fill n times
- Fill incremental
- Fill random

Popupmenu Sort

Popupmenu Sort by X-SampleData

Select in the Popupmenu the following menu items:

- Sort active Graph
- Sort all Graphs

Popupmenu Sort by Y-SampleData

Select in the Popupmenu the following menu items:

- Sort active Graph
 - Sort all Graphs
-

Popupmenu Sort by Z-SampleData

Select in the Popupmenu the following menu items:

- Sort active Graph
 - Sort all Graphs
 - Sort separate all selected Columns
-

Popupmenu Swap

Select in the Popupmenu the following menu items:

- Swap active x/y-SampleData
 - Swap all x/y-SampleData
 - Swap two selected Columns
-

Popupmenu Rotate

Select in the Popupmenu the following menu items:

- Rotate active X-SampleData
 - Rotate active Y-SampleData
 - Rotate all X-SampleData
 - Rotate all Y-SampleData
 - Rotate all selected Columns
-

Popupmenu Calculate

⇒ ***** Use x in Calculator *****

Simplexety is an external calculation program from the author of *SimplexNumerica*. It is used here for calculations with explicit formulas. Please select in the Popupmenu the following menu items:

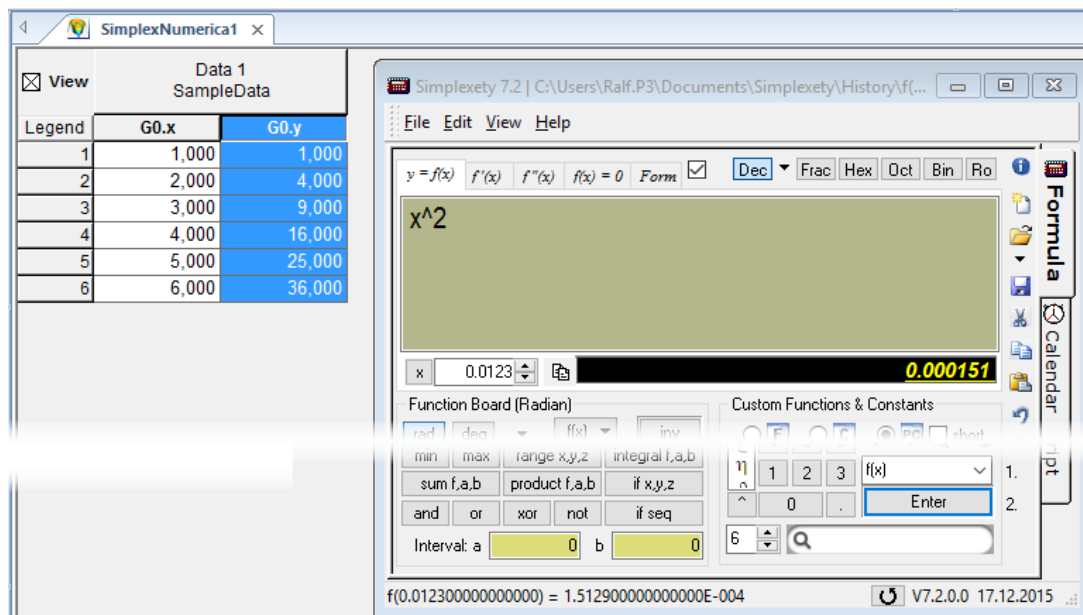
- Calc active X-SampleData
- Calc active Y-SampleData
- Calc all X-SampleData
- Calc all Y-SampleData
- Calc all selected Columns

For example, *Calc all selected Columns*

→ Please select all columns that you want to (re-) calculate.

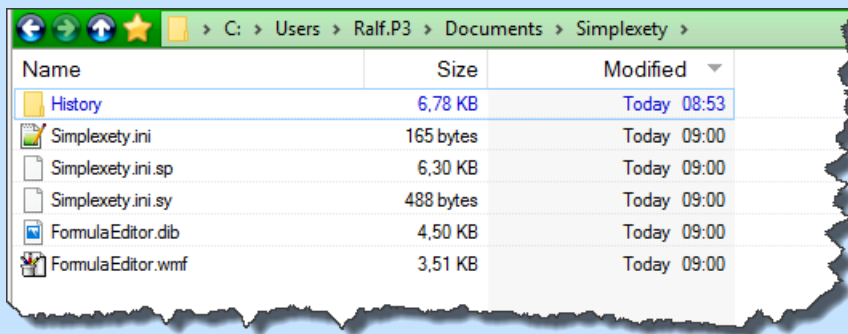
→ Put a formula in *Simplexety* with the variable **x** (x means value of a cell) and set the right constants. Then press **Enter** to calculate each cell.

→ Close Simplexety with the **Close** button on Title-bar.



Info

Simplexety saves its parameter and initial data in the user folder. If something goes wrong with the program, then delete this folder.



Popumenu Normalize

Select in the Popumenu the following menu items:

- Normalize to Maximum
- Normalize to each Z Value
- Normalize to Reference Value
- Subtract a Reference Value
- Set Single Reference Value
- Normalize to Reference Array
- Subtract a Reference Array
- Set Single Reference Column

Popupmenu Accumulate

Select in the Popupmenu the following menu items:

- Accumulate active Y-SampleData
 - Accumulate all Y-SampleData
 - Accumulate each selected Column
-

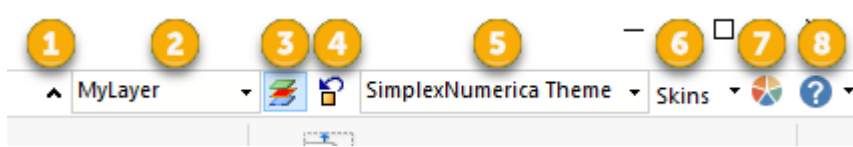
Popupmenu Transformation

Select in the Popupmenu the following menu items:

- Polar in Cartesian Coordinates
 - Cartesian in Polar Coordinates
 - Smith Chart, z-Level in r-Level
 - Smith Chart, r-Level in z-Level
-

12.12 Selection Bar

The Selection Bar is located on the top right area of the main frame. Here you can **show** and **hide** the Ribbonbar. You can display either the **Layer** from the selected shape or the current active layer, respectively. Then you can change the **Theme** of the chart. Call the **Start-up** dialog and the **Help** Pulldownmenu.



The following table explains the functions of the selection bar.

Pos	Symbol	Function
1		Show/Hide Ribbonbar
2		Select the active Layer or assign a Layer to the selected shape.
3		Active Layer in Combobox If this icon is selected, then it shows the active layer name in the combobox. Change this name will activate the other layer.
4		Shape's Layer in Combobox If this Icon is selected, then it shows the layer name of the selected chart/shape in the combobox. Change the name in the combobox will move the selected shape in another layer.
5		Select a Chart Theme
6		Select a Program Style/Skin
7		Start-up dialog
8		Help Pulldownmenu

13 Ribbonbar Reference


SimplexNumerica has optimized Ribbonbars (see last chapter). The content depends on the associated top-level window. Unfortunately, against Toolbars, the user cannot change the Ribbonbar items during runtime.

13.1 Category File

13.1.1 *New Evaluation < Ctrl + N >*

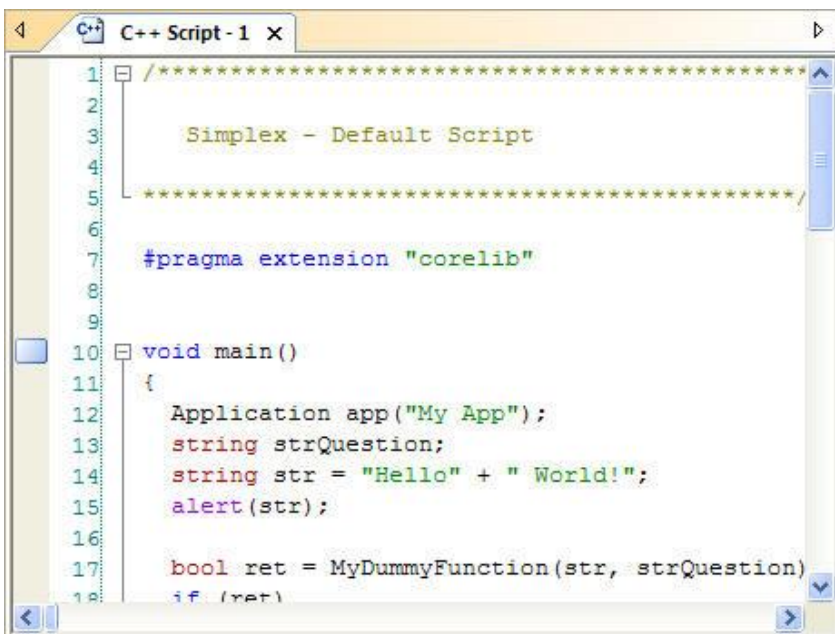
Use this menu item to create a new unnamed evaluation page (Tab-view) with a default layer. The new evaluation may be given a name using the *Save* or *Save As...* menu item on this File menu.

■ To create a new evaluation file:

1. Make a new evaluation.
2. From the File menu, choose *Save As...* or use toolbar icon . The Fileselectbox appears.
3. In the directory listbox, double-click a folder where you want to store the evaluation file (or move up or down a path to the appropriate folder).
4. Type the file name in the File Name box, and click OK. The default extension given to a file is '.sx'. Please do not specify something else.
5. Click "Yes" on the message box that appears, asking if you want to create the file.
6. Fill the evaluation page with charts and shapes and save again...

13.1.2 *New Scripting Host < Ctrl + M >*

Creates a new document for *SimplexNumerica's* **AngelScript** scripting host.



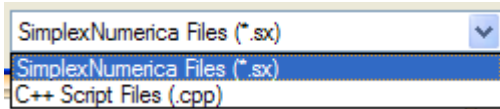
There is a default script that shows you some techniques (e.g. the use of main, strings, call by value, call by reference, outputs, etc.).

Please refer to separate manual [Programming SimplexNumerica with AngelScript](#) to get more details about the inbuilt scripting languages.

13.1.3 Open... < Ctrl + O >

■ Open an existing evaluation or script

1. From the File menu, choose Open. The File Open Fileselectbox appears.
2. Select the drive and folder where the file should be existed. The default path is the current drive and folder.
3. Set the types of files to display in the Files of Type box. Files with the chosen extension are displayed in the File Name box. This box serves as a filter to display all files with a given extension. For example, Evaluation (*.sx) or Script (*.cpp) displays all files with the given extensions. The drop-down box initially lists commonly used file extensions. Alternatively, you can specify wildcard patterns in the File Name box to display file types. The new wildcard pattern is retained until the dialog box is closed. You can also use any combination of wildcard patterns, delimited by semicolons. For example, entering "*.sx; *.c*" displays all files with those extensions.



4. In the File Name box, click a filename, and then click OK.

If the program is properly installed via the setup program, then you can Double-click the *.sx filename in the Windows Explorer. Alternatively, you can drag & drop from Explorer into the *SimplexNumerica* window.

13.1.4 Reload < Ctrl + R >

To reload the document from its disk file, choose the *Reload* command from the File menu. If the document has been modified, you will be asked if you want to proceed.

You can reload a file if you wish to update the current view of the file (for example, if the file has been modified) or restore its contents to what is on disk if you have modified the file but not saved. If the file has been changed on disk by another instance of *SimplexNumerica*, by default *SimplexNumerica* will not ask you if you wish to reload it.

13.1.5 Save as Graphic < Ctrl + B >

The precondition for this is that the *Graphics View* (Tab "Graphics") is in the foreground (and not the *GraphTable*).

■ Procedure:

1. Please turn on the graphics display if GraphTable is active.
2. Select the menu item "File | Save as Graphic..."
 - ↳ Use the Fileselectbox...
3. Put in filename and path.

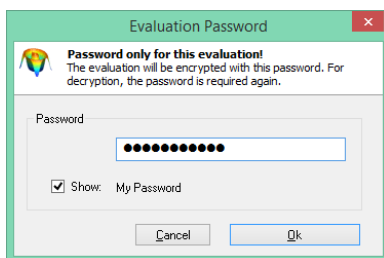
Hint

Should individual objects (like charts) inserted via clipboard into other applications, then click with the right mouse button in the Graphics window on a chart and select from the popup menu the item "Copy as Bitmap".

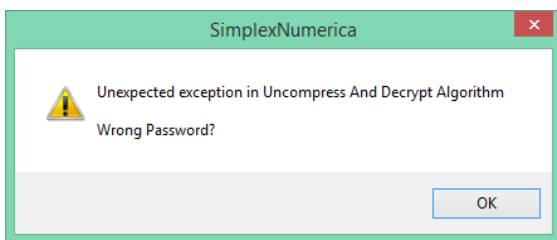
If instead of the whole page only individual objects should be saved as bitmap or image, then select the Pulldownmenu "File | Object | Save Object as Image".

13.1.6 Popupmenu Save

Encrypt with Password



When you checkmark the menu item *Encrypt with Password*, then all Save menus asking for a password, before the file want to be saved to disk.



The program always tries to load an evaluation file without any password. If it failed, then it opens the above password dialog. Remember the saved password and put this in the edit field. If the evaluation does not open, then the password was wrong and you will get an error message like this.

Save < Ctrl + S >

■ Procedure

1. Switch to the right evaluation window (Tab-view).
2. From the File menu, choose Save.
3. If your file is unnamed, the Save As dialog box will be displayed. In the File Name box, type the filename.
4. In the Drives and Directories boxes, select a drive and folder.
5. Click OK.

Note:

If the file has set the read-only attribute, or has been modified by another process, since it was opened for editing, the Save As dialog box will be displayed so that you can save it with a different name.

Save As..

- ##### ■ To save the active evaluation/script to a new file, while preserving its original file:

1. From the File menu, choose Save As. The Save As dialog box appears.
2. Select the drive and folder where the file is to be stored. The default is the current drive and folder.
3. In the File Name box, type the filename.
4. Click OK.

Note:

The active document will CHANGE to the new file name!

 *Save Copy As...*

■ To save the active document to a new file as copy, while preserving its original file:

1. From the File menu, choose Save Copy As. The Save As dialog box appears.
2. Select the drive and folder where the file should be stored. The default is the current drive and folder.
3. In the File Name box, type the filename.
4. Click OK.

Note:

The active document will NOT change to the new file name!

 *Save Copy As & Open It...*

■ To save the active document to a new file as copy and open it again:

5. From the File menu, choose Save Copy As and Open It. The Save As dialog box appears.
6. Select the drive and folder where the file should be stored. The default is the current drive and folder.
7. In the File Name box, type the filename.
8. Click OK.

 *Save All*

To save ALL documents (evaluations), use this command.

Save & Close All

To save ALL documents and CLOSE each one, use this command.

Save & Close All but this

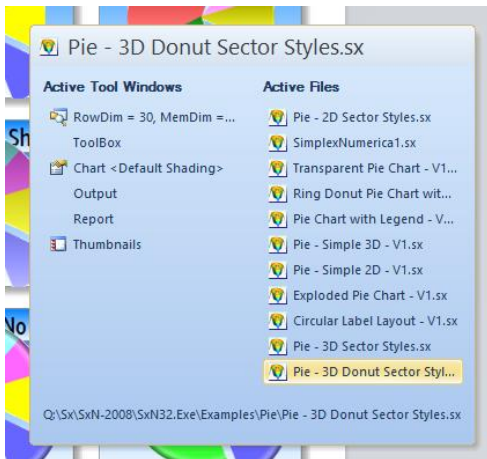
To save the ALL documents and CLOSE each one - but not the current one, use this command.

13.1.7 Popumenu Close

Close

■ Close an evaluation window

1. Use tabs to switch to the right window*.
2. From the File menu, choose Close. This action closes the active window and any additional views of the window.



* There is a new function to switch between MDI windows in *SimplexNumerica*: The extended application keyboard navigation. Implemented in *SimplexNumerica* is a Microsoft Visual Studio-like MDI Windows Navigator.

The keyboard shortcuts <Ctrl + Tab> and <Ctrl + Shift + Tab> can be used to invoke the left menu. Click on an item will open the corresponding window.

Close All

To close ALL documents, use this command.

Close All but this

To close ALL documents - but not the current one - use this command.

Save & Close All

To save ALL documents and CLOSE each one, use this command.

Save & Close All but this

To save the ALL documents and CLOSE each one - but not the current one, use this command.

13.1.8 Popumenu Project

Please have a look to previous chapter 10.3.

13.1.9 Popumenu Profile

Please have a look to previous chapter 10.10.

13.1.10 Popumenu Template

A template is an evaluation file without data and without any data or graph structure, respectively.

Note:

A template can be putting over an existing evaluation, only! You have to have an evaluation before. You can save a template from this one.

Load Template

It loads a previously saved template file (default extension '*.stx') as a new template evaluation and puts it over an existing evaluation together in a new window.

To open a template:

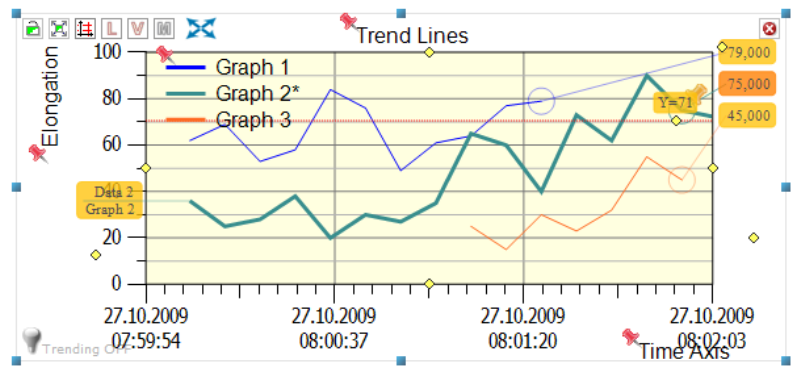
1. Select an existing evaluation window.
2. From the File menu, choose Template, Load Template... The Open File dialog box will be displayed.
3. Browse for the template file you want to open.
4. Click Open.
5. If you want, then close the "old" evaluation.

Save Template

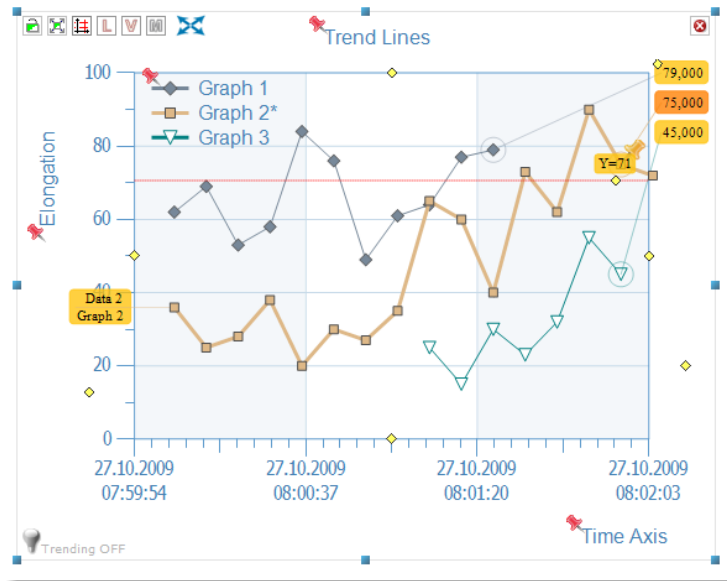
Stores the existing evaluation without data as a template. The extension is '*.stx'.

Example:

Use a standard thumbnail picture and put that on an empty evaluation page.



...then prepare the look & feel a little bit or select another theme from the toolbar, so that it looks like...



...no, save that as a template. Then empty the page and use again the thumbnail above. But no, load the template from disk and it should look like the screen before.

Tip:

Useful when the chart has not the dimension for a desired printer output. Then you can use a template (i.e. prepared for DIN A4) and put that over it, before you print the page.

13.1.11 Popu^menu Object

An Object is everything loose in an evaluation window. That can be any single chart or shape. A template object is an object without data.

Chart or Single Object

Load Object...

You can explicitly load any object from disk into an existing evaluation with available objects or into an empty one. For instance, the thumbnails are objects.

Save Object...

Save the selected object to disk. Hint: If you drag a thumbnail, then its path is on the clipboard!

Template

Load Template Object...

Pulldownmenu Load Options

A template object needs a selected object to prepare during loading from disk. The selected object will become new "clothes" but does not lose its data.

Change Chart Dimensions

Is this menu checked, then the chart dimensions of the selected chart will be changed to that from the template object.

Change Page Size

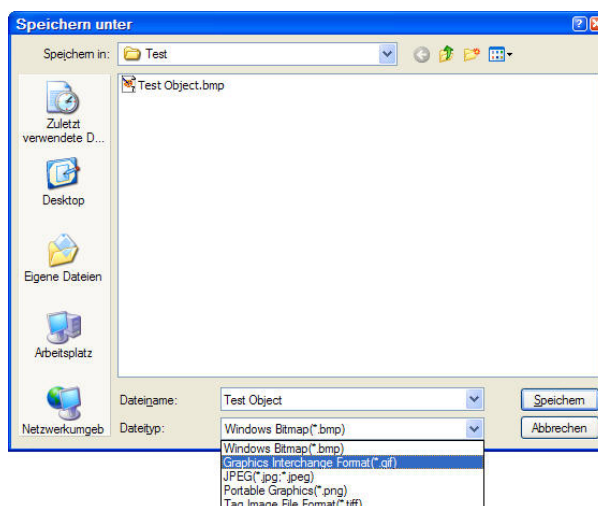
If this menu is checked, then the page size will be changed to that from the page as the template object was saved.

Save Template Object...

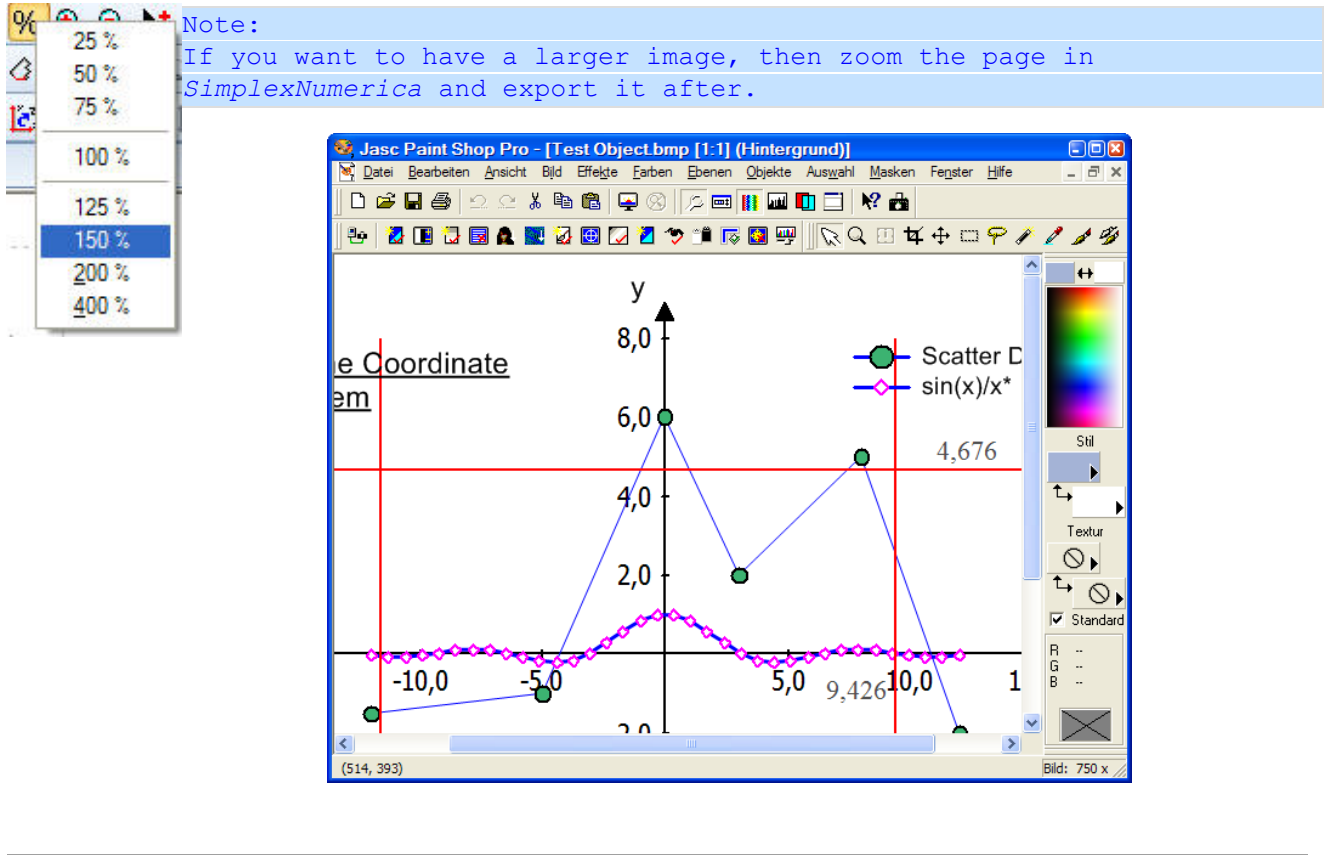
Save the selected object to disk. Then it will be saved without data and getting a template.

Save Object as Image...

You can use either the right mouse on an object and use that menu item in the popup menu their or use this menu here to save an object (like a chart or shape) as an image.

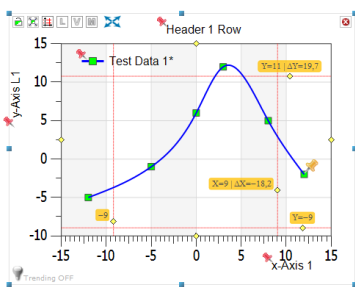


Open the image file in another program to see the result (here in *PaintShopPro*):



13.1.12 Popupmenu Data Export To

Export Table in a *.csv File



Use this menu to export the content of the *GraphTable* (the whole table) to a *.csv file.

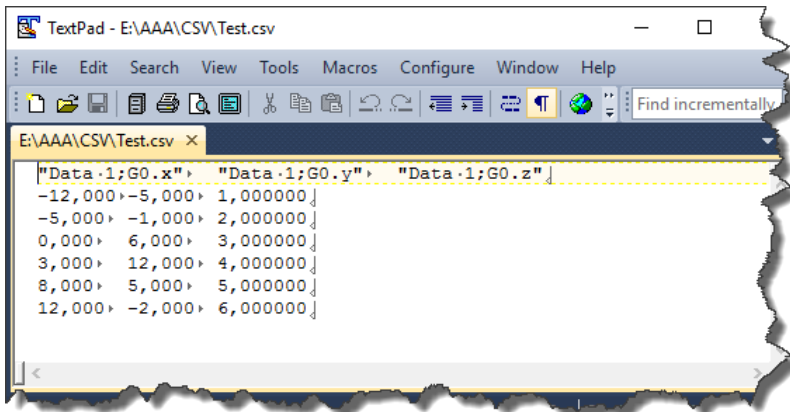
Given an example:

→ Select the *Physics* chart and call this export menu here...

→ Put filename in the Fileselectbox...

Data 1 SampleData			
Legend	G0.x	G0.y	G0.z
1	-12,000	-5,000	1,000000
2	-5,000	-1,000	2,000000
3	0,000	6,000	3,000000
4	3,000	12,000	4,000000
5	8,000	5,000	5,000000
6	12,000	-2,000	6,000000

Ribbonbar Reference



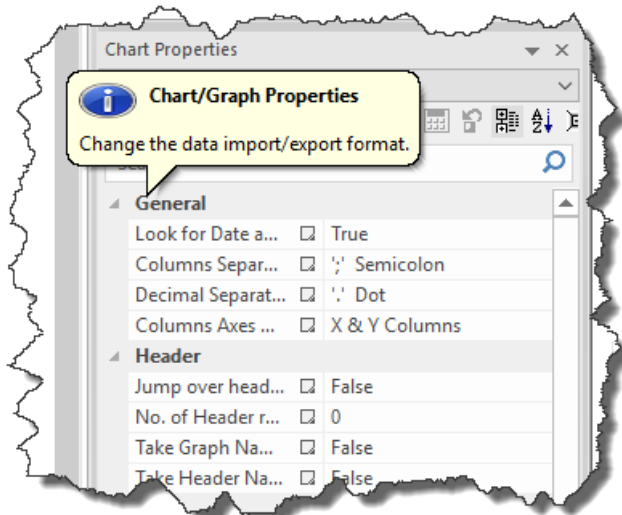
→ Open an external text editor to see the content of the file...

- ⇒ **Data** is the name of the Graph
 - ⇒ **G0.x** = x-Column of Graph No. 0
 - ⇒ **G0.y** = y-Column of Graph No. 0
 - ⇒ **G0.z** = z-Column of Graph No. 0
- Columns separated with a **Tab**

You can change the format with the Format Properties...

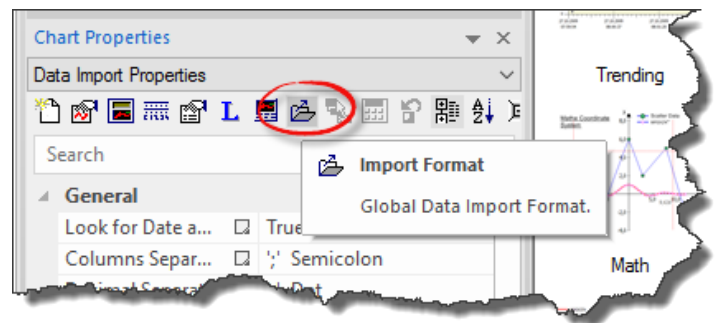
Show Format Properties

Call this menu and the program opens the file import/export properties for you

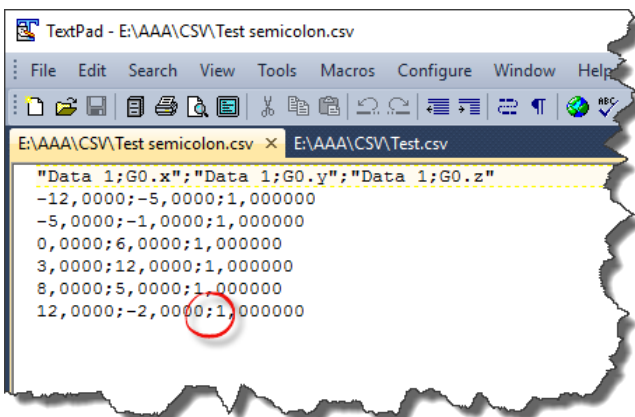


Remark:

It is the following icon in the toolbar on top:

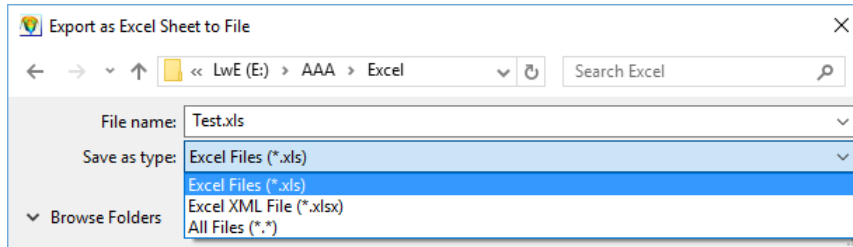


→ Change the Columns Separator from **Tab** to **Semicolon**, to see the result:

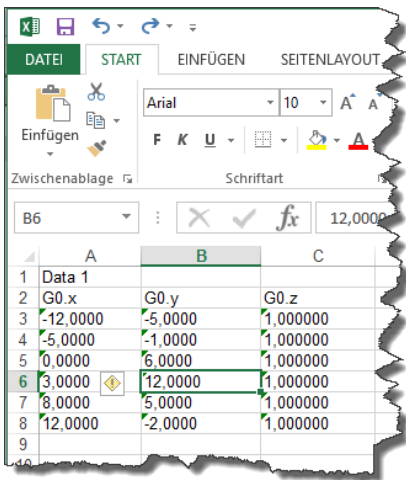


Export Table in Excel *.xls or *.xlsx File

Use this menu to export a *GraphTable* to a native Excel file format, either *.xls or *.xlsx.

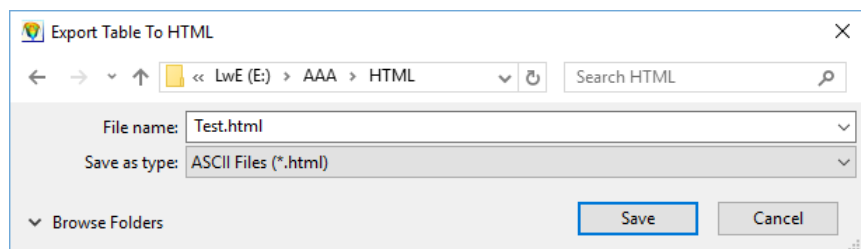


→ Open the file in Excel to see the result.

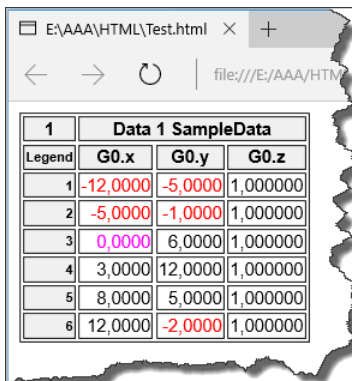


Export in HTML Table (*.html)

Use this menu to export a *GraphTable* to a HTML file.

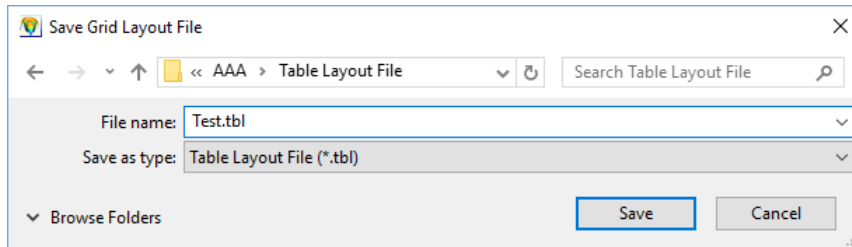


Open the file in a browser to see the result.



Export in Table Layout File (*.tbl)

Use this menu to export a table from the *GraphTable* to a Table Layout File. In the *Graphics View* is this menu disabled.



The file content is binary, so that we cannot read it without a Hex Editor.

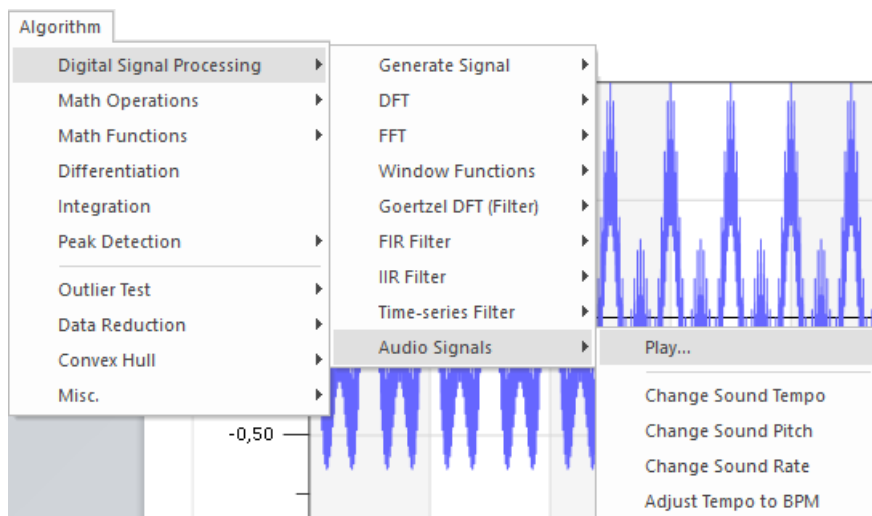
→Use this file format to export and import data tables from *SimplexNumerica* User-A to *SimplexNumerica* User-B.

Export in Default Table Layout File (Default.tbl)

The same as before, but with a fix filename. It used here always the fix filename “Default.tbl”. Advantage is that you can avoid one step.

Export in Wave File (*.wav)

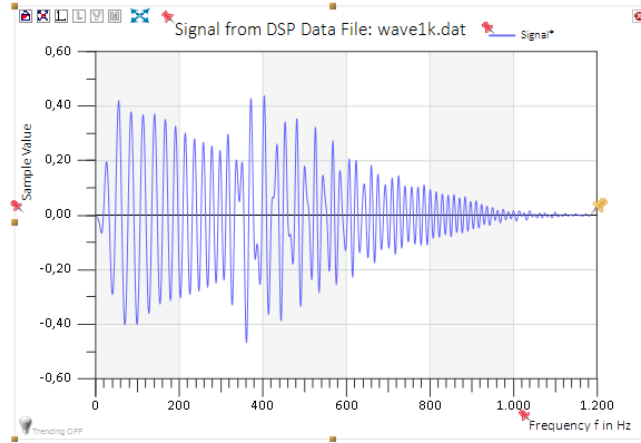
Use this for appropriated signals. Use it together with the extensive *Digital Signal Processing* in *SimplexNumerica*.



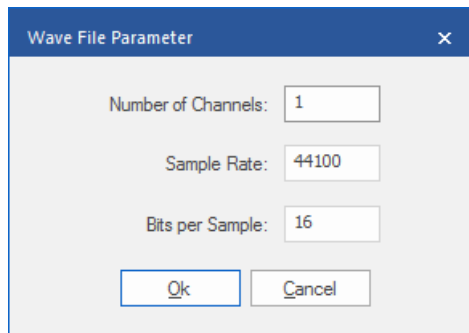
→Here you can play a wave file, too.

Use this menu to export signal data from the *GraphTable* to a Wave file.

→ Import a small wave file into the program and then export it here...

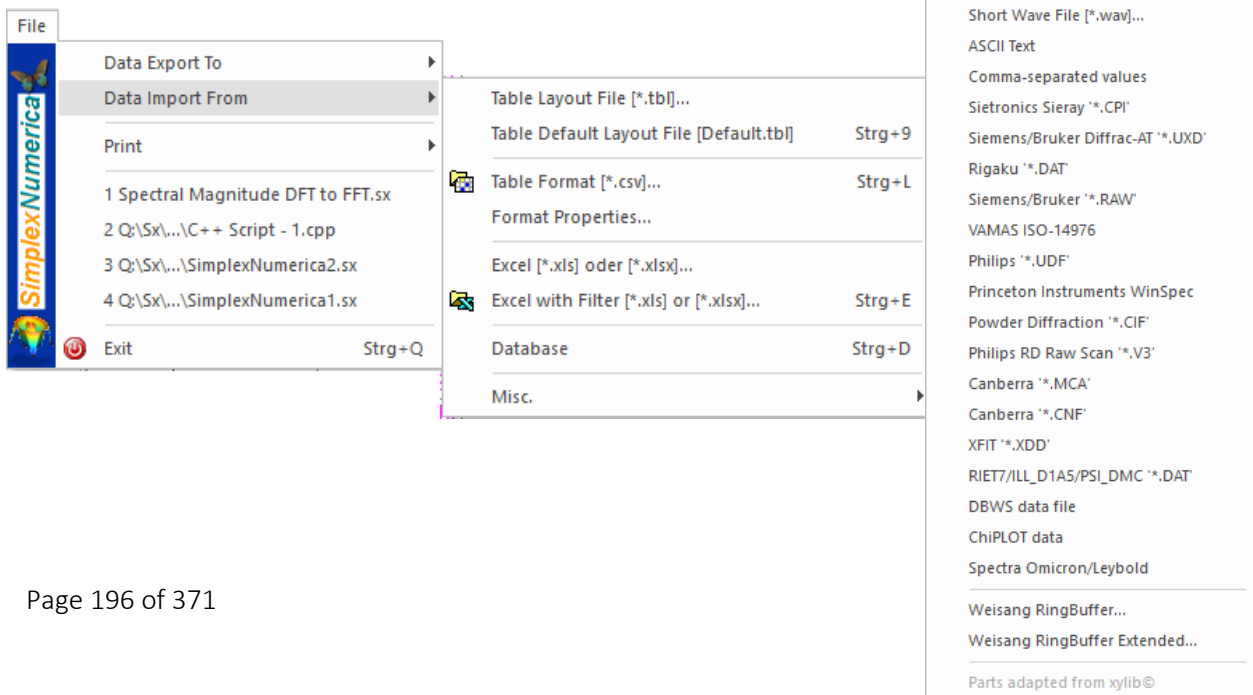


When you call the menu, then the program shows the following dialogbox for related input parameter:



Double-click in the *Windows Explorer* on that saved file to hear it (or not) ...

13.1.13 Popupmenu Data Import From



You can import data from various formats like separated values (*.csv) or Excel format (*.xls; *.xlsx).

Table Layout File (.tbl)*

As you can see in the last chapter Data Export, the *.tbl file has a binary format and can be used for data exchange between different *SimplexNumerica* user.

→ You can only use it from the *GraphTable*. In *Graphics* mode is the entry disabled.

Table Default Layout File [Default.tbl]

The same as before, but with a fix filename.

Import CSV File

Table Format (*.csv)

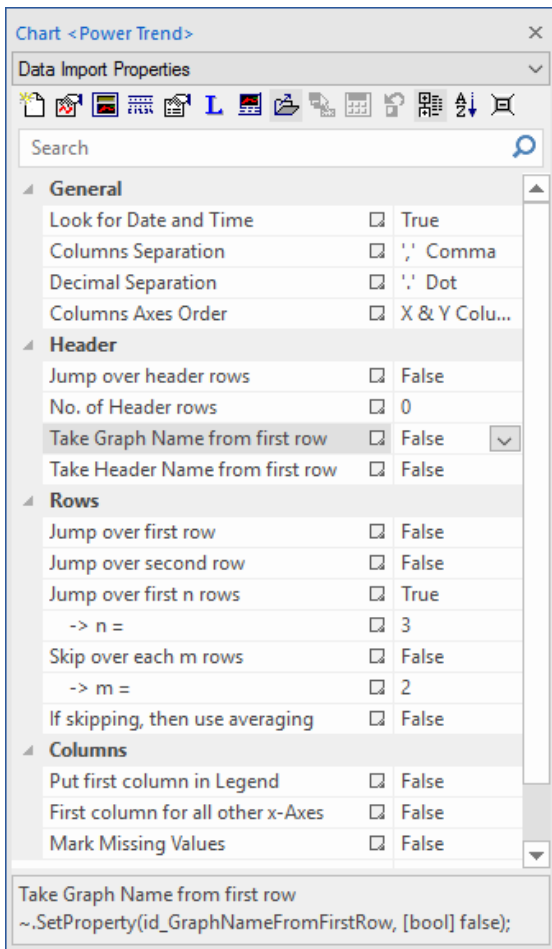
Use this menu to export the whole table of the *GraphTable* in a comma separated value (*.csv) file format. That is an ASCII format, which you can read with any other spreadsheet or text editor.

SimplexNumerica will swap to the *GraphTable* of the selected chart when you call this menu from the *Graphics View*. The format can be set in the Property Window (see Export Format).

CSV files are very popular for storing tabular data because they are simple textual files with a very few rules. This makes them very interoperable because CSV readers and writers are relatively easy to implement. Interoperability is, probably, the first reason why someone would choose to save the data in CSV format.

Although rules for writing and reading CSV files are relatively known and widely accepted, one rule is an exception – determining a character that will be used as a separator. CSV files, as the name Comma

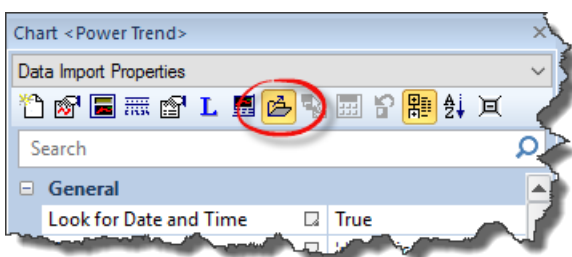
Separated Values says, should use comma [,] as the separator but there are many CSV files that use semicolon [;] or horizontal tab [\t] as a separator.



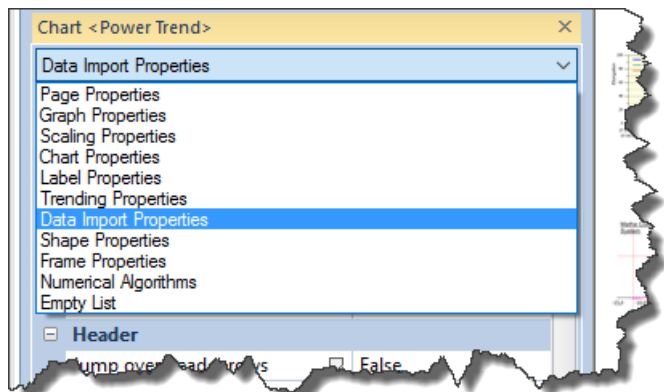
So a program like *SimplexNumerica* should support different file filters, so that you can read various *.csv formats. *SimplexNumerica* has a common dialogbox for this filter purpose (described beneath the properties).

The Import Format can also be explicitly set here in the *Data Import Properties!*

Format Properties/Data Import Properties



To activate the *Data Import Properties* from the Pulldownmenu, please use the menu item *File → Data Import From → Format Properties*, or click on the icon in the toolbar, or use the combobox:



Here now the entries of the *Data Import Properties*:

General

- Look for Date and Time
The program tries to interpret the first column as a Date and Time value, e.g. 29.11.2003 20:02
- Columns Axes Order
Select two or three axes (x & y columns or x, y & z columns)

Columns-Separation

- Semicolon [;]
- Comma [,]
- Vertical Bar [|]
- TAB [\t]
- Space

Decimal- Separation (e.g. 3.14)

- Comma [,]
- Dot [.]

Header

- Jump over header rows
Check that entry to jump over the succeeding Number of Header rows.
- Number of Header rows
Put in the number data rows that can be jumped over.
- Take Graph Name from first row
This check box will change the graph names.
or
- Take Header Name from first row
This check box will not change the graph names.

Rows

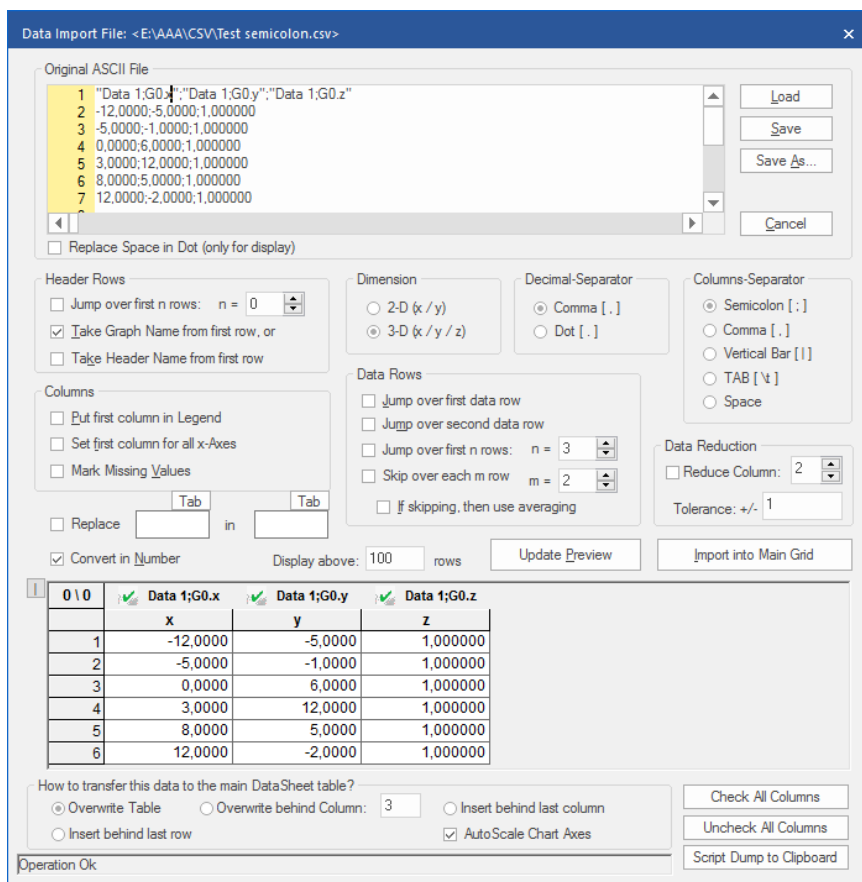
- Jump over first data row.
The first row in the file will be ignored.
- Jump over second data row.
Also the second row in the file will be ignored.
- Jump over first n rows.
The first n rows will be ignored.
- Skip over each m row.
Each m row will be used for the table.
- If skipping, then use averaging.
If <Skip over each m row> is activated, then it will average the skipped values and put these in the table.

Columns

- Put first column in Legend.
The Legend is the left grey column.
- Set first column for all x-Axes
Use the first x-Axis for all x-Axes.
- Marking Missing Values

Data Import Dialog

If you load an external file from another application and *SimplexNumerica* cannot recognize the content so it will automatically call this data import dialog. Set it up so that it can read the content and the next time the same parameter should be pre-selected.



Import into Main Grid

- ➔ Updates the main grid (GraphTable).
- ➔ Closed the dialogbox.

Header

- Jump over first n rows
Check that entry to jump over the succeeding Number of Header rows.

- Take Graph Name from first row
This check box will change the graph names.
or
- Take Header Name from first row
This check box will not change the graph names.

Columns

- Put first column in Legend.
The Legend is the left grey column.
- Set first column for all x-Axes
Use the first x-Axis for all x-Axes.
- Marking Missing Values

Dimension

- 2-D (x / y)
- 3-D (x / y / z)

Decimal- Separator

- Comma [,]
- Dot [.]

Columns-Separation

- Semicolon [;]
- Comma [,]
- Vertical Bar [|]
- TAB [\t]
- Space

Rows

- Jump over first data row.
The first row in the file will be ignored.
- Jump over second data row.
Also the second row in the file will be ignored.
- Jump over first n rows.
The first n rows will be ignored.
- Skip over each m row.
Each m row will be used for the table.
- If skipping, then use averaging.
If <Skip over each m row> is activated, then it will average the skipped values and put these in the table.

Data Reduction

- Reduce Column.
Reference column to reduce. All other columns will be removed analog to this column.
- Tolerance
This is the tolerance value +/-

Replace

- Replace the text from string 1 to string2.
If you need to replace a tab character, the use the button above the edit field.

Display above N rows

Shows in the preview grid (underneath this entry) only the first N number of rows (if the file is very long, then that is much faster).

Convert in Number

Converts each entry in a number with the country specific format else it used the entry as it is.

Update Preview

Updates in the preview grid (underneath this entry) with the (new) parameter.

How to transfer this data to the main GraphTable table?

Before you press the button "Import into Main Grid", please check here the right entry.

- Overwrite Table
- Overwrite behind Column: No.
- Insert behind last column
- Insert behind last row

AutoScale Axes

If this entry is checked, then after importing the data, the program makes an AutoScale on the chart axes.

Buttons Check / Uncheck All Columns

Check or uncheck all columns in the preview grid. Please be aware, that only checked columns are transferred to the main grid.

Hint:

Only checked columns will be transferred into the main grid.

Script Dump to Clipboard

As you already know, a lot of functionalities inside *SimplexNumerica* can be automatized via **AngelScript**. Also repeating data import from external files makes sense to automate via script.

To know which parameter to adjust, please use this data import here one times to set up the filters and copy these ones into the clipboard with the help of this button. You will get e.g.:

```
// CSV Parameter, Dump for Scripting Host
// Made by button <Script Dump to Clipboard> at the bottom of the Import
Dialogbox
// =====

Chart ch = app.MakeChart("My Chart", idChartTypePhysics, 50, 50, 400, 250);

ch.SetColumnsSeparation(1);
ch.SetDecimalSeparation(1);
ch.SetOrderAxesToColumns(2);
ch.SetAppendToGraphMemory(false);
ch.SetJumpOverFirstNRows(false);
ch.SetJumpOverFirstRow(false);
ch.SetJumpOverSecondRow(false);
ch.SetPutFirstColumnInLegend(false);
ch.SetbSetNextColumnForAllOtherXAxis(false);
ch.SetExpectingMissingValues(false);
ch.SetGraphNameFromFirstRow(true);
ch.SetHeaderNameFromFirstRow(false);
ch.SetSkipOverEachMRow(false);
ch.SetUseAveraging(false);
ch.SetJumpOverNumberOfStartRows(3);
ch.SetSkipOverNumberOfRows(2);
ch.SetJumpOverNumberOfHeaderRows(0);
ch.SetJumpOverFirstNHeaderRows(false);
ch.SetColumnsSeparation
```

Please copy this text into the scripting editor or load the example:

```
..\Scriptings\Import and Calc Data.cpp
```

The example is shown here:

```
/******
Simplex - Sample Script
******/

#pragma extension "corelib"

double __min(double a, double b)
{
    return ((a < b) ? a : b);
}

double __max(double a, double b)
{
    return ((a > b) ? a : b);
}

void main()
```



```

{
Application app("My App");

string simplexAppPath = app.GetSimplexAppPath();

string filename = simplexAppPath + "Examples\\DataPlots\\Spectrum Data.sx";
app.Output(filename);

if (app.FileExist(filename))
{
// Load an evaluation
app.LoadEval(filename); // A chart with the name "First Chart"

// Make a second chart similar to "First Chart" and call it "Second Chart"
app.SelectChart("First Chart");
app.CopyChart();
app.PasteChart();
app.ArrangeCharts(10);

// Copy & Paste a chart brings up an index behind the copied name
Chart ch2 = app.GetChartByName("First Chart.1");

// Rename second chart
ch2.SetName("Second Chart");

// Get the first chart object
Chart ch = app.GetChartByName("First Chart");

// Set the CSV Import Dialog parameter (see function below on this page)
SetCSVSettings(ch);

// Import any data from a CSV file!
ch.LoadCSV(simplexAppPath + "Data\\Sample3.csv");

// Manipulate the data and write it back to the chart memory
for (int i = 0; i < ch.GetNumberOfSampleData(0); i++)
{
int graph = 0; // first graph
double y = ch.GetDataY(i, graph);

y *= 100 / sqrt(2); // Calc anything

ch.SetDataY(i, graph, y);
}

// Now, write the y data from second chart to a script array
array<float> ay(ch2.GetNumberOfSampleData(0)); // 0 = Graph No. 0

for (int j = 0; j < ch2.GetNumberOfSampleData(0); j++)
{
ay[j] = ch2.GetDataY(j, 0);
}

// Next, add this data to the first charts graph data
for (int i = 0; i < __min(ch.GetNumberOfSampleData(0), ch2.GetNumberOfSampleData(0)); i++)

```

```
{
    double y = ch.GetDataY(i, 0);

    y += ay[i];

    ch.SetDataY(i, 0, y);
}

ch.SetLogScaleY(true);
ch.AutoScale();

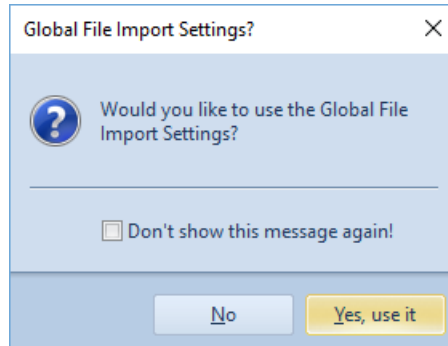
// Finally update properties on screen
app.UpdateWindows();
}
else
{
    app.Error("Could not find the chart");
}
}

void SetCSVSettings (Chart& ch)
{
    // =====
    // CSV Parameter, Dump for Scripting Host
    // Made by button <Script Dump to Clipboard>
    // at the bottom of the Import Dialogbox
    // =====

    ch.SetColumnsSeparation(4);
    ch.SetDecimalSeparation(2);
    ch.SetOrderAxesToColumns(1);
    ch.SetAppendToGraphMemory(false);
    ch.SetJumpOverFirstNRows(false);
    ch.SetJumpOverFirstRow(false);
    ch.SetJumpOverSecondRow(false);
    ch.SetPutFirstColumnInLegend(false);
    ch.SetbSetNextColumnForAllOtherXAxis(false);
    ch.SetExpectingMissingValues(false);
    ch.SetGraphNameFromFirstRow(false);
    ch.SetHeaderNameFromFirstRow(false);
    ch.SetSkipOverEachMRow(false);
    ch.SetUseAveraging(false);
    ch.SetJumpOverNumberOfStartRows(3);
    ch.SetSkipOverNumberOfRows(2);
    ch.SetJumpOverNumberOfHeaderRows(0);
    ch.SetJumpOverFirstNHeaderRows(false);
}
}
```

Accompanying Messageboxes

The following dialogboxes accompanying the data import. The first, before the main dialogbox appears, is next one:



What does it mean?

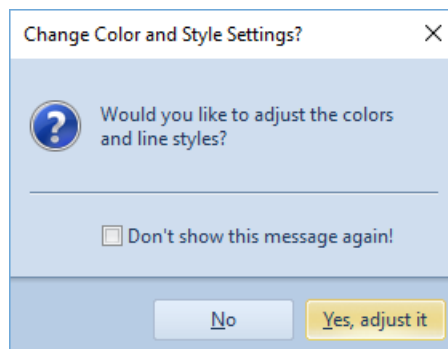
When you have setup the filters, and then call the import again for another file, then you maybe want to have the same parameters as adjusted before.

Hence, the question is, where are the filter settings be saved?

The program supports two place to save:

A global one in the registry and an individual one in the chart properties (saved within the evaluation). If you click the button "Yes, use it", then it used the global settings otherwise the individual setting.

After the main dialogbox is finish, the next one appears:



What does it mean?

The program asks for changing the line colors and line styles of the graphs.

But if you do not want that, because you intend to set it up for all the next imports, equally, then press the button "No" here, otherwise press "Yes, adjust it".

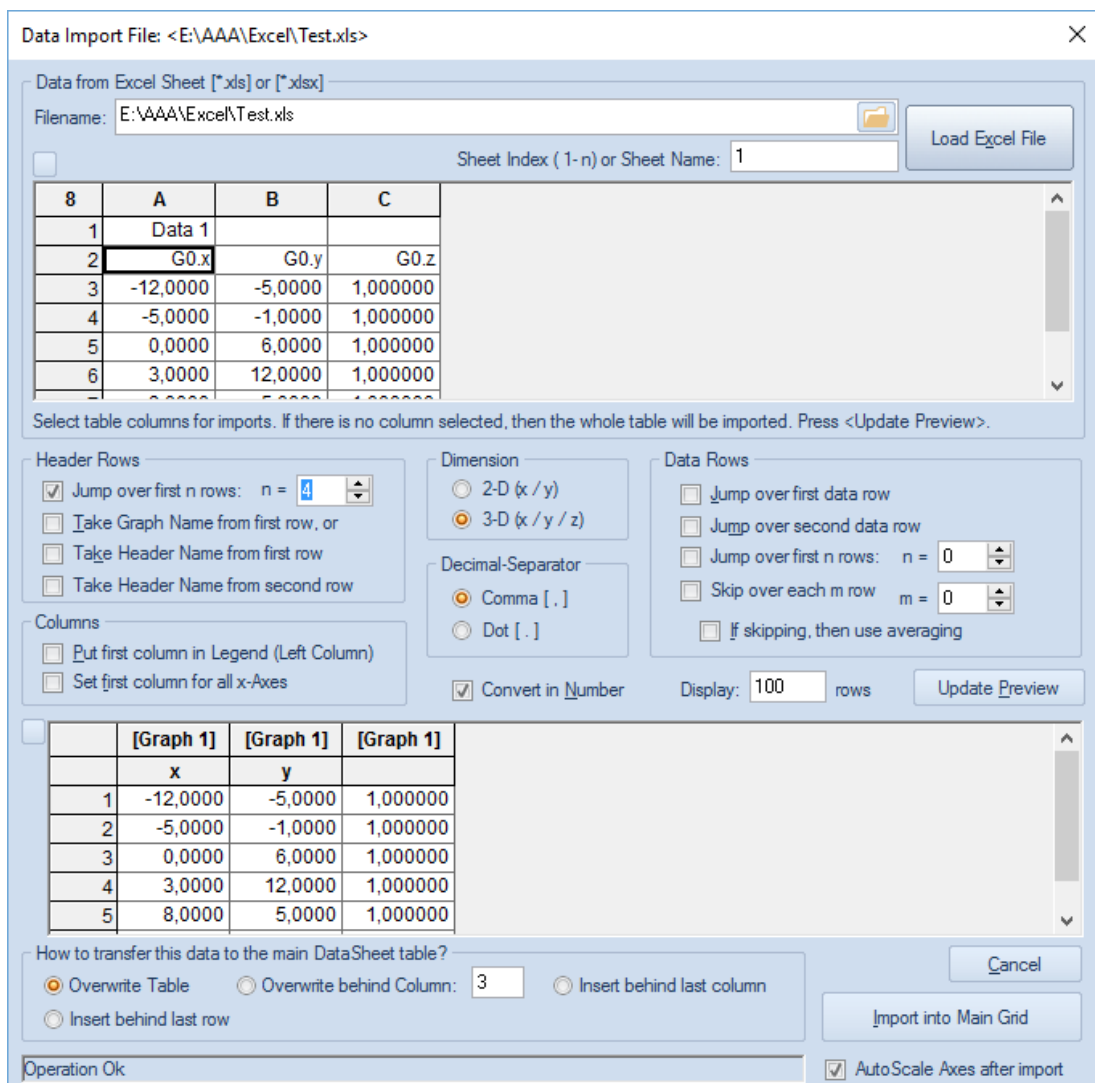
Import Excel File

Excel (*.xls) or (*.xlsx) File

Use this menu to import a native Excel file format (*.xls) or a newer file format (*.xlsx) in a *GraphTable*. If the data in the Excel sheet are formatted in that the program cannot interpret similar to the format in SimplexNumerica, then use the next menu with filter.

Excel with Filter (*.xls) or (*.xlsx) File


Use this menu to import a Excel file format (*.xls) or (*.xlsx) in a *GraphTable* with the help of a similar filter dialogbox like above.

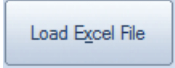


Tip

For the filter settings, please have a look to the previous chapter.

Steps to go:

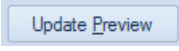
1. Put a path plus filename into the edit box or use this icon  to select the right place for the Excel file that you want to import.

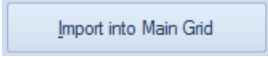
2. Load the Excel File  .

Do not forget to this!

3. Adjust the right filter settings, so that the bottom grid looks fine for you.

	[Graph 1]	[Graph 1]	[Graph 1]
	x	y	
1	-12,0000	-5,0000	1,000000
2	-5,0000	-1,0000	1,000000
3	0,0000	6,0000	1,000000
4	3,0000	12,0000	1,000000
5	8,0000	5,0000	1,000000

4. Press the Button  , if you make modifications to the setting.

5. Press the Button  to apply the data to the main grid, the *GraphTable*.

Import Database

Use this menu to import a database table into *SimplexNumerica's GraphTable*, as the main grid editor behind each chart.

Hint

Please have a look at the *Prime Example, Generate Reports* in chapter 0

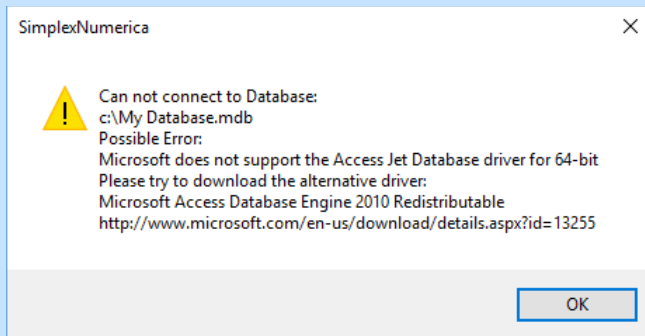
Use this menu to start a wizard and follow them in steps...

The screenshot shows a 'Database' wizard dialog box. It is divided into three main sections. The top section, titled 'Database', contains a list of database drivers with radio buttons: 'Microsoft Access [Driver not available!]', 'Microsoft SQL Server', 'MySQL [Driver not available!]', 'IBM DB2 [Driver not available!]', 'Oracle (Oracle Provider) [Driver not available!]', 'Oracle (Microsoft Provider) [Driver not availa...', and 'Any Database (Generate Connection String)'. A 'Connect' button is located below this list. The middle section, titled 'Database Connection (e.g. for Server Database)', contains text boxes for 'Server' (192.168.1.111), 'Database:' (MyPersonalDB), 'User:' (Ralf), and 'Password:' (masked with dots). A 'Connect' button is to the right of the password field. The bottom section, titled 'Database File Path (e.g. for Microsoft Access *.mdb)', contains a 'Filename:' text box (c:\My Database.mdb) and an 'Access' button. On the left side of the dialog, there is a vertical panel with a black box at the top containing the word 'DISCONNECTED' in red, and below it, a 3D database cylinder with a spider on top. At the bottom right of the dialog are 'Next >' and 'Cancel' buttons.

1. Select the right database
2. Fill the right database connection parameter (if necessary) or Fill the database file path (only for Microsoft Access)
3. Press button **Connect** or Press Button **Access**

Hint

If you get an error like this one



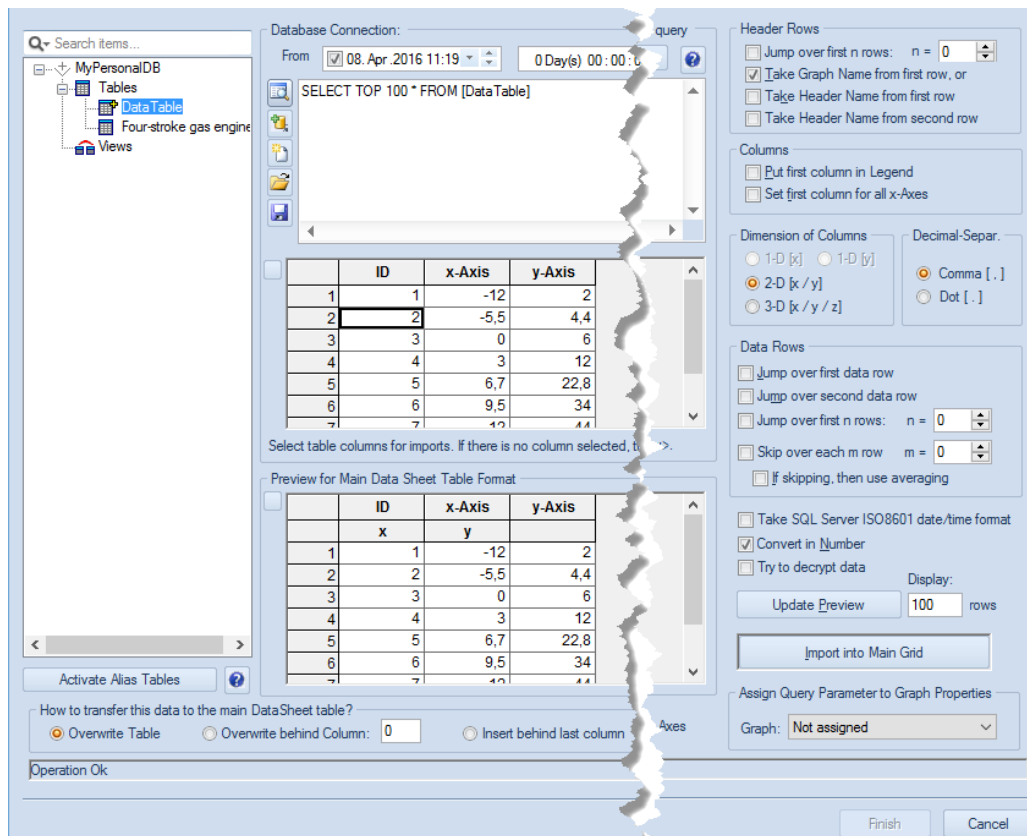
then the Access file is maybe not available or the database driver (Windows driver) is incompatible or not available. Follow the tip inside the message box for Access and 64-Bit Windows.

If you get an error with a database server (like MS SQL Server), then try to find out the right parameter for the connection and try to find out the security rights inside the SQL Server.



Maybe the Windows Firewall avoids connections, too.


We try to avoid here the stupid sentences: Please ask your administrator..

Next wizard step:

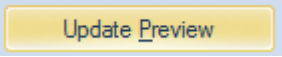
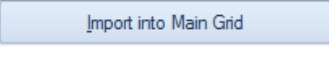



Follow these steps:

1. Click in the left tree control on the table text, as stated above in the dialogbox: „Data Table“
2. Type e.g. the following SQL string into the SQL Text Editor (Icon ):
`SELECT TOP 100 * FROM [DataTable]`
3.  Store the SQL string for later use.

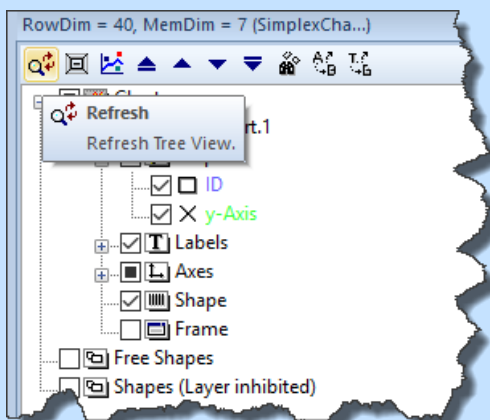
4.  Perform the database query.

	ID	x-Axis	y-Axis
1	1	-12	2
2	2	-5,5	4,4
3	3	0	6
4	4	3	12
5	5	6,7	22,8
6	6	9,5	3
7	7	12	

5. Adjust the filter settings on the right side of the dialog appropriated to your expectations.
6. Press the button  for redraw.
7. Look to the Preview table, if it is right then...
8. Press the button  to save the data into the main grid, the *GraphTable* related to its selected chart.
9. Finally, quit from the dialog with the button  .

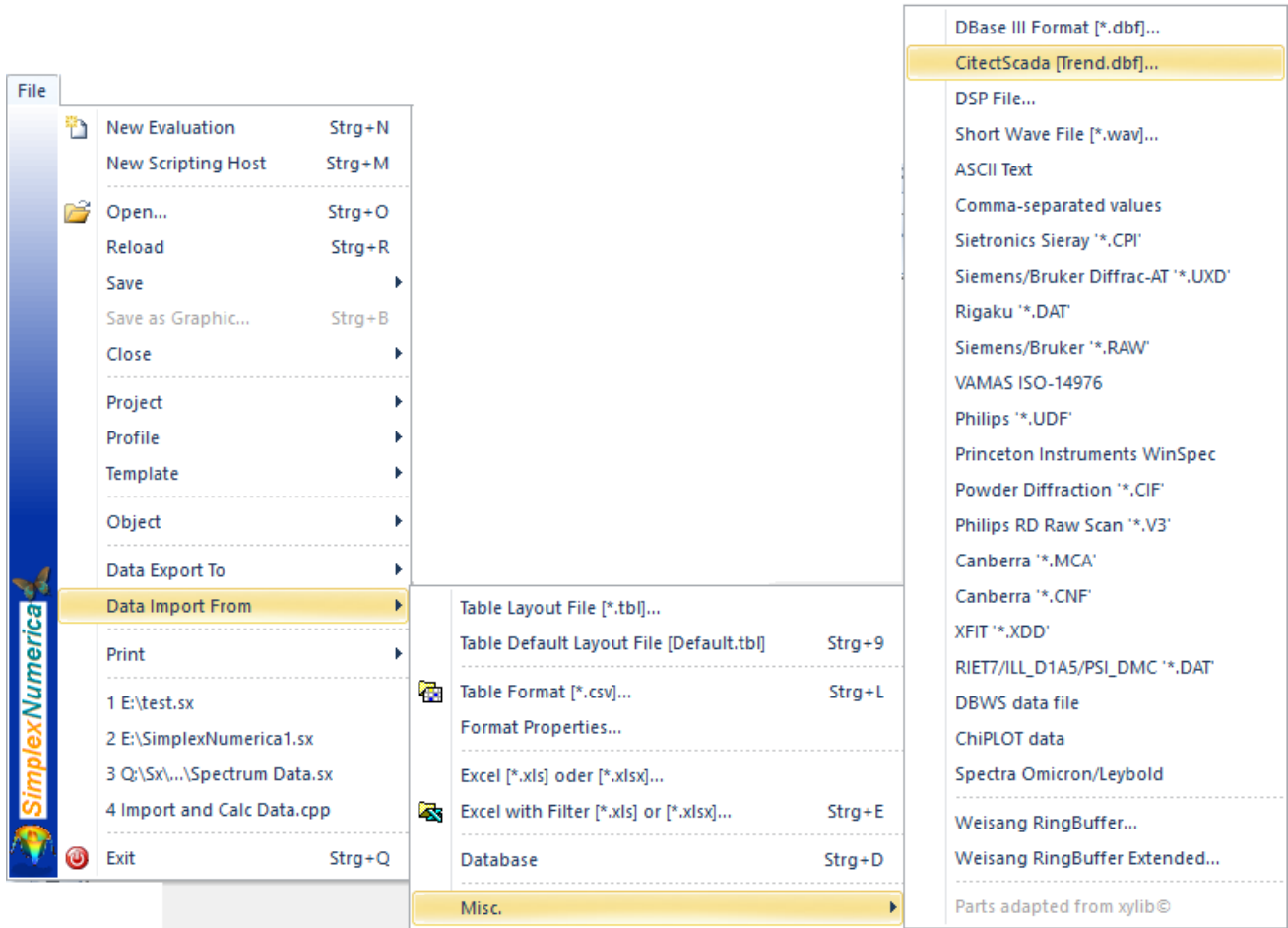
Hint

Please refresh the **Chart Explorer** if some graphs are missing.



Import Miscellaneous Files

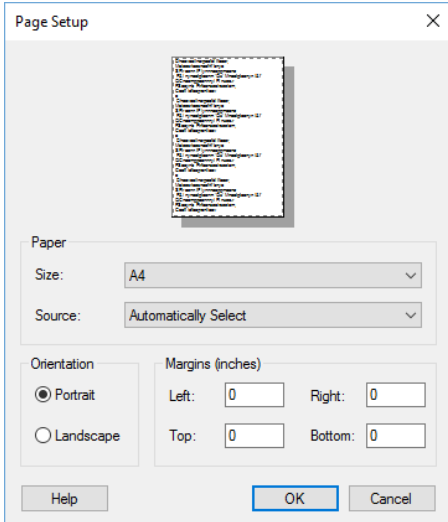
Please refer to the internet for more information about the different file specifications or drop an email to the support.



Please refer to the internet for help to the several data formats.



13.1.14 Popupmenu Print

Page Setup

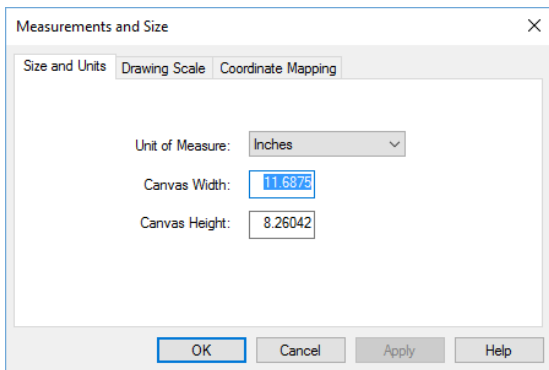


Use this command to configure the page margins, the header and footer for printing of the evaluations.

→ Select the right size of the page (e.g. DIN A4)

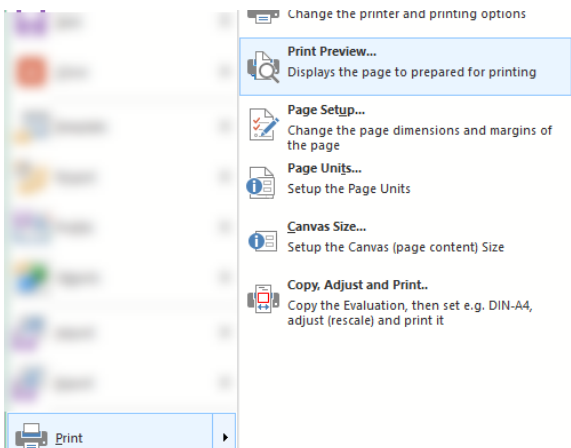
→ Select Portrait  or Landscape  format.

Page Units



Use this menu to configure the page units. Makes sense, if you like to adjust your custom page.

Print Preview

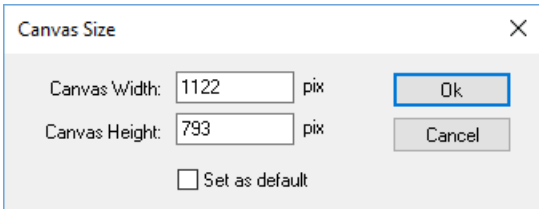


Print preview is a feature that allows you to view what a printed version of the evaluation page would look like on the screen before printing it.

By using print preview, you can find any errors that may exist or fix the layout before printing, which can save ink or toner and paper by not having to print more than once.

To open the print preview feature, click the print preview icon on the Ribbonbar **File**, like that shown in the picture or click the same icon in the Ribbonbar **View**.

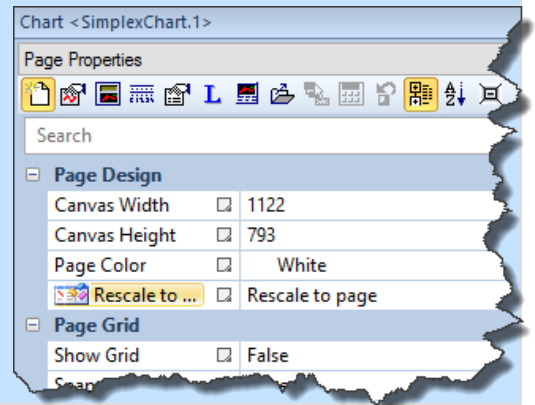
Canvas Size



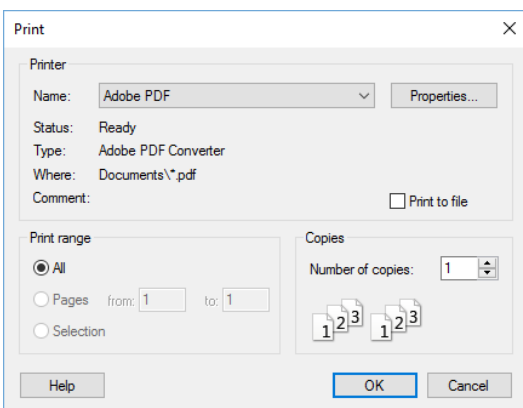
Use this menu to set the canvas size. Canvas is equal to the white page in the background.

Hint

Please have a look at the *Page Properties*.
Also here you can set the canvas width and height.



Print / Print Setup



Use these menus to setup and print the active evaluation.

This command presents a Print dialog box, where you may specify the number of copies to be printed, the destination printer, and other printer setup options.

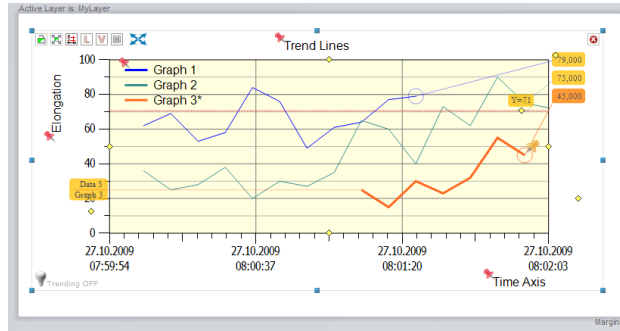
Copy, Adjust and Print

This menu does three steps successively, that means one after another.

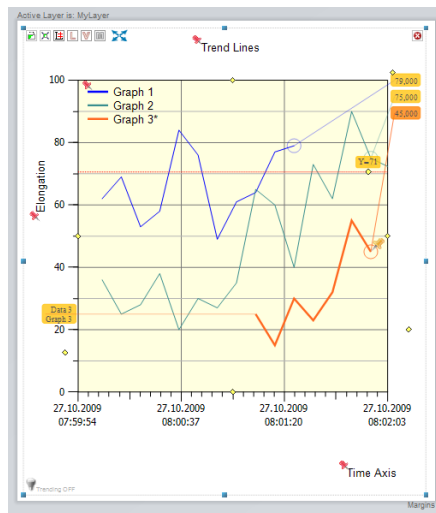
1. Page Setup

2. Rescale to fit into page
3. Print

Imagine you have a paper size for your monitoring of the graphs in wide-screen format.



And you want to print it in a paper format like DIN A4, then it makes sense to have such a function that does that temporarily formatting for you, automatically.



Hint

The program does not change the original evaluation. It makes a copy in a new Tab window.

If you like to do that semi-automatic, then use the three menus:



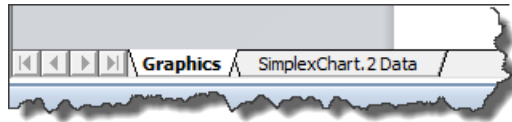
13.1.15Exit

Use this command to quit the *SimplexNumerica* program. You can also use the Close command on the application Control menu. You will get prompted to save any documents with unsaved changes. You will get prompted to leave the app as well.

13.2 Category Edit

For this menu, there is an interdependence between the *Graphics* or *GraphTable* view lying on top, respectively. Also menus in this Pulldownmenu might be enabled or disabled.

Because of this, we want to distinguish between these two views.



A) If the *Graphics View* is on top, then the following functions are used...

13.2.1 A) Undo < Ctrl + Z > and Redo < Ctrl + Y >

Some changes you make (except data and graph actions) can be undone, and you can redo changes you undo.

But everything related to the internal measuring data buffer cannot be undo, because of the fact that this buffer is not redundant. Has something to do with performance issues and certainly size.

The *GraphTable's* native data can be undoing, but they are not used for the real time part (see checkbox Table view in the main grid editor from the *GraphTable*).

13.2.2 A) Cut < Ctrl + X >

Cuts the selection from the document and save it on the clipboard.

13.2.3 A) Copy < Ctrl + C >

Copies the selection from the document and save it on the clipboard.

13.2.4 A) Copy As Bitmap

Copies the selection from the page and saves it to the clipboard as a bitmap.

13.2.5 A) Paste < Ctrl + V >

Use this command to insert the contents of the clipboard. That works only for native content like text or *SimplexNumerica* objects and not for bitmaps from outside.

13.2.6 A) Delete < Ctrl + Del >

Delete the selected object from the page. If you want to use the keyboard to delete object(s), then hold down Control key first (→ Ctrl + Del). That avoids unconsciously deleting actions.

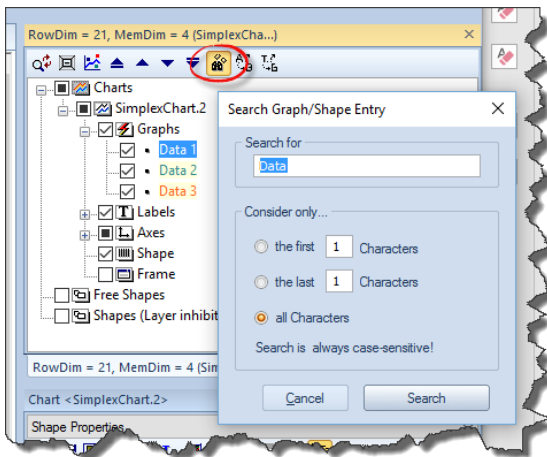
13.2.7 A) Select All < Ctrl + A >

Select all objects, charts or shapes on drawing screen.

13.2.8 A) Deselect All

Deselect all objects, charts or shapes on drawing screen.

13.2.9 A) Find Graph or Shape Entry < Ctrl + F >



Use this menu here or click on the toolbar icon on the **Chart Explorer**.

It should be clear what's going here:

It searched for a graph or shape name and selects this entry in the **Chart Explorer** and Property window, if available.

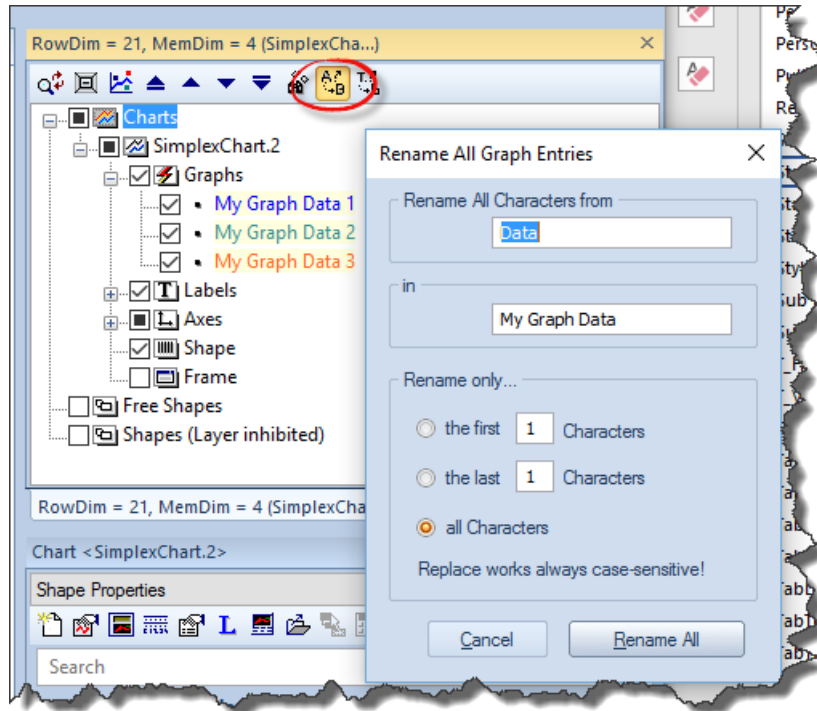
Parallel it scrolled the main window on the right place and selects the object.

13.2.10A) Find Next

Use this menu to find the next entry.

13.2.11A) Rename All Graph Entries

Use that menu to rename all Graph entries that matched the entry. You can also click on the toolbar icon on the **Chart Explorer**.



As you can see here that we have renamed **Data** in **My Graph Data** for all graphs belonging to that chart.

13.2.12A) Replace Individual Shape Entries

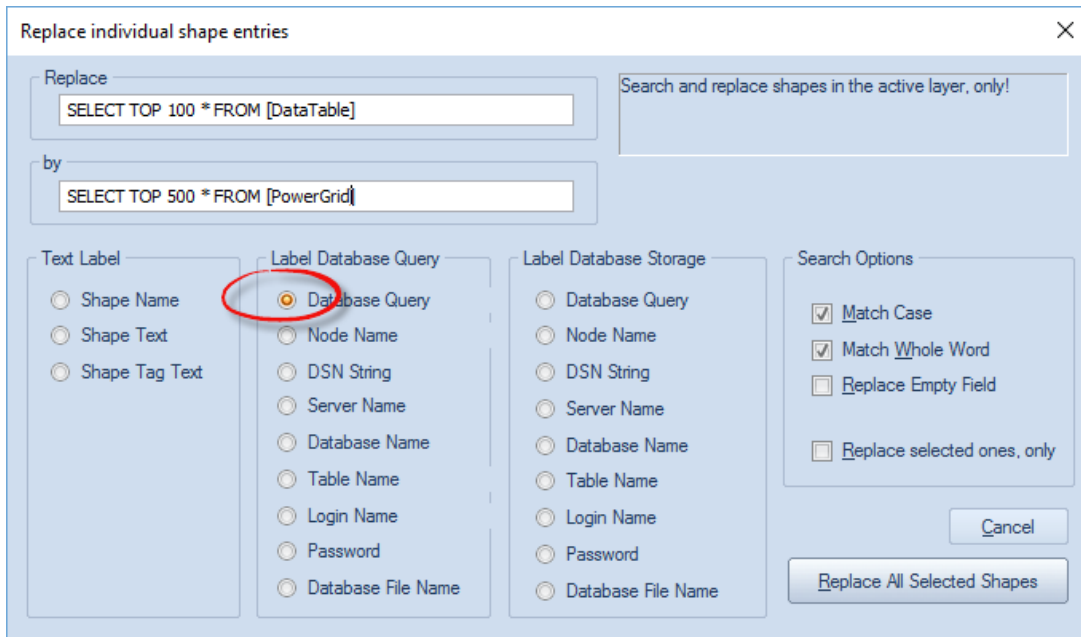
Use that menu to replace individual shape entries. You can also click on the toolbar icon on the **Chart Explorer**.

Hint

It searched and replaced shapes in the active layer, only!

Do you know?

A chart based also on a shape!



Please select a label and filter the search options, then press the button Replace **All Selected Shapes**.

Check the entry Replace selected ones, only if you like to touch only the selected shapes.

It searched for a label entry and selects this entry in the **Chart Explorer** and Property window, if available.

Parallel it scrolled the main window on the right place and selects the object.

B) If the **GraphTable** is on top, then the following functions are used...

13.2.13B) Undo < Ctrl + Z > and Redo < Ctrl + Y >

The **GraphTable**'s native data can be undoing, but they are not used for the real time part (see checkbox Table view in the main grid editor from the **GraphTable**).

13.2.14B) Cut < Ctrl + X >

Cuts the selection from the grid and save it on the clipboard.

13.2.15B) Copy < Ctrl + C >

Copies the selection from the grid and save it on the clipboard.

13.2.16B) Paste < Ctrl + V >

Use this command to insert the contents of the clipboard. That works only for native content like text or ASCII data tables, e.g. CSV format.

13.2.17B) Delete < Del >

Delete the selected region from the grid.

13.2.18B) Select All < Ctrl + A >

Select all rows and columns.

13.2.19B) Deselect All

Deselect all rows and columns.

13.2.20B) Find... < Ctrl + F >

Use this menu in the **GraphTable** to find any number in the column where the cursor is placed.

Hint

The program searched for any matched number in the column where the cursor is placed, only.

13.2.21B) Replace...

Use this menu in the **GraphTable** to replace any number in the column where the cursor is placed.

Hint

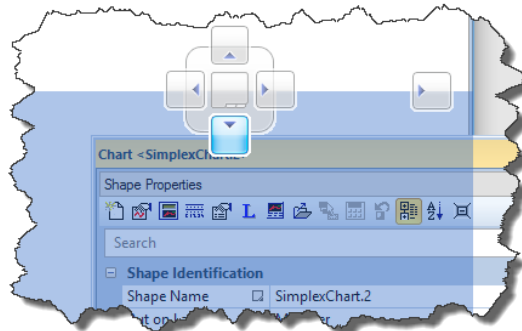
The program replaced any matched number in the column where the cursor is placed, only.

13.3 Category View

This of the same name Ribbonbar hosts menus primarily for the layout of the GUI framework and its environment.

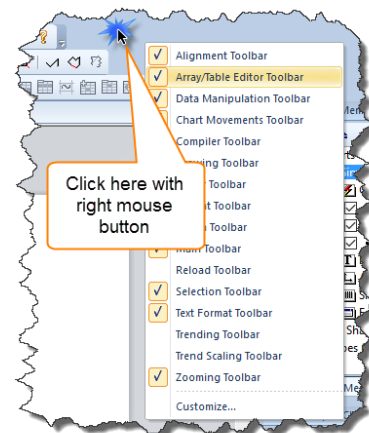
Notes:

- The environment can be saved as Profiles in the Pulldownmenu *File* (...have a look at chapter 10.10).
- You can close the full screen also with the ECS key.
- Instead the Tab Window, you can use the key < Ctrl + Tab >
- Instead the menu Page Zoom, you can use the mouse wheel, together with the keys **Ctrl** and **Shift**.
- Sure, you can use the toolbars, always...
- Are you knowing, that you can grab each window inside SimplexNumerica's GUI and dock it anywhere. Small boxes with arrows will help you to dock while dragging.



→ Are you knowing, that a menu with an icon in front does not check the menu entry, when a window is visible on screen, instead it highlights the background, only.

→ When you click on a free area to the right, then you can call the same Popupmenu as here in this, **Toolbars**.



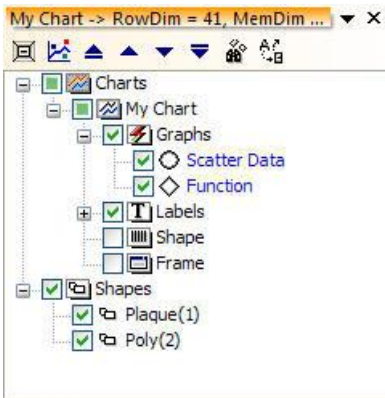
13.3.1 Full Screen

Removes all dockable windows and shows on top the Pulldownmenu and the Tab-views beneath.

13.3.2 Tab Window

Please have a look at chapter 10.3 Extended Keyboard Navigation

13.3.3 Chart Explorer



The **Chart Explorer** is a hierarchy tree view of the objects (charts/shapes) on the main page and belonging to the active evaluation.

There are two main categories: **Charts** and **Shapes** (whereby a chart is also based on a shape, so that it has also a shape entry).

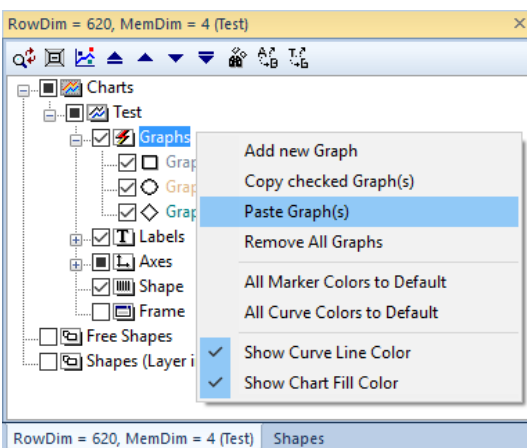
A **Chart** is divided in **Graphs** (Curves and Marker), **Labels & Legends**, its **Shape** and **Frame**.

Under **Shapes** are listed the objects like Rectangle, Lines, etc.

If you check/uncheck the tree view, then you can show/hide or activate/deactivate, respectively, some shapes or categories.

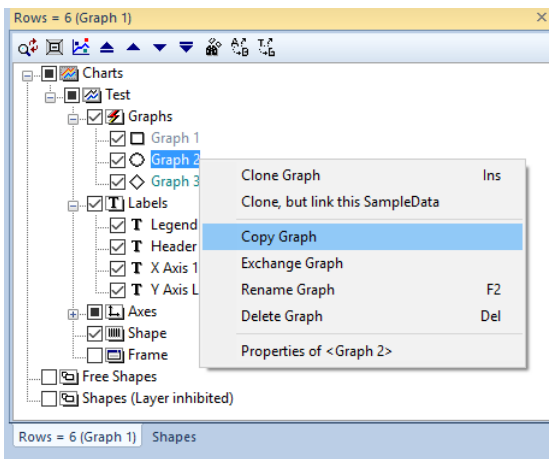
Chart Explorer Popumenus

When you right click on a **Chart Explorer** list entry, then you can open an assigned Popumenu (whereby some do not have one). Nevertheless, if they do or do not have a Popumenu, in parallel, the property window has changed its listing (see sub-chapter below).



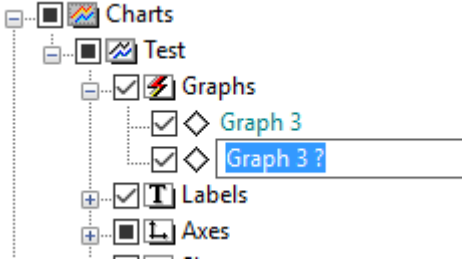
Right Click on Graphs

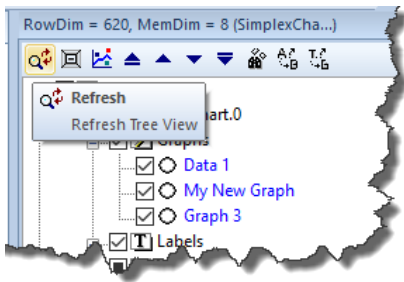
Right mouse click on **Graph** shows the following Popumenu. Its task should be clear and understandable to read...



Right Click on any Graph entry

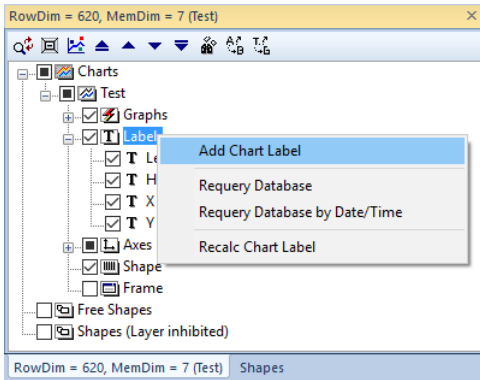
Right mouse click on a graph entry shows the left Popuption. Its task is not so clear. It will be described next...

Text	Function
Clone Graph*	Internal copy and paste of the selected graph makes a new graph entry as an exact data copy (clone) of this graph. Then, please rename the graph name to an unique text label (→Rename). Each graph based on its own SampleData .
Clone, but link this SampleData*	The same as before, but... The cloned graph still based on the copied graph's SampleData .
Copy Graph	Copies the graph in an internal buffer .
Exchange Graph*	Exchanged the selected graph with the buffered graph.
Rename Graph	Rename the selected graph 
Delete Graph	Removes the graph entry from the list and its data behind from the chart.
Properties of <Graph Name>	Shows the properties of the selected graph.



*Hint

If the **Chart Explorer** does not show the new added graph, then try to refresh the entries...

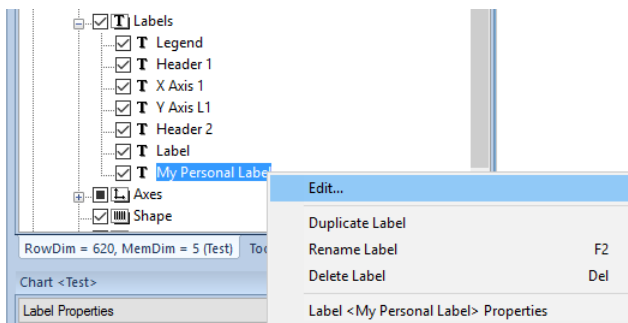


Right Click on entry Labels

Right mouse click on the list entry **Labels** shows the left Popupmenu with the entries:

Description of the entries:

Text	Function
Add Chart Label	Adds a new chart label to the chart. Opens a dialogbox to setup the label. → Please have a look at chapter 0
Requery Database	→ Please have a look at chapter Pulldownmenu Interface
Requery Database by Date/Time	→ Please have a look at chapter Pulldownmenu Interface
Recalc Chart Label	→ Please have a look at chapter Pulldownmenu Interface

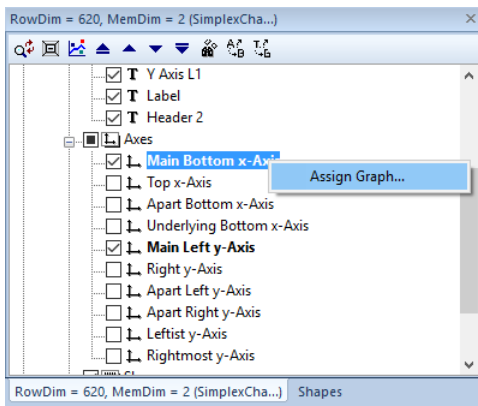


Right Click on any Label entry

Info: Behind the entry **Legend** is no Popupmenu!

Right mouse click on a **Label** entry shows the left Popupmenu with the following entries:

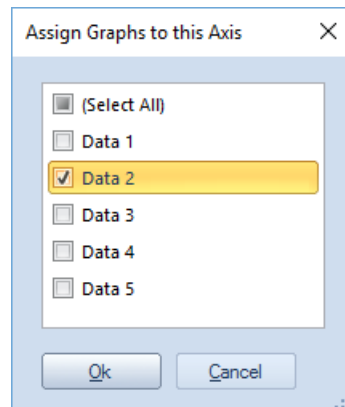
Text	Function
Edit	Calls the labelling dialogbox where you can edit the text.
Duplicate Label	Makes a copy of the selected label and opens the labelling dialogbox to edit the text for the copy.
Rename Label	Rename the label name.
Delete Label	Removes the label from the chart.
Label <selected> Properties	Shows the label properties.



Right Click on any Axes entry

This here is one of the several possibilities to assign a graph to an axis or vice versa.

It opens the dialogbox below. Please select one or more graphs that should be belonging to the selected axis.



13.3.4 Chart Properties

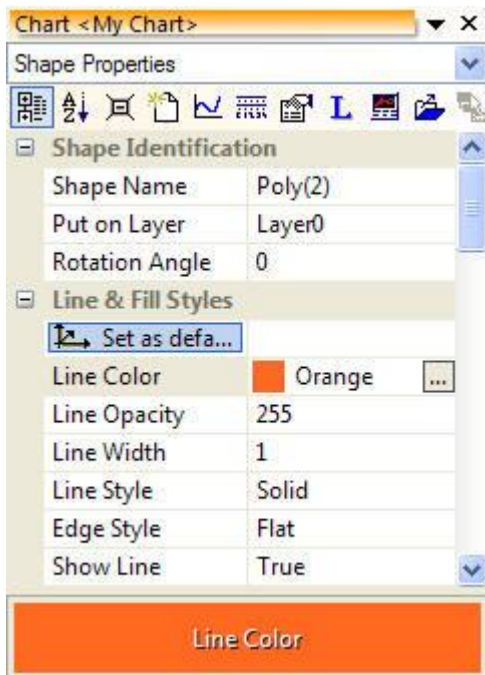
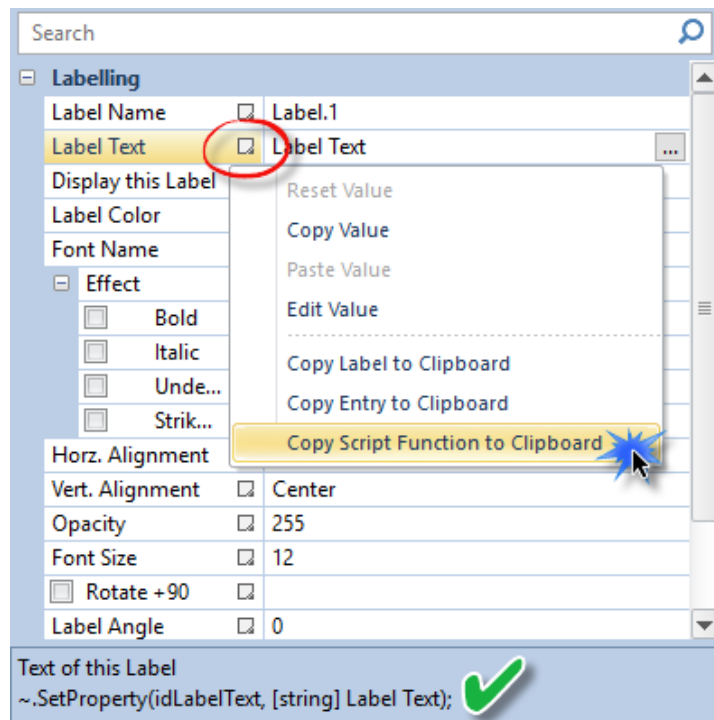


Chart Explorer & **Chart Properties** are related to each other like Action & Reaction.

→ Click on a **Chart Explorer** entry and immediately you will get the properties to this entry in the property window.

→ Have a look on chapter 10.8 to see more about the property window.

→ When you click on an entry, then you can see a short help note at the bottom and the property command for the scripting engine.



As you can see, the list entries on the first column have a small box on the right side. Click on this box to open the Popumenu. You can simply read what you can do with the menu entries. As an example we will show you the use of the menu **Copy Script Function to Clipboard**.

The picture above grabs the function `~.SetProperty(idLabelText, [string] Label text);`

The function will be used like:

```
Chart ch = app.MakeChart("My Chart", idChartTypePhysics, 100, 100, 400, 300);
```

```
ch.SetProperty(idLabelText, "Hello World");
```

Here is another short sample script:

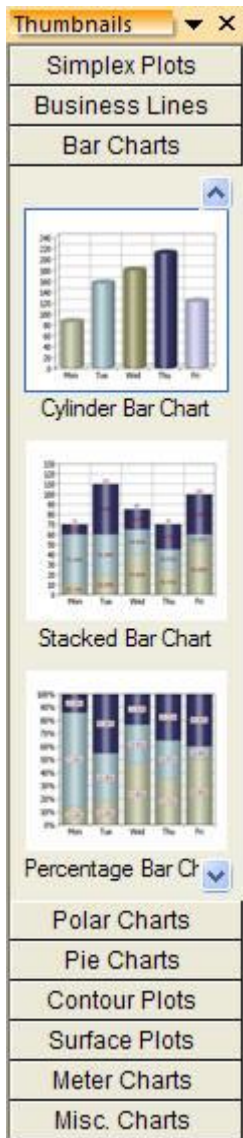
```
/******  
  
    Simplex - Sample Script  
  
*****/  
  
#pragma extension "corelib"  
  
#define IDYES          6  
#define IDNO           7  
  
void main()  
{  
    Application app("Simple App");  
  
    string simplexAppPath = app.GetSimplexAppPath();  
  
    string filename = simplexAppPath + "Examples\\Curve Fit\\Gauss-Fit.sx";  
    app.Output(filename);  
  
    if (app.FileExist(filename))  
    {  
        app.LoadEval(filename);  
        Chart ch = app.MakeChart("My Chart", idChartTypePhysics, 100, 100, 400, 300);  
        ch.SelectPropertyGroup("Chart Properties");  
        ch.SetProperty(idShowGrid, false);  
        ch.SelectPropertyGroup("Page Properties");  
        ch.SetProperty(idShowPageGrid, true);  
        app.SelectChart("My Chart");  
        app.SaveEval(simplexAppPath + "test.sx");  
  
        if (alertYes("Close Evaluation?") == IDYES)  
        {  
            app.CloseEval();  
        }  
    }  
    else  
    {  
        app.Error("File does not exist!");  
    }  
}
```

Note:

Use SetProperty() to set the properties (simple to use, but slow) or use the individual object functions from the scripting host (fast, but more knowledge necessary).

13.3.5 Shape Properties

Each object is based on a shape, also a chart has a shape behind. This menu item activates these shape properties in the property window.



13.3.6 Thumbnails

Thumbnails are small pictures of real charts saved on disk as objects.

Note:

- Objects can be saved as described in chapter 13.1.11
- All objects are stored into the *SimplexNumerica* folder e.g.: <C:\Users\MyName.MyPC\Documents\SimplexNumerica\TN>
- Find out more about the thumbnail window in chapter 0.
- If you want, then you can change every object in this folder.

Inside each of these folders, there are two sub-folders called Bitmaps and Objects. The files inside these folders must have the same file name (except the extension).

Empty page or no page available

→ Click on a picture in the thumbnail window to activate a new evaluation and the clicked chart object will be dragged to the page. You can also drag it by hand to the evaluation page.

Page available, existing chart selected

→ The chart is still selected! Now, if you click on a thumbnail picture, then two possibilities of displaying this new chart are available:

Either, the new chart will exchange the old one or the new one will be put beside the old one.

SimplexNumerica has the following rule: If the old one is selected, then the new one will remove it and will be placed instead (on the same position) of it. However, the data will be used from the old one. If there is no chart selected, then the new one will be placed beside the old one and have their own (default) data.




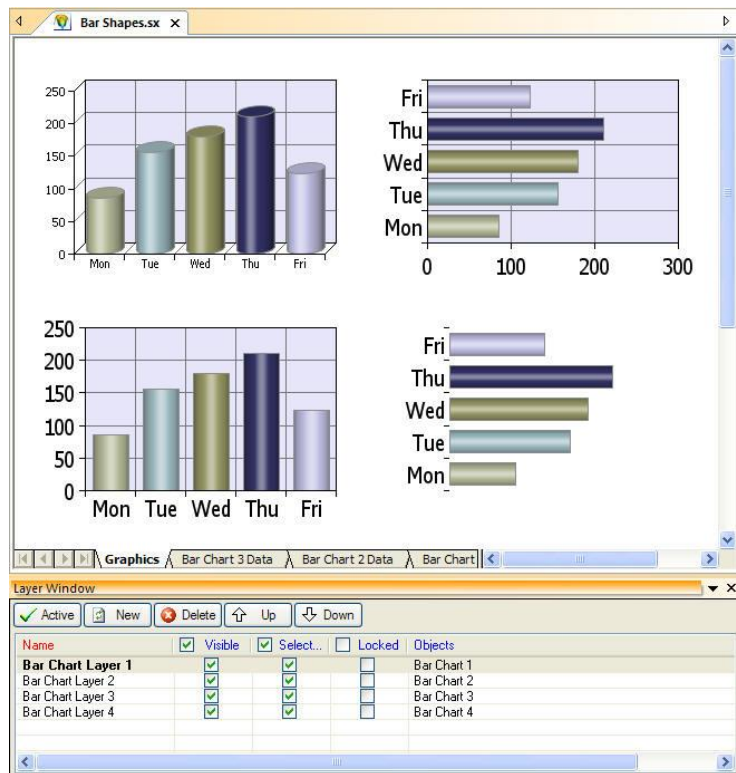
By the very first time of clicking a second chart, *SimplexNumerica* will show next dialog, so that the user can decide what to do.

Use Don't show this message again to avoid this dialogbox.

13.3.7 Page Layer

This menu hides/shows a Layer Window.

A layer is a group of objects that lay in front of or behind another layer. All of the objects in a layer may be hidden, locked, or moved in front or behind other layers as a group. Normally, there is just one Layer in a window, and all objects in a drawing are in this layer. However, for the complex diagrams, where more charts may be in a different layer to another, multiple layers are preferred. You can use Layer Button  in the toolbar to activate the Layer Window or use this Pulldownmenu and define more than one Layer in your drawing (see next picture).



As you can see in the above picture, there are five columns within the Layer Window, which are Layer Name, Visible, Selectable, Locked and Objects. See Adding/Deleting and Editing Layers on how to use them. There are four buttons at the top of the window, which are Active, New, Delete, Up and Down. New is used to add a new layer; Delete is used to delete one unwanted layer; Up is used to move one layer one level up; and Down is used to move a layer on level down. You can activate a layer by pressing Activate button (but please avoid the Name column). Rename the layer with click on the layer name cell.

Add a new Layer

To add a new layer, please click the "New" button within the **Layer Window**, a new layer will be added and set as activated (layer name shown in bold). You can change the name of the layer by clicking the layer name and edit the layer name. To make a layer visible/invisible, check/uncheck the visible box for the corresponding layer. The objects in an invisible layer are hidden and cannot be selected and edited. The

objects in a visible layer can be selected if the Selectable box is checked for that layer. To make the objects in a visible layer un-selectable, uncheck the Selectable box for that layer.

Delete a Layer

First, select the layer that you want to delete by click the layer row once (not in the name cell), then click Delete button within the Layer Window. All the objects in the deleted layer will also be removed. If a layer is locked, it cannot be deleted.

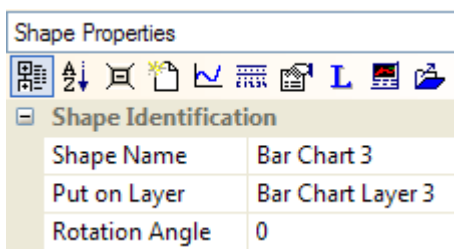
Changing a Layer's Order

For the layers in the Layer Window: The layer that appears at the first row is the back most one and the objects within this layer will appear behind the objects in other layers. Correspondingly, the layer appears at the bottom row is the front most layer and the objects within this layer appear in front of the objects in other layers. You can change the order of the layers by moving a layer up/down button. First, select the layer you want to change by click the layer row (not the name cell), then click the Up/Down button to move the layer one level towards the front/back. The back most layer (the first row) cannot be moved down, and the front most layer (the last row) cannot be moved up.

Add new objects to a Layer

First, activate the corresponding layer, and then add new objects (Charts, Shapes, etc.) to the activated layer. Move objects within Layers: Objects reside in different layers. After an object is generated, you can check to see which layer it belongs to in Object cells.

Move an object to another Layer



You can also move the objects to another layer by choose a different layer. To check whether the objects are moved or not, selected the destination layer and make it invisible (uncheck the visible box), the objects that have been moved should be hidden.

To move an object, first, select the object (if more than one object is selected, then the target object is referred) you want to move, then select the Shape Properties. Use "Put on Layer" to select another one.


Quickly re-order the objects

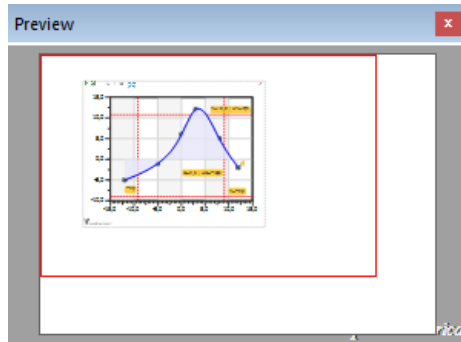
You can re-order the objects one by one, see Order the objects. You can also easily re-order several objects at once. First, consecutively select the objects in the order you want (the first in the back, the last in the front; hold Ctrl and click the object to select more than one object, see Select Objects); then within the Property Window, choose the Property Window, "Put on Layer", choose one layer you want to sent these objects to (you can even sent them to the same layer as before). The objects will be re-ordered as the order you select them.

→Have a look on chapter 10.3 to see more about the layer functionality.

13.3.8 Preview Window

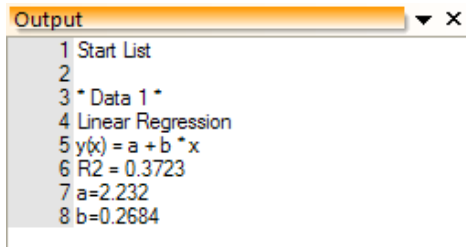
The Preview Window is used to preview and navigate in your evaluation page, especially when the size is huge.

The **Preview Window** is implemented as a normal dockable window inside the mainframe. You can show/hide it by checking/unchecking this menu item or by pushing the icon  in the toolbar.



In this picture, the small white page rectangle shows the size of the drawing page. The red rectangle illustrates where your view window is over the drawing. The objects within the view window can be seen. You can click and drag the red rectangle to move the view window over the interesting area in your drawing.

13.3.9 Output Window



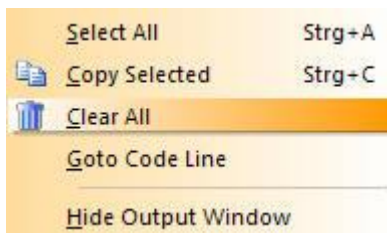
The Output Window is used by the program to print out any alarm, messages or formula results.

This sample shows you the result of a linear regression calculation.

You can use the Output Window also from Scripting Engine like

```
bool ret = MyDummyFunction(str, strQuestion);
if (ret)
    app.Output(alertYes("You said Ok.\n" + strQuestion));
else
    app.Error(alertYes("You said No.\n" + strQuestion));
```

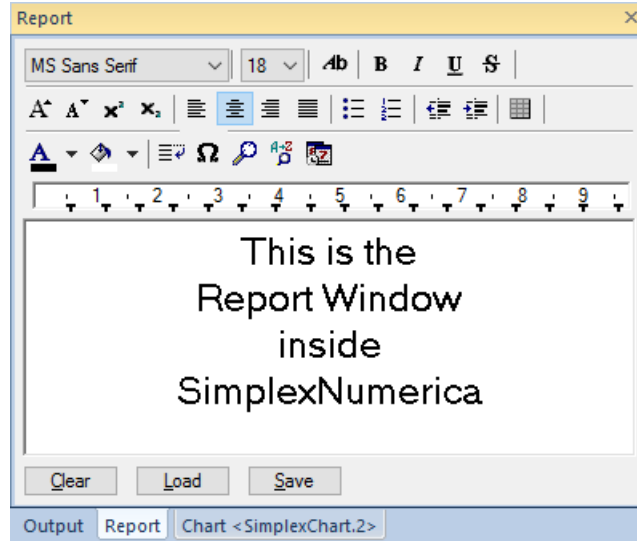
If there is a compile time error in your code, then double-click on the line in the Output Window to show the row in the code editor where the error is located.



Use right mouse click in the Output Window to show a popup menu for more editing options.

13.3.10 Report Window

The **Report Window** can be used similar to **WordPad** in Microsoft Windows.













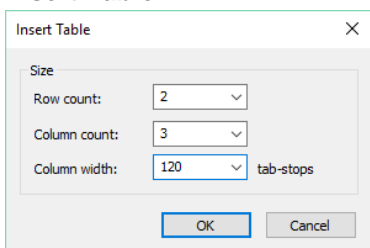
It should not be difficult to find out its functionality, because a description here inflates the manual too much.

Info

The content of the *Report Window* will be stored (automatically) each time together with the evaluation.

The following table explains the functions of the report format toolbar.

Symbol	Function
Ab	Properties Text Format Properties
Symbol ▾	Font
A ▾	Shrink Text
9 ▾	Text Height
A ^	Grow Text
B	Bold Text
<i>I</i>	Italic Text
<u>U</u>	Underline Text
x ³	Superscript

Symbol	Function
	Subscript
	Foreground Text Color
	Background Color
	Align Left
	Center
	Align Right
	Bullet List
	Numbered List
	Decrease/Increase Indent
	Insert Table 

13.3.11 Statusbar

Displays or hides the status bar.

The status bar shows additional information about the currently active evaluation and consists of individual sections. The first section shows the status of the program or the certain menu description. During long operations (e.g. load of long table) a text with the percent of progress is shown here.

The next section shows the x/y value from the mouse cursor position in the drawing window.

CAP tells you the key state (highlighted/disabled) of the upper-/lowercase key (Capslock).

NUM tells you the key state Numlock key.

SCRL tells you the key state Scroll key (not often used).

During long operations, a progress bar shows you the progress in the Statusbar.

13.3.12 Shape Toolbox

The **Shape Toolbox** is described in chapter 0.

13.4 Category Chart & Graphs

These menu items show you everything about charts and their graphs.

→ To make a new chart, maybe it is better to use the **Thumbnail Window**.

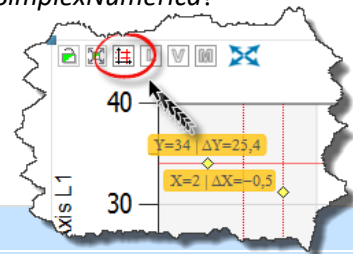
→ Arrange All Charts makes sense when you have more than one chart on your page.

→ Rescale to fit into page can be used when you have a small sized plot and want to print it out in for example DIN A4.

→ Use AutoScale all the time.

→ Do not forget the menu items around the Graph during your work with *SimplexNumerica*!

→ The Physics chart has also Cursor Lines in addition to this menu.



Note

Use the **Thumbnail Window** to select an individual chart from the original picture of the chart.

SimplexNumerica has some of the following main chart types:

Logarithmic/Linear Cartesian Coordinate Systems, Physics and Mathematical Charts, Polar Charts, Smith Diagram, Triplots, Business Line Charts, Pie Charts, Radar Charts, Bar Charts, Contour Plots, 3D Surface Plots, Angular Meter Gauges, Misc. Charts, etc.

Please refer to the following link to see their appearance:


*** Gallery of Chart Types *** www.simplexnumerica.com

Note

You can exchange a selected chart against one of the others with the help of the Pulldownmenu **Change Chart to...** or use the **Thumbnail Window**.

13.4.1 Arrange All Charts

Are there more than one chart in your page, then you can use the following layout menus from the Pulldownmenu Objects (or their corresponding toolbars).

But you can also use **Arrange All Charts** to arrange the charts. You can use the toolbar icon  to do the same.

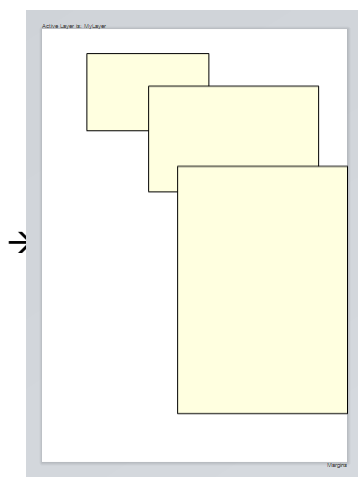
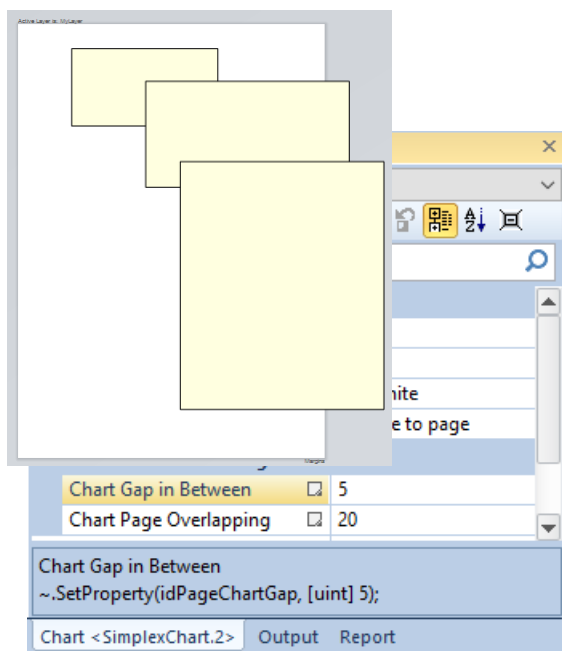
If the page is too small, then the program stops with the arrangement and writes an error in the **Output Window**.

Go to the **Property Window** and select **Page Properties**. Then set the two parameters to your own values:

- Gap between the charts.
- Chart page overlapping.

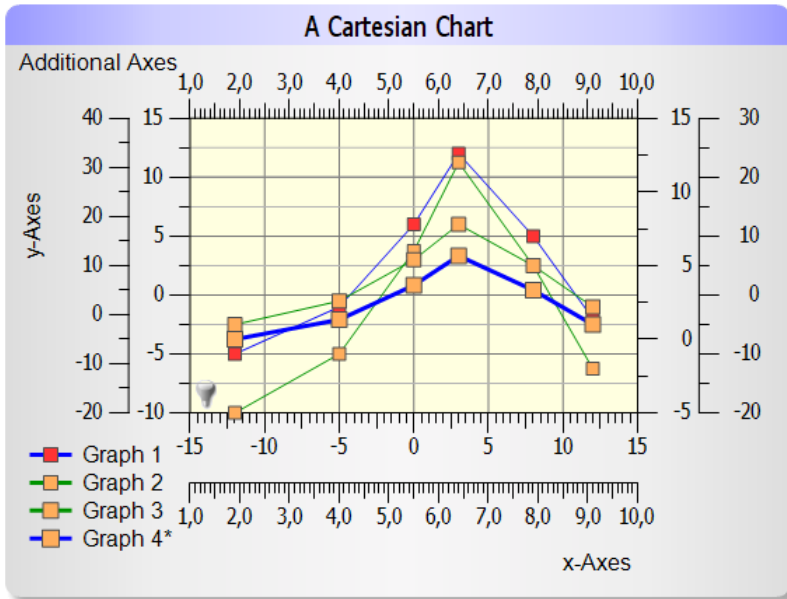
13.4.2 Rescale to fit into page

Imagine you have shrunk the page size and want to adjust the charts to the new dimension. You can do that by hand or use this menu item here.



The program automatically rescales the dimensions of the shapes/charts, until they fit back into the page.

13.4.3 Locate Axes



Use this menu or the **Chart Explorer** to setup the main chart axes.

→ Only for the Cartesian-coordinate-system (**Physics Chart**) available.

The following axes can be set/hidden:

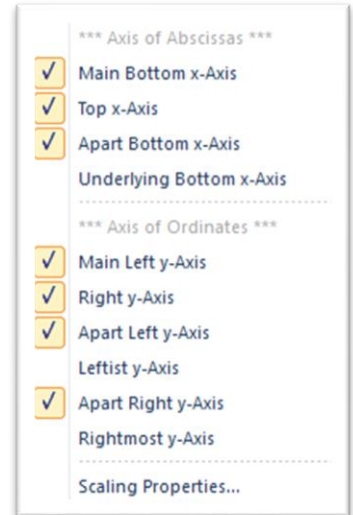
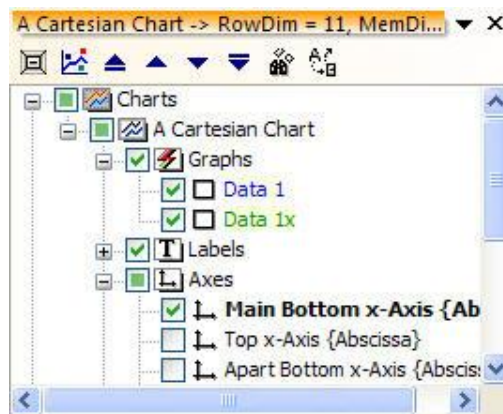
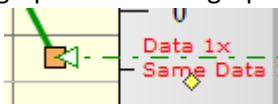


Chart Explorer:

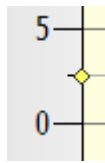
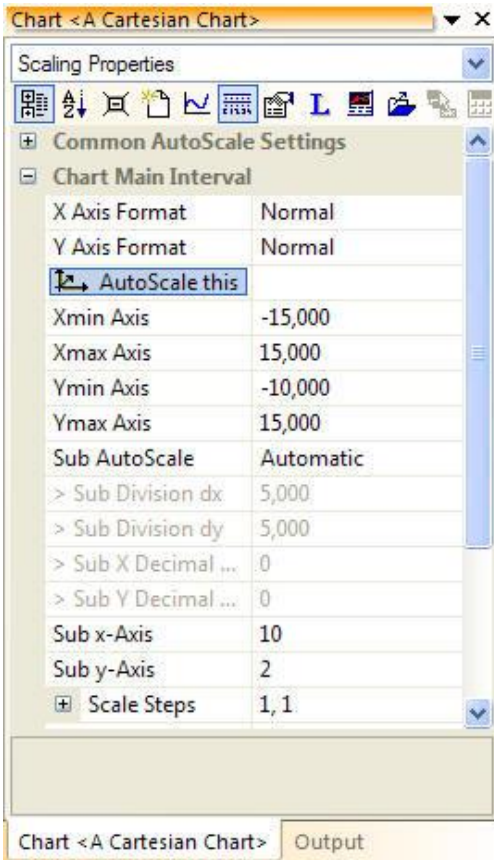


In the above chart, there are two graphs with identical data behind. They are different scaled in y direction. The correct (y) axis for the blue graph (Data 1) is left and for the green graph (Data 1x) is on the right side. The green one is in **green bold** because it is the active graph. The active graph is marked with an arrow and

the Graph Name on top and Graph Legend on bottom.



→ Have a look also to the **Chart Explorer**.

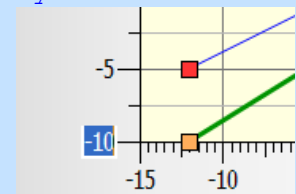


To scale an axis, please click on the yellow handle on that axis.

Then look to the **Property Window** - that has reacted - to show the related scaling.

Change the scaling values if you like (here the left y-axis).

Note:
 There is also another way to edit the scaling.
 Double-click on min/max of any axis and edit



directly the min/max values.

Info:

In this *SimplexNumerica* version, that feature is only available in the **Physics Chart**.

How to associate a Graph to the considered Axis?

In this example, the green graph is associated with the right y-axis. How to do that? Click on a Graph in the

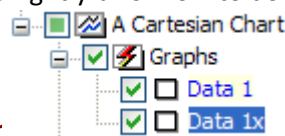


Chart or click on the graph name in the **Chart Explorer**

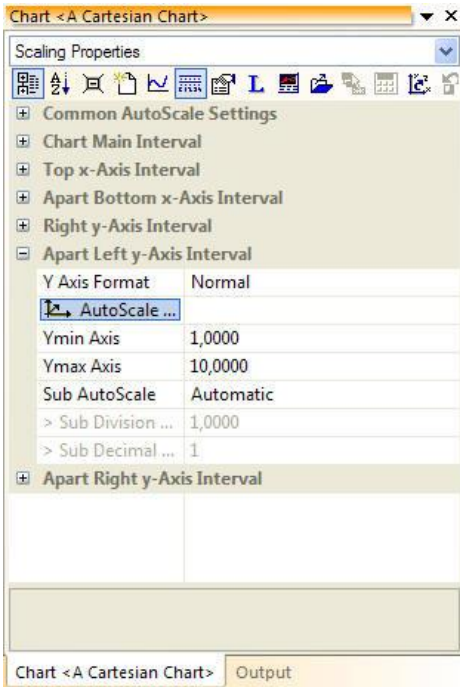


Then scroll down the **Property Window** to the entry

Now, assign the graph "Data 1x" to the right y-axis (Ordinate). Do the same with other axes (if necessary).


Scaling Properties

This menu calls the **Scaling Property Window** from the Pulldownmenu Charting.




13.4.4 Auto Scale Main Axes

All available axes will be scaled by the AutoScale function.

Use this menu or the toolbar icon  for all main x/y axes.

13.4.5 Auto Scale Y-Axes

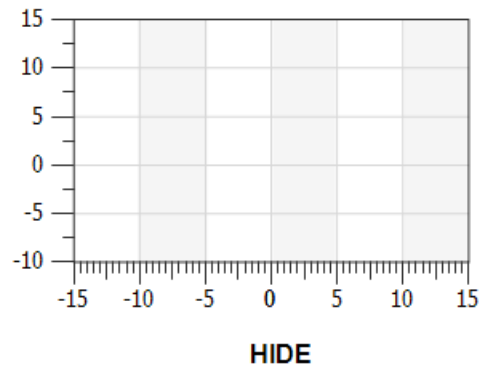
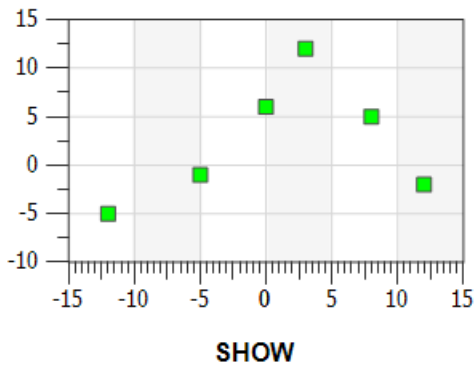
Use this menu or the icon  to Auto Scale only the main y-axis.

13.4.6 New Graph


Please have a look at chapter 0.

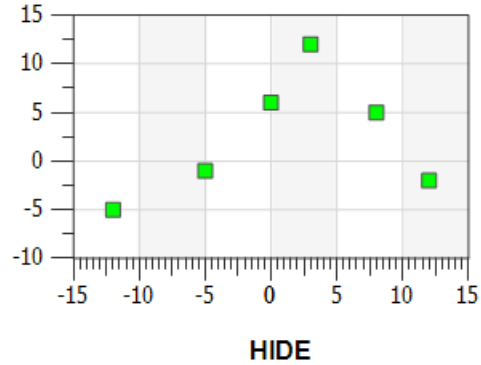
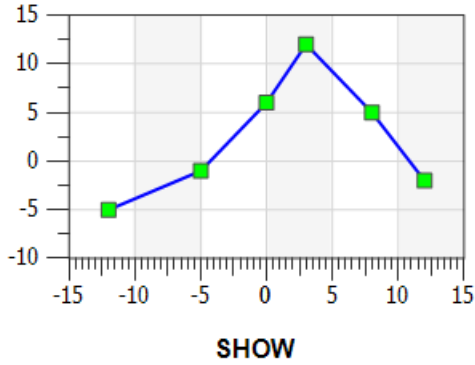
13.4.7 Show/Hide SampleData (Marker)

First, select a chart, then use this menu or the associated toolbar icon .




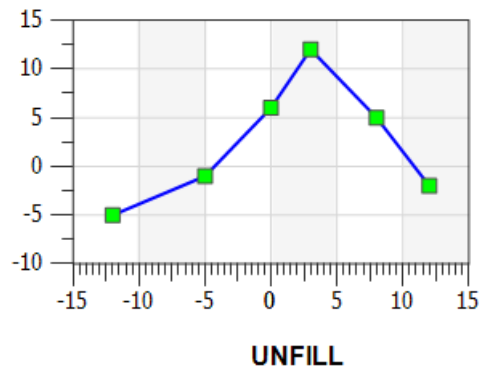
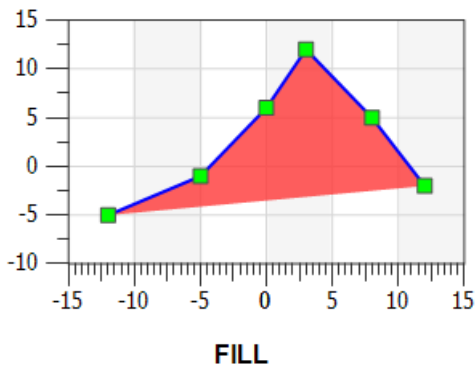
13.4.8 Show/Hide Marker Polylines

First, select a chart, then use this menu or the associated toolbar icon .




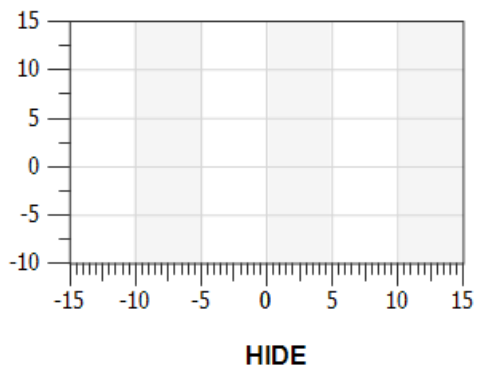
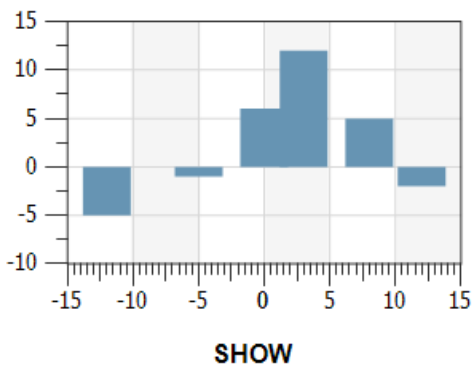
13.4.9 Fill/Unfill Marker Polylines

First, select a chart, then use this menu or the associated toolbar icon .




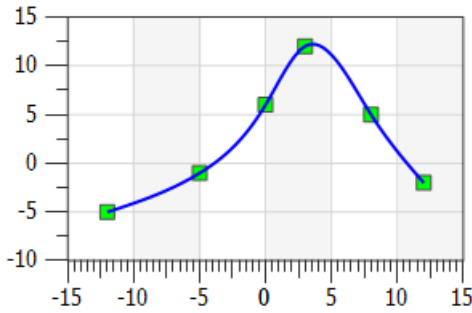
13.4.10 Show/Hide Bars

First, select a chart, then use this menu or the associated toolbar icon .

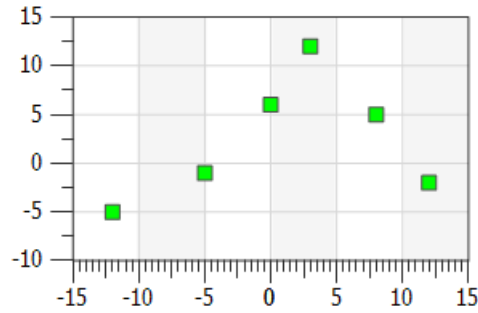


13.4.11 Show/Hide CurveData (Curved Line)

First, select a chart, then use this menu or the associated toolbar icon .




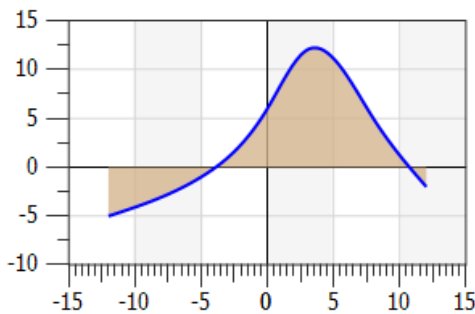
SHOW



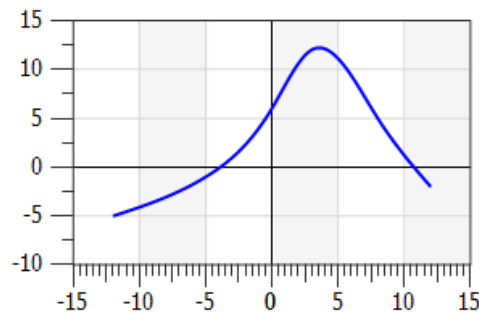
HIDE

13.4.12 Fill/Unfill CurveData (Curved Line)

First, select a chart, then use this menu or the associated toolbar icon .



FILL



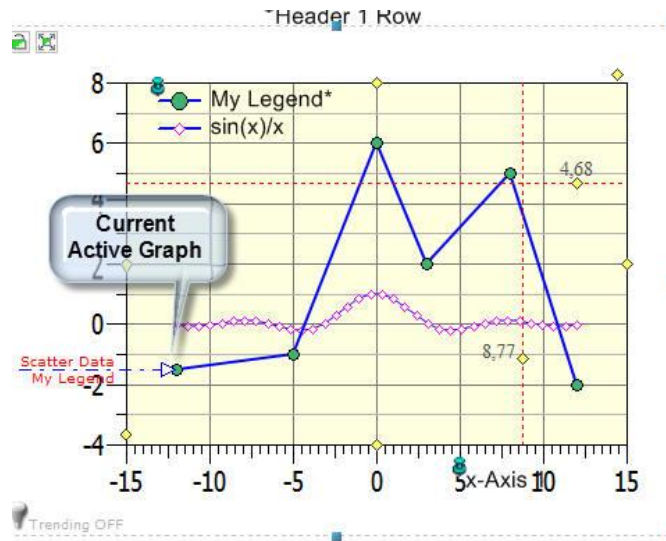
UNFILL

13.4.13 Highlight Active Graph

A Graph can be highlighted (e.g. for calculations, to match its properties) so that the user knows which Graph it just modifying.

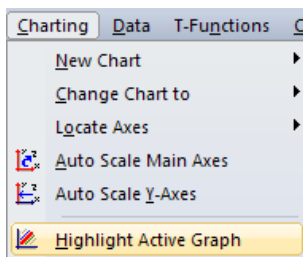
Which one is the selected (= active) graph?

1. You can see it in the **Chart Explorer** (press key F4)
2. You can see it in the graph plot; the selected graph is highlighted with a broader curve.
3. The Physics Chart shows the name and the legend on the axis side.



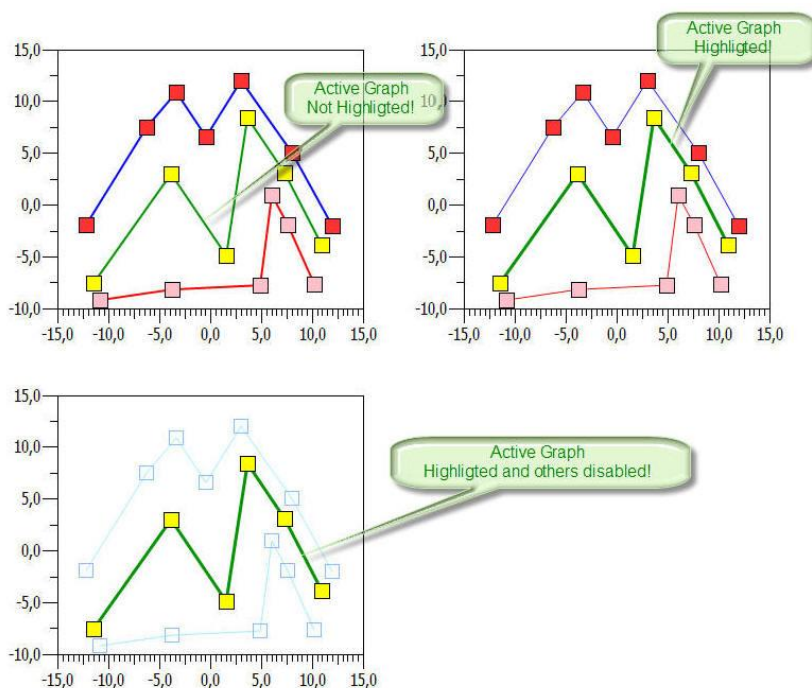
How to highlight the selected graph?

You can switch on/off the highlight of the selected graph in three steps:



Use this menu item or the toolbar icon  to highlight the selected graph in three steps.

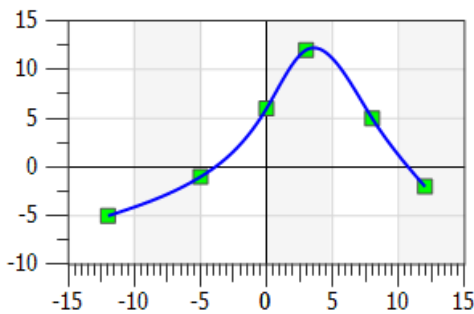
The next figure shows the highlighted graph in three different steps:



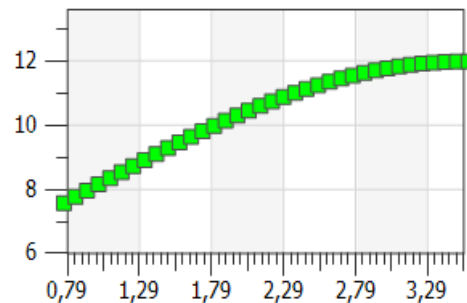
The top left chart is the original one. In the bottom left chart is the selected graph shown with a broader green polygon, the others are in gray. The top right chart shows the others in original color and the active graph with a broader green polygon.

13.4.14 Swap Active Data/Curve

This menu is to swap the **SampleData** and the **CurveData** of an **Active Graph**.



(M)arker and (C)urve



M&C swapped and zoomed
Swap SampleData / CurveData

13.4.15 Swap All Data/Curves

This menu is to swap the **SampleData** and the **CurveData** of **All Graphs**.

13.4.16 Popu menu Graph Labels

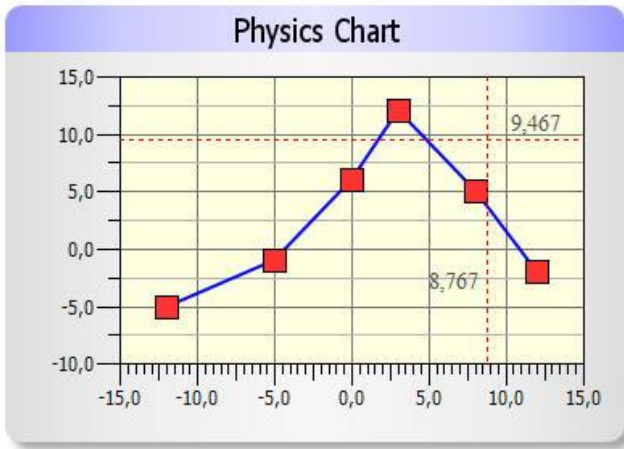


- Show No Data Points
-
- Show All X Data Points
- Show All Y Data Points
- Show ArrayEditor Legend
-
- Show X Values pass the Limit
- Show Y Values pass the Limit
- Show Z Values pass the Limit
-
- Set Exclusive Data Points
- Use Exclude Data Points
-
- Show Label

Use this menu to monitor Graph actions.

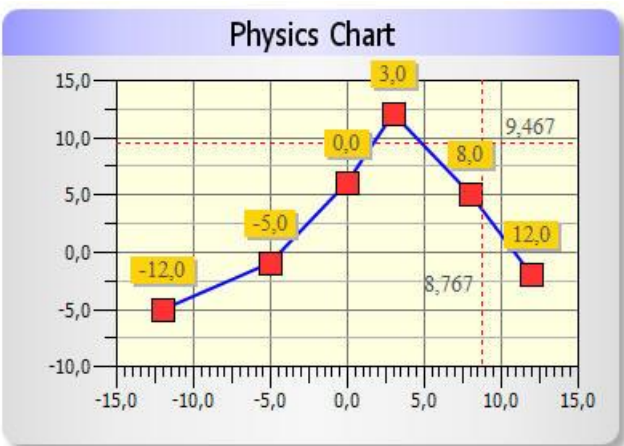
It is only for the Cartesian-coordinate-system (**Physics Chart**) available.

Show No Data Points



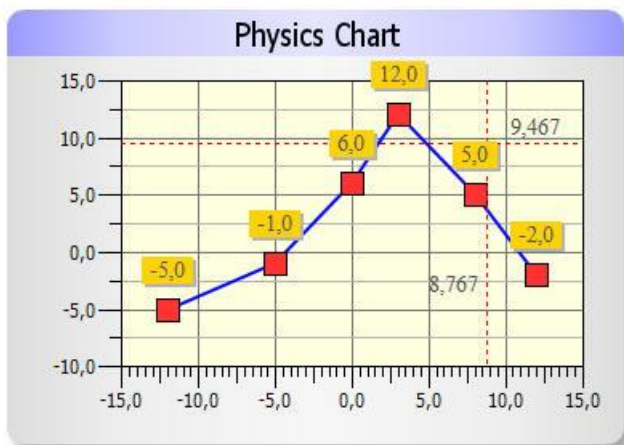
Data points (x/y values) can be shown as labels beside the marker on a graph. But this menu deactivates these labels.

Show All X Data Points



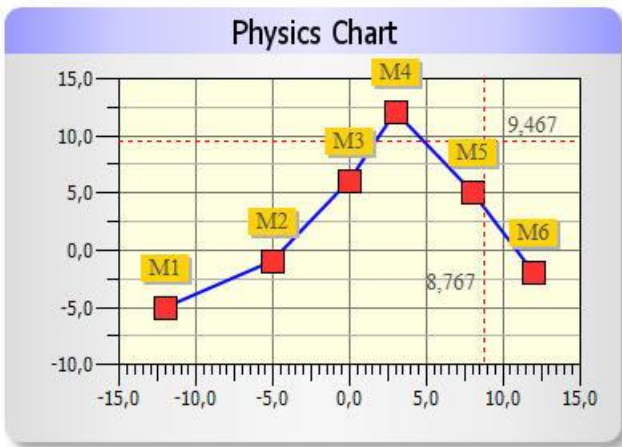
Shows all x values as labels beside the markers on the active graph.

Show All Y Data Points



Shows all y values as labels beside the marker on the active graph.

Show ArrayEditor Legend



Shows the legend per data row as labels beside the marker on the active graph.

→ You can edit the legend in the **GraphTable**.

The "Data Point Labels" dialog box shows a table with the following data:

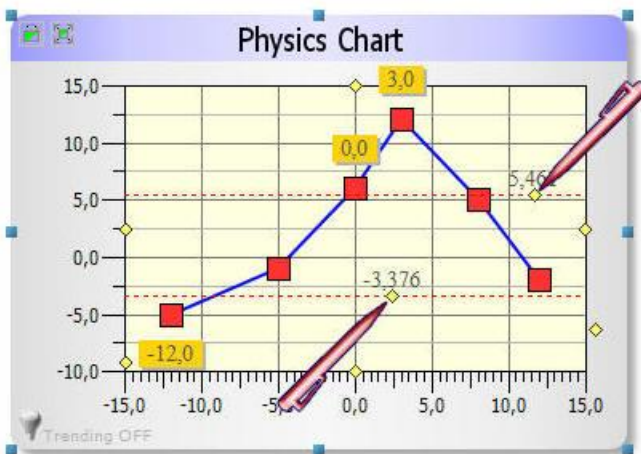
Legend	G0.x	G0.y	G0.z
M1	-12,0000	-5,0000	1,000000
M2	-5,0000	-1,0000	1,000000
M3	0,0000	6,0000	1,000000
M4	3,0000	12,0000	1,000000
M5	8,0000	5,0000	1,000000
M6	12,0000	-2,0000	1,000000

Click the button Legend to call next dialog and edit the labels for each data row.

The "Legend" dialog box shows a table with the following data:

	Legend	Color
1	M1	#0000FF
2	M2	#0000FF
3	M3	#0000FF
4	M4	#0000FF
5	M5	#0000FF
6	M6	#0000FF

Show X/Y/Z Values pass the Limit



Shows all x, y or z values pass two limit lines as labels beside the marker on the active graph.

Note:

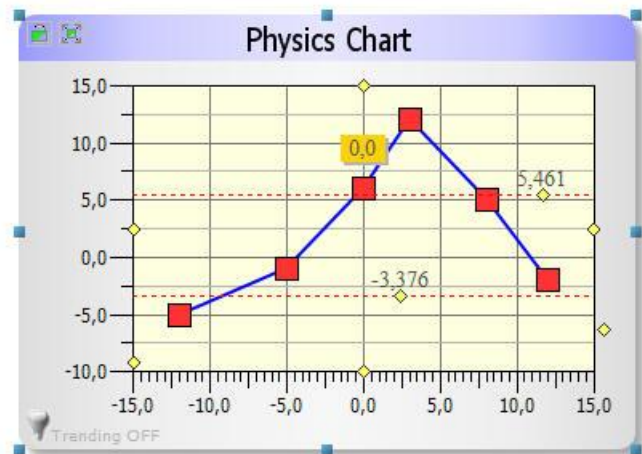
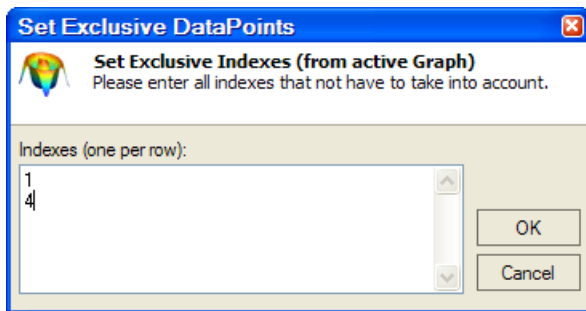
Click on a yellow rhombus handle, hold the left mouse button down and move the line.

Set Exclusive Data Points

Use Exclude Data Points

If there are e.g. measuring points that are not interested to shown, then you can hide their labels. Put their indexes into the next dialog and check the menu **Use Exclude Data Points**.

Result:



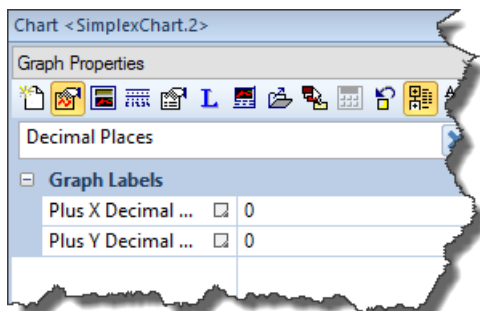
Note:

If the menu Use Exclude Data Points is not checked, then all data points are labeled.

Show Label Box

Switch on and off the labels.

Label Decimal Places



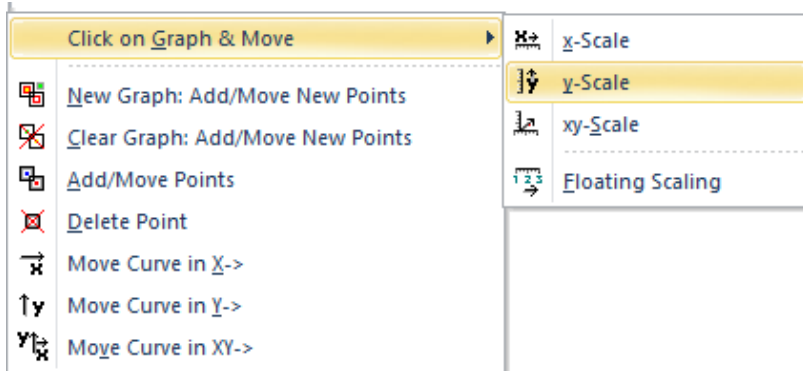
Set the decimal places of the labels in the **Graph Properties**.

→ When you use this menu item here, then the program filters the properties to the **Graph Labels**.

→ Do not forget to clear the filter afterwards...

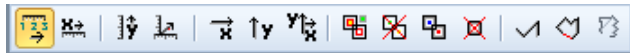
13.4.17 Graph Manipulation

Use these menu items or the associated toolbar to manipulate the position and the data points of a graph.



→ Please have a look at toolbar chapter **Fehler! Verweisquelle konnte nicht gefunden werden..**

Floating Scaling



Move x-Axis-Scaling during movement of a Graph.

Move Graph/Scale X->

Move Graph/Scale in X->Direction.

Move Graph/Scale Y->

Move Graph/Scale in Y->Direction.

Move Graph/Scale XY->

Move Graph/Scale in both XY->Direction

Move only Graph X->

Move Graph in X->Direction (Scale ossified)

 *Move only Graph Y->*

Move Graph in Y->Direction (Scale ossified)

 *Move only Graph XY->*

Move Graph in both XY->Direction

 **Make new Graph, Add or Move Points**

Make a new Graph, then add or move marker points.

 *Clear Graph, Add or Move Points*

Clear existing Graph, then add or move new points.

 *Let Graph, Add or Move Points*

Add or move points from any existing Graph.

 *Delete Point*

Delete an existing data point.

 *Draw Polyline*

Draw an independent poly segment line.

 *Close or Open*

Close or open polyline.

 *Reduce Polyline*

Reduce polyline with less point.

13.4.18 Lasso Graph Data



Sometimes it will be necessary to alter data points in a Cartesian-coordinate-system. For instance, if data points are lying outside a normal graph expectation, then it can be difficult to find out which indexes these points are have inside the *GraphTable* array. For selecting strange data points, the Lasso is predestined.

Note: Before you can manipulate any data points, a Lasso has to be drawn via mouse like a normal polygon.

Use Active Graph

The Lasso functions will only manipulate the active Graph, but only if the graph data points are lying inside the Lasso region.

Use all Graphs

The Lasso functions will manipulate all Graphs, but only if their graph data points are lying inside the Lasso region.



Draw Lasso and delete Data Points



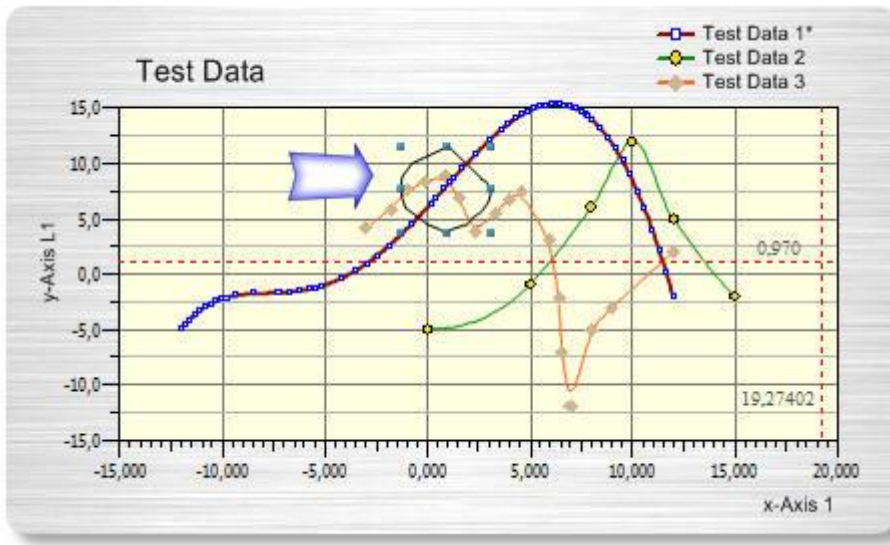
To delete certain data points, chose this menu and draw a lasso around the data points.

Note:

The data points will be deleted immediately.

You can also use the toolbar icons   either for the active Graph or for all Graphs.

Draw and select Lasso, then **Delete Data Points**



The same as the menu above but without to delete immediately the data points.

Note:

The lasso is waiting for any command.

Legend	G0.x	G0.y	G0.z	G1.x	G1.y
9	-10,028056	-2,2412	0,000000		~
10	-9,787575	-2,1075	0,000000		~
11	1,304442	8,6755	0,000000		~
12	-9,306613	-1,9198	0,000000		~
13	0,831850	7,6914	0,000000		~
14	-8,440882	-1,7626	0,000000		~
15	-7,286573	-1,6831	0,000000		~
16	-6,757515	-1,6228	0,000000		~
17	-6,228457	-1,5160	0,000000		~
18	-5,699399	-1,3456	0,000000		~
19	-5,410822	-1,2208	0,000000		~
20	-5,122244	-1,0712	0,000000		~
21	-4,189446	-0,4002	0,000000		~
22	0,418331	6,9260	0,000000		~
23	1,127220	8,2381	0,000000		~
24	-3,486974	0,2959	0,000000		~

Draw and select Lasso, then Mark Data Points in Table

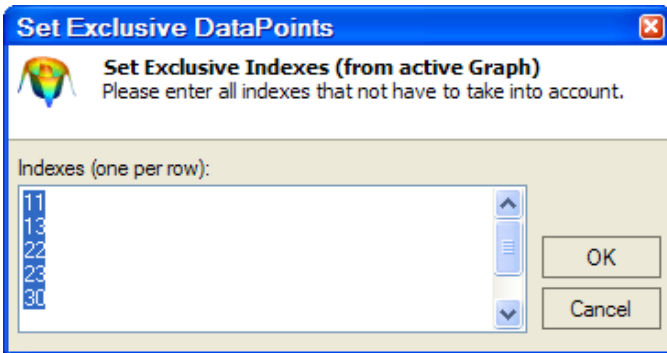
Marks the data points inside the hull of the lasso in the GraphTable.

Draw and select Lasso, then Show Data Points in Output

Legend	G0.x	G0.y
1	1,304442	8,6755
2	0,831850	7,6914
3	0,418331	6,9260
4	1,127220	8,2381
5	0,182035	6,3793
6	1,658887	9,5503

Shows the marked data points in the Output Window.

Draw and select Lasso, then Use for Exclude Data Points



Puts this data point indexes in the left dialog.

Note:

Use [this](#) link to see for what.

Draw Lasso and delete Data Points

Yes, the title says what it makes.

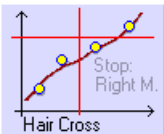
Remove last Lasso

Removes the last lasso from screen.


13.4.19 Popumenu Cursors

The following menus are for cursor functions and visual zooming.

Crosshair Cursor



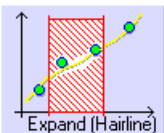
Invokes the Cross Hair Cursor on screen. Right mouse click to quit.

Toolbar Icon 

Expand Cursor

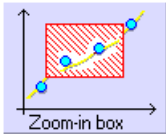
Expands (zoom) the area in the Physics Chart.

Toolbar Icon 




Herewith you can expand a horizontal area with two vertical borders. It appears a perpendicular line with current indication of the coordinates in the Status Bar. Click with the left mouse button to set the interval. After that, all available graphs are expanded immediately. After Expand the interval borders are shifted.

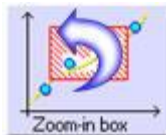
Zoom Cursor




The same for a rectangle Zoom area (only made for the Physics Chart).

Toolbar Icon 

Zoom Back




Zooms back, step-by-step, to the original area.

Toolbar Icon 

Delete Data Outside Chart

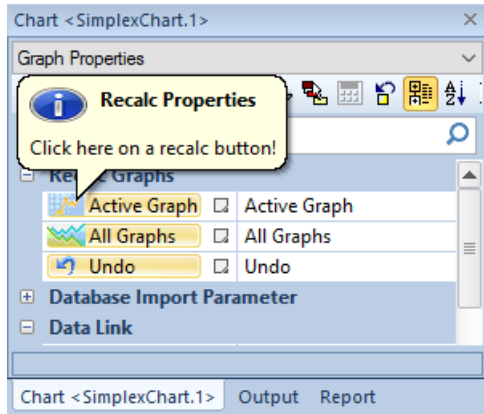
Deletes all the data points left and right from the chart. Be careful, because all are removed, after. No Undo possible!

→ Toolbar Icon 

13.5 Category Algorithm

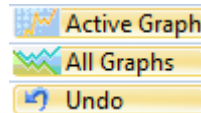
Here you can select an algorithm and then calculate it.

13.5.1 Recalculation with Properties




Call this menu item and the program will guide you to the **Graph Properties, Category Graphs**, as shown to the left.

→ Press the buttons...





...to re-calculate the algorithm(s), assigned to each graph.

 **Active Graph** Recalc the current (active) graph from the selected chart.

Hint

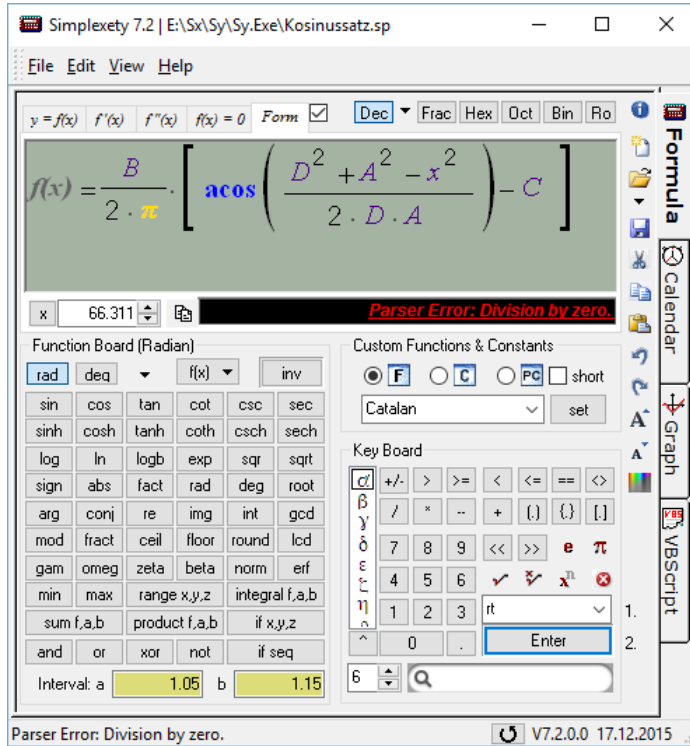
You can highlight a graph to see which one is active. Please have a look at chapter 13.4.13!

 **All Graphs** Recalc all graphs from the selected chart.

 **Undo** Explicitly Undo the last action. Extra button here, because (big) data is involved.

13.6 Category Interface

13.6.1 Enter Simplexety

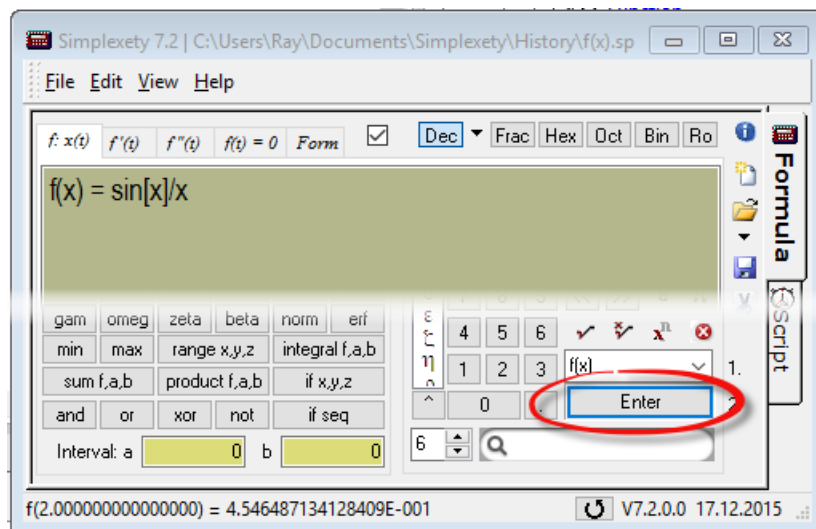


Simplexety is an external calculation program from the author of *SimplexNumerica*. It is used here for calculations with explicit formulas.

Return Nothing

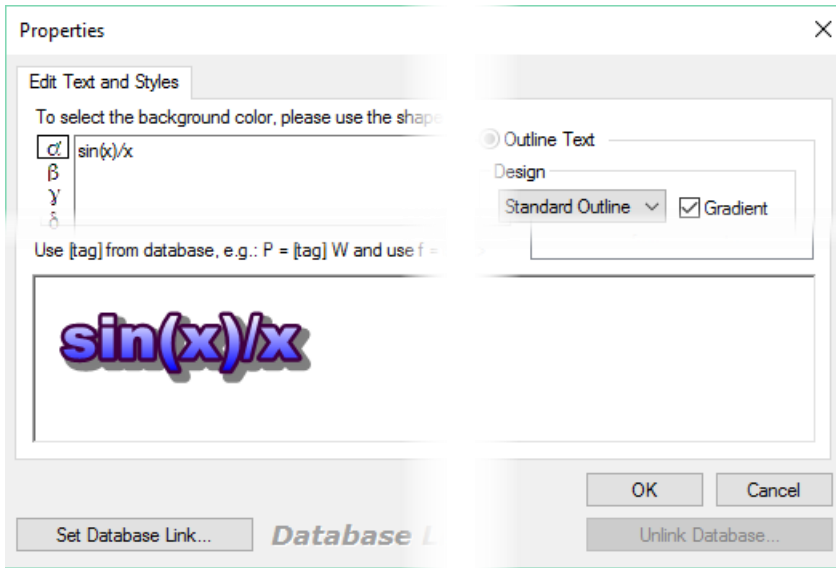
Use *Simplexety* only for your calculation purposes.

Return Formula String



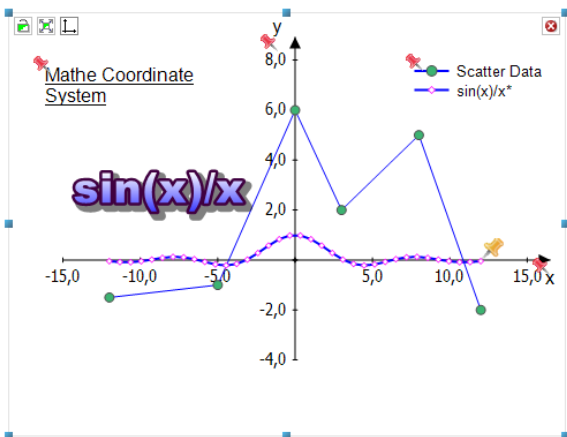
Step 1

Use *Simplexety* to edit the formula in the window below and press **Enter** to return it to *SimplexNumerica*.



Step 2

Edit the formula string and set up the text parameters to your satisfaction.



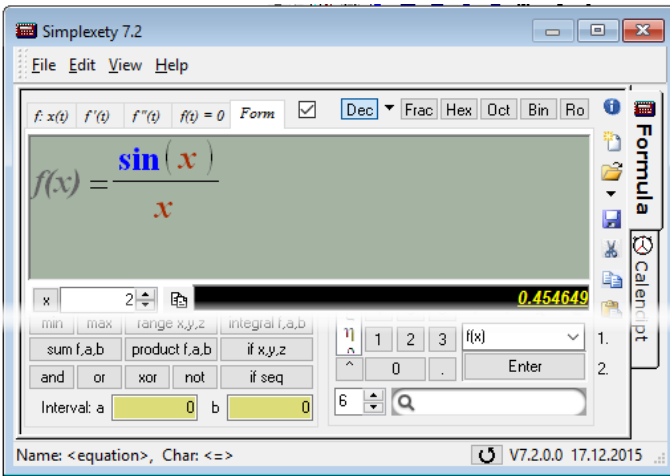
Step 3

Move the, now **Text Label**, around the chart.

Return Formula Form

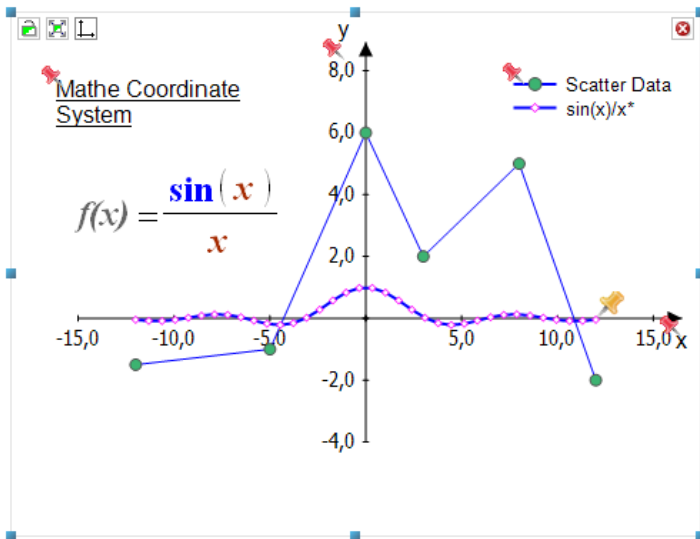
Step 1

Use **Simplexety** to edit the formula in the **Form Tab** and press **Enter** to return it to **SimplexNumerica**.



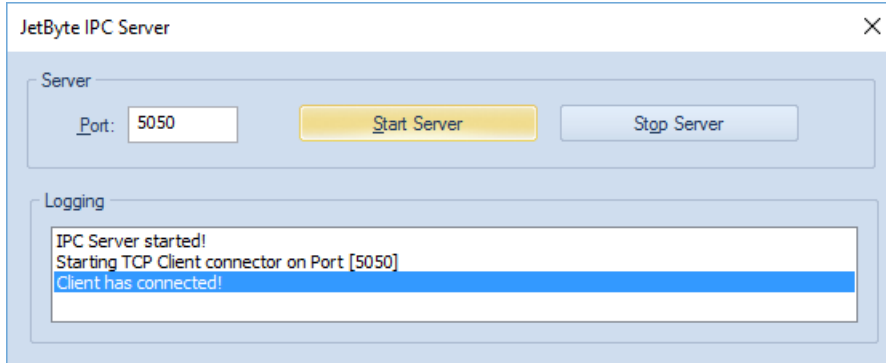
Step 2

Move the, now **Image**, around the chart.



13.6.2 Set IPC Connection

Use this menu item as the starting point for the **SimplexNumerica Inter Process Control (IPC)** Client/Server functionality.



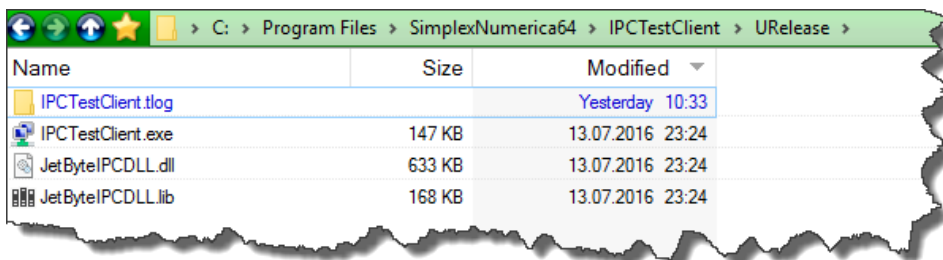
You can use **SimplexNumerica** remote-controlled with external applications (yes, more than one client app). Then **SimplexNumerica** acts as a **Server** and the external application(s) acts as a **Client**.

To test this, we have provided a **Client** demo application. First, call **Start Server** in the dialogbox.

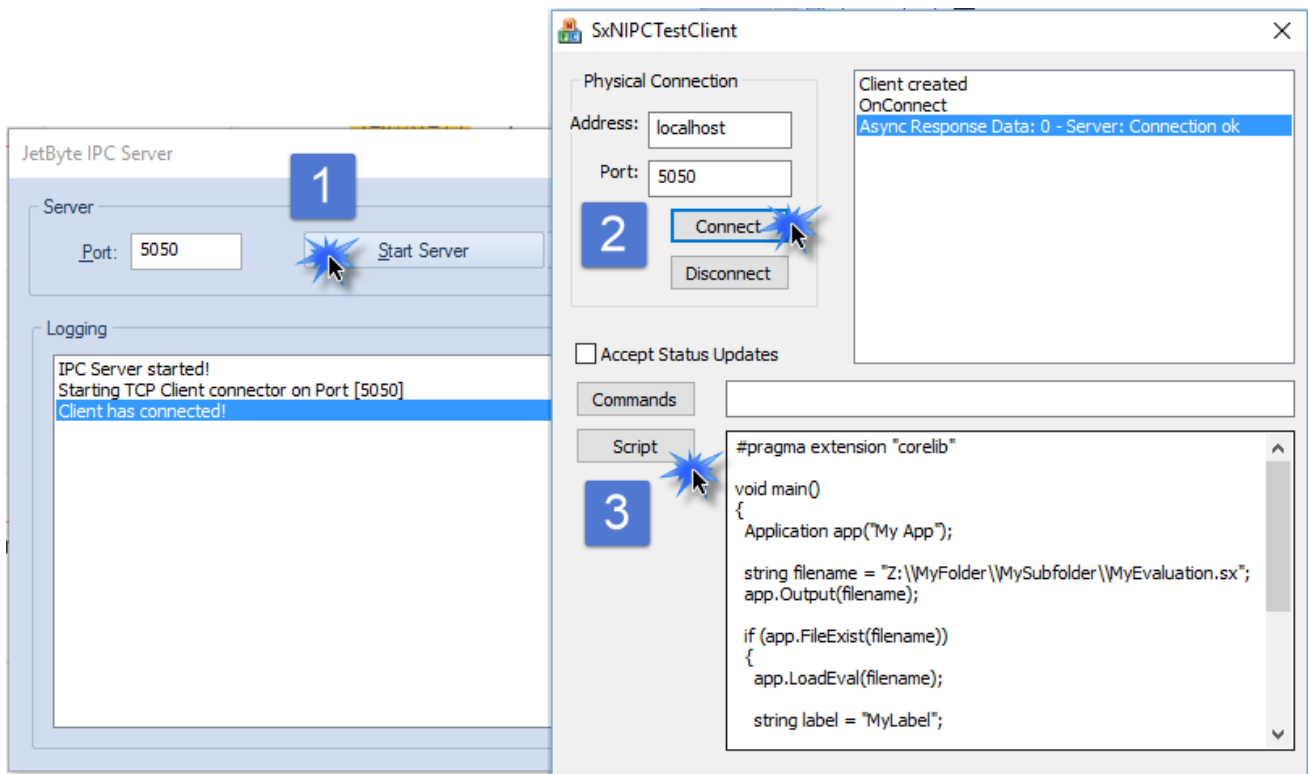
Please have a look in the installation folder:

```
< .. \ IPCTestClient >
```

You will find the files:



Please call the program **IPCTestClient.exe** (alternative the new program **SimplexIPC.exe**) and press the button **Connect** to connect to the IPC Server (= **SimplexNumerica**).



Here are the steps:

1. Start Server
2. Connect Client/Server
3. Send Command or Script

You can send a command or a script from the **Client** to **SimplexNumerica**. It will execute the command immediately and compile and run the script.

Address:

Use the address localhost, in the case that both programs are running on the same machine, else use IP address or the client machine name.

Port:

Let the default port 5050, or change it.

Quit:

After the transaction, make a disconnect with the button **Disconnect**.

Info

Please refer to separate manual "Programming SimplexNumerica with AngelScript" to get more details about the inbuilt scripting languages.

13.6.3 Push in Runtime Mode

In Runtime Mode are some selection methods not available, so that the program looks like a dashboard or SCADA application.

Maybe this functionality will be extended in future releases.

13.6.4 Database Storage and Requery

Here, you will find the following menu items for database requery:

- Requery Import Database
- Requery Chart Label
- Requery Chart Label by Date/Time
- Requery Text Label
- Requery Selected Text Label
- Requery Text Label by Date/Time
- Jump over inhibited Layers
- Properties

Hint

Please refer to the **Prime Example, Generate Reports** at chapter 0. Here at the tutorial the functions and procedures for **Database Requery** will be explained in detail.

13.6.5 Recalc

Here, you will find the following menu items:

- Recalc Chart Labels
- Recalc All Text Labels
- Recalc Selected Text Label(s)
- Set Recalc Tag Names equal Shape Names
- Set Recalc Tag Names equal Report Names
- Set Constants...
- Number of Iterations...
- Display Progress Bar
- Jump over inhibited Layers
- Enable Save Result to Database

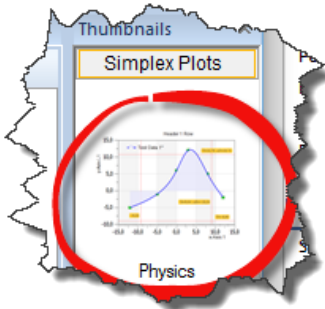
The same hint as before...

Please refer to the **Prime Example, Generate Reports** at chapter 0.

Recalc Chart Labels

Function: Recalc the tag of each **Chart Label**.

Before it gets to complicated in chapter 0, we can demonstrate that function here in a shorter way.

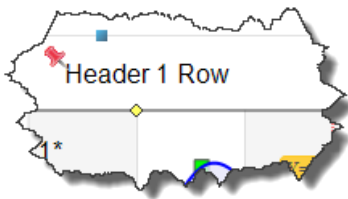


Let's add a chart from the thumbnail window and then choose a predefined **Chart Label** for this purpose here.

→ Please close all evaluations (pages).

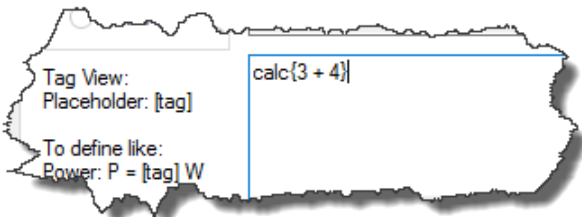
→ Please click on this symbol or move it to an empty page.

→ Please have in mind, that a **Chart Label** is always related to a chart, whereby a **Text Label** is independent and not fixed on that.



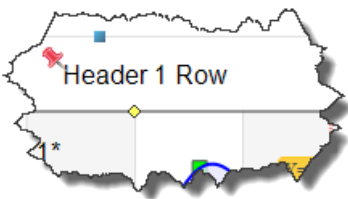
We will choose the **Header Chart Label** for the re-calculation of a formula.

→ Double-click on the red pin opens the **Labelling** dialogbox...

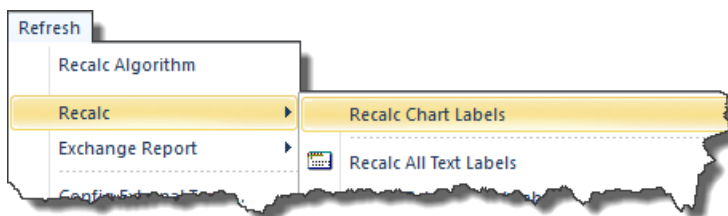


We want to put a simple formula into the tag edit field:

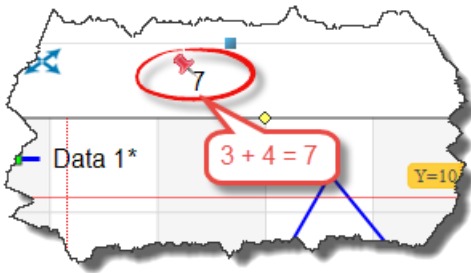
calc{ 3 + 4 }



You can't see any change at the Header text, yet.



Now, call the menu item...



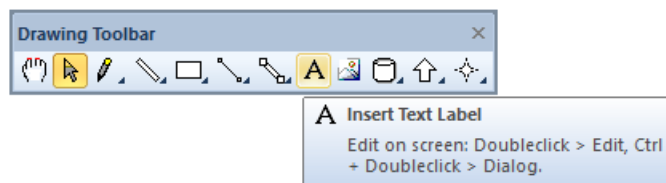
...and get the right result.

Recalc All Text Labels

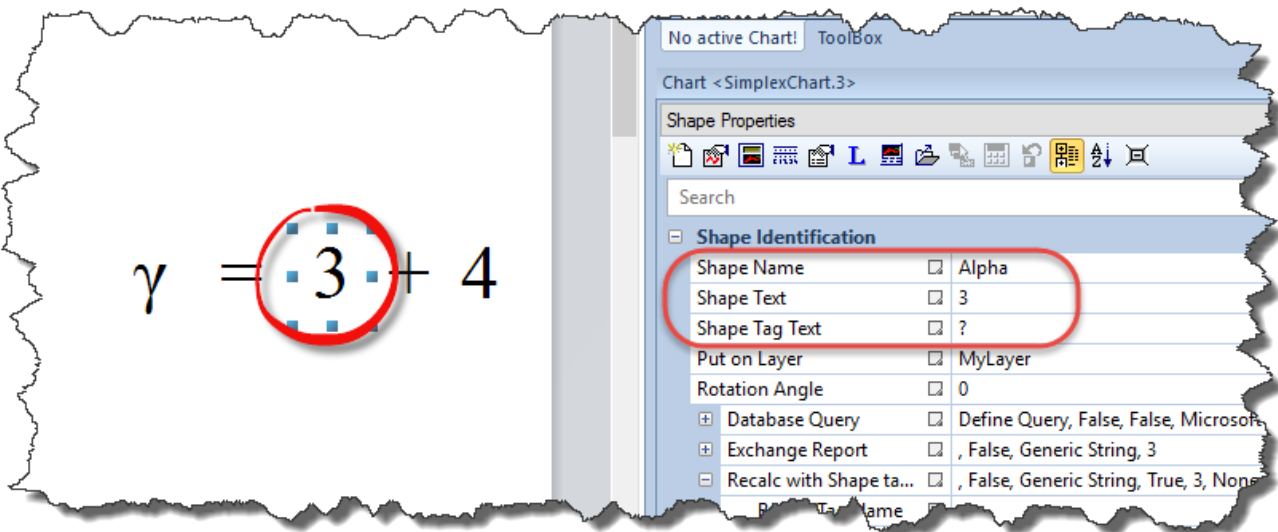
Function: Recalc all **Text Labels** (Doesn't matter whether selected or not).

Now, we want to do the same as before with a **Text Label**.

→ Let's add a **Text Label** from the **Drawing Toolbar**.



Call it **Alpha** (**Shape Name**) with the **Shape Text**: 3, **Shape Tag Text** will be ignored.

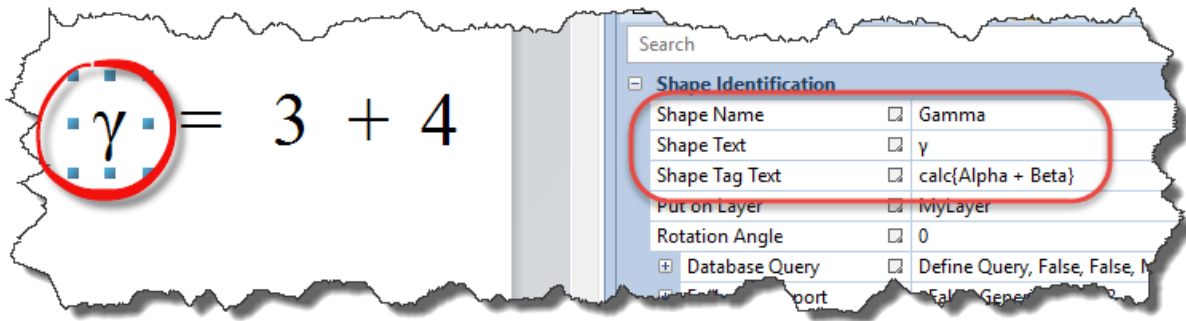


Add the next equal steps:

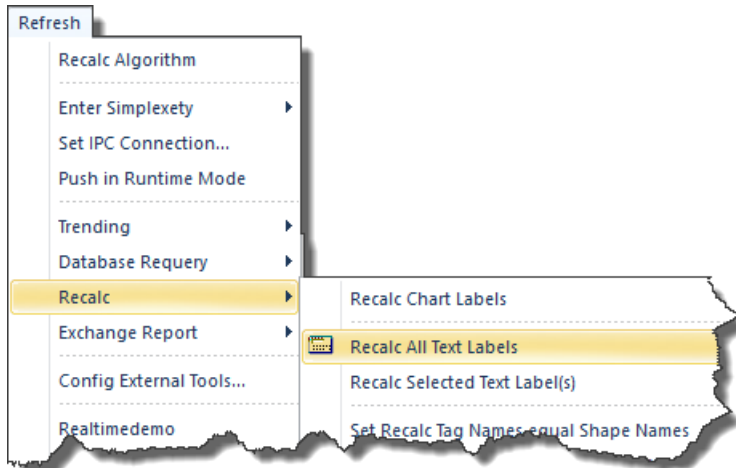
1. Add a **Text Label Beta** with the value 4
2. Add a **Text Label Plus**
3. Add a **Text Label =**
4. Finally add the **Text Label gamma**
5. Arrange it to the formula...

$$\gamma = 3 + 4$$

The Text Label **gamma** is different:



Now, call the menu item,
 Recalc All Text Labels or
 Recalc Selected Text Label(s)
 And you will get:



$$7 = 3 + 4$$

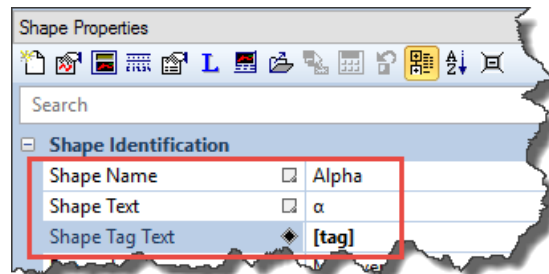
What is the sense behind?

Again: Please refer to the *Prime Example, Generate Reports* at chapter 0.

Now, we want to demonstrate the same with database support. Write this on screen...

$$\gamma = \alpha + \beta$$

...and the properties of alpha are now (beta are the same):



The **Shape Tag Text** [tag] is a placeholder for the expected database query entry.

The Shape **Gamma** is the same as above.

The next step is to use the **Database Query** menu item from chapter 13.6.4 to fill the placeholder [tag] with data from the database source.

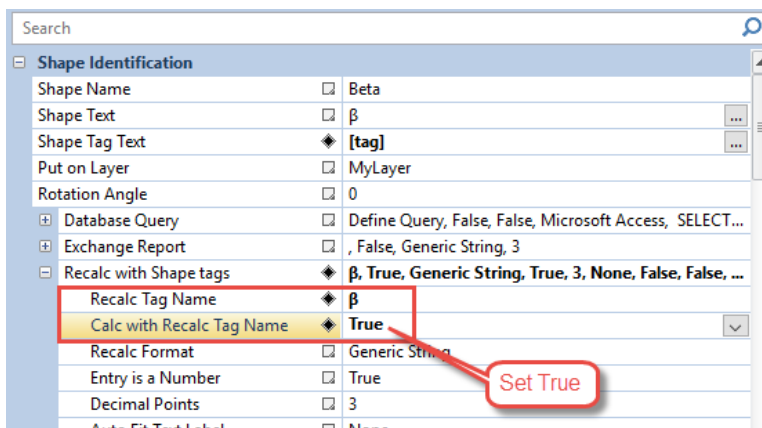
Then, you can call this menu item to recalc Gamma, again.

Recalc Selected Text Label(s)

Function: Recalc selected all **Text Labels**, only.

Please have a look to previous chapter.

Set Recalc Tag Names equal Shape Names



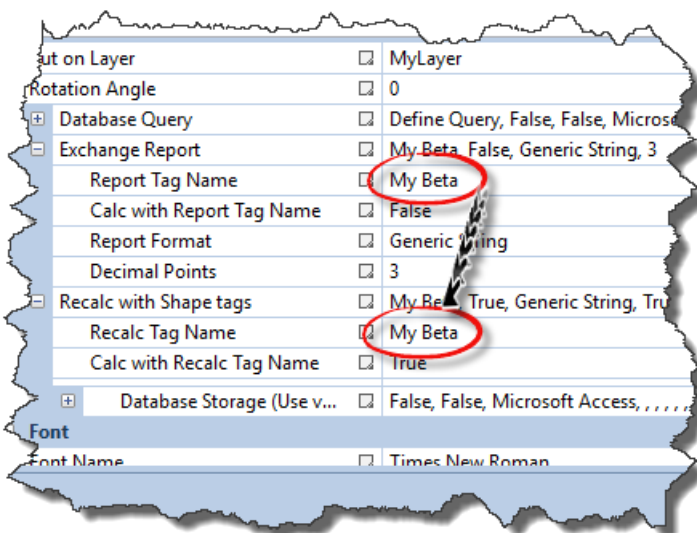
Instead to use the full Shape Name for (re-) calculation purposes, you can use a shorter form, if you like (e.g. **β** instead **Beta**).

The shorter form can be set in the properties in the rubric **Recalc Tag Name**.

Don't forget to set the flag below to **True**.

If you do not like a shorter or different name, but the same as the **Shape Name**, then use this menu item here to set all equal to this.

Set Recalc Tag Names equal Report Names



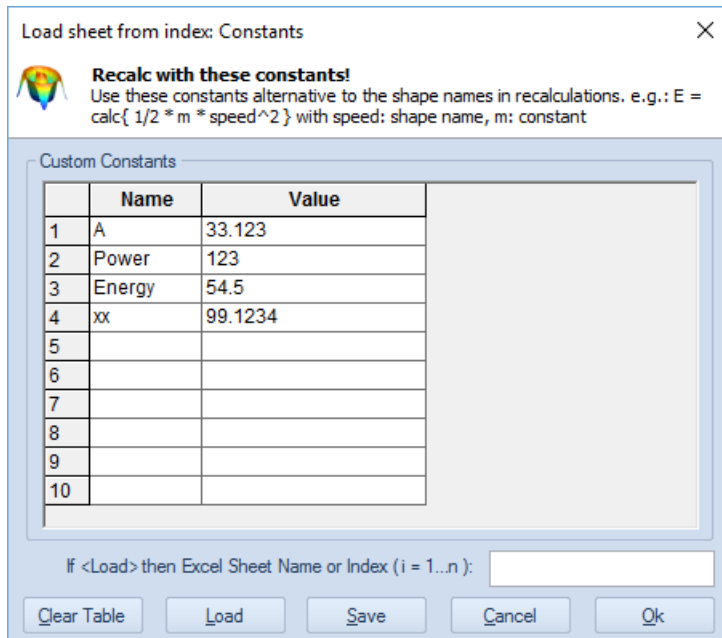
Use this menu item to automatically set for all shapes the **Report Tag Name** into the **Recalc Tag Name**.

Hint

If you have a lot of shapes on your page, then this menu item's help will be appreciated.

Set Constants...

Constants can be used in formulas for calculations. These constants here are special ones for the **Text Shapes**. Constants should be unique.

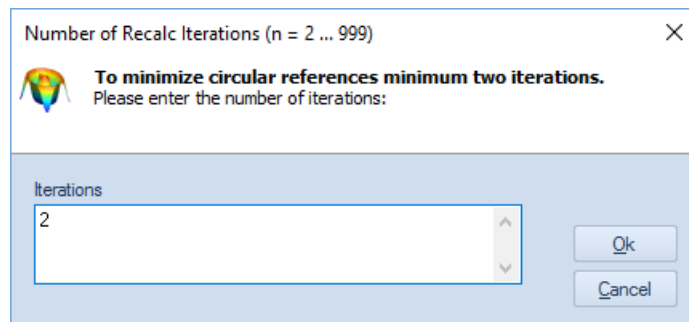


You can save the table to and load it from a Microsoft Excel© file.

If you load an Excel file, then put its **Sheet Name** or **Sheet Index** in the edit field below. If edit field is empty, then the program loads the first one.

Number of Iterations...

Here you can set the number of turnarounds. To avoid so called **circular references**, the program default makes minimum two passes (turnarounds) over all text shapes. But, you can change the number in the dialogbox:



→ You can set the value also to 1, but that is not recommended!

What does **circular references** mean. Here an example: Imagine you want to calculate again $\gamma = \alpha + \beta$, and this time α, β values were not queried from database, as above, but also calculated, like $\alpha = 5 * \text{sqrt}(2)$ and $\beta = 2 * \alpha$. You will have definitely a **circular reference** if β was calculated before α . From bad to worse, maybe γ was calculated before α and β .

→ To avoid this, use more than one pass, or

→ to avoid this, put the **Text Labels** in the right order; try to reproduce this:

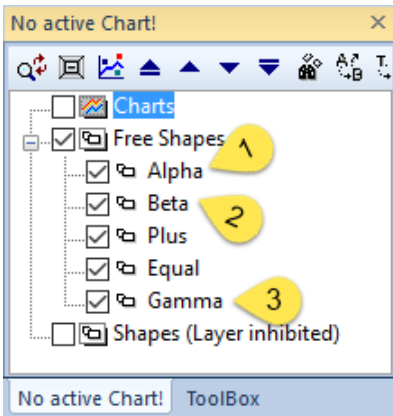
$$\gamma = \alpha + \beta$$

$$\alpha = 5 * \sqrt{2}$$

$$\beta = 2 * \alpha$$

The right order is: calc α , then β and finally γ .

To reflect this in *SimplexNumerica*, look at the **Chart Explorer**:



→ That is the right order.

The right order is:

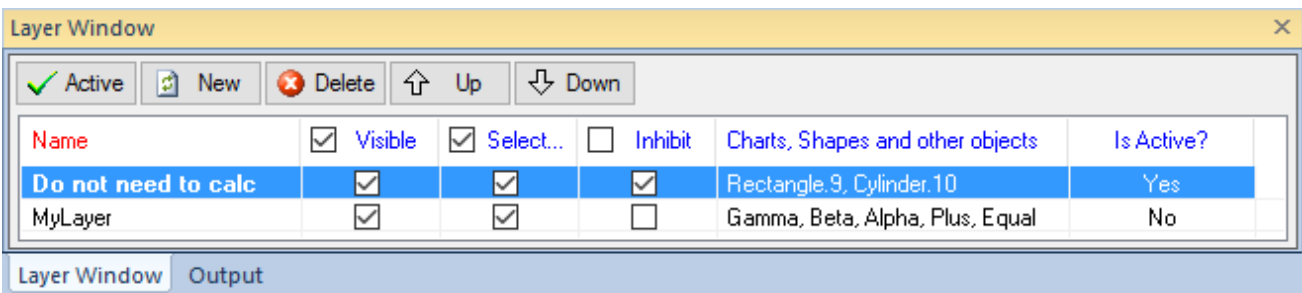
On top of the list always the first to calculate Text Shape, then the next and the last on bottom of the list.

Display Progress Bar

Displays a **Progress Bar** during calculation. In fact, that is a little bit slower...

Jump over inhibited Layers

If there are (text) shapes not necessary to recalc, then put them on an inhibited layer.



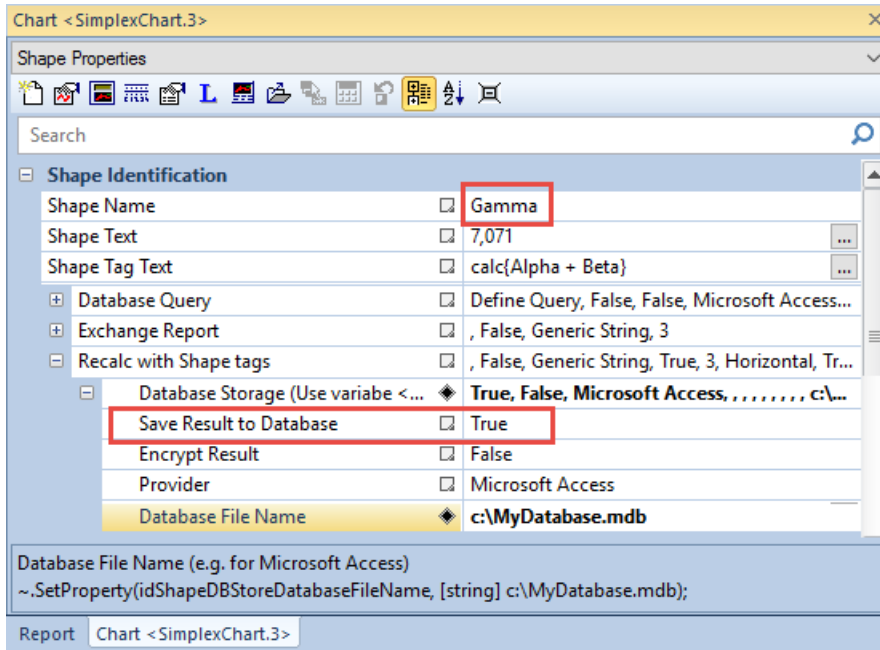
Gamma, Beta and Alpha are lying on a not inhibited layer.

Info

When you going to checkmark this menu item here, then inhibited layers will not be re-calculated.

Enable Save Result to Database

After the calculation, you can save the results to an external database (server). Here you can globally enable and disable this behavior. But you need to enable it for each individual text shape, too. That makes sense; imagine you want, during maintenance of the database, for a short time disable the storages...

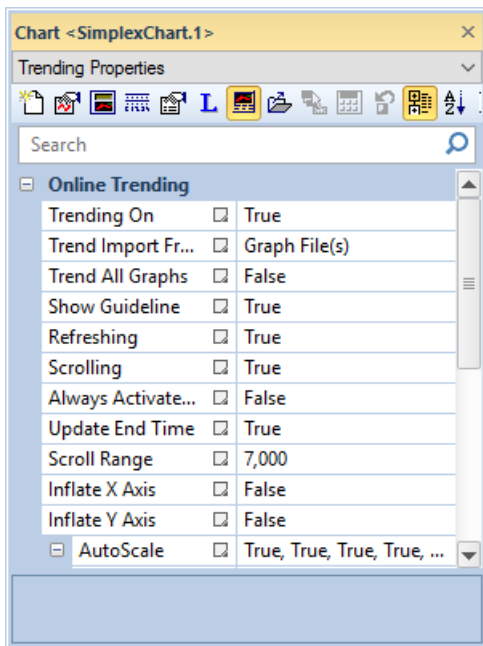


Use the properties to set each text shape differently.

13.7 Category Trending

This is the start menu for online trending of external data inside *SimplexNumerica*. Here, you will find the following menu items:

- Start Trending
- Stop Trending
- Refresh Trending
- Scrolling
- Properties

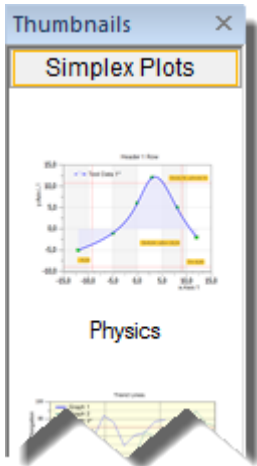


The menu item *Properties* will guide you to the Property Window.

Please refer to the *Trend Tutorial* at chapter 15. Here at the tutorial the properties and the procedures for trending will be explained in detail.

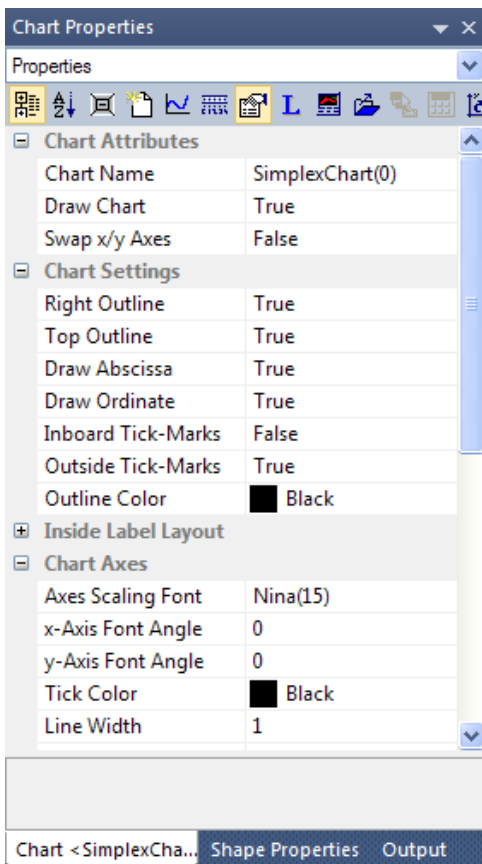
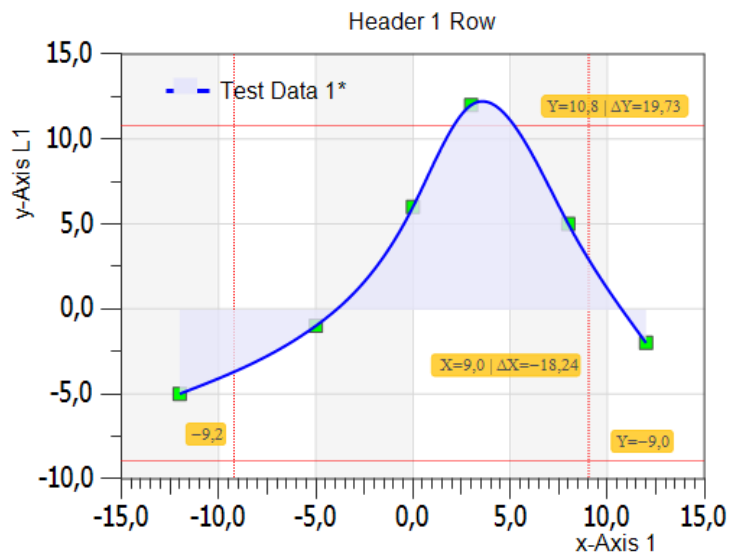
14 Simple Tutorial

Now we will show you the making of a simple chart, a *Physics* chart, typically named as Cartesian-coordinate-system.



First, for this tutorial, close all existing *Tab-views*.

Next, open the Thumbnail bar. Then click on the pictogram *Physics*. The result should be similar to this picture:






Use the property pages on the left to change the appearance of the chart. The icons on top of the property page can be used for sorting, expanding or different belongs to the entries.

Next, we will change the data of the chart...

Use the assigned grid view, called *GraphTable* for this purpose.

Each chart has its own data sheet. You can swap between

selected chart and sheet, very simple with the toolbar icon  or key <F3> or Pulldownmenu *GraphTable, Swap Graphics / Data Sheet*. If the chart is not selected, then select the chart and press <F3>.

Click on the toolbar icon  or the Pulldownmenu *File, New...* or press key <Ctrl + N> to clear the content of the sheet. You can also use the new icon .

Within the grid you can be in *Table Mode* or *View Mode*.

⇒ See chapter 10.2.2 for the differences of the table and view mode.

Legend	G0.x	G0.y
1	-12,000	3,000
2	0,000	-4,000
3	3,000	6,000
4	4,000	12,000
5	7,000	15,000
6	10,000	20,000

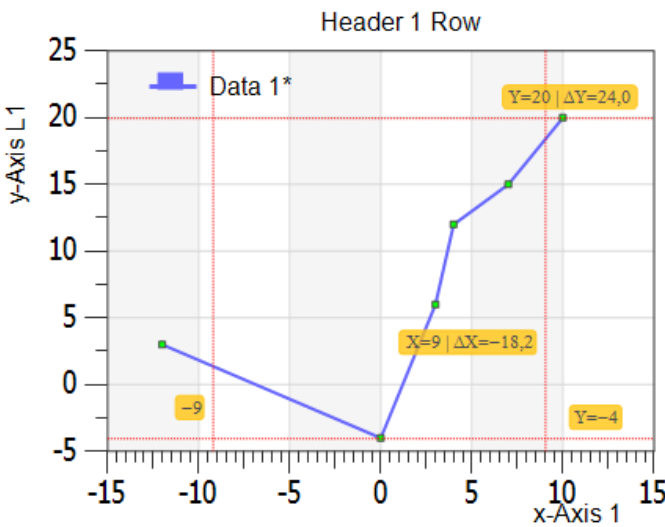
Remark:
SimplexNumerica has two modes for data editing inside the same data sheet, *Table Mode* (→Uncheck View checkbox) for comfortable editing like Excel and the *View Mode* (→Check View checkbox) for nearly real time display, but limited data input.

Tips:

→ If you need more rows, then deselect checkbox View and press return in the last row.

→ If you like to see the real format of your data, then click on View to change to the *View Mode*.

→ If you need less rows, then stay in View and put ~ in any row (Icon).



Put any data points into the sheet and press <F3> to swap back to the *Graphics View*.

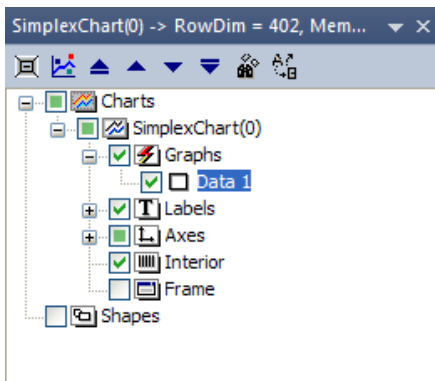
Next, make an Auto Scale to format the range of the axes more convenient.

Press the icon from the toolbar (or use the Pulldownmenu *Charting, Auto Scale Main Axes*).

If nothing happens, yet, then the program has already called the AutoScale, before.

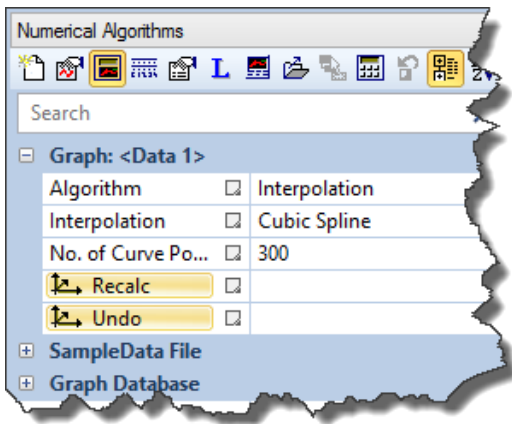
Next, go ahead and choose a curve fit algorithm to interpolate your data. To do that,

first click on the graph (marker or line) in the chart.



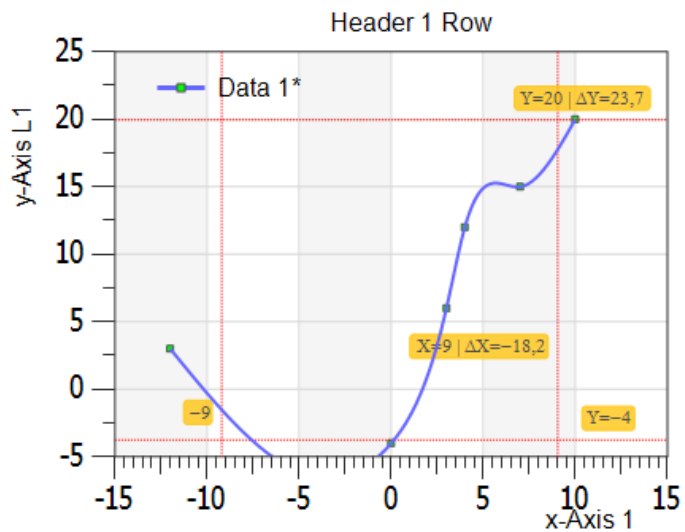
This will select the chart and the graph in the *Chart Explorer* (use key <F4> to show/hide).

Please select the Graph "Data 1" in the *Chart Explorer*.



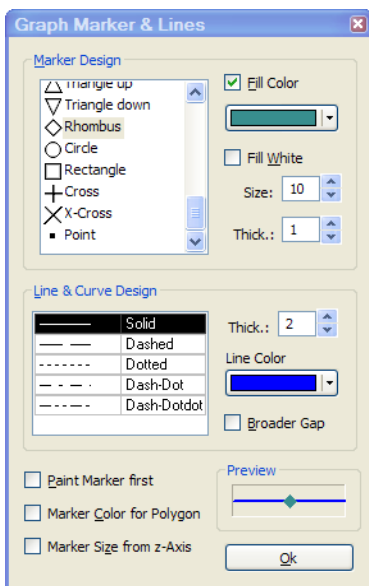
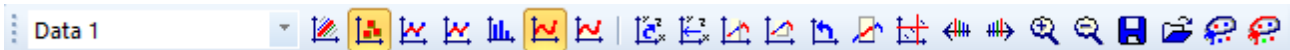
Parallel to the selection in **Chart Explorer**, the Entries in the **Chart Properties** have changed.


Please go ahead and select the entry *Numerical Algorithm* inside the *Chart Properties*. Please popup the Algorithm menu. In the popup menu, please choose *Interpolation* and then *Cubic Spline*. Put 300 Curve Points in the edit field. Then click on the button **Recalc**. The result will look like:

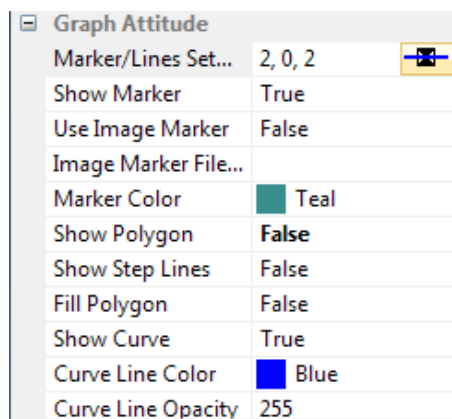


The program has removed the polygon line and put a curve instead with the marker sets.

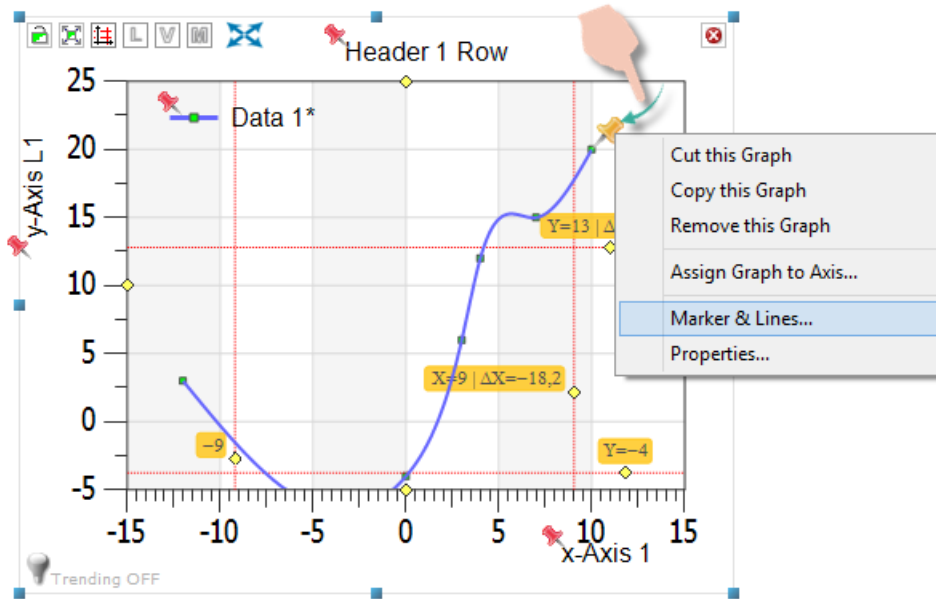
Please use the next toolbar to play around graphs:



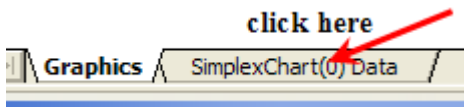
Use again the Chart Properties and click on button  right to Marker/Lines to change the marker type (or something else).




You can also click on the pin on the right side of the graph...




Next step: Put another x/y data column (Graph) into the chart. Press <F3> to show the sheet. If there is more than one chart in the view, then you have to select the right chart before you call the sheet. Of course, you can click on the tab on the bottom of the window to change to the right data sheet.



We do not use the z-axis. Click the toolbar icon  to hide the z column.

	G0.x	G0.y
1	-12,000	3,000
2	0,000	-4,000
3	3,000	6,000
4	4,000	12,000
5	7,000	15,000
6	10,000	20,000

As you can see the checkbox, the checkbox left to **View** is checked. That means the GraphTable editor has swapped to the fast View Mode. In *View Mode*, the program shows only the visible parts of the internal arrays in the sheet. The *Table Mode* (uncheck View) holds always a copy of all array entries. *View Mode* is much faster than *Table Mode* but *Table Mode* is more comfortable to handle for the user.

To put a new column in, you can click on the icon .

SimplexNumerica always appends two x/y columns (or three x/y/z columns) because it works with arrays, internally. That is also much easier for the user because there is no need to select columns to see the graphical result.

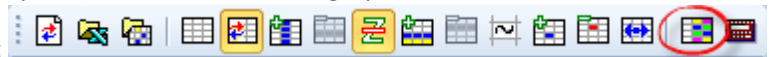
<input type="checkbox"/> SM	Data 1		Graph 2	
Legend	G0.x	G0.y	G1.x	G1.y
1	1,000	2,000	1,000	2,000
2	3,000	25,000	3,000	25,000
3	5,000	33,000	5,000	33,000
4	12,000	44,000	12,000	44,000
5	15,000	50,000	15,000	50,000

click here to select a column

In fact, the program makes a copy of the active graph.

⇒ *Tip: Do not forget to save your evaluation from time to time.*

Next, click on G1.y to select a y-column in Graph 2 (Data 1 was our first graph). Let us fill the column with a random sample. Use this red-bordered icon:



Data Fill ✖

min =

max =

n =

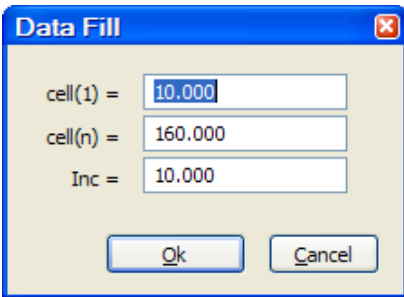
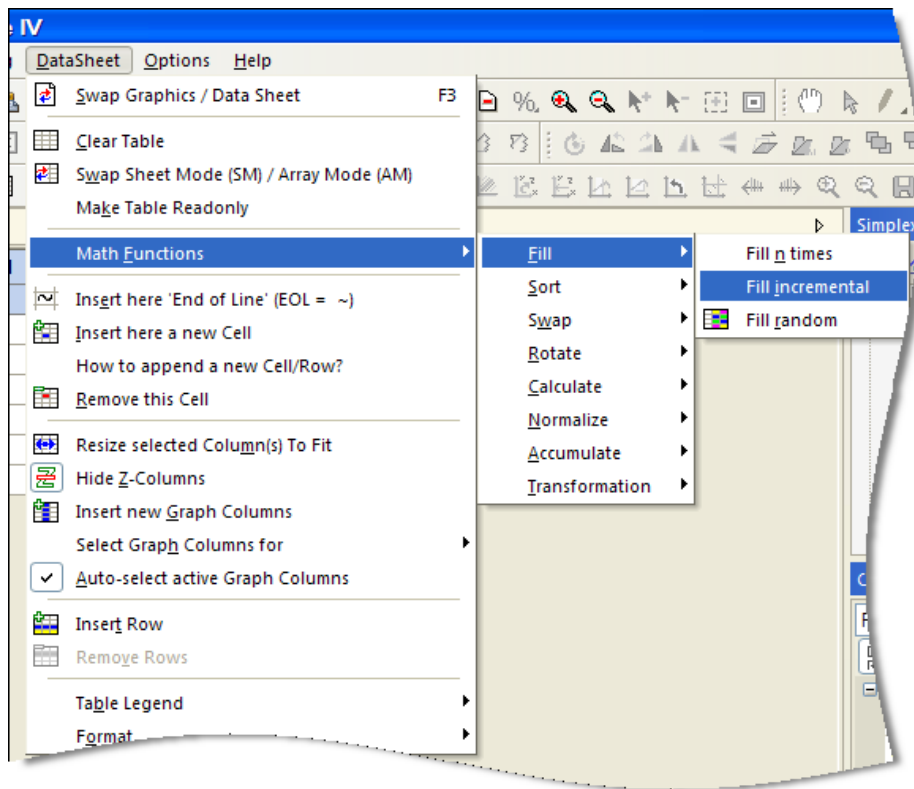
<input type="checkbox"/> SM	Data 1		Graph 2	
Legend	G0.x	G0.y	G1.x	G1.y
1	1,000	2,000	1,000	35,000
2	3,000	25,000	3,000	58,000
3	5,000	33,000	5,000	26,000
4	12,000	44,000	12,000	42,000
5	15,000	50,000	15,000	47,000
6	~	~	0,000	18,000

As you can see the G1.y column has one cell more than in the first graph. Parallel the x-axis (G1.x) has gotten also one cell more (with zero initialized). The cells of *Data 1* have tilde signs.

➔ Tildes are guessing NO DATA AVAILABLE.

You can set tildes manually with the toolbar icon .

Next step, we could change the G1.x column. For instance, you can change the 0.000 in 20 or something else - but let us fill again a column automatically. Please select the G1.x column and call *Fill incremental* from the Pulldownmenu (show next picture).



Please fill exactly the same values into the dialog box.

<input type="checkbox"/> SM	Data 1		Graph 2	
Legend	G0.x	G0.y	G1.x	G1.y
1	1,000	2,000	10,000	1,000
2	3,000	25,000	20,000	3,000
3	5,000	33,000	30,000	5,000
4	12,000	44,000	40,000	12,000
5	15,000	50,000	50,000	15,000
6	~	~	60,000	18,000
7	~	~	70,000	0,000
8	~	~	80,000	0,000
9	~	~	90,000	0,000
10	~	~	100,000	0,000
11	~	~	110,000	0,000
12	~	~	120,000	0,000
13	~	~	130,000	0,000
14	~	~	140,000	0,000
15	~	~	150,000	0,000
16	~	~	160,000	0,000

You will see the next picture.


Do this:

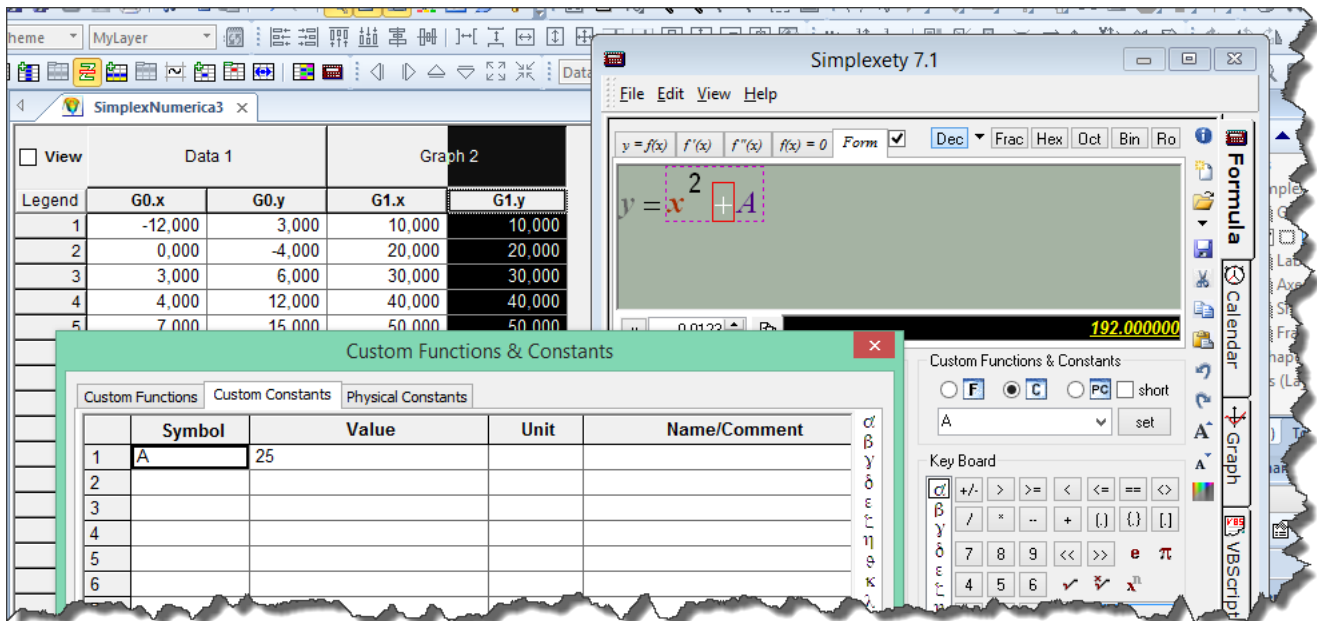
Please let the column selected and Copy (Ctrl + C), click (with left mouse button) on G1.y (will selected) and Paste (Ctrl + V) it to the right next column (G1.y).

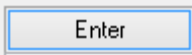
Legend	Data 1		Graph 2	
	G0.x	G0.y	G1.x	G1.y
1	1,000	2,000	10,000	10,000
2	3,000	25,000	20,000	20,000
3	5,000	33,000	30,000	30,000
4	12,000	44,000	40,000	40,000
5	15,000	50,000	50,000	50,000
6	~	~	60,000	60,000
7	~	~	70,000	70,000
8	~	~	80,000	80,000
9	~	~	90,000	90,000
10	~	~	100,000	100,000
11	~	~	110,000	110,000
12	~	~	120,000	120,000
13	~	~	130,000	130,000
14	~	~	140,000	140,000
15	~	~	150,000	150,000
16	~	~	160,000	160,000

We have copy & paste the x-axis column to the y-axis column.

Next step, we want to calculate this column with the App *Simplexety*.

Please let the column selected and click on the toolbar icon  to call the tool. The first call takes a little bit longer but the next time it appears immediately.



Make a simple formula like $y = x^2 + A$ whereby $A = 25$ and press button 

Hint:

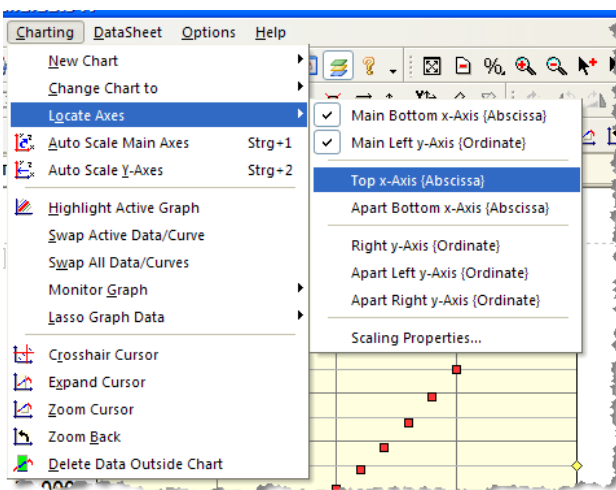
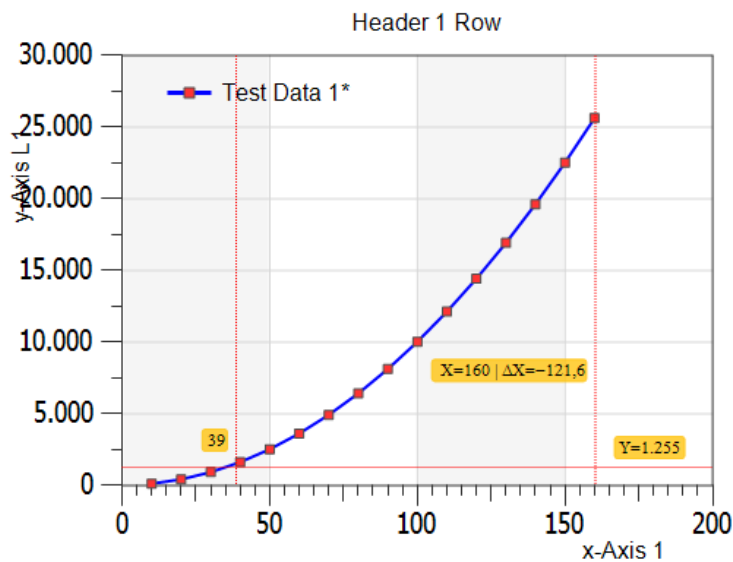
For filling columns, the information " y = " will be ignored.

→ x is the important variable. It stands for each cell in the selected column(s).

Legend	Data 1		Graph 2	
	G0.x	G0.y	G1.x	G1.y
1	1,000	2,000	10,000	125,000
2	3,000	25,000	20,000	425,000
3	5,000	33,000	30,000	925,000
4	12,000	44,000	40,000	1.625,000
5	15,000	50,000	50,000	2.525,000
6	~	~	60,000	3.625,000
7	~	~	70,000	4.925,000
8	~	~	80,000	6.425,000
9	~	~	90,000	8.125,000
10	~	~	100,000	10.025,000
11	~	~	110,000	12.125,000
12	~	~	120,000	14.425,000
13	~	~	130,000	16.925,000
14	~	~	140,000	19.625,000
15	~	~	150,000	22.525,000
16	~	~	160,000	25.625,000

You will see here the German numbering format.

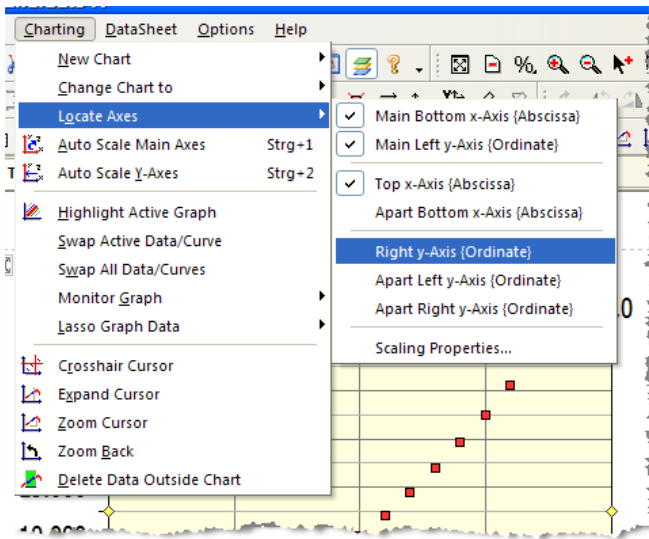
Next, press <F3> to go back to the chart. Then you should see something like that:



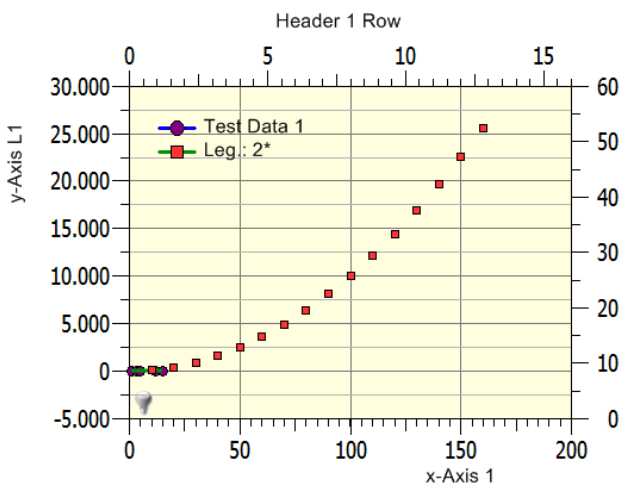
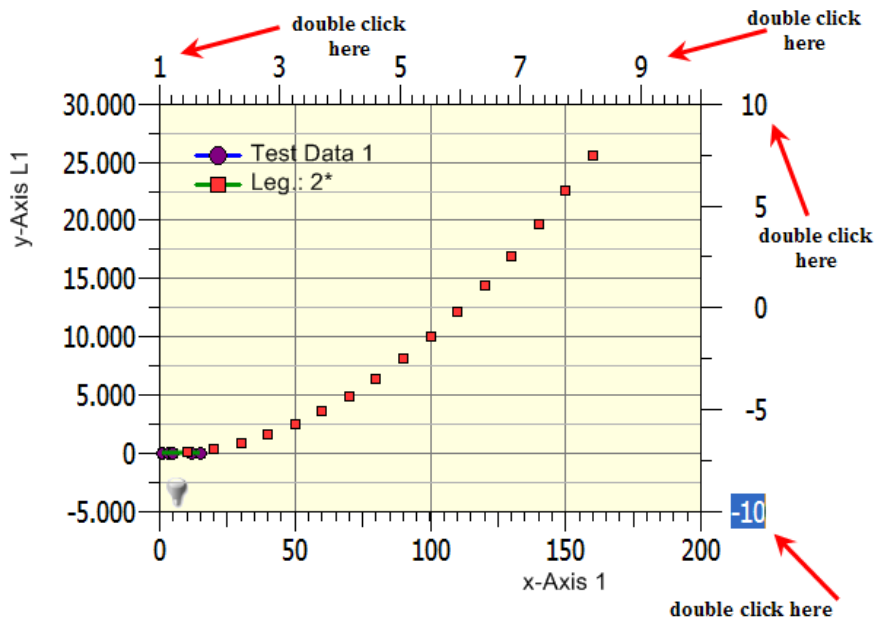
Unfortunately, we could not distinguish between the two graphs because the data of *Graph 1* is *versus Data 1* too huge. Second axes can help here.

To do so, please call the menu in the left picture to set a new x-axis on top of the chart...

... and a new right y-axis



The result should look almost as follows after a couple of reformatting:

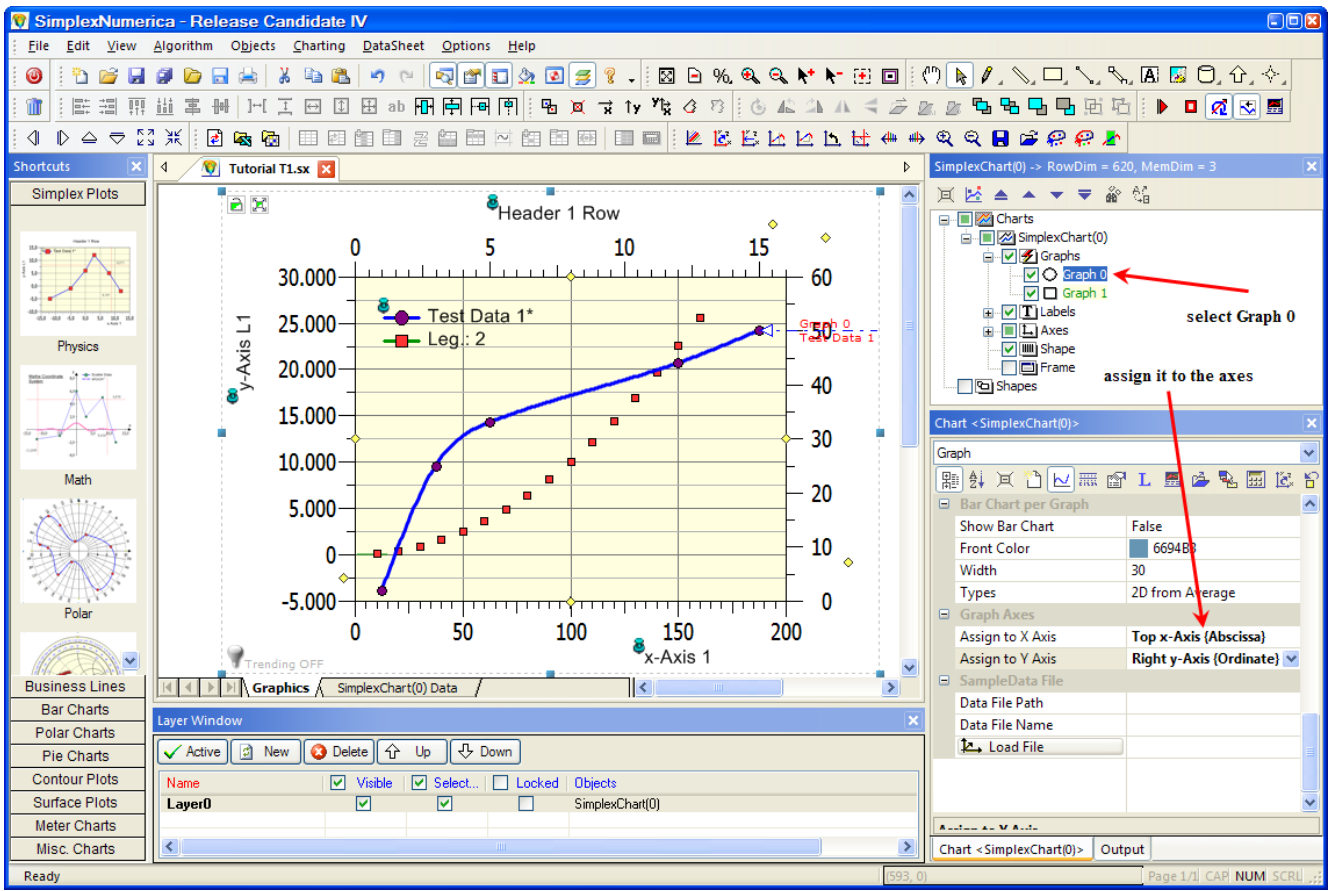


We will put the graph *Data 1* to the upper and right axes. Please change the interval of these axes. Double click on the min/max axis scaling of each axis. Change the values: x from 0-16 and y from 0-60.

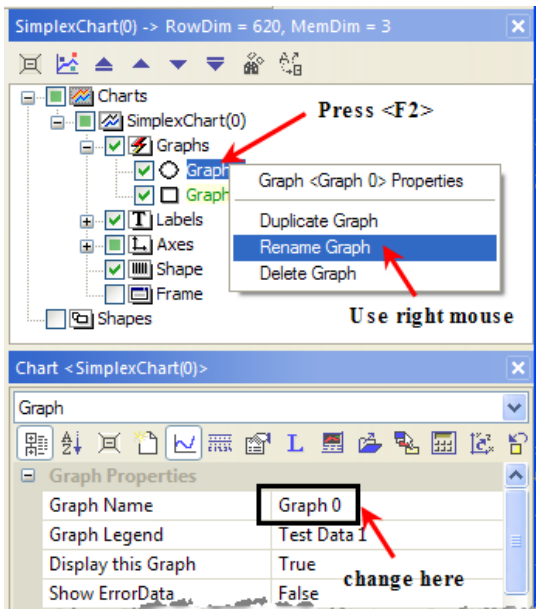
It should look like this picture now.

Now, we have to assign the graph *Data 1* to the new axes. Let us do it in the properties.

Simple Tutorial

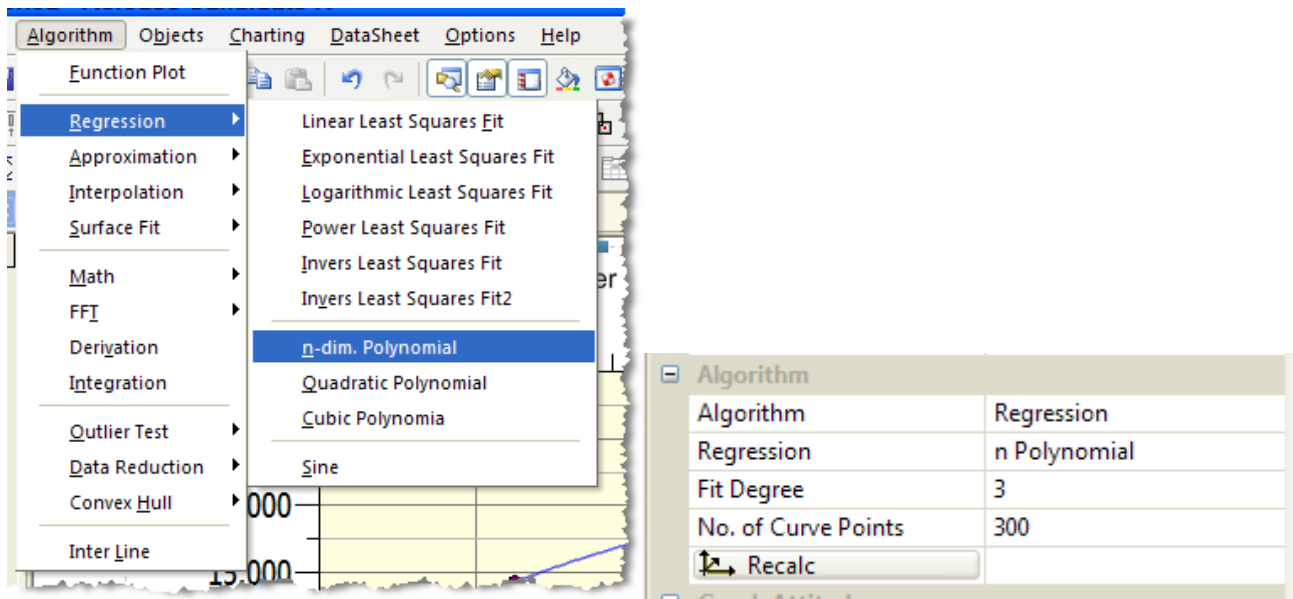


⇒ If you have here another graph names, then change the name to Graph 0 (instead of Data 1) and Graph 1



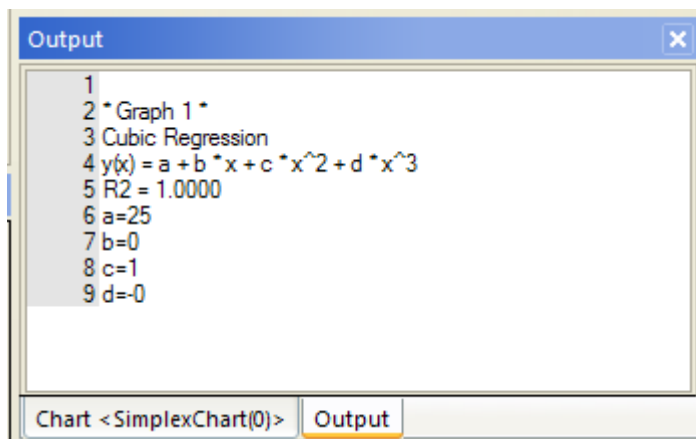
You can change the graph names here, too.

Right now, Graph 1 has only marker but no curve. Make a regression for Graph 1 either in the same way as before with Graph 0 or direct from the Pulldownmenu Algorithm.



In the properties, change the *Fit Degree* and *Number of Curve Points* and then press *Recalc* to calculate the curve.

The output of the fit is shown in the Output Window next to the properties.



Would you like to calculate all graphs in the chart? → Then hold *Ctrl* key and press *Recalc*.

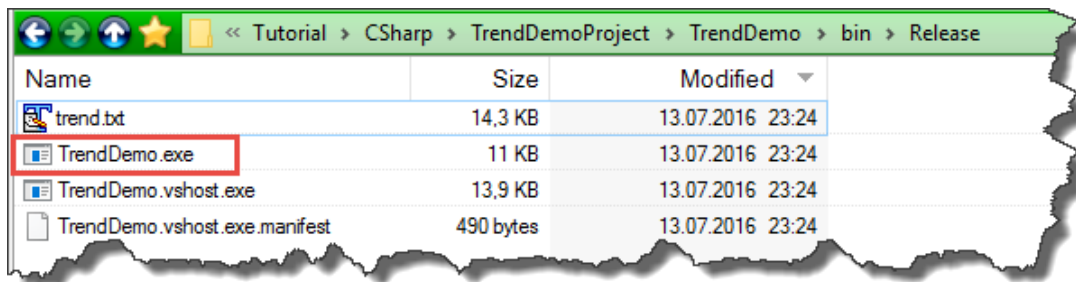
15 Trend Tutorial

The Online Trending System is the way to trend external data inside *SimplexNumerica*. Trending is for updating data as far as they have changed on a medium (for example a *.csv file on disk).

To start-up, we will use a file interface, because it is the simplest way to exchange data between different applications. Furthermore, if you are going to exchange data with the help of files you will have a persistent storage without any data losses when one of the programs is crashing. The data can also be stored persistently into the file. When the program comes back, then it can refresh the lost data immediately. This interface is normally fast enough, simple and very robust.

First, we need a source that will change data in a trend file. The author has made a small *CSharp* program that generates a data file and updates it with arbitrary data, continuously. You can find the *CSharp* project (incl. source code) in the *SimplexNumerica* tutorial folder, eg. in

```
[your_install_folder]\SimplexNumerica\Tutorial\CSharp\TrendDemoProject
```



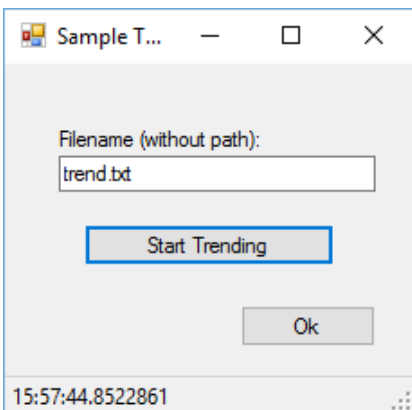
There is the solution file <TrendDemo.sln>.

For instance, the program can be in the folder (here for 64-Bit version)

```
C:\Program Files\SimplexNumerica64\Tutorial\CSharp\TrendDemoProject\TrendDemo\bin\Release
```



The name of the program is *TrendDemo.exe*.

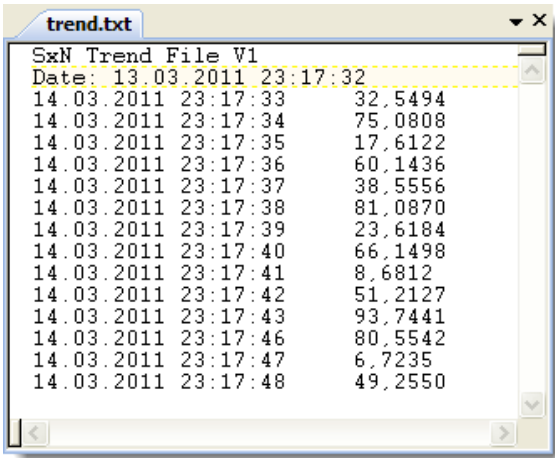


Info
You can find this program also in the folder:
C:\Program Files\SimplexNumerica64\Tutorial\Trending

Start this program and then put a filename in the edit field (without the path).

Then press the button *Start Trending*.

The content of the file will change each second. Next view is an example of some produced data.



To find the file, look e.g. here:

...\Tutorial\Trending\trend.txt

Info
The trend file is there where the program was started!

The file has two columns, date/time and a real value.

In the following chapters, we want to explain the reading functionality based on the next methods.

15.1 Method 1: Load a Sample Trend Evaluation

Please load the sample evaluation

...\Tutorial\Samples\Trending1.sx

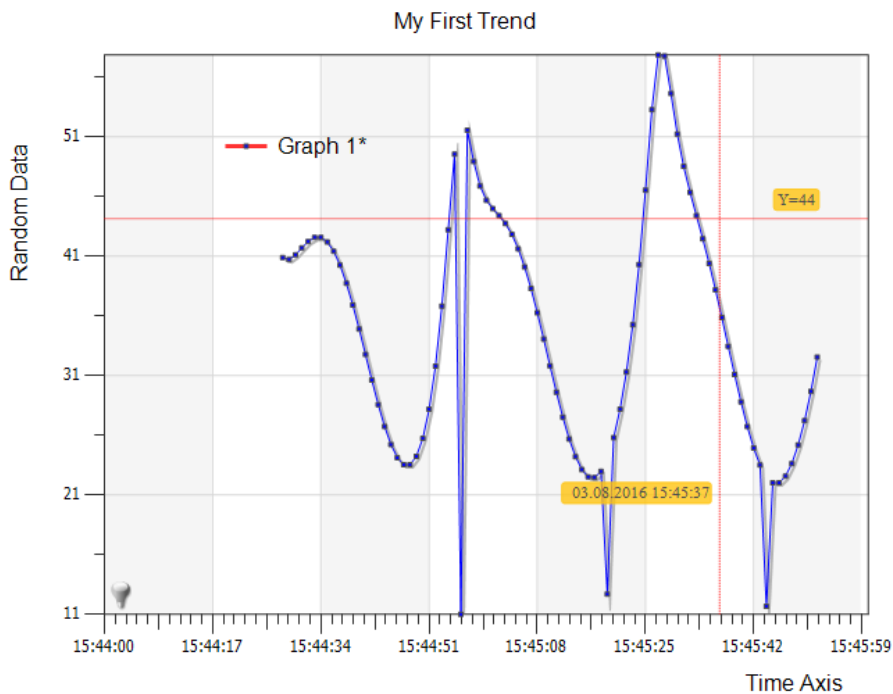
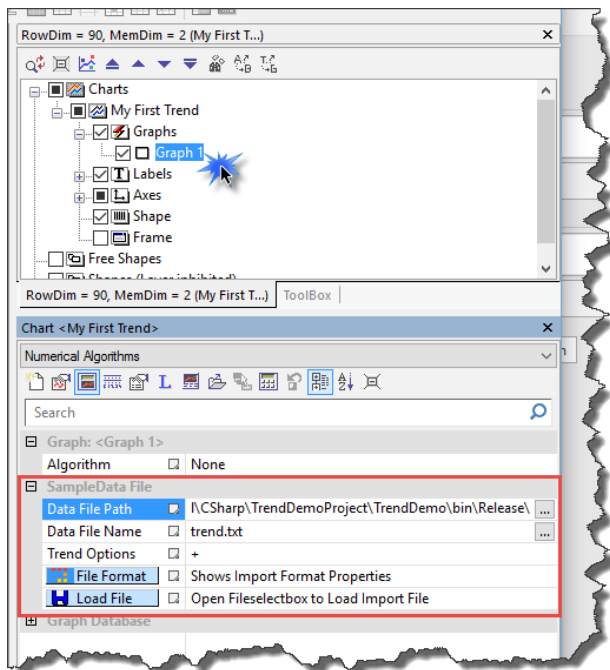
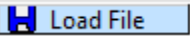


Fig.15-1: Trending a *.csv file

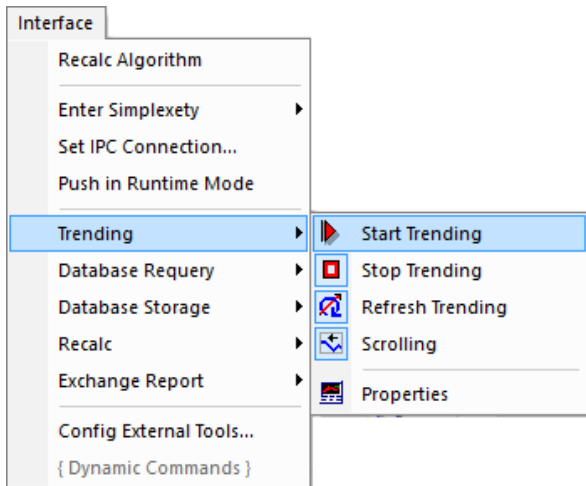
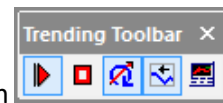


→ Now, click in the *Chart Explorer* on **Graph 1** and beneath on Numerical Algorithms Property icon. There you will find the **SampleData File** entries in the properties (see below).

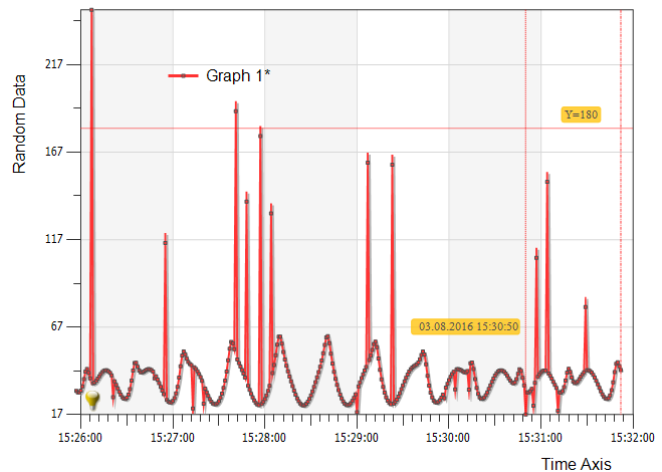
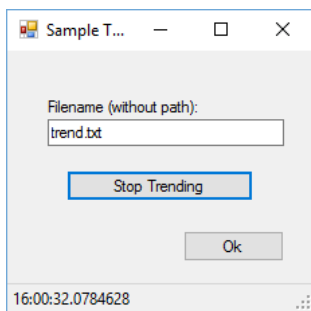
→ Please change the *Data File Name* entry to your trend file place.

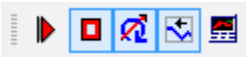
→ You can press the button  to test the right path.

→ Now, press the icon  **Start Trending**.



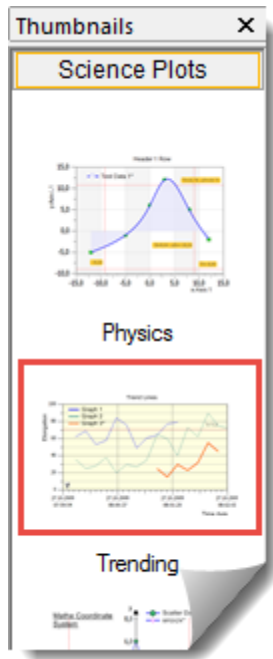
...or use the Pulldownmenu *Interface*



→ Please stop the trending here. Use the toolbar icon **Stop Trending** .

→ Please stop also the CSharp trending program (click Stop Trending)!

15.2 Method 2: Use Data Import Dialog



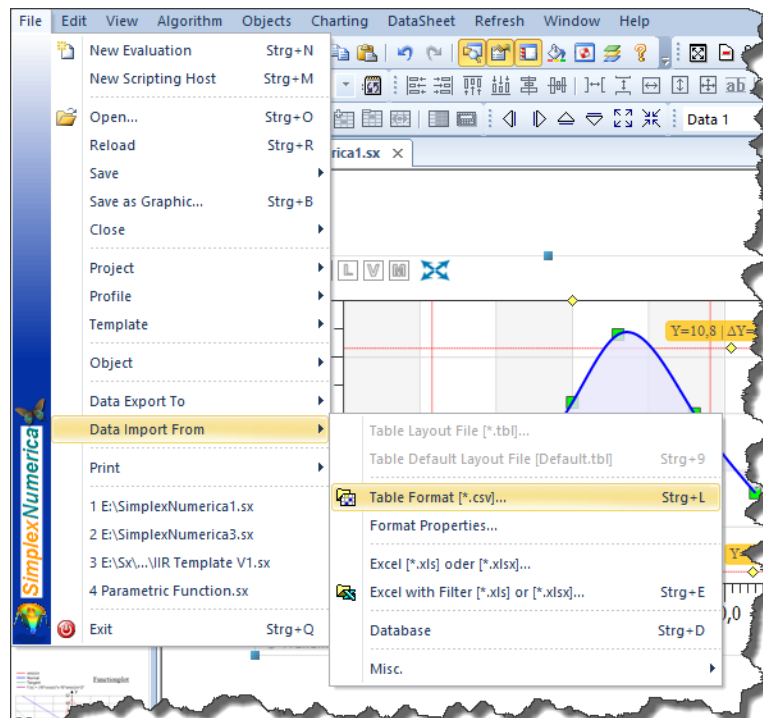
Next, we will show how this data structure can be imported via the *Data Import* menu.

Because we want to keep it simply:

→ Make an empty evaluation (Use Ctrl + N).

→ Click on the pictogram *Trending* on the *Thumbnail bar*.

Now, we want to import the produced data (trend.txt). Use the data import dialog from the Pulldownmenu *File, Data Import From, Table Format (*.csv)*.

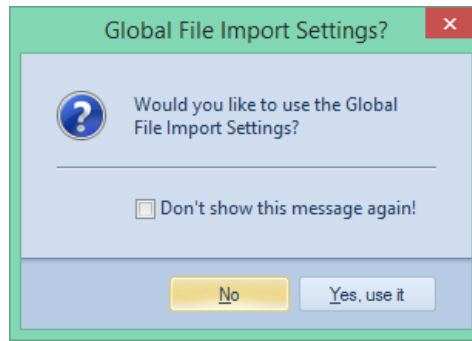


You can also use the icon  from the Array/Table Editor toolbar.

Open the right file, e.g.

`..\Tutorial\CSharp\TrendDemoProject\TrendDemo\bin\Release\trend.txt`

in the upcoming Fileselectbox. Please say **Yes** to the next dialogbox:



Hint:

SimplexNumerica either stores the data-import-settings in the registry - at the end of the program session, or if you like dedicated to each chart.

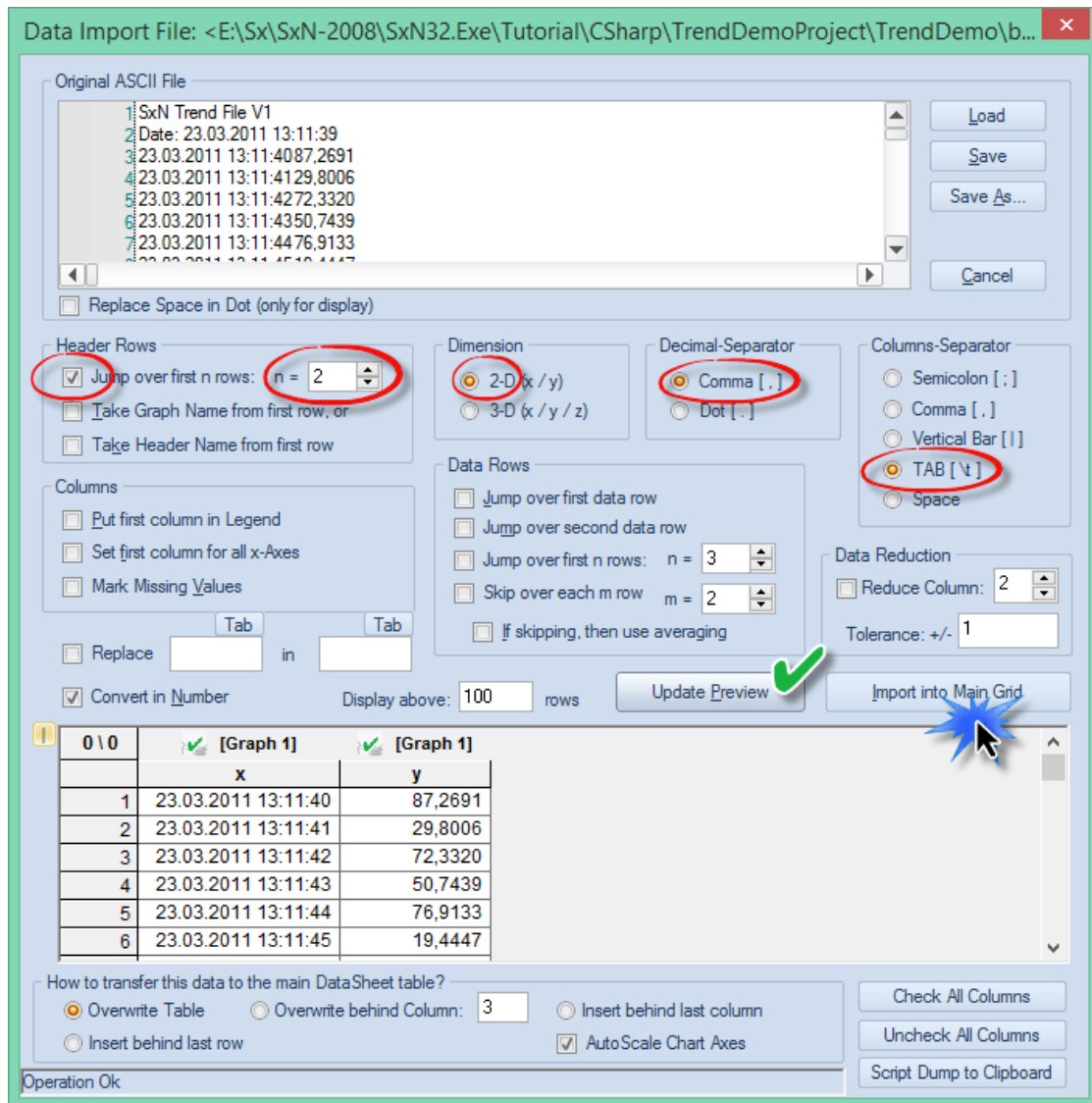
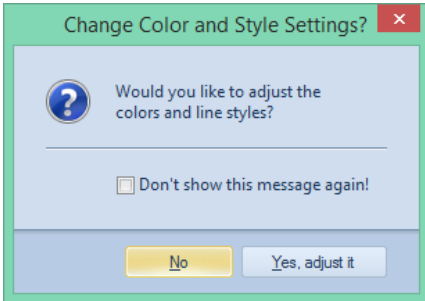


Fig.15-2: Settings for Data Import Dialog

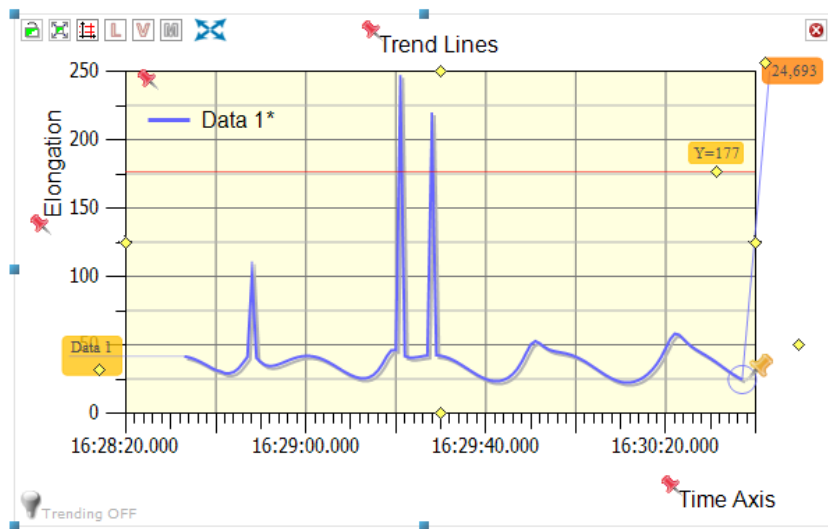
Trend Tutorial

Jump over the first two lines and press *Update Preview* to see a preview in the dialog data sheet. Then press *Import into Main Grid* to leave the dialog and see the result in the main *GraphTable*. Then press <F3> to see the graphics result.

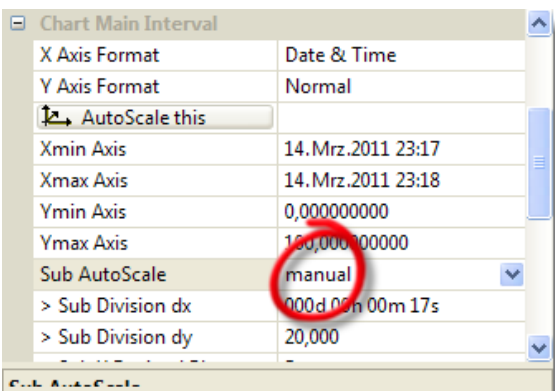


If you like to automatically adjust the graph colors and line styles, then say “Yes” to this messagebox.

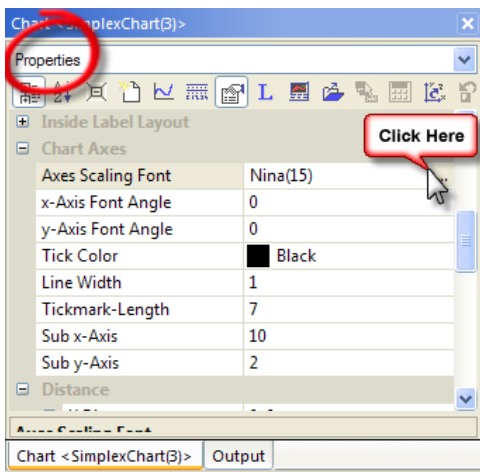
The result will similar look like this:



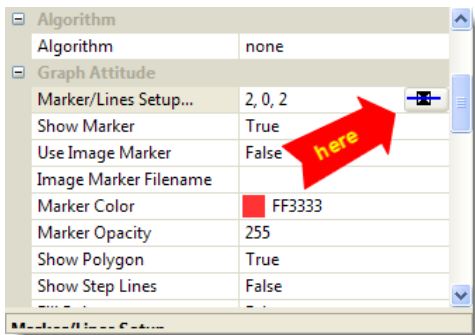
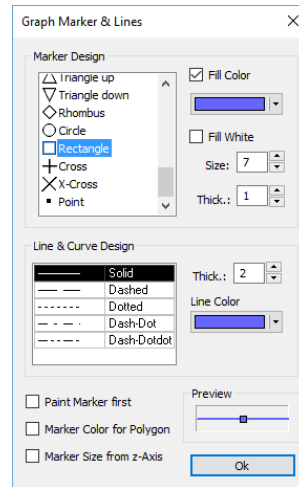
If you like, then you can change the axes scaling manually:



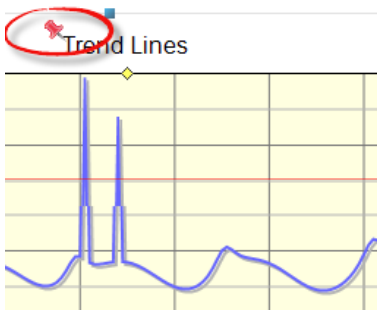
To do that, please set the property *Sub AutoScale* on “*manual*” instead of “*Automatic*”.



If the scaling text is also to height, then change it also in the properties.

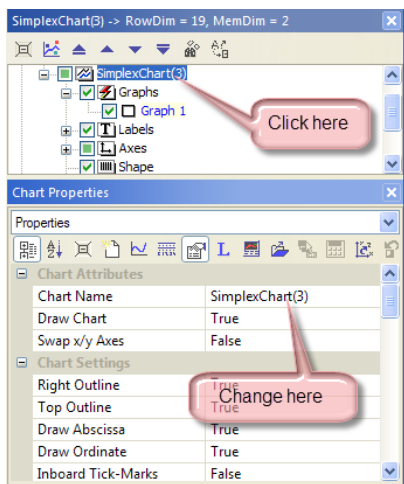


There are some other things here that could be changed: The red markers are too big. Simple, click on any red marker and change it in the properties.



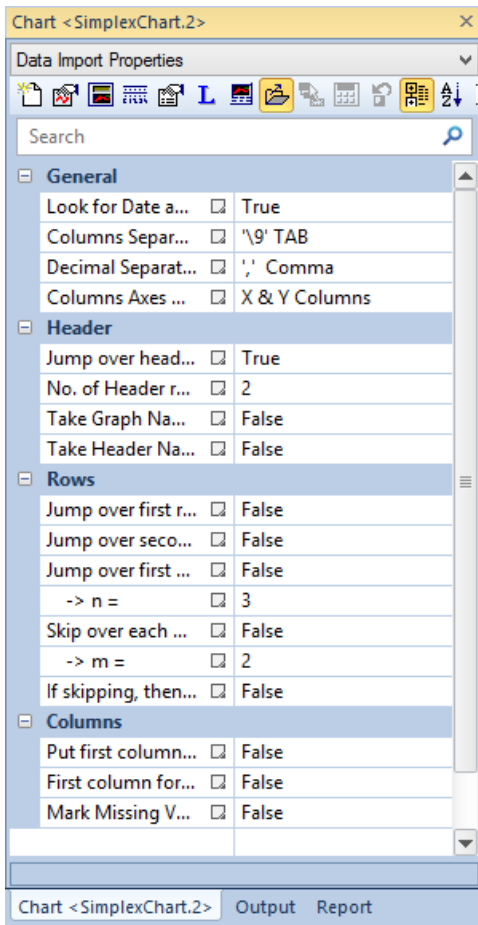
If you like to change header and axes label text, then that is also very simple.

Please double click on the red pin on top of each label text.



By the way, give the chart another name, instead of SimplexChart(n).

Please change the name of the chart for instance to "My First Trend".

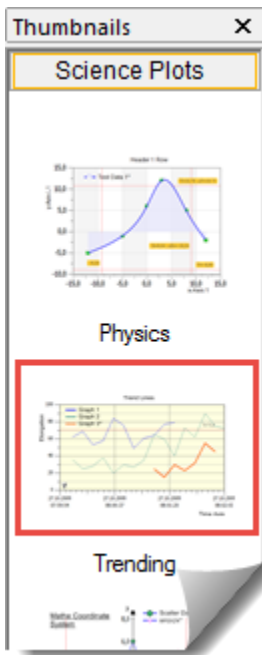


Now, it is time to come back to the trending issues...

Before, we had imported the file 'trend.txt' into the *GraphTable*, but without to trend afterwards.

The parameters of the import dialog are also available in the property section 'Data Import Format' (see left picture). In the case that you have manually imported data from file as done before, *SimplexNumerica* will put its data import settings to these properties.

15.3 Method 3: Use dedicated Graph Trend File

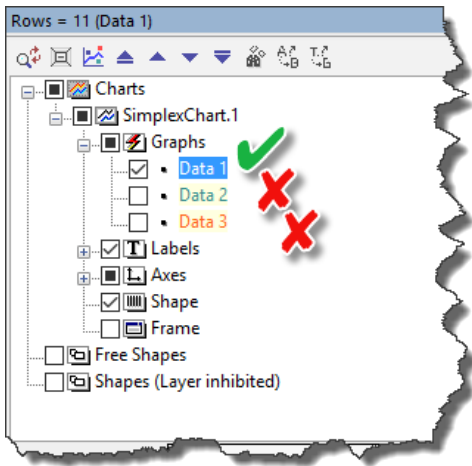


Next, we will show how our trend file can be assigned to a Graph (like above in chapter Method 1). If you have more than one Graph, then you need for every Graph to trend a dedicated trend file (except you are not going to trend every one).

Again, because we want to keep it simple:

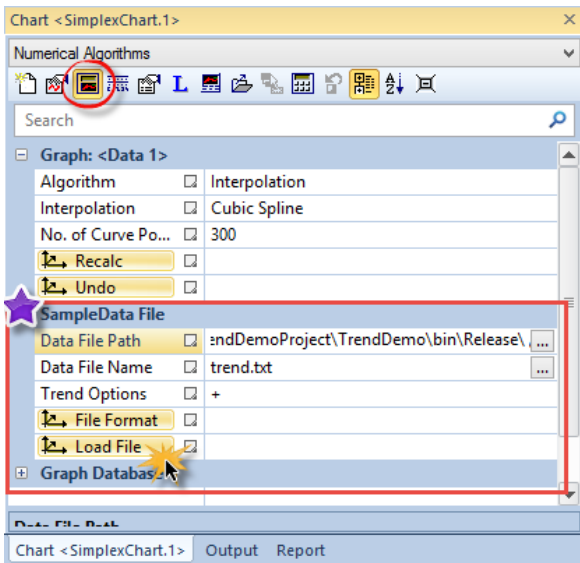
→ Make an empty evaluation (Use Ctrl + N).

→ Click on the pictogram *Trending* on the *Thumbnail bar*.



As shown above in chapter Method 1, each individual graph can also have its own data import file. To see that file entry, click in the **Chart Explorer** on the *Graph* with the name **Data 1** and put into the Property *Graph* section *SampleData File* the right file path.

→ For this tutorial, uncheck *Data 2* and *Data 3*.

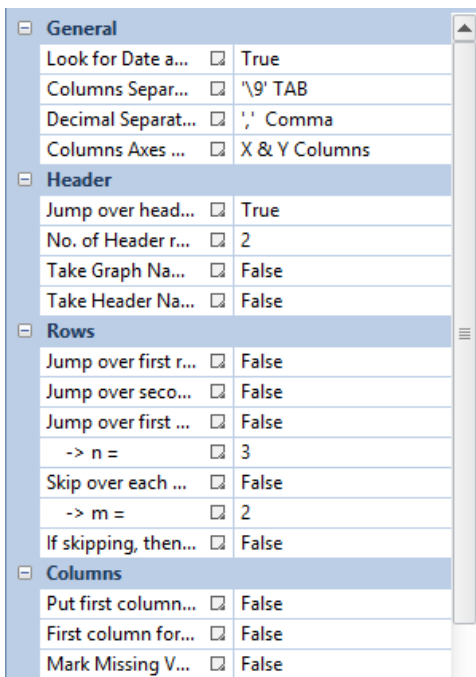


If you like, then you can reload the file again. Press button **Load File**. The chart should look the same like above.

As mentioned before, each graph can have its own trending file. That file should also match the data import format!

Important is that the file has only one x / y (/z) column, respectively, like the sample file.

The entry *Trend Option* (+ sign) indicate that the dedicated graph can be used for trending.



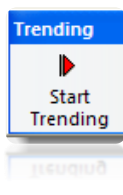
Here again:

→ Please set the **Data Import Properties** to the items shown left.

If this is done, then the graph is capable for trending. That means that you can resume our test the trend file continuously and *SimplexNumerica* is going to update the graph with the new data.

Use **Load File** to test!

To control the trending behavior, please use the dedicated toolbar (or the Pulldownmenu).

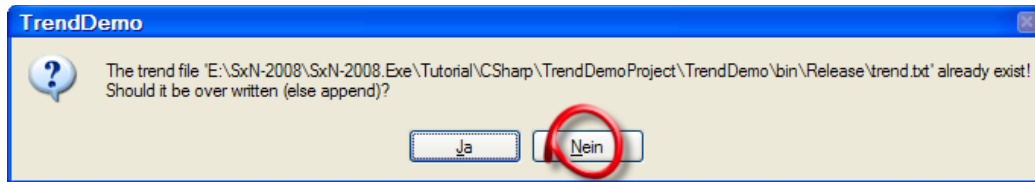
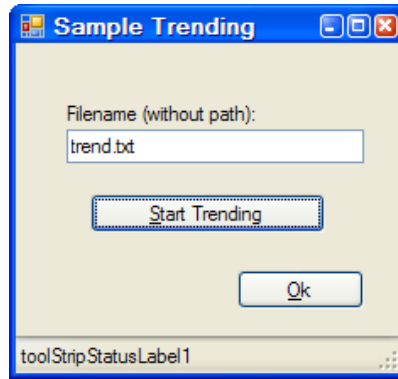


Trend Tutorial

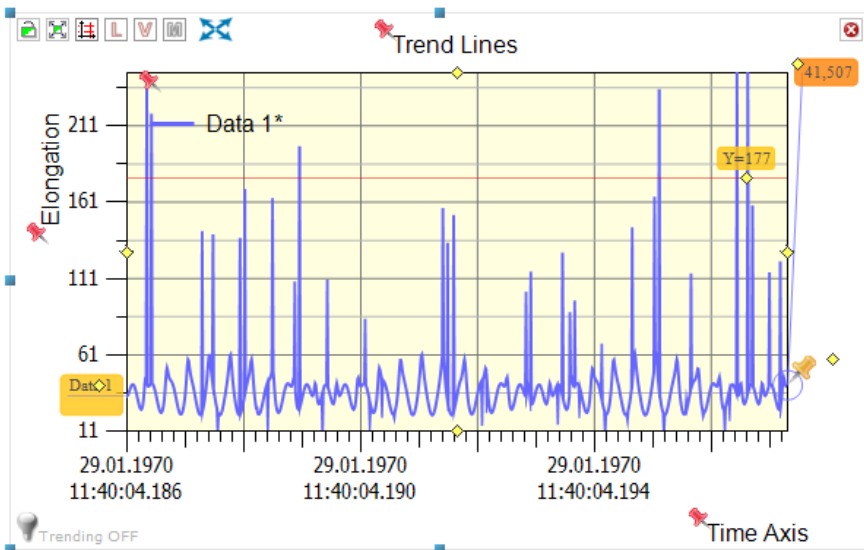
→ Please click on *Start Trending*.

On bottom left to the chart is a flashing lightbulb.  to identify a trending watchdog.

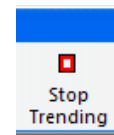
Please start the external trending program (see above) and press button *Start Trending* again.



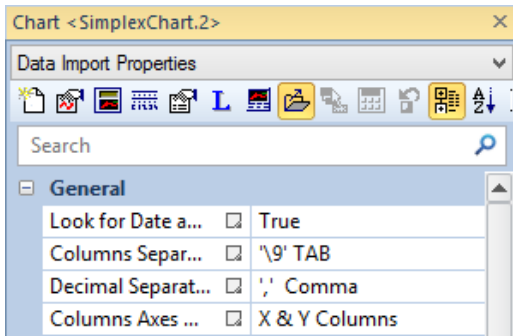
Press **No** in the MessageBox to append the new data to the old ones. You should see the new data in the chart updating every second.



Please click on *Stop Trending*.

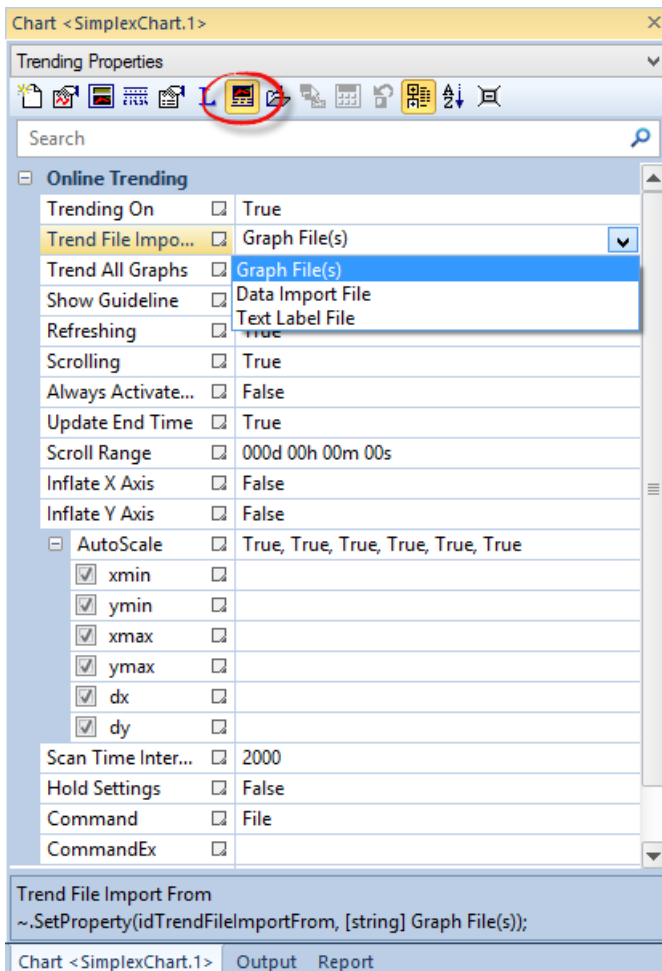


You can test it also with Notepad. Put some arbitrary sample data into the editor and press save.



When you set the entry “*Look for Date and Time*” to true, then the program accepts the following formats for date & time and for real values (separation is county specific):

Format	Example	or	or
Normal	123.14		
Scientific 1	1.2314E02		
Scientific 2	0.12314E03		
Technical	123.14E00		
Date	23.07.1996	07/23/1996	23-07-1996
Time	16:10		
Date and Time	23.07.1996	07/23/1996	23-07-1996
Time	16:10	16:10	16:10



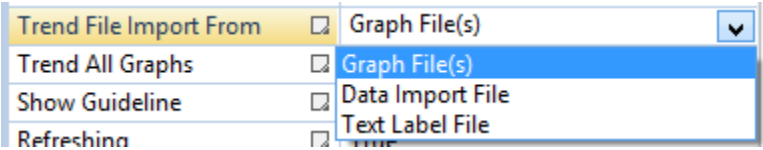
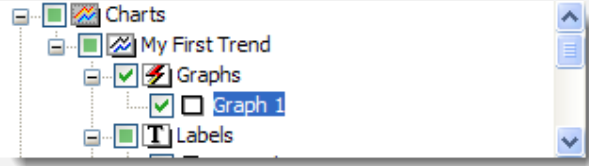
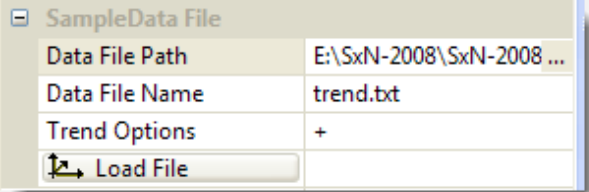

There are several other options for trending. We will have a look to each property and how it will influence the trending behaviors. Please click on icon *Trending Properties* in the toolbar and have a look to the properties for trending:

Hint for Always activate View: View means an evaluation in a window (*.sx files). Views are separated into tabs straight under the *Main Toolbar*.
 Normally, an invisible display (view) is not renewed (not updated)!
 However, if there are two views lying visible underneath, then they should have been updated.

You can also use this icon in the *Main Toolbar*:



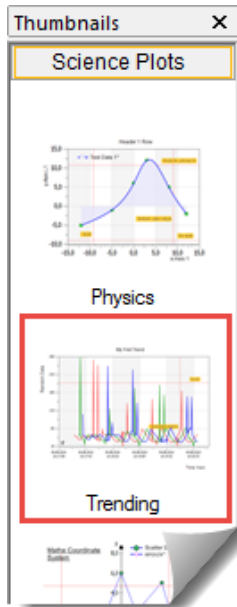
This table describes each entry:

Property	Action
<p>Trending On</p>	<p>Enable/Disable a chart for trending.</p> <p>If there is more than one chart in a view, then it makes sense to switch on/off one of them.</p>
<p>Trend File Import From</p>	 <p>Graph File(s) → Each individual graph will have its own data import file. Data Import File → One data import file for all graphs. Text Label File → Special file for trending shapes.</p>
<p>Trend All Graphs</p>	<p>Enable/Disable a graph for trending.</p> <p>If there is more than one graph in a chart, then it makes sense to activate/deactivate some of them for trending or not. This cannot be done here (see below the graph properties). Here you can adjust whether all graphs shall be trended or not.</p> <p>Chart Explorer: Click on Graph 1</p>  <p>Scroll down to Sample Data File and put a + right to Trend Options to mark this graph for trending.</p> 
<p>Show Guideline</p>	<p>The guideline is a vertical line at the end of the last data point from the active graph. The color of the guideline is equal to the color of the active graph.</p>
<p> Refreshing</p>	<p>There is an icon in the trending toolbar for Refreshing.</p> <p>Refreshing is only available for database and server online trending (see <i>SimplexNumerica Custom</i>).</p>

Scrolling	Scrolling equal True will scroll the graph along the x-axis. Use <i>Scroll Range</i> for the data time range.
Always Activate View	If there are more than one view on screen, then it makes not always sense to update the views in the background, because the program performance will get slower with the number of views. If there are views horizontal or vertical, respectively, ordered on the visible level, then each view should be activated.
Update End Time	This here is only available for database and server online trending (see <i>SimplexNumerica</i> Custom).
Scroll Range	000d 03h 01m 30s Scroll Range for scrolling along the x-axis. Edit day, hour, minute and second.
Inflate X Axis	If AutoScale has been activated for x-min/x-max values, then only if a data point exceeds the left/right border of the chart, min/max will be extended.
Inflate Y Axis	If AutoScale has been activated for y-min/y-max values, then only if a data point exceeds the top/bottom border of the chart, min/max will be extended.
AutoScale xmin ymin xmax ymax dx dy	AutoScale can be activated for xmin, ymin, xmax, ymax, dx and dy. Dx and dy are the real distance between two labels. <u>Hint:</u> <i>If you have checked this here, then no manual scaling will work during trending.</i>
Scan Time Interval	This is the scan time interval between two trend updates (in ms).
Hold Settings	unused
Command	File <i>SimplexNumerica</i> Standard Edition always the word file . <i>SimplexNumerica</i> Custom Edition command for Database and Client/Server-Connections Connections.
CommandEx	- <i>SimplexNumerica</i> Standard Edition nothing here (or -). <i>SimplexNumerica</i> Custom Edition commands for extended Database and Client/Server-Connections

15.4 Method 4, Data Import Trending

We have seen in chapter Method 2 how to import data via *Data Import Dialog*. Now, we want to trend this import in a similar way.



Again, because we want to keep it simple:

- Make an empty evaluation (Use Ctrl + N).
- Click on the pictogram *Trending* on the *Thumbnail bar*.

By the way:

Please compare this picture to the left with that from above chapter Method 2 + 3. The trending pictogram looks different. That is because I have changed it previously. How can we change that?

1. Make an empty evaluation (Use Ctrl + N).
2. Click on the pictogram Trending on the Thumbnail bar (or drag it).

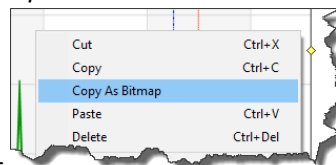
→ Info: The path to this is held by the Clipboard!

3. **Change the look** (Theme) of the chart...

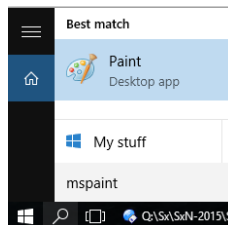
4. Save the selected Object (Chart)



→ Info: Paste the path from the Clipboard to the Fileselectbox.



5. Make a right mouse click on the chart and select



6. Call Microsoft Paint (MSPaint)

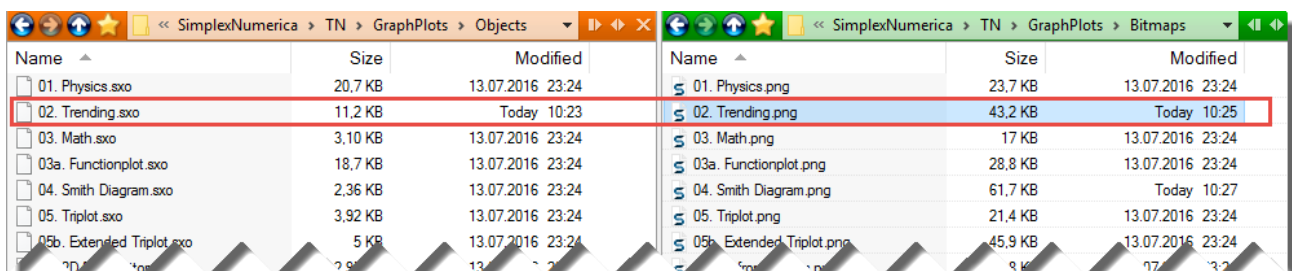
7. Paste the bitmap into MSPaint (and paint around it).

8. Click again on the pictogram Trending on the Thumbnail bar.

→ Info: The path to this is held again by the Clipboard!

9. Save the bitmap in Paint with the path in the Clipboard but change the word "objects" to "bitmaps" and the extension "sxo" to "png".

10. That's it!



Trend Tutorial

Back to the roots...

To import and trend a Data Import File, please follow the steps:

→ Change the Trend Properties to *Data Import File*.

Push the toolbar icon

→ Load the right trend file.

→ Set the right settings.

→ Push here again

Start Trending

Trending ON

Follow the trend...

	x	y
1	04.08.2016 05:08:28	41,6108
2	04.08.2016 05:08:29	40,9513
3	04.08.2016 05:08:30	39,8946
4	04.08.2016 05:08:31	38,5029
5	04.08.2016 05:08:32	36,8611
6	04.08.2016 05:08:33	35,0752

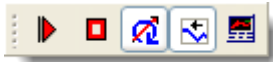
Fig.15-3: Settings for Data Import Trending

That's it!

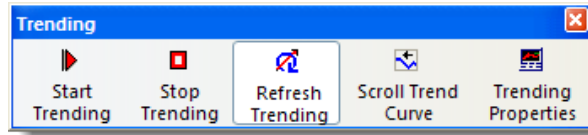
15.5 Trend Toolbars

SimplexNumerica provides two trend related toolbars:

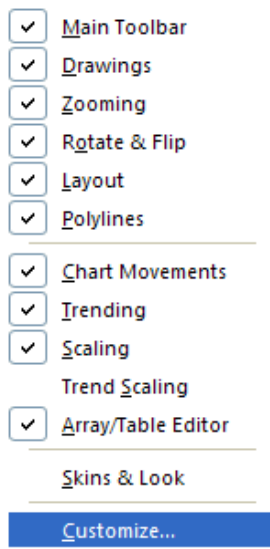
15.5.1 Trending Toolbar



..or change the toolbar to:

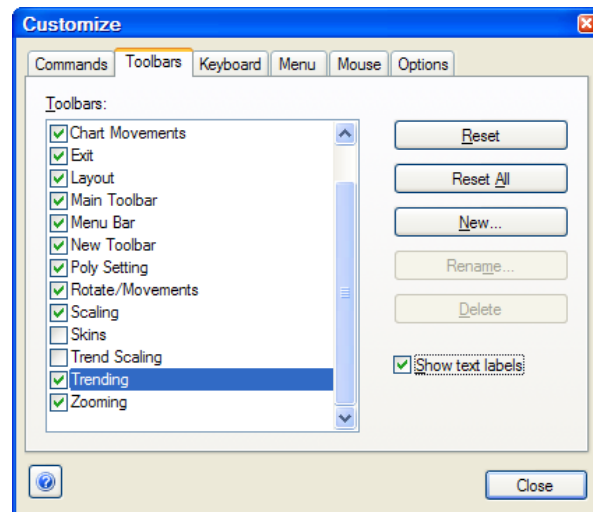


Change Toolbar Style:



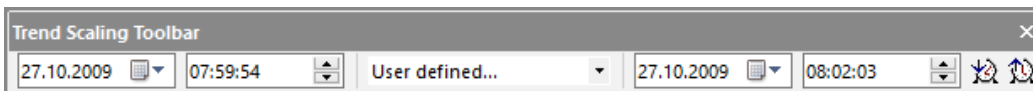
Right mouse click next to any toolbar opens the **Toolbar** popup menu. Click on **Customize...** will open the next dialog.

Select the Tab **Toolbars**, then e.g. entry **Trending** and then check the button **Show text labels**.

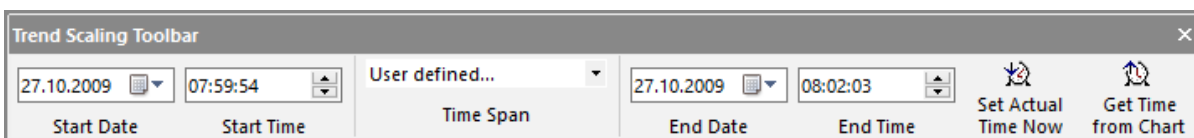


15.5.2 Trend Scaling Toolbar

Scaling toolbar without text:



Scaling toolbar text:

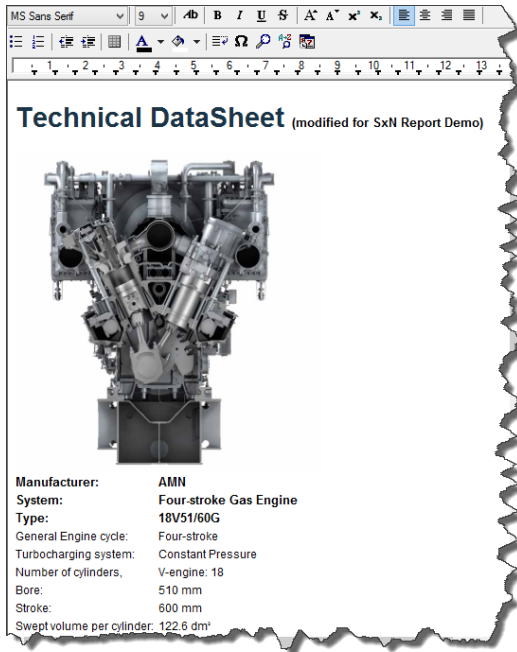


16 Prime Example, Generate Reports

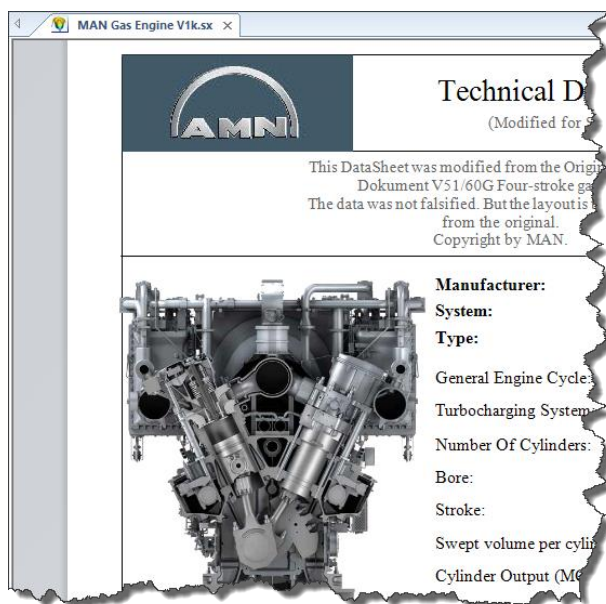
We want to do the following tasks:



1. Create Database
Create a Microsoft Access Database



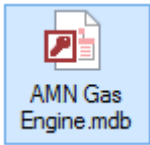
2. Document Report
Create a WordPad RTF⁴ template with transferring the data from the evaluation report in this document report.



3. Evaluation-Report
Creation of a data sheet for AMN gas engine with replenishment of data from a self-created Microsoft Access database.

⁴ RTF: Rich Text Format used by Microsoft Wordpad and Word

16.1 Create a Database



The Microsoft Access database is used as a data source for the evaluation report. The database is kept deliberately simple. It consists of only one table. In the example folder, you can already find a simple version of this database with the file name <AMN gas Engine.mdb>.

Please open *Microsoft Access* (If not present, then jump over and use this file, only).

In the so-called Design View, the field name and the field data type can be specified. For this model, the following fields are used (German version):

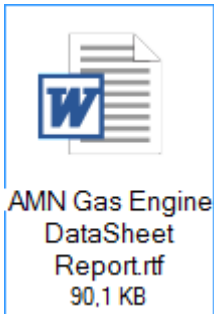
Feldname	Felddatentyp
ID	AutoWert
Datum	Datum/Uhrzeit
Manufacturer	Kurzer Text
System	Kurzer Text
Type	Kurzer Text
EngineCycle	Kurzer Text
TurbochargingSystem	Kurzer Text
NumberOfCylinders	Zahl
Bore	Kurzer Text
Stroke	Kurzer Text
SweptVolumePerCylinder	Kurzer Text
CylinderOutput	Kurzer Text
CylinderCooling	Kurzer Text
StartingMethod	Kurzer Text
Emissions	Kurzer Text
AmbientAirPressure	Kurzer Text
RelativeHumidity	Kurzer Text
AmbientAirTemperature	Kurzer Text
ChargeAirTemperature	Kurzer Text
SpecificGasConsumption	Kurzer Text
ElectricalEfficiency	Kurzer Text
NominalGeneratorEfficiency	Kurzer Text
LubeOilConsumption	Kurzer Text

Into the Data Sheet View, the data is entered:

ID	Datum	Manufacturer	System	Type	Engine cycle	Turbochargi	Number of c
1	29.06.2015	MAN	gas engine	18V51/60G	four-stroke	constant press	18 5

... namely on the basis of the in the documents report described subchapters.

16.2 Create a Document Report

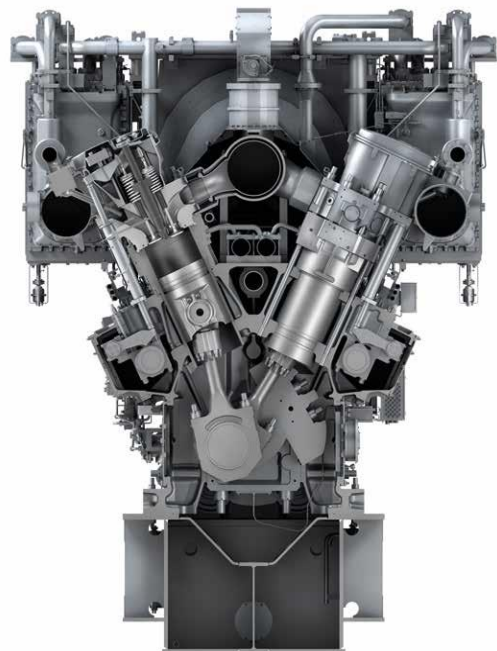


The document report can be created in *WordPad* or *Word*, but also in *SimplexNumerica* according to the following pattern:

Following, the Technical GraphTable (our document report) how it appears completed. Subsequently, the design should be an evaluation that will be used as a template for the exchange of information with *SimplexNumerica*. Therein the data (e.g. 18V51 / 60G) are shown as placeholders. The name of an item is not specified. So that not mistakenly a wrong text is replaced, you should put brackets [e.g. item1] around the placeholder.

Technical GraphTable

Manufacturer:	AMN
System:	Four-stroke Gas Engine
Type:	18V51/60G
General Engine cycle:	Four-stroke
Turbocharging system: cylinders, V-engine: 18	Constant Pressure Number of
Bore:	510 mm
Stroke:	600 mm
Swept volume per cylinder:	122.6 dm ³
Cylinder output (MCR)	at 514 rpm, 60 Hz: 1,050 kW
Cylinder cooling:	Fresh water Charge air cooler (two-stage)
Starting method:	Compressed air
Emissions: 500mg/Nm ³ dry @ 5% O ₂	NO _x -emissions maximum

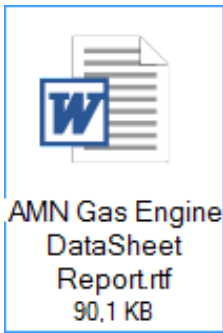


Reference conditions according ISO 3046-1: 2002

The stated consumption figures refer to:

- Ambient air pressure: 1,000 mbar
- Relative humidity: 30%
- Ambient air temperature: +25°C (77°F)
- Charge air temperature: According to engine type, corresponding to 25°C cooling water temperature

Specific gas consumption:	Heat rate: Optimized for power generation, TA-Luft: 7597 kJ/kWh
Electrical efficiency:	Optimized for power generation: 47,4 %; Gas combined cycle: 46,8 %
Nominal generator efficiency:	97.7 %
Lube oil consumption	18V51/60G: 9.0 kg/h

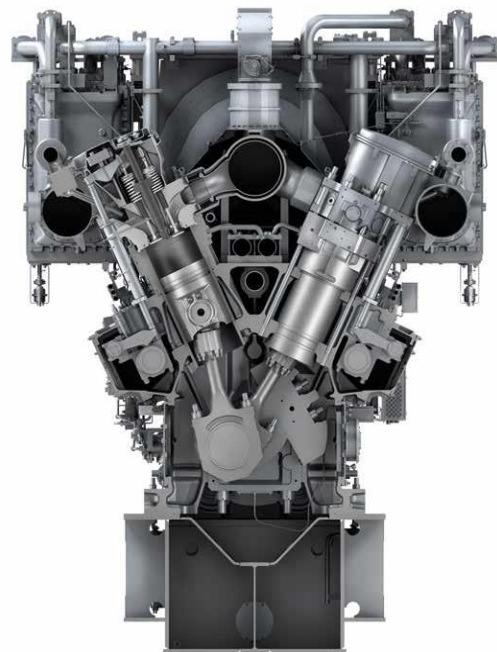


As describe above, here the template with the placeholders.

In this GraphTable, the placeholders have been defined arbitrarily.

Technical GraphTable

Manufacturer:	[Factory]
System:	[System]
Type:	[Type]
General Engine cycle:	[Engine]
Turbocharging system:	[Item1]
Number of cylinders,	[Item2]
Bore:	[Item3]
Stroke:	[Item4]
Swept volume per cylinder:	[Item5]
Cylinder output (MCR)	[Item6]
Cylinder cooling:	[Item7]
Starting method:	[Item8]
Emissions:	[Item9]



Reference conditions according ISO 3046-1: 2002

The stated consumption figures refer to:

- Ambient air pressure: [AmbientAirPressure]
- Relative humidity: [RelativeHumidity]
- Ambient air temperature: [AmbientAirTemperature]
- Charge air temperature: [Item10]

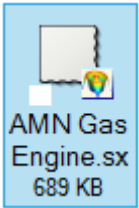
Specific gas consumption: [Item11]

Electrical efficiency: [Item12]

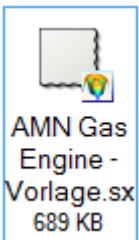
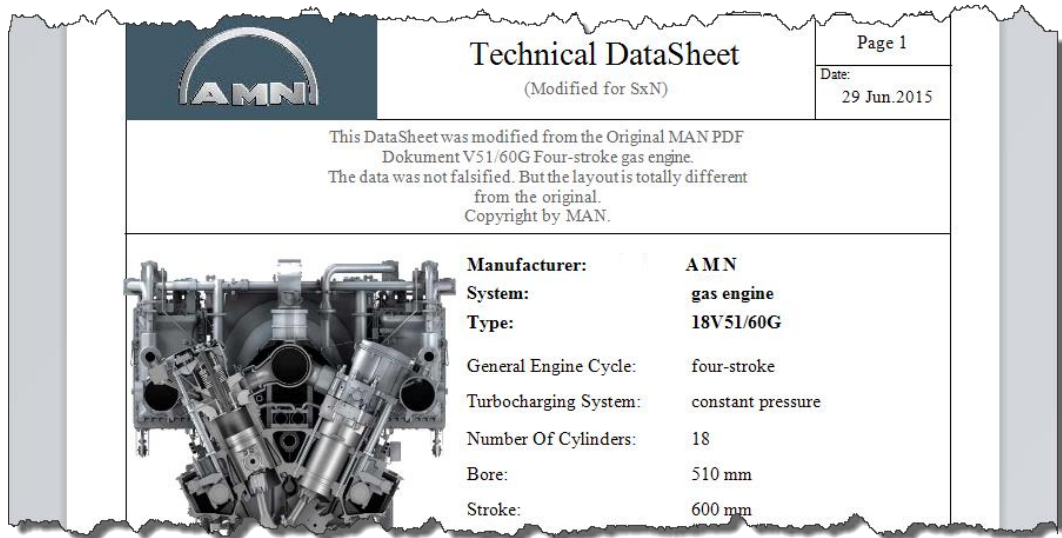
Nominal generator efficiency: [Item13]

Lube oil consumption [Item14]

16.3 Create Evaluation Report

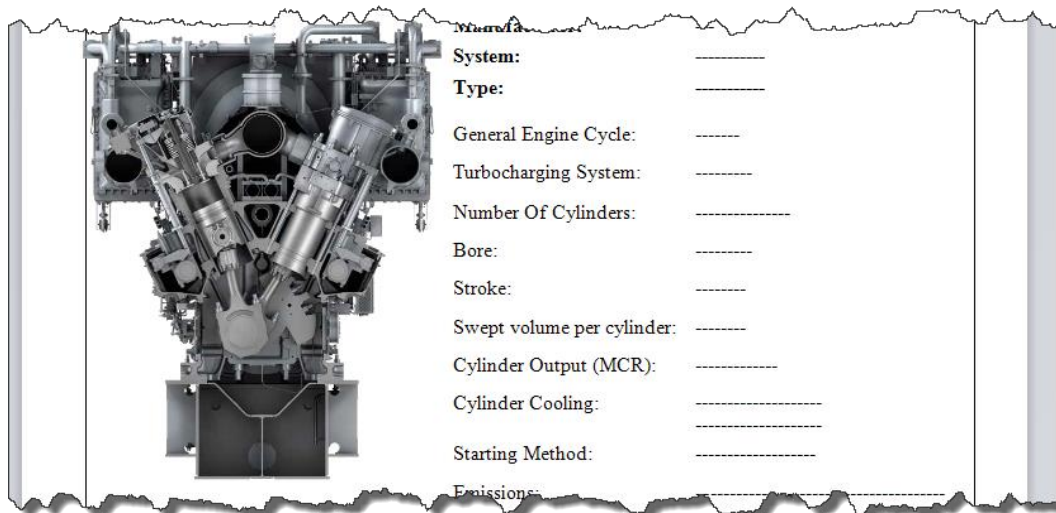


Now, the evaluation report can be created in SimplexNumerica similar to the sample file <AMN gas Engine.sx>. However, this file already shows the queried data from the database (eg 18V51 / 60G).



Unlike the placeholders described above, here the items are expressed by name. These names are listed in the properties, so the properties of the individual objects (shapes, charts, etc.).

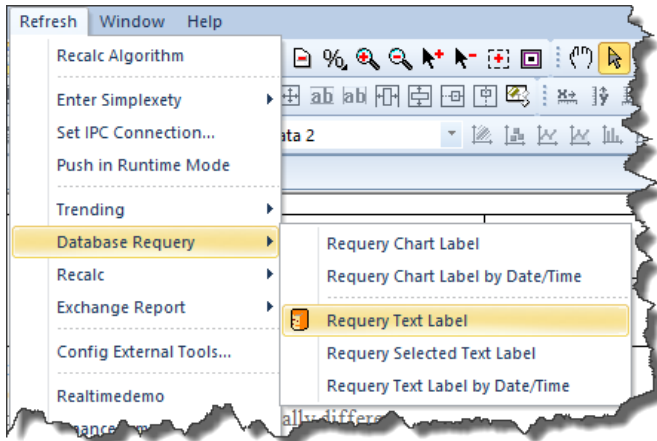
The user should recognize the template as such. Therefore it is better to mark the data with these placeholders, for example, with a dash (-) or question mark (?).



Tip: For better formatting, multiple placeholders (e.g. -----) should be present so that the formatting can be guided accordingly.

Next, we will load the example evaluation file <AMN Gas Engine - Vorlage.sx> and make a database query based on its content.

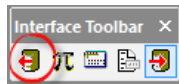
16.3.1 Database Query



Please open the file

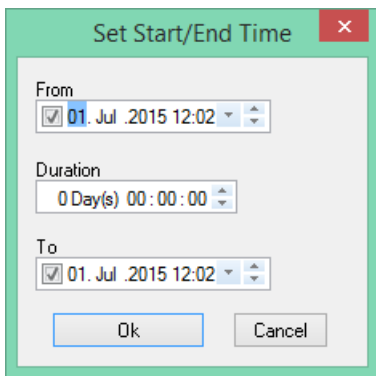
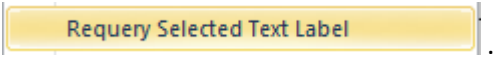
<AMN Gas Engine - Vorlage.sx> and call the adjacent menu. All text labels are scanned and the contents are replaced by the value of the database query.

The prerequisite is that each text label has been previously prepared for it. That means its properties should have been adjusted accordingly.

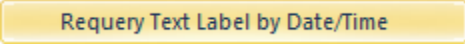


You can also use the toolbar icon from the *Interface* toolbar.

If you want to query only selected text labels, then use



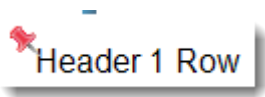
If the SQL string uses a date, so you can retrieve any other time with the menu item



It appears the adjacent dialog for entering the time range. This dialog is not used in this prime example, however.


Since we do not use a chart in this prime example, the chart labels are not used.

Chart labels are the texts that move with a chart with, e.g. the Header text, like:




Here is the result of the database query:

Active Layer is: Label

	Technical DataSheet (Modified for SxN)	Page 1
		Date: 29 Jun 2015

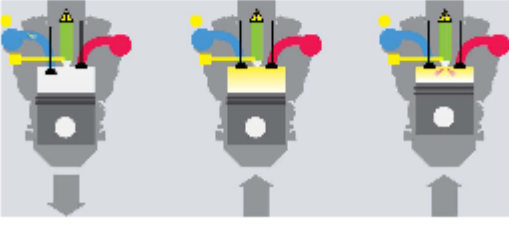
This DataSheet was modified from the Original MAN PDF Dokument V51/60G Four-stroke gas engine. The data was not falsified. But the layout is totally different from the original. Copyright by MAN.

	Manufacturer:	AMN
	System:	gas engine
	Type:	18V51/60G
	General Engine Cycle:	four-stroke
	Turbocharging System:	constant pressure
	Number Of Cylinders:	-----
	Bore:	510 mm
	Stroke:	600 mm
	Swept volume per cylinder:	122.6 dm ³
	Cylinder Output (MCR):	at 514 rpm, 60 Hz: 1050 kW
	Cylinder Cooling:	Fresh water Charge air cooler (two-stage)
	Starting Method:	Compressed air
	Emissions:	NOx-emissions maximum 500mg/Nm ³ dry @ 5% O ₂

The stated consumption figures refer to:

Ambient Air Pressure:	1000 mbar
Relative Humidity:	30%
Ambient Air Temperature:	+25°C
Charge Air Temperature:	25°C
Specific Gas Consumption:	7597 kJ/kWh
Electrical Efficiency:	Optimized for power generation: 47,4 %; Gas combined cycle: 46,8 %
Nominal Generator Efficiency:	97,4 %
Lube Oil Consumption:	18V51/60G: 9.0 kg/h

Principle



Reference conditions according ISO 3046-1: 2002

Margins

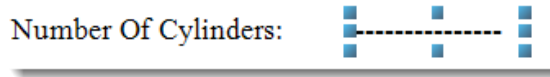
It can be seen that the entry "Number of Cylinders" has not been filled. By using a template with placeholders, you can easily find that out!

Now, let us examine why the entry has not been filled...

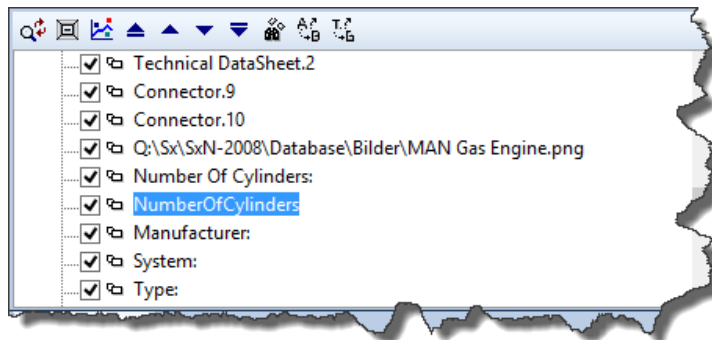
16.3.2 Assignment of a Database Query

The assignment of a database query to a text label can be done in various ways.

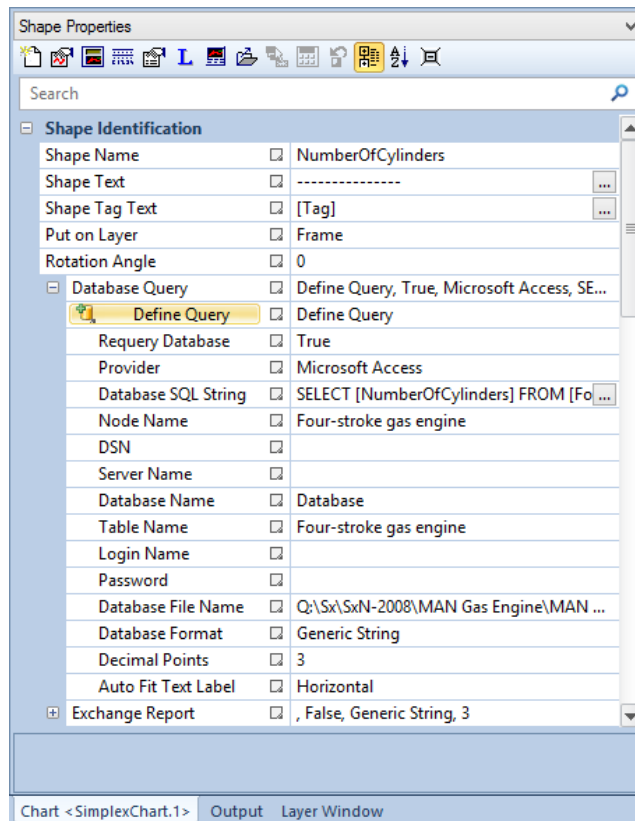
Select the previously not queried text label with the left mouse button:



Then its properties are displayed in the Property Window. Have a look to the *Chart Explorer*. The shape name NumberOfCylinders should also be selected.



Here are the properties:

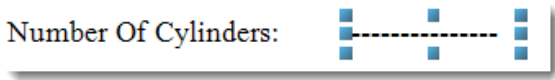


Here you can see the dashes (-----) beneath the heading “Shape Text”, which have not been overwritten. The entries are available under the heading „Database Query“. They are consistent with the other text label

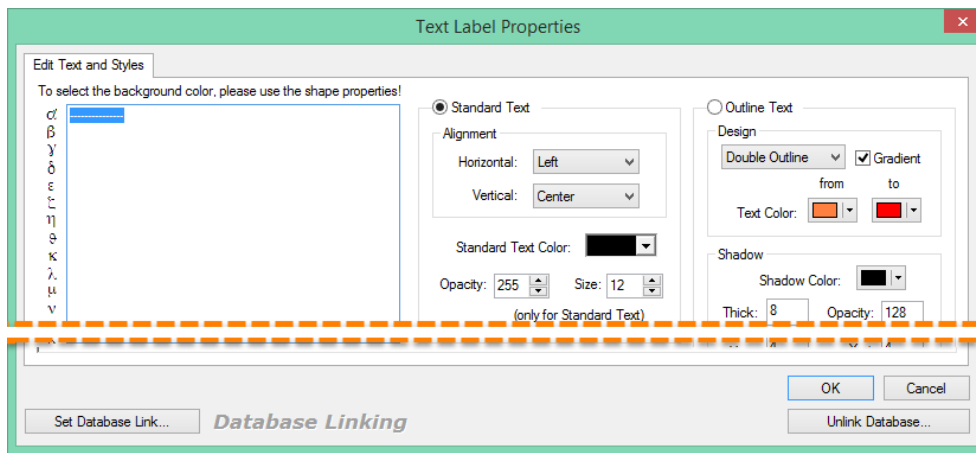
entries. To find the cause, you can spent most of the approach of the creation of such a text label or simple click on the button *Define Query*.

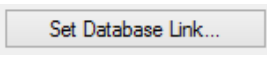
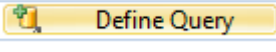
Creation Approach

Please hold down the Ctrl key and click with the left mouse button on the marked position (the placeholders):

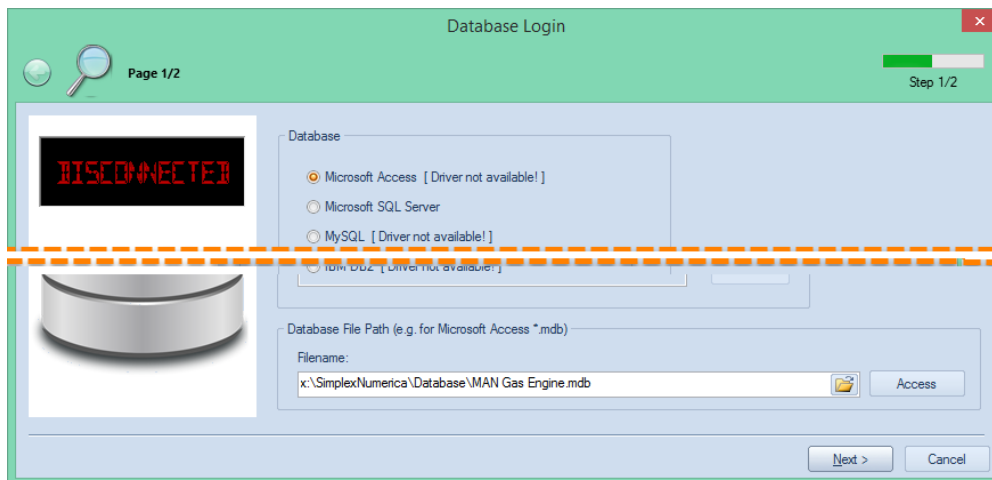


...then the following dialog appears (parts removed) with the *Text Label Properties*.

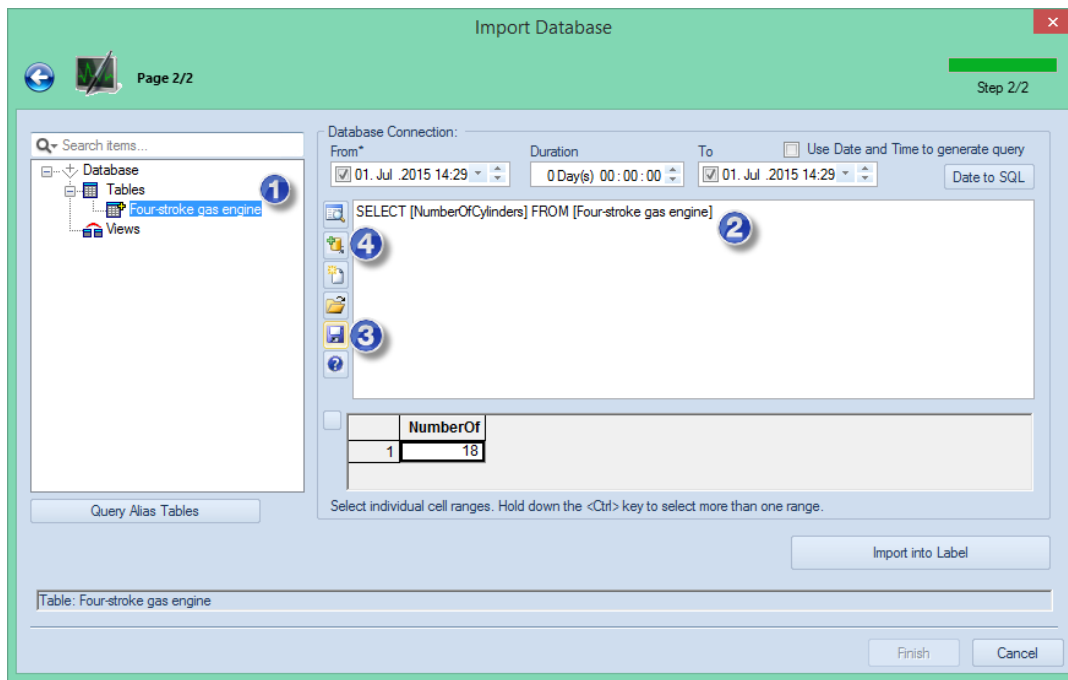


Now click on the button  , then the *Define Query Dialog* appears similar to the direct click in the properties  .



In the first property sheet dialog, please connect to the Microsoft Access database with the file name: <x:\SimplexNumerica\Database\AMN Gas Engine.mdb>. The x: stands of course for any pathname.



Then it goes on to the property page, which is for the database query responsible...



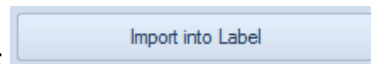
Follow these steps:

10. Click in the left tree control on the text: „Four-stroke gas engine “
11. Type the following SQL string into the SQL Text Editor (Icon  Store the SQL string for later use.
13.  Perform the database query.

	NumberOf
1	18

The result should be in the table.

14. Click on the cell with the 18, and then select the button:



Tip:

The table has only one cell because the SQL string has been so declared, that only one value can emerge from the database query. If several values were returned, then several rows or columns would be present in the table. These cells could then be selected differently (just as you would do it in Windows Explorer with files and folders).


15. Finally, quit from the dialog with the button  .

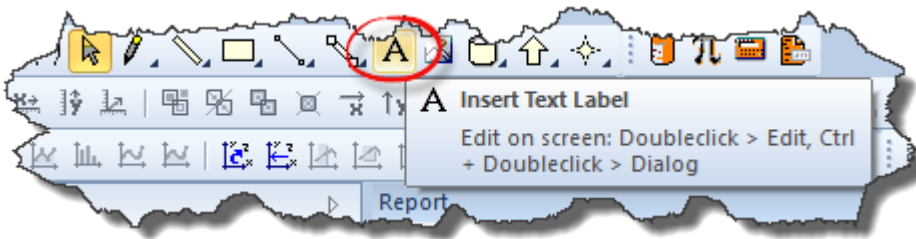
16. The database query works the same as above described.

16.3.3 Create a New Database Query

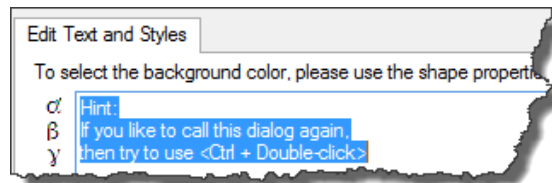
This works the same as in the previous chapter 16.3.2!

16.3.4 Creating a New Text Label with Database Query

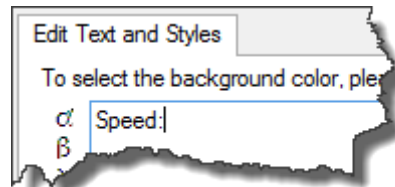
The simplest way is to use the toolbar icon  *Insert Text Label*.



Then click with the left mouse button on the position in the report where the text should be placed.

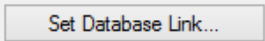


Overwrite once the notice...



...with a new placeholder text, for example

The database settings are the same as in the previous chapter 16.3.2. Click on the button



and go on...

However, if you want a statement such as:

Speed: v = 1234 km / h,


then you can either create three text labels

Label1: Speed: v = ', Label2: 1234, Label3: km / h'

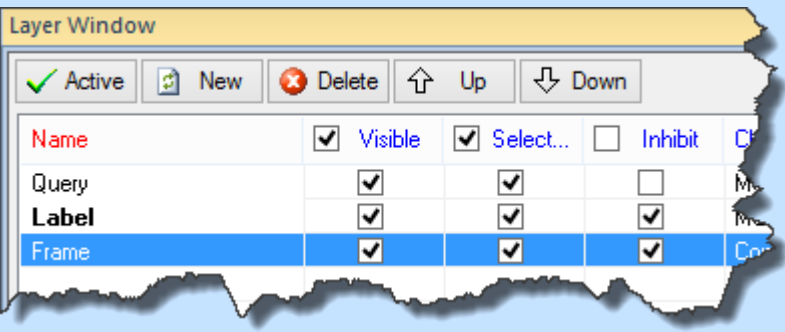
or you can use one text label with a defined tag (called *Text Tag Label* or *Shape Tag Text*) as shown in the following chapter. It also shows how you can calculate with tags.

16.3.5 Creating a New Text Tag Label with Database Query

We will now explain the *Text Tag Label* using the parameter Stroke. The statement shall read: ‚Stroke s = 600 mm‘. We will use the Stroke parameter, because this is already a record in the database.

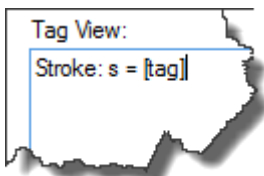
Again, use the toolbar icon  *Insert Text Label* and place the text at a point on the free area of the evaluation side.

Important:



Name	Visible	Select...	Inhibit
Query	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Label	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Frame	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Please make sure that you do not place the text on a suppressed (inhibit) layer.
 .. Inhibit , otherwise it will not be queried!

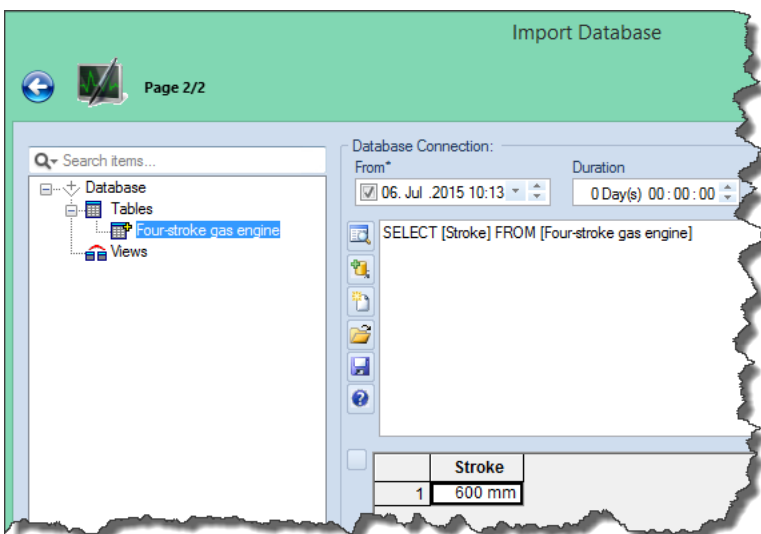


The dialog with the Text Label Properties opens. Put in the text

→ Stroke: s = [tag],

here at the *Tag View*.

→ The statement [tag] is a placeholder for the later database entry.



Import Database

Page 2/2

Database Connection:

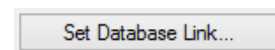
From* 06. Jul. 2015 10:13 Duration 0 Day(s) 00:00:00

SELECT [Stroke] FROM [Four-stroke gas engine]

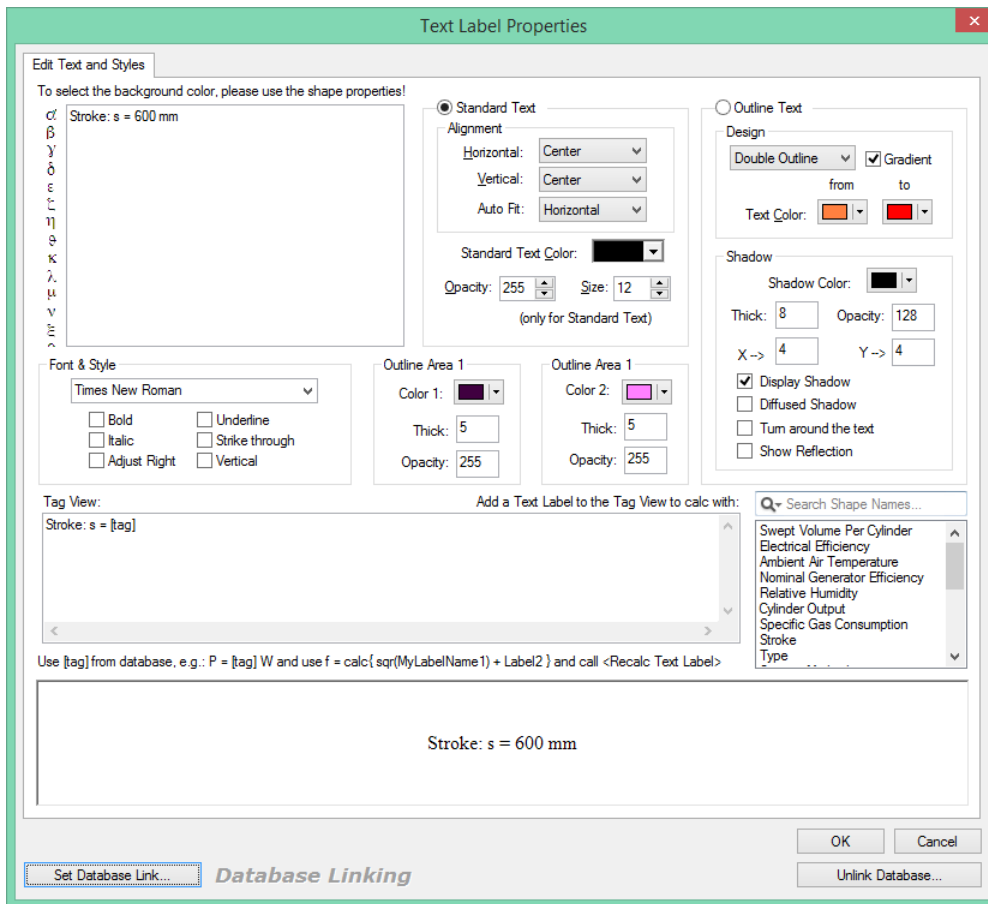
Stroke
1 600 mm

The database settings are the same as in the previous chapter 16.3.2.

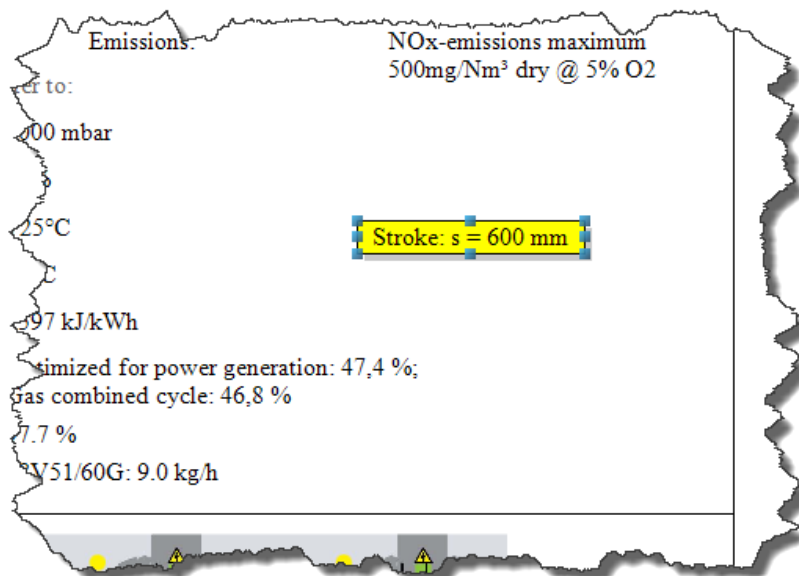
Push the Button



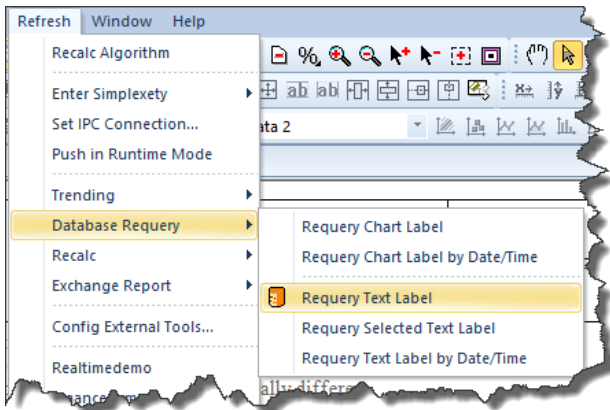
When the database settings are finish, then the result will be shown in the Text Label Properties:



Please confirm this dialog with Ok, so the sheet changed as follows:



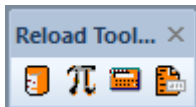
The following (user) database query is already described above, but shortly explained here again.



Please call the adjacent menu.

Then all text labels will be queried and its content replaced by the value of the database query.

The prerequisite is that each text label has been previously prepared for it. That means, its properties have been adjusted accordingly (done as above) and the layer is not set to suppress (inhibit).



You can also use the toolbar icon from the reload toolbar.

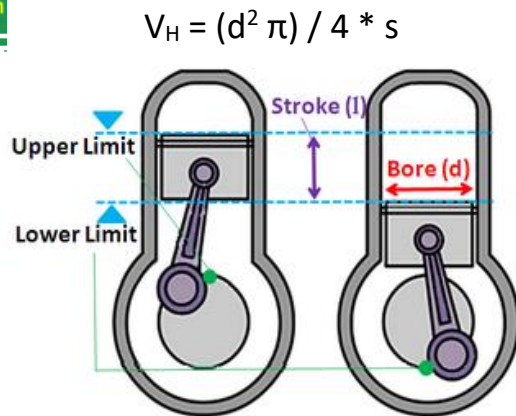
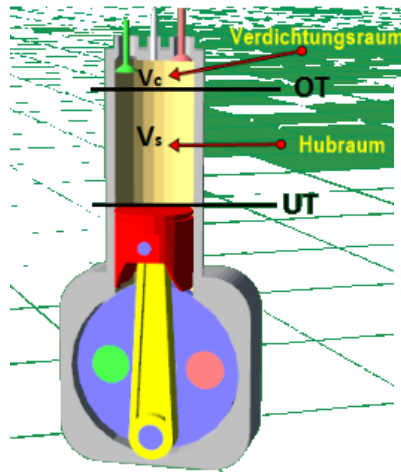
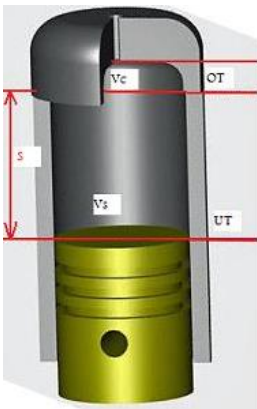
If you want to query only selected text labels, then use **Requery Selected Text Label**.

Hint:

If one no longer need the tag, then simply remove the tag entry from the dialog.

16.3.6 Creating a New Text Tag Label for Calculation

Now we want to create another text label and automatically perform a calculation with the help of two other text labels. We will use for these two text labels the parameters Stroke and Bore. The new text label should be assigned to a calculated stroke volume.



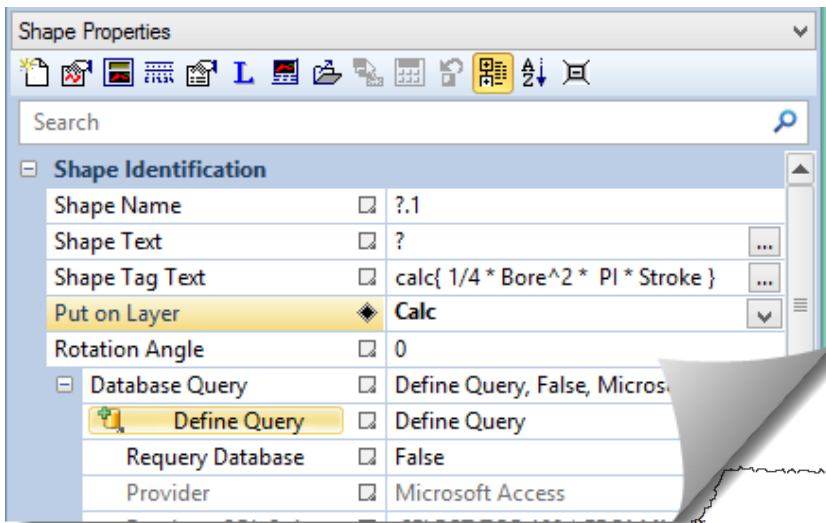
Again, use the toolbar icon **A** *Insert Text Label* and place the text at a point on the free area of the evaluation side. Finally, please put the above formula in the Tag View. It is handy that you can look right into the list box to the (unsuppressed (not inhibited) in Layer) tag names. The tag names are of course the other text labels.



A formula is always framed by means of the word calc {...}. An integrated formula parser can later interpret the formula. Here the statement:

→ calc{ 1/4 * Bore^2 * PI * Stroke }

Thus, the new third label consists of calculating other labels. It may itself not be included in the calculation.

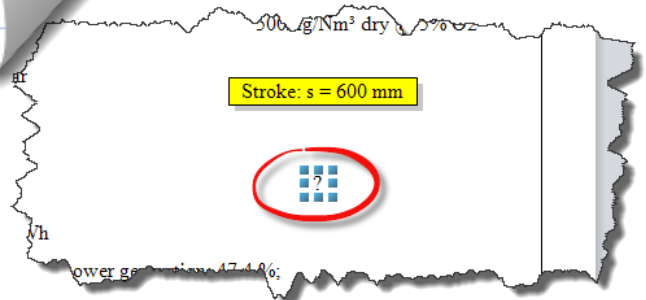


Of course, the formula can be changed later in the Properties.

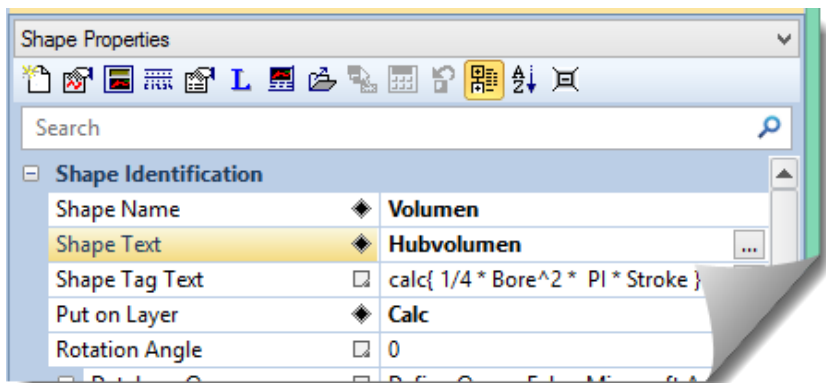
On the screen, the evaluation looks like this:

→ Only a selected question mark!

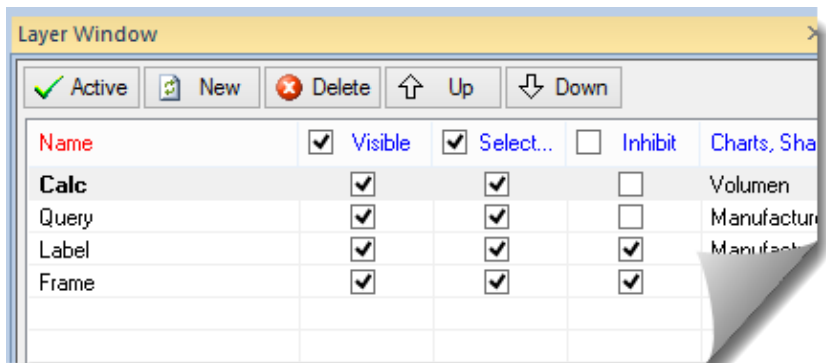
Please go to the Properties and correct the information as follows:

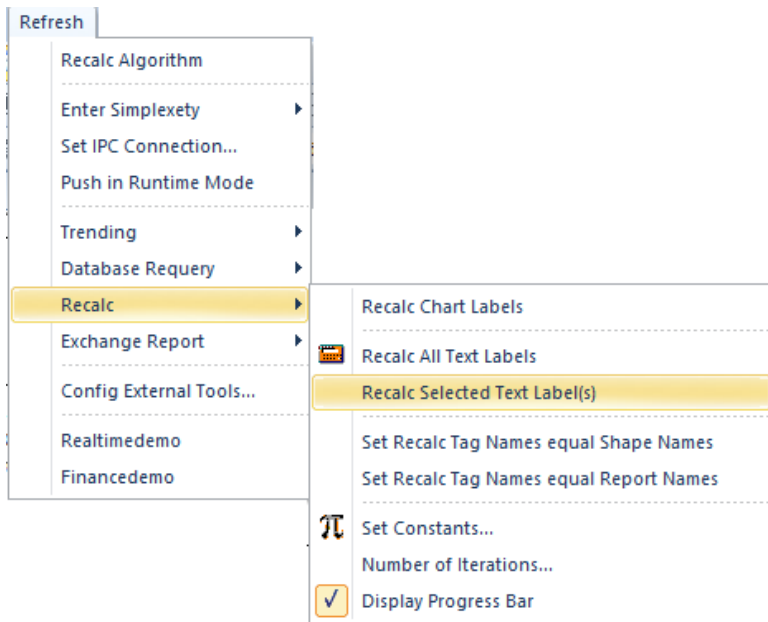


To change the question mark also in the shape name it is best to use the properties of the text labels (here the German Names):



Furthermore, a new layer named "Calc" was created and the text label placed on or assigned to the layer, respectively.

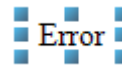




Next, the execution of the calculation is made.

If you want to re-calculate all text labels, or only the selected ones, then please select the text labels on the screen and call the adjacent menu or the corresponding icon in the toolbar.

Unfortunately, the calculation was not working right. It appears the word:



The output view shows you the information about the error:

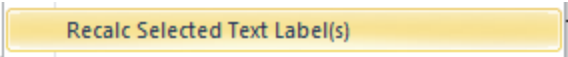
Text Label: Volumen

Formula: $1/4 * Bore^2 * PI * Stroke$

Error Message: Undefined token "PI" found at position 15.

Token: PI on Position: 15

- ➔ Please change PI (Upper Case) in pi (Lower Case) to fix this error!
- ➔

Please press  again...

Then you get this error:

Text Label: Volumen

Formula: $1/4 * Bore^2 * pi * Stroke$

Error Message: Can't evaluate function/operator "*": Argument 2 of function/operator "*" is of type 'i' whereas type 'm' was expected.

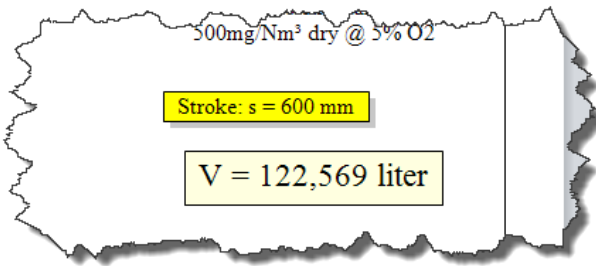
Token: * on Position: 18

You can see that the error messages can sometimes be a little bit cryptic. The reason here is that "Bore" and "Stroke" were exchanged against the database entries "510 mm" and "600 mm". Now, the program formula parser tries to calculate with the string "510 mm" instead of the number "510". Right, the input "mm" should not be in there!

Use the properties and try to manually replace 510 mm in 510 and 600 mm in 600 or better directly in dm (decimeter) instead of mm: 5.1 and 6.0. Then recalc again... See the result; should be ok.

Next, place this in: "V = calc{ 1/4 * Bore^2 * pi * Stroke } liter", then you will get:

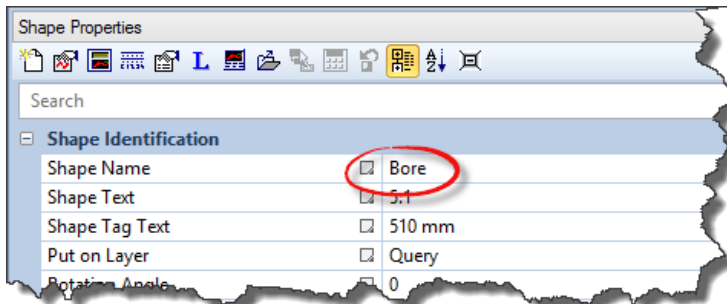
Prime Example, Generate Reports



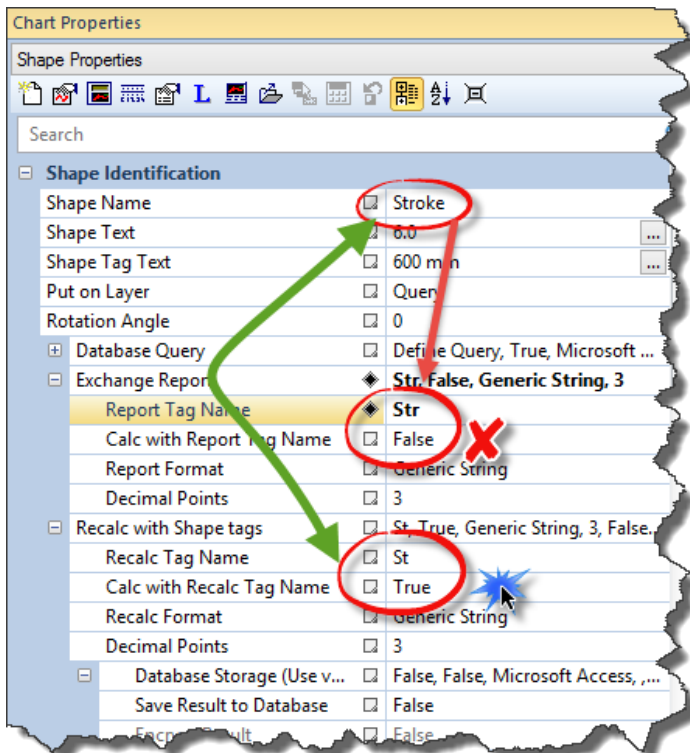
You have seen that it is very important to edit a proper formula string and shape text related to the text label properties.

Let's look again at the formula: $\rightarrow \text{calc}\{ 1/4 * \text{Bore}^2 * \text{pi} * \text{Stroke} \}$

...it is noticeable that the two variables "Bore" and "Stroke" denominated equal to the name in the Shape Properties:



If one uses a longer Shape name, it is often undesirable to use these in the calculation formula. Therefore, you can enter a nickname either under the headings "Exchange Report" or "Re-calc with Shape tags".



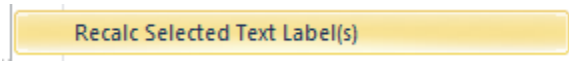
→ If the flag is set to True, then the entry will be used. The report-item is taking precedence.

→ Because of the fact that the Flag *Calc with Recalc Tag name* is on True, this entry takes precedence.

Thus, the formula can be written as follows:

→ $\text{calc}\{ 1/4 * \text{Bo}^2 * \text{pi} * \text{St} \}$

Please press the button



...and see the result as above:

$V = 122,569 \text{ liter}$

Note:

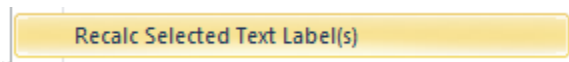
Is *Recalc Format* set to *Generic String*, then the program tries to convert the string into a number.

The entry *Decimal Points* specifies the number of decimal places.

Now, we can repeat the calculation with the abbreviations of the category *Exchange Report*, and the formula looks like (change the Flags, too!):

→ $\text{calc}\{ 1/4 * \text{Bor}^2 * \text{pi} * \text{Str} \}$

Please press the button



again...

...and see the result as above:

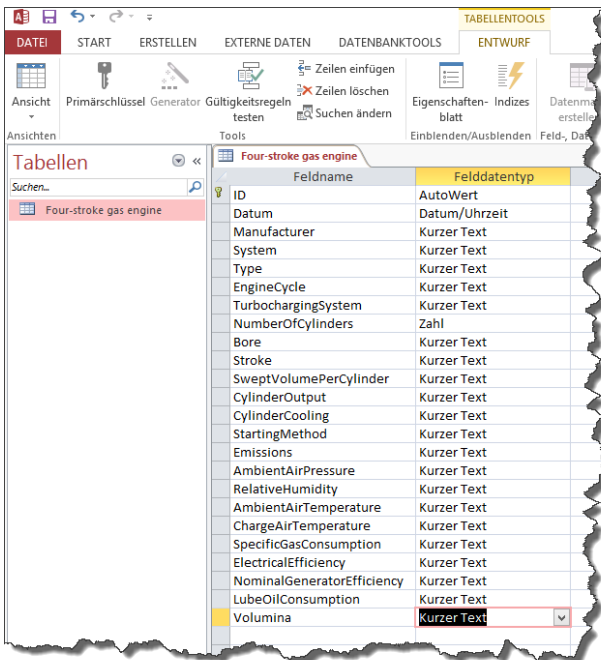
$V = 122,569 \text{ liter}$

16.3.7 Calculating and Storing in Database

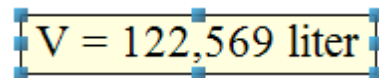
The values are displayed according to the calculation in the evaluation and can also be stored as such.

After the calculation, maybe you want the data stored back in the same database or in a different on another machine.

To do this, please follow the steps...

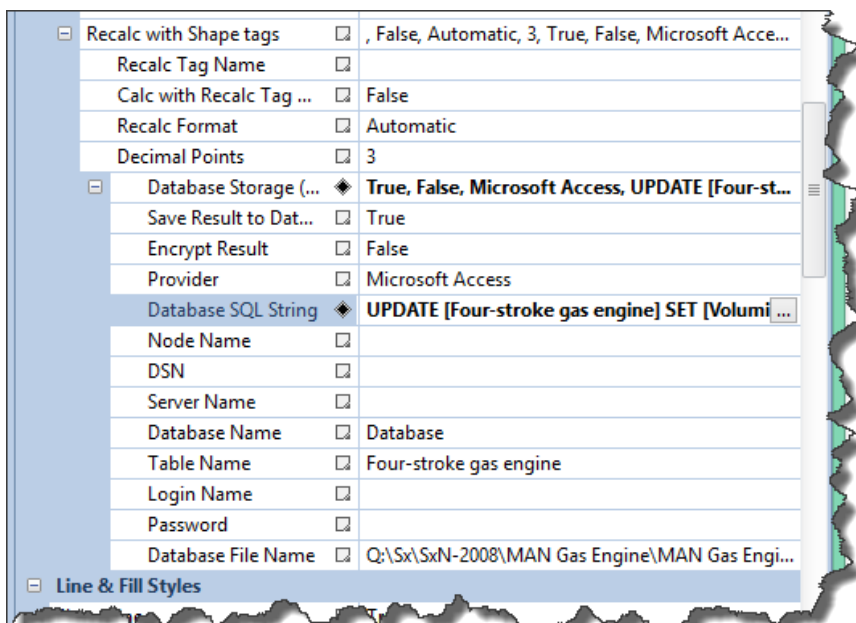


1. Use Microsoft Access and expand the database to create a new column named *Volumina*.

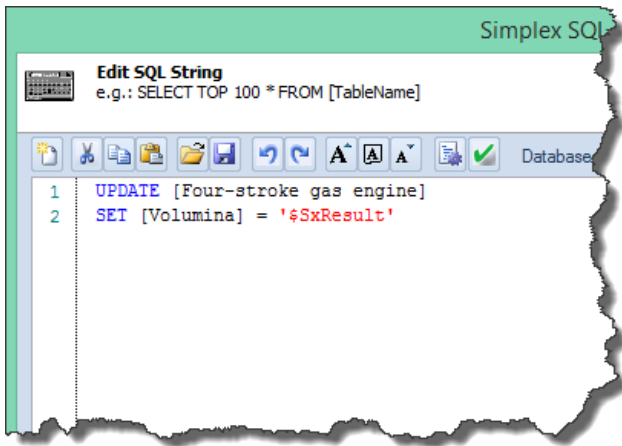


2. ...click on the evaluation sheet.

3. Editing the Properties under the heading: *Recalc with Shape tags*



- ➔ Please put *Save Result to Database on True*
- ➔ Please let *Encrypt Result on False*
- ➔ Provider is Microsoft Access
- ➔ The Filename should be the same, too.
- ➔ The Database SQL String must be adapted for writing on a database.
- ➔ In order to make it not too complicated, a simple update string is used (as shown in the next picture):



Important:

The alias name **\$SxResult** is always given as a synonym for the expected result of the program calculation. → Therefore, the result is entered in this variable!

Hint:

Here is a more complex SQL statement (for Microsoft SQL Server):

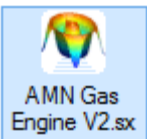
```
IF NOT EXISTS (SELECT * FROM [DBResults].[dbo].[CalcTbl]
WHERE [myStringVar1] = '$Var1'
AND [ExperimentNo] = $ExperimentNr)
INSERT INTO [DBResults].[dbo].[CalcTbl] ([myStringVar1], [ExperimentNo],
[Volumina])
VALUES ('$Var1', $ExperimentNr, '$SxResult')
ELSE
UPDATE [DBResults].[dbo].[ CalcTbl]
SET [Volumina] = '$SxResult'
WHERE [myStringVar1] = '$ Var1'
AND [ExperimentNo] = $ExperimentNr
```

der	LubeOilConsumption	Volumina
	18V51/60G: 9.0 kg/h	122,569

The 'Volumina' column header and its corresponding value '122,569' in the first data row are circled in red.

We have understood that the result of the executing - after the menu item **Recalc Selected Text Label(s)** - is set to the variable **\$SxResult** and that it needs a SQL-Statement to update the database.

Now, press this button and look to the Microsoft Access Database to the column *Volumina*; there should be the value 122.569 in the cell beneath.



If not, then please load the sample evaluation and compare these with yours.

16.4 Filling Documents Report



The Document Report was introduced in chapter 16.2. Now, we referring back to...

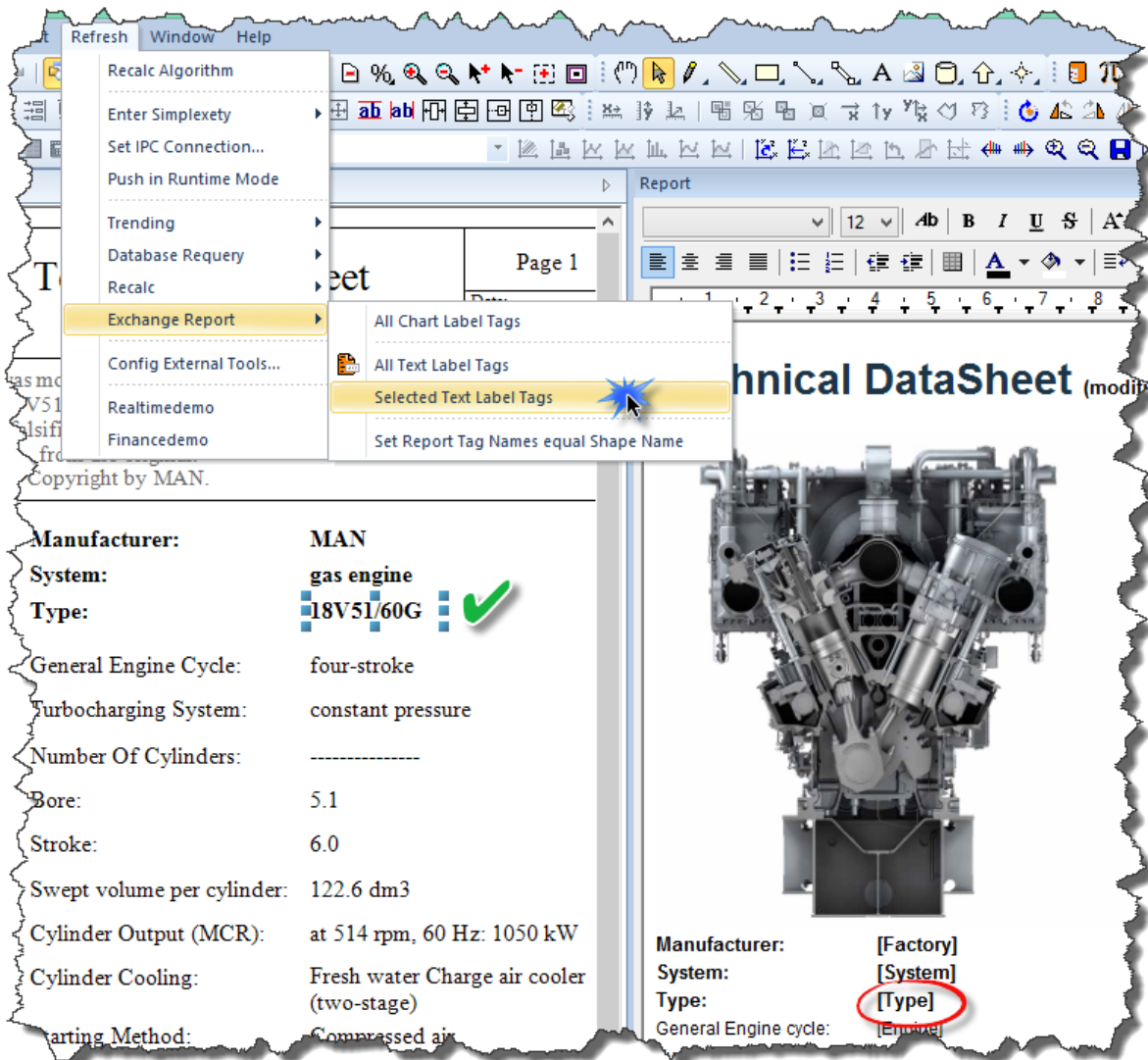
➔ The point is to feed out the placeholders with data from the evaluation.

Manufacturer: [Factory]

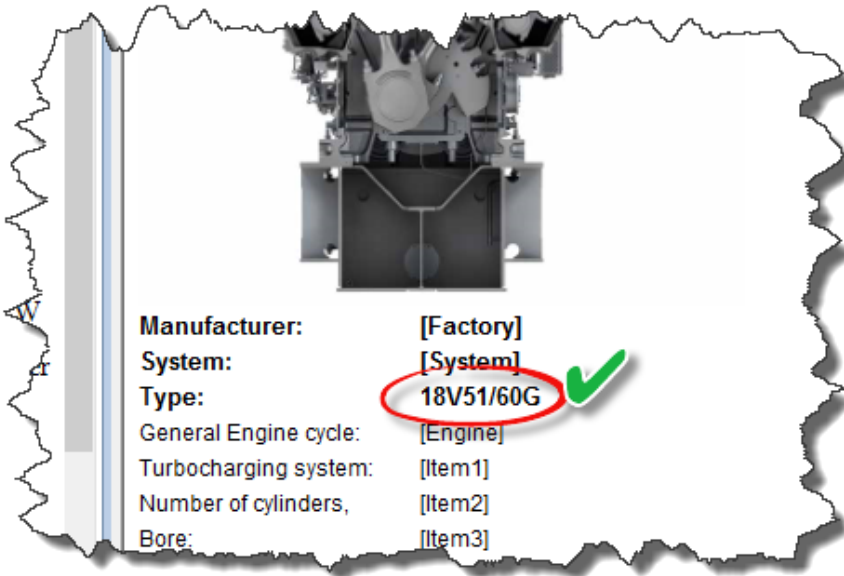
System: [System]


Type: [Type]

Take for example the type of the machine with the same *Shape Name* "Type". After the database query, the *Shape Text* will be filled with the string „18V51/60G“.This string is to be written in the document Report. As this has been already provided above with wildcards, a menu item must here be invoked only, see next picture.



➔ After running *Exchange Report*, the value of the evaluation is in the report.



 All Text Label Tags

To describe all the Report placeholders, please use the menu item:

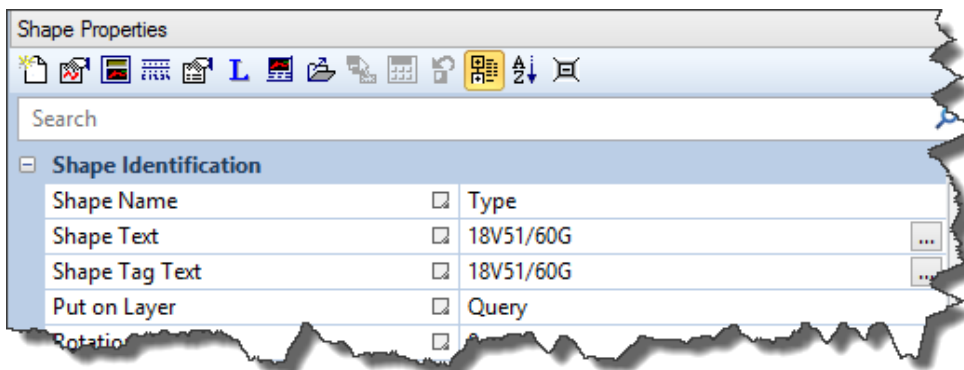
Let's look again at the placeholders used above:

Manufacturer: [Factory]

System: [System]

Type: [Type]

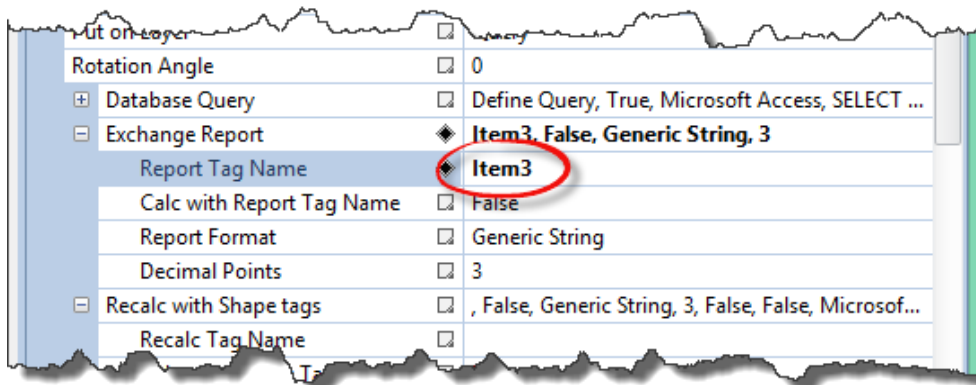
- Compared to the *Text Label Name (Shape Name)* in the Properties:



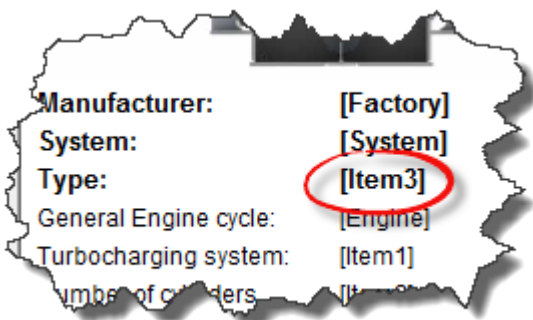
They are the same; both are called „Type“. If this is not the case, then there must be a possibility to enter the corresponding placeholder name.

➔ Use the Properties *Report Tag Name* to put in a different placeholder name (e.g. Item3).

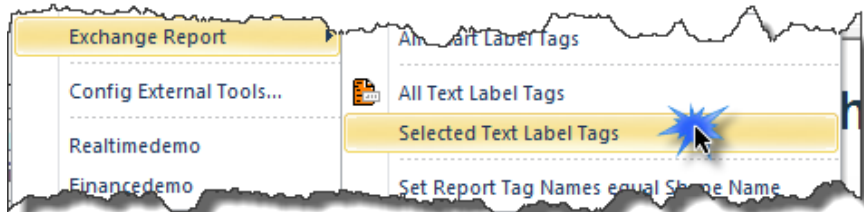
Prime Example, Generate Reports



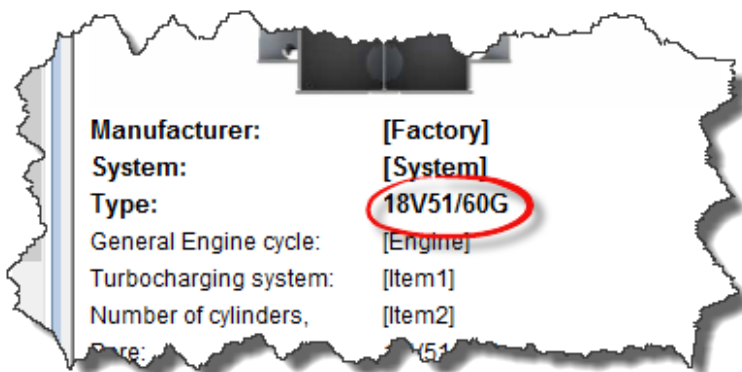
In the report, to be seen as:



The result is by calling the menu item...



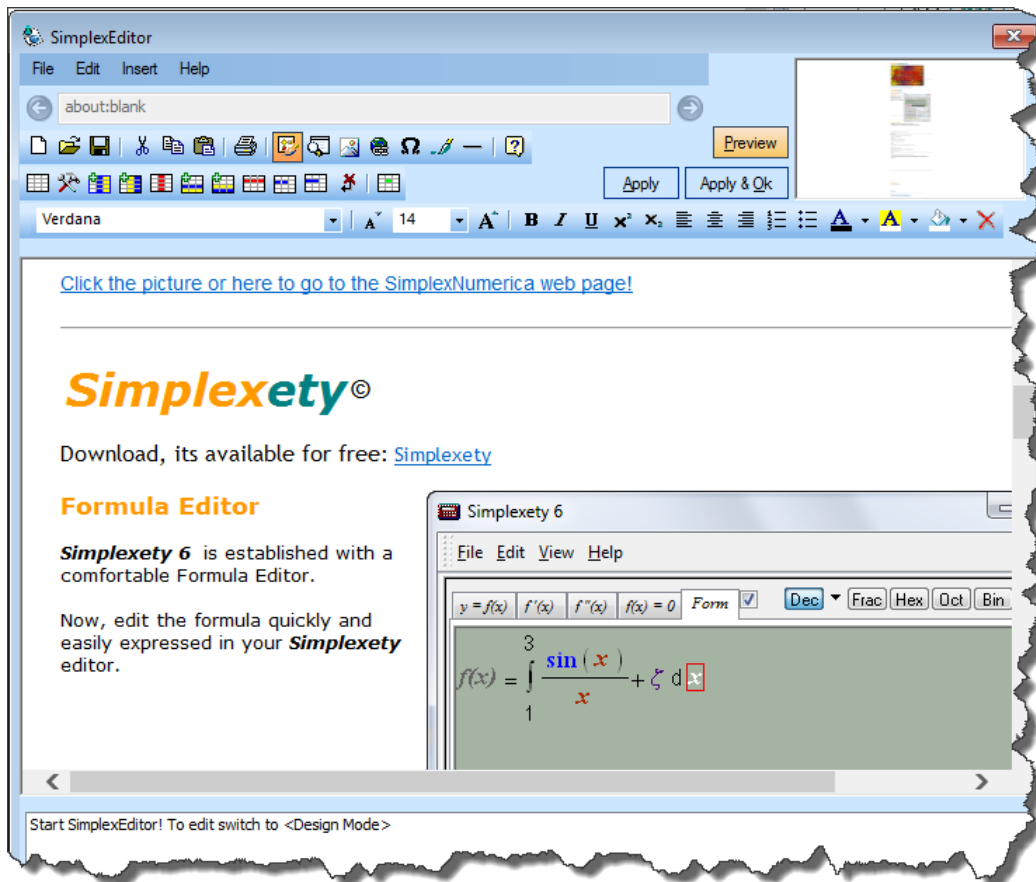
...the same as above!



That's it!

17 Advanced Label Editor

This here is a short description of the extended **SimplexEditor** inside *SimplexNumerica*. A simple HTM text, table and graphic editor. It can load web pages from the internet or from your harddisk. It has a design and runtime mode and a source editor.

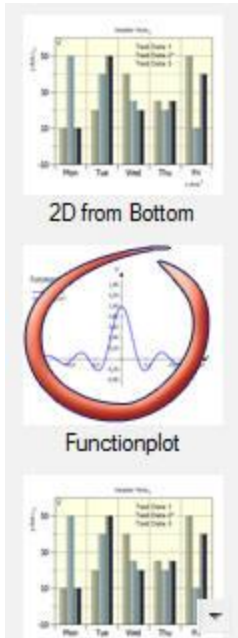


UNDER CONSTRUCTION

We will describe this chapter only at popular request!

18 Working with Function Plots

18.1 Insert a Function

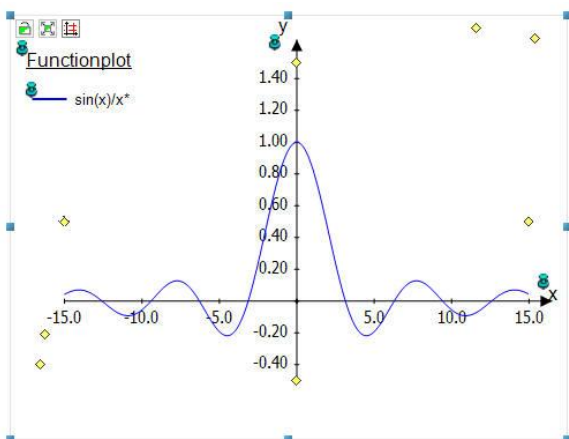


Close all evaluations (Tab-views), use the *Science Plots*, and click on the **Functionplot** thumbnail to open a sample chart object. Remove the graph with the name *Scatter Data*.

Then use the Pulldownmenu **Algorithm, Function Plot** and one of the sub-menus (e.g. *Regular Function Plot*) either to call the calculation program *Simplexety* or directly to open the Function Plot Properties (Use or close *Simplexety*).

Graph Properties	
Graph Name	Function
Graph Legend	sin(x)/x
Display this Graph	True
Show ErrorData	False
Ignore for AutoScale	False
Algorithm	
Algorithm	Misc.
Misc.	Regular Function Plot
f: y = f(x) =	sin(x)/x
Customize	
Intervals	-15.000000, 15.000000, ...
Display	Graph Plot
No. of Curve Points	300
Graph Attitude	
Marker/Lines Setup...	10, 0, 1
Show Marker	False

Function Plot Properties



Put the formula **| sin(x) / x |** in the y = f(x) field and look to the chart to see the function plot.

All other Function Plots will work the same way.

18.2 Function Types

You can choose between three different types of functions:

1. Standard Function,
2. Parametric Function
3. Polar Function.

A standard function is defined as $y = f(x)$, i.e. for each x-coordinate there is exactly one y-coordinate. For a parametric function the x- and y-coordinates are calculated from an independent variable t, called the parameter, i.e. a parametric function is defined as two functions: $x(t)$ and $y(t)$.

A polar function $r(t)$ indicates an equation to calculate the distance from the origin to a point on the function given an angle t. t is the direct angle between the initial ray and the point on the function. This means that the x- and y-coordinates are given as $x(t) = r(t) * \cos(t)$, $y(t) = r(t) * \sin(t)$.

Function Equation

The equation for a function can be $f(x)$, $x(t)$, $y(t)$ or $r(t)$ depending on the function type. Under List of functions, you can see all the available variables, constants and functions, which may be used to draw the graphs.

Argument Interval Range

You can choose an interval for the independent variable. *Graph From* and *Graph To* indicates the start and end of the interval. The graph range should be inside the chart range.

☐ Intervals	-15.000000, 15.000000, ...
Graph From	-15.000000
Graph To	15.000000
Chart xmin	-15.000000
Chart xmax	15.000000
Chart ymin	-0.500000
Chart ymax	1.500000

No. of Curve Points

You have to specify the number of steps for which you want the function to be evaluated. When you specify a higher number of steps, the graph will appear smoother, but it will take longer to plot.

Display Graph Plot or Graph Data

Imagine the $\tan(x)$ function, it has to be drawn in steps instead of one polygon line because the points will get infinite. Graph Plot will plot the functions in steps, Graph Data in one polygon line.

Graph Plot will not produce any Graph Data (e.g. for cursor, storage, etc.).

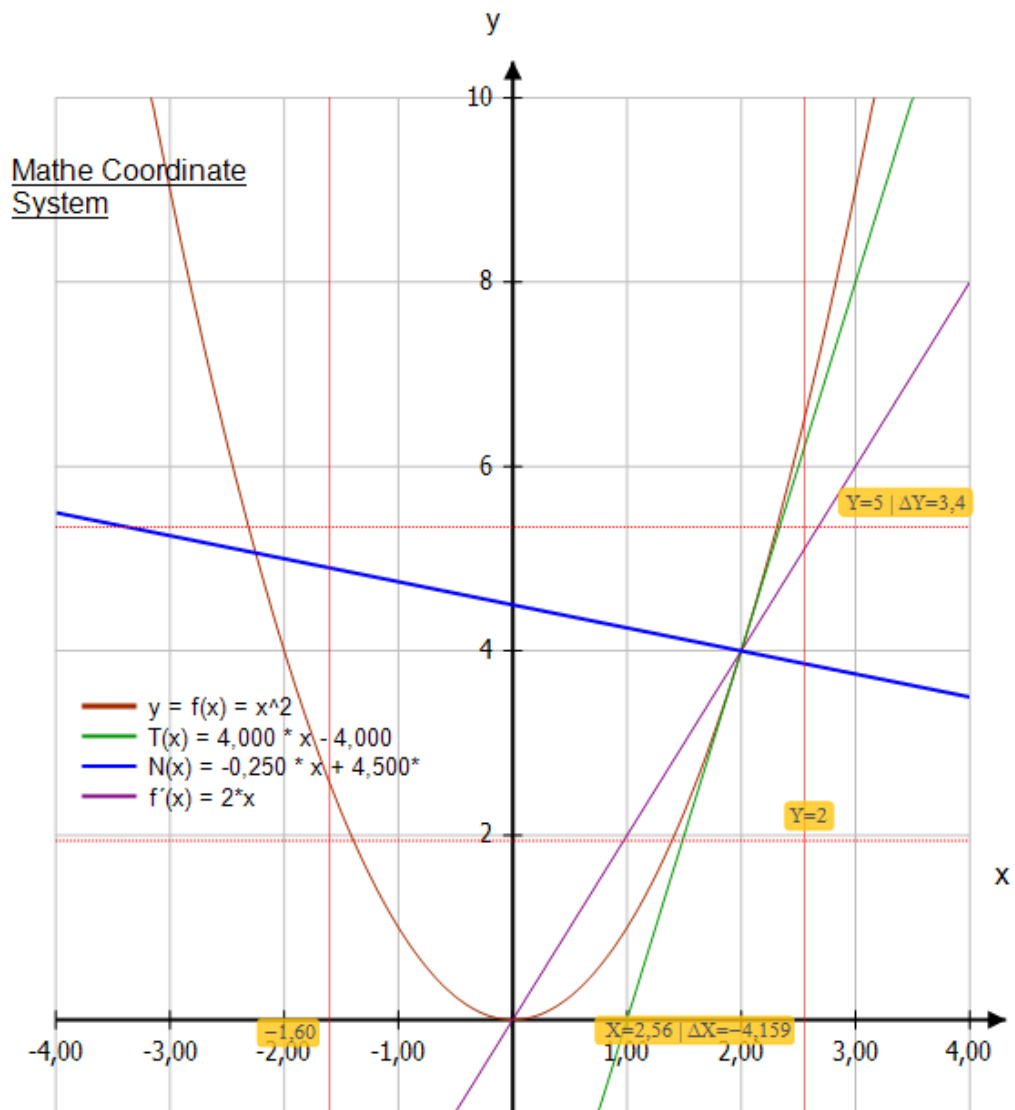
Recalc

Only for Graph Data available to explicitly calculate the graph data.

18.3 Add Tangent / Normal

Use Pulldownmenu **Algorithm**, *Function Plot* and then Add Tangent or Add Normal to a function.

A tangent is a straight line that touches the graph of the function at a given point without crossing it. The tangent may however cross the graph elsewhere. A normal is a straight line perpendicular to the graph of the function at a given point. If the item is a standard function, the point is identified by the x-coordinate, while the point is identified from the independent t-parameter for parametric and polar functions.



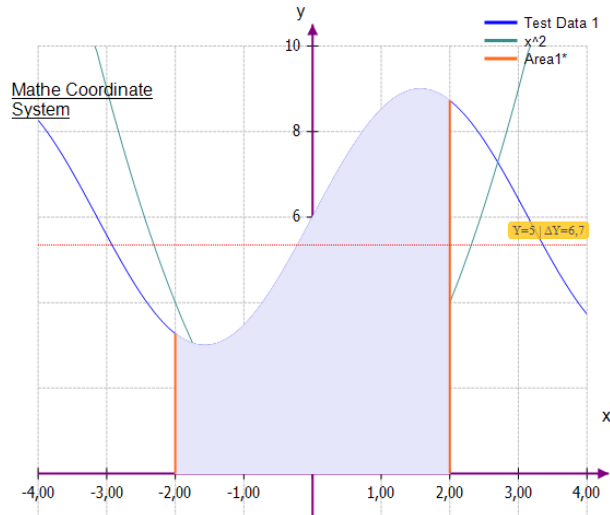
Hint:

A Normal looks not "normal" in the chart when the x-scale is different from the y-scale (see above)!

18.4 Fill Area

You can fill an area between graphs or the x-axis in the chart.

Please load the demo evaluation *Fill Area.sx* from the example folder to see how it works.



Algorithm	
Algorithm	Misc.
Misc.	Fill Area
First Graph	$\sin(x)$
Second Graph	x^2
Area	Between Function and x-...
Intervals	-2.000000, 2.000000, -2.0...

The Area can be filled as:

Between function and x-axis

This is the most commonly used type of shading. This will shade the area between the graph of the function and the x-axis in the selected interval. If you check Decrease to intersection or Increase to intersection, the interval will decrease or increase until the graph is crossing the x-axis.

Between function and y-axis

This will shade the area between the graph of the function and the y-axis in the selected interval. This is rarely used and probably most useful for parametric functions. Notice that you still use the x-coordinates for the interval. If you check Decrease to intersection or Increase to intersection, the interval will decrease or increase until the graph is crossing the y-axis.

Below function

This will shade the area below the graph of the function down to the bottom of the graphing area in the selected interval. If you check Decrease to intersection or Increase to intersection, the interval will decrease

or increase until the graph is crossing the bottom of the graphing area.

Above function

This will shade the area above the graph of the function up to the top of the graphing area in the selected interval. If you check Decrease to intersection or Increase to intersection, the interval will decrease or increase until the graph is crossing the top of the graphing area.

Inside function

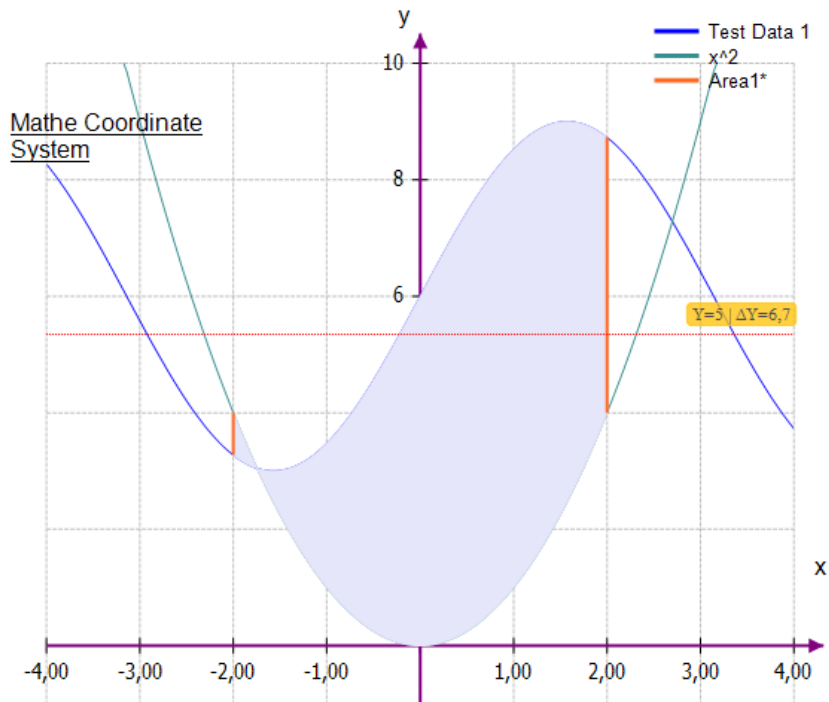
This will shade the area inside the graph of the function in the selected interval. If you check Decrease to intersection or Increase to intersection, the interval will decrease or increase until the graph is crossing itself. This is especially useful to shade a closed part of a parametric or polar function, but it can also be used to shade standard functions.

Between functions

This will shade the area between the graphs of two functions. The first function is the one you selected in the function list in the main window, before you invoked the dialog. The second function is selected in the list box in the 2nd function tab. For standard functions, the interval will be the same for the two functions. For parametric functions, you may select different intervals for the two functions. If you don't select an interval for the second function, it will use the same interval as the first function.

Second Graph

When you have chosen *Between functions*, you may select the second graph function in the Second Graph field of the properties.



Algorithm	
Algorithm	Misc.
Misc.	Fill Area
First Graph	$\sin(x)$
Second Graph	x^2
Area	Between Functions
Intervals	-2.000000, 2.000000, -2.0...

Shading Range for Second Graph Function

This is used to select the interval for the second function, just like you selected the interval for the first function in the property field. This is only available for parametric functions and not for standard functions. For standard functions, the interval for the second function is always the same as the interval for the first function. If you enter neither a start nor an end of interval for a parametric function, the values for the first function will be used for the second function as well. Shadings are a great way to mark an area, but if you get weird results, check that you selected the right function and the right interval. If you try to shade an interval crossing an asymptote or your shading is associated with a weird parametric function, you might get weird results.

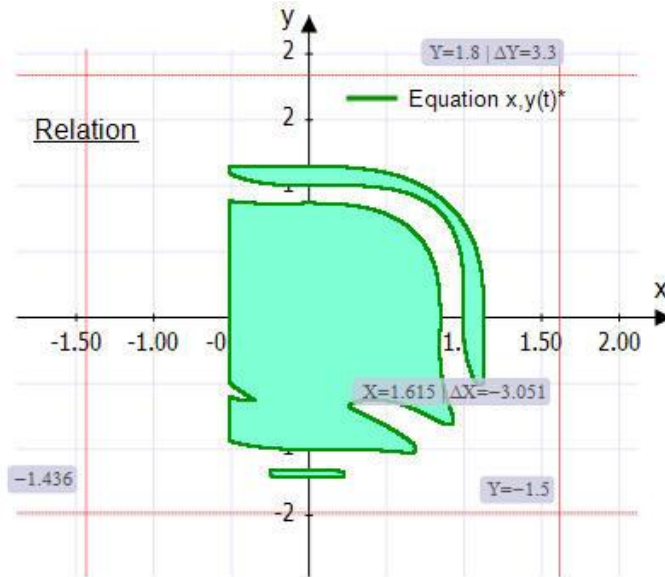
Area	Between Functions
Intervals	-2.000000, 2.000000, -2.0...
Graph1: Area From	-2.000000
Graph1: Area To	2.000000
Graph2: Area From	-2.000000
Graph2: Area To	2.000000
Chart xmin	-4.000000
Chart xmax	4.000000
Chart ymin	-1.000000
Chart ymax	10.000000

18.5 Relation Plot

Relation is a common name for inequalities and equations, also known as implicit functions.

Use Pulldownmenu **Algorithm**, *Function Plot* and then *Relations (Equations/Inequality)*. This menu is used to insert a relation in the coordinate system.

Please load the evaluation *Relation1.sx* from the example folder *..\Examples\Functionplot*



Algorithm	
Algorithm	Misc.
Misc.	Relation Plot
Relation	$x^2+y^2 \leq 1+0.5 \cdot \sin((x^3+y^3) \cdot 2\pi)$
Constraints	$x > -0.5$
Customize	
Intervals	-1.879245, 2.120755, -1.879245, 2.120755, -...

Relation

Here you enter the relation you want to graph. This must be either an equation or an inequality. x and y are used as the independent variables.

An **equation** is a statement that one quantity equals another and the quantities must be separated by the = operator. For example the equation $x^2 + y^2 = 25$ will plot a circle of radius 5.

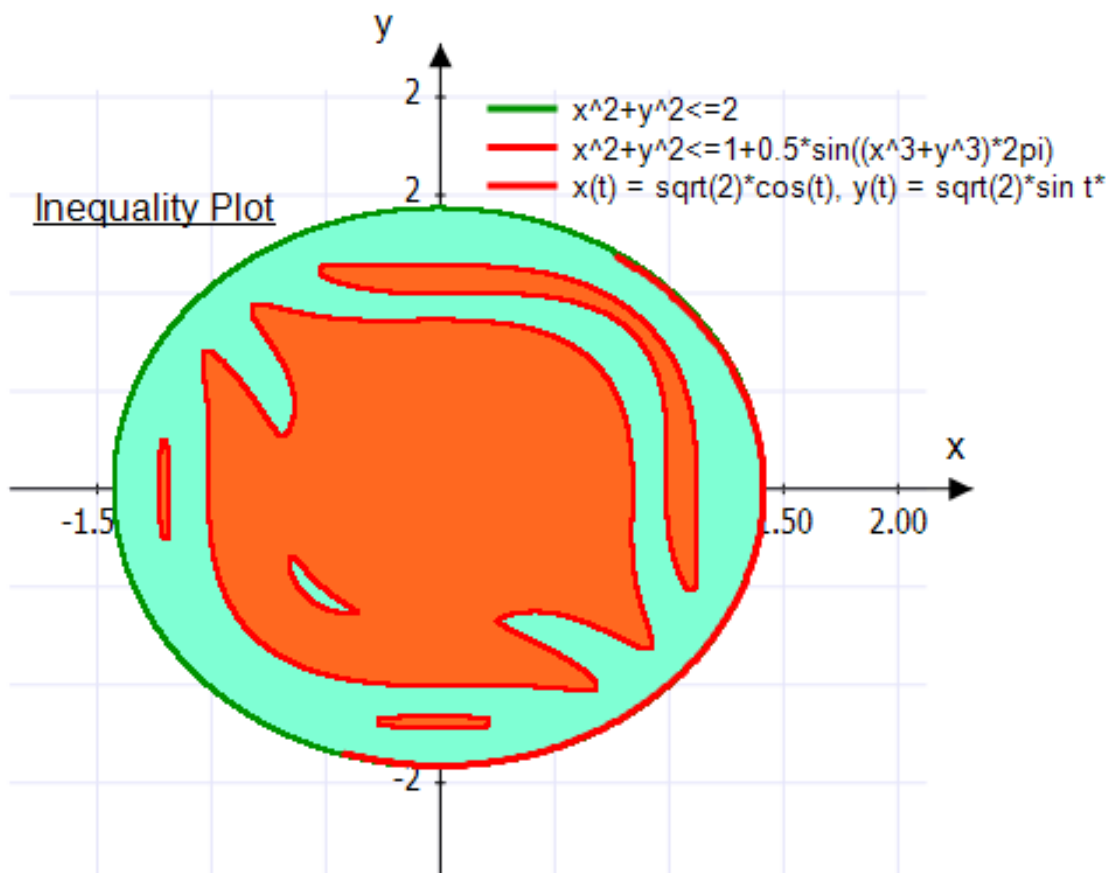
An **inequality** is a statement that one quantity is greater or less than another, and the quantities must be separated by one of the four operators: <, >, <=, >=. An inequality can for example be $\text{abs}(x) + \text{abs}(y) < 1$. Two operators can be used to specify a range, for example $y < \sin(x) < 0.5$.

You can use the same operators and built-in functions as for plotting graphs of functions. In addition, you can also create custom functions.

Constraints

Here you can enter optional constraints, which can be any numeric expression. The relation will only be valid and plotted where the constraints are fulfilled, i.e. evaluates to a non-zero value. The constraints usually consist of a series of inequalities separated with the logical operators (and, or xor). As for the relation, x and y are used as the independent variables. For example, if you have the relation $x^2 + y^2 < 25$, which is a shaded circle, the constraints $x > 0$ and $y < 0$ will only show the part of the circle in the 4th quadrant.

Here is the same example adapted from the famous program Graph:



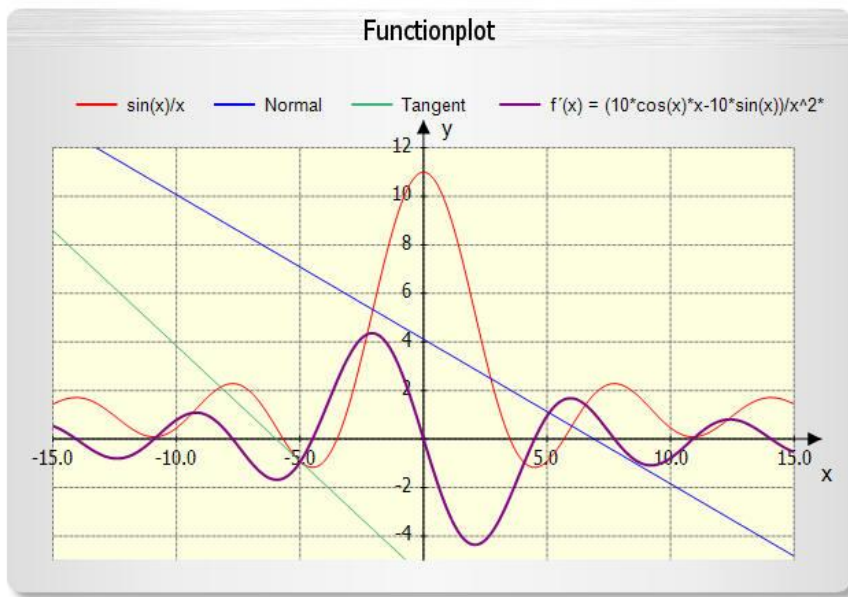
Adapted from the program Graph© by Ivan Johansen

18.6 Differentiation

This menu is used to create the first or second derivative of a function. To create a derivative, make a new Graph and select the function you want to differentiate. If the function is a standard function, the first derivative is the slope of the function, and it is defined as the function differentiated with respect to x : $\rightarrow f'(x) = df(x) / dx$.

Tip:

You can load the example evaluation ..\Examples\Functionplot\Functionplot.sx to see how it works!



The violet colored curve is the first derivative of the red colored function $\sin(x)/x$.

Next see the entries of the **Chart Explorer** and the according Properties for this chart, whereby the graph with the name Differentiation is selected and hence active in the Property Window.

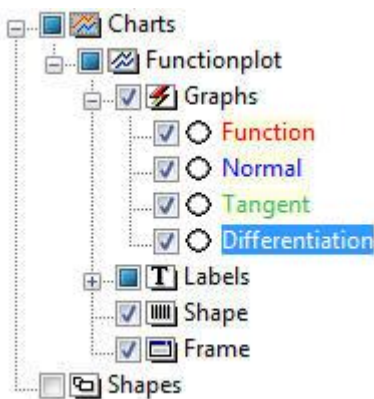


Chart Explorer

Algorithm	
Algorithm	Misc.
Misc.	Differentiation
Derive from Graph	Function
From its Function or Data	Function Plot
Degree	1
Intervals	-15.000000, 15.000000, -...
No. of Curve Points	300
Recalc	
Undo	

Properties

Hint:

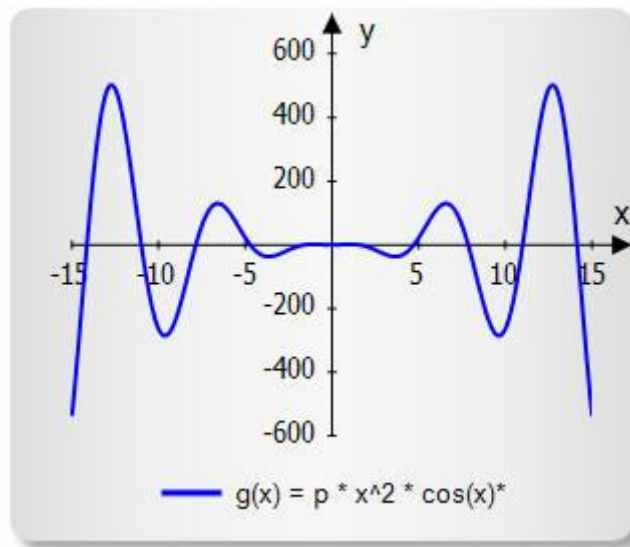
After pressing the button *Recalc* the function (in text form) of the first derivative is setting in the *Graph Legend* field.

18.7 Custom Functions & Constants

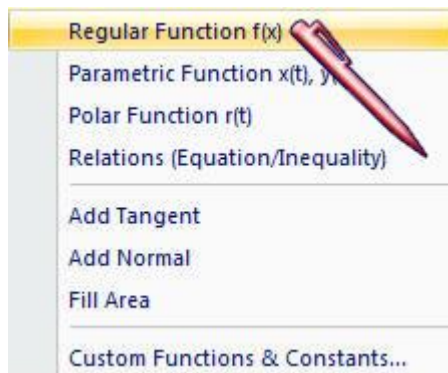
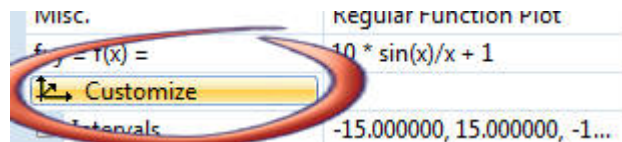
SimplexNumerica allows you to define your own custom functions and constants, which you can use in other expressions in the program. You may want to use this to factor out frequently used constants and sub-expressions to make it faster and easier to use these items.

Tip:

You can load the example evaluation `..\Examples\Functionplot\Custom Functions2.sx` to see how it works!

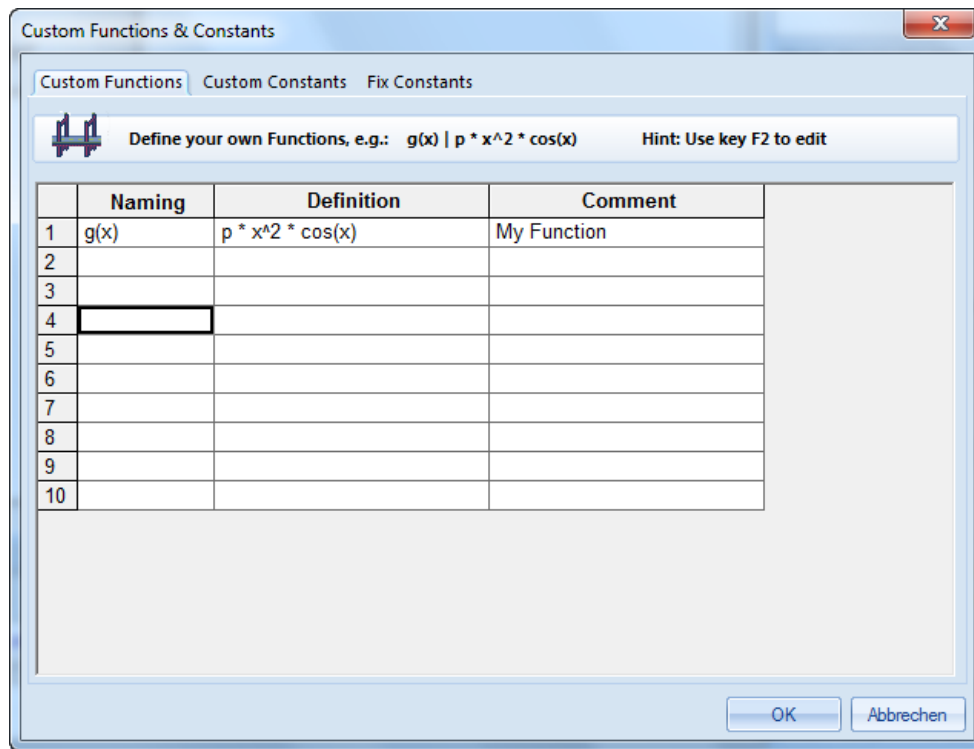


Please use the Pulldownmenu **Algorithm**, *Function Plot* and then *Custom Functions and Constants* or click in the Properties on the button *Customize* as shown below:



Hint: The button is available only if a *Graph* made by a *Function Plot* is selected.

Now, if you click on the button *Customize* the following dialog appears:



Entering functions

The names of the functions (or constants on the other dialog tab) are entered in the first column *Naming*. The name may contain any combination of letters, digits and underscore, but it must always start with a letter. You may not use a name that is already assigned to a built-in function or variable. Function arguments are entered after the name in brackets separated by comma, e.g. $f(x,y,z)$ is a function named f taking three arguments named x , y and z . Like the function name, the argument names must start with a letter and only contain letters and digits. The expressions you want to define are entered in the second column. The expressions can use the arguments specified in the first column and all built-in functions, other custom functions and constants, and even call themselves recursively. A comment can be written after a $\#$ symbol at the end of an expression.

Changing and removing functions

You can remove a function or constant by clearing the name and definition. All elements using the deleted function or constant will fail when evaluated. When you press Ok in the shown dialog, all elements are updated to reflect any changes to the functions and constants.

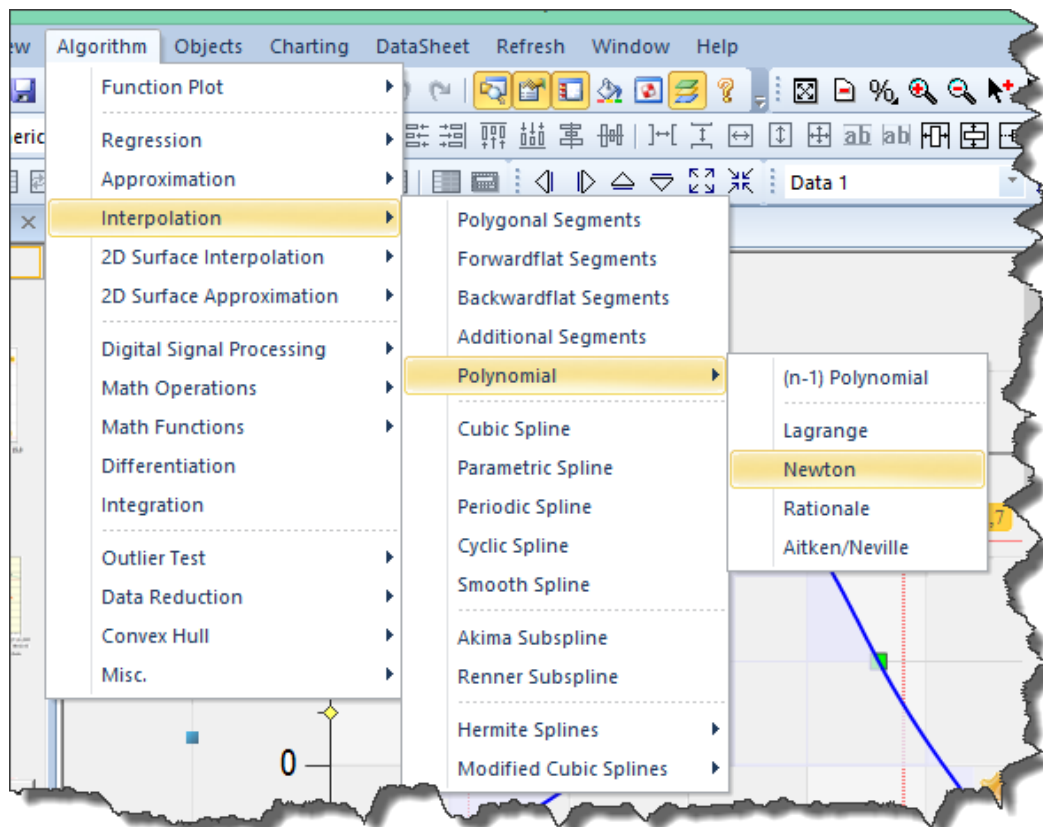
List of functions

Please see Appendix A for a list of functions...

19 Algorithm in *SimplexNumerica*

Curve and surface algorithm are important topics in *SimplexNumerica* for geometric modelling and visualization courses. The algorithm functions in *SimplexNumerica*, especially the Interpolation and Approximation algorithm, providing another level of sophistication.

In many situations such as surface re-engineering and facial movement animation, you may specify a set of data points that describes a desired shape (e.g., surface model) through any probing or scanning, and obtain a surface that contains all data points. Interpolation is also important in computer animation. An animator may specify a number of key camera positions and orientations (i.e., key frames), interpolate these positions with any Spline curve (i.e., camera path), and interpolate the key frames with additional frames. While interpolation can produce a curve/surface that follows the shape of the data points, it may oscillate or wiggle its way through every point. Approximation can overcome this problem so that the curve/surface still captures the shape of the data points without containing all of them.



Nowadays, at the age of [Wikipedia](https://en.wikipedia.org/), it makes no sense to blow-up a documentation with detailed information about specific algorithm. Instead, we will set a link to interesting articles.

SimplexNumerica provides the following algorithm:

19.1 Function Plot

Here you will find the following functions:

- Regular Function $f(x)$
- Parametric Function $x(t), y(t)$
- Polar Function $r(t)$
- Relations (Equation/Inequality)
- Add Tangent
- Add Normal
- Fill Area
- Custom Function Constants

⇒ Please have a look at chapter 18 for detailed information.

19.2 Regression

- Linear Least Squares Fit
http://en.wikipedia.org/wiki/Regression_analysis
- Robust Linear Regression
http://en.wikipedia.org/wiki/Robust_regression
- Exponential Least Squares Fit
<http://mathworld.wolfram.com/LeastSquaresFittingExponential.html>
- Logarithmic Least Squares Fit
<http://mathworld.wolfram.com/LeastSquaresFittingLogarithmic.html>
- Power Least Squares Fit
<http://mathworld.wolfram.com/LeastSquaresFittingPowerLaw.html>
- Invers Least Squares Fit
<http://mathworld.wolfram.com/LeastSquaresFitting.html>
- Invers Least Squares Fit2
<http://mathworld.wolfram.com/LeastSquaresFitting.html>
- n-dim. Polynomial
<http://mathworld.wolfram.com/LeastSquaresFittingPolynomial.html>
- Quadratic Polynomial
http://en.wikipedia.org/wiki/Quadratic_function
- Cubic Polynomial
http://en.wikipedia.org/wiki/Cubic_function
- Sine Wave
- Line Form
- Circle Form
- Ellipse Form
- Inner Circle Arcs
<http://www.codeproject.com/Articles/282972/Curve-representation-by-ICAS-Inner-Centered-Arcs>

Consider the nature of most experimental data. Typically, such data include noise due to many different effects. The noisy data from an experiment might appear as shown in the following Table and Figure. We assume that the x values are accurate. Visual inspection of the data suggests a positive relationship between x and $y = f(x)$, i.e., higher values of y are associated with higher values of x . One strategy for deriving an approximating function for this data might be to try to fit the general trend of the data without necessarily matching the individual points. A straight line could be used to generally characterize the trend in the data without passing through any particular point. The line in next Figure has been sketched through the points. Although this approach may work well in many cases, it does not provide us with any quantitative measure of how good the fit of the line is to the data. We need a criterion with which to measure the *goodness of fit* of the line to the data. One way to do this is to derive a curve that minimizes the discrepancy between the data points and the curve. The technique for accomplishing this is called *least-squares regression*.

Often data are available at discrete points and we require estimates at points between the discrete values. In this section, we will discuss techniques to fit curves to data in order to estimate intermediate, or fitted, values. Two methods of curve fitting are generally considered, depending on the amount of error in the data. When the data are known to be precise, the method of interpolation is used. The primary purpose of interpolation is to provide information between tabular data, and, as accurately as possible, to force the approximating function to assume exactly the value provided at each of the points where the data is supplied. For significantly “noisy” data, a single curve representing the general trend of the data is derived by the method of *least-squares regression*.

In statistics, Regression means finding a description of a data set. For example, if a data set fits into a normal distribution, the whole data set can then be described by two numbers: its mean and standard deviation.

The next functions are also available in SimplexNumerica:

Linear Least Squares: $y = a + b x$

Exponential function: $y = a e^{bx}; a > 0$

Logarithmic function: $y = a + b \ln(x)$

Power function: $y = a x^b; a > 0$

Power function with weighting: $y = a x^b; a > 0$

Parabolic Regression: $y = a + bx + cx^2$

Cubic Regression: $y = a + bx + cx^2 + dx^3$

Polynomial 0-9ten of degree $y = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \dots + a_n x^n$

The coefficients are determined by the solution of the Gauss' Eliminationsverfahren with partial Pivotierung.

Error messages result:

During logarithmic computation by values for $x_i < = 0$;

During exponential computation for values of $y_i < = 0$;

During computation to a power function, x_i and y_i must be positive values.

The results will be shown in the Output Window.

19.3 Sample Consensus

- Random Sample Consensus (RANSAC)
<http://en.wikipedia.org/wiki/RANSAC>
- Progressive Sample Consensus (PROSAC)
- Randomized RANSAC (RRANSAC)
- Least Median of Squares (LMEDS)
- M-Estimator Sample Consensus (MSAC)
- Randomized MSAC (RMSAC)
- Maximum Likelihood Estimation Sample Consensus (MLESC)

⇒ Please have a look at chapter 20. Here you can find a fictive sample chapter about these functions.

19.4 Approximation

Approximation or Fitting means finding a smooth curve that describes the underlying pattern without necessary to touch it data points.

- Standard Simplex Algorithm
- Gauß Algorithm
- Bezier
- Bezier V2
- B-Spline
- Smoothing Spline
- Param. Smoothing Spline
- Cyclic Smoothing Spline

19.4.1 Simplex-Fit

The Simplex-Algorithm or shorter Simplex-Fit is a very effective procedure for a nonlinear Fit. The Simplex algorithm function performs non-linear approximation of all the parameters that have been in the formula marked to be floated. As always in non-linear approximation, good starting guesses are essential (for the nonlinear parameters).

Therefore, before executing the fit command, it is essential that parameter estimates are entered into the Formula parser. A similar fitting strategy implemented in SimplexNumerica is the Gauß-Algorithm.

This program originally appeared in the May 1984 issue of Byte Magazine. It was originally written in Pascal by M. S. Caceci & W. P. Cacheris at Florida State University. This program is based upon the Simplex curve fitting algorithm. For a detailed description of this program and its workings see the above mentioned article. I acknowledge the work of Marco Caceci and William Cacheris for writing the original Pascal program from which this is derived. The original authors explicitly stated "no copyright".

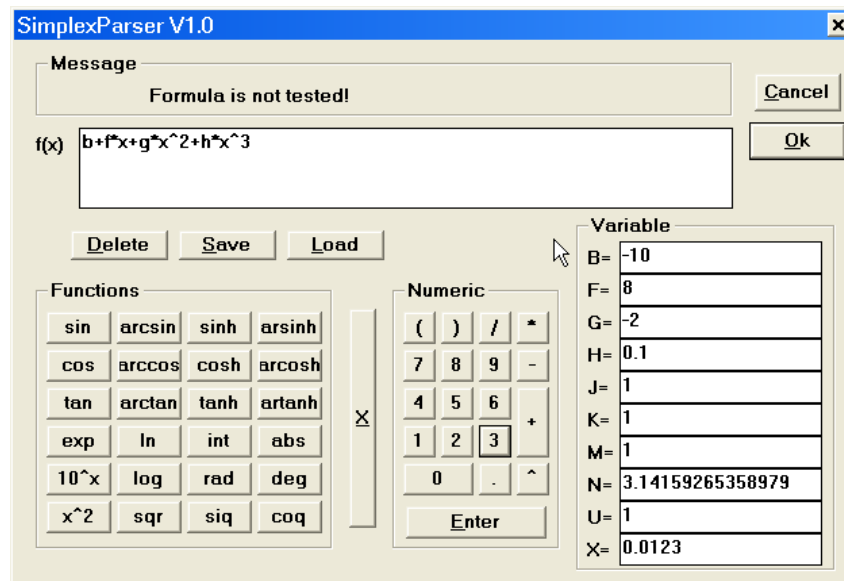
The Simplex-Fit is quite fast and uses no analytical derivative of the fit function. The draw-back is that there is no direct error estimation of the optimized parameters. To get an idea of the error, one would need to repeat the fit very often starting from random initial conditions and then evaluate the statistics of fit results. Although the Simplex-Fit is not always the most efficient approach, it is known to be very stable. Starting from the initial parameter estimates, a set of random variations of the parameters are generated. The sum of squared residuals is calculated for each of the variations, and the simplex algorithm performs a series of optimization steps, in each of which the worst parameter set is eliminated and a better one is introduced. The algorithm is known to be susceptible to 'circling' the optimum, i.e. it can get trapped in a path of parameter values close to the optimum without converging. As convergence criterion, the sum of squared residuals and all of the parameters have to be within the pre-determined Tolerance value. After convergence, the simplex is repeatedly restarted (using randomly selected variations around the previously found optimal values), until the parameters and the values are within the tolerance. Two consecutive simplex procedures are required to converge to the same values and to the same parameter values for the fit to stop. After the simplex has converged, SimplexNumerica will show you the results.

The text output during the fitting procedure shows the number of simulations of the sedimentation process, and the simplex number, the simplex step # and the finite element gridsize. The remaining lines show the values and the parameter values from the current simulation. The last line shows residuals from the current simulation.

Convergence can be observed if the value does change only very little, and when the parameter values stay virtually the same.

The Simplex algorithm used four mechanisms of vertex movements. Vertices are moved toward the minimum point by the four mechanisms, reflection, expansion, contraction, and shrinkage. Reflection moves the highest (worst) vertex to the opposite side of the center of the other vertices. Expansion moves the highest vertex to twice the distance from the center, which is used when a reflected vertex is lower than the lowest vertex and the expanded vertex becomes the lowest one. Contraction moves to the middle between the highest vertex and the center, which is used when a reflected vertex is higher than the highest vertex. When the contracted vertex is still higher than the highest vertex, all the vertices except the lowest vertex move toward the lowest one by half, which is called shrinkage.

Put the function equation (formula) with the associated parameters into the Simplex Formula Parser (SimplexParser).



The operation of the above formula box facilitates the input of the function equation for the user. One can arrange the formula both over the keyboard and by activating the small buttons with the mouse. Go to the Gauß-Fit in this manual for getting more info about the formula parser dialog and the right parameter order.

The parameters are start values for the algorithm. The program varies these parameters and tries to find a minimum of the sum of the discrepancy squares.

If the algorithm found a minimum, then one says: it converges. It can be possible, that there is more than one minimum are available. Then, the algorithm does not have necessarily found the absolute minimum. As abort criteria will be the maximum number of iterations and the difference of the remaining variance between two iterations. When it falls short of these criteria, thus the Fit becomes cancelled. Sometimes it is difficult to find suitable initial values and increments to a convergence of the algorithm.

For this some references:

The initial values should be oriented at the orders of magnitude of the measured values. The increments should amount to approximately a third step of the data, whereby they can be also more largely selected at the beginning. If the algorithm a minimum, it reduces the increment independently. The results of a not handy Fit should be used as new initial values for the next try.

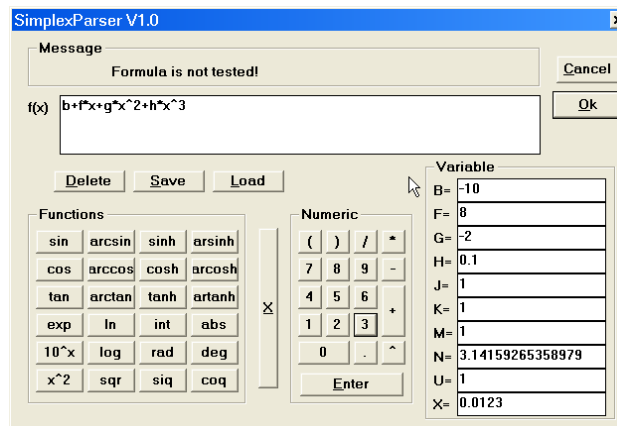
19.4.2 Gauß-Fit

The Gauss-Fit proceeds from the same problem definition as the Simplex-Fit.

Application:

If the intervals of the measuring data move in very small number ranges (e.g. $x_{max} = 10^{-9}$), then it makes sense, to scale the data to larger values, e.g. by multiplication with the factor 10^9 . Reasons for this are the rounding errors of approximation at too small values.

Next the function equation has to be entered into the Formula parser.



The operation of the above formula box facilitates the input of the function equation for the user. One can arrange the formula both over the keyboard and by activating the small buttons with the mouse.

If one presses the Return key, then the program examines the formula immediately and indicates a possible error in form of a message text.

The Gauss' algorithm expects a certain number of parameters from the user, with which it can adapt the entered function equation to the x/y pair (at least 1, at the most 10 parameters).

These parameters are indicated on the right side in the dialogbox. It is very important to know that SimplexNumerica expects the parameters in a right order. If a formula has for instance three parameters, then the parameters in the formula have to be in sequence B, F and then G (and not differently)! It must have the same order as in the dialogbox B, F, G, H, J, K, M, N and U!

These parameters are changed in the course of the calculation by the program and given afterwards as an output result in the **Report Window**.

19.4.3 Bézier-Curves

Bézier curves were independently discovered in the late 1960's by two French engineers, Pierre Bézier and Paul de Casteljau, who worked for different French automobile companies. Bézier curves used in drawing packages are determined by parametric polynomials of low degree, and are used because they give local control of shape, the resulting curves are smooth and continuous, derivatives can be evaluated at any point (although sometimes will be infinite) and are very easy to adapt in SimplexNumerica.

19.4.4 Smoothing Spline

The Smoothing Spline Approximation provides a useful way of approximating a smooth function $f(x)$ only when the data points lie along the path of the function or very close to it. If the data is scattered at random in the vicinity of the path, then an interpolating polynomial, which is bound to follow the same random fluctuations, will belie the nature of the underlying function. Therefore, in the interests of smoothness, we may wish to allow the spline to depart from the data points.

19.4.5 Parametric Smoothing Splines

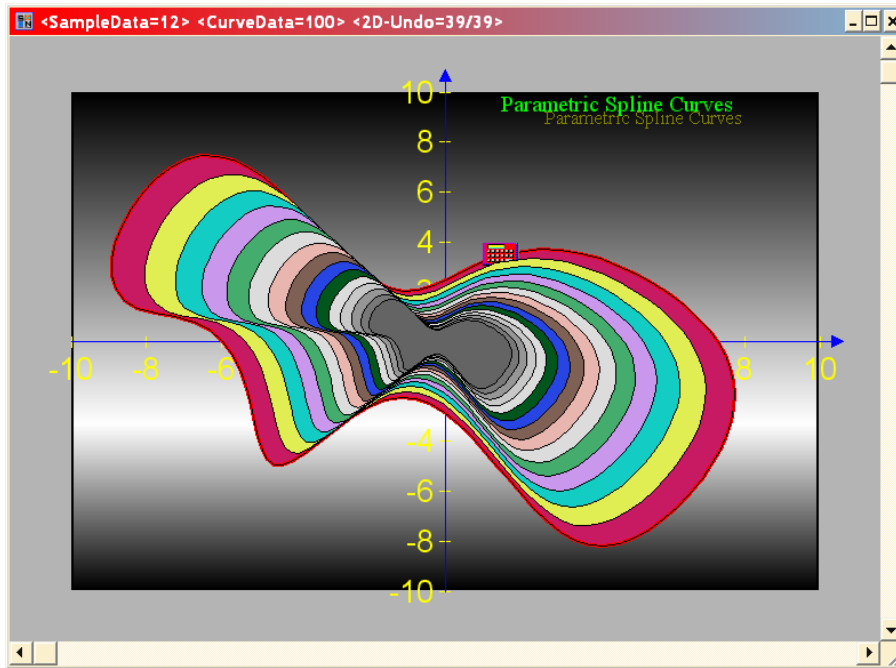
A paper entitled "Connecting the Dots Parametrically: An Alternative to Cubic Splines." which is published in *The College Mathematics Journal* and written by W. Hilderbrand⁵, describes a method for obtaining the parametric equations of a smooth curve that passes through a sequence of points. The method presented shows how to connect any set of n ordered points with smooth curve that is defined parametrically. The arc that connects two successive points is determined by four points, namely, the two points, the point preceding them, and the point following them. Substituting the coordinates of these four points into the general form of the parametric equations completely determines the parametric equations of the arc. At each given point of the ordered set, the tangent to the curve exists and is parallel to the chord that connects the preceding point to the succeeding point. The parametric equation does not require y to be a function of x nor must x values be equally spaced.

⁵ 1. J. H. Ahlberg, E. N. Nilson and J. L. Walsh, *The Theory of Splines and Their Applications*. (Academic Press, New York) 1967.

3. W. J. Hilderbrand, "Connecting the Dots Parametrically: An Alternative to Cubic Splines." *The College Mathematics Journal*, **21**, 208-215, 1990.

19.4.6 Cyclic Smoothing Splines

With the help of the Cyclic Spline function you can interpolate arbitrary closed curves. This splines are particularly appropriate for the representation of closed smooth curves, e.g. for isolines.



19.5 Interpolation

Similar to curve fitting, interpolation methods attempt to find a function (or often a set of functions) that represents a set of discrete data points (SampleData). However, in this case, the data points are considered to be very accurate, such that the approximating relationship must not only pass exactly through each point, but also allow accurate interpolation between them. These methods are most commonly used as a means of obtaining a continuous representation of accurately measured experimental data (e.g., equilibrium data) for subsequent computational purposes. They are also particularly useful in situations where a tedious numerical method has been employed to generate a fairly sparse set of discrete information, and this data must then be used in continuous form as a starting point for some other type of analysis on the computer. For example, when a mathematical function like the sine function is evaluated on the computer, it is not determined from scratch using, e.g., its infinite series representation. Rather, a call to $\sin(x)$ invokes an interpolation method that determines functional values at positions intermediate to a small number of very accurately determined values of the sine function. Interpolation methods are also used extensively in graphical routines, to produce smooth curves connecting a set of discrete points.

Thus the **general point of view** in this chapter can be stated as follows:

Given a set of "accurate" data points, (x_i, y_i) , $i = 1, 2, \dots, n$, construct a function $f(x)$ such that $f(x_i) = y_i$ for each i and $f(x)$ assumes "reasonable" values for all x between the data points.

One approach to the problem of approximating a set of data according to the above criteria is to simply find the $(n-1)$ -order polynomial that passes through all n points. This approach certainly meets the first condition that $f(x_i) = y_i$, but, in most cases, because higher-order polynomials tend to oscillate, it usually won't meet the second. Thus, most interpolating methods attempt to find many separate functions that fit only portions of the data, often just the region between each pair of neighbouring x values. Furthermore, these interpolating functions are usually lower-order polynomials, e.g., quadratics, cubics, quartics, etc.

There are two different approaches that can be taken to find a lower-order polynomial which passes through two neighbouring data points and allows accurate interpolation at all intervening x values. One method is to determine the polynomial that passes exactly through several points surrounding the interpolation interval. This approach is illustrated below, where 3rd-order polynomials are passed through the 4 points (2 on either side) surrounding each interval.

SimplexNumerica provides the following interpolation algorithm:

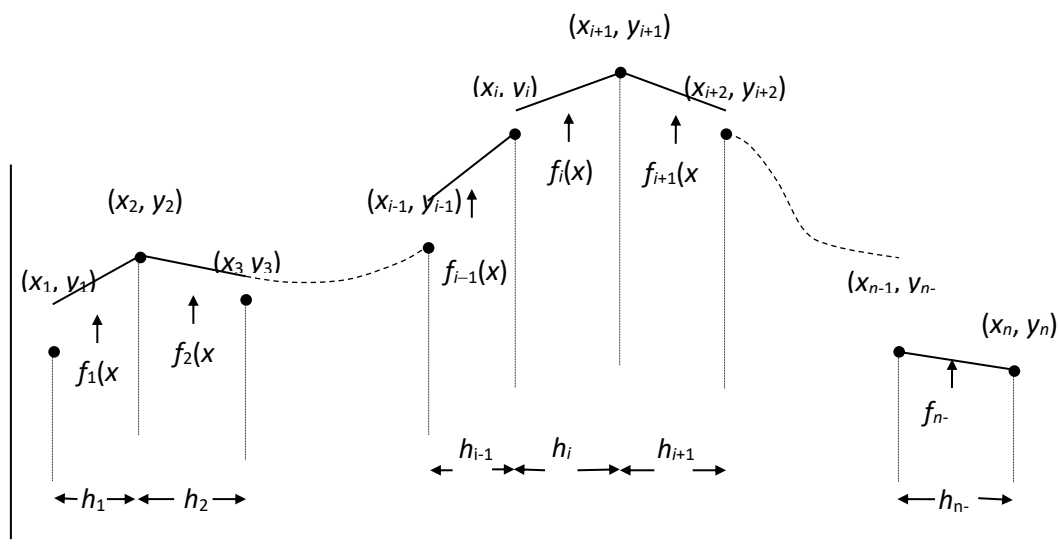
- Polygonal Segments
- Forwardflat Segments
- Backwardflat Segments
- Additional Segments
- Cubic Spline
- Parametric Spline
- Periodic Spline
- Cyclic Spline
- Smooth Spline
- Akima Sub spline
- Renner Sub spline
- Polynomial Interpolation

- (n-1) Polynomial
- Lagrange
- Newton
- Rationale
- Aitken/Neville
- Hermite Splines
- Catmull-Rom Spline
- Kochanek-Bartel Spline
- Cardinal Spline
- Modified Cubic Splines
- Natural Overshooting
- Non-overshooting in 1st Derivative
- Non-overshooting in 2nd Derivative
- Parabolic Interpolation
- Fritsch-Butland Interpolation
- Akima Interpolation
- Kruger Interpolation
- Extrapolation Cubic Spline

The most algorithm can be find in the internet and they are not described here (see the link underneath the bullet point).

19.5.1 Polygonal Curve

The simple polygonal function connects the individual measuring points by straight lines. These straight lines are also present as CurveData. The individual measuring points are not only simply connected; in each subinterval a linear curve is computed. Thus one can integrate or differentiate a polygonal curve.



For a given set of data containing n points, there are $n-1$ intervals and hence $n-1$ separate Polygonal Curve that must be determined. Assume that each pair of neighbouring points, (x_i, y_i) and (x_{i+1}, y_{i+1}) , is joined by a linear Polygonal Curve (i.e., a 1st-order polynomial) of the form:

$$f_i(x) = p_i + q_i(x - x_i), \quad i = 1, 2, \dots, n - 1$$

where p_i and q_i ($i = 1, 2, \dots, n-1$) are $2n-2$ constants that must be determined from the following conditions:

$$\begin{array}{lll} f_i(x_i) = y_i, & i = 1, 2, \dots, n-1 & \longrightarrow \quad n-1 \text{ equations} \\ f_i(x_{i+1}) = y_{i+1}, & i = 1, 2, \dots, n-1 & \longrightarrow \quad n-1 \text{ equations} \\ & & \hline & & 2n-2 \text{ equations} \end{array}$$

The first condition yields:

$$f_i(x_i) = p_i = y_i, \quad \therefore \quad p_i = y_i, \quad i = 1, 2, \dots, n - 1$$

The second condition gives:

$$f_i(x_{i+1}) = y_i + q_i(x_{i+1} - x_i) = y_i + q_i \cdot h_i = y_{i+1}$$

$$\therefore \quad q_i = \frac{y_{i+1} - y_i}{h_i}, \quad i = 1, 2, \dots, n - 1$$

19.5.2 Additive Segmentation

The procedure for the curve with additive segmenting is primarily for series of measurements with a large number of measuring data. The number of **SampleData** should be more than 50, so that one gets a smooth course of the curve.

The algorithm of the Additive Segmentation contains a calculation specification, with their assistance the progression of a function is described by a finite number of values, laying on a curve; their curvature are closely as possible at the point process.

The procedure divides the existing segments (places of the measuring points) with the help of auxiliary points into smaller segments. The number of the added segments depends on the curvature of the function. Within the range of a strong curvature the points are nearer together.

Hint:

For the production of the auxiliary points the number of **CurveData** should be adapted!

19.6 2D Surface Interpolation & Approximation

2D Surface Interpolation

- Bi-Linear
- Nearest Neighbors Linear
- Smoothing Spline
- Thin Plate Surface Spline

2D Surface Approximation

- Nearest Neighbors Distance
- Nearest Neighbors Around Distance
- Thin Plate Surface Spline
- Bivariate Cubic Spline

3D Approximation and Interpolation is sometimes difficult to handle. The result is very depended from the sample data and the used algorithm.

SimplexNumerica has integrated some different algorithm for 3D fits. The following fits are implemented:

- Thin Plate Surface Spline Interpolation
- Thin Plate Surface Spline Approximation
- Bivariate Cubic Spline Approximation
- Nearest Neighbours Distance Weighted
- Nearest Neighbours Linear Interpolation
- Nearest Neighbours Around Distance Weighting

19.6.1 Thin Plate Surface Spline

Thin Plate Surface Spline, or TPS for short, is an interpolation method that finds a "*minimally bended*" *smooth surface that passes through all given points*. TPS of 3 control points is a plane, more than 3 is generally a curved surface and less than 3 is undefined.

The name "Thin Plate" comes from the fact that a TPS more or less simulates how a thin metal plate would behave if it was forced through the same control points.

Thin plate splines are particularly popular in representing shape transformations, for example, image morphing or shape detection. Consider two equally sized sets of 2D-points, A being the original shape and B the target shape. Let $z_i = B_{ix} - A_{ix}$. Then fit a TPS over points (a_{ix}, a_{iy}, z_i) to get interpolation function for translation of points in x direction. Repeat the same for y .

In some cases, e.g. when the control point coordinates are noisy, you may want to relax the interpolation requirements slightly so that the resulting surface doesn't have to go exactly exactly through the control points. This is called *regularization* and is controlled by regularization parameter λ . If λ is zero, interpolation is exact and if it's very large, the resulting TPS surface is reduced to a least squares fitted plane ("bending energy" of a plane is 0). In our example, the regularization parameter is also made scale invariant with an extra parameter α .

19.6.2 Bivariate Cubic Spline

The authors *Jörg Haber, Frank Zeilfelder, Oleg Davydov and Hans-Peter Seidel* from *Max-Planck-Institut für Informatik, Saarbrücken*, have described an article about *<Smooth Approximation and Rendering of Large Scattered Data Sets>*. So search in the internet for this article about Bivariate Cubic Splines.

They have presented an efficient method to automatically compute smooth approximations of large sets of unorganized scattered data points. The method is based on the construction of a differentiable bivariate spline with respect to a uniform triangle mesh over an arbitrarily shaped planar domain. For a uniformly distributed subset of triangles we compute local polynomial least squares approximations by using singular value decomposition (SVD) of small matrices.

The smooth approximating spline is constructed by gluing together these patches using Bernstein-Bezier smoothness conditions. We emphasize the following key features of our method: They develop a completely local approach, which means that we do not use any global optimization or other techniques involving computation with large portions of the data set. They employ the rank-revealing features of SVD to control the polynomial degree of the initial patches, which allows taking into account the local variation and distribution of the data points.

Nearest Neighbor Algorithm

The nearest neighbor query ranks all objects in terms of their distance from a query object which is a point. The point query object is specified by positioning the mouse over it and clicking it. The objects are displayed in the order of their distance from the query object along with their position in the ranking.

The neighboring objects are found in an incremental manner. In other words, having found the k nearest neighbors, in order to find the $k+1$ st nearest neighbor, the algorithm does not recompute the set of $k+1$ nearest neighbors; it just finds the additional neighbor. The incremental nearest neighbor algorithm (see G. Hjaltason and H. Samet, [Ranking in spatial databases](#) in *Advances in Spatial Databases - 4th Symposium, SSD'95*, M. J. Egenhofer and J. R. Herring, Eds., Lecture Notes in Computer Science 951, Springer-Verlag, Berlin, 1995, 83-95) makes use of a priority queue where the queue elements are the blocks of the underlying data structure as well as the objects themselves. The priority queue is ordered on the basis of the distance of its elements from the location of the query object which is a point in our implementation. In case of a tie between two spatial objects (i.e., two non-block objects have the same distance from query point p) and if the distance is zero and if the object has extent and area (i.e., a rectangle), then use the distance from

p to the nearest boundary of an object that contains p (if such an object exists) as the discriminator for the ordering.

The algorithm works in a top-down manner in the sense that as elements are removed from the queue, they are checked if they correspond to blocks that are not at the lowest level of the hierarchy (i.e., nonleaf nodes). If this is the case, then their immediate descendants (i.e., the sons) are inserted in the queue ordered according to their distance from the query object. Otherwise, the objects that they contain are inserted into the queue ordered according to their distance from the query object. If the element e that has been removed from the queue is a data object, then e is reported as the next nearest neighbor of the query object.

19.7 Digital Signal Processing

19.7.1 Simple Waveforms

- Sine Waveform
- Sine Waveform with Harmonics
- Square Waveform
- Triangle Waveform
- Sawtooth Waveform
- Gaussian Noise

19.7.2 Complex Waveforms

- Summation of sine waves
- Sawtooth wave by summation
- Sawtooth wave by direct calculation
- Inverse Sawtooth wave
- Triangle wave
- Square waves
- Pulse wave
- Frequency modulation FM
- Phase modulation PM
- Amplitude modulation AM
- Ring modulation AM
- Pulse wave buzz
- Pulse wave buzz2
- Dynamic spectrum
- Bandwidth limited
- Waveshaping
- White noise

19.7.3 Envelope Generators

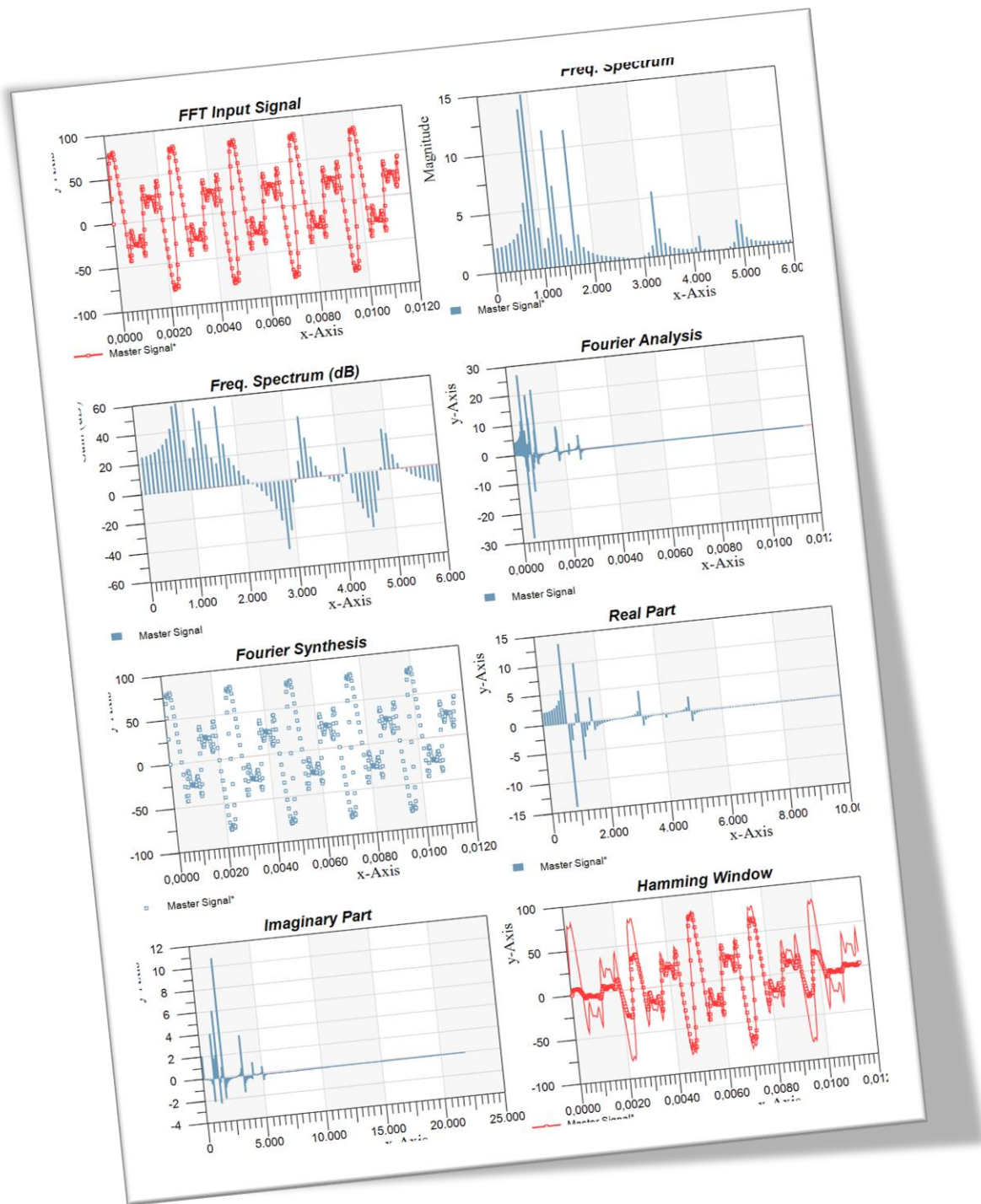
- Simple Linear Integration
- Convex Exponential Interpolation
- Variable Exponential Interpolation
- Logarithmic Interpolation
- DB Interpolation
- Simple State Machine
- Multiple Segments ADSR
- Multiple Segments State Machine
- Constant Rate ADSR
- Constant Rate ADSR Transformed
- Amplitude Envelope

19.8 DFT

- Approximation
 - Spectrum
 - Phase
 - Real Part
 - Imaginary Part
-

19.9 FFT

- Approximation
- Spectrum (Simplex FFT)
- Spectrum (Complex FFT)
- Spectrum (Real FFT)
- Phase
- Real Fourier Analysis
- Real Fourier Synthesis
- Real Part
- Imaginary Part
- Interpolation (2:1 ratio)

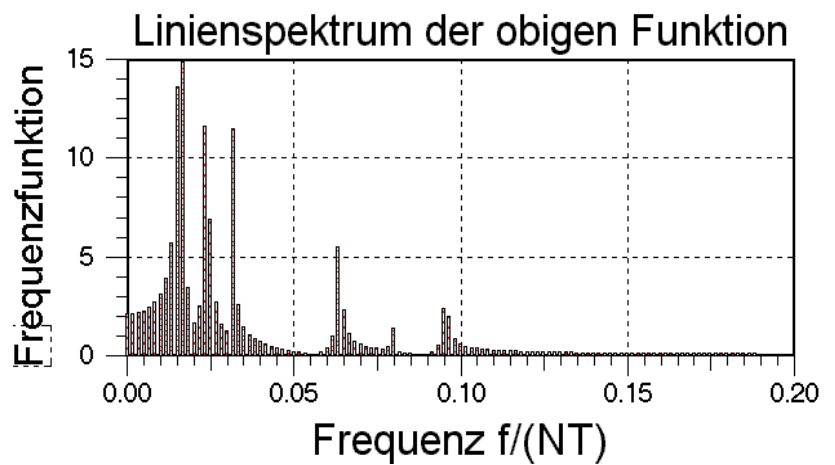
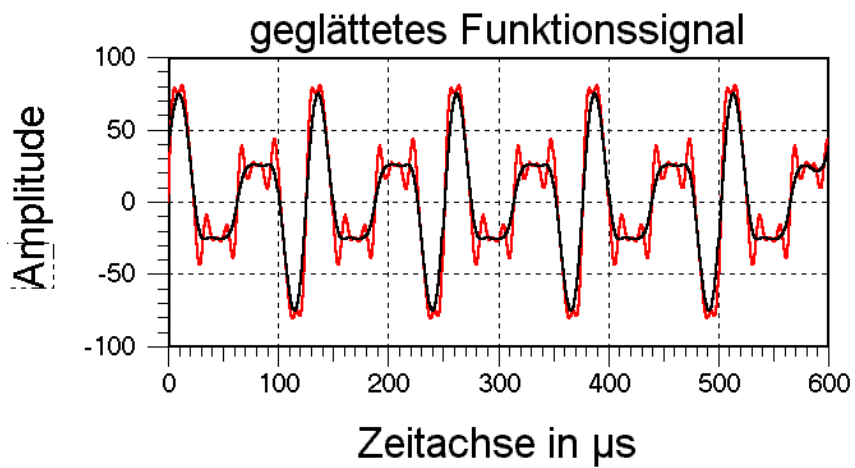
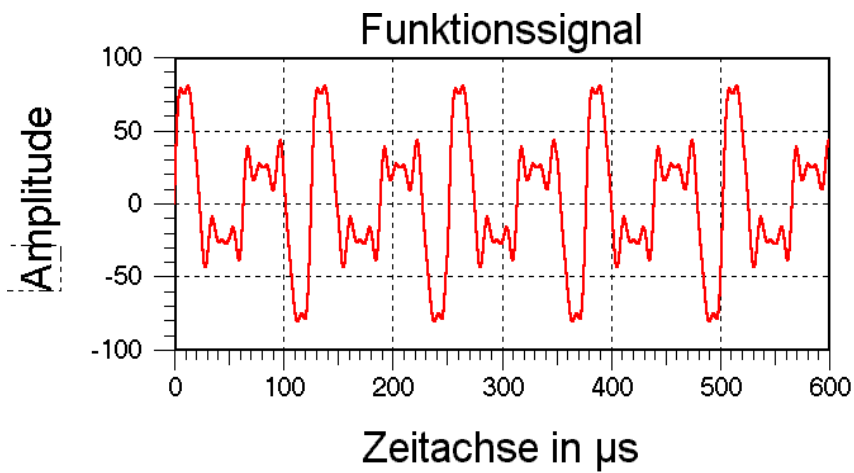


19.9.1 Fast Fourier Transform (FFT)

The Fast Fourier Transform [FFT], suggested by Tuckey and Coolidge⁶ in 1965 is a powerful tool used in many engineering disciplines. It was developed to perform the Discrete Time Fourier Transform in a faster and

⁶ Cooley, J. W. and Tukey, J. W., 1965, An algorithm for the machine calculation of complex Fourier series, *Mathematics of Computation*, **19**, 90, pp. 297-301.

efficient manner. The following plots show an evaluation signal smoothed by the input signal. The last screen-shot shows the resulting FFT spectrum.



Fourier Subtotal

The result of the FFT Fourier Subtotal corresponds practically to the Fourier series, except that the Computation algorithm is different.

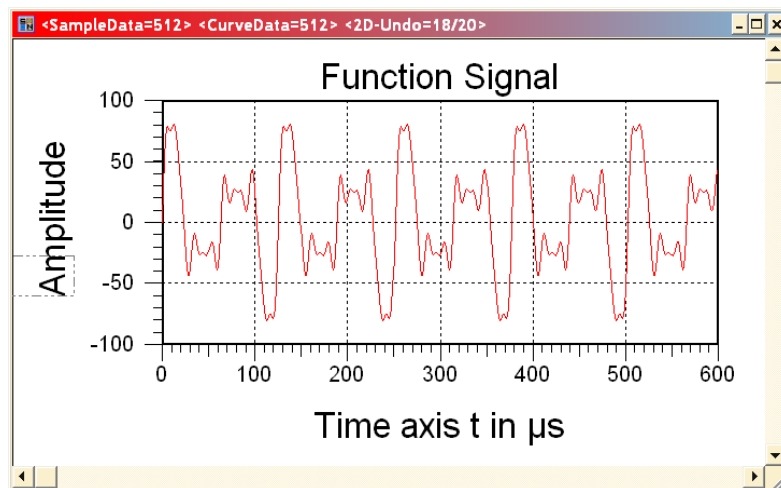
SimplexNumerica computes to $M = 2^\tau$ given real function values $y(0), y(1), \dots, y(M-1)$ the discrete Fourier coefficients $A(0), A(1), \dots, A(M/2)$ und $B(0), B(1), \dots, B(M/2)$ from the discrete Fourier Subtotal.

$$A(0) + \sum_{k=1}^{M/2-1} [A(k) \cos(k \omega x) + B(k) \sin(k \omega x) + A(M/2) \cos(M/2 \omega x)]$$

$$\text{with } \omega = \frac{2\pi}{T}$$

T : Period duration

The value τ corresponds to the twosome logarithm of the number of function values. The number of the function values is $M = 2^\tau$. It must be $\tau \geq 2$.



An index value smaller than the final index leads to an approximation of the measuring data. The fit of the measuring data is called filtering.

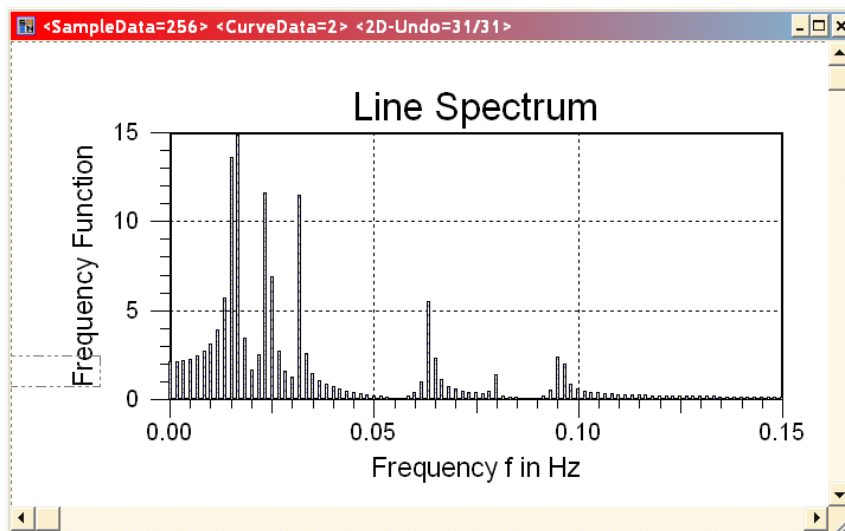
Info:

With the Fourier Subtotal we are staying in the time interval and not in the frequency region.

Spectrum

Many technical procedures run periodically with a frequency (number of revolutions). Periodical Processes possess spectrum of lines.

So, how is it made in SimplexNumerica? You have to start with the original function signal as it shown in the previous chapter. Then call the Pulldownmenu Algorithm → Approximation → FFT → Spectrum.



This means that beside the first harmonic frequency f_0 there are other terms of frequencies - that are integer multiples of the basic frequency - so called higher harmonics ($n * f_0$).

The amplitude of these spectral lines with $f = n f_0$ are given by (continuous) pulse spectrums, depend on the time scale (form of the impulse) from the respective measurement value certain within one period. The spectrum is defined as the amount from the real and imaginary part of the complex discretional Fourier coefficient.

Phase Angle

This menu is for the calculation of the phase angle.

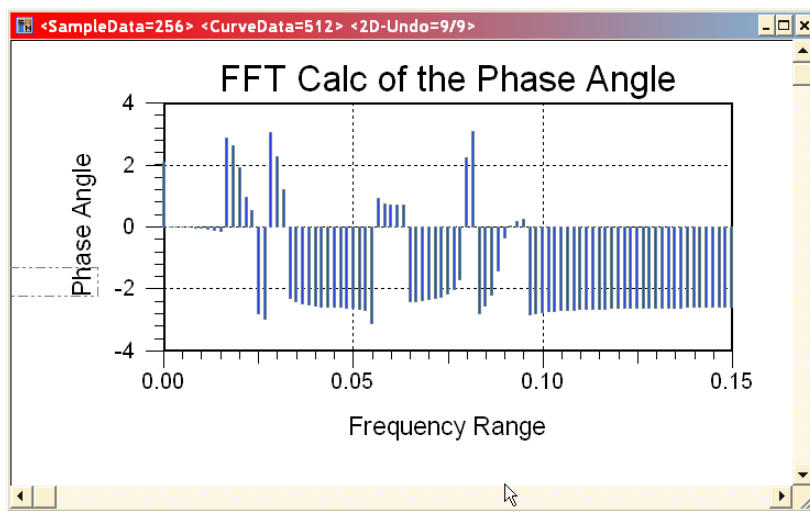
The zero-phase angle is defined as:

$$\varphi = \arccos \frac{\text{Re}}{S} + 2 k \pi \quad \text{für } \text{Im} > 0$$

and

$$\varphi = -\arccos \frac{\text{Re}}{S} + 2 k \pi \quad \text{für } \text{Im} < 0$$

The abscissa (x-axis) is shifted from the time interval into the frequency range.



Fourier Analysis

The program calculates to $M = 2^{\tau}$ given real function values $y(0), y(1), \dots, y(M-1)$ the discretional Fourier coefficients $A(0), A(1), \dots, A(M/2)$ and $B(0), B(1), \dots, B(M/2)$ from the discretional Fourier Subtotal (see above). Afterwards no further calculation will be done. The x-measuring data are not changed.

Fourier Synthesis

Fourier-Synthesis means the determination of a repetitive function from the discrete Fourier coefficients $A(0), A(1), \dots, A(M/2)$ and $B(0), B(1), \dots, B(M/2)$ from the associated discrete Fourier subtotal. Afterwards no further computation is accomplished. The x-measuring data are not changed.

Before the execution applies to the function: In the y-array stands now the discrete Fourier coefficient, as follows:

$$y(0) = A(0)$$

$$y(k) = A[(k+/-)-] \quad \text{for } k = 1, 2, \dots, M/2,$$

$$y(k) = B(k/-) \quad \text{for} \quad k= 1, 2, \dots, M-2 ,$$

thus in the order:

A(0), A(1), B(1), A(2), B(2), . . . (like above)

After the execution applies for the function: The y-Array has now the functions values.

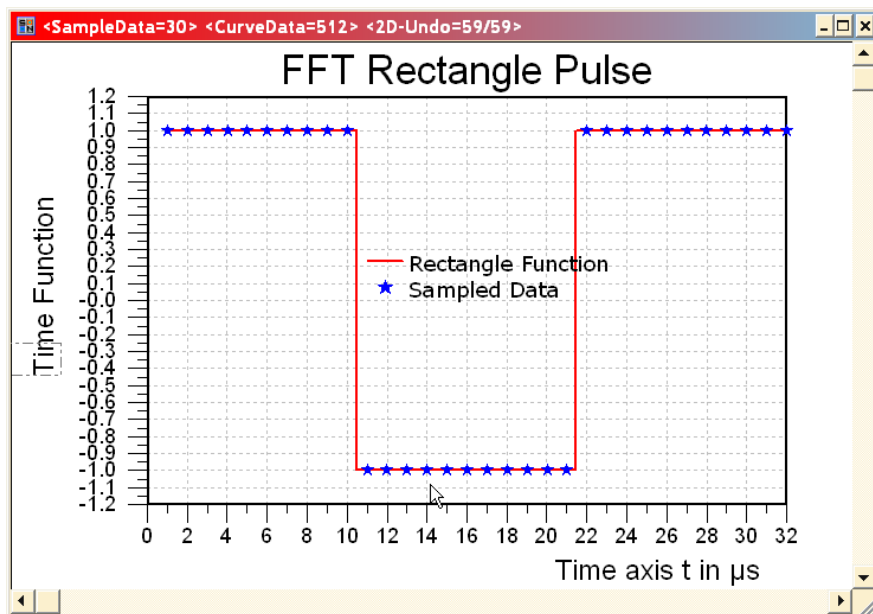
Advantage of this way of writing: You can put the results in the clipboard or save it as curve data. You can use in SimplexNumerica immediately the inverse function, it then corresponds Fourier Synthesis. The array of the inverse function expects this parameter arrangement.

Real Part

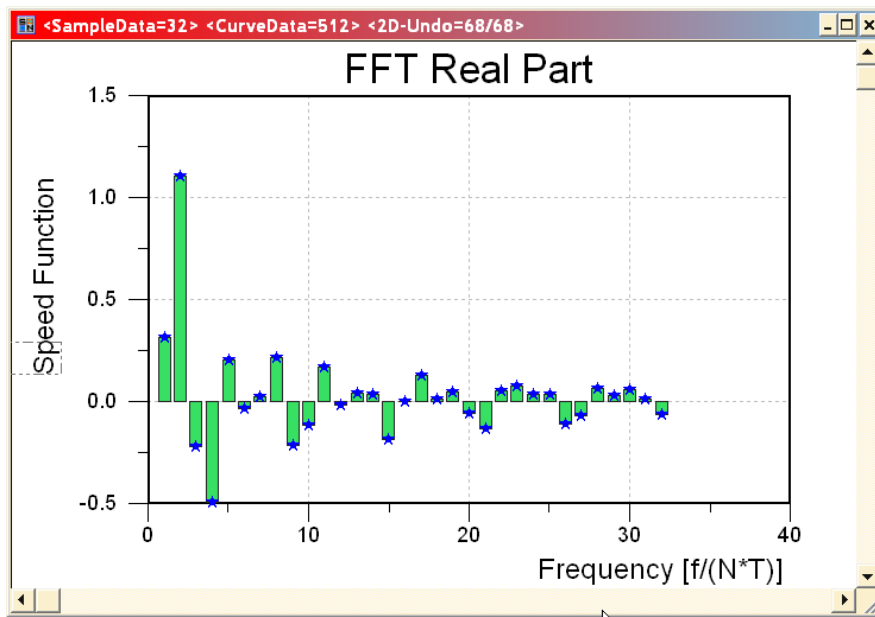
This function sets particularly only the real part of the complex discrete FFT. This is naturally the discrete Fourier analysis described above. The transformation can be done as follows:

$$H\left(\frac{f}{NT}\right) = \frac{T}{NT} \sum_{k=0}^{N-1} h(kT) e^{-\frac{j2\pi f k}{N}}$$

The divisor $N * T$ is the period duration (harmonious) of the component of the signal with the lowest frequency, which can be determined. The N scanning values of $h(k * T)$ must be exactly one period of the repetitive function $h(t)$, so that the above equation supplies exact values. The following figure shows a rectangle pulse as an example.



The computation of the analysis supplies the following real part of the discrete Fourier Analysis:

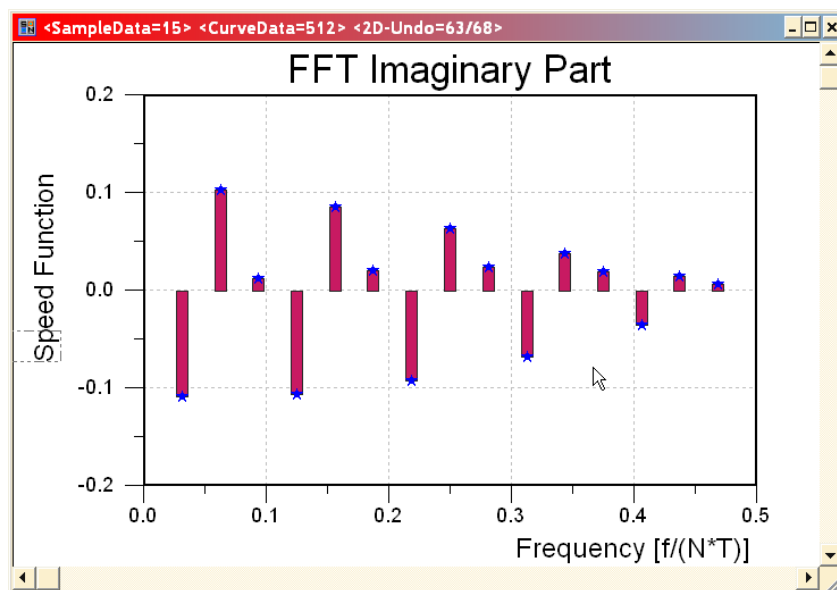


The bar chart view is here not automatically done by the program. You must set it up manually.

Since the results are symmetrical concerning $f = N/2$, only one half of the diagram becomes places. Acceptable values were obtained for harmonious lower order. With a reduction of T and an increase of N a larger accuracy can be reached with high ordered harmonious.

Imaginary part

Similarly to the Fourier Real Part this function represents only the imaginary part of the discrete complex Fourier transform.



19.10 Window Functions

- None Window (Rectangle)
- Hamming Window
- Hanning Window
- Hann Window (Matlab)
- Blackman Window
- Triangular Window
- Sqrt Window
- Hann Window (Numerical Recipes)
- Blackman-Harris Window
- Bartlett Window
- Parzen Window
- Welch Window
- Steeper Window
- Kaiser Window
- Flat Top Window
- Flat Top Window (Stanford)

19.11 Goertzel DFT (Filter)

- Scaled Magnitude
- Tone detection

19.12 FIR Filter

- FIR Coefficients (Remez Algorithm)
- FIR Filter Graph (Remez Algorithm)
- FIR Coefficients (Parks McClellan Algorithm)
- FIR Filter Graph (Parks McClellan Algorithm)
- FIR Coefficients (Iowa Hills Algorithm)
- FIR Filter Graph (Iowa Hills Algorithm)

19.13 IIR Filter

- RBJ Biquad
- Butterworth
- Chebyshev I

- Chebyshev II
- Elliptic
- Bessel
- Legendre
- Custom

19.14 Time-series Filter

- Simple Moving Averages
- Exponential Moving Averages
- Linear Moving Averages
- Savitzky-Golay Filter
- FIR / IIR Real Filter

19.15 Audio Signals

- Play
- Change Sound Tempo
- Change Sound Pitch
- Change Sound Rate
- Adjust Tempo to BPM

19.16 Math Operations

- Add Array
- Add Number
- Sub Array
- Sub Number
- Mul Array
- Mul Number
- Div Array
- Div Number

19.17 Math Functions

- Use Formula Parser
- Bernstein Polynomial [0,1]
- Bernstein Polynomial [a,b]
- Bernoulli Polynom of order N
- Euler Beta Function (Euler's Integral)
- Gaus Error Function
- Gaus Error Function Inverse
- Legendre Polynomial
- Hermite Polynomial
- POPUP Bessel Functions
- Bessel Function of the first kind
- Bessel Function of the second kind
- Modified Bessel Function of the first kind
- Modified Bessel Function of the second kind
- Spherical Bessel Function of the first kind
- Spherical Bessel Function of the second kind

19.17.1 Airy Functions

- Airy function Ai
- Airy function Bi
- Airy function Ai'
- Airy function Bi'

19.17.2 Elliptic Integrals

- Carlson's elliptic integral RC
- Legendre's complete elliptic integral of the first kind
- Legendre's complete elliptic integral of the second kind
- Legendre's complete elliptic integral of the third kind

19.17.3 Jacobi Elliptic Functions

- Function cd
- Function cn
- Function cs
- Function dc
- Function dn
- Function ds

- Function nc
 - Function nd
 - Function ns
 - Function sc
 - Function sd
 - Function sn
 - Riemann Zeta Function (left)
 - Riemann Zeta Function (right)
-
-

19.18 **Differentiation**

19.19 **Integration**

19.20 **Outlier Algorithm**

- Auto Detection
 - Dean-Dixon Outlier Test
 - Nalimov Outlier Test
 - Grubbs Outlier Test
 - Significance of extreme values
 - Show Outlier Test Limit
 - Show Outliers in Output Window
 - Acoustics Alarm if any Outlier
-

19.21 **Data Reduction**

- Routine from MIR (Russian Space Station)
- Band Slope Method
- Scherenschnitt Method
- Removing nth Data Points
- Radial Vertex Reduction
- Perpendicular Vertex Reduction
- Retake Perpendicular Vertex Reduction
- Reumann/Witkam Reduction
- Ramer/Douglas/Peucker Reduction
- Optimized Ramer/Douglas/Peucker Reduction
- Opheim Simplification

- Lang Simplification
-

19.22 Convex Hull

- Hull Edge Points
 - Hull Polygon
 - Hull Curve
-

19.23 Misc.

- Histogram
- Inter Line
- Stochastic Alpha, BetaRho (SABR)

20 New Approach for Regression Analysis

The aim of this chapter is to obtain the best possible result for the measurement of data points for the fictive *Engine Retardation*.

The results of any measurement can be misleading because of:

- A low magnitude that cause inaccurate measurements.
- The presence of measurement dips that result in significant variation in the calculated value over the period of a scan.
- The results can be influenced by data spikes.
- Unintentional generation, propagation and reception of electromagnetic energy among an electromagnetic device (engine, generator, etc.) with reference to unwanted effects (electromagnetic interference, or EMI) that such energy may induce.
- Inaccurate measurement devices with too high deviations.

All these effects can have massive influence of the accurate of a measurement. Most of the effects cannot be resolved without going further, but can be covered with the help of the algorithm described below.

Here in this document, these misleading data points are simply called outliers.

To calculate the straight regression line from fictive measurement points (called engine retardation), a floating Linear Least Squares Fit (LLSF) algorithm is used. The LLSF estimation is a good method if assumptions are met to obtain regression weights when analyzing the engine data. However, if the data does not satisfy some of these assumptions, then sample estimates and results can be misleading. Especially, outliers violate the assumption of normally distributed residuals in the least squares regression. The fact of outlying engine power data points (engine dips), in both the direction of the dependent (y-axis) and independent variables (x-axis / timestamp), to the least squares regression is that they can have a strong adverse effect on the estimate and they may remain unnoticed. Therefore, techniques like RANSAC (Random Sample Consensus) that are able to cope with these problems or to detect outliers (bad) and inliers (good) have been developed by scientists and implemented into *SimplexNumerica*.

Robust consensus algorithms like RANSAC are important methods for analyzing data that are contaminated with outliers. It can be used to detect outliers and to provide resistant results in the presence of outliers.

A new approach based on the Maximum Likelihood Estimator Sample Consensus (MLE SAC⁷) and Random Sample Consensus (RANSAC⁸) for an improved Engine Retardation measurement routine inside the device is described for robustly estimating floating linear regression relations from engine power point correspondences. The method comprises two parts. The first is a new robust estimator MLE SAC that is a generalization of the RANSAC estimator. It adopts the same sampling strategy as RANSAC to generate putative solutions, but chooses the solution that maximizes the likelihood rather than just the number of

⁷ The MLE SAC here represents an implementation of the MLE SAC (Maximum Likelihood Estimator Sample Consensus) algorithm, as described in: "MLE SAC: A new robust estimator with application to estimating image geometry", P.H.S. Torr and A. Zisserman, Computer Vision and Image Understanding, vol 78, 2000.

⁸ <http://de.wikipedia.org/wiki/RANSAC-Algorithmus>

inliers. The second part of the algorithm is a general-purpose method for automatically parameterizing these relations, using the output of MLESAC.

Quintessence:

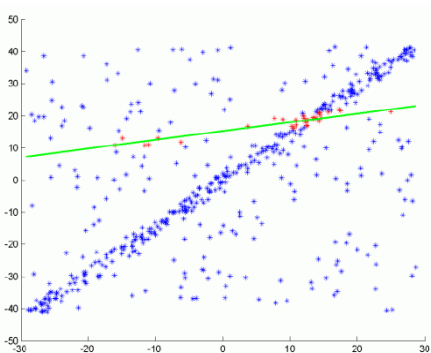
The new approach should be an established algorithm for maximum-likelihood estimation by random sampling consensus, devised for *Engine Retardation* measurement to avoid the influence of the above-described misleading results.

20.1 RANdOm SAMple Consensus (RANSAC)

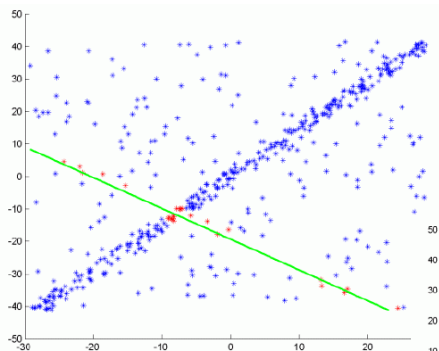
The Random Sample Consensus (RANSAC) algorithm proposed by Fischler and Bolles⁹ is a general parameter estimation approach designed to cope with a large proportion of outliers in the input data. Its basic operations are:

1. Select sample set
2. Compute model
3. Compute and count inliers
4. Repeat until sufficiently confident

Step (i)

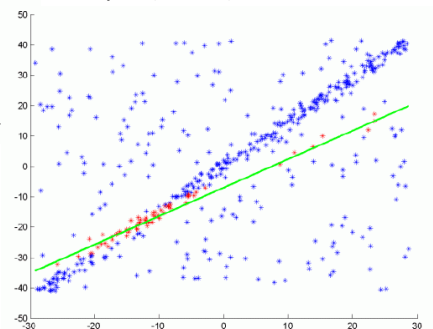


Step (n - j)

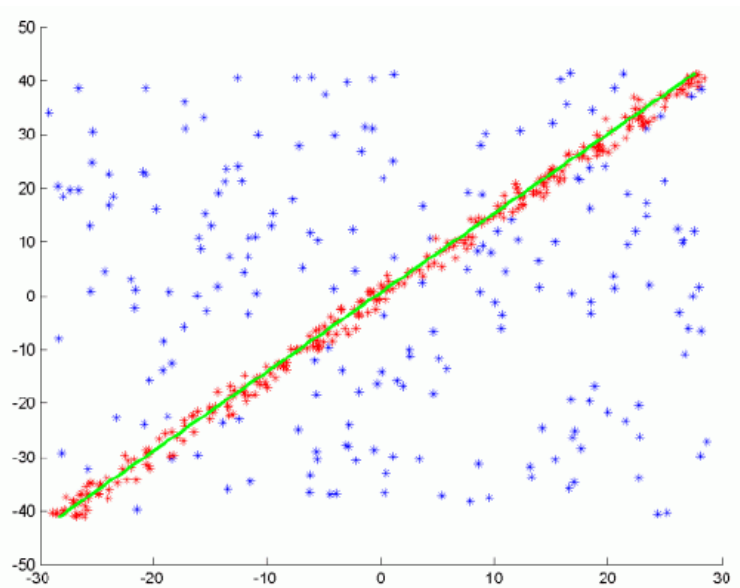


Step (i + j)

Step n (result)



⁹ Martin A. Fischler and Robert C. Bolles (June 1981). "Random Sample Consensus: A Paradigm for Model Fitting with Applications to Image Analysis and Automated Cartography". *Comm. of the ACM* 24 (6): 381–395. doi:10.1145/358669.358692



Result

The RANSAC steps in more details are¹⁰:

1. Select randomly the minimum number of points required to determine the model parameters.
2. Solve for the parameters of the model.
3. Determine how many points from the set of all points fit with a predefined tolerance.
4. If the fraction of the number of inliers over the total number points in the set exceeds a predefined threshold, re-estimate the model parameters using all the identified inliers and terminate.
5. Otherwise, repeat steps 1 through 4 (maximum of N times).

Briefly, RANSAC uniformly at random selects a subset of data samples and uses it to estimate model parameters. Then it determines the samples that are within an error tolerance of the generated model.

These samples are considered as agreed with the generated model and called as consensus set of the chosen data samples. Here, the data samples in the consensus as behaved as inliers and the rest as outliers by RANSAC. If the count of the samples in the consensus is high enough, it trains the final model of the consensus with using them. It repeats this process for a number of iterations and returns the model that has the smallest average error among the generated models. As a randomized algorithm, RANSAC does not guarantee to find the optimal parametric model with respect to the inliers. However, the probability of reaching the optimal solution can be kept over a lower bound with assigning suitable values to algorithm parameters.

¹⁰ From: Overview of the RANSAC Algorithm, Konstantinos G. Derpanis, kosta@cs.yorku.ca, Version 1.2, May 13, 2010.

Or: M.A. Fischler and R.C. Bolles. Random sample consensus: A paradigm for model fitting with applications to image analysis and automated cartography. *Communications of the ACM*, 24(6):381–395, 1981.

20.2 Maximum Likelihood Estimator Sample Consensus (MLE SAC)

This chapter describes in a simple and concise way the robust estimator, MLESAC¹¹, which can be used for calculation instead of the floating regression algorithm LLSF.

In particular, MLESAC is well suited to estimating the *Engine Retardation* trend or more general, it manifolds the engine's power data to timestamp miss relation in Engine Retardation measurement because of the fact that the timestamp is set maybe inaccurately inside the internal clock of the measurement device.

Technical descriptions and own tests have shown that the RANSAC algorithm has been proven very successful for robust estimation, but with the robust negative log likelihood function having been defined as the quantity to be minimized it becomes apparent that RANSAC can be improved on. One of the problems with RANSAC is that if the threshold for considering inliers is set too high then the robust estimate can be very poor and the slope of the regression line goes wrong.

As an improvement over RANSAC, MLESAC has a better estimate for elimination of noise dips for instance influenced by neighborhood machines. The minimal set point, initially selected by MLESAC, is known to provide a good estimate of the data relation. Hence, the initial estimate of the point basis provided by MLESAC is quite close to the true solution and consequently the nonlinear minimization typically avoids local minima. Then the parameterization of the algorithm is consistent, which means that during the gradient descent phase only data relations that might actually arise are searched for. It has been observed that the MLESAC method of robust fitting is good for initializing the parameter estimation when the data are corrupted by outliers. In this case, there are just two classes to which a datum might belong, inliers or outliers.

Torr and Zisserman have shown that the implementation of MLESAC yields a modest to hefty benefit to all robust estimations with absolutely no additional computational burden. In addition, the definition of the maximum likelihood error allows it to suggest a further improvement against RANSAC. As the aim is to minimize the negative log likelihood of the data it makes sense to use this as the score for each of the random samples.

After MLESAC is applied, nonlinear minimization is conducted using the method described in Gill and Murray¹², which is a modification of the Gauss–Newton method. All the points are included in the minimization, but the effect of outliers is removed as the robust function places a ceiling on the value of their errors, unless the parameters move during the iterated search to a value where that correspondence might be reclassified as an inliers. This scheme allows outliers to be reclassified as inliers during the minimization itself without incurring additional computational complexity. This has the advantage of reducing the number of false classifications, which might arise by classifying the correspondences at too early a stage.

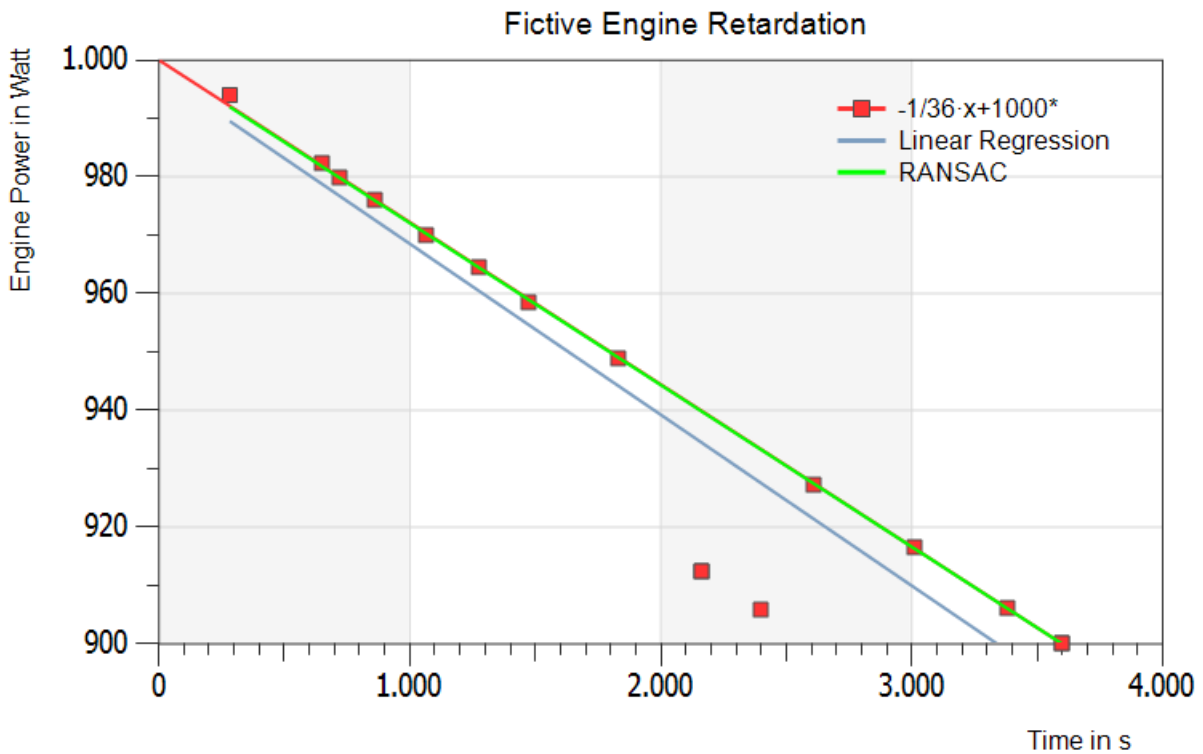
¹¹ MLESAC: A New Robust Estimator with Application to Estimating Image Geometry P. H. S. Torr Microsoft Research Ltd., St George House, 1 Guildhall St, Cambridge CB2 3NH, United Kingdom and A. Zisserman Robotics Research Group, Department of Engineering Science, Oxford University, OX1 3PJ, United Kingdom

¹² P. E. Gill and W. Murray, Algorithms for the solution of the nonlinear least-squares problem, SIAM J. Numer. Anal. 15(5), 1978, 977–992.

20.3 Evaluation of Samples

To show some results of the new *SimplexNumerica* algorithms, the following samples are evaluated. All have simulated data randomized around the slope $f(x) = m x + b$, $m = 1/36$, $b = 1000$. The inverse value of the difference quotient (m) is equal to the rundown time in (s/W). The next figure shows two outliers down under the theoretical graph - fitted by RANSAC (green line).

Example with two outliers:

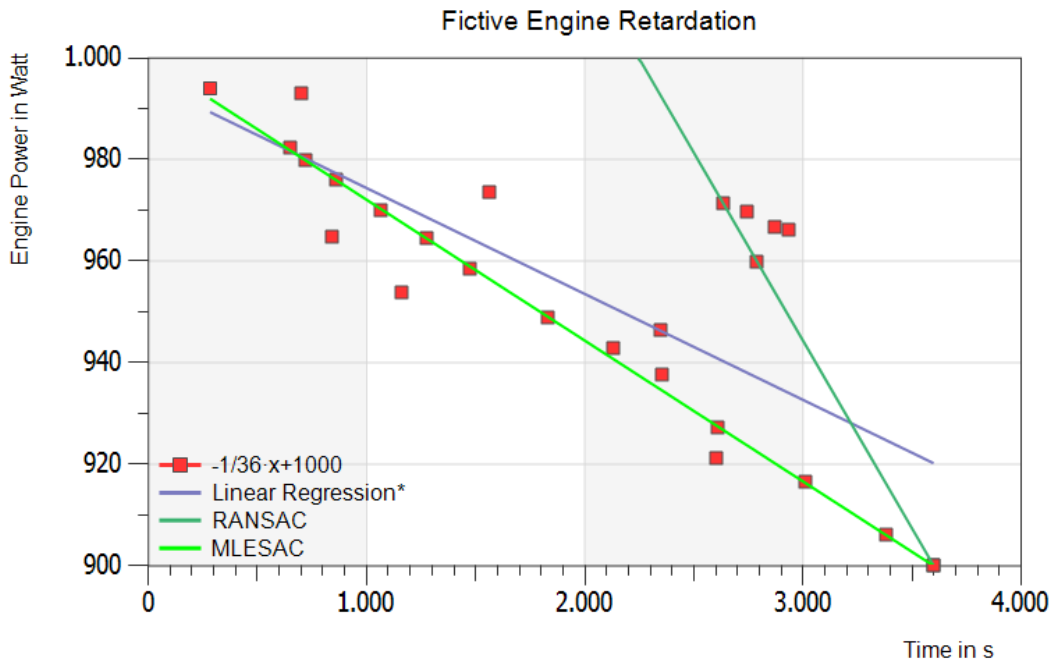


The above figure shows the theoretical regression line $f(x) = m x + b$ in red, the floating Linear Least Squares Fit (LLSF or Linear Regression) in blue and the RANSAC line in green (on top of the red one).

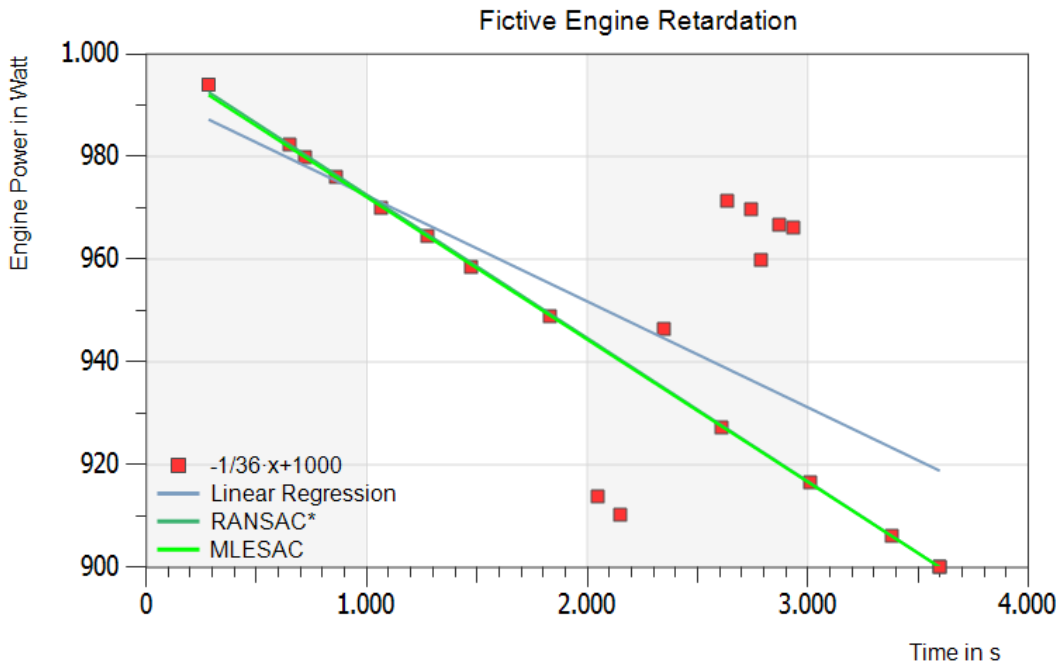
Result:

RANSAC and theoretical line are nearly equal. The Linear Regression line drops away.

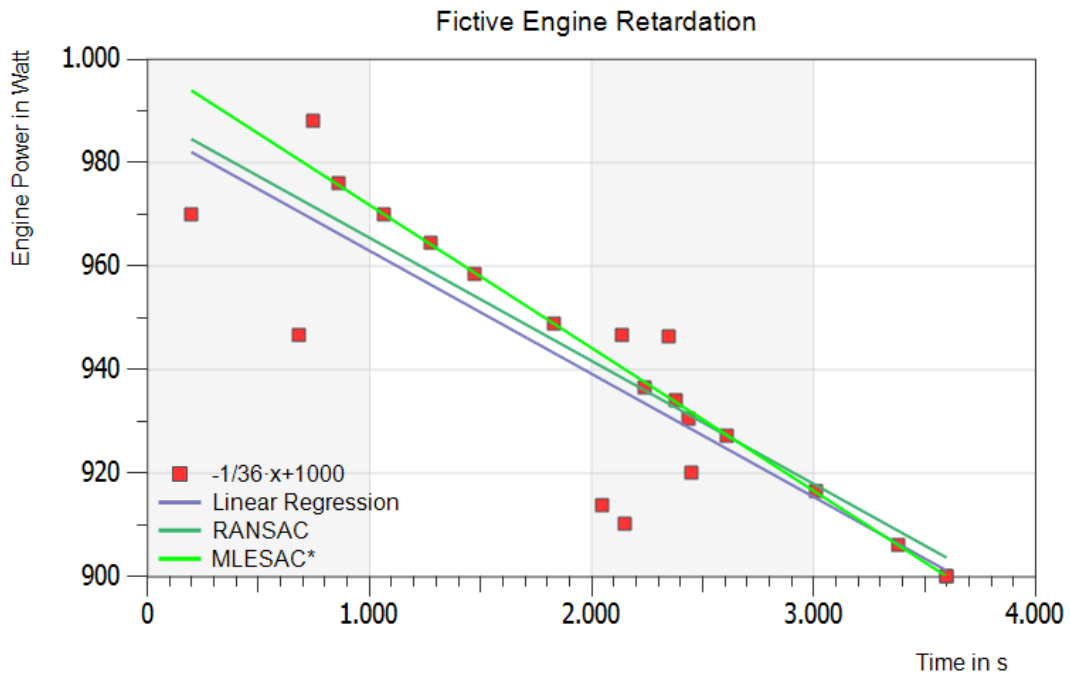
The next figure has more outliers and some inliers to direct the real engine power.



The above figure has more outliers and some inliers to direct the real rundown slope. The Linear Regression (blue line) goes away again. RANSAC (dark green line) does not find the right way. But finally: MLESAC (bright green line) shows the right fit to the real inliers.



The above figure is similar to the previous one, but the additional two outliers have more distant down under the real line as in the figure before. Result: RANSAC and MLESAC are fitting best and lying on the same line.



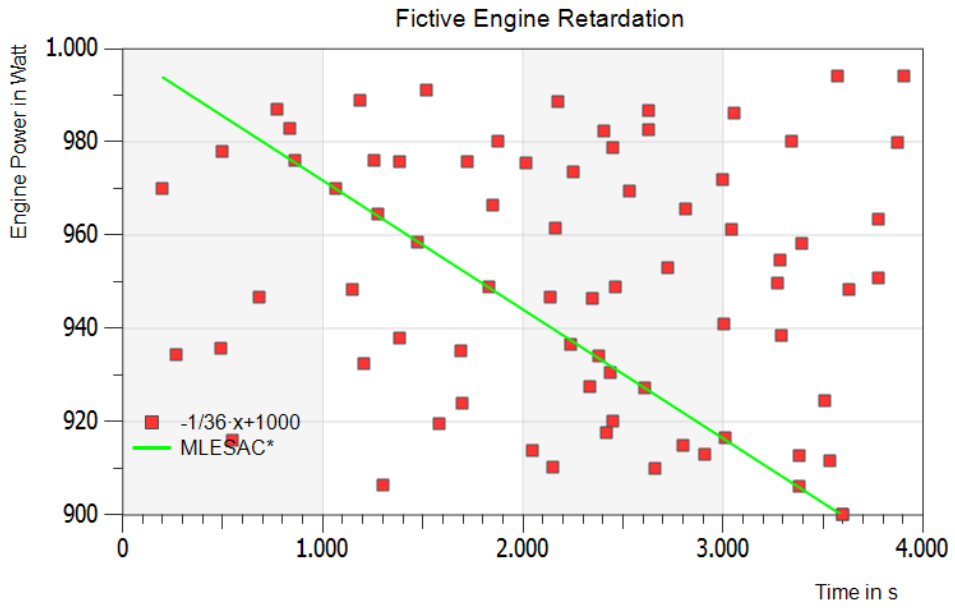
The bright green MLESAC regression line $y(x) = m x + b$ yields best with the following statistical data:

- Estimated Slope: $m = -0.0276023 \rightarrow 1 / 0.0276023 \sim \boxed{36 \text{ s/W}}$
- Estimated Y-axis Intercept: $b = 999.415 \sim \boxed{1000 \text{ W}}$
- Maximum number of iterations: $n = 1000$
- Distance to the model threshold: $d = 0.001$
- Probability of at least one SampleData free from outliers = 99 %

Conclusion:

Also under these extremely difficult to identifying conditions, the MLESAC algorithm can accurately predict the right offset and slope of the Engine Power line with the result that the Engine Retardation is now the right one.

Lastly, extreme outliers far from realism - but still the right regression line:



21 End-user License Agreement

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