The *Figure* module

Use ***Figure*** to manipulate, edit and plot figure and phase diagrams already calculated by ***FactSage***.

Table of contents

The *Figure* module

Click on ***Figure*** in the main ***FactSage*** window.

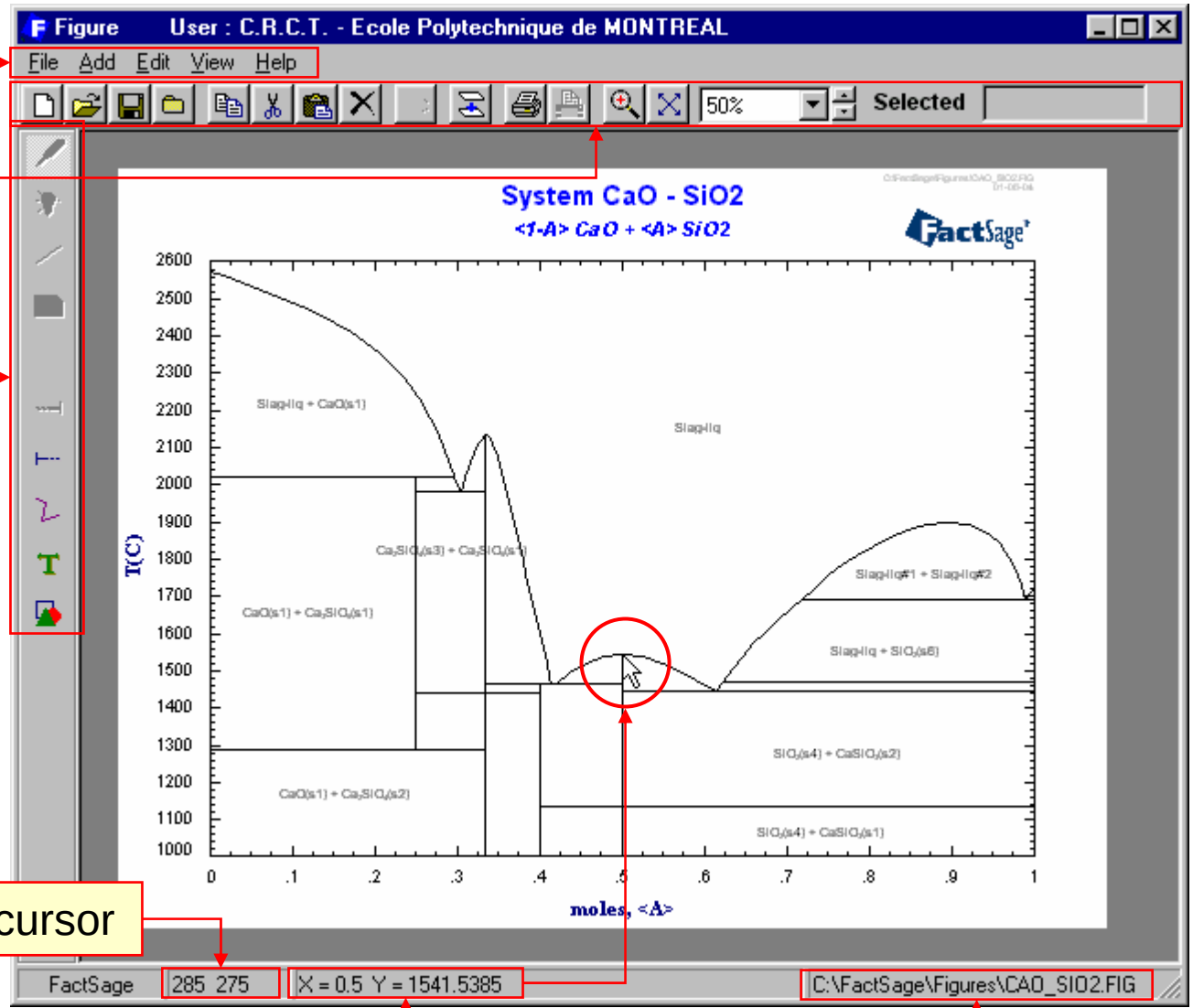
Figure Main Window

Figure menu bar

Normal edition mode toolbar

Figure toolbar

If you don't see the Figure edition toolbar, **go to** the **menu View** and **check Tool Bar**.



Pixel coordinates of the cursor

Graphic coordinates of the cursor

File name

The following three slides show the basic command environment of the ***Figure*** module.

A Menu bar and a Tool bar are available in order to perform the various tasks that are possible with ***Figure***.

Figure Menu Bar

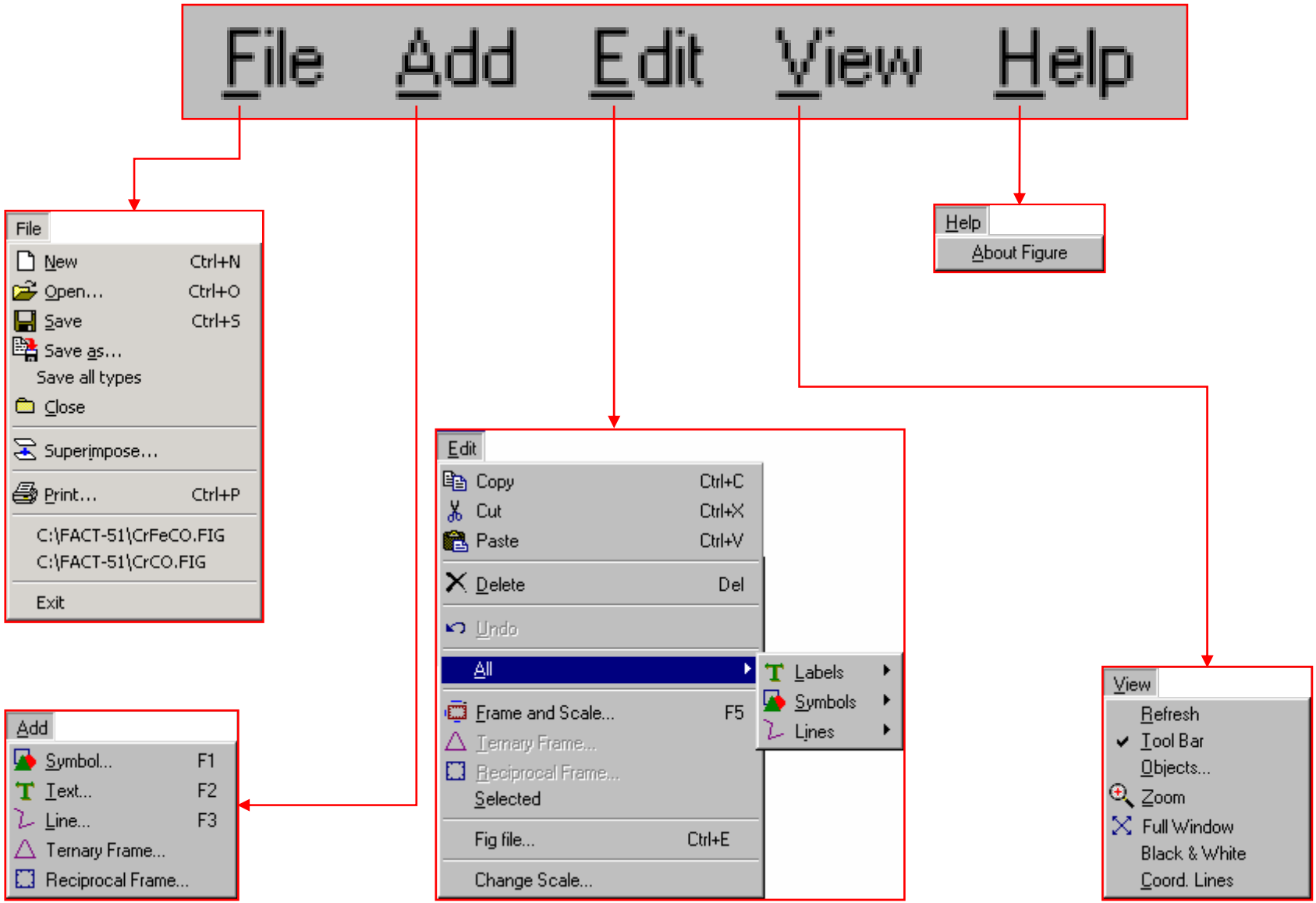


Figure Normal Edition Mode Toolbar

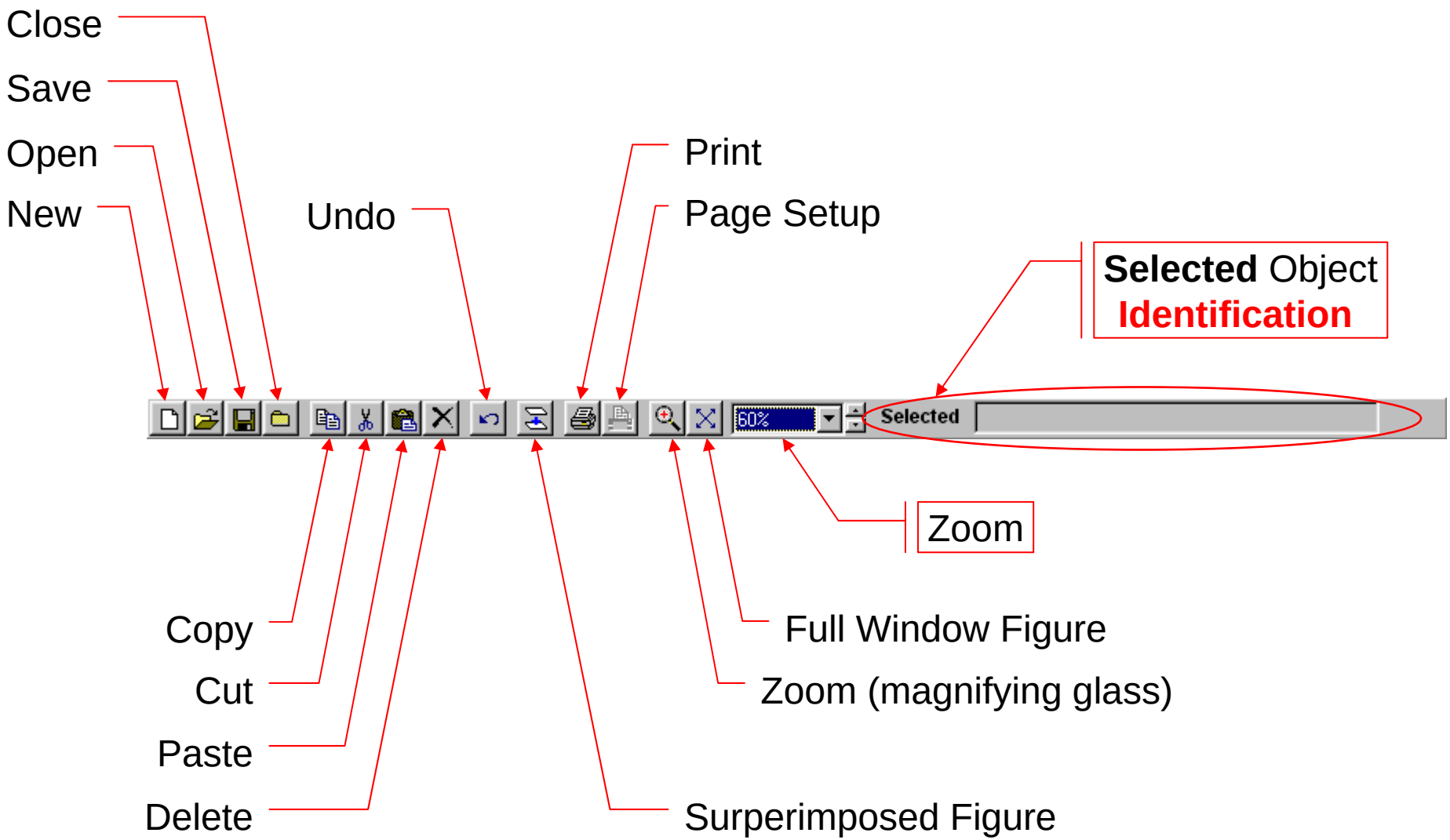
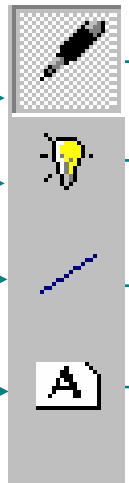


Figure Toolbar

Phase diagram program



normal edition mode → **Click** to **enable** the **normal edition mode**

phase equilibrium mode → **Click** to **enable** the **Show results** window mode to see the output of the calculation of a phase diagram at the selected coordinates.

2-phases tie-lines mode → **Select** to **enable** the mouse activated drawing (with a click) of 2-phases tie-lines.

stable phases label mode → **Select** to **enable** the mouse activated labeling (with a click) of stable phases.

Close the new line → **Click** to **disable** the mouse activated mode for the entry of points coordinates of a line.

Open a new line → **Click** to **enable** the mouse activated mode for the entry of points coordinates of a line.

Add Line → **Keyboard** mode for the entry of points coordinates of a line (**opens** the **Add Line** window).

Add Label → **Opens** the **Add Label** window.

Add Symbol → **Opens** the **Add Symbol** window.

Opening and editing a **FIG**ure file

Graphical output from calculational modules such as ***Reaction***, ***Predom***, ***Equilib*** or ***Phase Diagram*** can be post-viewed and edited using the ***Figure*** module.

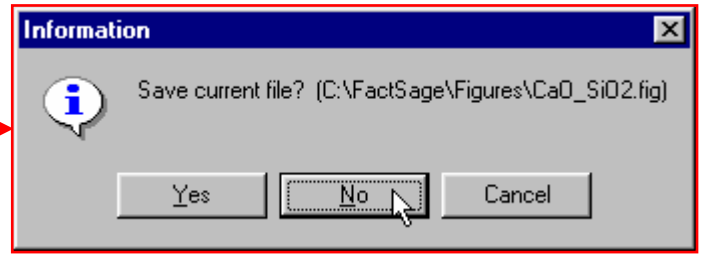
Such output is stored in files with the extension FIG. Use the Open File dialog box to select the desired file from the folder in which it is stored. The pre-view window helps you to select the file you want.

Once the file is opened the figure is displayed on the screen and ready for further operations.

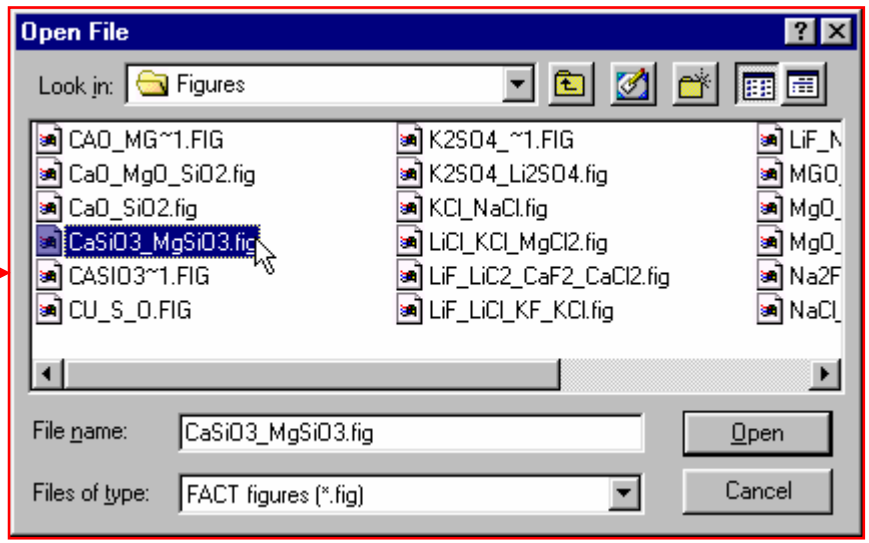
The following two slides show how to select and open a figure file.

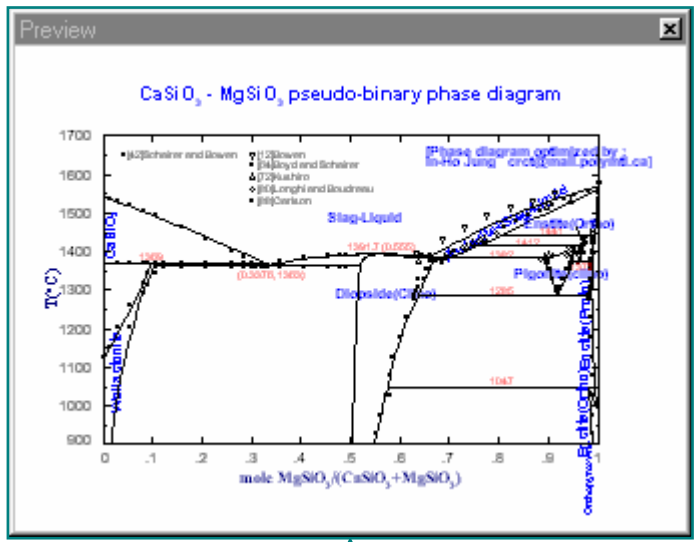
Opening a figure file

Select File > Open… from the menu bar or **click** on the **Open** icon in the standard toolbar. You will be asked if you want to save the current file.



For example, **choose** the **CaSiO3_MgSiO3 FACT figures (*.fig)** file from the ***FactSage*\Figures** folder.

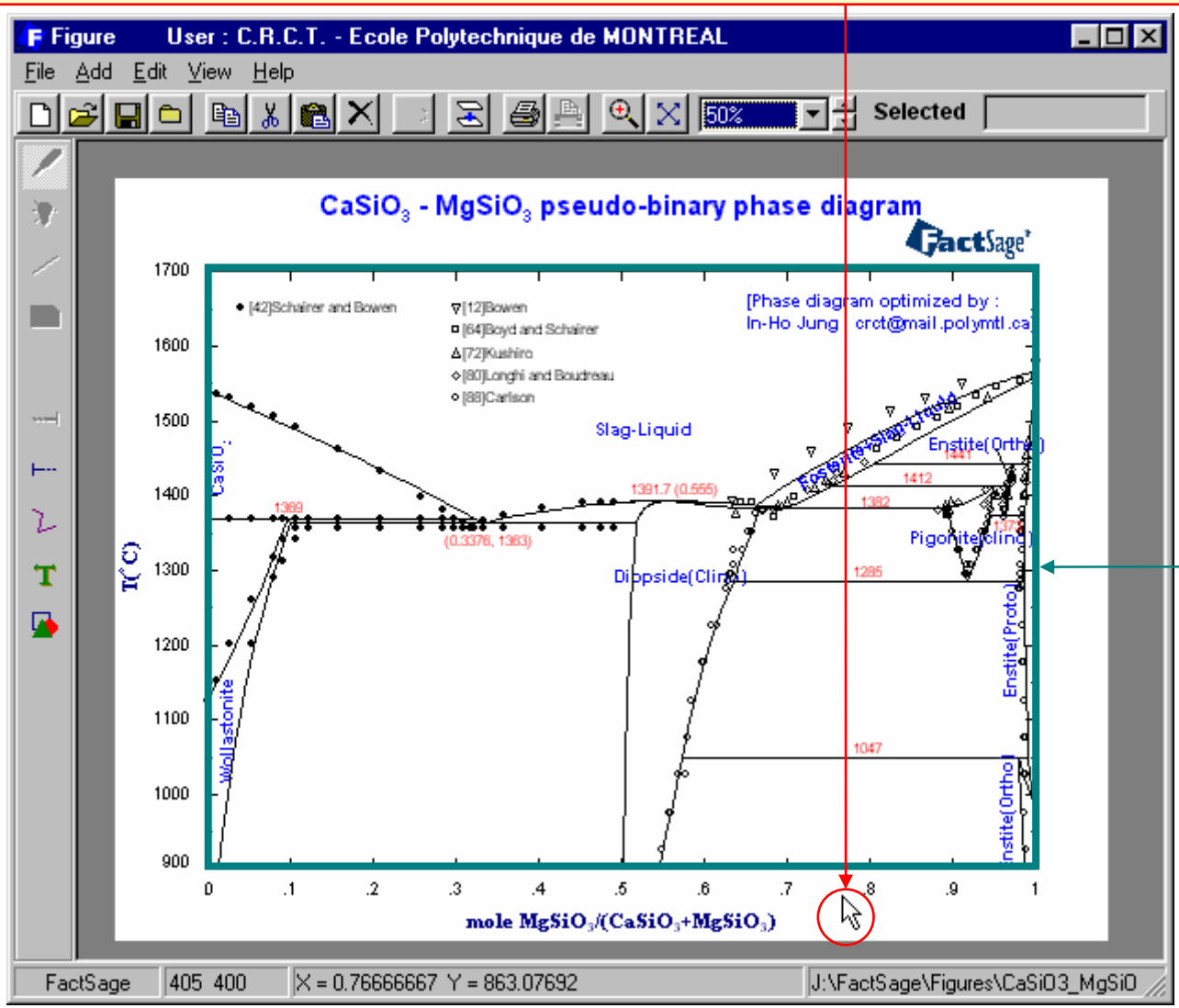




File preview appears when filename changes

The $CaSiO_3$ - $MgSiO_3$ pseudo-binary phase diagram

Double-click in the area **outside** the **graph frame area**, **press** «**F5**» or **select** **Edit > Frame and Scale…** from the **Menu Bar** to **open** the **«Frame and Axis»** dialog box.



Graph frame area

Editing Frame and Axes

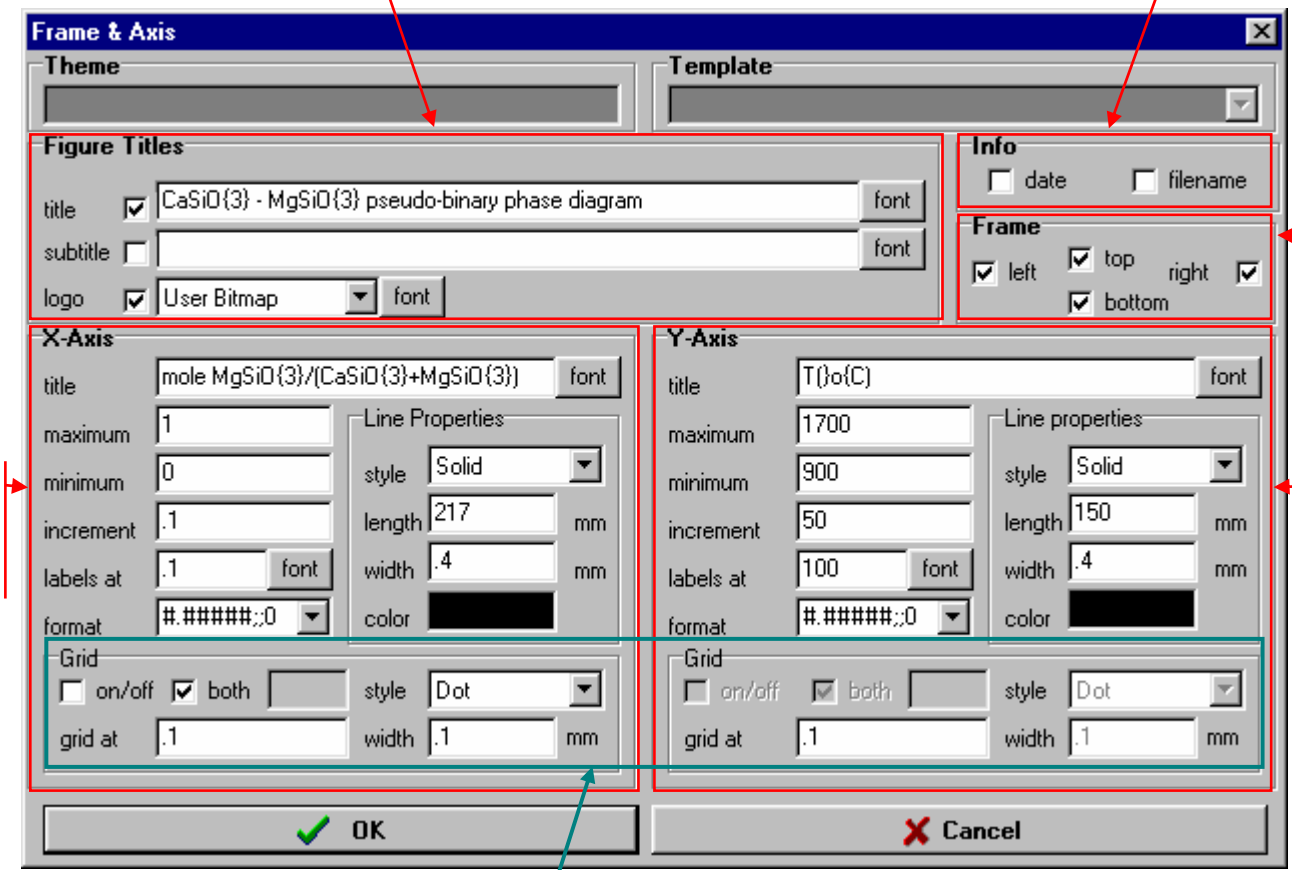
Figure permits to manipulate the frame and the axes of a diagram.

The following two slides show how this is done.

The Frame and Axis Window

Figure title, subtitle and logo edition

Info selection (date and filename)



Frame borders selection

X-Axis edition

Y-Axis edition

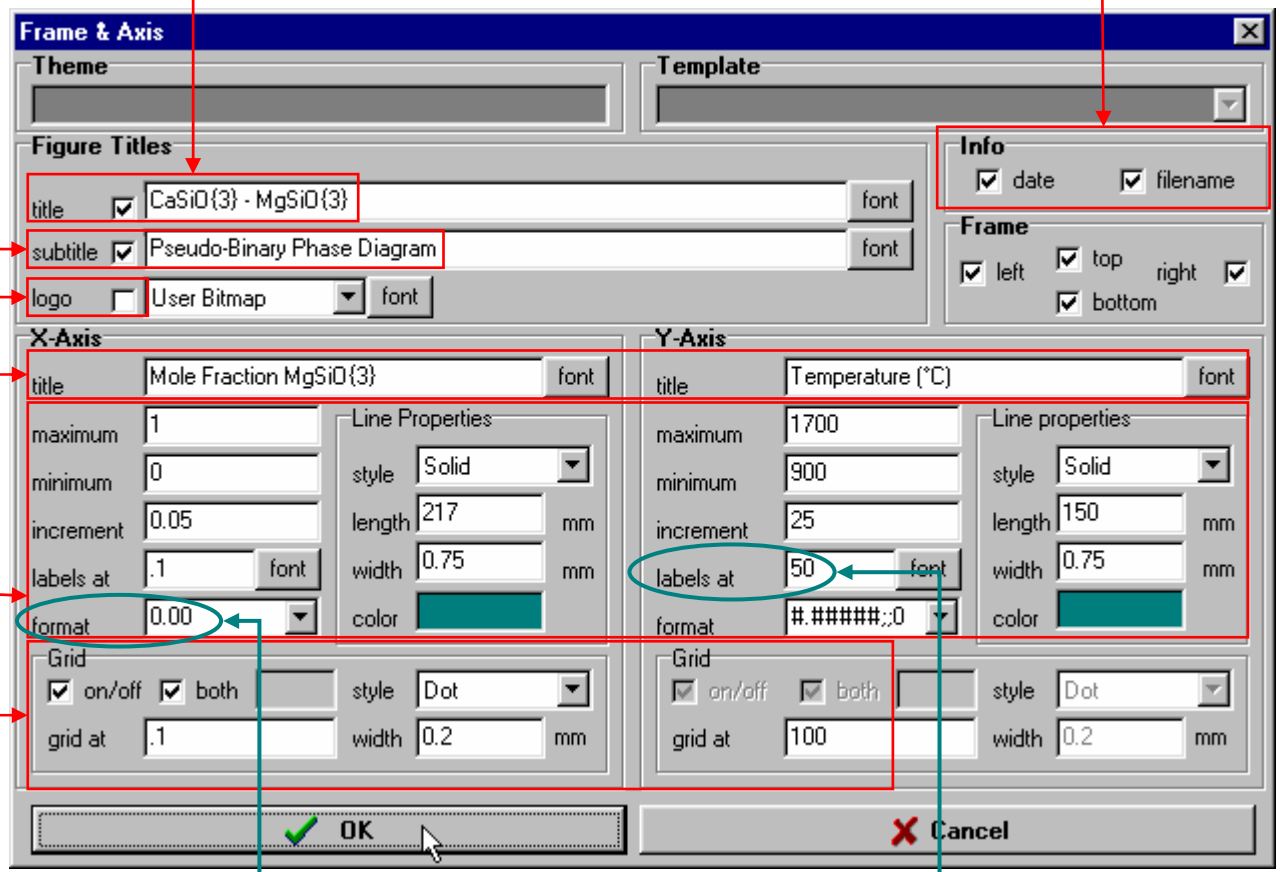
Grid edition

Figure 5.1

Editing the frame and the axes

Making changes:

1. Modification of the figure title
2. Addition of the date and the filename at the top right corner
3. Addition of a subtitle
4. Removal of a logo
5. Modification of the axes titles
6. Change (on both axes):
   - of the increments
   - of the font of the labels
   - of the width and the color of the lines
7. Addition of grid and specification of the separation and the width of the lines
8. Modification of the format of the labels on the X-axis
9. Modification of the labeling increment on the Y-axis

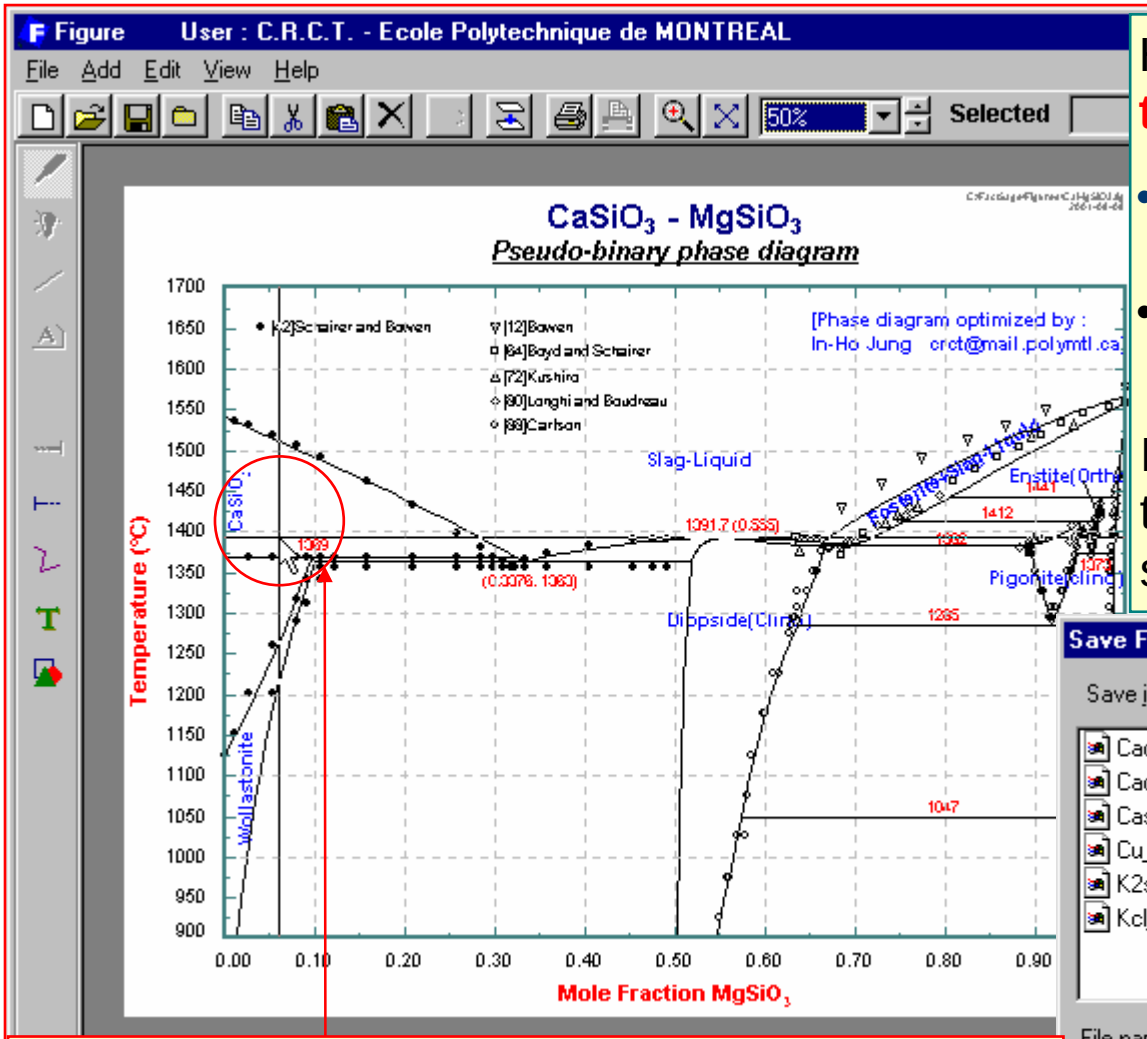


Saving the edited diagram and viewing the result

Once all modifications of a diagram have been made it is possible to store this diagram for further use. Various output formats are available such that a diagram can be directly transferred to Windows based text editors for report writing or to PowerPoint for the generation of computer based presentations.

A further task that can be performed with the ***Figure*** module is the numerical inspection of a diagram. The cursor can be used for the purpose, and it is also possible to use a zoom window in order to have a better means for positioning of the cursor in the diagram.

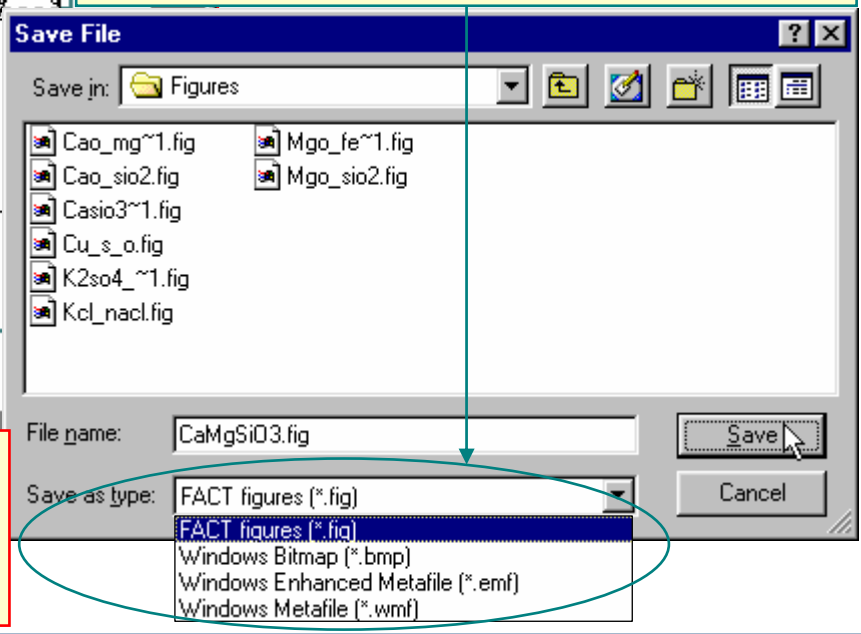
Saving the results of the edition of the frame and the axes



Here, you have the choice between **two** kinds of file types:

- ***FACT*** figures (*.fig), ASCII files, which are **editable** with ***Figure***;
- **Windows** (*.bmp, *.emf and *.wmf) which are **exportable** files.

It is **strongly** recommended to save the figure under **.fig** format before saving under any other format.

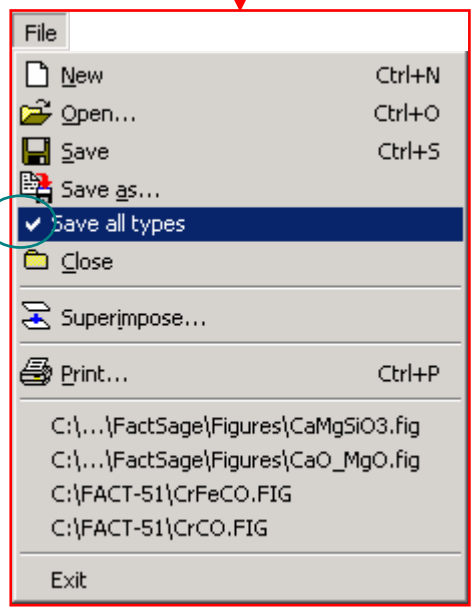


Crosshairs can be viewed when you **press** the mouse left button and **maintain** it (the option **Coord. Lines** (**View** menu) has to be checked).

« Save all types » option

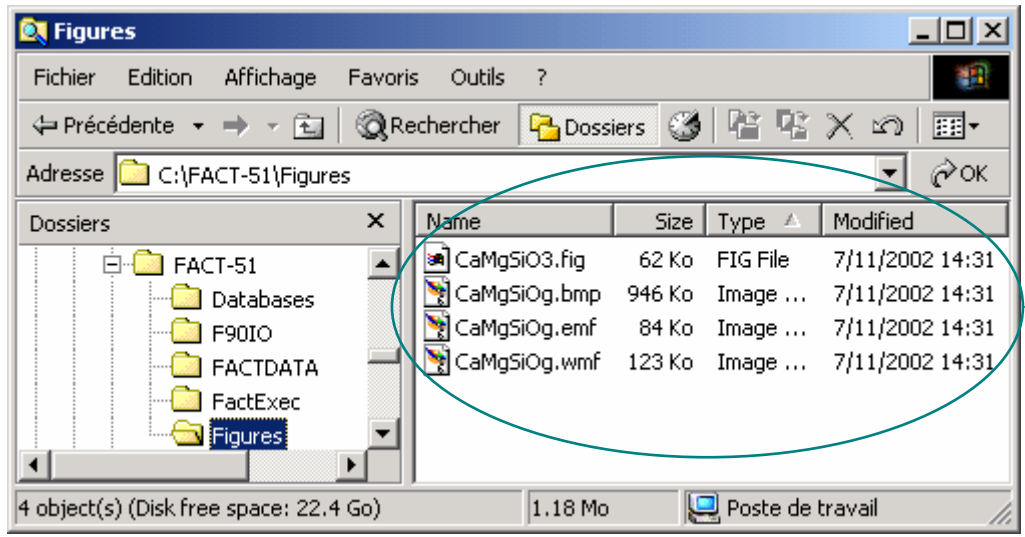
You can now save your figure in all 4 formats (*.fig, *.bmp, *.emf and *.wmf) by enabling the «**Save all types**» option.

To **enable** this option, go in the **File** menu and click on **Save all types**.



A **checkmark** in front of the option's name indicates that the option is **enabled**.

The next time you select the « **Save** » or the « **Save as…** » command you save your file in 4 formats (***.fig**, ***.bmp**, ***.emf** and ***.wmf**) in the directory of your choice.



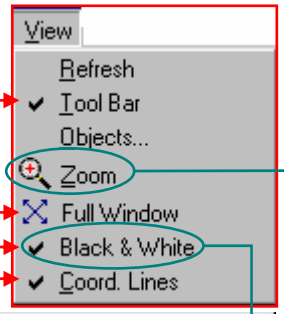
Viewing options

Show / hide the **Edition Tool Bar**

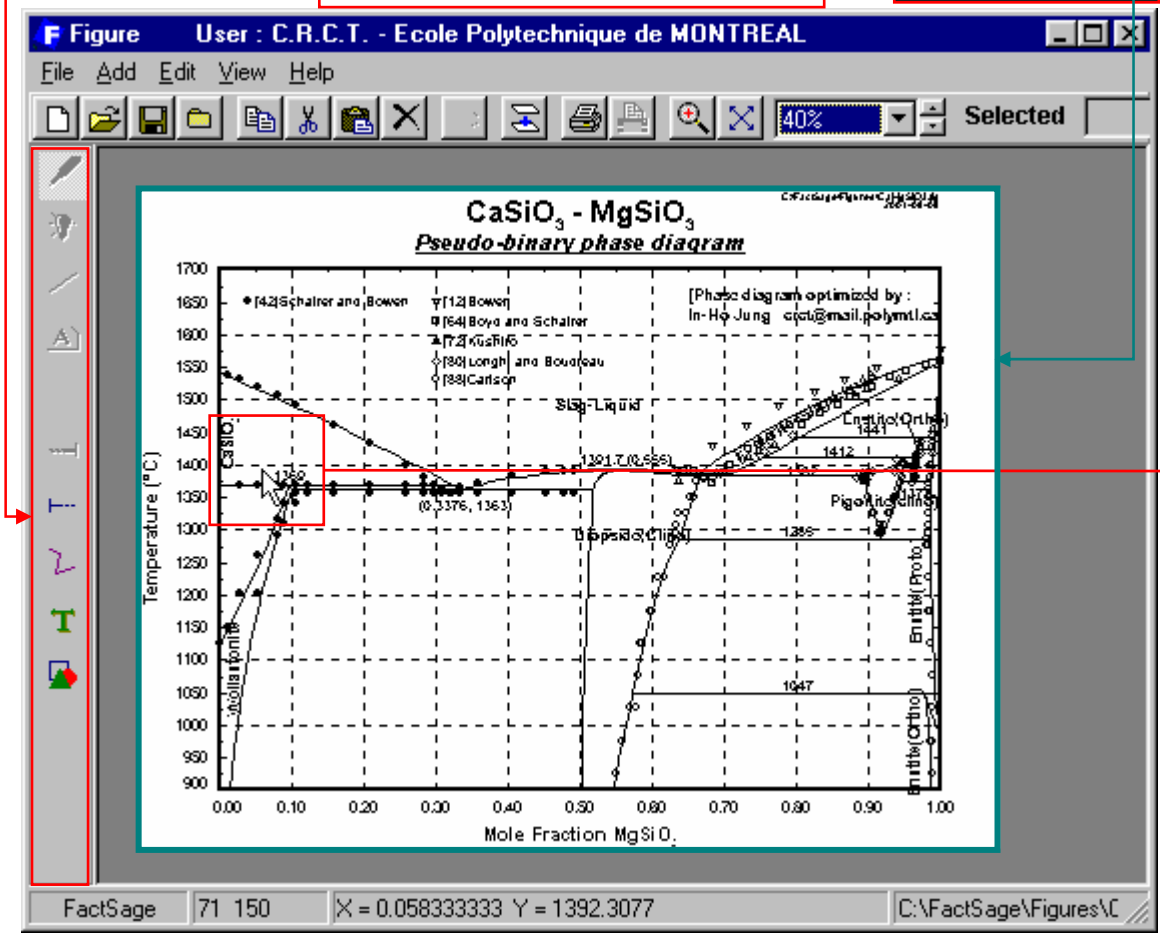
Maximise the figure in the window

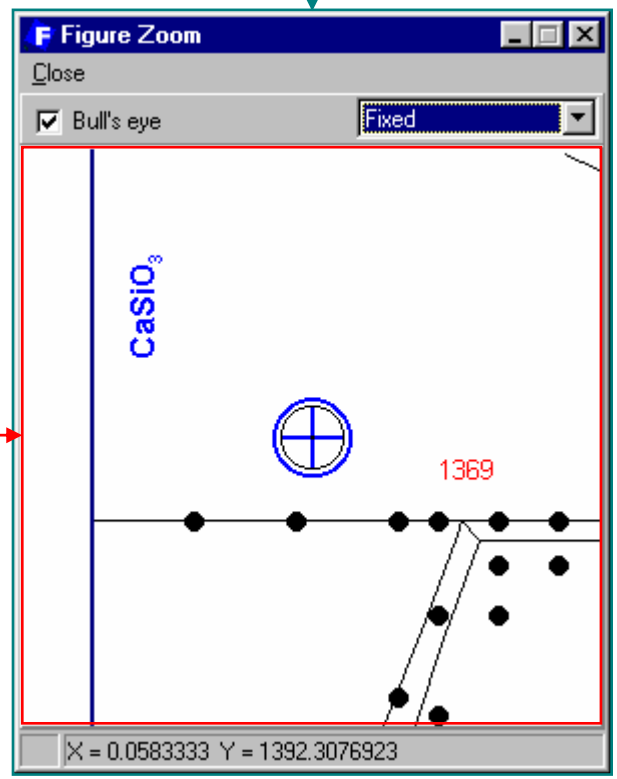
Show in **black and white**

Show the **crosshairs**



Magnifying glass
(6X current zoom),
- **bull's eye enabled**,
- **fixed mode**
(instead of proportional)





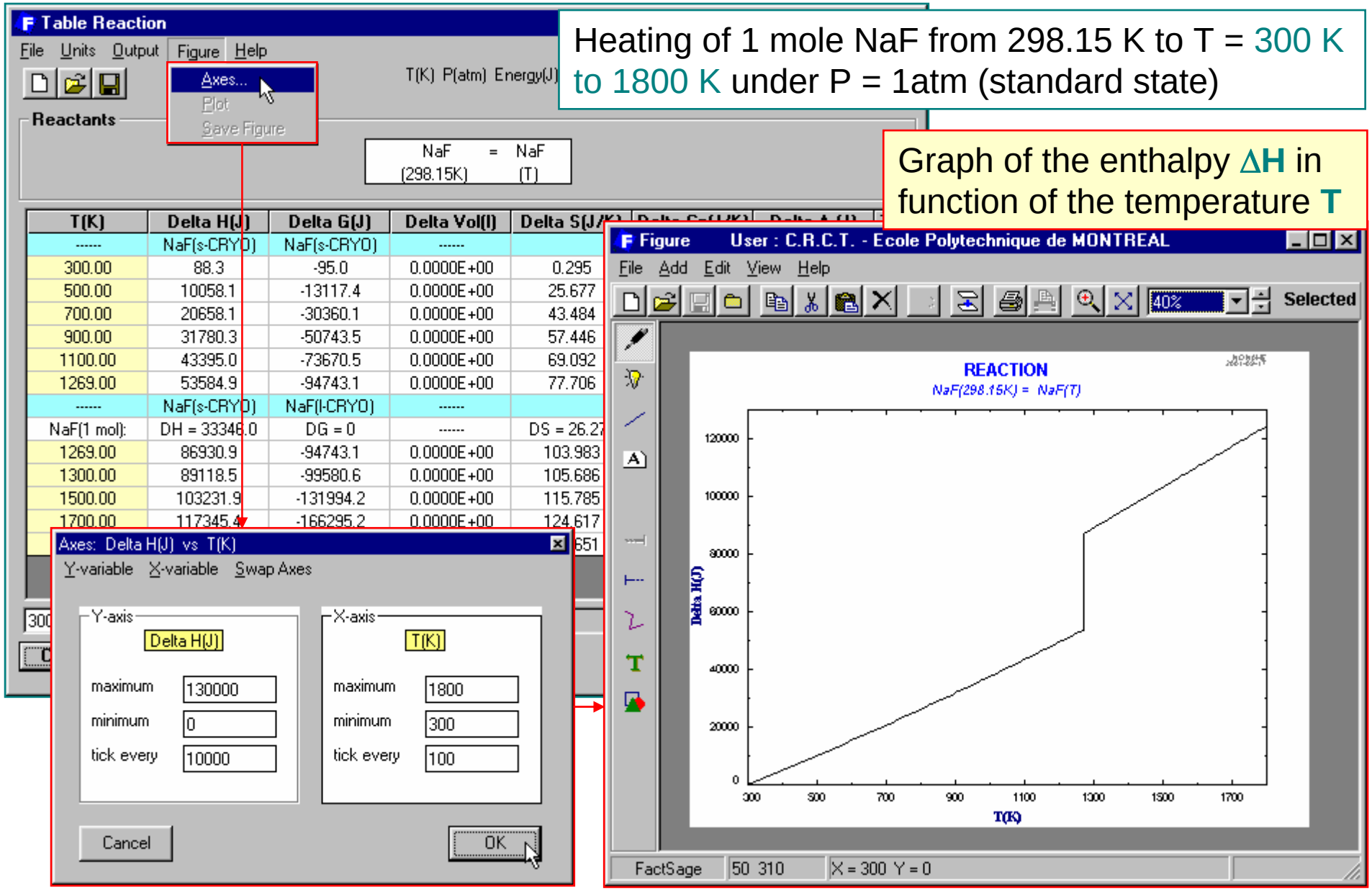
Adding and editing experimental data points

The following four slides show how to use a diagram generated with the ***Reaction*** module as a basis into which experimental data are added.

Obtaining a *figure* file from the *Reaction* program

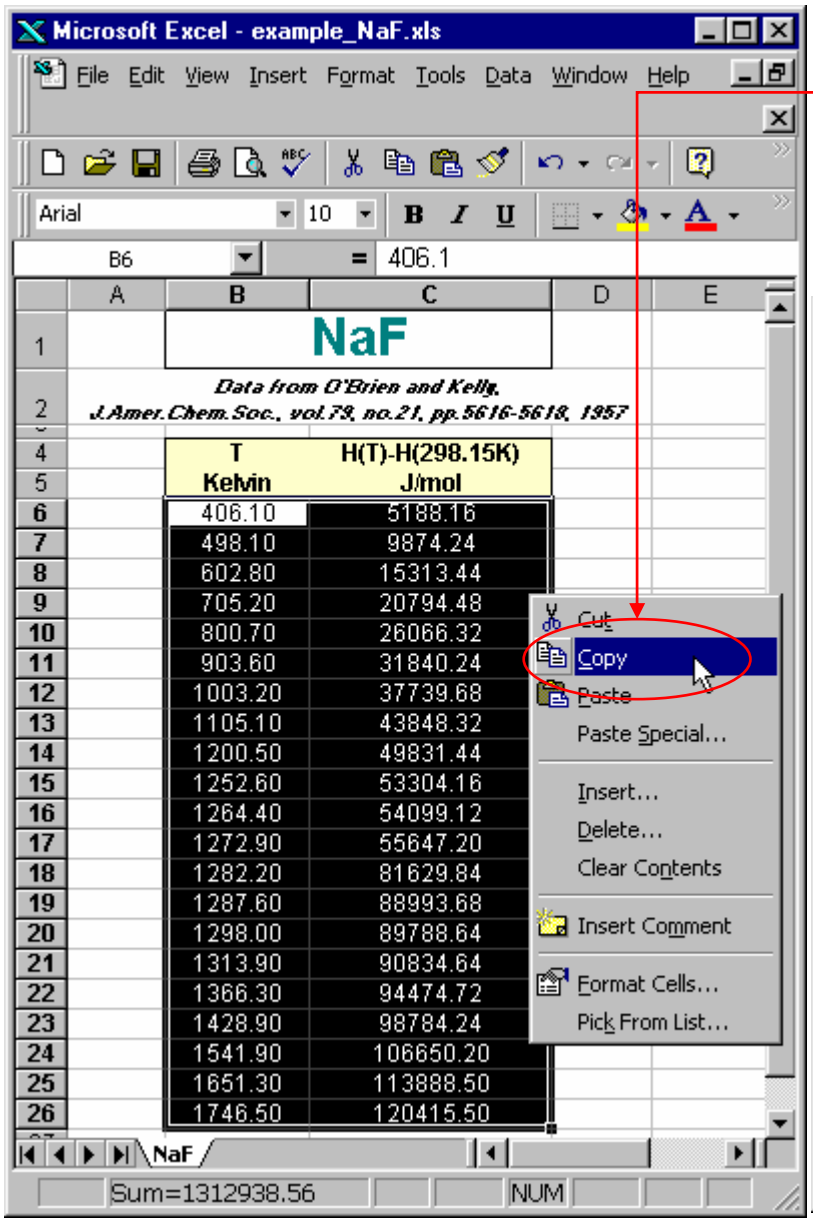
Heating of 1 mole NaF from 298.15 K to T = 300 K to 1800 K under P = 1atm (standard state)

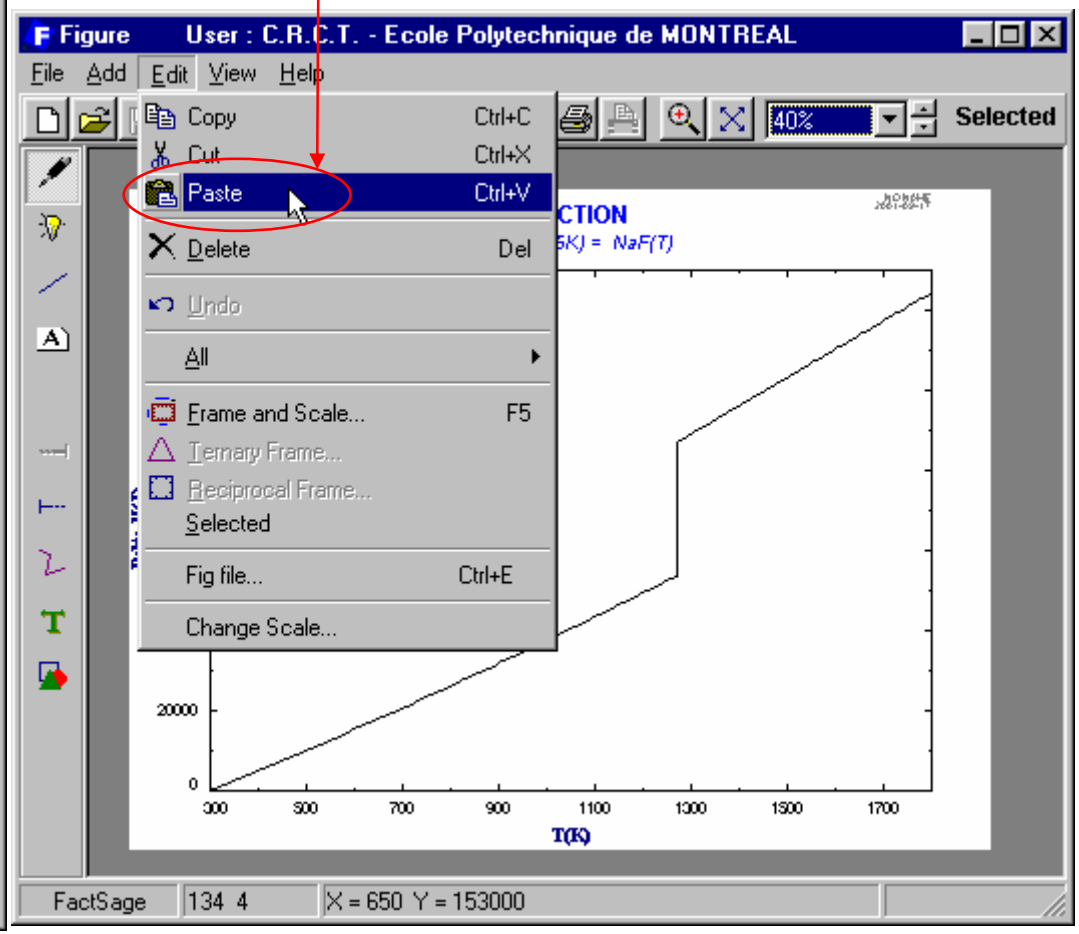
Graph of the enthalpy **ΔH** in function of the temperature **T**



Adding experimental data from an Excel file to the *Figure* program

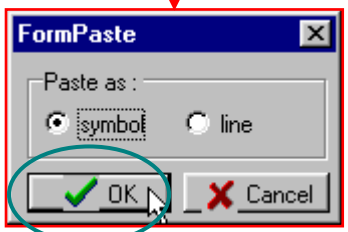
You **select** and **Copy** your data points from the Excel® file and you **Paste** it in the ***Figure*** program.

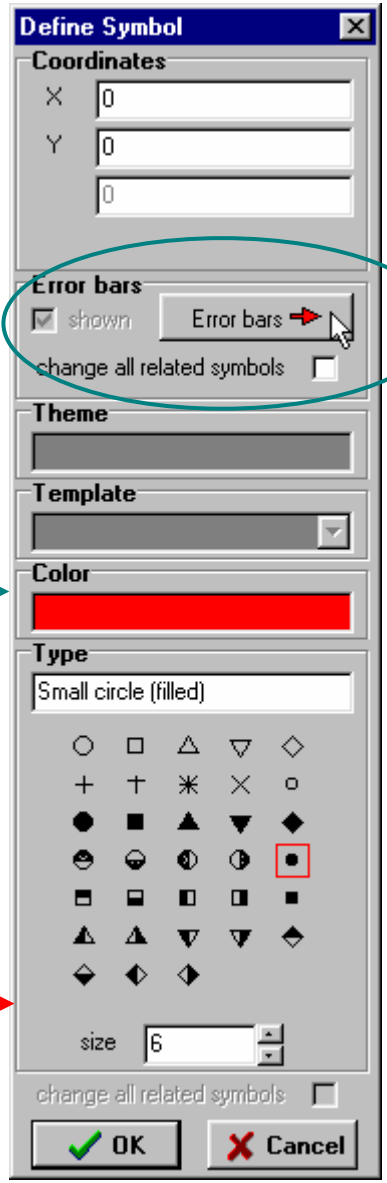




Editing the experimental data: Selection

Choose your data representation: **symbol** or line.
Press «**OK**».

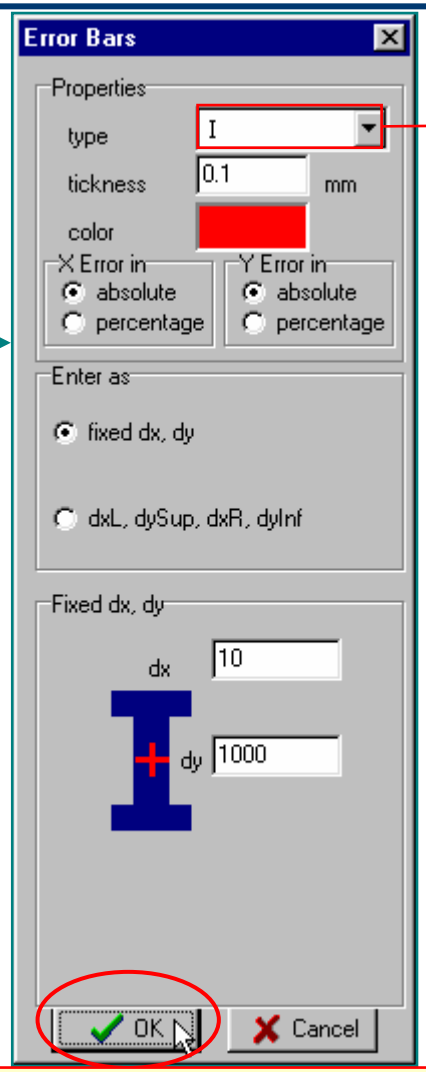


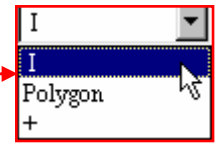


Define your **Symbol**:

- Color: **Red**
- Type: **Small circles** (filled)
- Size: **6**

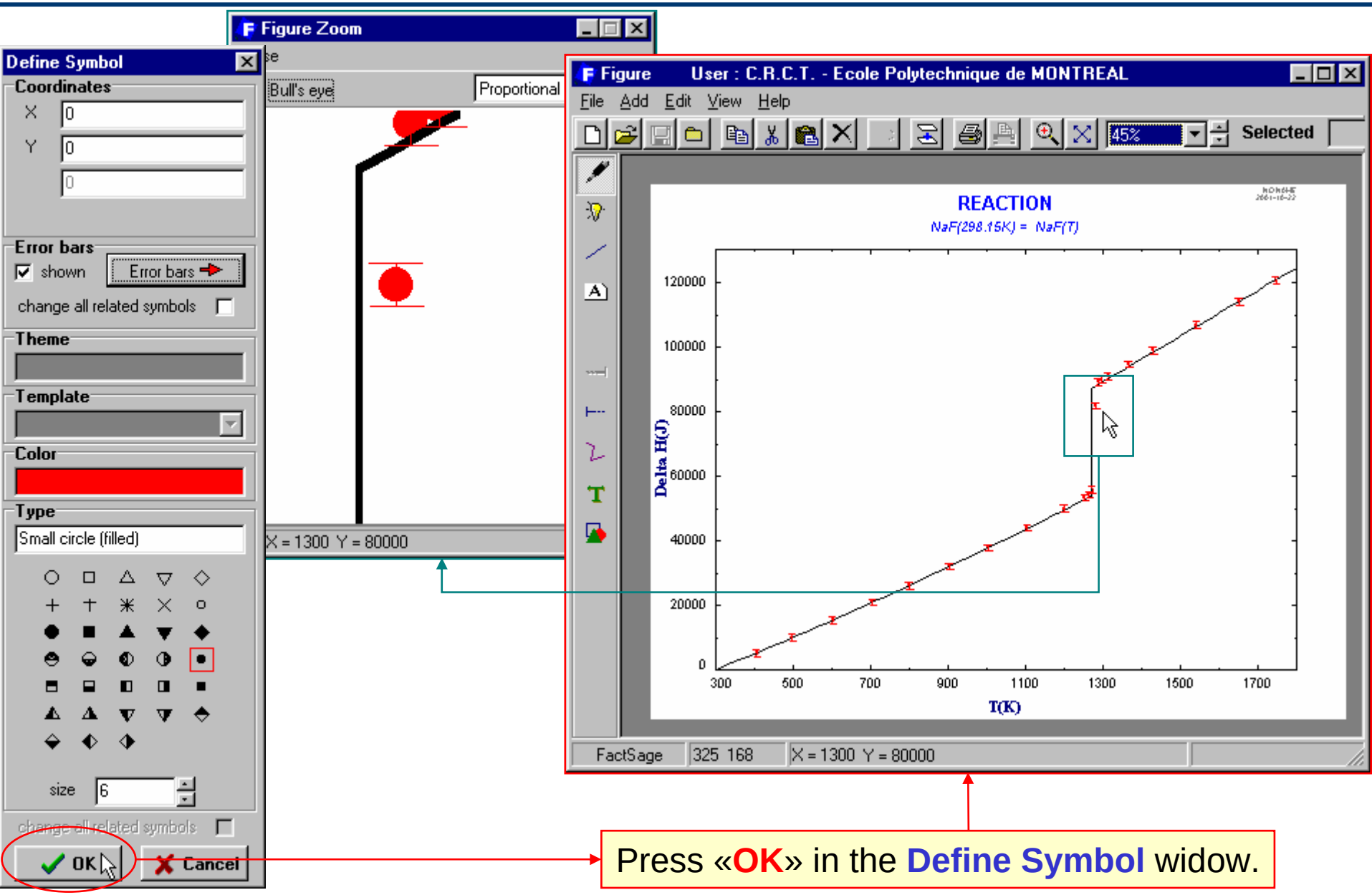
Press «Error bars→».





Make your choice of **Error bars** properties: type, thickness, color and dimensions.
Press «OK».

Editing the experimental data: Output



Press «**OK**» in the **Define Symbol** widow.

Adding a legend into a figure

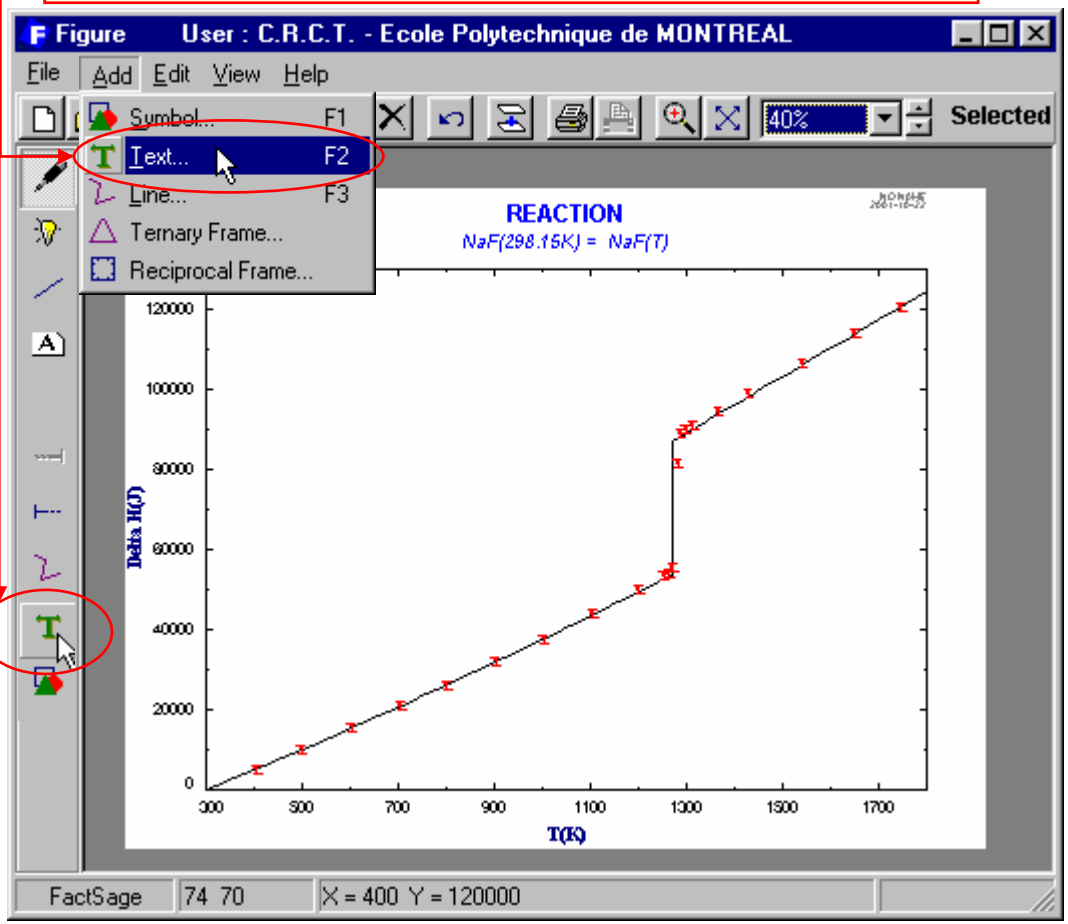
Figure permits the addition of a legend into a diagram.

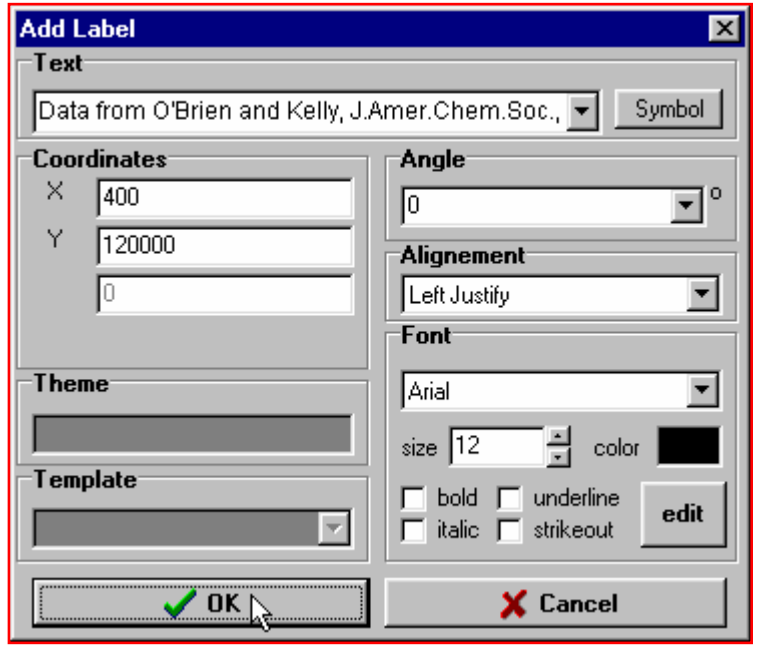
The following two slides show how to do that.

Adding a legend or text to your *Figure*

To **open** the **Add Label** window, you can:

- **click** on the **Add Label** icon on the edition tool bar,
- **select** **Text…** from the **Add** menu **or**
- **press** «**F2**» on the keyboard.





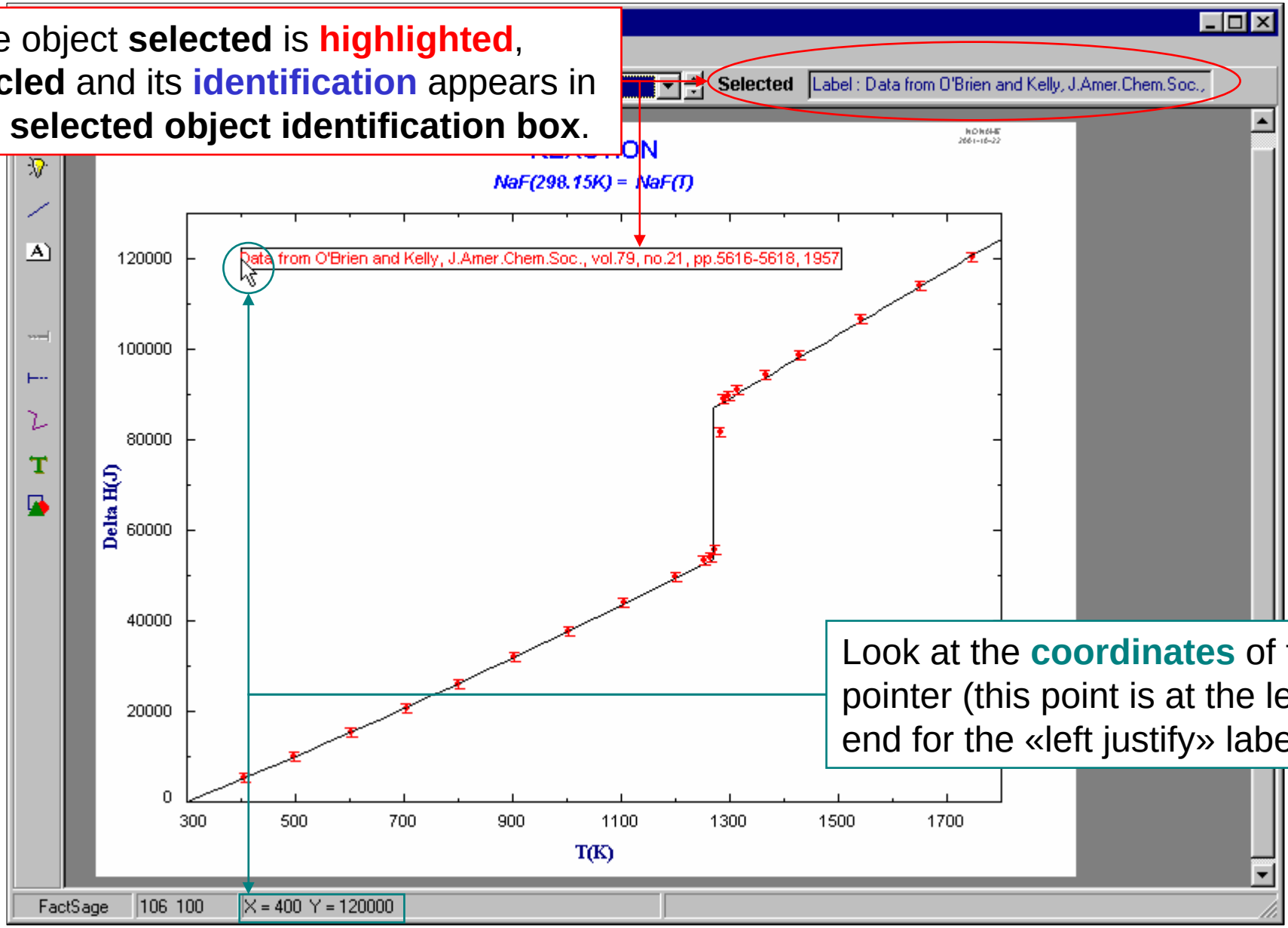
Type:

- your **Text**;
- the **Coordinates** of the anchor of the text box (here **X=400** and **Y=120000**);
- the **Angle** of the text box;
- the **Alignment** of the text box;
- the text **Font**, size and color.

Press «**OK**».

An **Enthalpy ΔH** vs **temperature T(K)** graph

The object **selected** is **highlighted**, **circled** and its **identification** appears in the **selected object identification box**.



Look at the **coordinates** of the pointer (this point is at the left end for the «left justify» label).

Adding and editing symbols to a figure

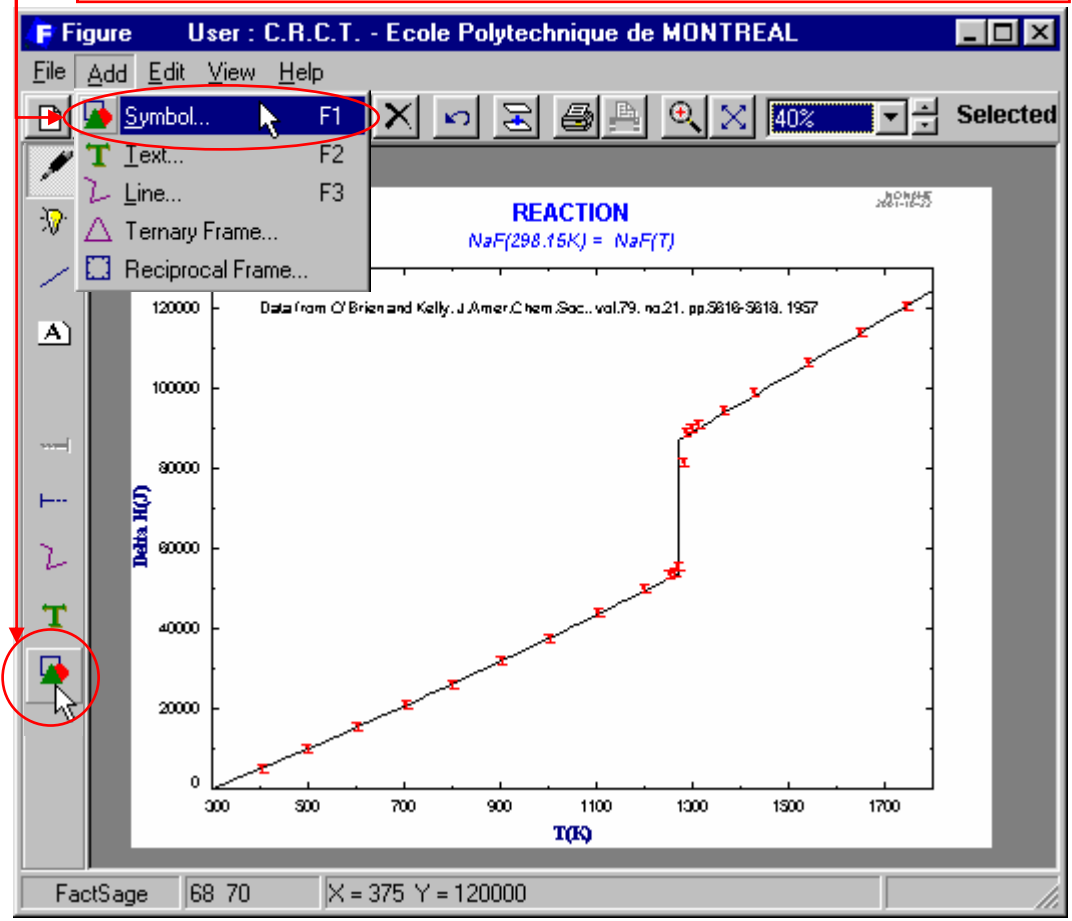
Figure permits the addition of symbols into a diagram. Symbols that have been added may also be edited.

The following three slides show how to make use of the adding and editing of symbols.

Adding a symbol to your *Figure*

To **open** the **Add Symbol** window, you can:

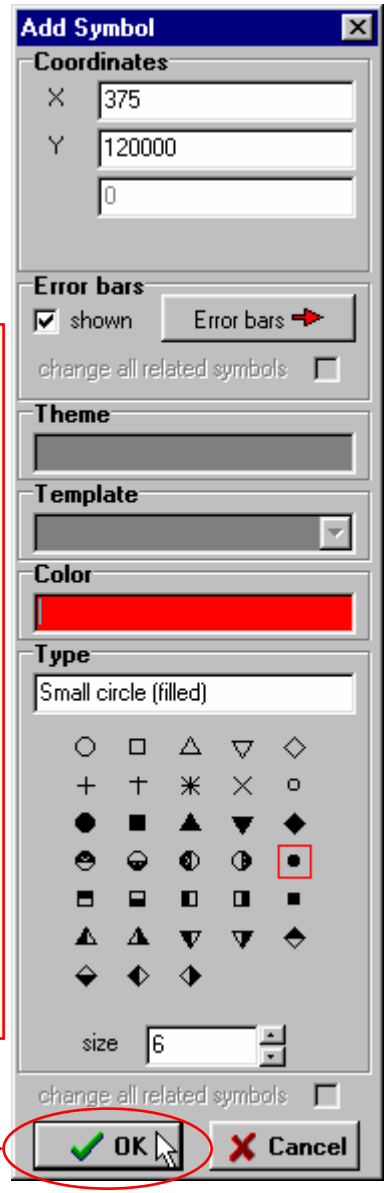
- **click** on the **Add Symbol** icon on the edition tool bar,
- **select Symbol…** from the **Add** menu **or**
- **press** «**F1**» on the keyboard.



Select:

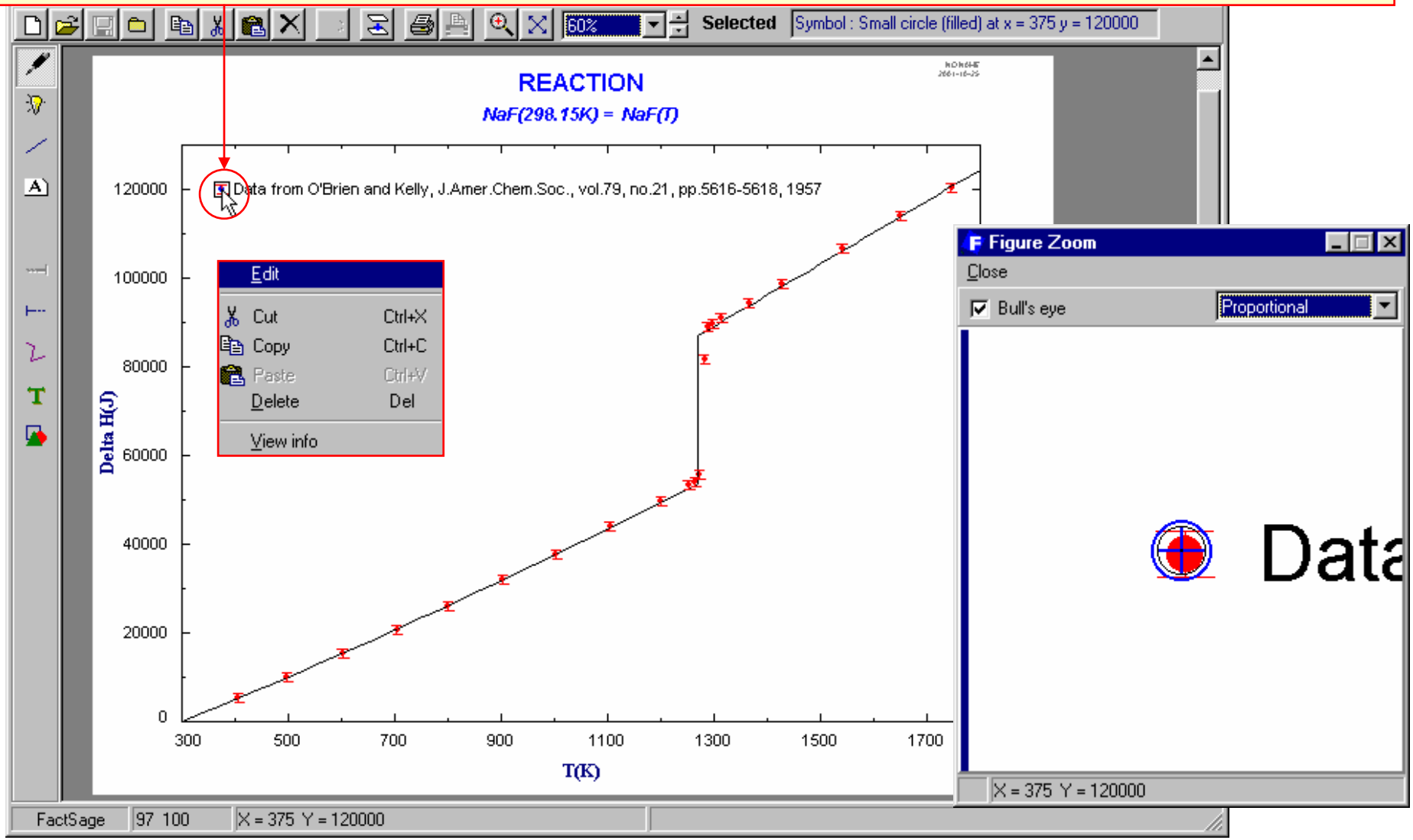
- the **Coordinates** of the symbol (here **X=375** and **Y=120000**);
- the **Color**, the **Type** and the size;
- and the **Error bars**.

Press «**OK**».

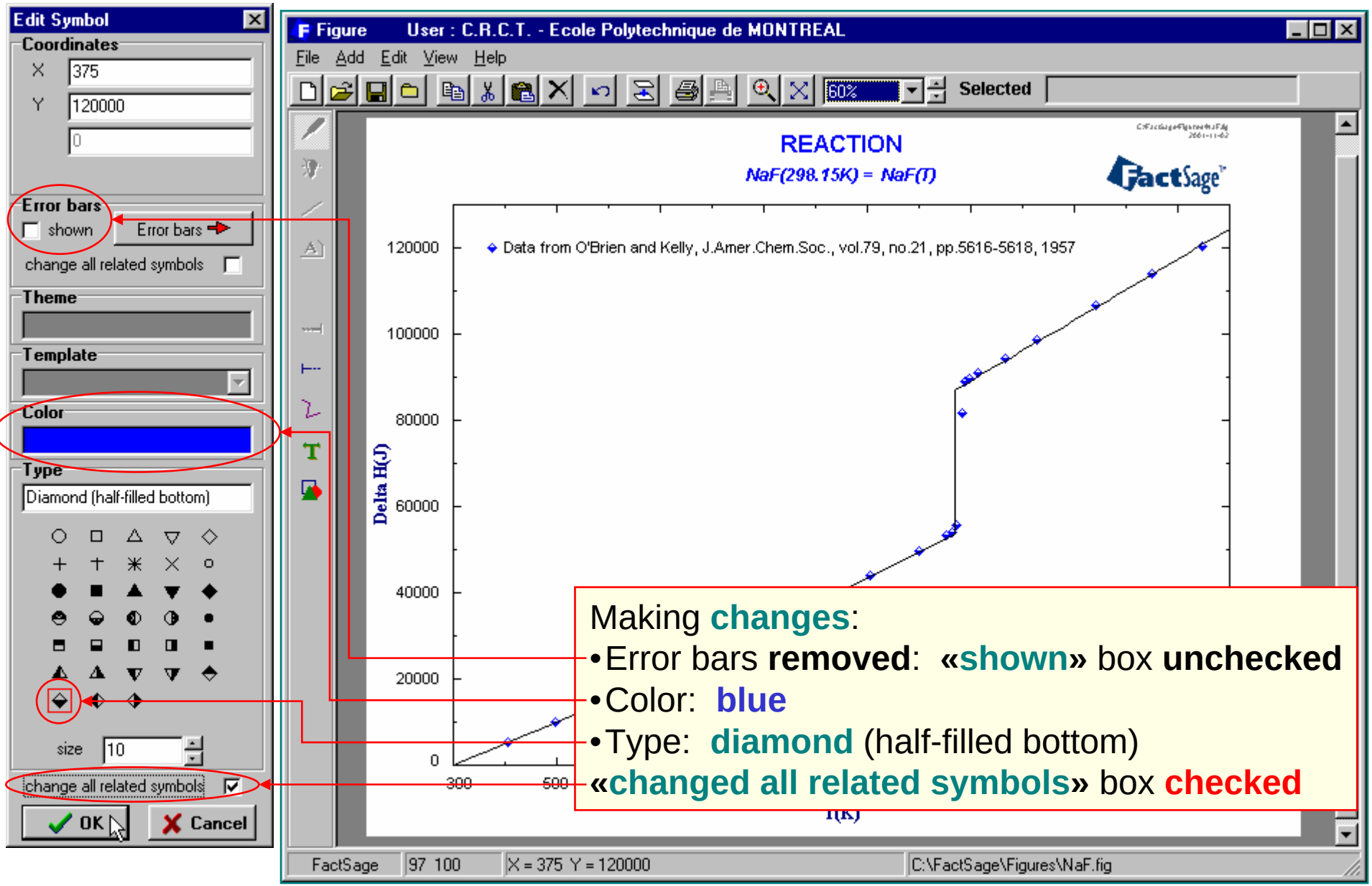


Editing all symbols together

Left click on a symbol to **open** a **pop-up menu**, then select **Edit**. The **Edit symbol** window will appear (**shortcut**: **double-click** on a symbol will do the same).



Editing all symbols together: Results



Making **changes**:

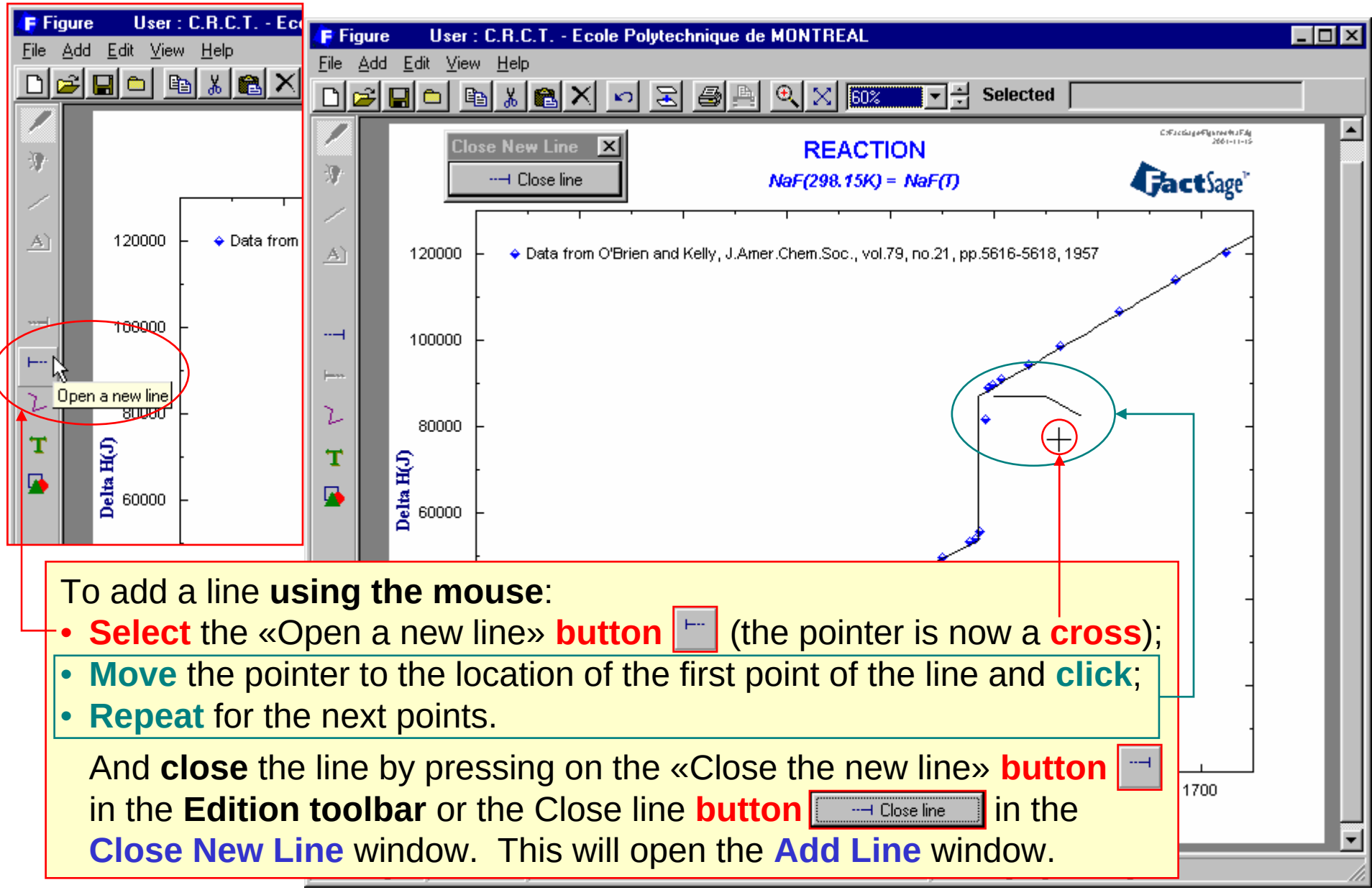
- Error bars **removed**: **«shown»** box **unchecked**
- Color: **blue**
- Type: **diamond** (half-filled bottom)
- **«changed all related symbols»** box **checked**

Adding and editing lines

The ***Figure*** module permits the addition of lines into an already existing diagram. Once the line has been added it is also possible to edit it, e.g. in terms of the line color, line thickness etc.

The following four slides show how to make use of the adding and editing of lines.

Adding lines to a figure using the mouse



To add a line **using the mouse**:

- **Select** the «Open a new line» **button** (the pointer is now a **cross**);
- **Move** the pointer to the location of the first point of the line and **click**;
- **Repeat** for the next points.

And **close** the line by pressing on the «Close the new line» **button** in the **Edition toolbar** or the Close line **button** Close line in the **Close New Line** window. This will open the **Add Line** window.

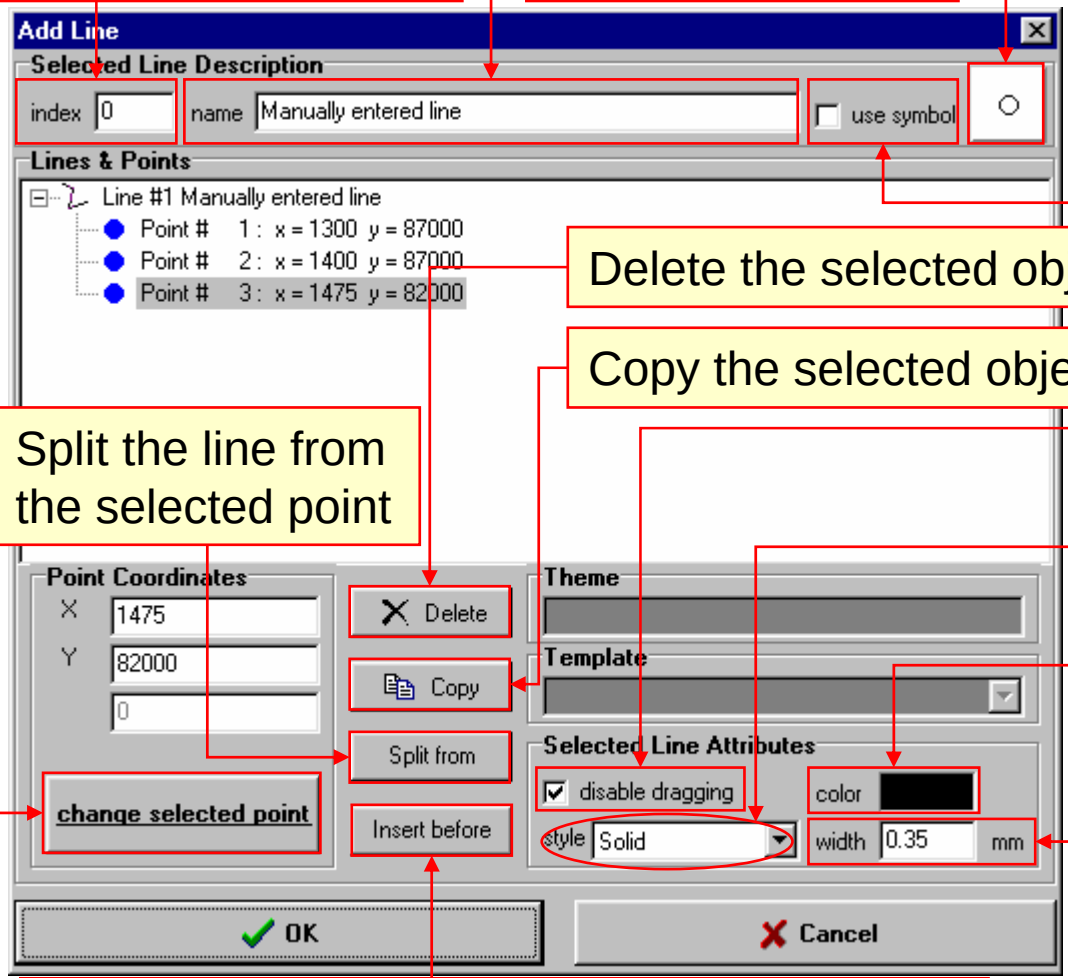
The **Add Line (Edit Line)** window **features**

Enter a line number

Enter a line name

Click to change symbol type

Check to put a symbol at every calculated point of the line



Delete the selected object

Copy the selected object

Split the line from the selected point

Check to enable the drag-and-drop of the selected line

Select the line appearance

Click to change the color of the selected line and symbol

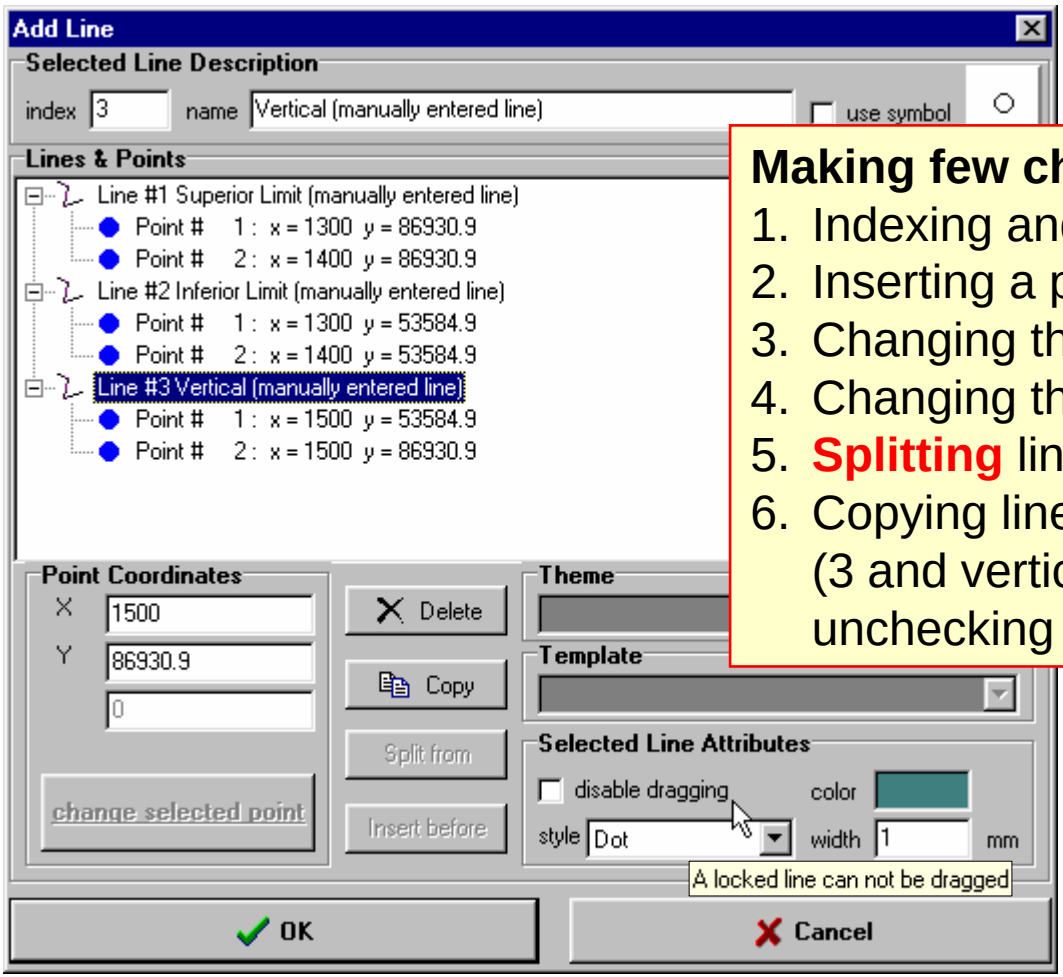
Enter the width of the selected line

Insert a new point before the selected point

Change the selected point by the new value

Clicking on the **Add Line** button or selecting **Add > Line…** also opens the Add Line window and you can enter the points coordinates of lines **using the keyboard**.

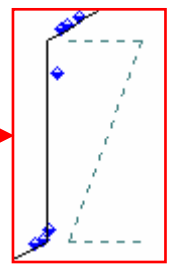
Editing in the Add Line (Edit Line) window



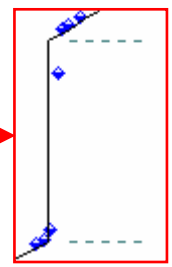
Making few changes:

1. Indexing and labeling the line;
2. Inserting a point bebore point #2;
3. Changing the coordinates of the four points;
4. Changing the color, style and width of the line;
5. **Splitting** line #1 at point #3;
6. Copying line #2, indexing and naming the new line (3 and vertical), changing coordinates and unchecking «disable dragging» of line #3

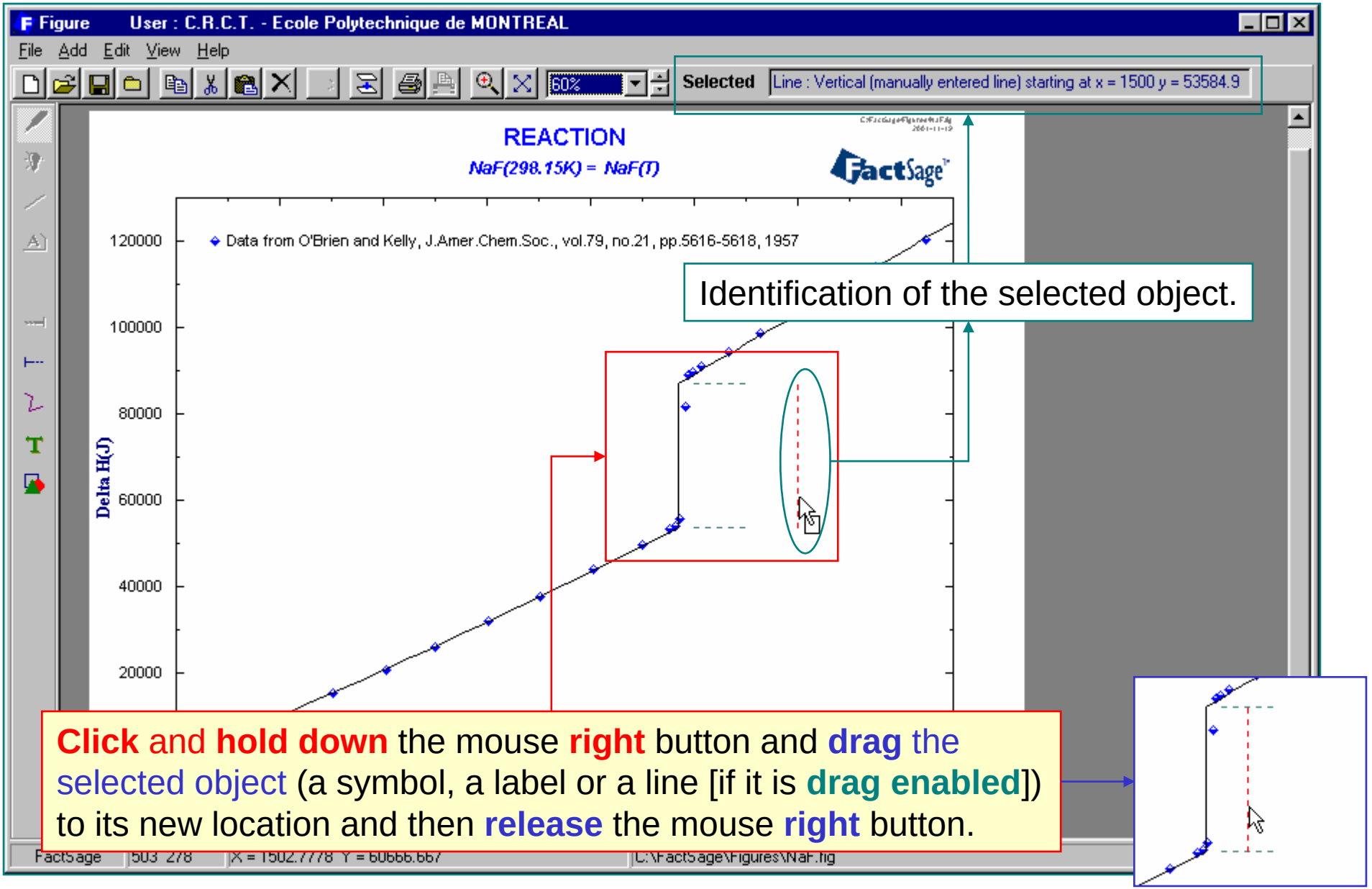
Step 5:
Before splitting



Step 5:
After splitting



Result of the lines' edition and **Drag-and-Drop** feature



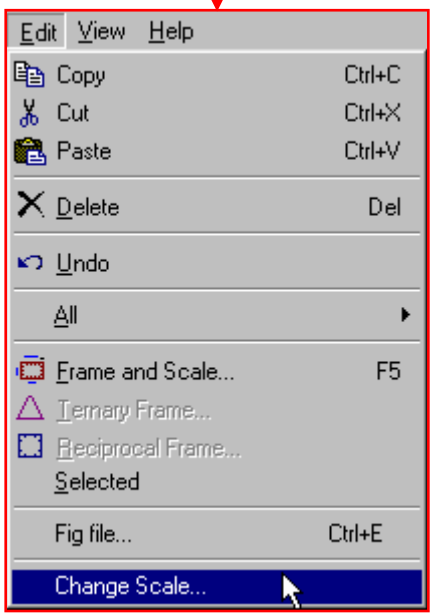
Changing Scale

The following two slides show how the **Change Scale** option is called and applied in adjusting the axes variables of a diagram.

The **Change Scale** window

For example, you want to change **enthalpy** values from **joules** to **calories** and change **temperature** values from **Kelvins** to **Farenheit degrees**.

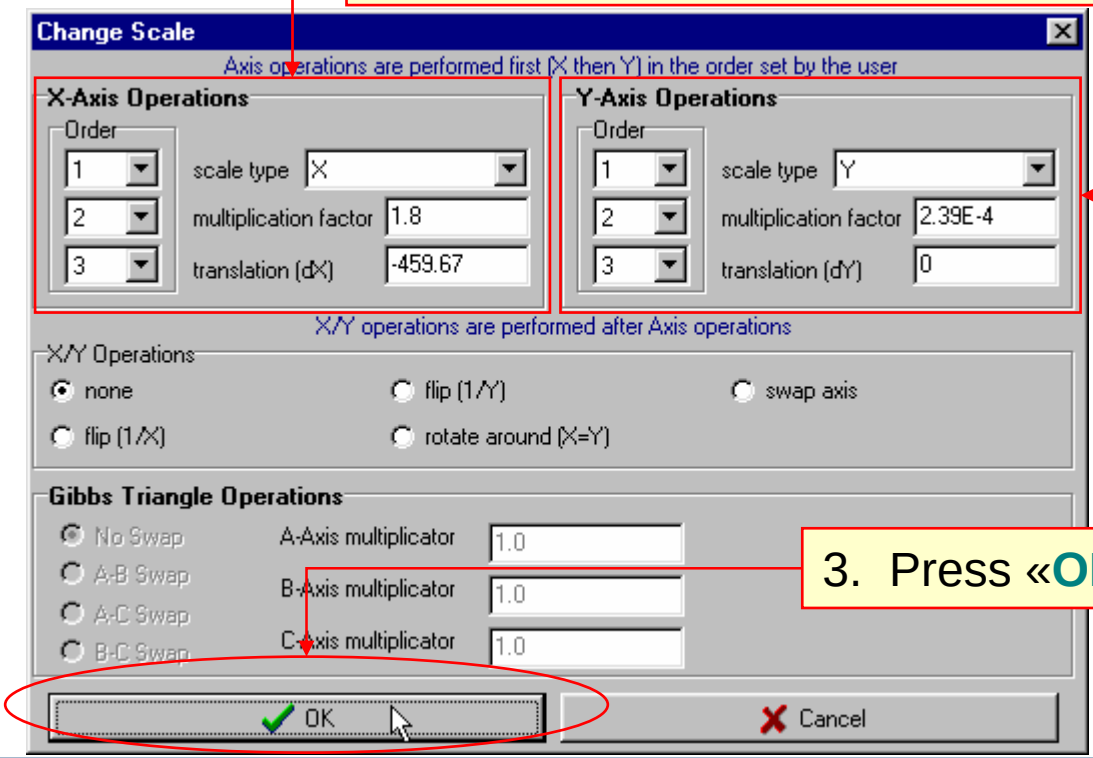
1. From the Menu bar, select: Edit > Change Scale… to open the **Change Scale** window



2. Enter the operation you want to perform.

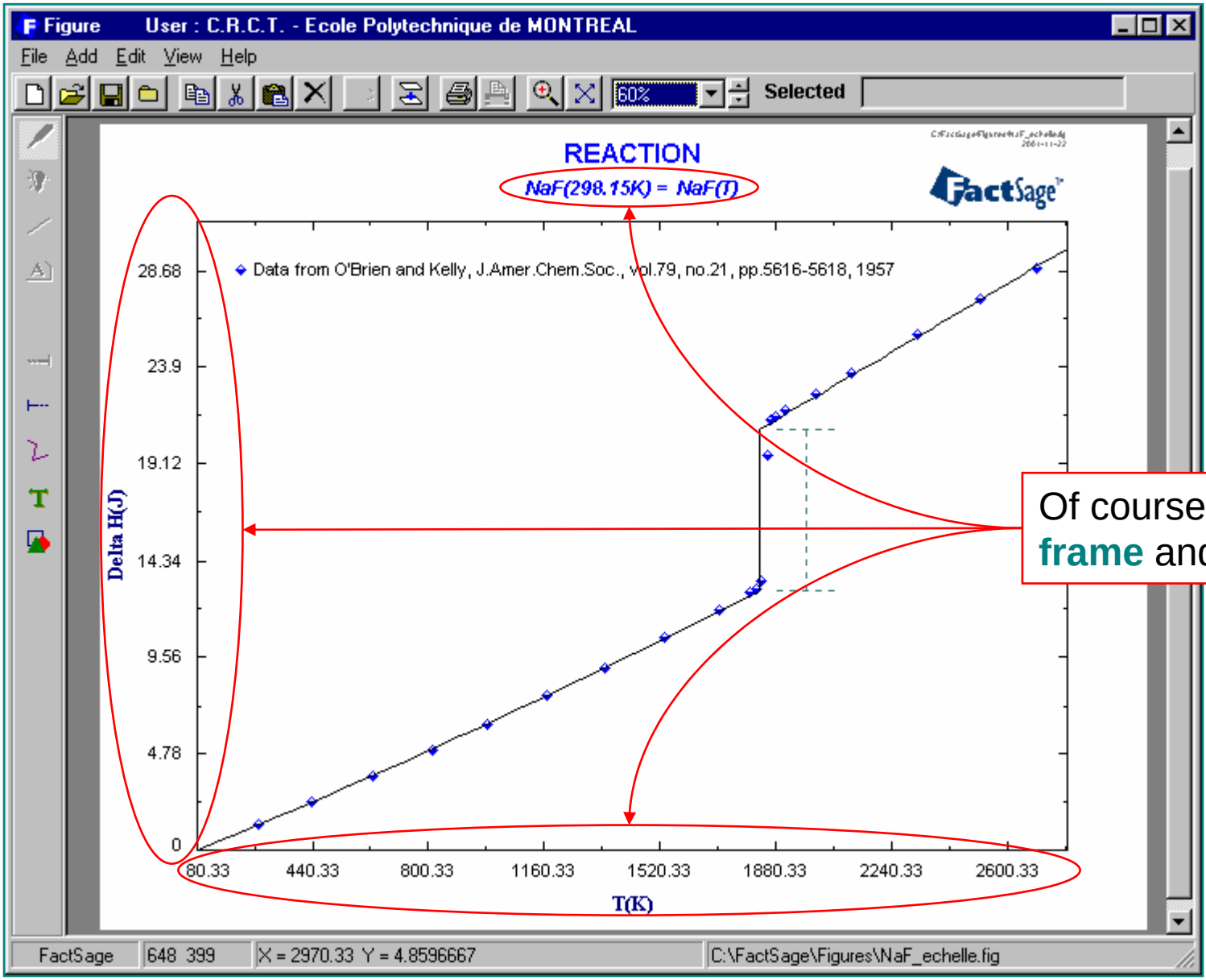
For the X-axis, the **temperature**:
$1.8 \times [T(K) - 273.15] + 32 = T(°F)$
or $1.8 \times T(K) - 459.67 = T(°F)$

For the y-axis, the **enthalpy**:
$\Delta H(J) \times [1\ Kcal / 4184\ J] = \Delta H(Kcal)$
or $\Delta H(J) \times [2.39 \times 10^{-4}] = \Delta H(Kcal)$



3. Press «**OK**»

Change scale: Result



Of course, you can **edit** the **frame** and the **axes** again.

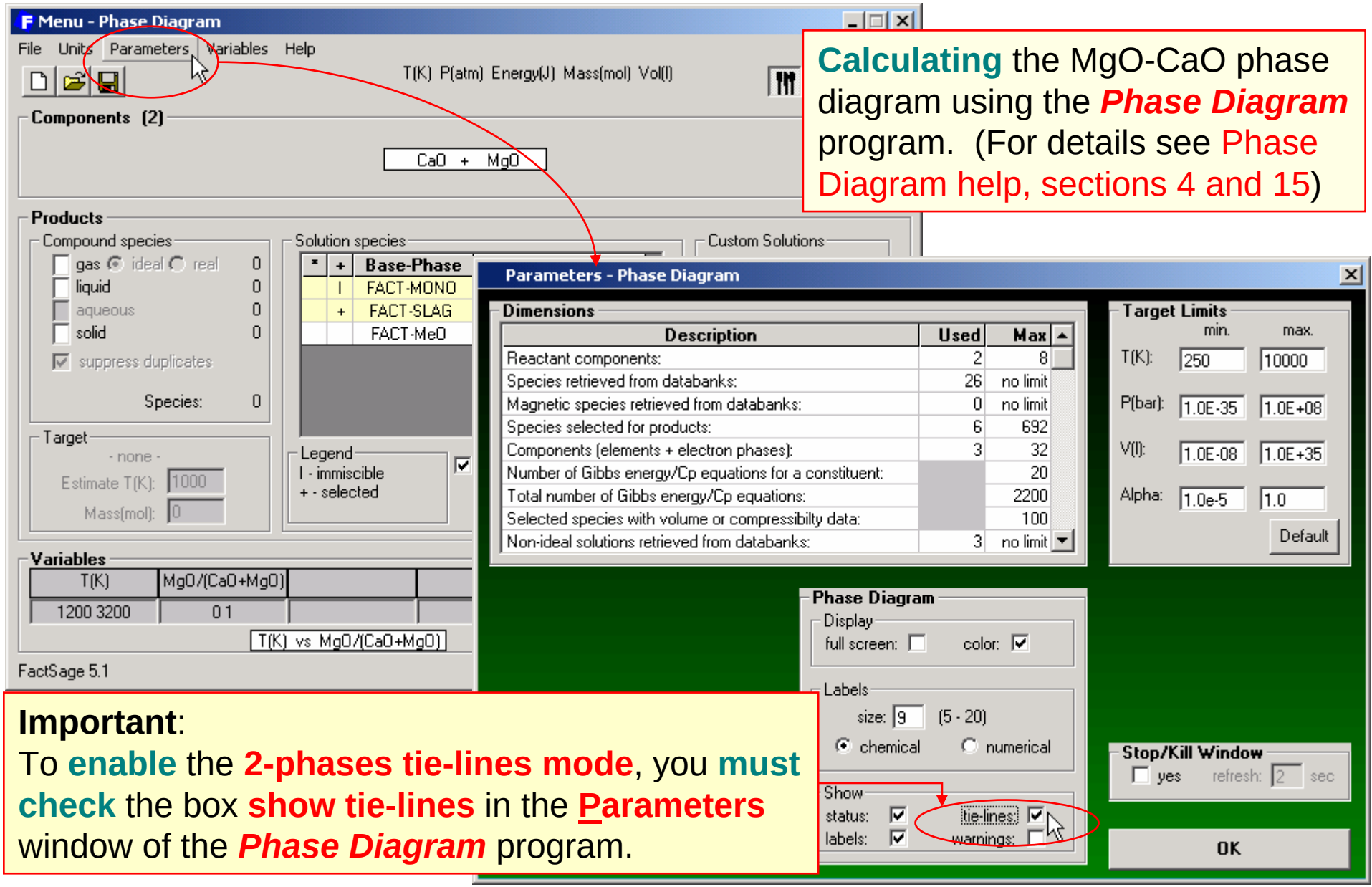
Using ***Figure*** in the ***Phase Diagram*** module

One of the major uses of the ***Figure*** module is in conjunction with the ***Phase Diagram*** module.

In that context the ***Figure*** module is called/opened automatically when the calculation of the phase diagram begins.

After the diagram is complete the ***Figure*** module is used to post-process the diagram on-line. Labels can be generated and fixed to a user selected position in the diagram, tie-lines can be calculated and plotted (if applicable), it is even possible to use the cursor to generate input for a point equilibrium calculation for a given x-y position in the diagram.

Calculating and drawing a binary ***Phase Diagram***

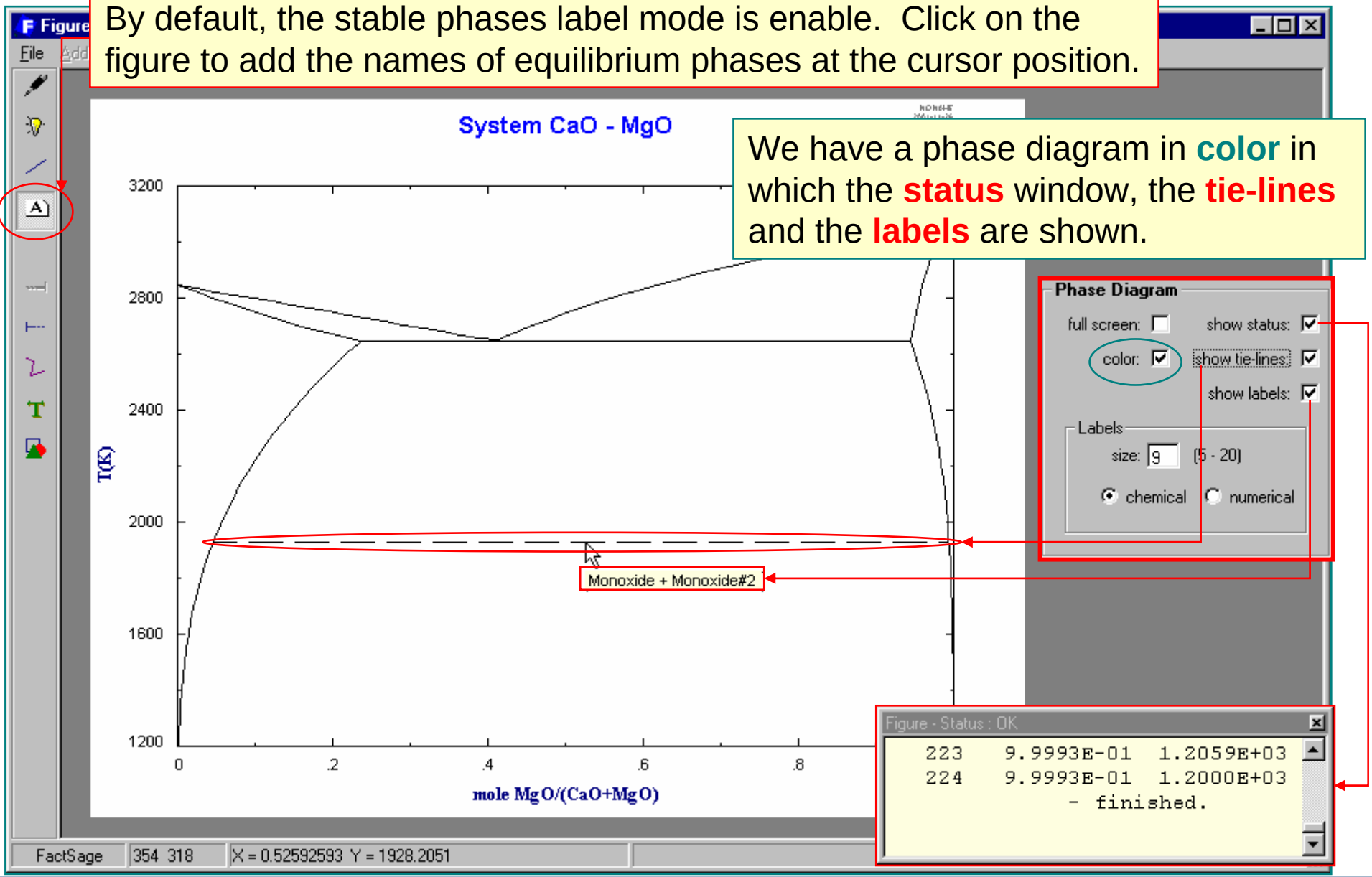


Calculating the MgO-CaO phase diagram using the ***Phase Diagram*** program. (For details see Phase Diagram help, sections 4 and 15)

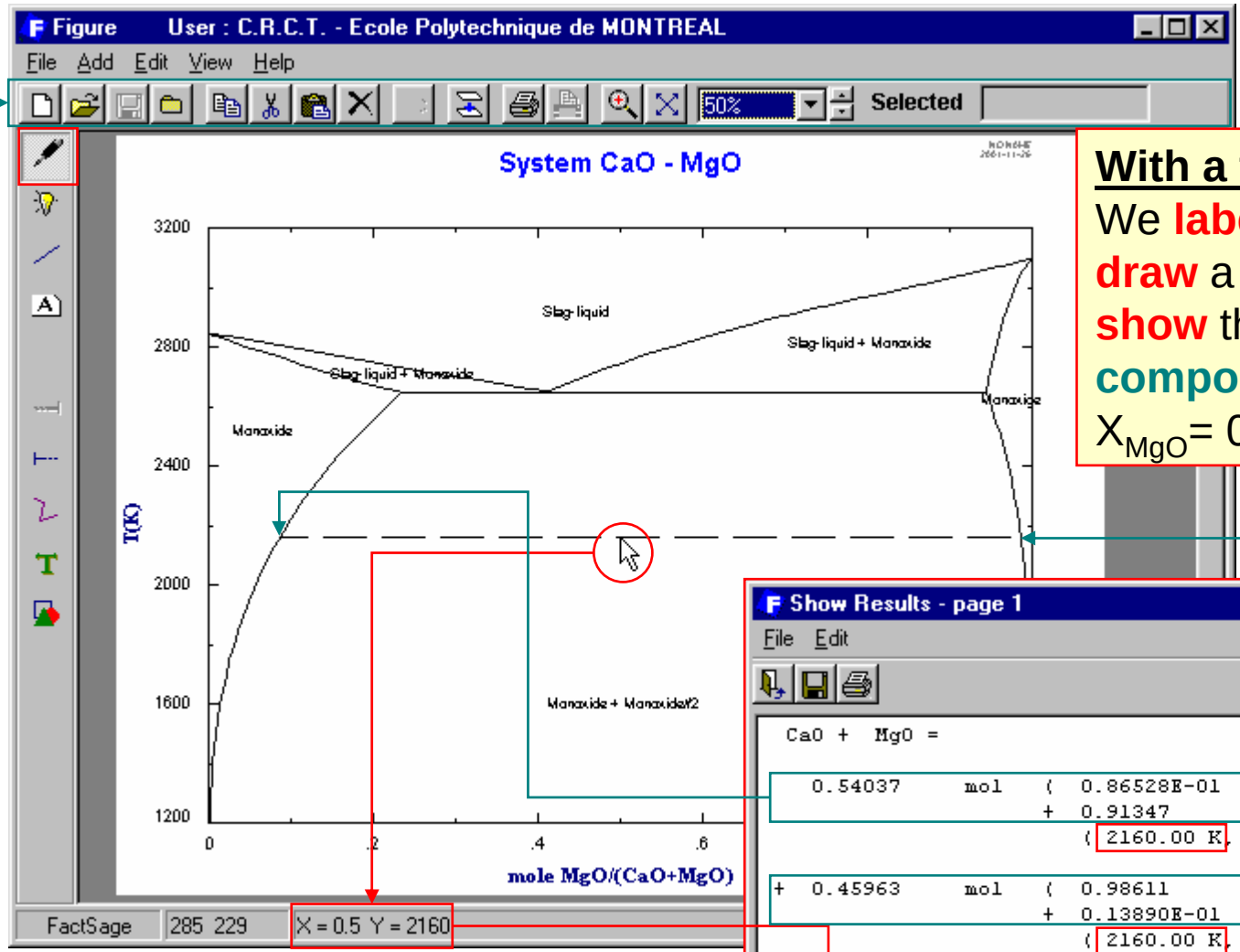
Important:
To **enable** the **2-phases tie-lines mode**, you **must check** the box **show tie-lines** in the **Parameters** window of the ***Phase Diagram*** program.

Phase diagram: *Figure* output

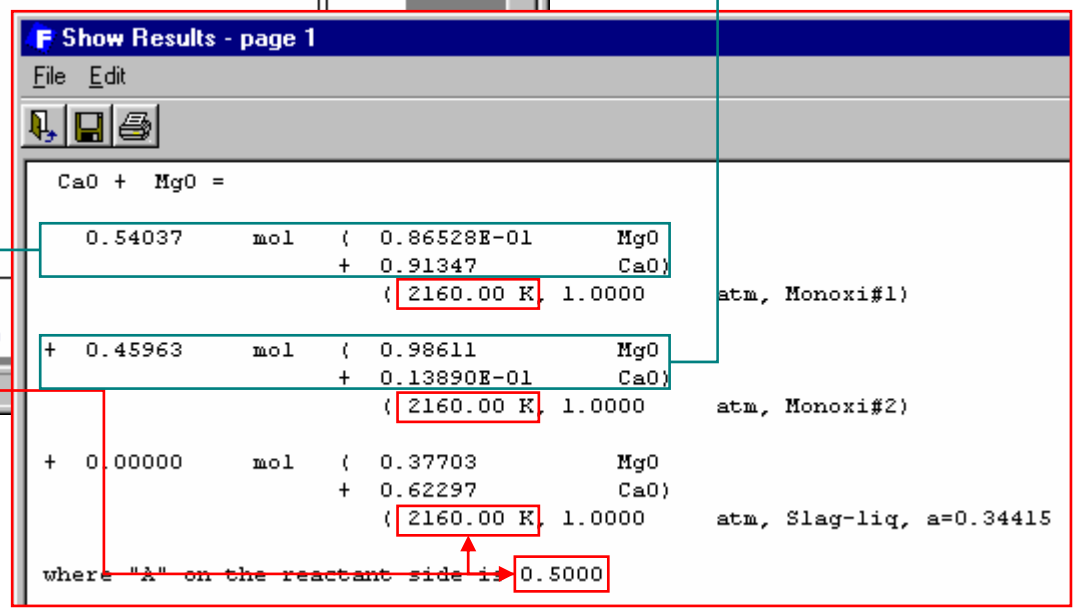
By default, the stable phases label mode is enable. Click on the figure to add the names of equilibrium phases at the cursor position.



Labeling phase domains, **drawing** tie-lines and **showing** results of calculation



With a few mouse clicks,
We **label** each domain [A],
draw a tie-line at 2160 K [/],
show the **proportion** and the **composition** of the phases at X_{MgO}= 0.5 and T = 2160 K [bulb].



The **normal edition mode toolbar** appears when the normal edition mode is **enabled** [pencil]

A Ternary (Gibbs triangular) diagram

The following two slides show how a ternary isothermal phase diagram (Gibbs triangle) is pepared and plotted.

It is also shown that a group of items (here all phase boundaries) can be treated with an «ensemble» command, for example to change the color of all members of the group.

Calculating and drawing a ternary ***Phase Diagram***

Calculating the LiF-KF-NaF phase diagram using the ***Phase Diagram*** program. (For details see Phase Diagram help, section 12)

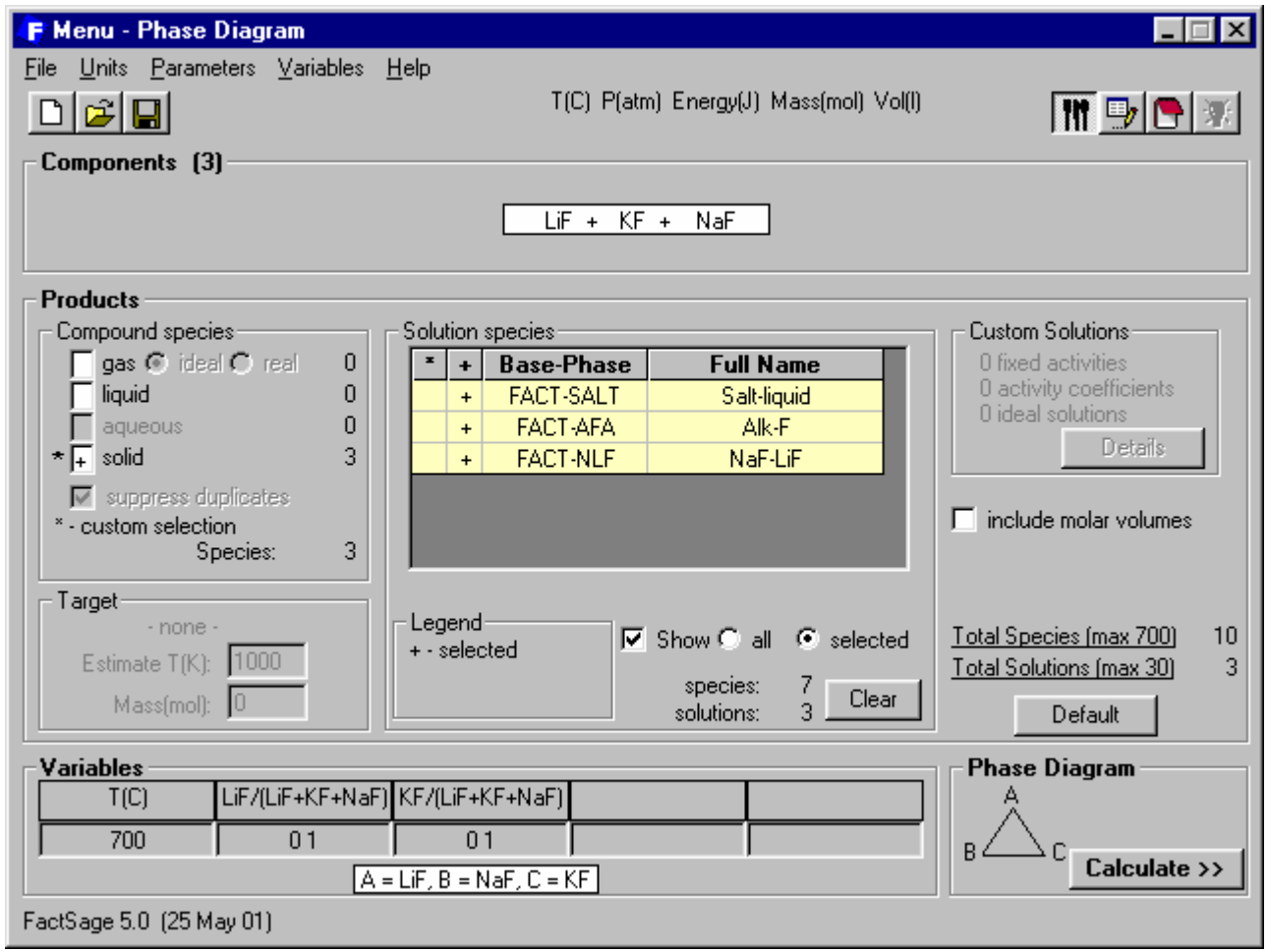
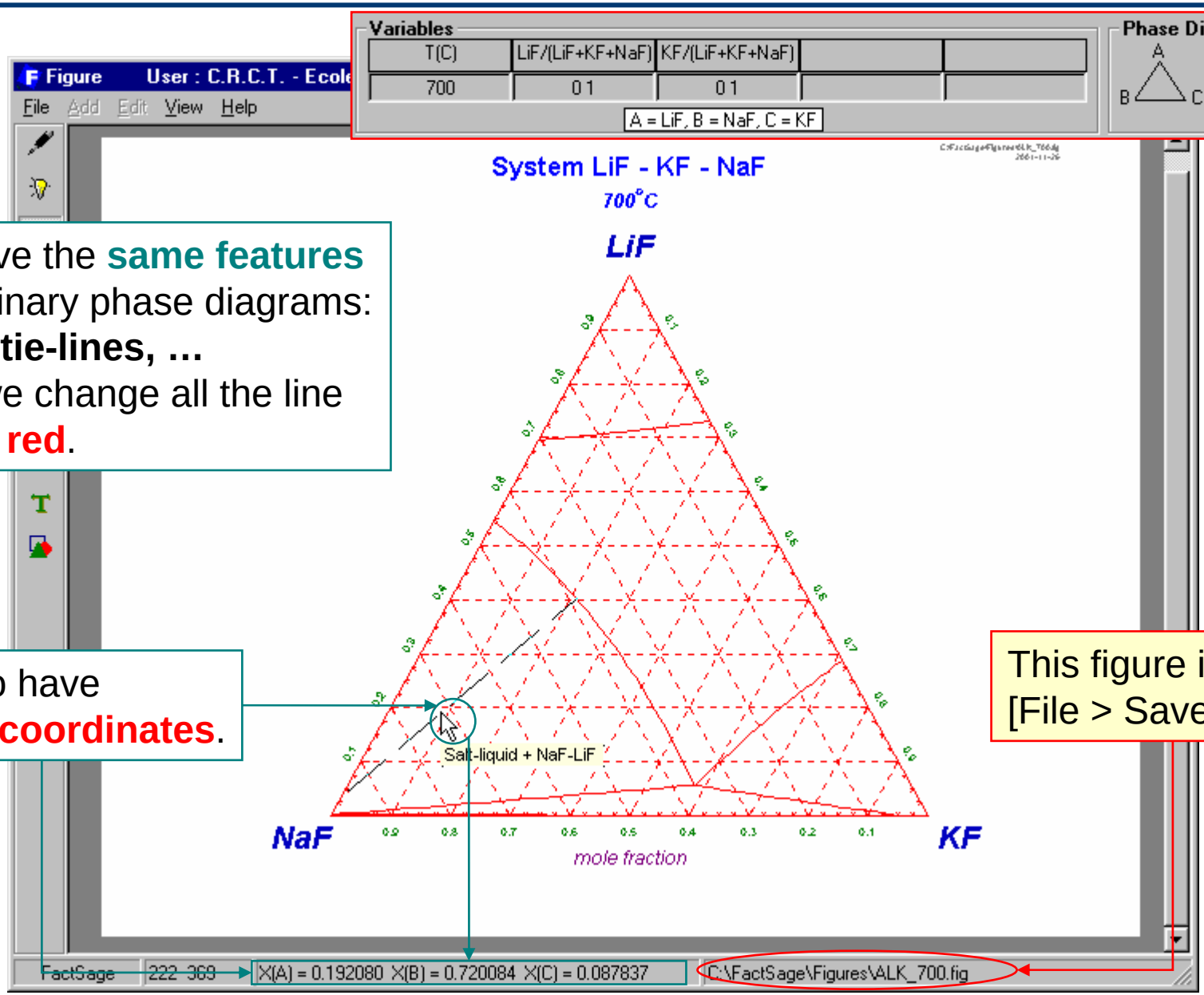


Figure 13.5

Ternary coordinates



You have the **same features** as on binary phase diagrams: **labels, tie-lines, …** Here, we change all the line color to **red**.

You also have **ternary coordinates**.

This figure is saved [File > Save as…]

Superimposed diagrams

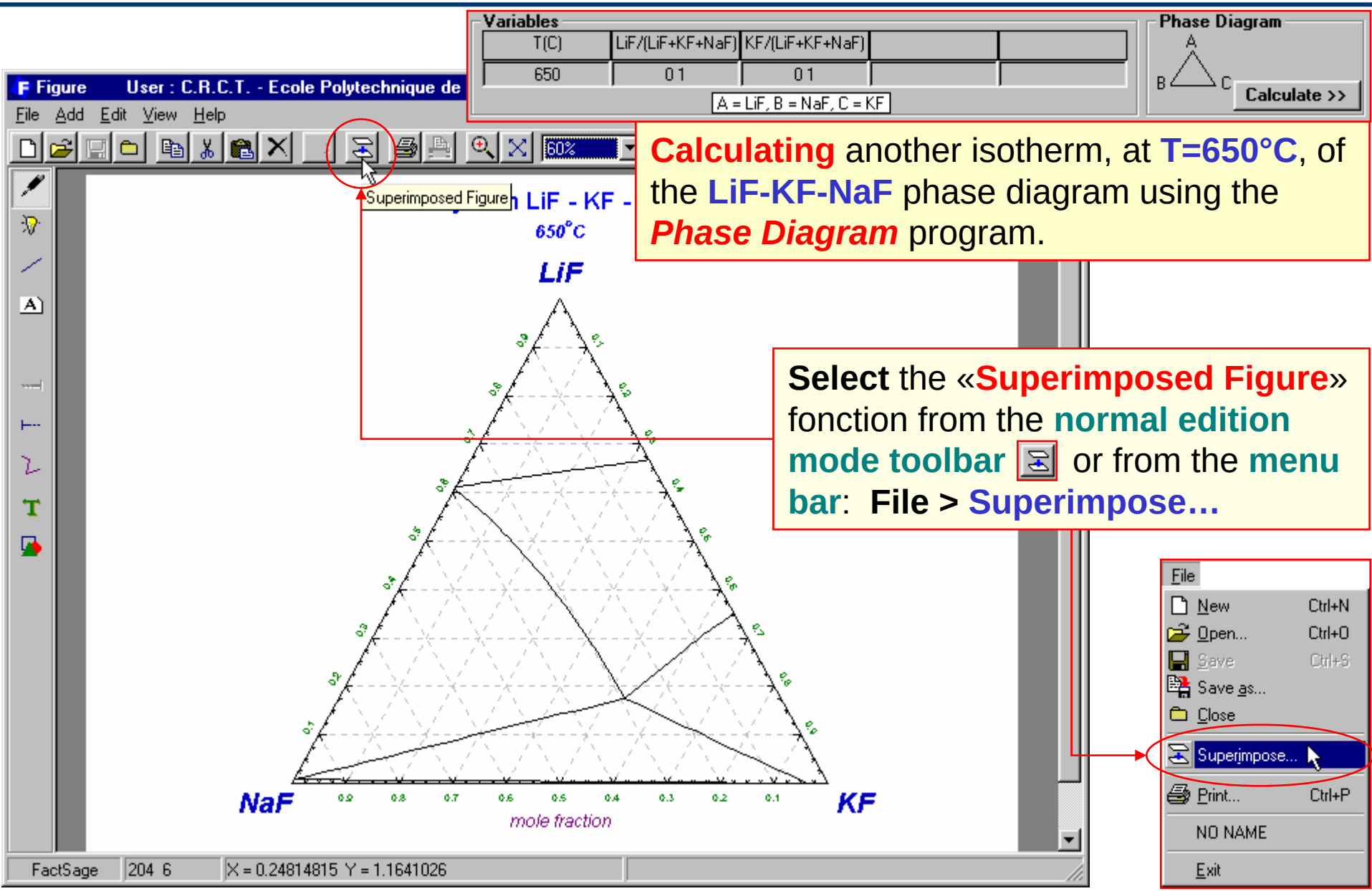
The following two slides show how to make use of the **Superimpose** feature of ***Figure***.

It is often useful to be able to draw diagrams in which a series of curves appear which depend on one particular parameter. The value of this parameter is different for each diagram, but the type of diagram is the same for a whole series.

As an example an overlay of two isothermal ternary phase diagrams is generated in which the temperature is the parameter.

NOTE that this feature is particularly useful if so-called **liquidus projections** are to be generated.

The Superimposed Figure feature



Calculating another isotherm, at **T=650°C**, of the **LiF-KF-NaF** phase diagram using the ***Phase Diagram*** program.

Select the «**Superimposed Figure**» fonction from the **normal edition mode toolbar** or from the **menu bar**: **File > Superimpose…**

Superimposed figures

Select the figure to be superimposed on the previous one and press «**Open**»