



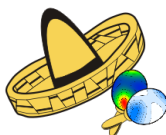
# StaTect

user guide

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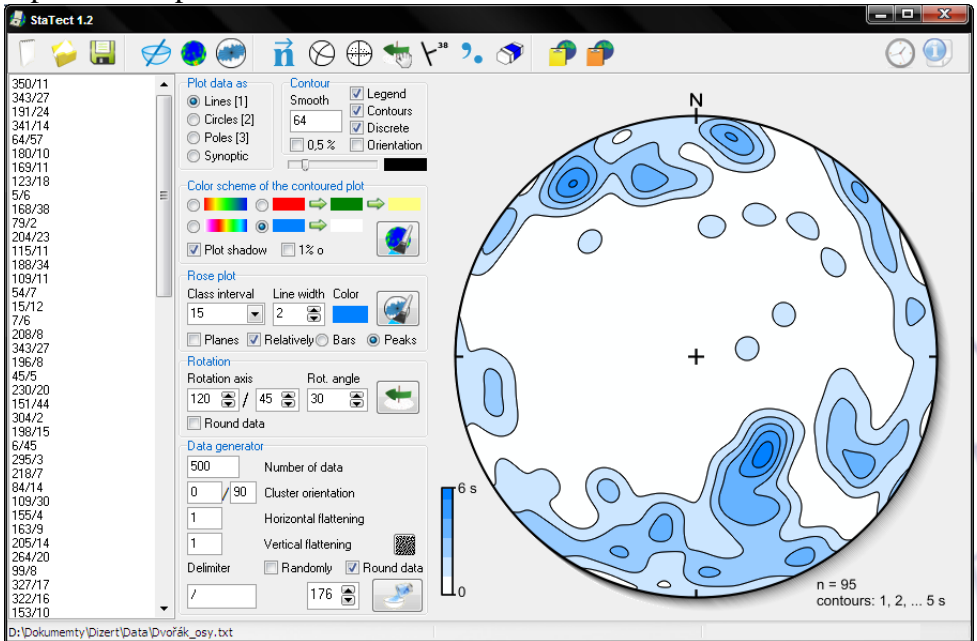
## Introduction

StaTect is a simple application for compass data plotting and statistical analysis. It was created in Object-Pascal using some libraries by doc. Melichar, Masaryk University Brno, Czech Republic ([www.ugv.cz](http://www.ugv.cz)) and graphic library GR32 ([www.graphics32.org](http://www.graphics32.org)). StaTect can plot data as points (poles), great circles or both ways (used e.g. for faults etc.), compute rose and contoured plots, rotate and generate data. All plots use equal-area projection on lower hemi-sphere and are generated as bitmaps and metafiles.

*StaTect can be used and distributed only for non-commercial purposes!*

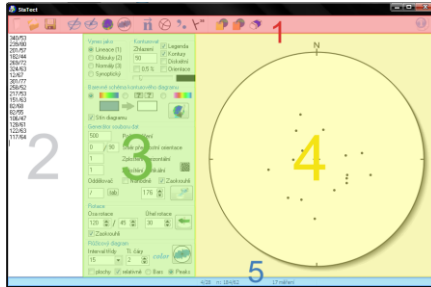
## Application use

Input and output as well as the controls can be found on one form:





The main form has five parts:



**1 – Tool bar** – contains the procedures' buttons.

**2 – Text field** – for the input data.

**3 – Settings** – contains panels with individual procedures settings.

**4 – Plot** – is the canvas for output plots.

**5 – Status bar** – shows mainly the cursor orientation in the plot and densities in the contoured plots.

## 1. Tool bar

The main tool bar contains buttons for all procedures StaTect can perform and is divided into four parts:



– **data file management**

- **New file** – deletes all data, deactivates all tools and clears the plot. No other settings are changed.
- **Open file** – loads selected text file and plots the data according to the settings (see below). **Pay attention to the data format!**
- **Save file** – saves the contents of the text field into a text file.








– **basic StaTect tools**




- **Plot data** – plots the data put in as the Euler angles ( $\alpha/\phi$ ). **Note:** StaTect only accepts the data in the trend/plunge or dip direction/dip format (0..360/0..90)! All other data must be converted elsewhere. The delimiter can be set in the panel [Data generator](#) and must be identical in the whole data set. When a file is loaded or data pasted into the text field, StaTect recognizes the delimiter automatically. No header is allowed. The data can be pasted into the text field also as vectors (one vector per line). In such case, the user has to right-click on the button. Data is converted to Euler angles (trend/plunge) on the lower hemisphere.
- **Contoured plot** – calculates and plots the contoured plot. This process is time-consuming (the density function is calculated in extremely dense grid for 40 835 points). The calculation progress is indicated by a progress-bar in the status bar. StaTect uses up to 4 CPU – cores.
- **Rose plot** – calculates and plots the rose plot.




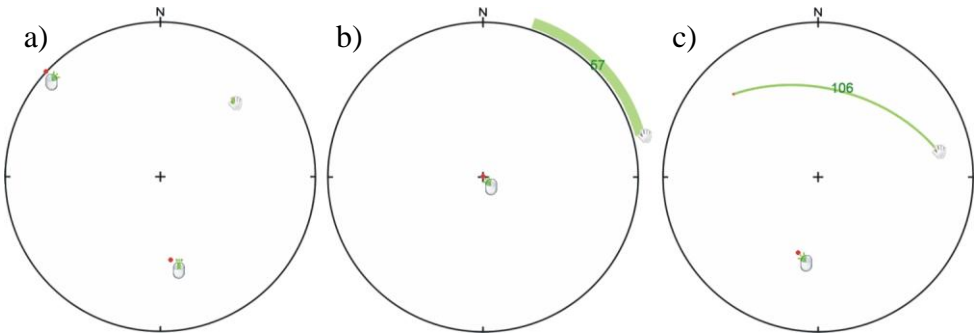
– useful tools:




- **Convert to normals** – converts the dip lines to normals.
- **Calculate fold axes** – calculates a fold axis from two measurements directly one after another in the text field (so sort the data carefully!). If the data are not normals to the planes, you have to either plot the data as poles or great circles or convert them (see above) otherwise the results are completely wrong!
- **Rotate data into the plot axes** – rotates the data, to align the biggest eigenvector with the vertical axis and the smallest eigenvector with the East-West axis.
- **Rotate data manually** – activates manual data rotation (the button icon changes to  and the cursor in the plot changes to ). The data can be rotated around vertical, arbitrary horizontal or any axis. Possible rotation axes are indicated by red dots with mouse-button hints (see figure-a below):  – left button,  – right button and  – the wheel (clicking,




not scrolling!). The starting point of the rotation is the pointing finger of the cursors hand. During the rotation the button must be held pressed! If the cursor finds itself out of the plot, the data can be rotated around vertical axis by using the left mouse-button. The rotation angle is indicated by a light green circle sector – see figure-b below b). If the cursor finds itself inside the plot, the data can be rotated around horizontal axis by the right mouse-button, around arbitrary axis (but fixed during the rotation) using the mouse-wheel, or around dynamically changing axis using the left mouse-button () . The rotation axis is in this case calculated as the vector product of starting and current cursor position vectors. The rotation angle is indicated by a section of a great circle in light green (fig-c).

Results of manual rotation are plot in real-time, data in the input text field are updated every time the user releases the mouse-button. The rotation can be undone (whole, not individual steps) by pressing ,



which occurs on the tool bar next to the button . The manual rotation tool can be deactivated and the results accepted by pressing  which then changes back to .

If the user wants to rotate planes, their dip-lines must be converted to normals by clicking on the button  or the data must be plot as great circles or poles (by checking the appropriate radio-button on the panel [Plot data as](#)). If the data is mixed, the user has to indicate the type of them (see below).



- **Map symbols** – activates the map symbols plotting tool. The panel with settings appears in the lower part of the form (for details see page 8).
- **Commas to dots** – converts commas to dots
- **Data eraser** – activates manual data eraser (for details see page 12).



#### – copy plot to the clipboard

- **Copy to clipboard** – copies the plot into clipboard in EMF format (enhanced metafile). Note: the process for the contoured plot takes 1-5 sec, depending on your hardware, all other plots are instant. During this time stays the button pressed.
- **Copy to clipboard** – copies the plot into clipboard in BMP format.



#### – last buttons

- **Tectonic clock** – the only real clock ;-)
- **Information about the application**






## 2. Text field

The text field contains the input data for all other procedures. The data can be directly written into, pasted from clipboard or loaded from a text file (📄 button on the main tool-bar; no header!). The data format is important: one measurement on each line,  $\alpha$  a  $\varphi$  are separated by a delimiter set in a edit box in the [Data generator](#) panel in the bottom part of the form. The delimiter must be only one character and not a number. The delimiter is set automatically if the data is loaded from a text file or pasted from clipboard. **Only one delimiter is possible in the input file!**

input data example:

```
34/34
124/45
45/23
```

StaTect plots the data as lineations, great circles or poles as set on the [Plot data as](#) panel. The implicit symbols are dots, the symbol can be altered by adding a delimiter and 1-4 (see below). The poles are plot as unfilled symbols, if the user wants to plot the poles filled, just convert it to normals by pressing  on the tool-bar. If the plot is synoptic, the number added to the line tells StaTect how to plot the measurement (the appropriate number is on the [Plot data as](#) panel in brackets).

input data example:

	<b>synoptic plot</b>
34/34/1	plots as lineation
124/45/2	plots as great circle
45/23/3	plots the pole to 45/23
342/65/4	plots as lineation

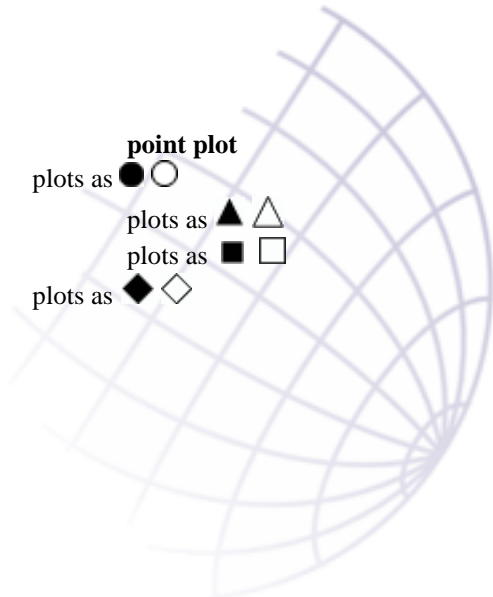
**point plot**

plots as ● ○

plots as ▲ △

plots as ■ □

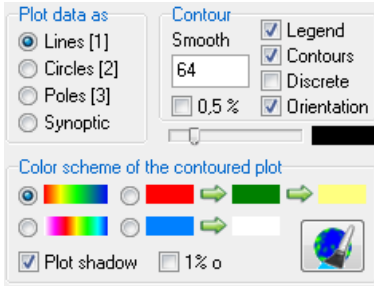
plots as ◆ ◇






### 3. Settings

This section contains panels with each tool settings. The plot is updated immediately after changing any setting.



Orientation matrix	
Eigenvectors	Eigenvalues
321/27	2,7326
98/55	0,2674
220/20	0
Shape factor $F_i$ :	0,098
Lode ratio:	-0,804

**Plot data as** panel sets the plot type. If  Synoptic is checked, the input data must be modified (see above). The symbol size can be set by the track bar under the panel **Contour**, its color by clicking on the black rectangle next to the track bar. If  Orientation is checked StaTect plots eigenvectors of the orientation matrix (as points and also great circles) and writes its characteristics into a text field **Orientation matrix**, which occurs instead of the **Data generator** panel. If it is checked using the left mouse-button () , the eigenvectors are plot in red, if it is checked using the red mouse-button () , the eigenvectors are plot in color: in red the biggest eigenvector, in green the middle and in blue the smallest eigenvector.


**Contour** and **Color scheme of the contoured plot** panels set the style and computing method of the contoured plot. When the user wants to contour planes, he has to either check the radio-buttons  Normals or  Great circles on **Plot data as** panel, or convert the dip-lines to normals by clicking on the button . Mixed data cannot be contoured!

The contoured plot can be calculated using either the Watson distribution function (by default) or 1% circle (by checking  1% o). The smoothing parameter can be set on the **Contour** panel (the higher the value, the sharper the maxima; 64 gives the sharpness comparable to the 1% circle method). The Watson function gives the values in multiples of the expected density for uniform distribution (s), the 1% circle method gives values in percents.



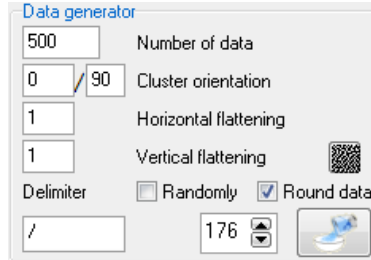



Panel **Contour** sets the contoured plot appearance: should the contoured plot contain graphical legend –  Legend (left mouse-button) or only written contours values –  Legend (right mouse-button), should the density function be contoured –  Contours and should the density color fill between contours be smooth or uniform –  Discrete. The step of the contours is set automatically. If the maximum is less than 15, every contour is plot, if the maximum is between 15-30, every other is plot, etc. In any case, the first contour is 1 s (%). If the maximum is less than 5 s (%) one can plot the contours with 0,5 step by checking the  0,5% in the **Contour** panel (the EMF is however plot with 1 s (%) or higher step).

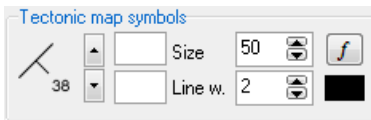
**Color scheme of the contoured plot** sets the color scheme of the plot. The user can choose between two fixed color schemes and customizable two and three colors fills. The colors can be changed by clicking on the colored rectangles on the panel, maximum on the left, minimum on the right. The colors can be easily switched by clicking on the arrow between the rectangles. The color of the contour lines is the same as the dots and great circles and can be changed by clicking on the black rectangle on the panel **Plot data as**. The changes take place immediately. The button  redraws the contoured plot (StaTect remembers the densities even if the original input data have been changed). The plot shadow switch on/off control is also located on this panel –  Plot shadow.



**Rose plot** panel sets the parameters of the rose plot. The class interval can be set in the combo box Class interval: 5, 10, 15, 20 a 30° are for the user's disposal. The colored rectangle Color sets the fill color. If the check box  planes is checked, the strike of the planes is used for the frequency counting. The histogram can be plot as  Bars or  Peaks.

The panel **Rotation** is used to rotate data, when it is necessary to use a particular rotation axis and angle. The results can be round up by checking the  Round data check box which of course changes the angles between data!



StaTect can generate data in two ways: directly by clicking in the plot and automatically using the panel [Data Generator](#). By default is used an algorithm by Sato, Yamaji, 2006<sup>1</sup>, which generates data with uniform distribution. The algorithm can be influenced by changing the value in the spin box next to the button for data generating . Better results can be obtained by unchecking -  Round data. The user can also use random data generation by checking  Randomly. Parameters Cluster orientation, Horizontal flattening and Vertical flattening control the orientation and shape of the data.



Panel [Tectonic map symbols](#) is hidden by default and appears when the button  is pressed, which also activates the tool, quite handy when drawing maps e.g. in Corel. The symbol orientation can be put in by two ways: 1) written in two edit boxes in the middle of the panel ( $\alpha$  in the upper  $\varphi$  in the lower one, the symbol is copied to clipboard after pressing Enter in the lower edit box), or 2) clicking in the plot in the appropriate place/orientation. Symbol size, line width, font and color can be set in the panel. The map symbol is copied to clipboard directly after clicking. The arrows right to the image on the panel change the map symbol type, which is based on the Czech Geological Survey template (see tab below). To deactivate the tool press the  button.

<sup>1</sup> Sato, K. & Yamaji, A. 2006. Uniform distribution of points on a hypersphere for improving the resolution of stress tensor inversion. *Journal of Structural Geology* **28**, 972-979.



bedding



overturned bedding



schistosity



cleavage



magmatic foliation



lineation



fold axis

**Note:**

Only two first map symbols do work, the others are not finished, because I plan to upgrade StaTect to a better metafile graphic library.







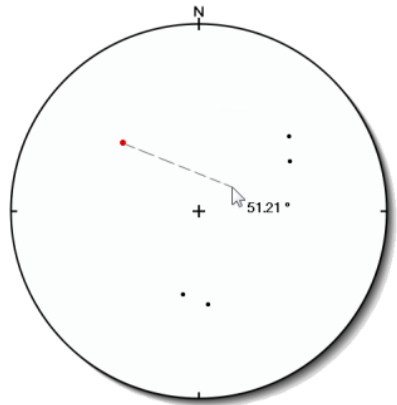
## 4. Plot

The diagrams are plot using Equal area projection (Lambert) on the lower hemisphere. StaTect can plot lineations, great circles and poles, constructs contoured and rose plots as a bitmap, which is shown in the form and as an emf file, which is stored in RAM. Either image can be copied to clipboard by clicking on buttons on the toolbar.

While moving the mouse cursor in the plot, its orientation and the orientation of a normal to it are shown in the second section of the status bar on the bottom of the form - 293/55 n: 113/35. When a contoured or rose plot is shown, the density in the orientation is shown instead of the normal - 293/55 D: 3,2%.

The use can measure the angle of between two points using the mouse wheel (by clicking). The angle is measured while the wheel is held down (= wheel-click on the first point and hold the wheel while moving the cursor on the second point. The angle is shown in a label next to the cursor).

Data can be deleted in the plot by activating the rubber tool by clicking on  button. The cursor changes into a red rectangle. The tool behaves as a standard eraser in any graphical editor. Its size can be changed by scrolling the mouse wheel. The rubber tool is deactivated by clicking on  button.





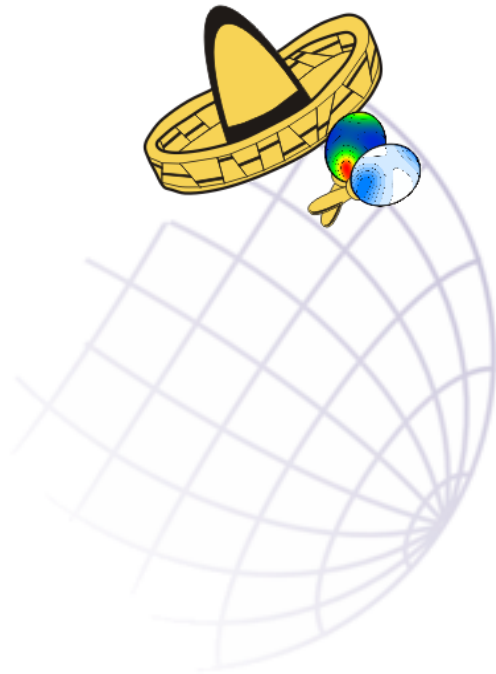
## 5. Status bar

The status bar shows the file name, orientation of the cursor and normal/density and the number of data. Also the progress-bar indicating the calculation progress is located in the status bar.

## Epilogue

StaTect is meant to be a simple, but freeware alternative to commercially available applications for structural analysis. As mentioned above, some libraries by doc. Melichar, Masaryk University Brno (Czech Republic, [www.ugv.cz](http://www.ugv.cz)) were used to create this application as well as GR 32 – a library package for bitmap graphic ([www.graphic32.org](http://www.graphic32.org)) mainly due its swiftness and high quality of the graphics. I apologize for any bugs left, and will try to fix them if you contact me: [jura@eltekto.cz](mailto:jura@eltekto.cz).

Hail to structural analysis :-)





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