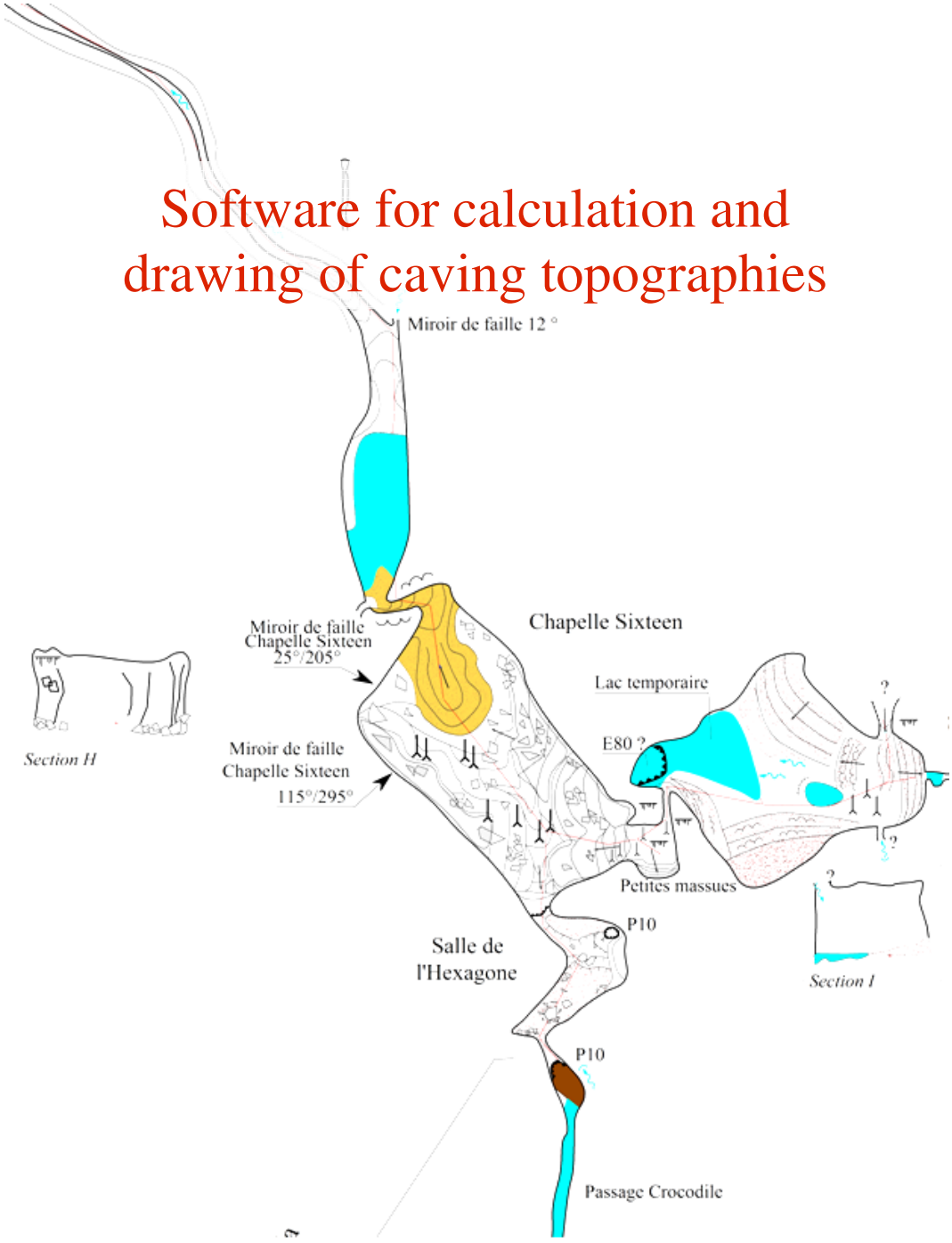
Topo Calc'R

Software for calculation and
drawing of caving topographies



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The software can be downloaded from the website: http://topocalcaire.free.fr//

Designation Version: Version 3.06.11

Software Features

It is intended for the calculation and the drawing of caving topographies. Its main features include:

- **Management cavities at the level of a massif** (or a network). One file for several cavities that can be viewed and plotted simultaneously.
- **Direct input of survey data** with management of instruments and operators as well as the possible continuations.
- Dynamic **drawing** of the **skin** on the screen with an option to raise the notes (or other image) in the background.
- **Import** of surface points from a GPS (GPX file)
- **Import** of survey data and drawing from a **topographic electronic pad (Pocket Topo, Auriga, TopoDroid, Qave)**
- **Import** of survey data from **Visual Topo, Toporobot or GHTopo** files
- **Import** of survey data from a **text file made with a spreadsheet**
- **Digitalisation** from an old scanned topography.
- **Import** of a drawing in **SVG** format.
- **Visualization and plotting** at different scales of plans and sections. Possibility to see in the background scanned card or other raster (with georeferencing function)
- **3D visualization**
- **Direct visualization in Google Earth**
- **Export** drawing to **SVG** format
- **Export** drawing in **DXF** format
- **Export** drawing to KML for viewing in **Google Earth**
- **Export** data to **.TRO** files **(Visual Topo)**
- **Export** of topographic path in GPX format for display on a GPS
- Print and export survey data and caves data in various text formats.

Features of this new version.

This version includes all the features of previous versions. It is however a break because it was carried out with a new development environment (Delphi 11.3 instead of Delphi 7) which will allow me to make it evolve more easily in the future.

It does, however, bring some new features:

- Ability to enter or import coordinates in WGS 84
- New management of drawing patterns (lines, symbols and writing) with the possibility of classifying them in categories.
- Ability to define symbols to illustrate the nature of surface points: we can for example differentiate a cave from a chasm.
- Removal of the notion of “oriented longitudinal sections” category: Developed sections can now have oriented shots in different directions. The new category “developed sections” includes the two old categories developed and oriented.
- Ability to automatically rename points (see right click menu in the list of shots).
- We can now add the list of patterns used in a layout.

- Possibility to set masks in the layout to not print part of the drawing.
- Export of «zoomable» SVG files in an Internet browser.

Notice:

Thank you for indicating the errors met by e-mail at the address above. See also the section "Anomalies and Suggestions"

Data Structure

Digital data

The basic datum is the caving **network**. It may contain **surface points** and **cavities.** Each cavity must be connected to a surface point which constitutes an entrance. A cavity consists of **galleries** that contain the survey **points**. The points include the following information: designation (in alpha numeric), galleries dimensions, and comments. They are connected together by **survey shots** which comprise azimuth, slope, and length, and a reference to a session (see below).

Some points of a cavity other than the initial entrance can also be attached to a surface point. This allows to take into account the **multiple entrances** or **positioning** with transmitters.

The software also manage the characteristics of **sessions:** a session shows, for each survey shot, the instruments used, operators, date of lever, the declination.

Topographic maps or other funds can be attached to the network. The software allows to geo-reference (link to the coordinate system used).

The points are created when entering survey shots. These are entered in principle from the previous station point. The software does not take into account the points ID to create the architecture galleries. It is created automatically when entering points. It is also possible to create a survey shot from a station that does not yet exist, such surveying a cave starting from the end of a cavity back towards the entrance. This portion of the survey should be later connected directly to a surface point or to a part itself connected.

Graphic data

The drawing of the skin is done freehand with a mouse click. Each drawing element is attached by the software to a point of topographic survey (in principle the nearest) and its shot of attachment. **Drawing is dynamic,** meaning that if you change or recalculate the points of topographic survey the drawing is automatically repositioned to suit their new coordinates.

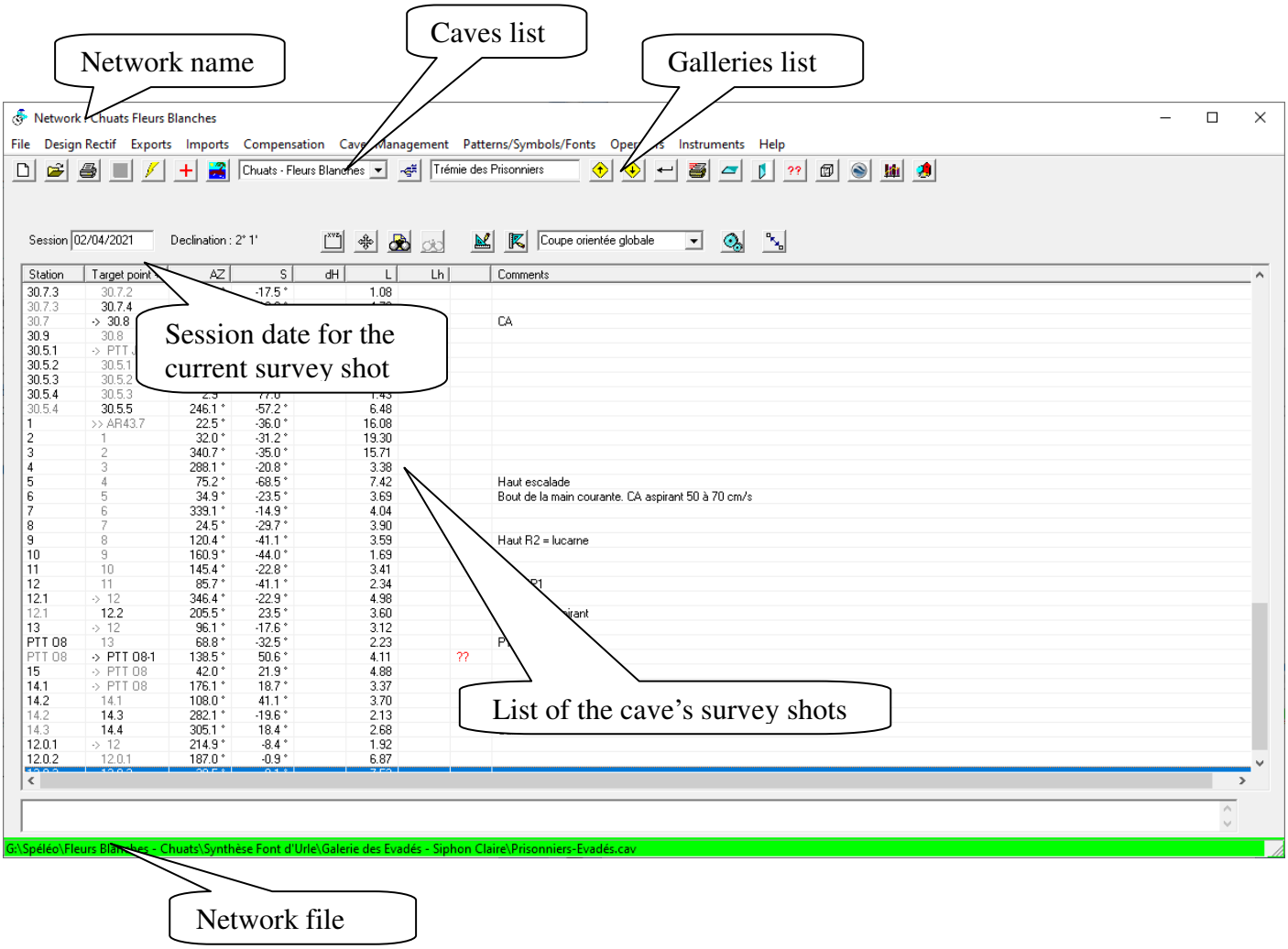
Help

The « Help » menu display these operating instructions file in the pdf format. It is located in the software's documents folder (by default Documents\TopoCalcR).

The « About » menu displays the number of the version of the software.

Visual presentation:

The main screen of the application is as follows:



Detailed functioning of the software

Literal data

Manual entry of basic data

You must first **create a network** with the button  or with the menu *"File \ New"*. The software asks for the name of the network. You should also indicate in which coordinates system you are working: either as independent coordinates or select a system from the list. By default the software display the systems used in Europa. You can choose systems from other parts of the world with the configuration function (see menu *« File / Configuration »*). If you want later to view the network directly in Google Earth or export it in Kml format (Google Earth format - see below) or GPX, the network must be attached to a coordinates system in the list.

If there is only a cave in the system you can directly create the cavity (see below)

Then you must enter the **surface points.** (see below the management of surface points). If there is only a surface point, it can be create when entering the data of the first survey shot.

Then you need to **create a cavity** with button and type its name. When the network has only a cavity, or if it bears the same name as the first cavity, you can directly create the first cavity. The network will be created with the same name.

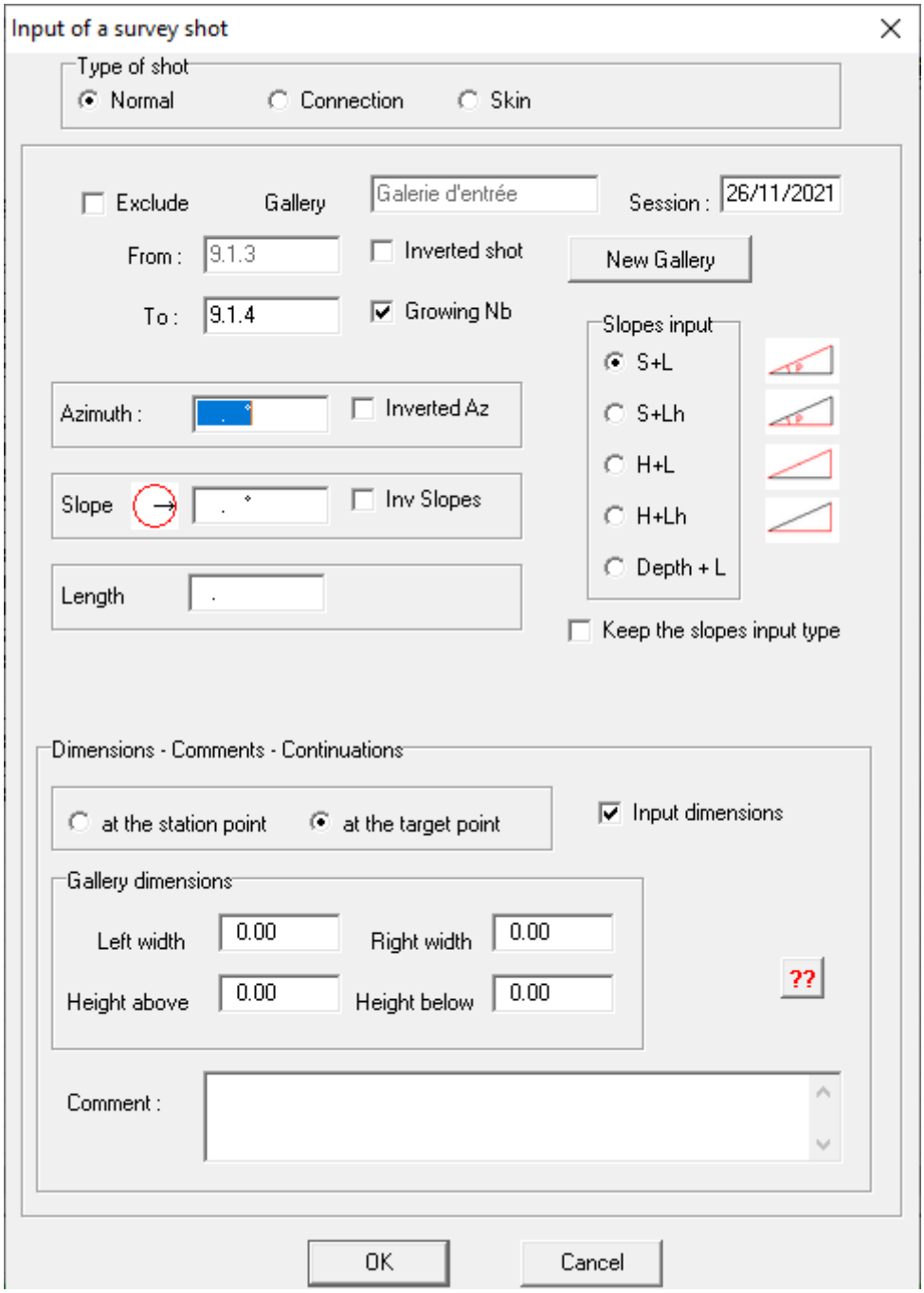
You can now **create survey shots.** If it is the first survey shot of the cave, the software asks you to choose the station point in the surface points list. If there is no point, you have to create it. You also can add a new point in the list if it doesn't exist.

For the next survey shot, you must select the existing survey shots which contains the point of its station then click on the button. Except for a not attached survey shot: in this case, the selected survey shot doesn't matter.

There may be three types of survey shot:

- Normal: the survey shot is made between a known point and a new one that will be created at the same time as the new survey shot.
- Connecting: to create a survey shot between two existing points: This can be used to attach a survey part starting from the bottom or create a looping between two branches. It can also be used to connect the cavity to a new entry.
- Skin: these shots are only used to measure the dimensions of the galleries and serve essentially to record the measures of skin made with devices such as Disto X. They are not included in the calculation of the path. The target point has no ID.

NB: Since version 2.33, the possibility of creating "not connected" shots has been removed because it generated confusion and anomalies. If you have files with shots of this kind, you must open them with a version earlier than 2.33 and modify those shots, putting them in a separate file and then deleting them.



The check box « Exclude » means that the shot will not be include in the calculation of the total length of the cave. Unlike the skin shots (see further), the excludes shots can be used in the survey path. You can attach a shot to one of their points, what you could not do with skin shot,

When entering the first survey shot of a cavity, it is not necessary to enter a gallery. The software automatically creates a gallery called "Entrance gallery".
You can enter the elements of the session (See further "Entering a session"). This feature allows you to change the units of azimuth angles and slope (the default unit is the degree) and indicate the declination.

For each survey shot you must enter the station point or the target point. If the survey shot is normal, the station point corresponds to the calculated target of the selected survey shot, otherwise it is the target point. By default, the software provides the attachment point naming incremented (or decremented if the box "Growing Nb" is not checked) for the new point.

Is the type of the survey shot is “connecting”, click in the input box point designation shows a list of the cavity points. You have to choose which one is the target point.

Then indicate the azimuth, slope and length. For the last two data, one can choose the data format through the frame "Entering Slopes". According to the box which is checked, you will enter the following data:

- S + L: Slope and length measured along the slope
- S + Lh: Slope and length measured horizontally
- H + L: Height and length measured along the slope
- H + Lh: Height and length measured horizontally
- Depth + L: Depth and length measured along the slope

The box "Store slopes input" keeps the configuration input slopes and lengths between the different survey shots. Otherwise S + L is displayed by default. A sketch clarifies every configuration.

With the box "topofil" you can enter the measurements with a topofil (start and end reading).

The frame "Dimensions – Comments - Continuations" allows to input these data for the stationed point, or the target point by checking the appropriate button.

If the check box “input dimensions” is unchecked thou haven’t to input the dimensions of the gallery

The dimensions are the width on the left of the point, the width on the right, the height relative to the point and the height of the point from the ground (height inf). The left and right are relative to the sense of the survey shot.

You can then add a comment.

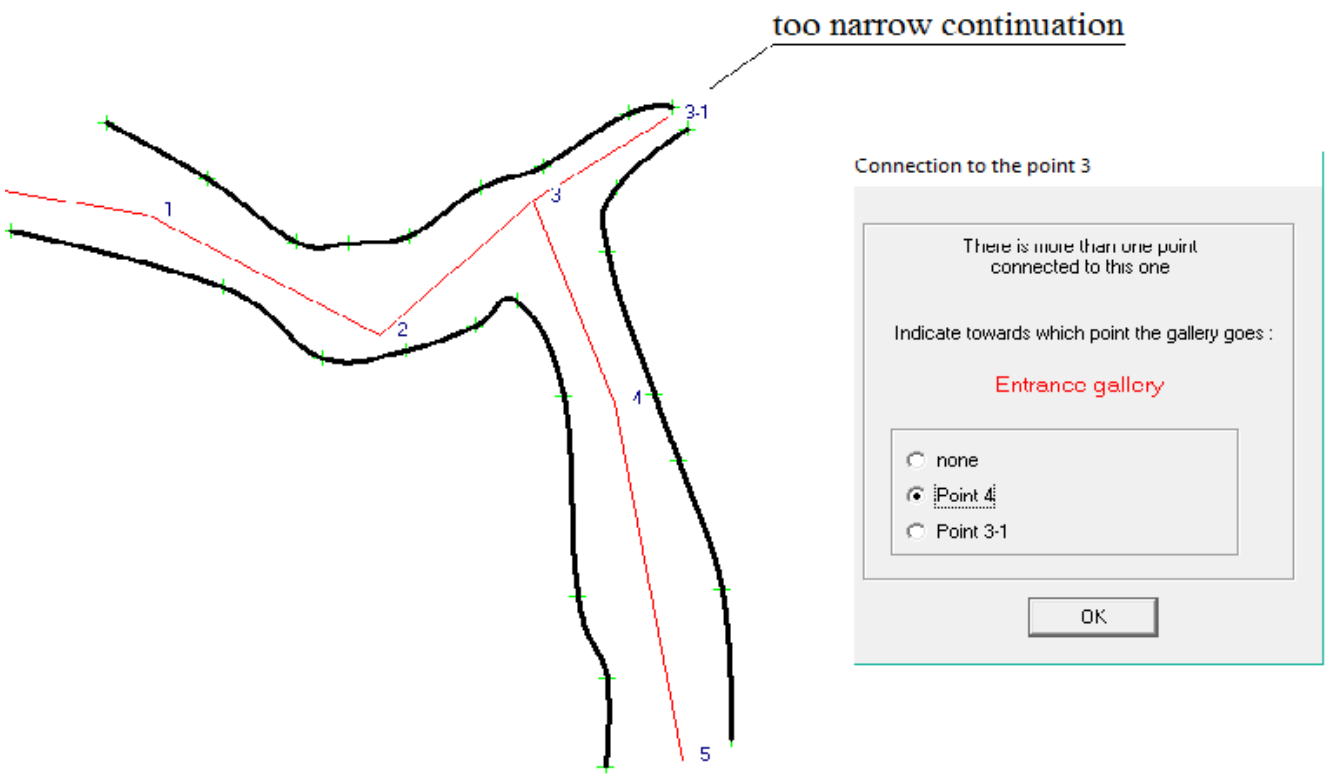
The button opens a form to input the possibilities of continuation on the point (see further).

Survey shots are entered in a continuous loop: when you validate the data from a survey shot that created the point n, the software switches to the input of the next survey shot. It takes as its point stationed the point n and proposes as designation for the target point the n incremented if the box "Increasing N°" is checked, or decremented otherwise.

The survey shot are automatically inserted in their place in the survey shots list (see below Showing survey shots)

To stop entering, you have to press the button "cancel" of the input form.

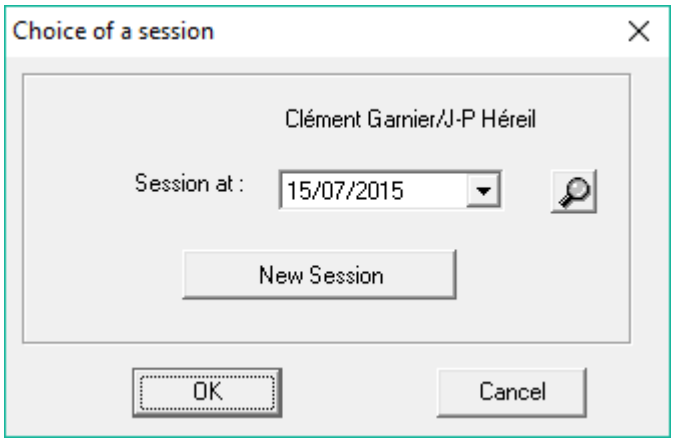
If the gallery has **diverticules** or if you want to enter a survey shot that is not the axis of the gallery itself, you can add points by selecting the survey shot that contains the stationed point and entering a new point. Upon validation of the point, the software asks what is the nature of the point from the current gallery.



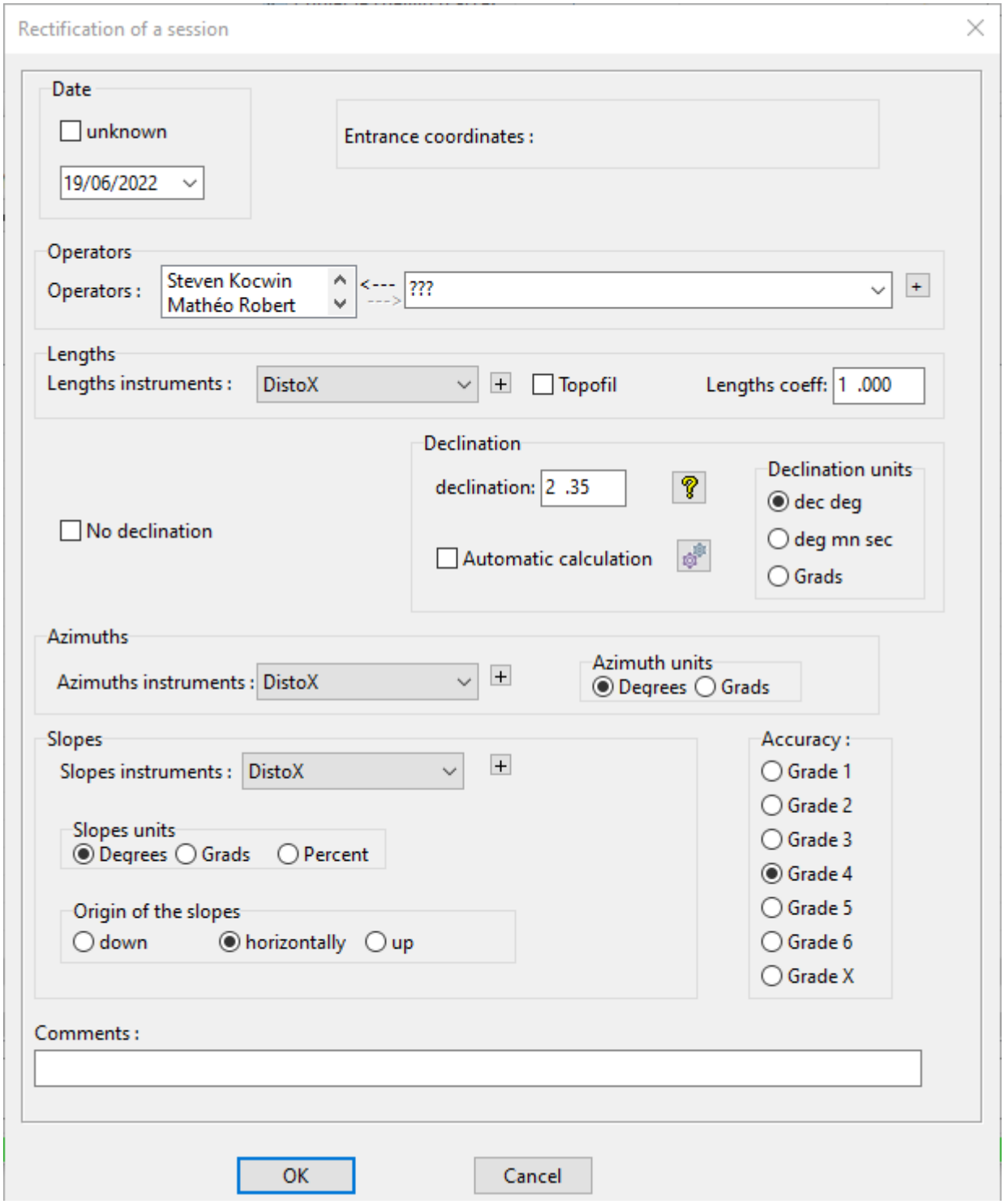
In the diagram above, the gallery consists of points 1, 2, 3, 4, 5. The survey shot to the point 3-1 is referred diverticulum attached to this gallery, but which does not deserve creating an individualized gallery. When entering, the software asks how is the continuation of the gallery.

To **create a new gallery,** having selected the survey shot that contains the point of attachment of the gallery, create a new survey shot. In the input form, click on "new gallery". You must enter the name of the new gallery, then continue entering the target normally. When validating the new point is added after the last point of the gallery to which it is attached.

Input characteristics of a session: in the input form of a survey shot, the click in the box "session" show the choice form of a session:



You can choose an existing session or enter the elements of a new one:



You can indicate the date of the session, the value and units of declination, the names of operators, instrument for measuring length, instruments and devices for measuring azimuth and slope. When you add an operator or an instrument, it is added in a list linked to the network. For other sessions performed by the same operator or with the same instruments, simply select them from the list.

If the network is connected to a geodetic system the entrance coordinates are displayed.

The declination must be relative to the Geographic North and not the north of the projection. The gap between the directions of the two north (meridians convergence) is calculated by the software et used in the calculation.

If the network is connected to a geodetic system and if you have entered the date of the session, pressing the button  makes an automatic calculation of the declination. The declination is then indicated with the units selected on the right. If you change the units, you have to redo the calculation because the change does not make a conversion.

If the "Automatic calculation" box is checked, the declination is calculated automatically each time the network is calculated, with the same restrictions as above. This option can be saved in the software configuration. In this case, all surveys created manually or when importing a survey will benefit from this option.

Declination is calculated using IGRF-14 data and software published on site https://www.ngdc.noaa.gov/IAGA/vmod/home.html

In the input form of the session to add an operator you must be positioned on its name in the list of operators who have already worked in the network (general list) and insert with the ← arrow. The arrow → remove the selected operator (it is not removed from the general list of operators). To create a new operator, you must click on the button  to the right of the general list and enter its name. Then you add it in the session operator's list using the ← arrow.

The instruments are chosen from the drop down list. To create an instrument click the button  . In front of each angle measuring instrument, you can indicate the unit used if it differs from that of the selected instrument. When entering an instrument, you can enter its name and its technical characteristics, units and accuracy. These are then used to calculate the accuracy of the topography (see Chapter calculation details).

You can indicate the precision of the session. By default it is set at 5 degree. Accuracy levels used are those defined by the International Union of Speleology in the document UISmappingGrades.pdf that you can found at: http://www.uisic.uis-speleo.org/UISmappingGrades.pdf.. Level 1 is a sketch without measure, the X degree a survey conducted with a total station and station points hard (see Chapter calculation details).

You can also add a comment.

The current session is applied to the current survey shot and all those connected with it, directly or indirectly, until the entry of a new session.

The correction and management of operators and instruments (delete, export, import) are made with menus Operators and Instruments of the main form.

Input of the possibilities of continuation:

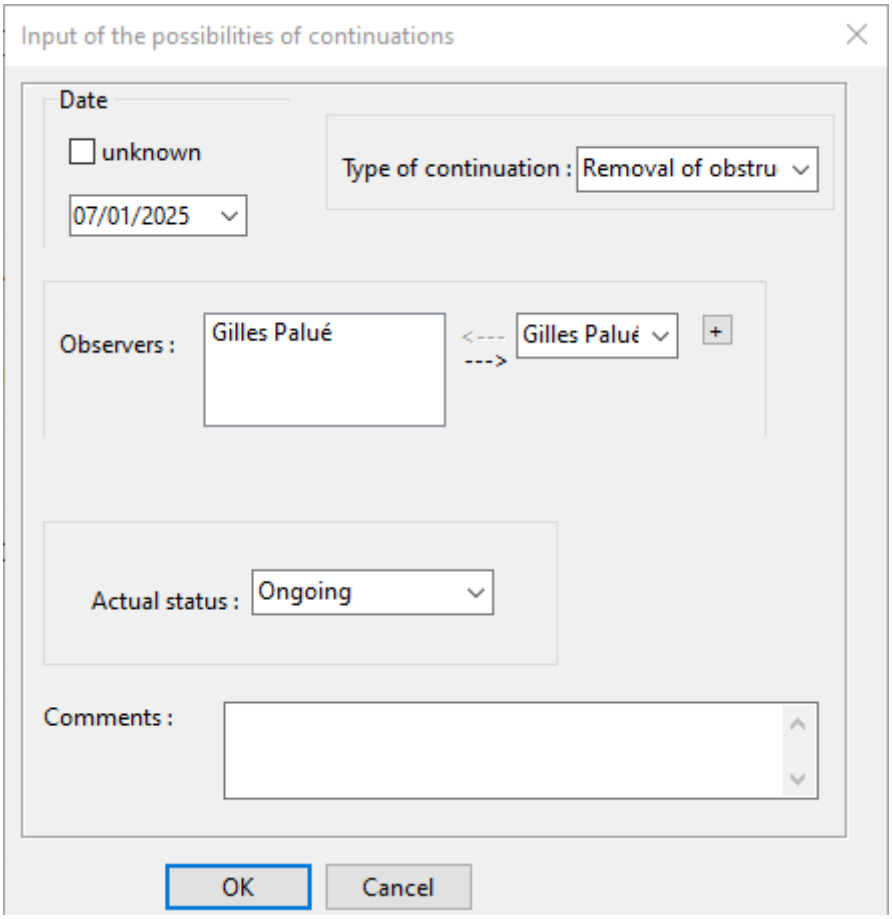
That data which can be added for each point will allow you to manage the explorations of complex caves (the others too).

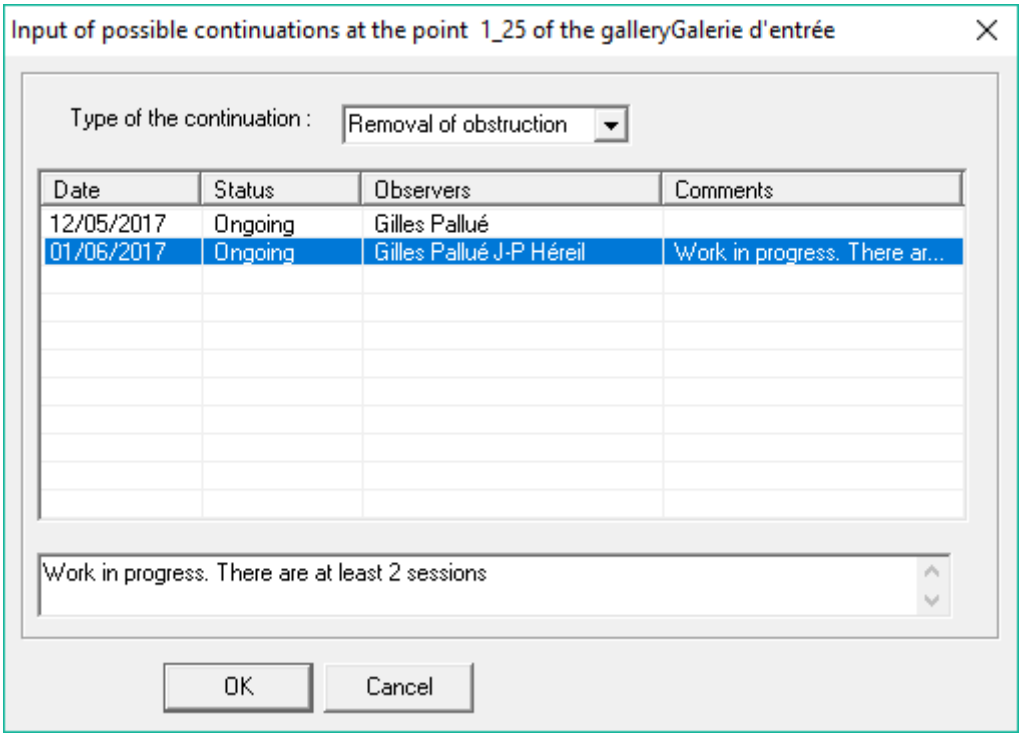
You can enter (see the input form below):

- the date.
- the type of continuation (stop on nothing, removal of obstruction, pitch, climbing, sump, other).
- the people who made the exploration. It's the same list that for the session and the input is identical.
- the status of the exploration at this place (ongoing, to review, without continuation, finished, other).
- comments to have more description

The information entered in the current survey session (date and operators) is indicated by default.

When the form is validated, a line is added at the list which displays the status of the continuations of the point:





In this way we can follow the evolution of the explorations in a point. In the list, a double click on a line allows to rectify it, a right click to delete the current line or to add a new one.

If you delete all the lines, the list of continuations of the point is deleted.

You can also modify or add possibilities of continuation when viewing continuations (see below).

Displaying survey shots

The survey shots are displayed in each gallery by topographic order. The galleries are arranged in the order of their point of attachment.

If the cavity has multiple entrances, their list is displayed above in a drop-down list. So you can choose from which entrance the survey shots will be displayed.

If the survey has skin shots, a sign + appears next to the header of the column "target point": .

Station	Target point +	AZ	S	dH
3003	3004	42.5 °	-10.6 °	
3004	3005	300.6 °	-2.6 °	
3005	3006	333.4 °	-3.7 °	

A left-click on this header display those shots (it's a - that appears) or hide them.

For each survey shot, you can view the following information: the stationed point's designation, that of the target point with an icon depicting the layout of galleries (see below), azimuth, slope, length, or possibly horizontal length and height difference and the values of the topofil ; X, Y, Z coordinates and SLh(sum of horizontal lengths from the entrance) ; the dimensions of the gallery, the comments on the point. When entering a depth, that appears in the column "End Tpf".

By default the topofil columns are masked. You can display them by changing the configuration of the software (see annex 2). They are also showed if you open a file with topofil measurements.

Survey shots are always displayed from point stationed to target point even if the survey shot is reversed. The designation of the known point is in light blue, that of the calculated point is black. Coordinates and dimensions are still those of the calculated point.

The preceding or following the designation of the points symbols are:

>>	beginning a gallery
→	beginning of a diverticulum or radiated point
^	Following the gallery after a diverticulum
#	means a point that is looped with another point.
*	means a point that is subject to a number of points (also equivalent to a loop).

The name of the gallery where is the selected survey shot appears in the header of the list of galleries. Above the survey shots frame appears the date of session and the declination corresponding to the selected survey shot.

Buttons  and  can display or hide respectively the coordinates of points and dimensions of the galleries.

When a symbol ?? appears before the comments column, a button  is displayed next to the lower headband of comments. A click on it displays the possibilities of continuation of the current point.

Browsing in the list of survey shots

Inside the network, you can pass from one cavity to the another by selecting it in the list of cavities.

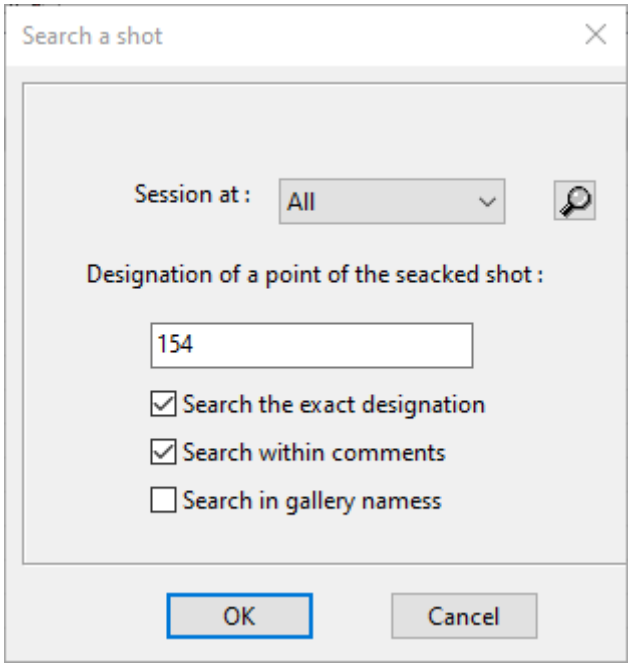
Similarly inside a cavity you can change gallery with the gallery list. This occurs either in alphabetical order (when the button  is displayed), or as a tree (button ). You can pass from a display mode to another by clicking on the button that indicates the type of display.

When changing gallery, the selected survey shot systematically becomes the last of the gallery. The beginning or end keys lead to the beginning or at the end of the cavity.

The button  lets go to the beginning of a gallery and the button  at the end. The button  is used to move the point of attachment of the gallery.

When a point is connected to another point by a **junction** (see below) you can go from it to another with the right click menu (see below).

You can search survey shot with the designation of one of its points with button  . you have to enter the searched designation in the following dialog box:



research is done on the exact designation if the check box is checked; otherwise, it is the points whose designation contains the text entered. If the box if checked the search is done also in the text of the comments. It is also possible to position yourself on a gallery by searching for its name or a part of it.

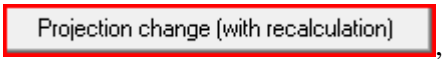
You can do the search all over the cavity or select a session by his date.

If you chose a date up leaving the searched text empty, the software searches for the first survey shot of the session chosen.

When a search yielded the button  is used to find the next occurrence or the next survey shot, if we wanted the first survey shot of a session.

Various corrections

Correcting the name of the network, the current cavity or active gallery, open the *"menu Rectif design "*.

The rectification of the data of the network allows to change projection system: if you press on the button 

, a new frame appears who allows you to indicate the new projection to be used. When you confirm the window, all the points of the network are transformed in the new projection as well as the attached documents (maps, survey notes, ...).

Changing the entry point of a cavity is done with a right click on the first survey shot of the cavity and the function *"Change attachment point"*. It allows either to enter a new point of attachment in the list of surface points, or to create a new one.

To **correct the data of a survey shot,** double click on it: input form opens to allow correct data.

To **delete a survey shot,** press the button "Delete". The survey shot is deleted after confirmation of a confirmation message. When you delete a survey shot in this manner, the following survey shots of the gallery are preserved (unless it's the last survey shot) and attachments are preserved. For reasons of consistency files however, it is impossible to delete a survey shot whose a point has multiple attachments (gallery or diverticulum). To delete a target destroying the attachment **see right click menu.**

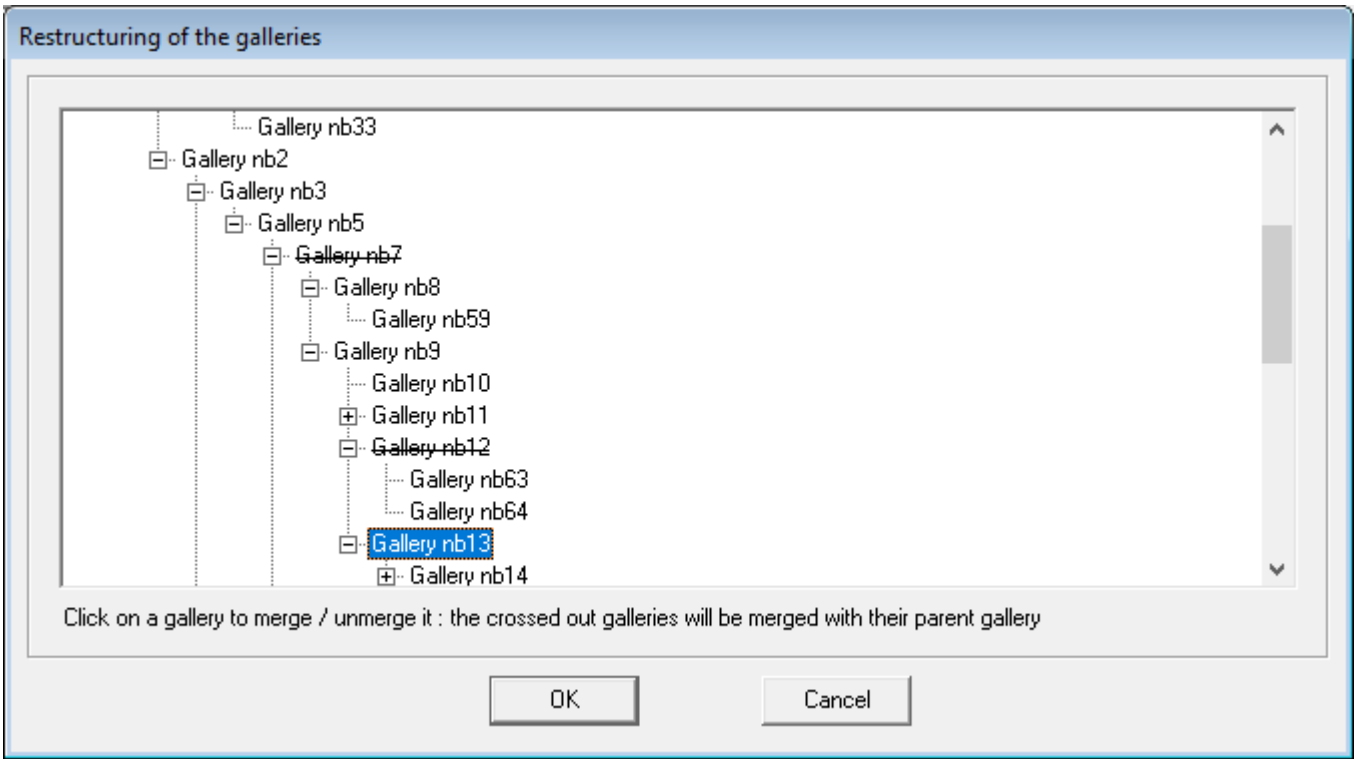
You can **insert a survey shot** by pressing the key "Inser". You then need to enter the new survey shot. Note that in this case, it is a point that will fit into the axis of the gallery and a non diverticulum.

Right click in the box showing the session's date (above the list of items) shows the characteristics of the current session.

Double-click on this box allows to **rectify the current session**.

When you rectify the data of a survey shot, if you change its session, all the survey shots who depend on that, directly or indirectly, and who had the same session will have the new session.

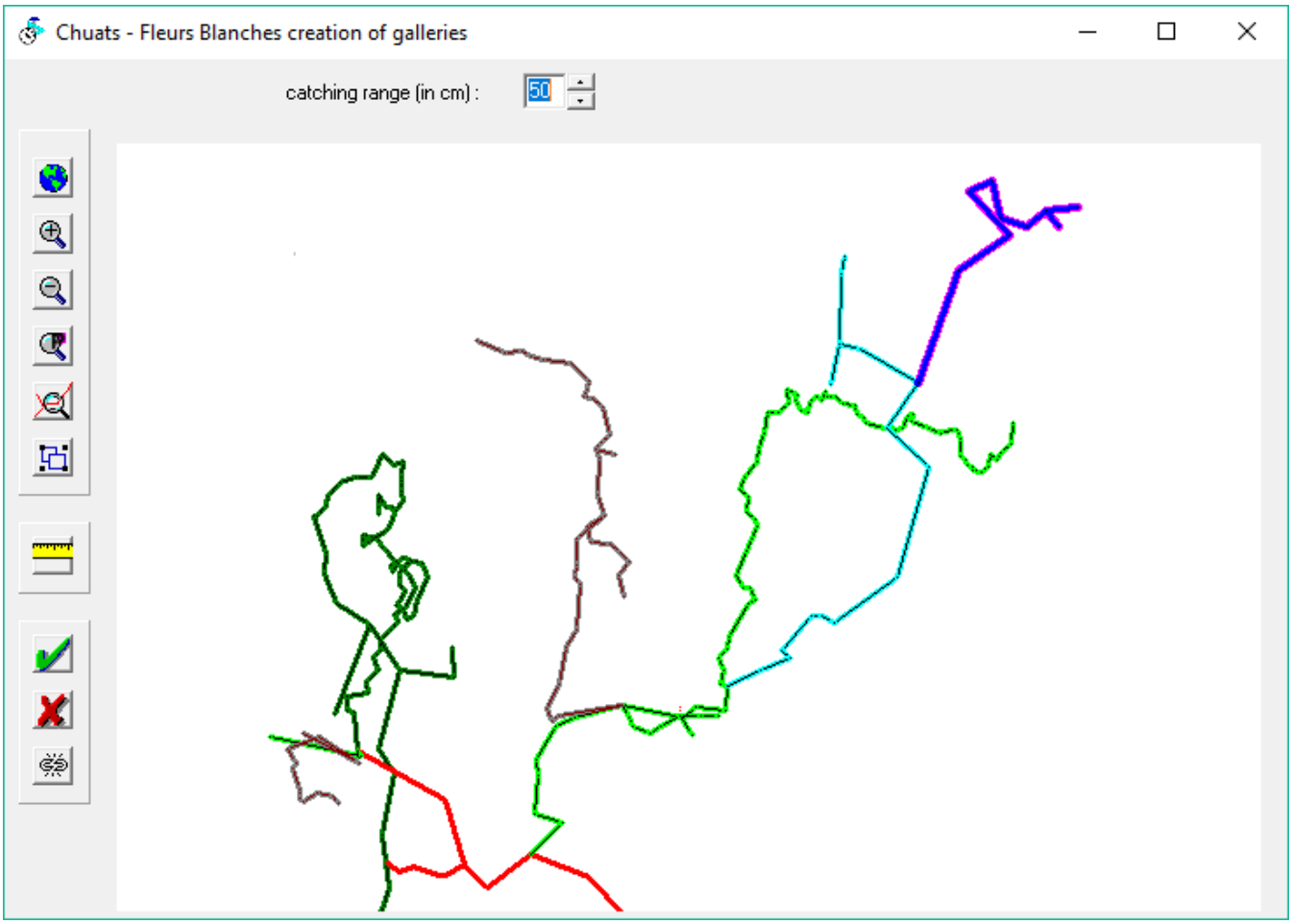
Galleries can be fused by the menu Cavities management / Galleries fusion:



From the tree galleries, indicate those to be merged with their parent gallery: Clicking on the name of a gallery selects or deselect it. The galleries whose name is crossed out will be merged with their parent gallery. In the example above, the Gallery 7 will be merged with Gallery 5: its points will be incorporated following the Gallery 5 points. Similarly Gallery 13 will be merged with the Gallery 7 To do the opposite and individualize a gallery operation, see the right-click menu below.

Individualize galleries

You can do it with the menu « Caves Management / Individualize galleries »



It displays a form which allows you to select the part of the gallery which you want to individualize. Each existing gallery is drawn with a different colour of the one of its parent gallery. There are 10 different colours, so that some galleries may have the same colour.

Click on the first shot of the gallery to be individualized. Another click change the selection.

You can change the range of catching which is 50 cm by default with the button situated at the top of the form.

With the button  you can remove the selection. When selection is right, the button  validates it. You must then indicate the name for the new gallery.

When they are more complex loops, the software may not find the end of a gallery and it is not possible to select the good shots. You can cut temporarily a loop with the button  . You click on the point to cut. Then you can select the wanted part.

Only one temporary cut is created. It is deleted if you create one another, or when you create a gallery or when you leave this function.

Opening an existing file

File / Open menu or the equivalent icon allows you to open an existing file. You can directly open a file Topo Robot, Visual Topo, Pocket Topo or an export for Therion from an electronic pad and also a table text file (see below the import function). The choice is made with the type selector file open dialog. A new network is created that can be saved as a file .cav.

Since version 2.24, it is possible to run the software several times and, possibly, to open the same file several times. In this case, only the first version of the open file can be saved. This is indicated by the color of the banner with the name of the file in the main window: if it is green, the file can be saved, if it is red, it cannot. In this case, it is possible to make changes, but to save them, you will have to go through the “save as” menu.

Surface points management

The management of surface points is done with the button  For each point, you must enter its designation and its coordinates (X, Y and Z). **Coordinates are expressed in meters.** This is important for exports in KML files or wedging maps (see below). You can assign a comment to each point and also identify the nature: This is an indication of the nature of the karst phenomenon identified: abyss, cave, resurgence. ... The nature of the point can be indicated by a symbol which appears on the drawings. To manage the nature of points and the corresponding symbols, see the chapter entitled "Managing patterns, symbols and fonts".

Several points can be selected for deletion by clicking on them either with the Ctrl key held down or with the Shift key. To delete, press the Delete key.

You can change the order of the list of surface points by clicking on the header of one of the columns. Clicking again sorts them in reverse order.

If the network is connected to a coordinate system and the point to be entered is in a different system, it is possible to make the system change at the time of entry by checking the box “convert coordinates into the network system”. It is then necessary to indicate in which system the point is added.

It is possible to import surface points from another Topo Calc’R file, a text file or file GPS in GPX format. In the first case, the file may contain the following data: Name, X, Y, Z and possibly comment. Data must be separated by a space or tab. This function is done with the button  . The choice (cav, text or GPX) is made with the selector file type of the points file open dialog.

When we open a file of points, a list of these items appears to possibly select those that you want to import.

When importing points from another Topo Calc’R file, if the coordinate systems of the source and destination networks are specified and different, the points will be processed upon import.

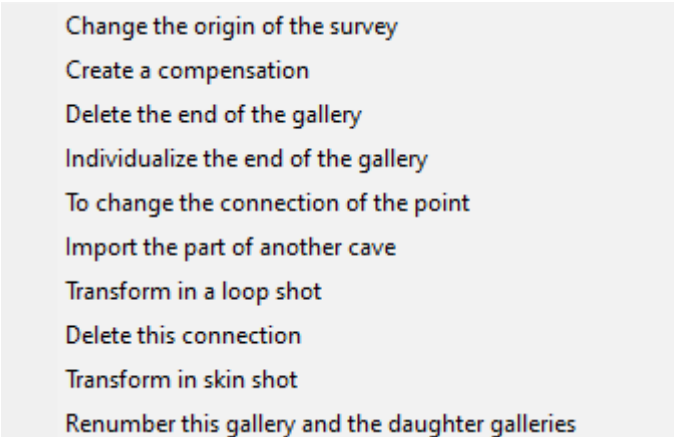
In GPX files, points are expressed in the WGS 84 system. If a coordinates system has been defined for the network, the data are automatically processed in this system.

When importing a text file, if the coordinate system of the destination network is specified, it is possible to specify the coordinate system of the imported points. If it is different from the network, the points will be processed upon import.

The button  exports the surface points to a text file. If the network is attached to a coordinate system, the points can be exported in WGS 84 with the button 

Right-Click Menu

Right clicking on a survey shot brings up a menu that includes several functions depending on the selected survey shot configuration:



- Create a **compensation** See further compensations management.
- **Delete the end of the gallery.** All survey shots of the gallery are removed from those where you are positioned. If there are related galleries, they are also deleted.
- **Individualize the end of the gallery.** Creates a new gallery from the current shot and moves in this gallery all the shots from the current shot to the end of the current gallery.
- **Change the attachment** point: You should enter the new point of attachment. The survey shots whose order is changed are then repositioned (if applicable).
- **Import part of another cavity** leads to the partial copy of a cavity (see below paragraph import)
- If the **point was calculated from several survey shots,** you can **view the survey shots from other points of the junction.** Click on this line of the menu to **position themselves the survey shot corresponding.**
- **Transform in a shot of loop**: allows to replace the target point by an existing point that you must choose in the list of the points as like the creation of a connecting shot (see before). In this way you can create a loop that does not exist when you have created the shot.
- **Delete attachment:** delete the selected survey shot, but does not shift the other survey shots, unlike pressing the Delete key (see above). This function allows for example to remove a loop survey shot. Warning !!! if it is not a loop survey shot, the continuity of the path can be destroyed.
- **Renumber this gallery** and daughter galleries: allows you to renumber all the points from the current shot. The new numbering follows the Topo Robot strategy: the points are designated by a series number followed by the number of the point in the series. A new series is created each time there is an intersection, unless the points are in the continuity of the gallery.

Depending on the type of shot, the menu may have more options:

- **Change the origin of the survey** for cavities with a single entrance and for a shot at the end of the gallery, the origin of the survey can be fixed at the end point of the shot.
- **For a shot of loop,** you can delete the loop.
- If it is a point followed by no shot, it can be **turned into a skin shot**.
- Conversely, a right click on a **skin shot** can transform it into a normal shot. In this case the point concerned takes the designation of the stationary point followed by "-" and a sequential number.

Deleting a cavity

If the network includes more than one cavity, you can remove the active cavity with menu "Cavities management / Remove"

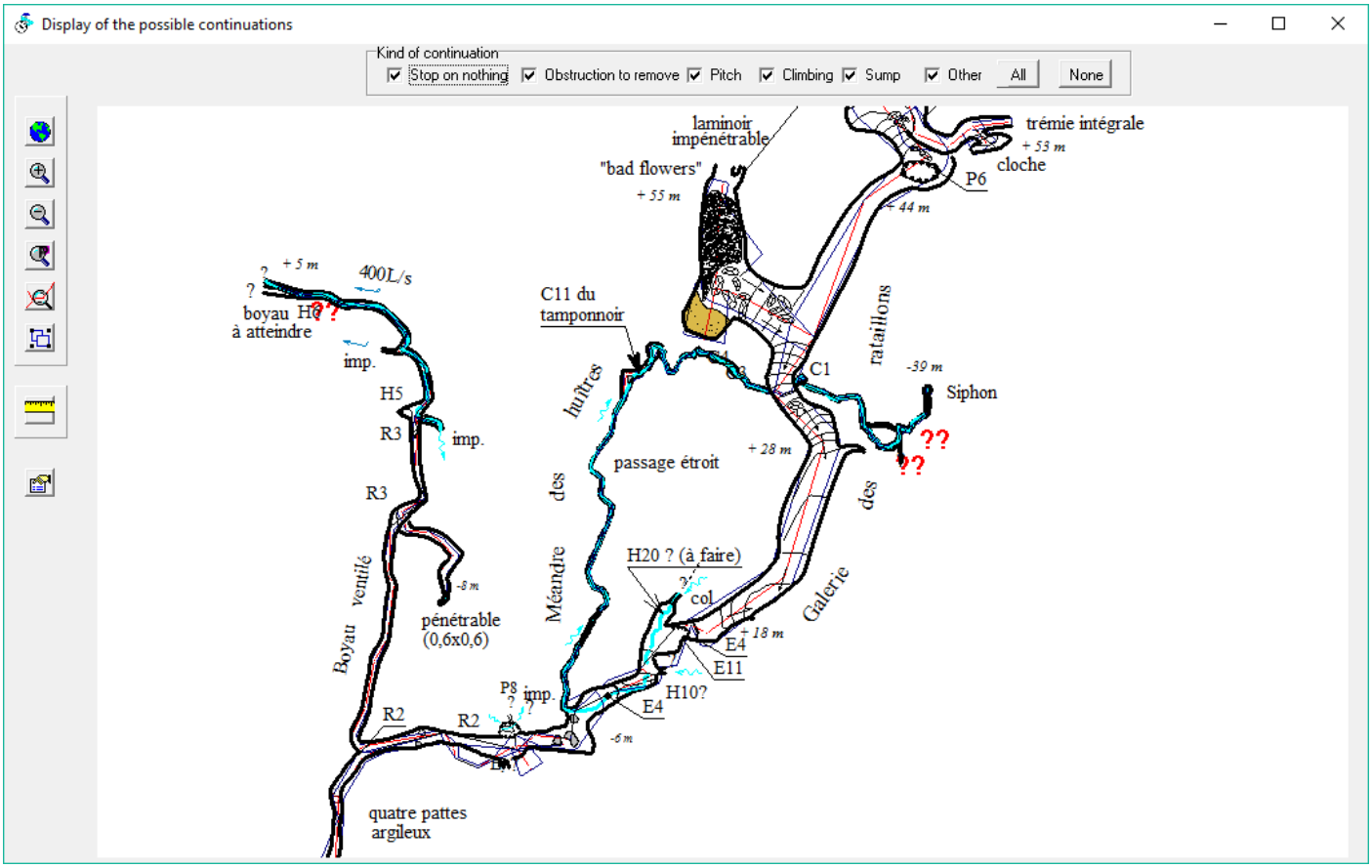
Literal data impressions

The printing is done with the button  or menu *"File \ Print"*. Printed items are those that are displayed in the survey shots view. If the coordinates are displayed, they are printed. The same applies to the dimensions of the galleries. For reasons of size paper, however, it is impossible to print both topofil measurements, dimensions and coordinates.

The button  allows to print only the data corresponding to the active gallery.
You can print the list of galleries with their tree with menu *"Cavities management / Printing tree galleries*".

Displaying the possible continuations

You can see all the possible continuations of the network with the button ?? of the top toolbar. It shows the next window:



The possible continuations are figured on the map of the network with the symbol ??. You can choose with the check boxes on the top the kind of continuation which you want to be displayed.

It is possible to add or modify a continuation on a point by making a Ctrl + left click on this point (for the entry of a continuation see the entry of the survey shots)

You can have a list of the continuations sorted by cave and by gallery with the button . It creates also a textfile named "*name of network*-Continuations.txt".

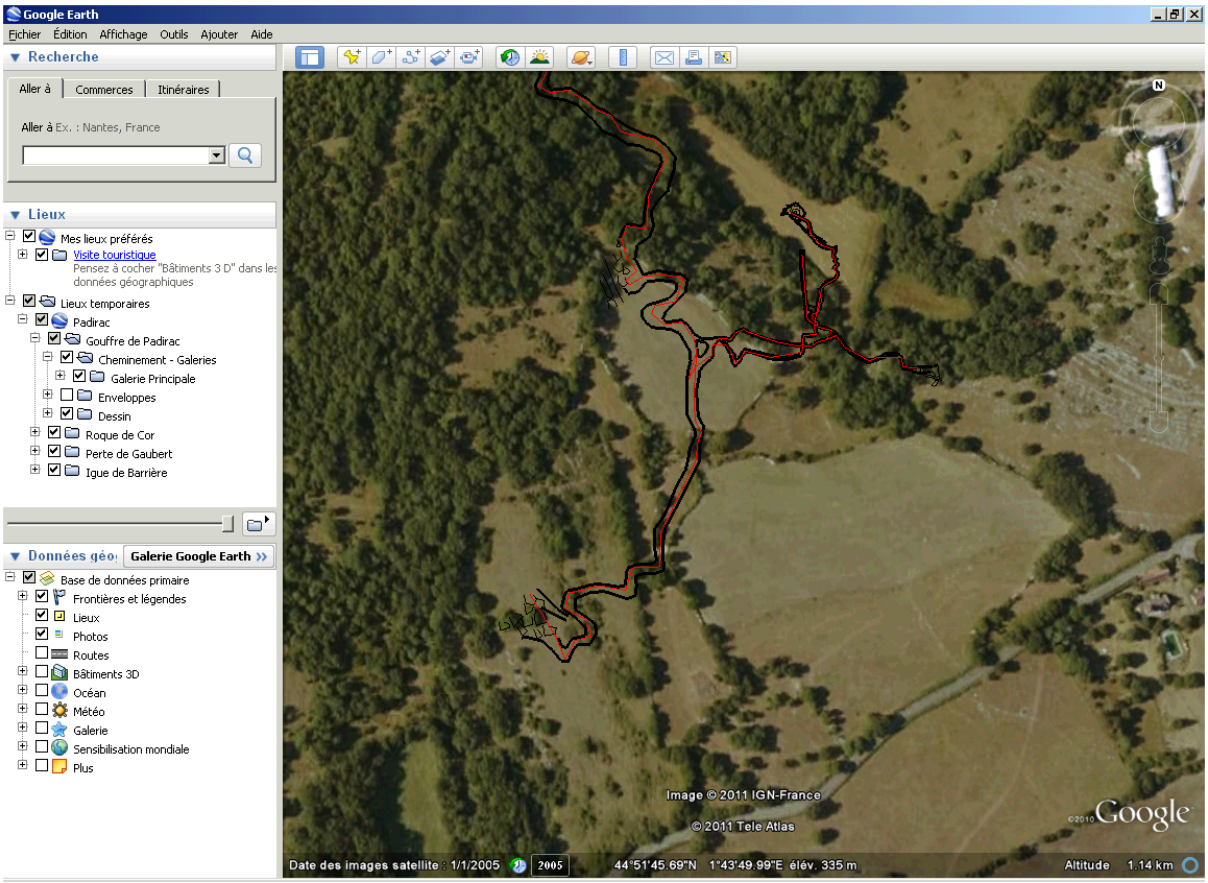
Exports

The menu "export" allows to export several types of information:

- Part of a cave: to export only the part of a cave: you must choose on the map of the cave, the first shot to be exported, by clicking on the survey path. The other shots are selected till the end of the gallery and the adjacent ones. You can reduce the selection by clicking on a selected shot. When the choice is right, you valid the window and the selected shots and all the data linked with them are saved in a file which has the name of the current file followed by "-part".
- Text file: all literal information and coordinates are exported to a text file that can be read by a spreadsheet (tab-separated data).
- Point file: creates a file of the survey path points in a text format that includes for each point its designation and its X, Y and Z.
- SVG Plani file: exports an SVG file with the plan of the entire network. Unlike the export, which can be carried out from the plan view or from a longitudinal section, you can choose the elements to be

exported. What's more, the file includes a JavaScript script that allows you to zoom in with the mouse wheel or move the drawing with the mouse after opening the SVG file with an internet browser (Firefox, Edge, etc.). This file can also be used to display the map on a website. See an example on the great topo of the Chuats

- KML file: creates a Kml file that can contain surface points et, for all cavities in the network, survey shots, envelope galleries (calculated from widths) and drawing (yet some elements of the drawing are not exported: these are surface objects, cuts, writings and symbols). Select the items you wish to export from a list. This file can be viewed using Google Earth. If this application is located on your computer, simply double click on a KML file to view the drawing cavities in Google Earth. The gallery's structure is also exported, so you can move to a particular gallery. To be exported, the network must be associated with a coordinate system (see entry of the network at the beginning of the document). You can also display directly the network with Google Earth (see further Displaying in Google Earth).



- DXF file (Autodesk Exchange format) used by many drawing programs. The DXF export contains the same data that KML files, but only for the active cavity.

- Trace GPS (GPX file): the software will generate a GPX file from the path. This file can be imported into a GPS in trace and used to track the cavity on the surface. Widths galleries are not included in this file. It is possible not to export surface points (option in the export menu).

- VTopo file: generates a file in Visual Topo format that can be used with this software but can also be imported into an electronic pad.

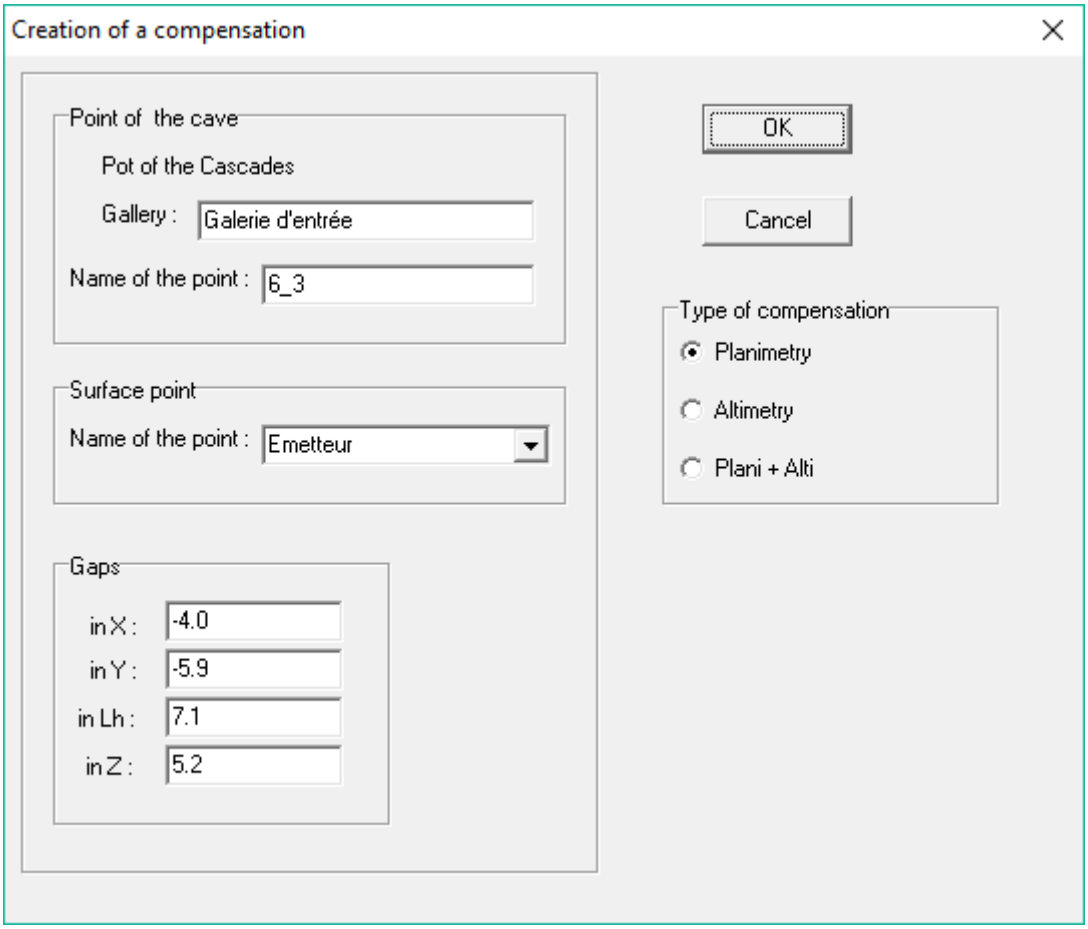
- File for Qave. Exports all or part of a cavity to a file with the ".cave" extension, which can then be imported into the Qave surveying software (only the path is exported).

It is also possible to export the surface points to a text file of the same type which the file of the points of a cavity: in: the management function of the surface points raised with  , you have to click on the button  . The resulting file is called *"name of the network* -pts surf.txt".

Compensation management

A compensation allows to adjust a cavity survey on a surface point, for example using a point located with a position transmitter.

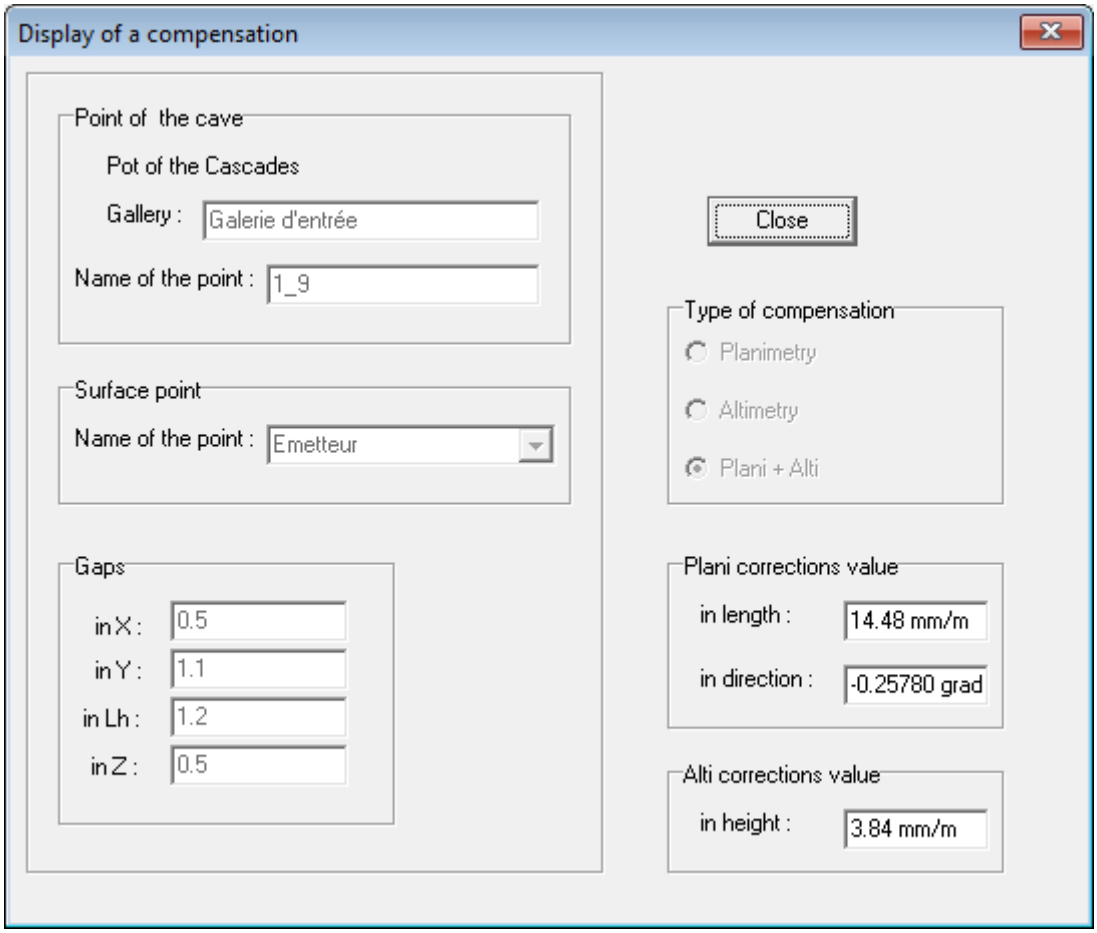
Creation: The surface point must have been previously entered (button ). You must select the survey shot that contains the point in the cavity and right-click (right-click menu see above). When selecting "create compensation" the software shows the following screen:



The proposed surface point is one whose coordinates are closest to the point of the cavity. You can choose another from the drop down list. The differences between the points of the cavity and the surface point are shown below. You can choose the type of compensation: planimetry, altimetry or both. Validation creates a new compensation which will be taken into account when calculating the cavity.

The menu "compensation" displays the list of compensations and rectify them.

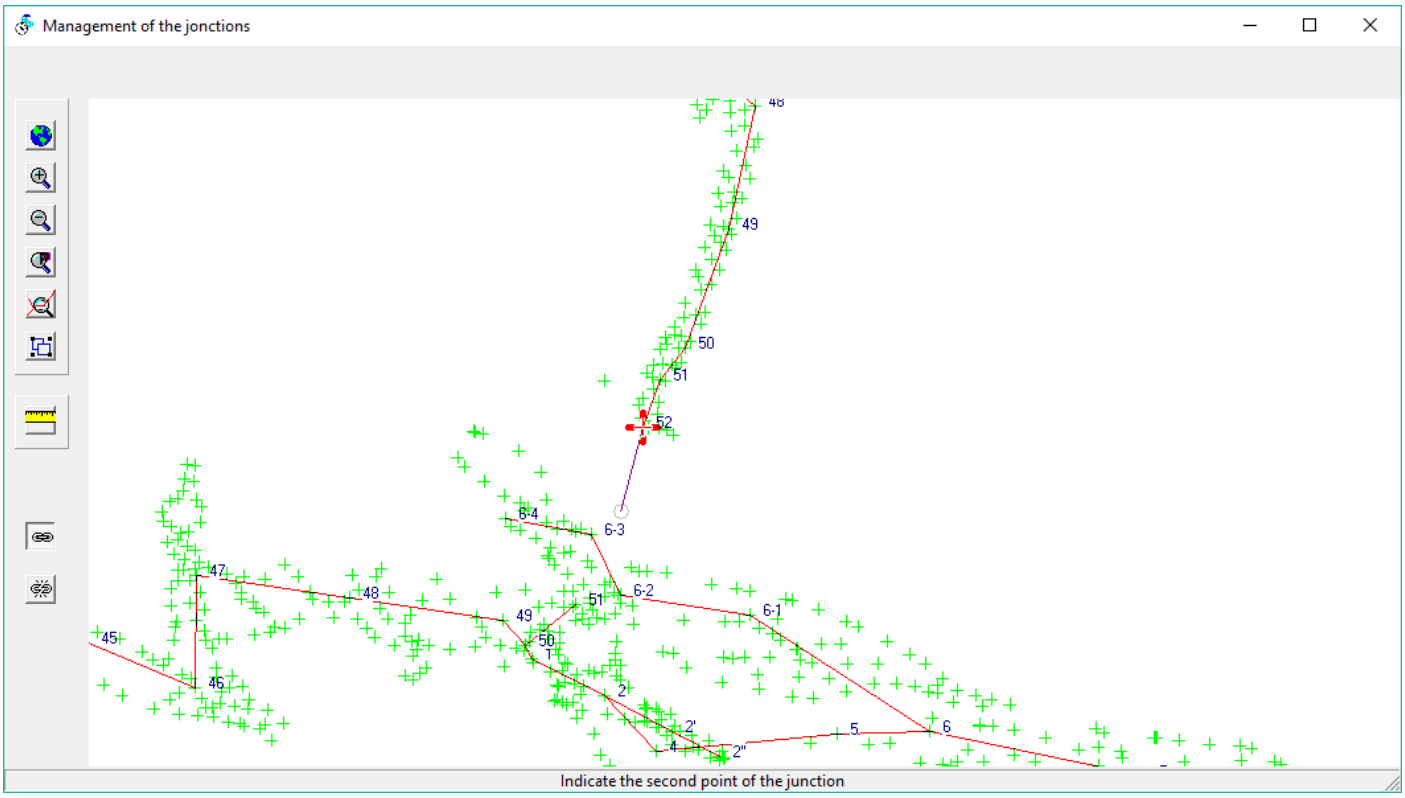
Compensation list: Double-click on one of the compensations of the list indicates its characteristics: Type, points of departure and arrival, surface point designation, gaps and corrections:



Rectification of compensation: double-click on one of the compensations of the list allows to correct it (see creation screen). Pressing the key "Delete" removes the selected compensation from the list.

Junctions management

A junction is the fusion of two identical points within one or two cavities. The points are normally entered as ordinary points, then you have to tell the software that they must be confused. To do this, use the button. With the next screen you would specify the points to be matched.



The button  allows you to create a junction: When clicked on the first point, it is marked with a red cross. Then you must specify the second point. The point to be selected must be in the mouse hooking radius (default set to 1 m).

The button  remove junction that has to be selected using the mouse.

When the window is closed, the survey shots list is updated. A # follows the name of the merged points.

You can only make a connection between two points inside a cavity. They may belong to different cavities. To associate an internal point to surface point, use compensation.

It is also possible to manage junctions with creating connected survey shots. (See survey shots input).

When two caves have at least a common junction point you can merge them with the menu “Fusion of caves”

Import from another network

It is done with the menu *"Imports \ From another network"*. You first select the file to be imported (source file). If the source network contains only one cavity, it's added to the destination network. If there are several cavities, you can choose those you want to import by checking their names in a list of cavities.

When importing cavities, the software adds the destination network operators, instruments, patterns and fonts of the source used in the imported cavities and that are not already in the destination network.

When importing, if the source network and the destination network includes an indication of a coordinate system and if they are different, the surface point sources cavities are converted into the system of the destination network

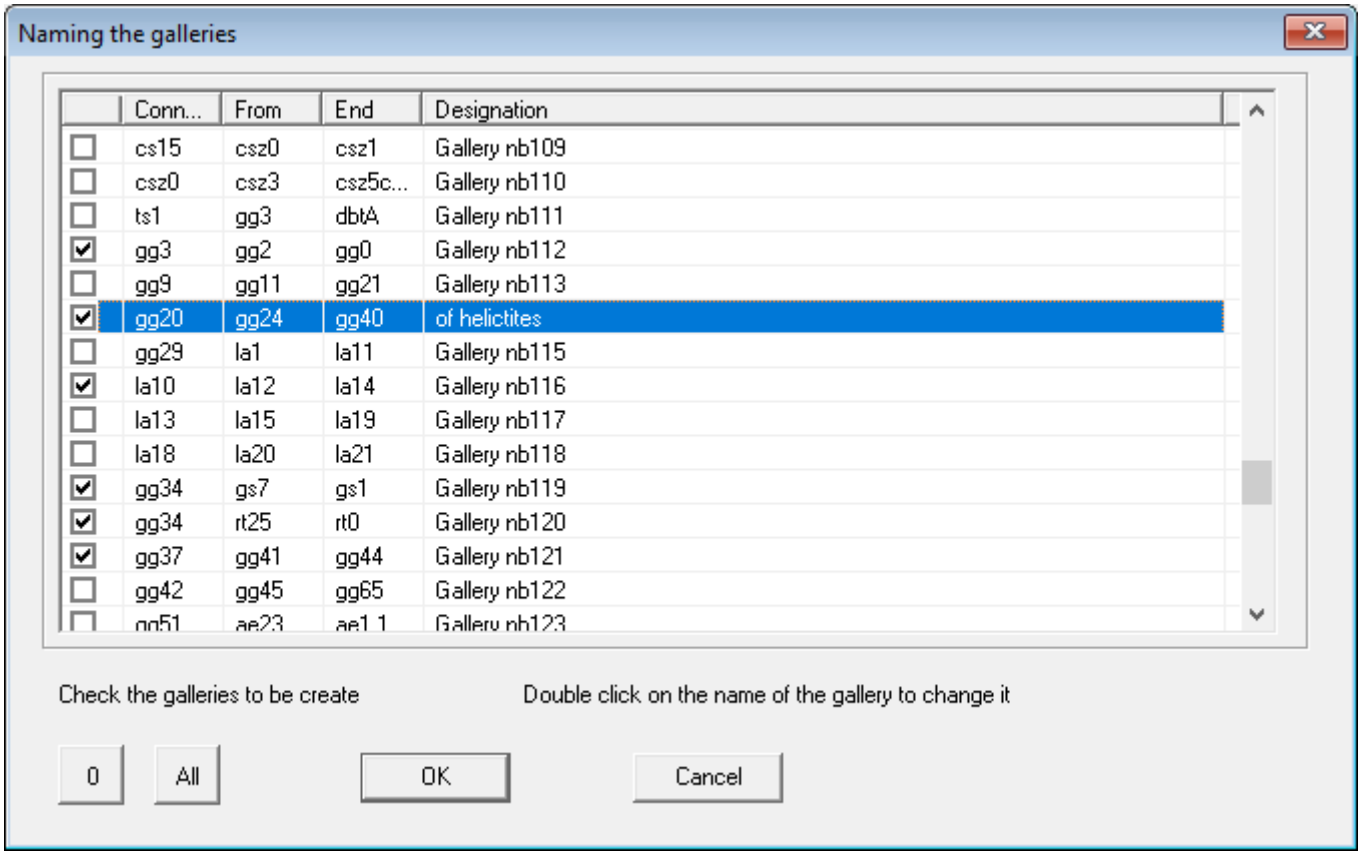
Import from Visual Topo

You can import a file from a Visual Topo file into an existing network. The creation of a new network from a V Topo file is now done directly with the opening function of the file menu.

The import is done with the menu *"Imports \ File Vtopo"*. After selecting the file to be imported, the software provides a structure of galleries from the point numbering in Visual Topo. Whenever it detects a gap in the numbering, and if these points are placed after the last point of the previous gallery, the software will create a gallery.

The first gallery is called "entrance gallery "; The following are called "gallery n", where n is the order number of the gallery during import.

The application then presents the following table of galleries:



You can choose to individualize the galleries by checking the box on the line (by default all the boxes are checked). The box of the first gallery cannot be unchecked. Button 

deselects all the galleries. On the contrary the button 

checks all of them.

To change the name of a gallery, double click on its name and type the new name.

With the button Change the point of origin, it is also possible to choose a different point of origin for the survey to be imported. For example, if you have taken a survey from the bottom of the cavity, you can define the entry as the point of origin, which will put it back in the right direction. When you press this button, you open a window with the plane of the imported survey. You must click on the point corresponding to the new origin and validate the window to change this origin. We are brought back to the previous screen, but with the new point as the start of the survey

Once this form is validated, the software incorporates the file in the open network: it creates a new cavity and adds it to the network.

For complex cavities, you can try several configurations galleries. The software proposes galleries individualizing from ruptures numbering, which does not always correspond to the desired configuration. Also the list of checked galleries and the name assigned to them are stored in a file called "GalCochees.txt". If you try several imports with the same file, the last setting is stored, what allows not to take back every time the work.

The surface point of the imported cavity is possibly converted into the system of the destination network in the same way as when importing from another network

Importing from Toporobot or GHTopo

It happens the same way as from Visual Topo. After selecting a Toporobot file "Tab" or a GHTopo one ”Xtb”, tick the galleries to be identified. If there are several cavities in the source file, you must choose the one that you want to import. You can import only a cavity at the same time. If there is several, it is necessary to renew the operation as often as necessary. For GHTopo files, there must be only one entry.

Importing from a text file made with a spreadsheet

You can load a file created with a spreadsheet. It must have been saved as a tab separated text file.

It can have header data as the name of the cave, the name and the coordinates of the entrance, the survey date ant the declination.

Each header datum must be on a separate line and preceded by its designation (see examples of excel files in the installation directory “examples”).

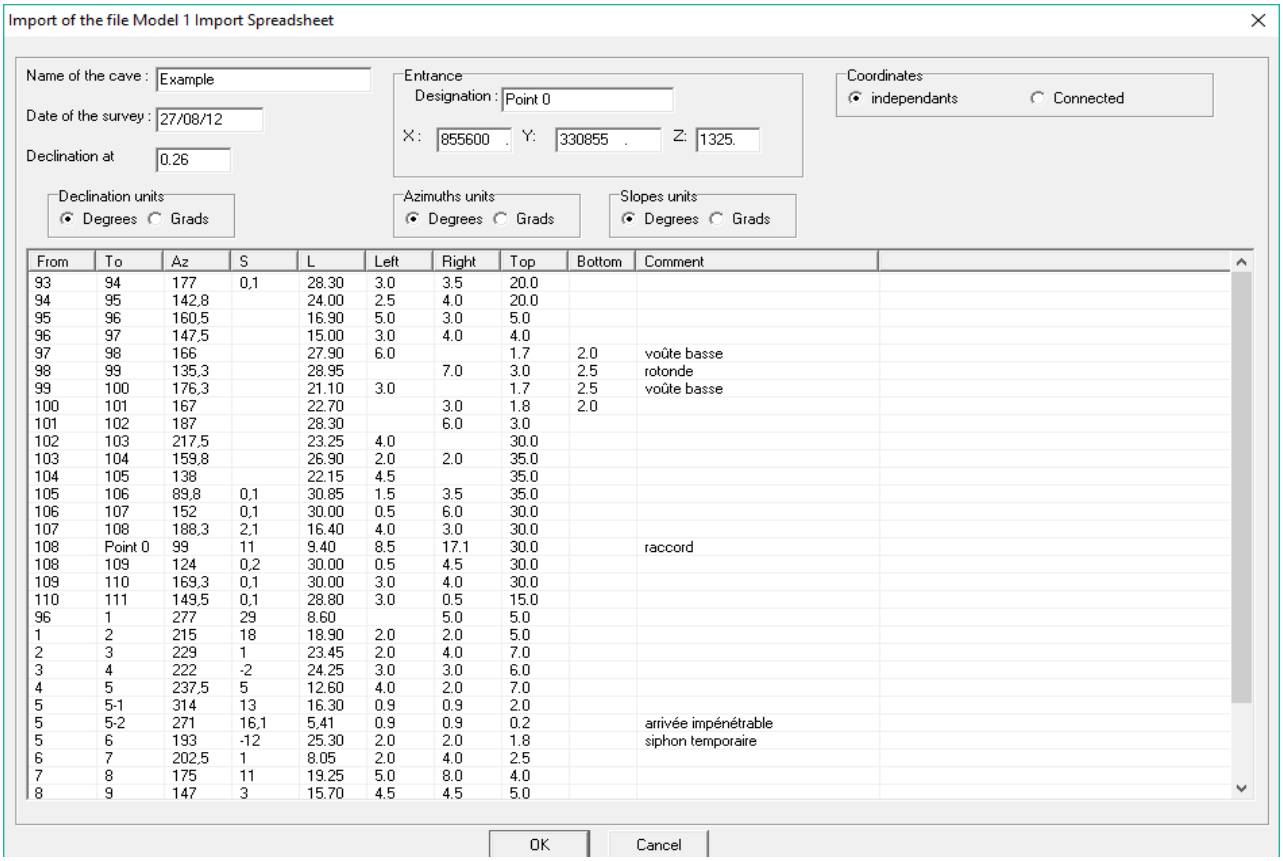
The header data must be separated from the survey data by an empty line or by a line which begins by the word "Shots". Even if there are not header data, it is necessary that there is such a line before the first survey data line

The data which can be imported are: stationed point, target point, azimuth, slope, length along the slope, length at the horizontal, difference in height, depth, dimensions (left, right, up, down) and a comment.

The file is first loaded in a temporary file in which you can complete or rectify the header data. You can also choose which kind of data is in each column by clicking on the column header et choosing the right data type in the drop box which appears.

If some data are in anomaly, they are displayed in red (ie alphabetical data in a column which must be only numerical or a value for an angle in degrees > 360).

Then, data are are imported in the same way that with Visual Topo. The cave structure is created from the points numbering. The cave is connected to the entrance in the header. It is not necessarily the stationed point of the first shot. But if there is none entrance in the header, the first point of the first shot is created as entrance.



From	To	Az	S	L	Left	Right	Top	Bottom	Comment
93	94	177	0,1	28.30	3.0	3.5	20.0		
94	95	142,8		24.00	2.5	4.0	20.0		
95	96	160,5		16.90	5.0	3.0	5.0		
96	97	147,5		15.00	3.0	4.0	4.0		
97	98	166		27.90	6.0		1.7	2.0	voûte basse
98	99	135,3		28.95		7.0	3.0	2.5	rotonde
99	100	176,3		21.10	3.0		1.7	2.5	voûte basse
100	101	167		22.70		3.0	1.8	2.0	
101	102	187		28.30		6.0	3.0		
102	103	217,5		23.25	4.0		30.0		
103	104	159,8		26.90	2.0	2.0	35.0		
104	105	138		22.15	4.5		35.0		
105	106	89,8	0,1	30.85	1.5	3.5	35.0		
106	107	152	0,1	30.00	0.5	6.0	30.0		
107	108	188,3	2,1	16.40	4.0	3.0	30.0		
108	Point 0	99	11	9.40	8.5	17.1	30.0		raccord
108	109	124	0,2	30.00	0.5	4.5	30.0		
109	110	169,3	0,1	30.00	3.0	4.0	30.0		
110	111	149,5	0,1	28.80	3.0	0.5	15.0		
96	1	277	29	8.60		5.0	5.0		
1	2	215	18	18.90	2.0	2.0	5.0		
2	3	229	1	23.45	2.0	4.0	7.0		
3	4	222	-2	24.25	3.0	3.0	6.0		
4	5	237,5	5	12.60	4.0	2.0	7.0		
5	5-1	314	13	16.30	0.9	0.9	2.0		
5	5-2	271	16,1	5.41	0.9	0.9	0.2		arrivée impénétrable
5	6	193	-12	25.30	2.0	2.0	1.8		siphon temporaire
6	7	202,5	1	8.05	2.0	4.0	2.5		
7	8	175	11	19.25	5.0	8.0	4.0		
8	9	147	3	15.70	4.5	4.5	5.0		

There are 3 excel files for examples in the directory “examples”. The two first "Model 1 (and 2) Import Spreadsheet.xls” can be imported as it after they have been saved as tab separated text files.

The third file named "Model 3 Import Spreadsheet.xls”. Must be corrected before importation : you must choose the kind of the data for each column from the fifth which must be the difference in height (dH),. The next is the length along the slope (L), the following are dimensions (left, right, top, bottom) and the last is the comments. There is also a wrong azimuth value. It must be corrected in the original spreadsheet or, after importation, by rectifying the corresponding shot.

Importing from Pocket Topo, Auriga or TopoDroid or Qave

This import recovers not only the topographic data of a survey made with these softwares on PDA or pads , but also the associated drawing. In the rest of these instructions, these softwares will be named “electronics pads”.

The software can read .top files generated by Pocket Topo or files exported in Therion format by Pocket Topo or Auriga, TopoDroid or Qave.

If there are loops in the survey, it is better to calculate them before exporting otherwise the TopoCalc'R drawing will not be identical.

For Pocket Topo, the software can directly read the «. top» files of Pocket Topo. All data (survey and drawing) contained in these files are imported directly into Topo Calc'R.

With Auriga, you must first make an export to native Therion format and txt Therion format. The first has an extension «th» and the second «txt». Both files must have the same name. In the first the software imports all the information concerning the topo, in the second, those of the drawing. If the second file is missing or does not have the same name as the first, only the topo is imported.

For Topo Droid, you have to export the survey data in Therion format (th) and an export of the sketches in the svg format. All exported files must then be placed in the same folder. Topo Calc'R will read the th file selected and will automatically import the associated sketches that have the same name but followed by a sketch number or name and then by "p" for the planes and "s" for the sections. For example, if you have a survey called “white cave”, you will have a th file called “white cave.th”. The sketch files will be referred to as “white cave-1p.svg” for the plan sketch and “white cave-1s.svg”. There may be other sketch files for the plan and section if several have been made in Topodroid. Their designation is identical, only the sketch number changes.

Topo Calc'R imports all the sketches that are in the same folder and adds them, depending on the case (letter p or letter s) in the drawing of the plane or in the drawing of the expanded section. For the moment the drawings of the projected sections of Topodroid are not taken into account as such. They are integrated like the other sections.

There may also be sketches of x-sections, such as “white cave-xx0.svg”, “white cave-xx1.svg”, etc. For the moment they are not integrated in the drawing.

For Qave, the import happens in the same way as for TopoDroid. In Qave you must export survey data in «th» format and drawing files in svg format with the same name. The software will add “_PLAN” for the plan and “_EXTENDED_E” for extended sections. For example, if we have a record called “white cave”, we will have a file called “white cave.th”. The sketch files will be referred to as “white cave_PLAN.svg” for the plan sketch and “white cave_extended_e.svg” for the extended. The extended section is imported as an expanded section in Topo Calc’R. There will also be a file “whitecavee_SECTION.svg” that corresponds to the projected cut, but it is not integrated by Topo Calc’R.

Warning: th file import does not include the full syntax of Therion. It has been written for import from Topodroid which includes only a limited number of Therion instructions. The import of files written by Therion can give uncertain results.

The import happens next in the same manner as for the other applications. After selecting the file to be imported, tick the galleries to be identified and possibly change the origin of the survey.

The menu allows you to import two types of import from electronic pads: the first line *"Imports / Electronic Pad File"* is used to create a new cavity from an electronic pad.

The second *"Imports / Update Electronic Pad"* is only active when the cavity displayed was created from an electronic pad file. It allows you to add survey shots and drawings from an electronic pad file only of Pocket Topo, Auriga, Qave or TopoDroid type. For the other type of notebook see below the import of a part of cavity. The software compares the imported topographic data and drawings with the existing ones in the cavity and adds only new ones. There must be at least one point in common between the existing data and the imported cavity. Otherwise, it asks the user if he still wants to import data. In this case, the result can be unpredictable because the new data will not be attached to the existing cavity.

Import a part of another cavity

It is made from the right click menu of the main window. It copies a part of another cavity from another file into the active cavity, following the selected survey shot.

You must open the file containing the source cavity. This can be another file Topo Calc'R, a Visual Topo file, a Toporobot or GHTopo file, a text file made with a spreadsheet**,** an electronic pad file (you make the choice with the open dialog type selector file). In all cases, the software begins by importing the file as indicated above.

As in the import of an entire cavity, you can individualise and name the galleries. However, it is not mandatory to individualise the first gallery. If the corresponding box is not checked, the points are imported into the current gallery.

The source cavity is then displayed graphically. You must click on the first survey shot to be imported. The portion of the cavity source selected is displayed in fuchsia. You can change the selection by clicking on another survey shot.

Validation with the button  will start the import into the active cavity, after validating a confirmation message.

Import of a longitudinal section from another file

It is possible to import a longitudinal section from another Topo Calc'R file. Only partial sections can be imported, and the shots on which the drawing of the section to be imported is attached must be present in the recipient cavity. This is done from the sections management menu. After having chosen the file containing the section to import, it is necessary to choose the cavity which contains it then to select the section chosen.

Comparison of the files of two caves

In the long or complex networks when surveys are made by many people, and where it can exist several versions of the topographic file, it can be difficult to see if the shots of a file are also in another.

The menu "*Cave Management / Comparison of caves*" allows you to compare the current cave with another one in another file. You must load the file of cave to be compared (either another cav file or a file in other format which can be loaded).

The software compares the shots of the current cave with those of the file by checking for each shot the measurements values (azimuthal angles, lengths and slopes). It doesn't take care of the names of the points. Also if points have been renamed from one file to the other, it doesn't matter.

Then a report is displayed. It shows first the list of the shots which are in the current cave and not in the imported one, then the shots which are in the imported cave and not in the current one.

You can print this report. A tab separated text file is also created. It is named "*name of the cave*_Rapport_MAJ.txt".

Fusion of caves

When two caves have a junction point, it is possible to merge them with the menu "*Cave Management / Caves fusion*". The only condition you need is that the two caves have at least a common point created with the function "Junctions management". The fusion is done towards the current cave. If there are possibilities of fusion of more than two caves, a choice menu is displayed.

Digitalisation of a scanned cave survey

This function is done from the menu *"Import"* . It allows you to digitalize galleries's axis and create the structure of the cavity. Digitalizing the drawing is done in the part "Drawing"(see below).

It has two parts: the digitalisation of planimetry with the menu "*Scanned cave survey digitalisation (Plani)"* and the altimetry with the menu "*Scanned cave survey Digitalisation (Alti)".*

You must first digitalize galleries's axis with the first function. If you have the extended profile of the cavity, you can then readjust altimetry.

If there is no profile of the cavity, and if the scanned cave survey includes requirements for altitude, you can make an altimetric adjustment in digitalizing planimetry.

Digitalizing planimetry

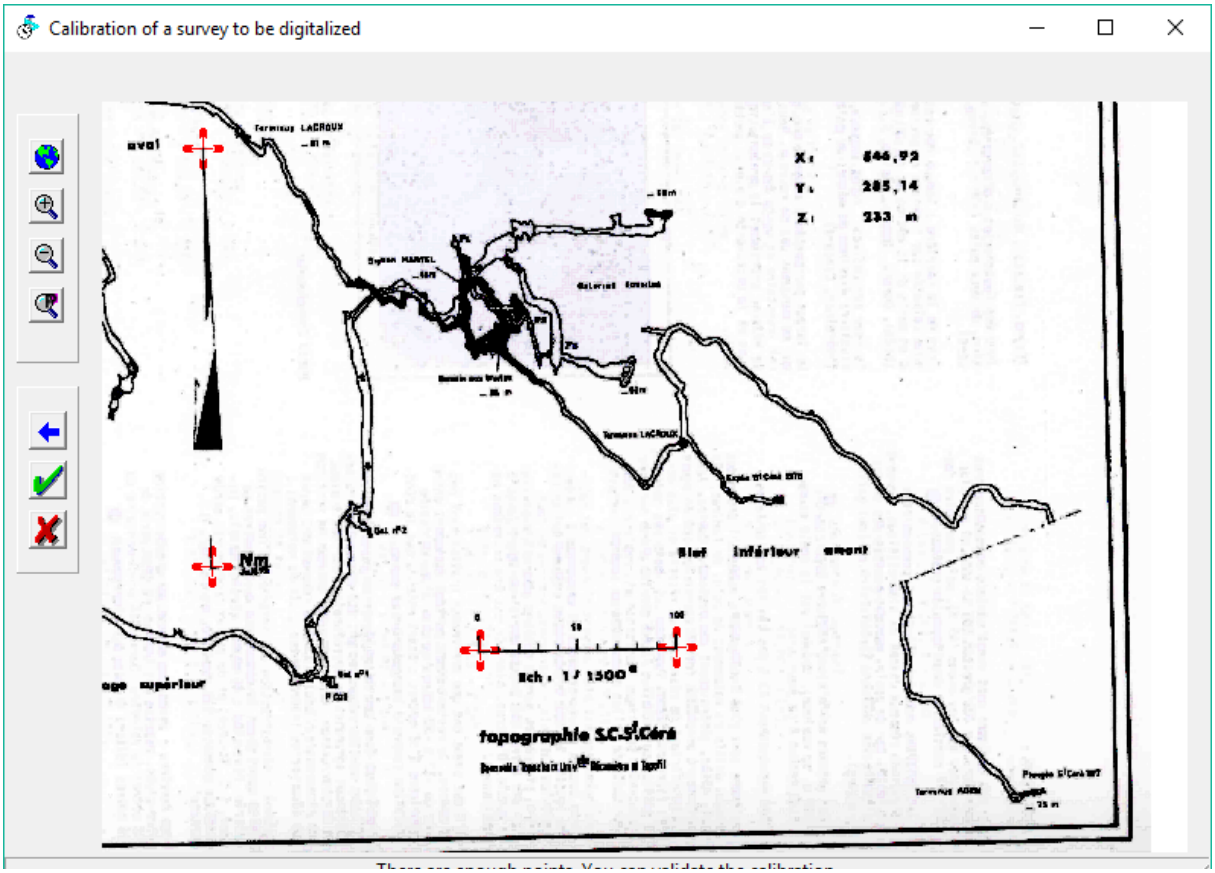
The digitalisation must necessarily be attached to an existing point, being a point of the surface, or a point of an existing cavity. If you want to create a cavity from a digitalisation, you must first create the cavity after entering the coordinates of the entrance point.

To add the digitalisation to an existing cave survey, just open the file of this cavity.

The menu opens the digitalisation window (for operation zooms, see the presentation of graphic displays in Appendix 1). To start digitalisation, you must first load the file containing the scanned cave survey. This is done with the button  that opens an image file.

After opening the image file, you must calibrate the image: you can use either a calibration by defining an orientation and a scale or a calibration from known coordinates grid. The first method is described below, the second is identical to that used to add a rastered map in background map (see below raster management in the chapter viewing and printing of topographies).

To calibrate from an orientation and scale, you must tell the software successively the starting point of the digitalisation (entrance point of the cavity or connection to another survey), lower and upper North arrow (or other line giving a known direction), and the beginning and the end of the scale (or a line of known length). The calibration window looks as follows.



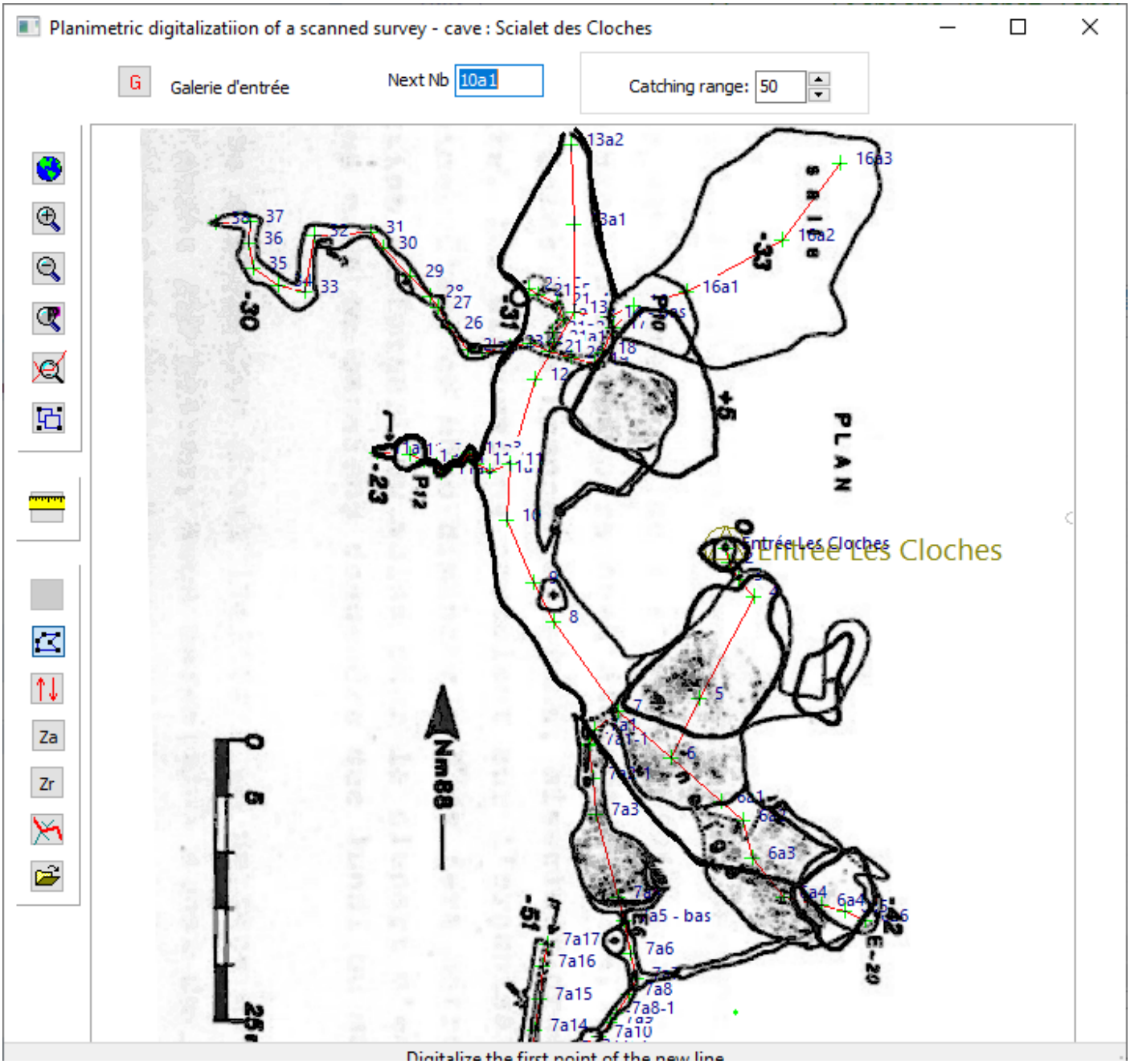
The messages provided in the bottom of the window allow you to follow the order of points to be digitalised. The seized points are represented by a red cross. Button  cancels the last point. The button  removes all points. When all the points have been designated, the button  validates the calibration.

You need next to indicate the value of the orientation direction (0 if the north arrow) and the actual length of the scale.

After the calibration window closes you must indicate what is the point corresponding to the start of the scan (connection point at an existing survey or entry point for a new cavity). The software looks for the point the closest to the clicked point and positions the image above.

If you made a mistake in all these operations, simply restart by opening the image file.

The digitalisation itself can begin. The window changes as follows:



A red line materializes digitised paths. The points are numbered as one goes along. Digitising always starts on a survey point (a point of an existing survey, or a point already digitised). After calibration, the starting point is necessarily the point of connection indicated during calibration. The cursor is tied to the latter digitised point by a purple "thread at the leg", thereby materializing the survey shot being digitised.

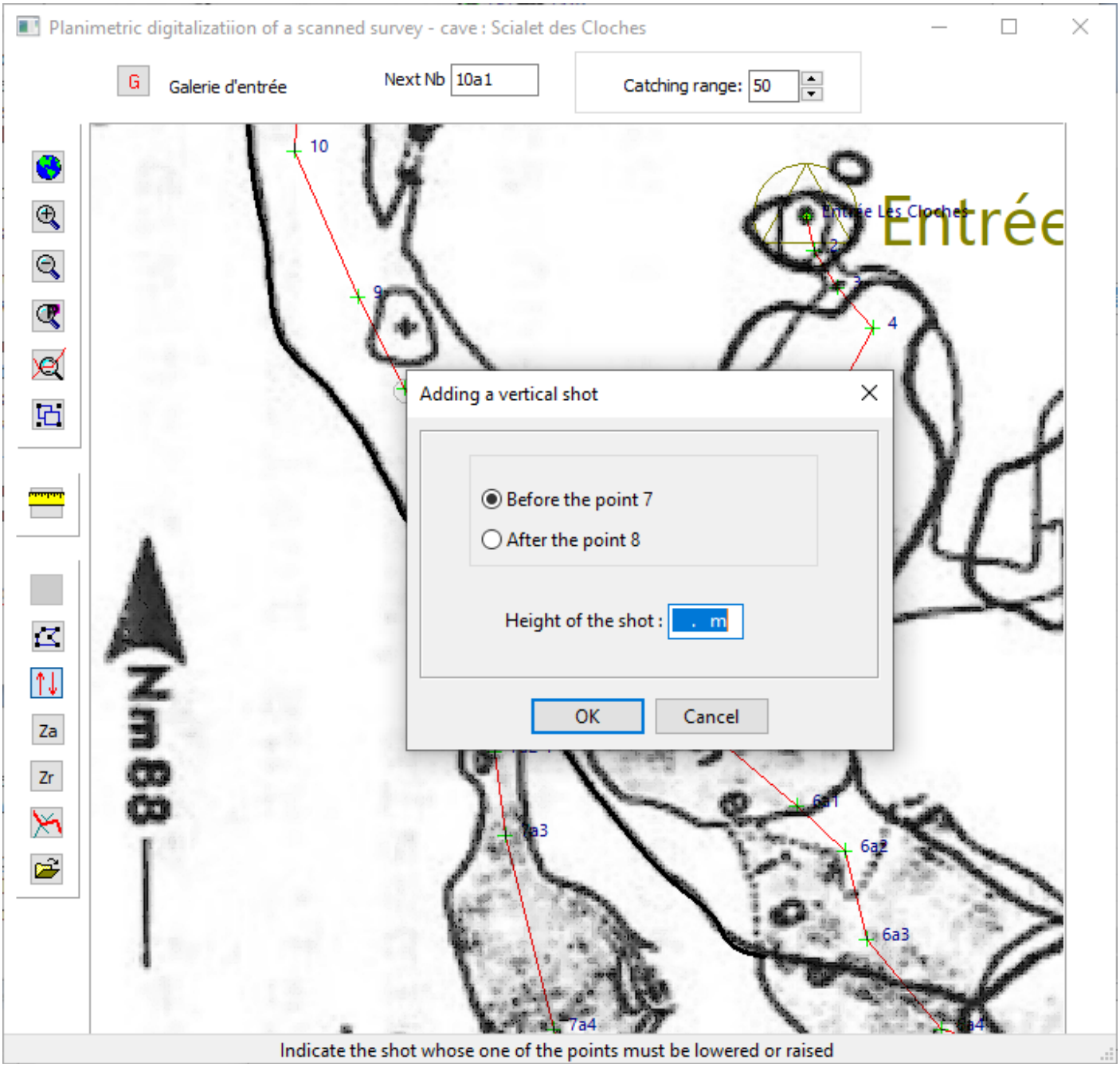
Button cancels the last point or last height adjustment. The button is used to interrupt the current polyline and start a new one. The button G creates a new gallery. You must enter the name of the new gallery that appears next to the button. The number of the next point is indicated in the designation window N° Suivant : 24a3. By default, the software assigns a number to the points.

When a gallery or radiated point is created, the designation of the new point is created by adding a letter after the point of attachment and the numbering starts from 1 For example, for a gallery attached to point 24, the first point of the gallery will be called 24a1. If there is another gallery attached to the point 24, his first point will be called 24b1, etc. you can change the name of the next point by double-clicking on the designation window: you must then indicate the new name (it can be alphabetic or alphanumeric).

When you close the digitalisation window the survey shots are automatically added in the file of the cavity. When closing the network file, the elements of the current raster positionning are saved in a "rrr.CFG" file (rrr is the file

name of the network) which stores the image file name and calibration parameters. When you will open the network file again, you can continue digitalisation without having to redo the calibration steps.

It is possible to add vertical survey shots with button  . You must click on the survey shot situated before or after which you want to add the vertical shot. You must then choose where the new shot will be added and indicate its height.



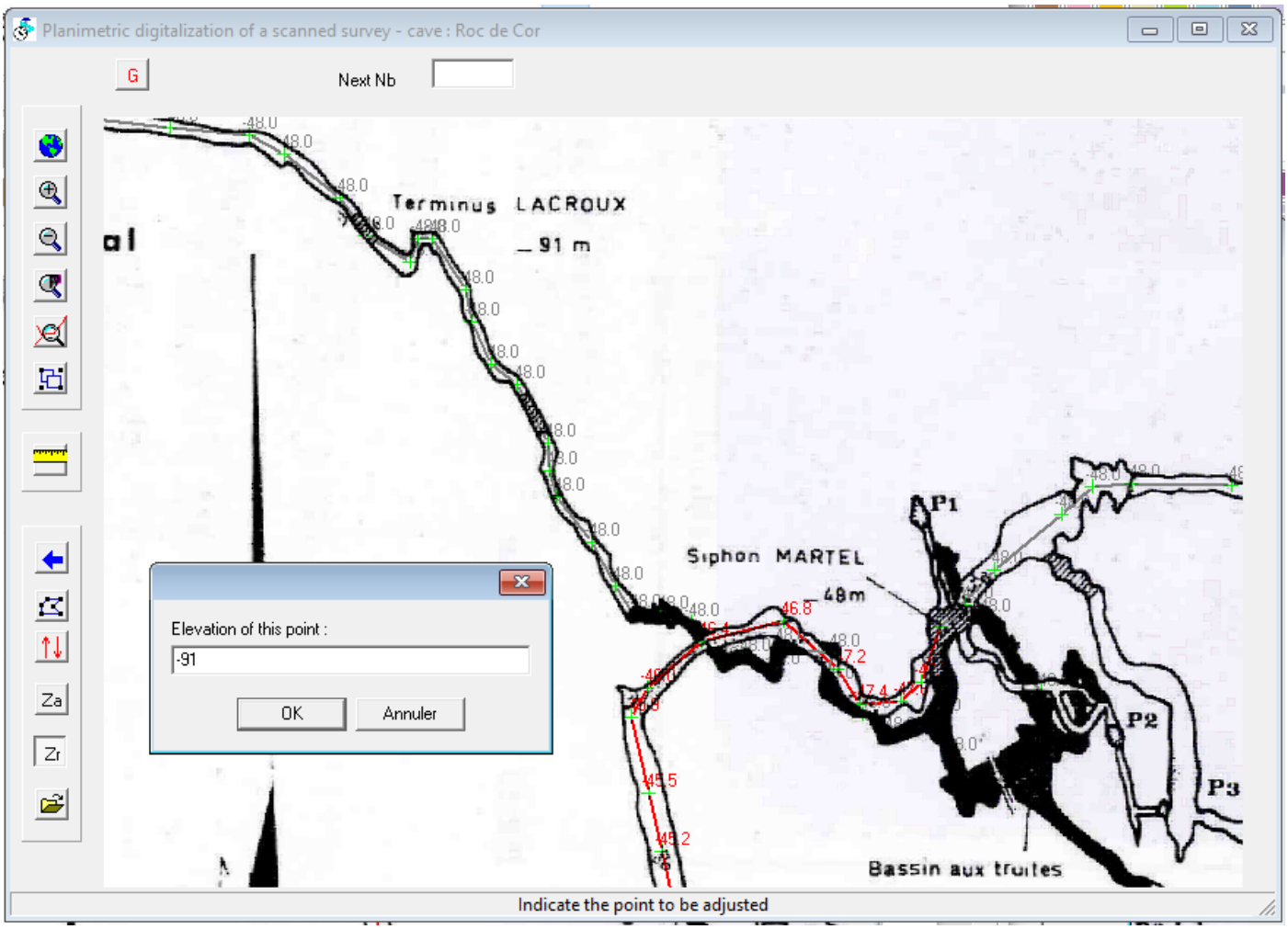
A new point is created and a vertical survey shot inserted.

In the above example, we create a point below the point 7 that will be added between points 7 and 8. It is automatically named "7-down".

Buttons  and  can be used to do a vertical adjustment of digitalisation from absolute or relative altitudes respectively.

When pressing one of these buttons, the points altitude is displayed instead of their designation.

We must first designate a point which will be the altitude reference for the adjustment. Then we click an other point and we indicate its absolute or relative height according to the case. The software divides the difference between the calculated point altitude and the input one proportionally to the survey shots length.



In the above example, we have first indicated as a reference point 0, then adjusted the point of the "Martel siphon" at -48 and in a second way the point of the "terminus Lacroux" at -91. The parties that have just been adjusted are represented in red and the latter in green.

When we leave this function, height adjustments are included in the data of the cavity. Its possible to cancel the successive adjustments with button  .

With the button  , you can create skin shots: after indicating the starting point of the shots, click on the other end of each shot. To change the starting point, click on the button again.

Digitalizing altimetry

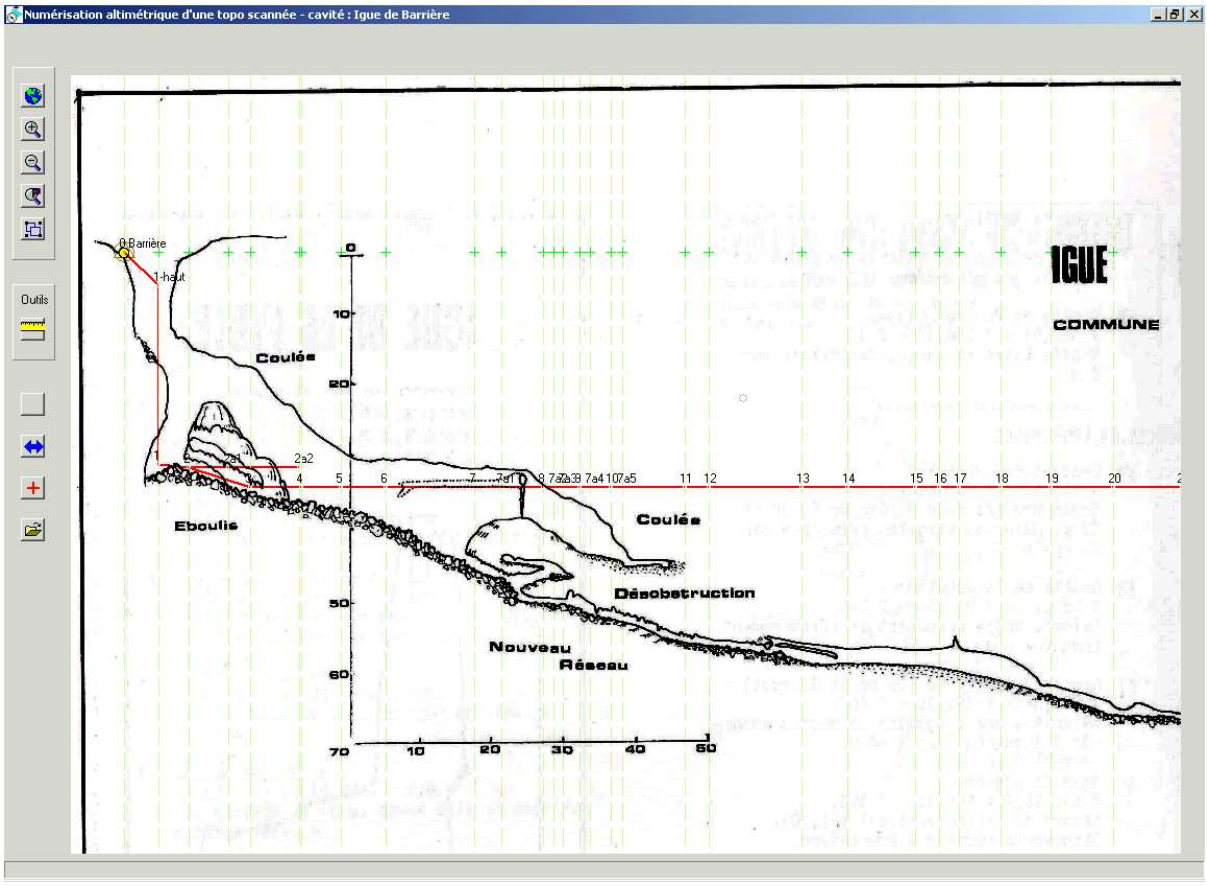
It is made in the same way as for the levelness. We must first calibrate the image of a longitudinal section then indicate the points we want to determine the altitude. It is not possible to add new points out of existing paths. It is only possible to divide existing survey shots.

The calibration of the image can be made by two manners: either from an identified point in the image and its counterpart on the survey path and defining a scale, either from two points identified on the image and their correspondents on the path.

The calibration screen is similar to that used for calibration of planimetry. In the first case, you have to click successively the origin, which corresponds to a point on the planimetric survey path, then two points that will give a vertical reference and finally the two points defining the scale. You then need to enter the value of the vertical reference (0 ° for the vertical, 90 ° horizontal) and the real length of the scale. After determining the point of origin on the planimetric path, the image is positioned on the longitudinal section of planimetric path.

In the second option you need first to click on the image of the longitudinal section two calibration points and two points defining a vertical reference. After entering the value of the vertical reference as above, you must indicate on the survey path what are the counterparts of the image calibration points. The image is positioned on the survey path.

The digitalisation screen is as follows:



The survey path longitudinal section is indicated by a red line. The points of the path are indicated by their designation. Vertically of each point is indicated by a dotted green.

To set the elevation of a point, just click on the vertical line at the intersection with the drawing of the longitudinal section. The path is adapted in altimetry and the survey path is redrawn. In the example above, altimetry has been readjusted to point 3, the rest was not affected (the path is flat).

We can undo the last point entered using key  . The button  gives the possibility to add points to the inside of the existing path. It can be inserted vertically from an existing point, for example to draw the height of a shaft or an ascent, or inserted between two points on the path to better paste altimetry with the drawing of the longitudinal section. To add a point vertically above another, you must click on the vertical at a distance in the grip radius (indicated by a circle on the mouse pointer). Otherwise, it is added to the nearest line.

In the example, point 1 up was added to materialize the top of the shaft.

The button  is used to reverse the direction of the survey path longitudinal section. It can be used when the direction of path is different from the image, or if a part of the section is drawn in another direction. Directional changes are not saved when exiting the software.

!!! Changing direction can affect the position of the image: the calibration is made with the points coordinates when we define it. When changing the direction of all or part of the longitudinal section, it may no longer be valid. It may be necessary to take it back.

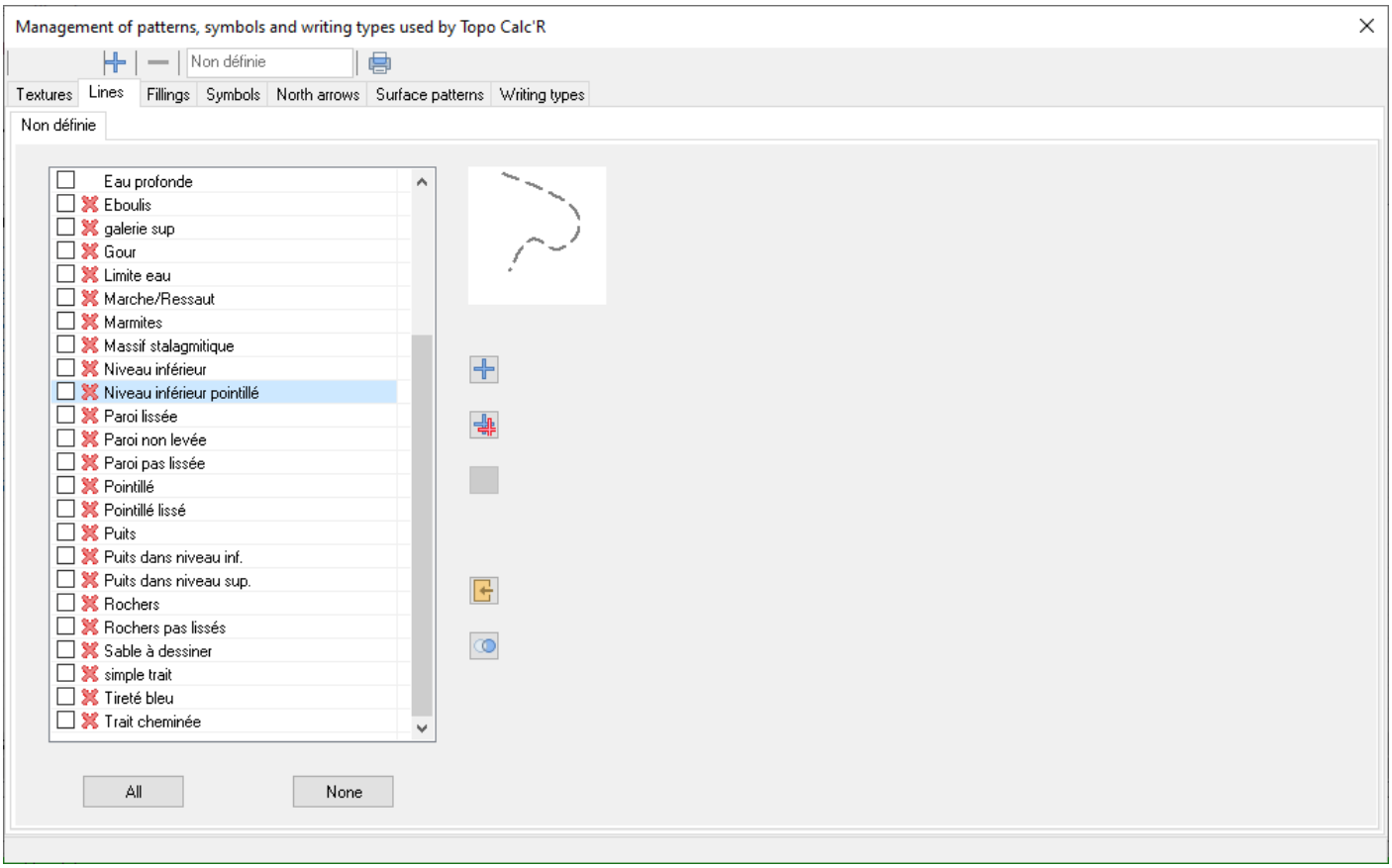
When you leave this function or if the longitudinal section direction is changed, all changes are automatically integrated into the data of the cavity.

Patterns, fonts, and symbols management

The patterns / symbols / fonts menu

It allows you to import or export patterns fonts and symbols files to use patterns fonts and custom symbols from one network to another: the function **export** creates a file with the same name as the network, but with the extension ".mtf". With i**mport** you can integrate a mtf file in the current network or import them from another network. Fonts patterns and symbols with the same name are replaced. See also the configuration menu to load this type of file in the starting up.

The following function is designed to manage patterns, symbols, north arrows, surface patterns and writing types. The management window is shown below:



You can manage 7 types of patterns that will be used for the drawing (see later the chapter Drawing topographies): textures, lines, fills, north arrows, surface patterns and types of writing. In order to facilitate their use, for each type we can create categories: for example for the lines, we will be able to create a category in which all the lines to draw rocks will be grouped

The top toolbar allows you to manage categories:  to add a category,  to remove one. If a category is deleted, all the elements in it are transferred to the "undefined" category. The following editing area is used to rename the current category (except the “undefined” category which cannot be deleted or renamed). The button  gives access to the impression of pattern types (see below).

In the list of patterns, the selected pattern appears in a viewport. A left click on the current line allows you to correct the name of the corresponding element. A double click in the viewport gives access to a window that will allow you to edit it. See below how each type of pattern is created and corrected. North arrows and surface patterns are edited as symbols.

Items in the list can be checked to clear or change categories. The “All” button selects all erasable items. “None” deselects all items. The following functions are available:

to **create** a new element.

create a new item by **copying** the selected item.

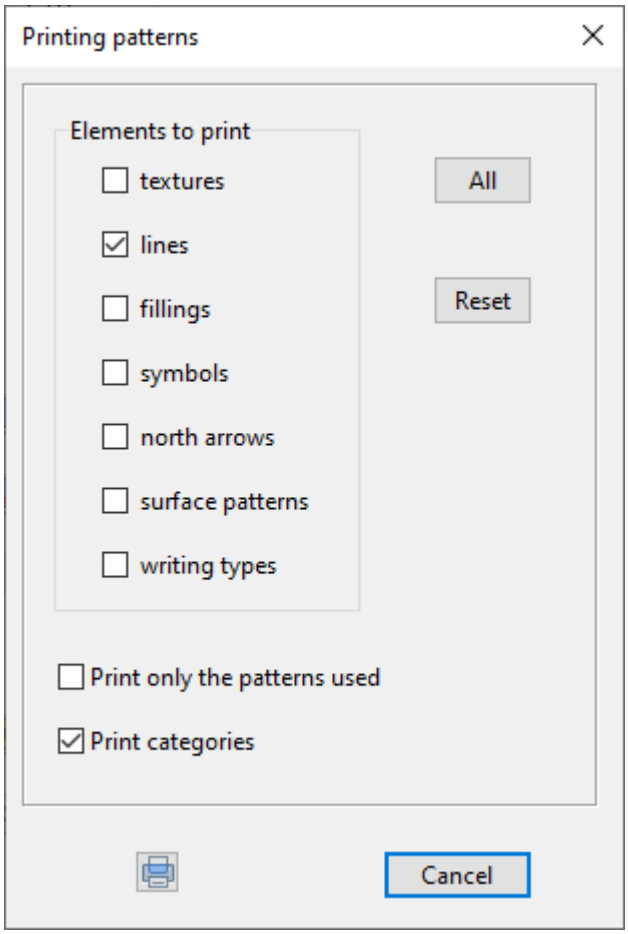
to **remove** checked items. Only those not used in the drawing will be deleted. The others are identified by a cross before their designation.

to **transfer** all checked items to another category.

to **import** items from another network or mtf file.

to **merge** one element with another in the drawing. When you activate this function, you can choose from the list of items that appears on the right the one that will be replaced by the one on the left after validation. The right element will be deleted after the merge. To exit this function without merging, click in the left list or click the merge button again.

The button allows you to print a list of pattern types. You can choose which types to print, group them by category and restrict the list to those used in the design.



Operators and instruments management

The operators menu

It allows to manage operators: correction or deletion (only operators not used can be deleted). When an operator is corrected, if another operator has the same name, they are merged and sessions that use it will be rectified accordingly.

This menu also allows you to export or import the list of operators. Export is a text file named "*network name* - ope.txt". You can import files of this type or, more generally, any text list in a text file (be careful with the contents of the file, this can generate lists of bizarre operators !).

The instrumentss menu

It has the same possibilities that the operators menu and works on the same principles.

The files generated by export are not text files but have their own format. They are named "N*etwork name.*instr".

Cavity statistics

The button  provides statistics on the cavity. There are four tabs

The first shows the statistics

They are grouped by gallery (total length, total difference in height, the highest point, lowest point, etc. ... and aggregated to the cavity.

You can print this table. It is saved in two files with the name of the cavity followed by "-stats." The first has a "RTF" format and can be displayed by a word processing; the second is a text file (CSV) that is formatted in tab-separated columns, allowing the use of a spreadsheet.

The second shows detail and accuracy of the calculations.

Its is a report on the calculation. It indicates the loops, the junctions between cavities or compensation calculated for each of them and the gap between the points before calculation and corrections.

Moreover it provides an estimate of the theoretical accuracy of the points based on the accuracy of the instruments used and the accuracy of surveying.

The third gives details on the survey sessions

It displays the list of sessions with their date, the first and last points of each session, the length and number of shots taken, and the list of operators.

A list of survey sessions is created and saved in a CSV file named with the name of the cavity followed of " - levers". It includes the same information as above, plus comments..

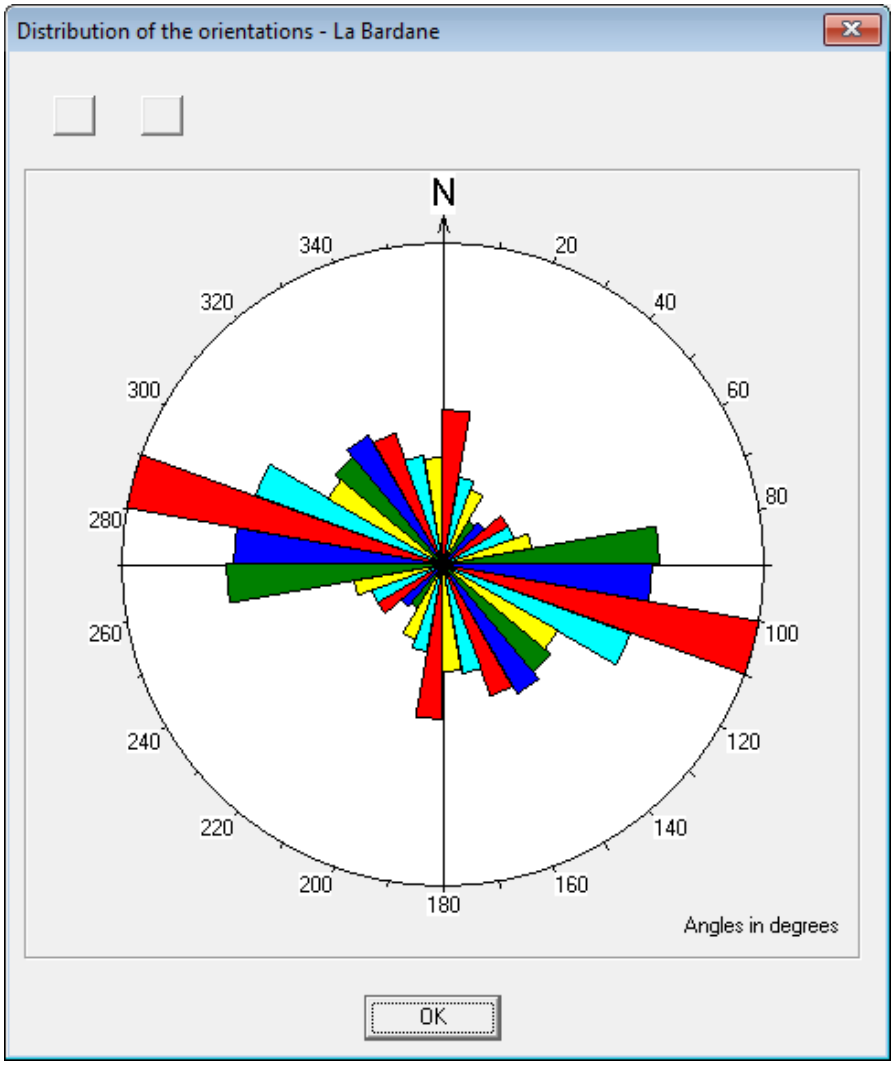
The fourth concerns survey operators

You can see the number of the survey sessions and the list of people who made the measurements.

A CSV file named with the name of the cavity followed by "-Operators" is also created with the same information as that displayed.

Rosette of the directions

The button  allows you to see the rosette of the directions of the cavity: the length of each segment is proportional to the sum of the lengths of survey shots having this orientation.



Graphic data

The software allows you to enter the galleries drawing, as well as for the plan than for longitudinal sections. It has lines patterns and predefined symbols which can be added by creation or by importation from another file.

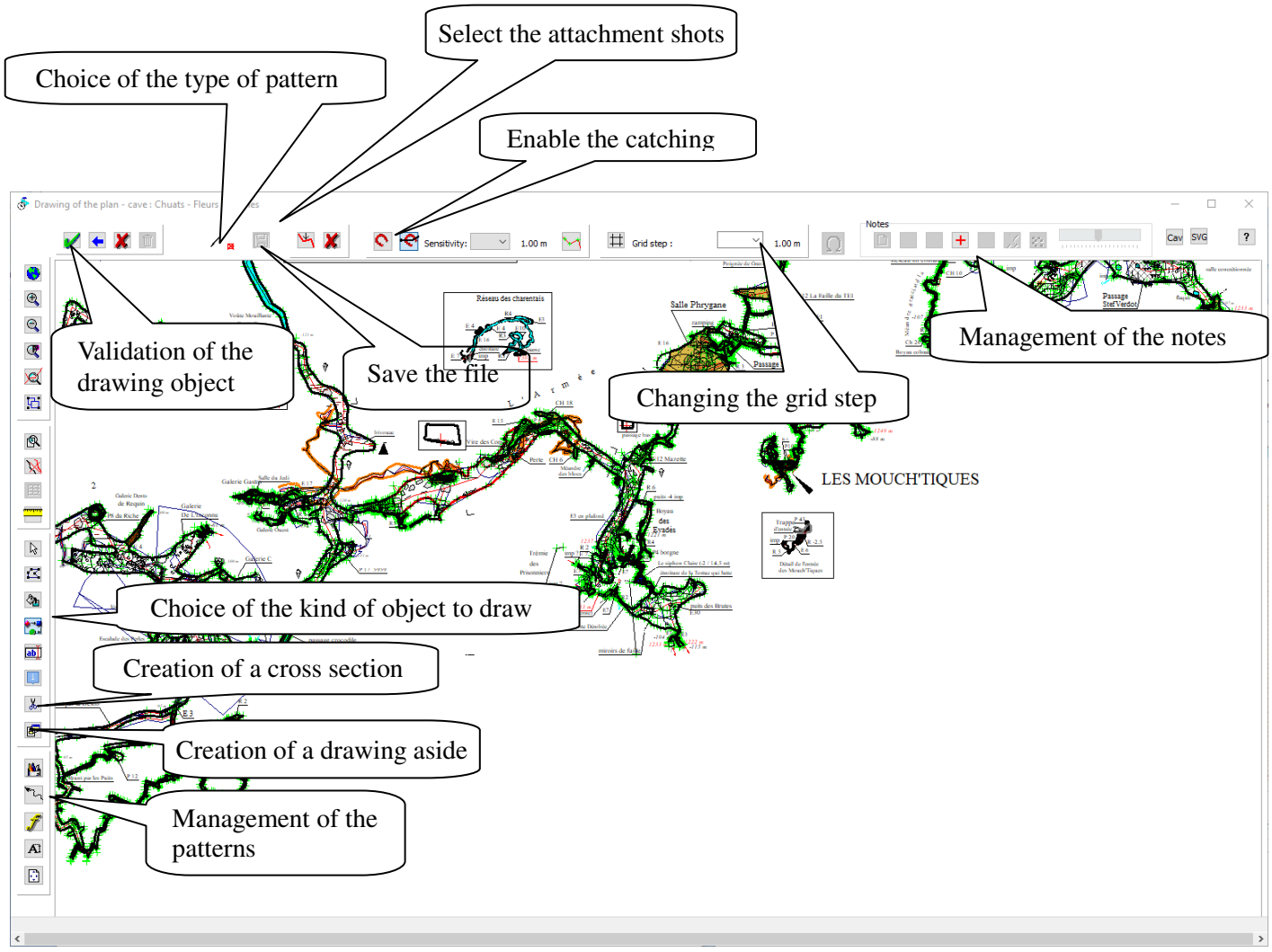
Drawing topographies

The drawing screen for the plan and longitudinal sections has the same functionalities and the same presentation. Only lists of drawing lines and symbols may be different. The points of the drawn objects are linked by the software to the closer survey shot. After a recalculation of the survey, the drawing can be changed automatically. The design of the plan and sections can be activated from the main window with buttons  , or  . They apply to the active cavity.

You can draw two types of longitudinal sections: the first is a section expanded, oriented on the longest direction of the cavity: the general direction of the cavity is calculated and the survey shots are reported positively if they go in this direction in 90 ° near, negatively in the other case.

The second is a projected section.

The sections may be global or partial. Their management and the specificities of their drawing are explained further.



The drawing window allows to dress topography leaning on the topographic path of the galleries and their widths or heights if they have been seized.

The management of the drawing is done with icons in the tools bars on the top and on the left of the window. You can however used shortcut keys. Their list can by displayed by clicking on the help button  (on the top right).

You can save the active file with the button  or with Ctrl S.

The drawing shows the **components point:** they are represented by small green cross. These are all the surveyed points (axes galleries and widths or heights) and all the points that make up the objects in the drawing excepted certain motifs that are part of the coating layer (see below lines patterns management). When entering a new point, the software tries to "hang" on an existing point if it finds one within range of **catching.** This ensures continuity paths.

By default, only the components of the items of the drawing are showed. You can also display those of the topographic elements (points of the survey path and width or height of the galleries) with the button  .

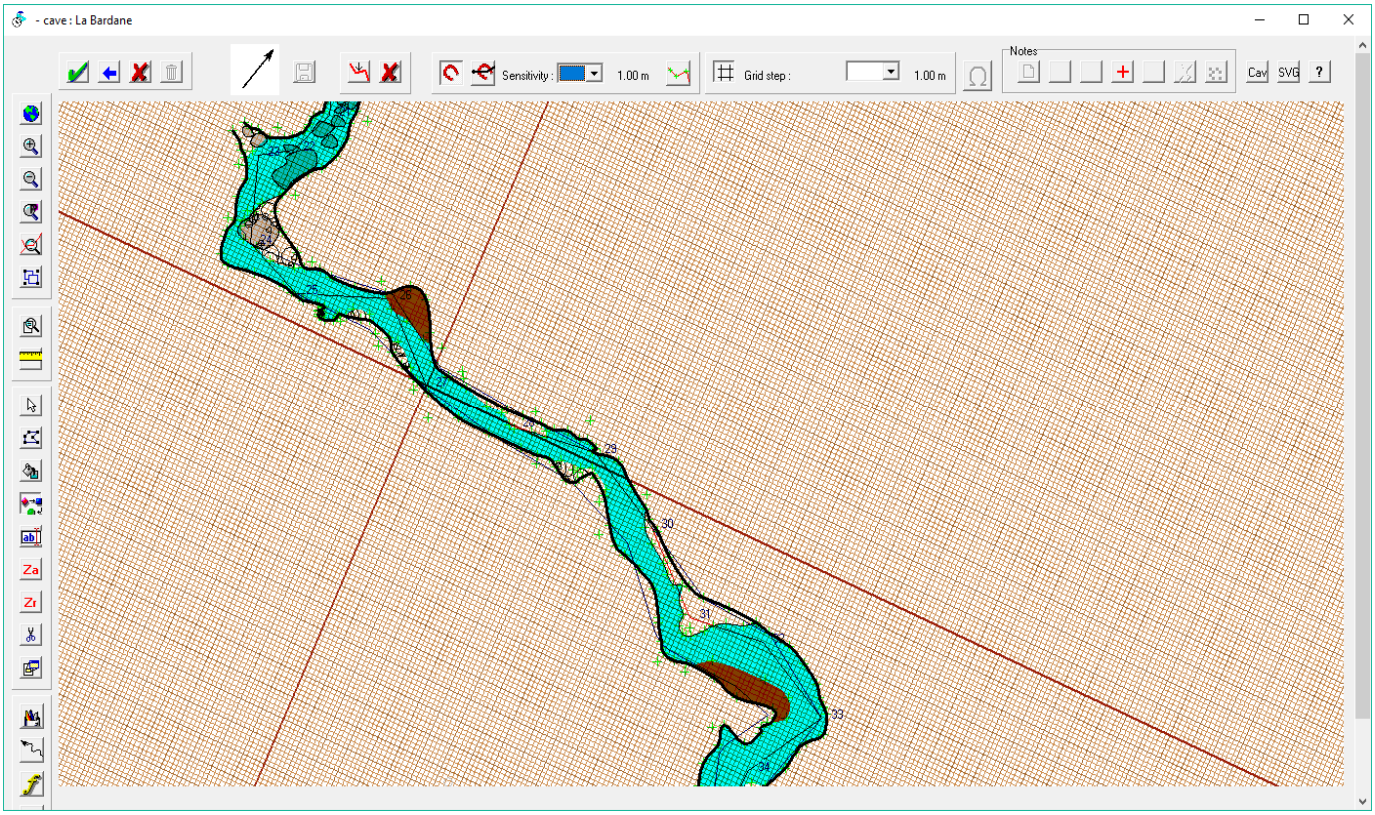
However, it can be annoying to catch at some points. You can adjust the catching radius by adjusting the sensitivity of the cursor (top of the window). It is marked by a circle related to the mouse pointer. It is also possible to **disable catching** by clicking the button  (or the key “Q”). Click again reactivates.

You can also choose a temporary catching with the button  (or the key "W"). The catching is enable for the first point clicked with you draw a line. It’s useful to draw a line which must be connect with another one.

When enter symbols and texts catching is disabled by default.

The software does not have functions of geometrical construction. However, it is possible to display a **grid** that is set on a survey shot. Pressing the button  allows you to show or hide it. To position it, you must indicate with the cursor the survey shot on which it is based. The origin of the grid will be the starting point of the shot. Orientation matches that of the shot when drawing the map or vertically when drawing longitudinal section.

By default, the grid step is 1m. You can change it with the drop-down list at the top of the window.

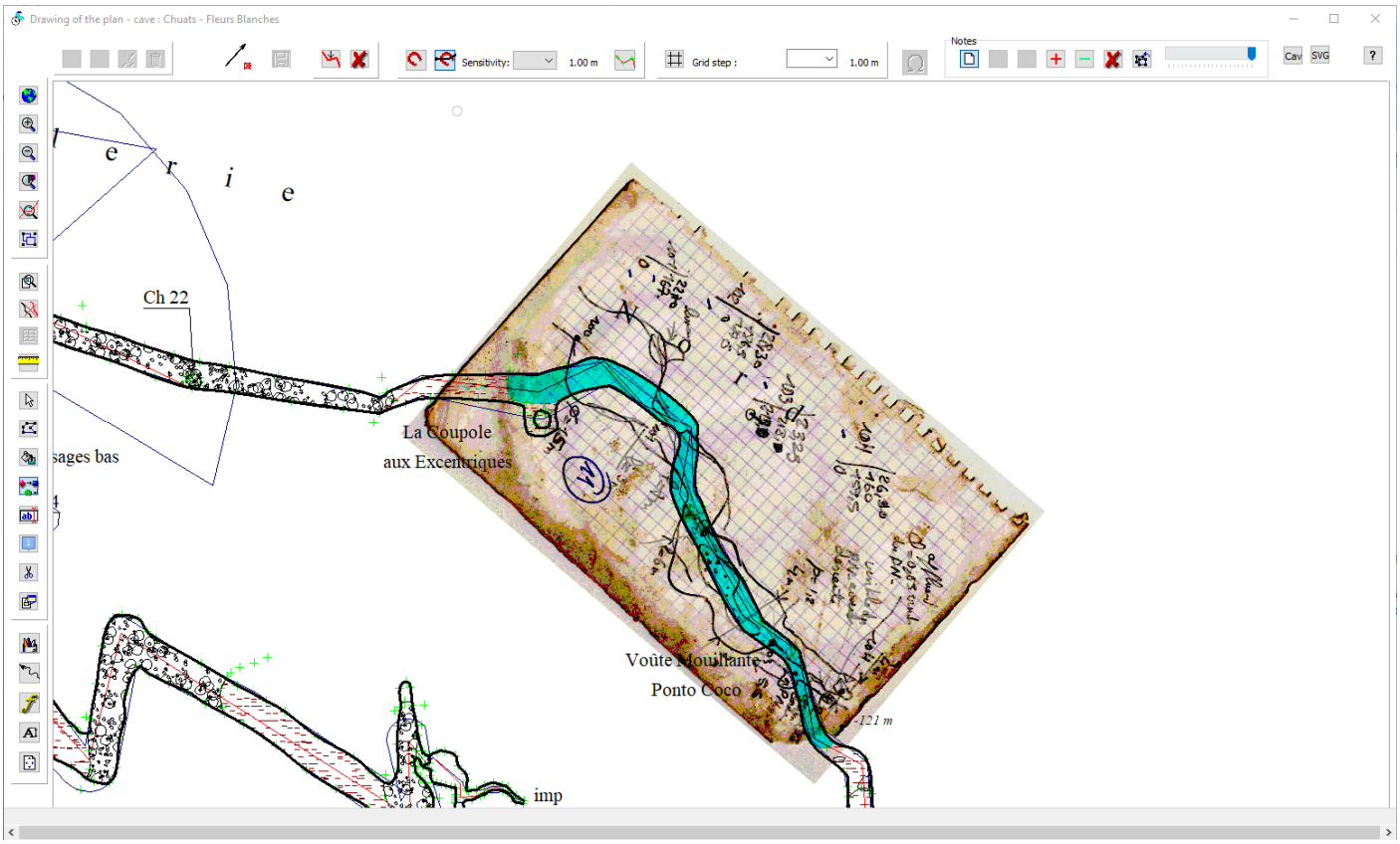


The figure above shows a grid with a step of 1m stalled on the 27-28 survey shot.

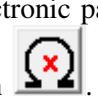
It is also possible to **raise survey notes (or other image) in the background:** it can be either the sketches made up during the survey session (on condition of course that we respected the proportions of the galleries when drawing the sketch) scan of a paper topography you want to digitalize after having previously digitalized the survey path (see

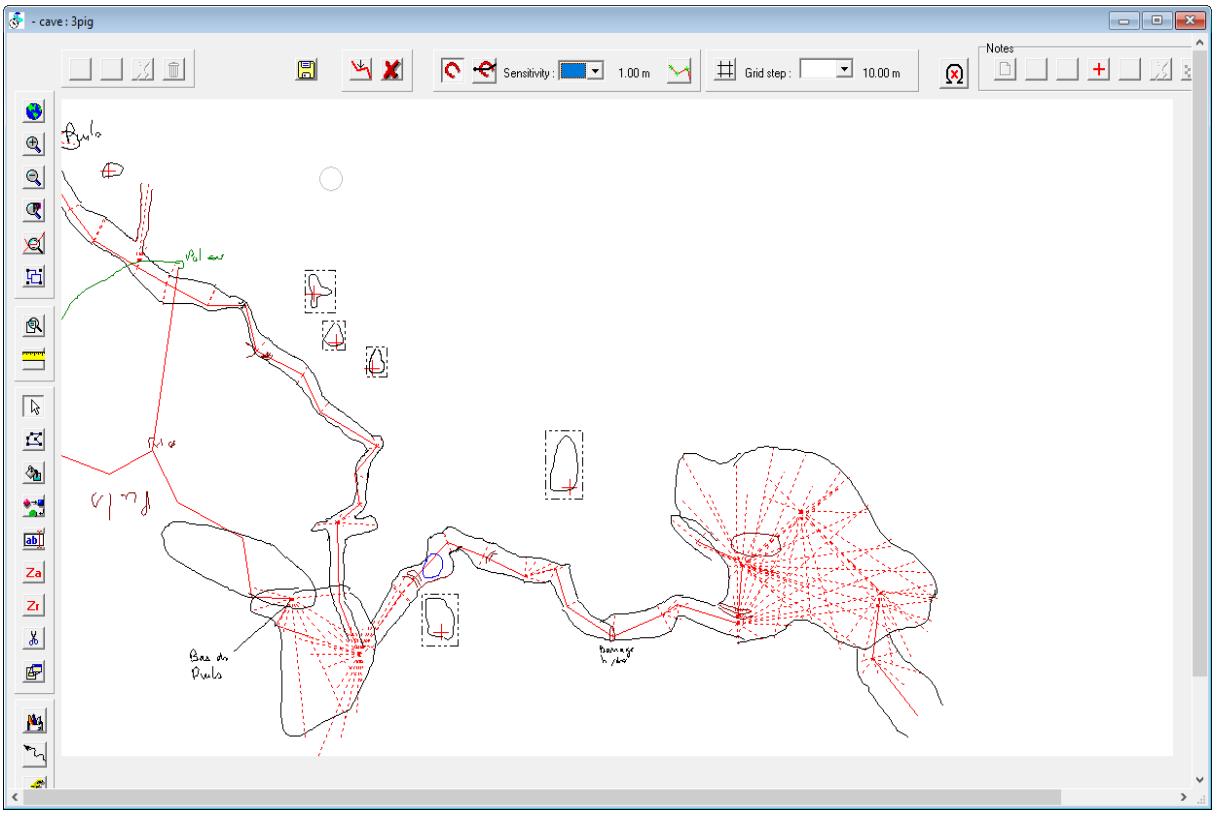
above "Digitalizing a scanned cave survey") or any other image file (see illustration below). You can also have in the background a drawing at the SVG format created by a software such as Inkscape or Adobe Illustrator.

For calibration and management of notes see below.



If the file is imported from an electronic pad file the drawing done with these softwares appears in the background.

You can hide or display it with icon  . It is not editable.



The button SVG allows you to import a drawing in SVG format, widely used in the world of cartography. See section below "import of SVG drawing"

When designing the plan, the software also allows you to create cross-sections (see management of cross-sections) by pressing the button .

If no button of drawing (see above) is active or if you are not in selection mode, you can see the data of a point of the survey path by clicking on it (see further “viewing and printing topographies”).

Drawing patterns

To start drawing, you must select the type of object to draw with one of the following buttons:

polylines: line or polygon objects (solid or dashed lines, consisting of a closed polyline areas) shortcut key = F1

surfaces defined by multiple polylines such as water level, deposits of sand, clay shortcut key = F2.

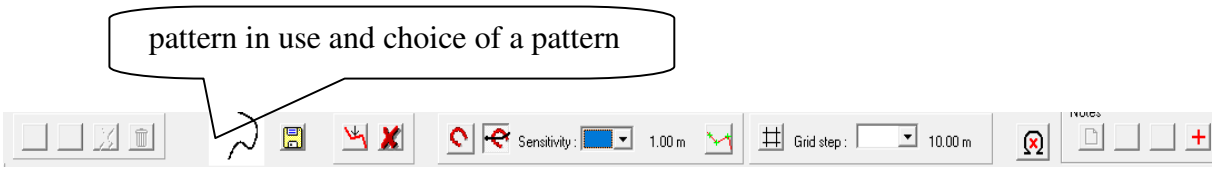
symbols: arrows, concretions, ... shortcut key = F3

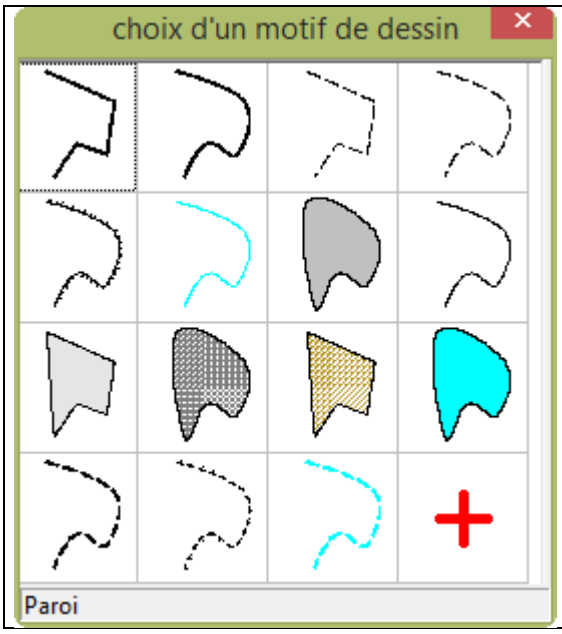
texts shortcut key = F4

retrieve the survey informations for a point on the survey path. This can be the absolute altitude, the difference in altitude in relation to the entry point (relative altitude), the distance from the entry point or the name of the station.

For the first three categories, you must then define the type of pattern to be used in the selection list of patterns at the top left of the window (see illustration below).

The software has a few default preset patterns, but the user can modify or add his own patterns. (See below "managing patterns"). To select a pattern, click on the box where the current pattern appears, which shows the patterns selection board.





You select the desired pattern by double clicking on the corresponding box. + box allows to create a new pattern (see also below "patterns management").

To close the board, click on an empty space, if there is one or on the close box

Before the first drawing of a sketch, it's necessary to indicate the reference scale for drawing : this scale determines the size of the writings and also the drawing of hatched lines or lines with repetitive patterns such as triangles. The spacing and the size of these patterns are determined from the scale of the drawing. According to the scale drawing on paper, it is necessary to have writings larger or smaller. For a cavity of small size, you will select the 1/100 1/200 while for a cavity with a kilometric development you will use the 1/1000 or smaller scale.

This scale is attached to each drawing. It can be different for example for the map and for the section of a cave. Afterward it can be changed with the button  .

Once selected the pattern, you must designate with the mouse the first point of the drawing (left click) and then the following points. The drawing is done progressively. The current line is indicated by a purple "thread at the leg" after the mouse.

As soon as we took the first point, the validation bar located at the top left, becomes active:

- Button  : Cancel the last point
- Button  : cancel current drawing
- Button  : validation of the drawing

The drawing must be validated to be recorded in the file. If the drawing is interrupted by any other action that the validation button, it is lost.

When drawing you can use the key "F" to shut the current line (loop on the first point)

In the same matter the key "D" connects the line to the nearest compo point.

However, we can change the current pattern of drawing with a click on the box who shows the current pattern (at the right of the validation bar) shortcut key = “A”.

Drawing surfaces: Some surfaces must be based on existing lines: for example, to draw a water level between two walls, there is no need to redraw the two walls, simply draw the upstream and downstream boundary of the water. That's what makes the button  .

area under construction

area after validation

In the example of the water between two walls, to create the surface, you must first select the "pattern water" then designate each of the walls and build the upstream and downstream limits (order does not matter).

When creating this type of drawing three additional buttons appear below validation bar.  The first allows you to draw polylines that make up the new boundaries of the surface, the second validates the polyline drawn,

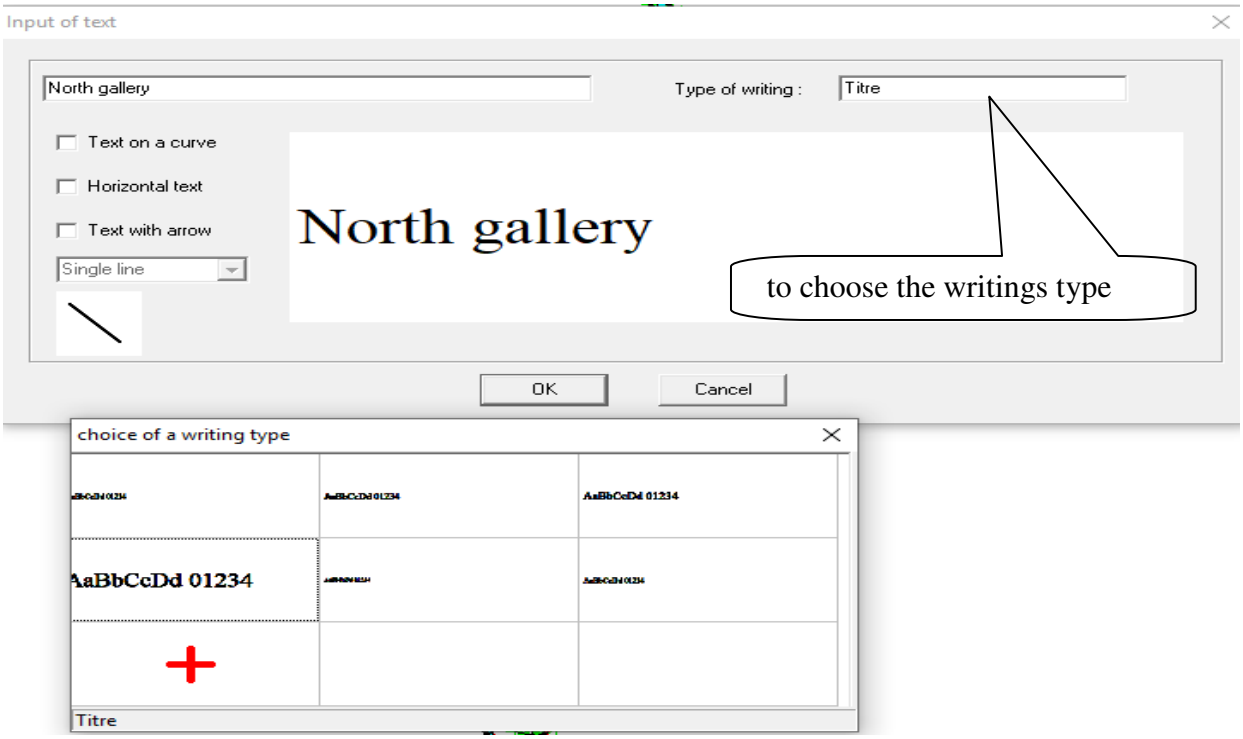
the third is used to select existing polylines to incorporate them into the surface. The created polylines don't need to be attached on an existing point. They must only have an intersection with another new string, or with an existing polyline incorporated into the surface. Polylines created or incorporated are drawn in red. When they are enough junctions to define a closed surface, it becomes possible to validate the drawing. It is then filled with the background pattern (color and fill pattern) and polylines components become invisible.

For this type of drawing, lines that are part of the coating layer (see below patterns management) may not be taken as flanking polylines.

Drawing symbols: after choosing the type of symbol to draw in the same way you chose a design pattern, make a mouse click. The symbol appears and follows the mouse cursor. It is fixed by making a second click . You can vary its size with the mouse wheel by holding down the ctrl button or with the + and – keys (except for symbols of fixed size) and its orientation (except for symbols with a fix direction) with the mouse wheel by holding down the shift button or with the right or left arrow keys. When you have set the position of the symbol, it's possible to resume its movement with the button  .

You can modify existing symbols or create new ones with the button  . See further symbols management

To **put texts**, you must first enter the text to be displayed. The next input window opens:



In addition to entering text, it allows you to choose the writing type to use. Clicking on the box will bring up a board that will allow you to choose the type of writing in the same way that a pattern is selected (see also below " types of writing management ").

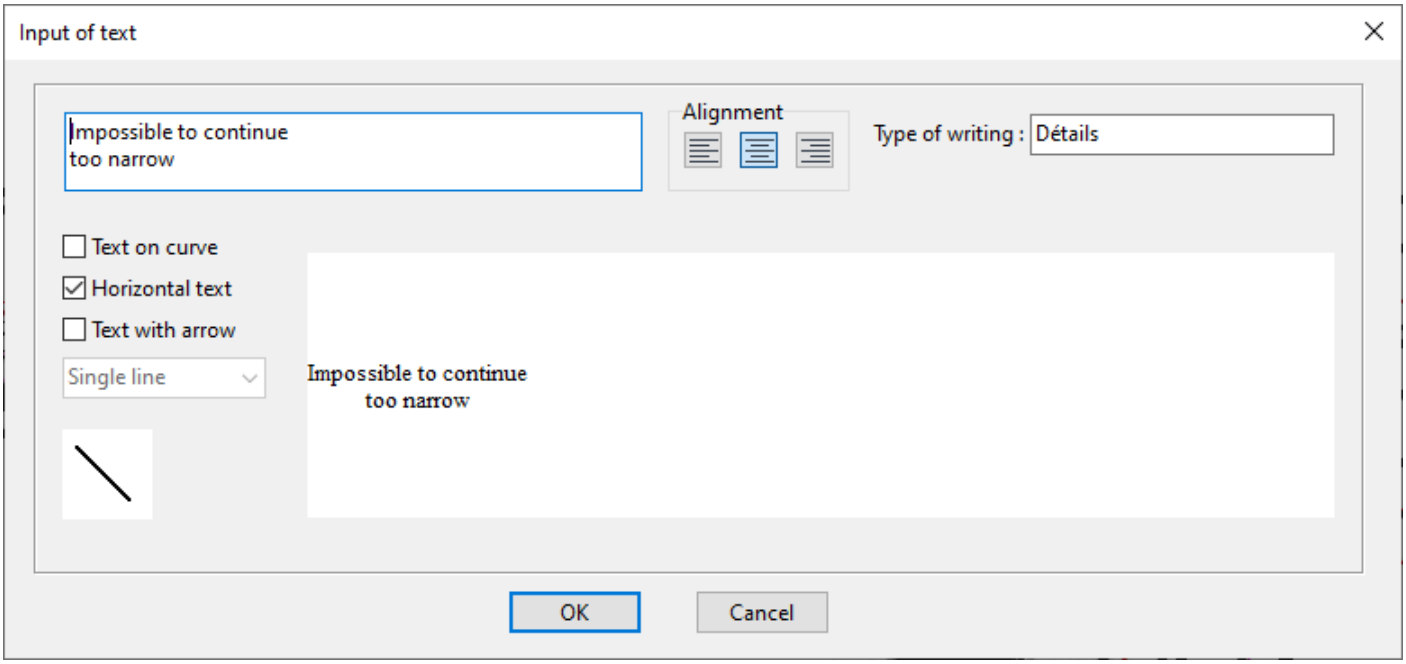
With the “text on curve” box, you can position a long text on a polyline: you first need to position the first point of the polyline, then add the other points with a mouse click.

The box "horizontal text" is used to position the text horizontally. The box "text with arrow" is used to add an arrow linked to the text.

In this case, you can choose the extremity of the arrow : none (a single line), filled arrow, openwork arrow or point.

The text is entered on the first line. The writing type to use is selected with the drop-down menu. The text that will appear in the drawing is displayed in the central window.

If the “Horizontal text” box is checked, the text can be entered on several lines. The “Enter” key moves to the line. In addition it is possible to choose the alignment of the text: left, centred or right.



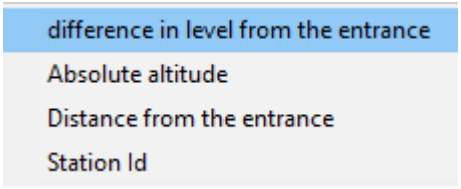
When you validate this entry window, if it is not a text on a curve, you position the text in the same way than a symbol. It may be oriented and scaled in the same manner. The font size is the one that appears on the screen. Changing the text size with the + or - buttons made from one type of writing to the next or previous. You can also change the type of writing by clicking on the box indicating the type of current writing that appears in place of the current pattern.

It is not possible to vary the orientation of the horizontal texts. They will remain horizontal even if the survey shot to which they are linked is modified and its direction changed.

The texts with an arrow are necessarily horizontal. To draw the arrow, just click on the position of the tip of the arrow after fixing the position of the text.

When you are drawing a text and you have not validated it, you can modify its spelling with "Ctrl+Enter".

The button  is used to insert various items of **information relating to the topographic survey** into the drawing. First of all, choose the value you want to retrieve from the menu that appears:



This can be the relative altitude at the point of entry, the absolute altitude, the distance from the point of entry or the station identifier. Use the mouse to select a point on the survey path. The selected information is retrieved as text and then positioned in the same way as ordinary text. By default, there is a type of text corresponding to each type of information. This can be changed in the same way as for ordinary text. This is a dynamic text: it is linked to the topographic point, which means that if the topographic values change, the drawing is automatically updated.

Survey shots selection

When a drawing function requires the selection of shots, the procedure is as follows:

- A left click selects a shot (if there are already selected shots, the selection is reset to zero).
- If there is at least one selected shot, a left click with the shift key pressed extends the selection.
- A left click with the ctrl key pressed starts a new selection area, or unselects a shot.

- Pressing the right arrow with the ctrl key pressed extends the selection from the last selected shot to the end of the cavity. This selection is made in the topographical sense. In cavities with several entries, the direction of selection depends on the entry chosen for the calculation.
- Right-click with ctrl key pressed deselects all of the shots following the clicked shot.

Attachment of the drawing

By default, each drawing object is automatically attached to the nearest shot when you validate it. This allows to change its position if the survey changes. This principle can raise problems in case of complex zones, such as galleries with many bends or superposed galleries. In this case the drawing could be not attached to the right shot and could result in a distortion of the drawing if the survey changes.

So its possible to choose the shots you want to attach the current drawing. The selection is made after pressing the button  . See the selection procedure above. The button  .unselects all the shots.

This function is useful only for tortuous caves. If the path is linear, there is no need of selection.

If the survey path has skin shots, only those attached to a selected shot are displayed.

Various display tools

They are located under the zoom button group:

	with the button, you **can display the drawing at its default printing scale**. That allows to have an idea of the real size of texts and others details which you are drawing.
	when a watermark is drawn, this can be annoying to draw the galleries above or below. You can temporarily **hide or re-display watermarks** with this button
	you can **display one of the layouts** used while printing with this button .This allows in the case of very vast drawings to fit writings to pages. If there are several cavities, you can also view the design of neighbouring cavities: in the list of displayed objects, a checkbox offers this option

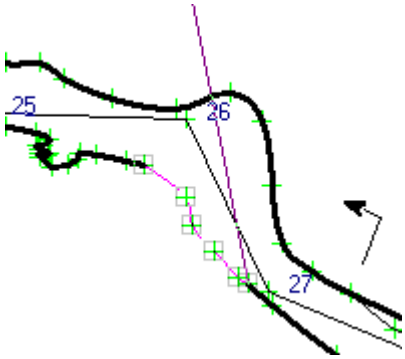
Corrections

With the button  . you can modify the scale of the drawing. When you change it, all the writings are modified as well as the the drawing of features that include hatching or triangles such as splashes or wells. The spacing and size of the patterns is fixed according to this scale.

To **modify or delete an object:** you must first select it. Activate the selection mode by pressing the button  .(shortcut key = shift).

You must then make a mouse click on the desired object. The rectification menu becomes active  .

Warning: In order to select an object, it is necessary that the catching is active and part of the object is in the catching radius. When switching in selection mode, catching becomes active. But if later it is disabled or if the catching radius is too small, it may be difficult to select an object.



When an object is selected, its components points appear as light gray squares. If it is a line, it appears dotted purple, if it is a surface in pink braces. For text, the line that supports it and enables the selection is just below.

The button  can be used to cancel the correction.

The button  deletes the selected item after confirmation however (shortcut key = Del).

The button  appears only if a polyline is selected (see below)

When a drawing object is selected, its line type or writing type appears in the box of the current pattern. You may change it in the same manner as in creating the drawing.

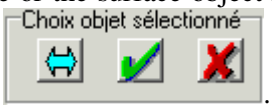
Peculiarity of the rectifications of polylines:

A "thread at the leg" appears at the end of the object. You are then in the configuration of a normal entry.

When a line is selected, **holding the Ctrl key pressed**, you can:

- **move one of its points by clicking** on it and then moving the mouse while holding it down.
- **add a point** by making a left click with the mouse. The clicked point is added even if it is outside the polyline.
- **delete a point** by a right click on it.
- if it is the initial or final point of a line, merge the point with the initial or initial point of another line provided that the point is within the hook radius: just click when both points are within the hook radius. This function makes it possible to **match the ends of two lines**, for example to use them in a surface

To cut a polyline: you first have to activate the cut mode by clicking on the button  . Then you click on the line where you want to cut it. To disable this mode, click the cut button

When you correct a line that belongs to a surface object, you must tell the software what is the purpose to correct either the polyline or the surface object it defines. A selection menu appears below the rectification menu to allow to make the choice. 

We choose the object with the button  ; the button  confirms the selection and  allows to abandon it.

You can either correct the surface object, or one of its components polylines. It is also possible to remove one of these polylines, but the surface object can no longer be closed. It is then drawn in red.

You can select an area by doing first a left click: a selection rectangle appears. By moving the mouse and doing another click, all the drawing objects which have at least a point inside the rectangle are selected. It is then possible to add or to remove drawings selected individually by clicking above.

If there is only one selected object in the area, it can be corrected as with the selection by a click (see above).

This can be useful for example to erase all the drawings of an area by clicking on the button  . You can also modify the attachment to the shots of all the selected drawings by clicking on the button  , in the same way as when you create or modify only one drawing object:: if shots are selected the attachment is done to the nearest shot in the selection otherwise it is to the nearest shot of the cave.

After clicking the button  , you must specify the position of the section by clicking on the survey path. A drawing form of a cross-section opens then. It has exactly the same functionalities as other drawing forms.

Particularity of electronic pads cross-sections: from a cross-section done by the electronic pad drawing, you can create a cross-section without having to specify a point on the survey path: just double click on the cross-section drawing, the drawing window of a new cross-section opens with the electronic pad drawing in the background.

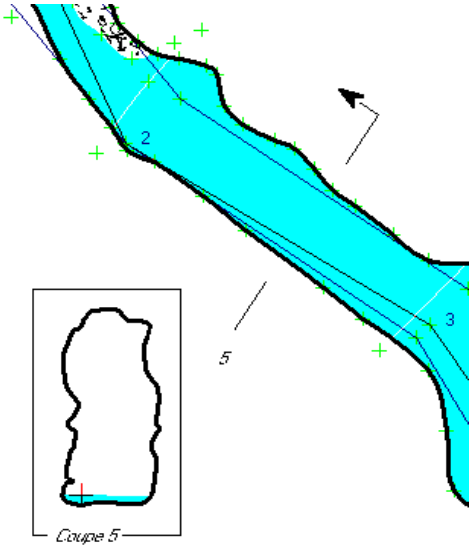
If they have been drawn, the software calculates the relative position of the walls at the crossing point, by intersection with the perpendicular to the survey shot. If other are lines located there (limit lake, filling, ...), their intersection is also calculated. A fuchsia dotted rectangle appears with the dimensions of the gallery at the crossing point, if they were seized with the survey data.

The intersection points are positioned as in the drawing as the components. The crossing point is indicated in red. After drawing the cross-section, you valid it with the validation button at the bottom left.

If the section is created on a survey point which contains skin shots, these are represented on the drawing of the section, what helps to its drawing.

The cross-sections are presented in their drawing window in the direction of topographic shots. They can be reversed to represent them if, for example, viewing the plan is in the opposite direction of survey shots. To reverse the representation of a cross-section, just check the "reverse" box next to the validation button.

The section is placed under the point of section on the survey path. You must then place it on the main drawing: press the Ctrl key and click on the section then move the mouse while pressing key and holding left button of the mouse pressed. The cross-section envelope remains attached to the mouse cursor until you stop pressing mouse button.



The cross-section is drawn in a rectangle. A line with an arrow through the gallery indicates its position.

Cross-sections are numbered by default in a series of numbers.

You can change the number at the creation or when correcting (see below) with the button 

of the cross-section drawing window. The numbering can be alphanumeric.

The direction of the arrow indicates the direction of the cross-section. If "reverse" box is checked the cross-section is represented by its symmetrical and arrow changes direction

The button  is used to display cross-sections with a different scale than the main drawing: when you click this button, you must specify the coefficient to display cross-sections relative to the scale of the plan.

The cross-sections appear on the screen if the display scale is sufficient.

If notes are used in the cross-section drawing window, their positioning is not stored (see "Notes management").

To correct a cross-section, double-click it, that opens the drawing window of the cross-section.

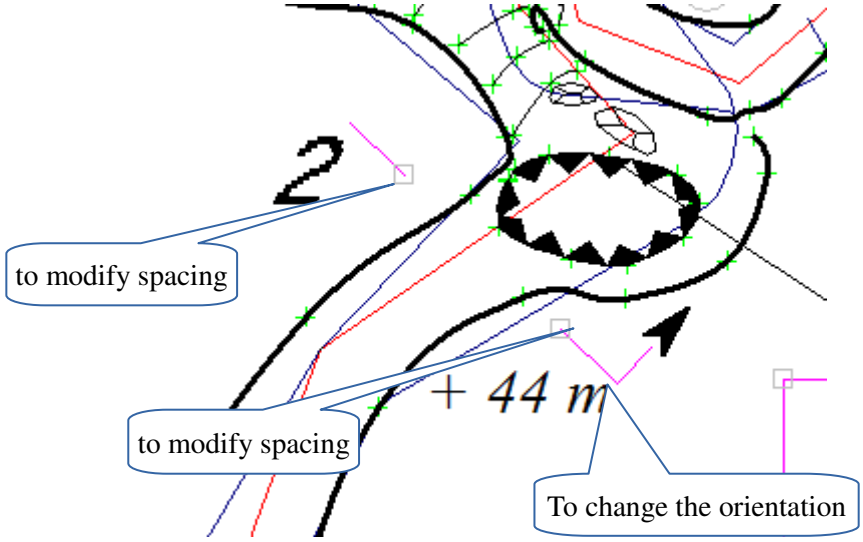
Modification of cross sections arrows:

It is possible to modify position, orientation and spacing of the cross sections arrows. First activate the selection mode and select the cross section. The frame and the arrow of the section are selected (colour fuchsia). The usual validation menu appears who allows to delete the section or to abandon or validate the modifications.

To change the position of the arrow, click on the new position on the survey path.

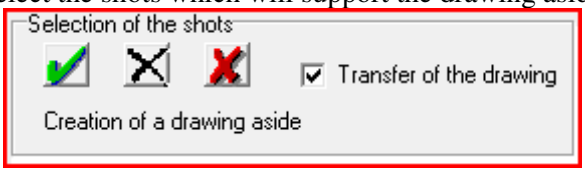
While pressing the Crl key you can:

- Modify the angle of the arrow by catching the base of the arrow with the mouse (clicking with left button and holding it down) and moving it.
- Modify the spacing of a side or the other of the arrow by catching one of the rectangles and moving the mouse.
- Modify the position of the number by catching it and moving the mouse.



Once the rectifications are done, you have to validate them with the usual menu.

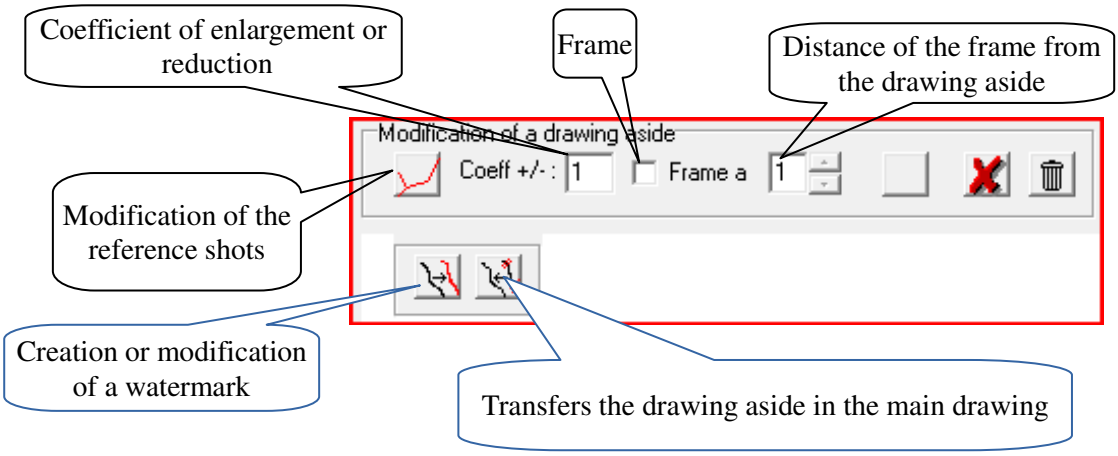
Management of the drawings aside

You first click on the button  . Then you must select the shots which will support the drawing aside by clicking on the survey path. A validation window is displayed: 

. Shots selection follows the procedure described above. When the selection is right you can validate it with the button  . The button  deletes the selection and  abandons the creation of the drawing. If the box "Transfer of the drawing" is checked, the drawing attached to the selected shots is transferred in the drawing aside (it is erased in the main drawing and copied in the drawing aside). See below for the various transfers of the drawing beetwen the main drawing and the drawing aside.

When you validate the selection of the shots, a drawing window opens for the drawing aside. It has the same functions than the others drawing windows. There are two buttons more:  to validate the drawing and  to abandon it. When you have validate the drawing aside, it takes place near the main drawing. You can move it in the same way that a cross section by catching it with the mouse while holding the Ctrl key down.

You can rectify a drawing aside in the same way that a cross section: first activate the selection mode. Then, with a double click you open the drawing window to modify the drawing aside itself. With a simple click you select the drawing and the below menu appears: it allows to modify its appearance in the main drawing.



You can modify the reference shots. It is also possible to enlarge or reduce the drawing aside with a coefficient. You can frame it and give a margin between the frame and the drawing. The three last buttons are used to validate or to abandon the modifications or to delete the drawing aside.

The first button below serves to create or modify a watermark (see further management of the watermarks). The second one is used to transfer a part of the main drawing in the drawing aside: when you activate this function, the drawing attached to the shots of the drawing aside is selected. You can add to it or remove of it by clicking on an element of the drawing. When you have selected the desired elements, you confirm by clicking on the button of validation of the menu which appeared to the right of the button of transfer, or you can abandon with the button abandonment.

The reverse operation that transfers a part of the drawing aside in the main drawing Is made from the window of drawing aside: having made a double click on a gap to reopen its window of drawing, it is necessary to cross(spend) in mode(fashion) selection and to select the zone containing the drawing to be transferred (see in the rectifications of a drawing the selection by zone).

The usual rectification menu has a button more on the right which allows to transfer the selected drawing in the main drawing. 

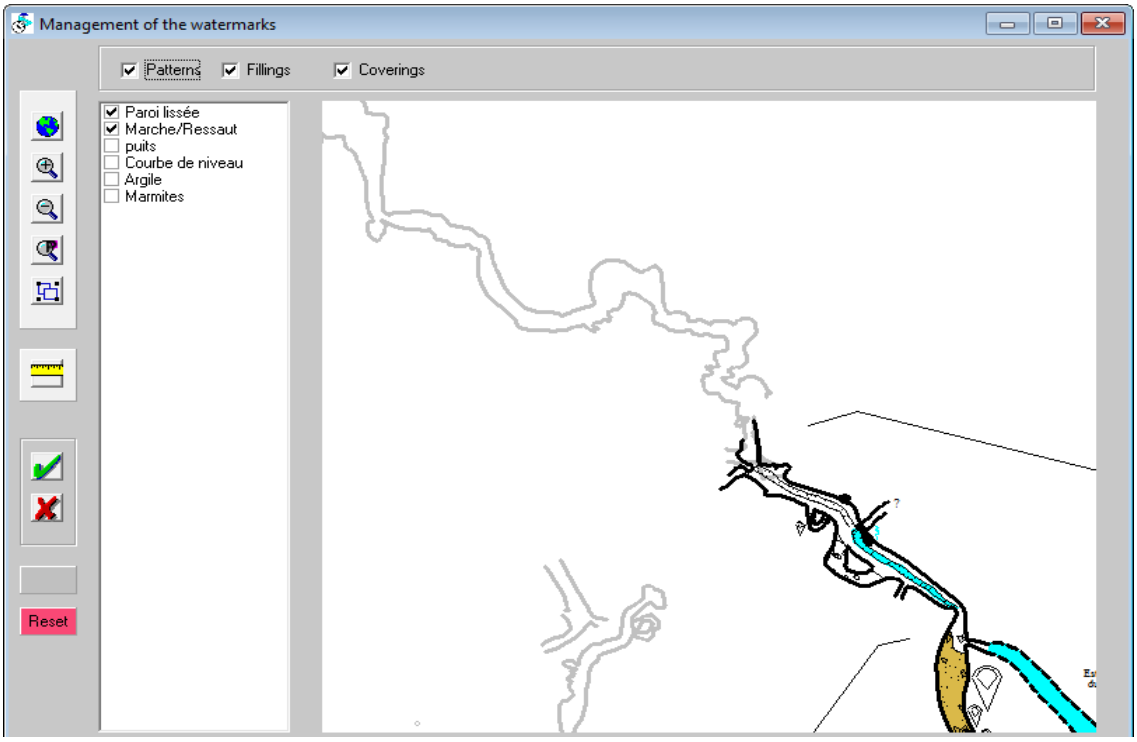
Management of the watermarks

The watermarks are used to display in reduced colour the drawing aside in the background of the main drawing. The window of management of watermarks serves to select the lines which will be displayed and their colour.

You can select or mask a whole category of lines by checking the corresponding box. It is also possible to hide only a line by clicking on it (to show it again, uncheck then check the box of its category).

To choose the colour, click on the corresponding button. The button below (Reset) set the colour of the watermarks at the default value which is defined in the menu configuration (see further)

You shut this window with the validation button or with the abandon one.



!!! when you add drawings in a drawing apart, the watermarks are not updated. You must think about doing it manually.

Summary of the shortcuts keys:

Shift: set the selection mode
F1: drawing lines
F2: drawing surfaces
F3: drawing symbols
F4: drawing texts
F5: drawing absolute altitudes
F6: drawing height differences

While editing a drawing:
Esc: cancel
Back step: delete the last point
Enter: valid the drawing
Del : if rectifying : delete the selected drawing
F: shut the current line
D: attaches the line to the closest compo

A: display the list of the patterns, the symbols or the writings types
Q: enable/unenable the catching
W: enable/unenable the temporary catching
?: shows / hides the help

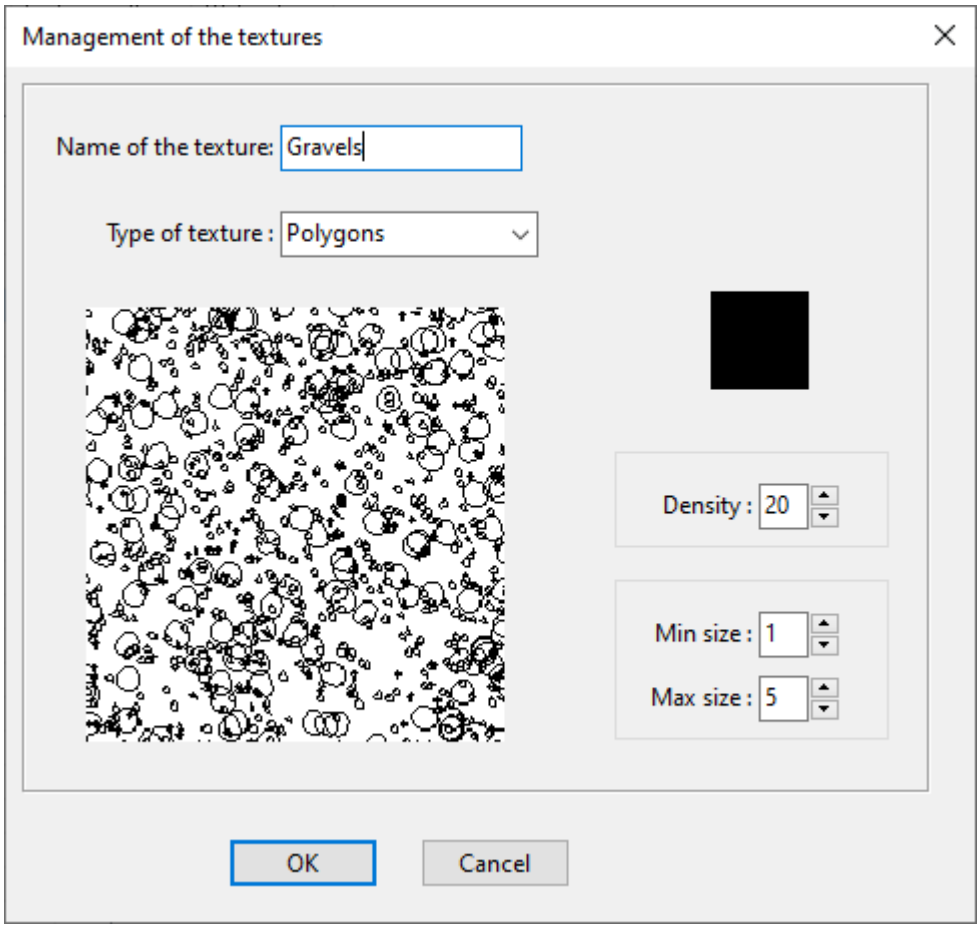
Managing patterns

The button  provides access to textures, lines and fillings management:

The management is done as indicated above in the menu patterns/ fonts

Textures editing

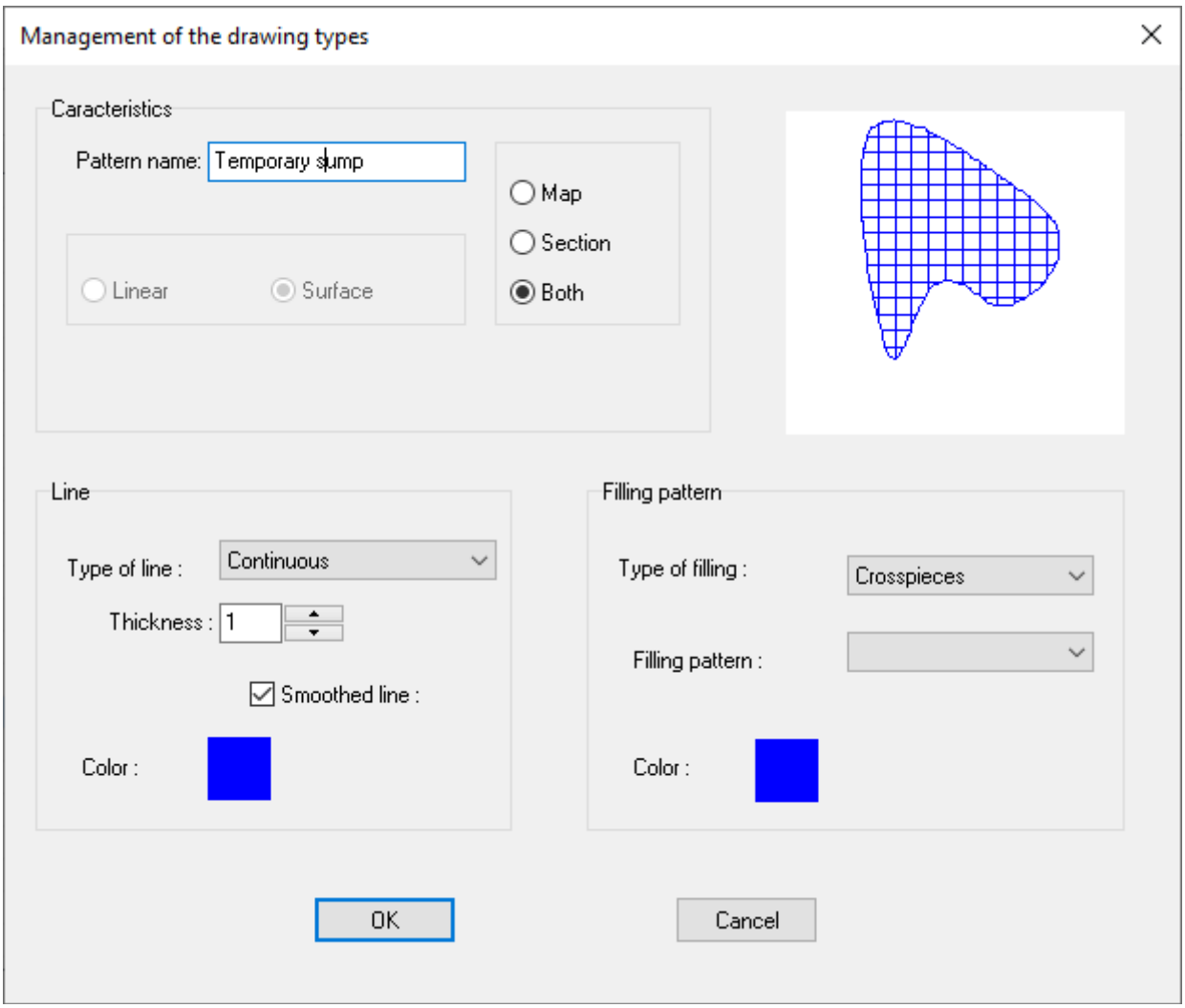
Some textures are predefined by the software You can modify them or create news. You can delete them only if they are no used in a filling pattern. The management window looks as follow:



You can change the name of a texture, choose the pattern among six types: points, dashes, polygons, filled polygons, stars and pebbles. It’s possible to modify their colour, their density and for some of them their minimal or maximal size.

Textures are generated in a random way when starting the software or when they are created or modified.

Editing lines and fillings



The window of patterns management (or drawing types) allows you to create, delete or modify a type of drawing

Each pattern is designated by a **name:** it is the one that appears in the selection board of drawing windows.

It can be linear (drawing lines or polylines) or surface (closed polylines, drawing surfaces by designating framing polylines and filling in the interior). Closed polylines are part of the lines, and surfaces delimited by framing polylines are fillings.

It can be in the layer **dressing**: it is drawn over the rest of the drawing. The points of its drawings may not be taken as components. Its polylines can not frame surfaces.

Finally, it may be only for plans or cuts or both.

The pattern being edited appears in a viewing window.

For linear patterns you define the characteristics of the line: you can set several characteristics:

- The **line type:** it can have 11 different values:
  - continuous
  - dashed
  - dotted
  - hatched (polyline with perpendicular hatches)
  - hatched 1-1 / 2 (the same than the previous but hatches alternate lines in length and 1 ½)
  - dashed dotted
  - hatched dashes.
  - alternated hatched dashes
  - polyline frame with triangles
  - polyline frame with filled triangles
  - Slope hatching
- The **thickness of the line:** defined in points. In the current state of the software for Bézier dashed lines a thickness of more than 3 points may give poor results.
- The **line style:** it can be normal or a Bezier curve. That allow you to draw curves through several points instead of connecting the dots with straight lines. This gives a more realistic rendering.
- The **colour of the line:** a click in the coloured square provides access to the Windows colour chart and to choose a colour.

For surface patterns, you must first determine the characteristics of the line around the drawing (as above), then the characteristics of the filling. you must define:

- The **type of filling**: it can be united, with hatching that can be horizontal, vertical, diagonal right, diagonal left, with horizontal or diagonal cross.
- The ***pattern* of filling**: it can be plain or use a texture as sand, clay, or gravel. You can create textures from some predefined patterns or modify them (see above).
- The **colour of filling**: as for traits you must choose the color by clicking the colored square.

Symbols management

This function is accessed with the button  : The management is done as indicated above in the menu patterns/ fonts

Editing symbols

A symbol consists of one or more elements that can be added, deleted or modified using the next screen drawing.

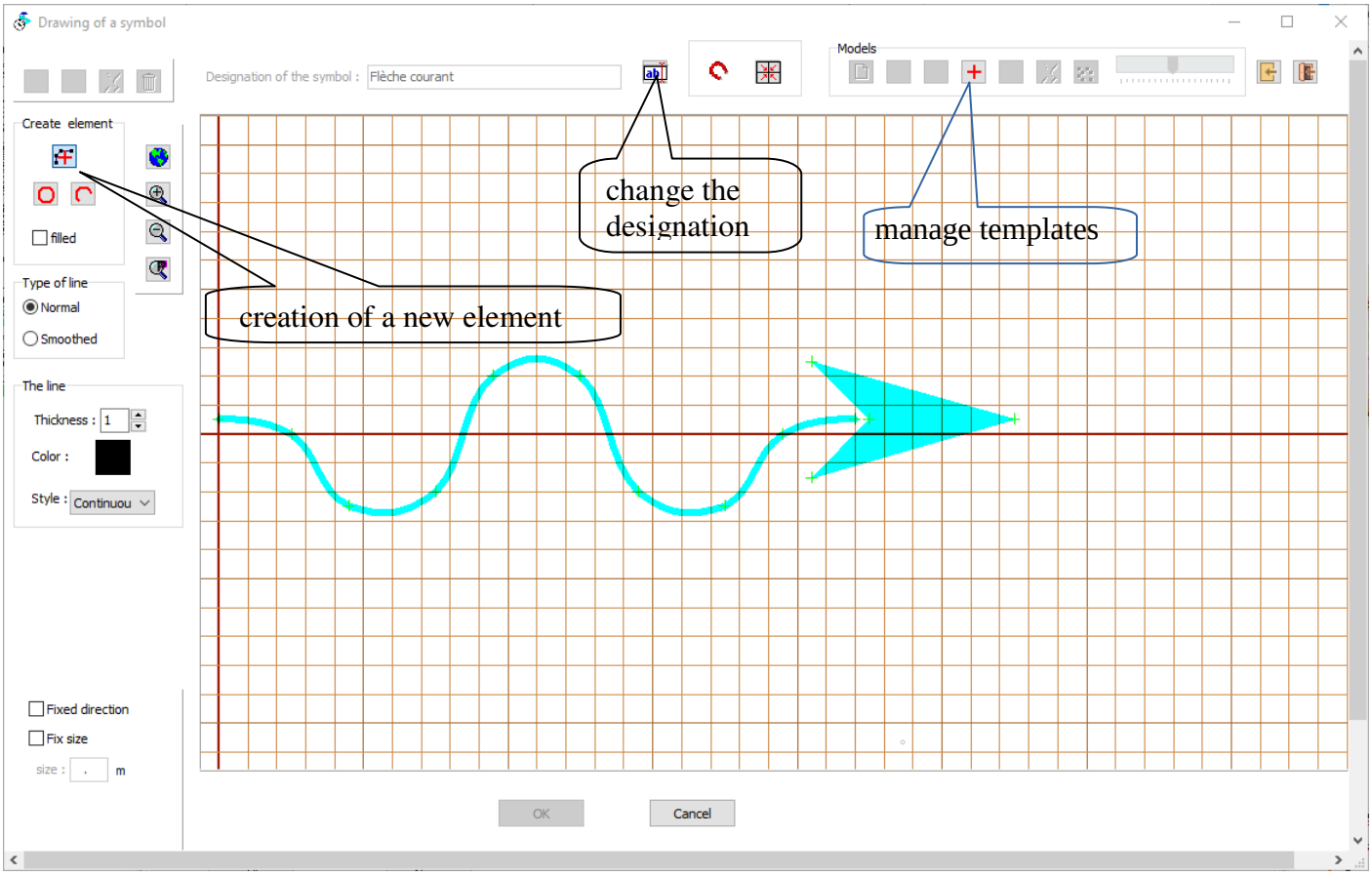
The items are created using buttons  for the linear ones,  for circles and arcs. If you want the element to be filled, check the corresponding box. The drawing is done freehand in the same way as drawing topographies (see above). A grid guide the drawing. If you activate the grid magnetization (button ), the points hang on this grid tiles, which allows for accurate junctions. As in the topography drawing, you can also hang the new drawing points on an existing point if the button  is activated. Circle drawing is done by clicking first the centre then the radius. Arc drawing is done from 3 points.

Shortcuts are the same that for the main drawing except those for the catching.

To correct an item, you have to double-click on it. The catching radius for this selection is indicated by a circle related to the mouse pointer. As for the survey drawings, you can move a point, delete it or add one. However, it is not possible to cut a line.

For each element of a symbol, you can choose the type of line, color and filling, in the same way that you define the drawing patterns above.

When you create a symbol, the software names it by default "symbol No. N", where N is the number of existing symbols. The button  is used to change this designation.



Symbols can have a fixed direction, for example, a stalagmite symbol. Their size can also be fixed. You need to indicate it in meters. This size is for a default drawing scale at 1/1000. If the default scale is different, the size is adapted.
We can put a model in the background of the plan, the same way we put a note in the background of a survey drawing. On the other hand, you can only put graphics files, the function is not intended for SVG files.

The buttons  import the drawing of another symbol from the current file or from another file (MTF pattern file or Topo Calc'R Cav).

This screen also allows you to draw **custom North arrow templates** for use in page layouts (see below) and **surface patterns**.

The design of the surface patterns is identical to that of the symbols, and the north arrows have a few special features: however, a text can be added with the button  to manage arrows with a magnetic north. After entering the text to be displayed it is positioned using the mouse in the same way as for a text in the survey drawing. The text is always horizontal. This text is essentially intended to indicate the year of decline when the arrow represents the magnetic north. A variable part can therefore be added which will be completed by the year of the declination when the arrow is inserted in the layout.

To indicate to the software that there is a variable part, it is necessary to insert two low dashes __ (key 8) at the location where the year is to be displayed.

When the arrow will be created in the layout, the dashes will be replaced by the year number entered at the time of creation.

For example, for the arrow to display Nm 18, the text Nm __ must be entered. The number 18 will then be entered.

In the symbol display windows, symbols with a fixed direction are drawn with a small green vertical arrow in the bottom right-hand corner.  , those with a fixed size have a red circle crossed with a cross 

Management of writings types

You can access this feature with the button  : The management is done as indicated above in the menu patterns/ fonts.

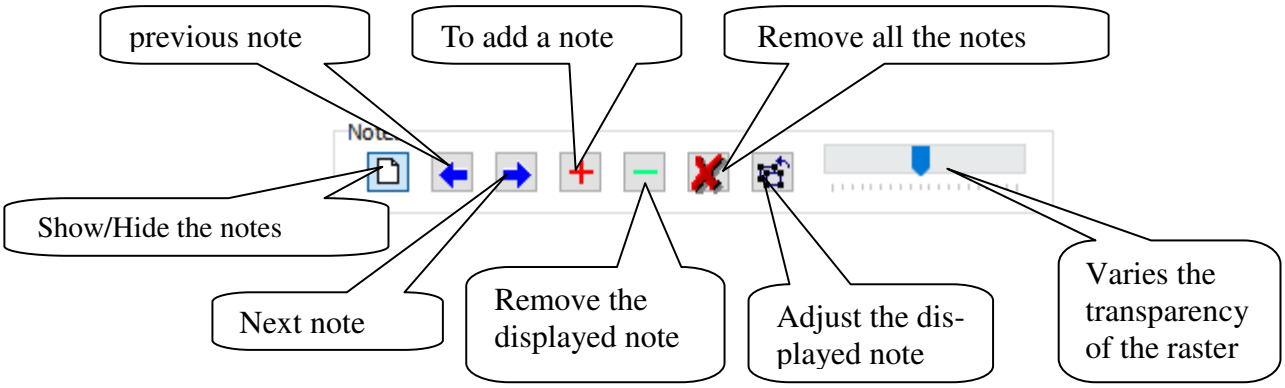
Editing writings types

You must provide its designation in the "name" box and enter its characteristics with the button  that opens the dialog for entering a font in Windows. The characteristics of the writing being edited are displayed in the properties panel and an example is shown in the window on the right.

By checking the “Apply this font to all writings types” box, you can generalize the current police to all the types of writings of the network.

N*otes management*

Management notes is done with the toolbar at the top right of the drawing window:

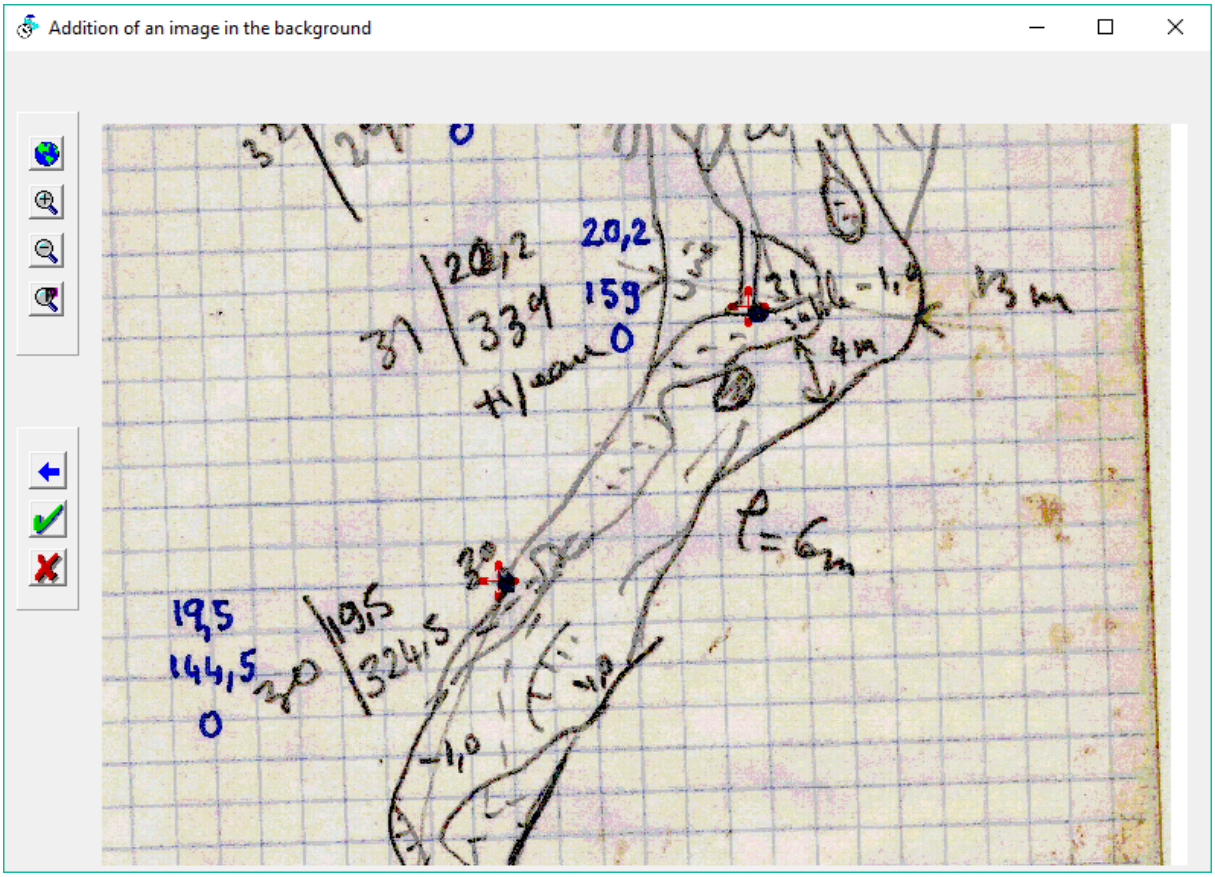


A note is a scanned file that is placed in the background and allows you to draw by tracing. It is set on the survey points.

It can be a sketch made during the survey session or a paper topography which was scanned and for which the galleries axis has been digitized (see above " Digitalisation of a scanned cave survey "). You can thus add dressing.

For example to draw a cross-section we can envisage to take a photo that shows the profile of the gallery on a survey point and measure the dimensions of the gallery here. This allows to calibrate the picture on the cross-section and draw the profile tracing.

Adding note: this is done with the button  . You must first select the image file or the SVG file to use, and then to adjust it with the calibration window:



You must identify two points corresponding to two points of the survey path.

The operating of this window is the same as the calibration window of an image for digitizing (see "Digitalisation of a scanned cave survey").

When two calibration points have been identified, you can validate the window.

It's then necessary to provide two homologous points on the design of the topography. When they have been appointed, the image is positioned in the background. You can stop the procedure pressing again the Add button.

You can add several notes or even add the same note with several different calibrations, for example when a page of sketches includes several survey shots.

If you have used SVG files to import an SVG drawing in the drawing (see further SVG Import), they are automatically add to the existing notes.

It is also possible to **reposition the note shown** with the button  . You must indicate successively, the first calibration point on the survey, then the corresponding point on the image, then the second point of the survey and its counterpart on the picture. A new note is created from the image displayed with the new setting. This feature allows for a rather coarse initial setting when creating the first note, then refine this setting by viewing the image in the background. You can stop calibrating by clicking again on the button recalibration.

You can **change the transparency** of the raster displayed by adjusting the position of the cursor  .

In the managing notes toolbar the other buttons have the following features:

 hides or shows the current note

 displays the previous note

 displays the following note

 deletes the displayed note

 delete all notes

Notes are saved to the "nnn.CFG" file (nnn is the file name of the network) that stores the image files names, the calibration settings and the value of transparency. When opening again the network file, it is not necessary to repeat the operations of calibration.

!!! when several notes have been stored, the first display of the drawing window can be long because the software must recalculate the calibration of all notes. It is advisable to remove the notes that are no longer used so as not to slow down the display.

Import of a drawing from another Topo Calc'R file

This function serves especially when several people work on the same drawing and is use to exchange only the drawing and not the other data of the survey. To be imported, the drawing has to be attached to shots identical to those of the destination file (they must have the same values even if the name of the points are different).

You start this function with the button  . You must open a cav file. The drawing of the import file is display, then you select the drawing to be imported in the same way that to select an area in the main drawing. When you have chosen the right drawing, you transfer it by clicking on the button  . Then you can go on and select other parts of the drawing. If some drawing objects are selected in several areas, they are imported only once.

When all the imports are done, you shut the window and the transferred drawing is displayed in the main drawing.

Import of SVG drawing

Drawings to SVG can be generated by many software drawing or mapping. For example the free software Inkscape allows you to draw in this format and convert drawings made with others software.

Topo Calc'R can recover drawings in SVG format and integrate them into its own drawings.

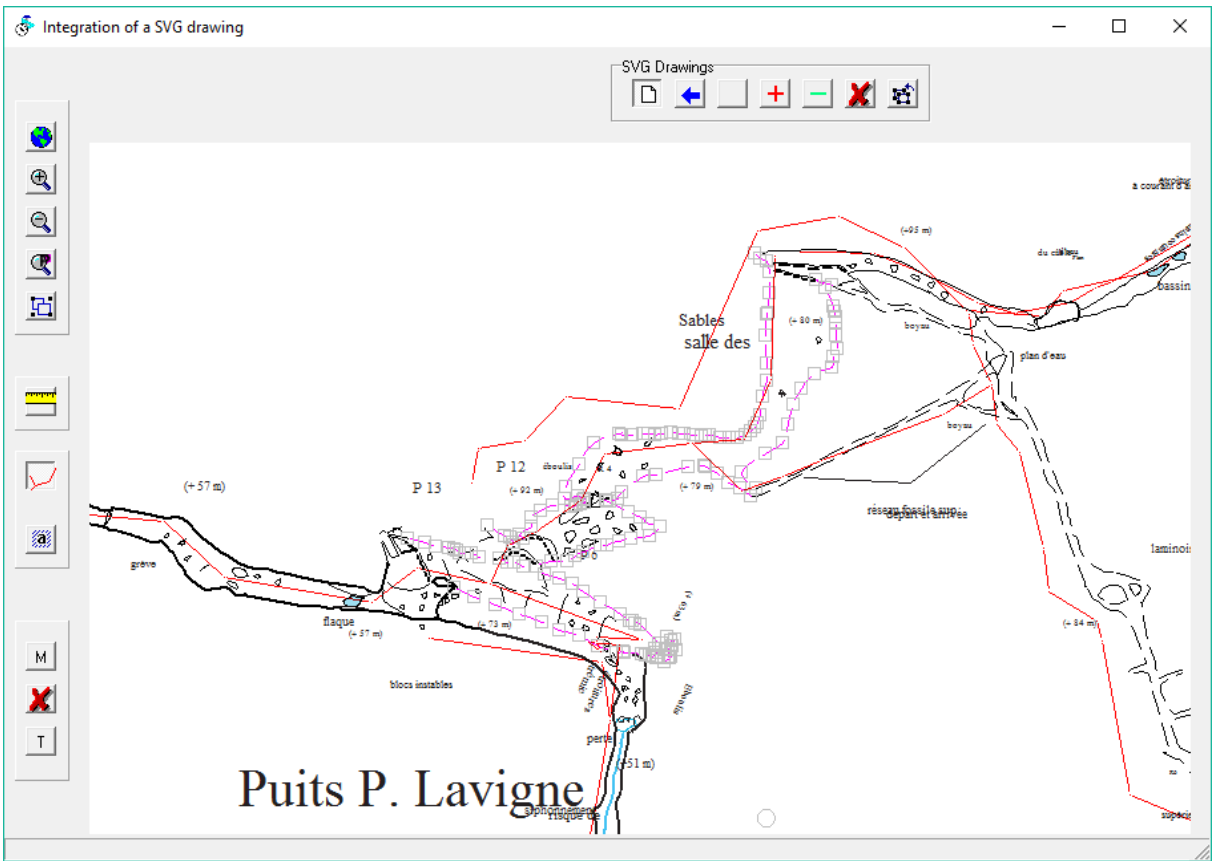
The recovery process is similar to the notes calibration described above. After opening an SVG file, it must be positioned on the drawing by designating two points as for the notes calibration. SVG drawing is positioned on the survey. As for the management of notes, it is possible to have multiple files (or even with different calibrations) that will be displayed successively.

The principle of import is to associate a line type of SVG file to a Topo Calc'R pattern. A line type corresponds to SVG lines having the same thickness, the same color and among which the characteristics of drawing (continuous or dotted lines, Bezier curve, ...) are the same.

To determine the lines with the same features, you must first select a line: it appears in purple and its points are surrounded by a gray square. Then you have to press the button 

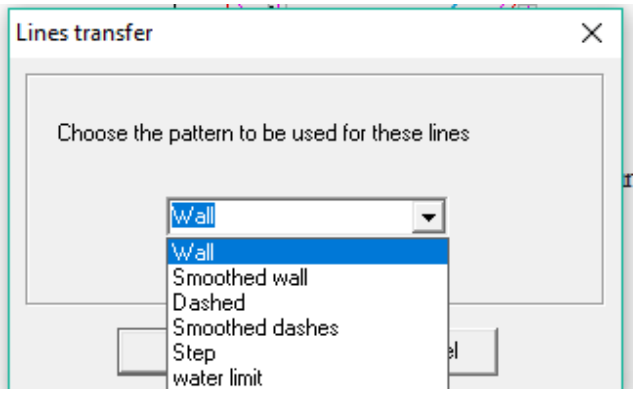
. All the lines of the same type in the drawing become selected. You can also select all the lines individually. It is also possible to select all similar traits to the first by defining a rectangular area with a left click of the mouse on its two opposite corners. All the lines with the same type located in the rectangle will be selected.

To deselect a line, you must click again on it. The button  will deselect all the lines.



When SVG lines have been selected, they are incorporated into the drawing with the key 

after setting the correspondence with a Topo Calc'R pattern as shown below.



As for notes, the list and the calibrations of the SVG drawings are stored in the network configuration file.

! The incorporation of Bezier curves of a SVG file in Topo Calc'R may give slightly different results: this results from algorithms and parameters for calculating Bezier curves that can differ in each software.

You can do the same thing for the texts by clicking on the button  . The texts which are horizontal in the SVG drawing before calibration, are considered as horizontal in Topo Calc'R. If the SVG drawing has not same orientation as that of Topo Calc'R, these texts will stay horizontal while the rest of the drawing will have turn with the calibration. This make changes in the relative position of texts of a sentence which are placed on different lines. So you have to correct this afterwards.

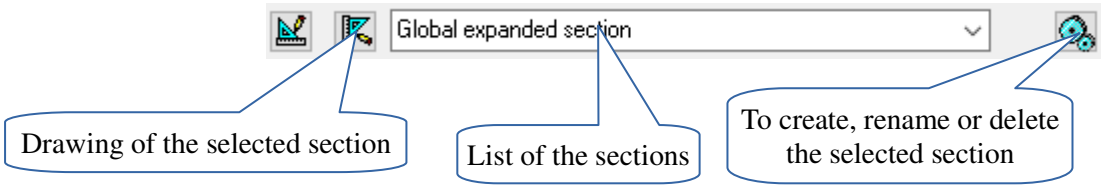
Management of the longitudinal sections

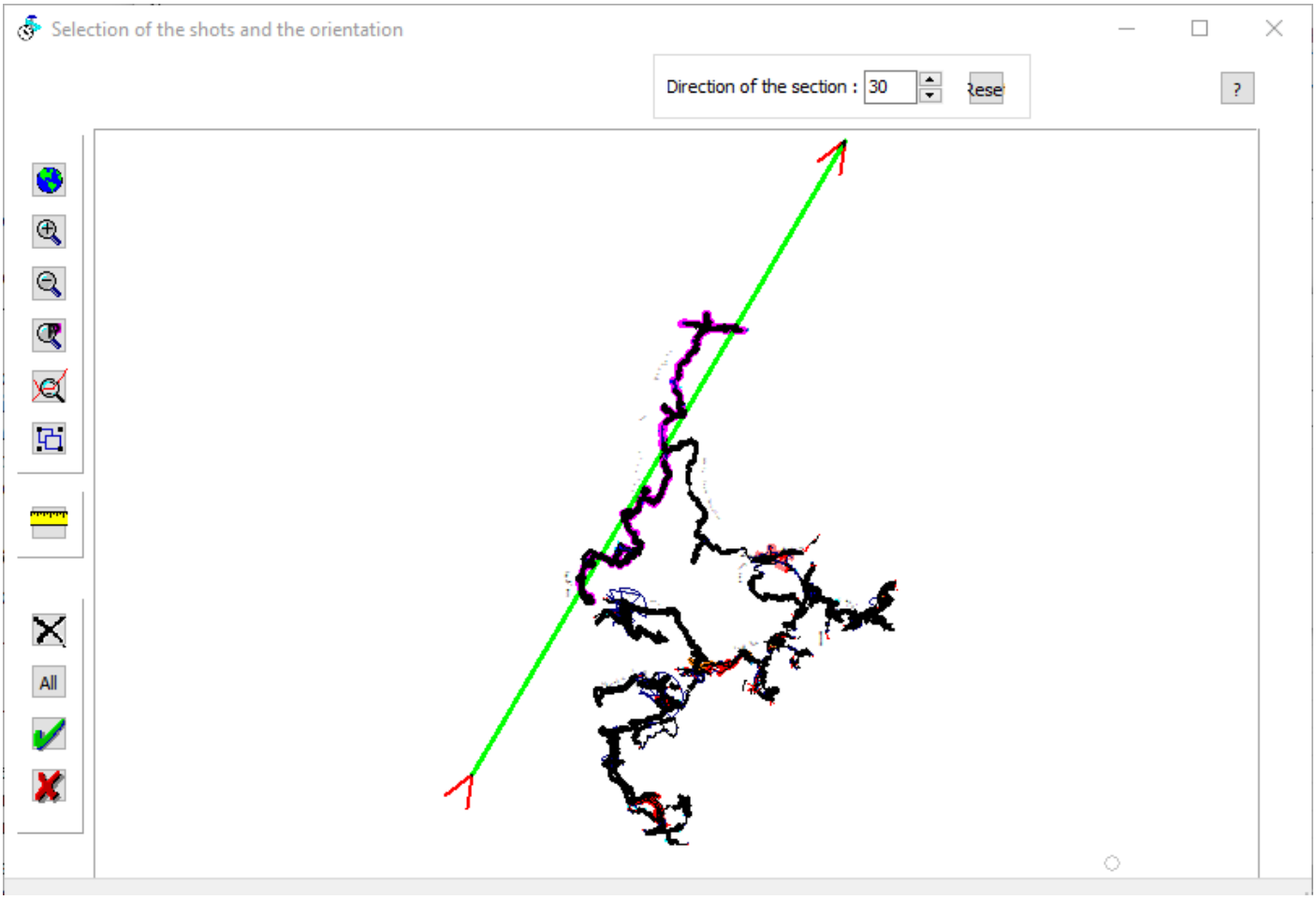
You can choose between 2 types of section:

1. Expanded sections: all the shots are drawn with their actual length and their orientation depends on the angle of the section plane (see further particularity of the expanded cuts).
2. Projected sections: the shots are drawn with their length projected on the section plane and their orientation depends on the angle of the section plane.

In the first case, the loops of the galleries are not calculated, to avoid deforming each branch of the loops. The designation of the end points of the loops is temporarily modified for the drawing of the section: the first keeps its designation, we add «bis» to the designation of the second

For each cave, the software automatically provides a predefined section: the global expanded section which include all the shots of the cave. You can create other sections, global or partial which will be added at the list of the sections of the cave. Drawing and displaying are relative to the section selected in the drop down menu.





To create a section it is necessary to choose at first his type expanded or projected, then to give its designation. By default it is its range in the list of the section and an abbreviation of its type

After you validate the creation, you have to choose the shots which will be in the section. The selection is done in the same way that for selecting shots (see creating a drawing aside or export of a part of a cave).

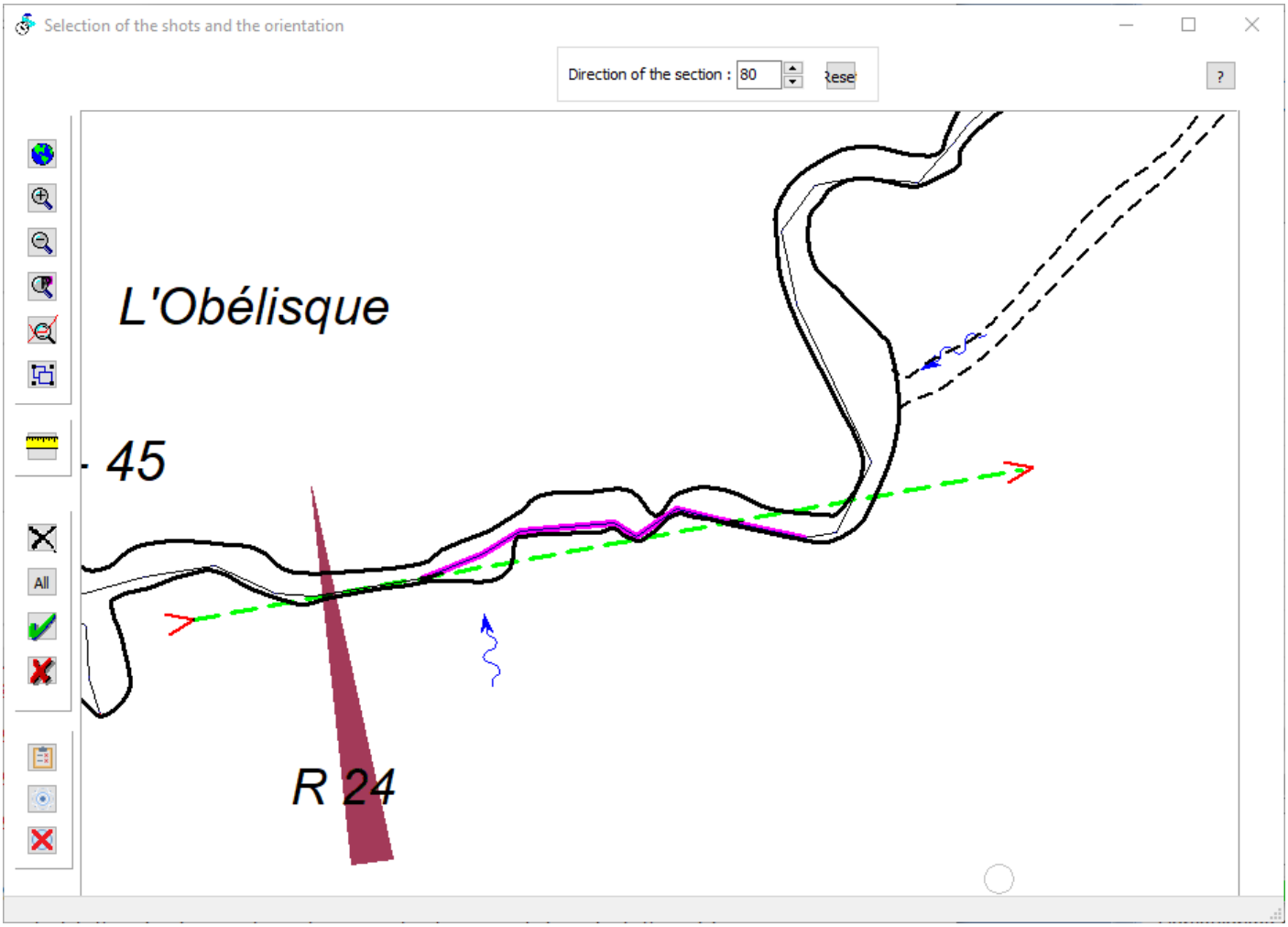
The software calculates the angle of projection of the section according to the selected shots. It is displayed as a green dotted line with a red arrow in every extremity. Moreover the value of the angle is indicated in a box at the top. You can modify the angle of the projection either with the mouse by moving the arrows which indicate the direction, or by changing the value in the top box with the arrows up and down. By clicking on the button Reset, you put back the angle to the value calculated by the software.

The 3 buttons on the left allows respectively to reset the selection, to validate or abandon the modifications.

A help button at the top right of the window brings up a help screen showing the shot selection options.

Choice of shots for projected sections

In files containing several cavities, it is possible to include other cavities (in whole or in part) in a projected section of the active cavity..



The shot selection window includes additional buttons :

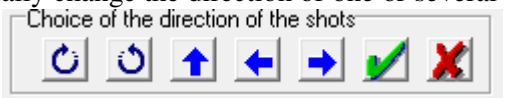
The first  allows you to select the cavities to be included in the section.

The second  selects the shots for all cavities.

The third  deselects the shots for all cavities.

Particularity of expanded longitudinal sections

The calculation of the expanded longitudinal sections topographic backbone is made from the average orientation of the cavity: the survey shots that go in the same direction are counted positively, others negatively. This allows to give an appearance of orientation for section, but in practice, only the designer is able to appreciate the direction to be used to give the most realistic rendering.

You can manually change the direction of one or several shots with the button  . The direction selection toolbar is displayed: 

It offers the following possibilities for the shots direction :

-  the shot is in the same direction as that calculated according to the direction of the section,.
-  the shot is in the opposite direction of the one calculated according to the direction of the section.
-  the shot is forced to the vertical.
-  the shot is forced to the left even if the direction of the section is changed
-  the shot is forced to the right even if the direction of the section is changed

The shots to be change are selected according to the procedure described above.

When the selection is right you can validate it with the button  . Otherwise you can abandon changes with the button  .

It is better to make these changes before starting drawing because, although it is recalculated, some changes can not be taken into account in the calculation, which leads to redraw some parts.

Drawing of longitudinal sections

For the drawing of these sections, with the button  you can come back to the selection of the shots or modify the projection angle. If this is the global cut created by default, it is not possible to delete shots: you can only change their orientation.

Viewing and printing topographies

This is made from the main screen of the application with the button  for the plan and  for section selected in the list of the sections. The sections apply only to the current cavity.

It is possible to display each cave with its own colour. This if only for the topographic lines (survey path and envelope of the galleries.

To modify the colour and the patterns of the topographic lines for the cave selected in the zooms list, you click on the button  . If there is only one cave the modification applies to it. These choices are saved in the network file.

Special features of the plan window

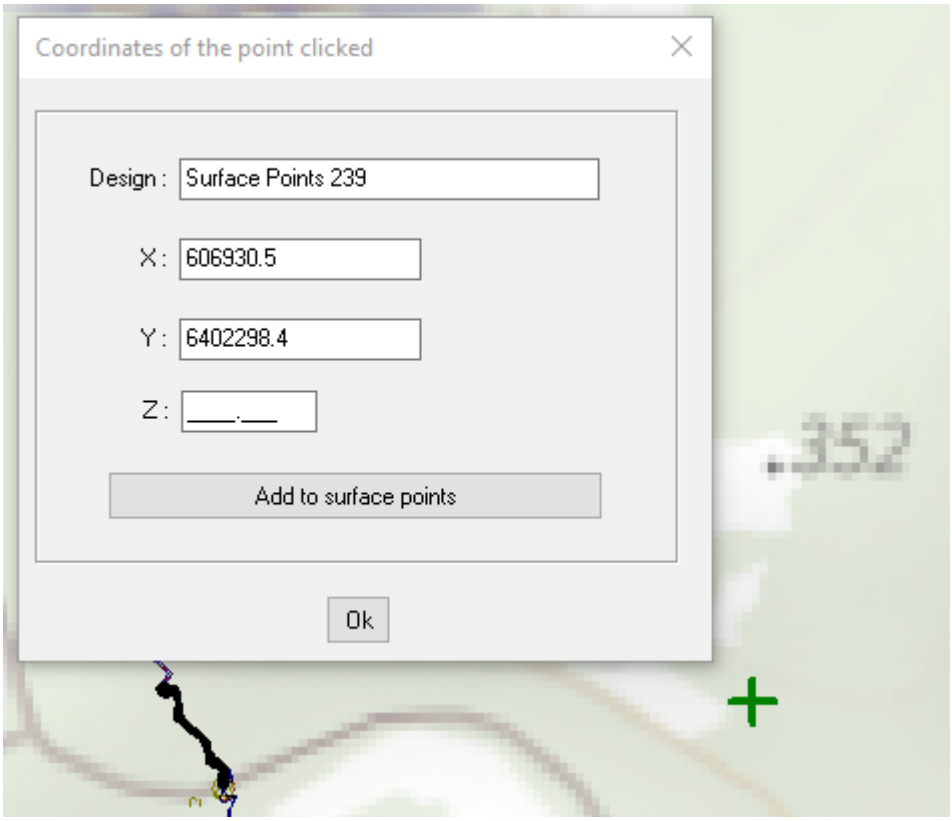
The plan window allows you to view all the cavities of the network. It is possible to download a background raster image (see below management raster) on which the drawing is superimposed.

The drop-down list on the top left contains the list of the cavities of the network so that you can zoom to the selected cavity.

If the network has more than one cavity, you can select the cavities you want to display with the button  . This function also applies to prints. The list of cavities to be displayed is stored when a layout is saved.

You can display a planimetric grid with the button 

It is possible to save the coordinates of a clicked point :



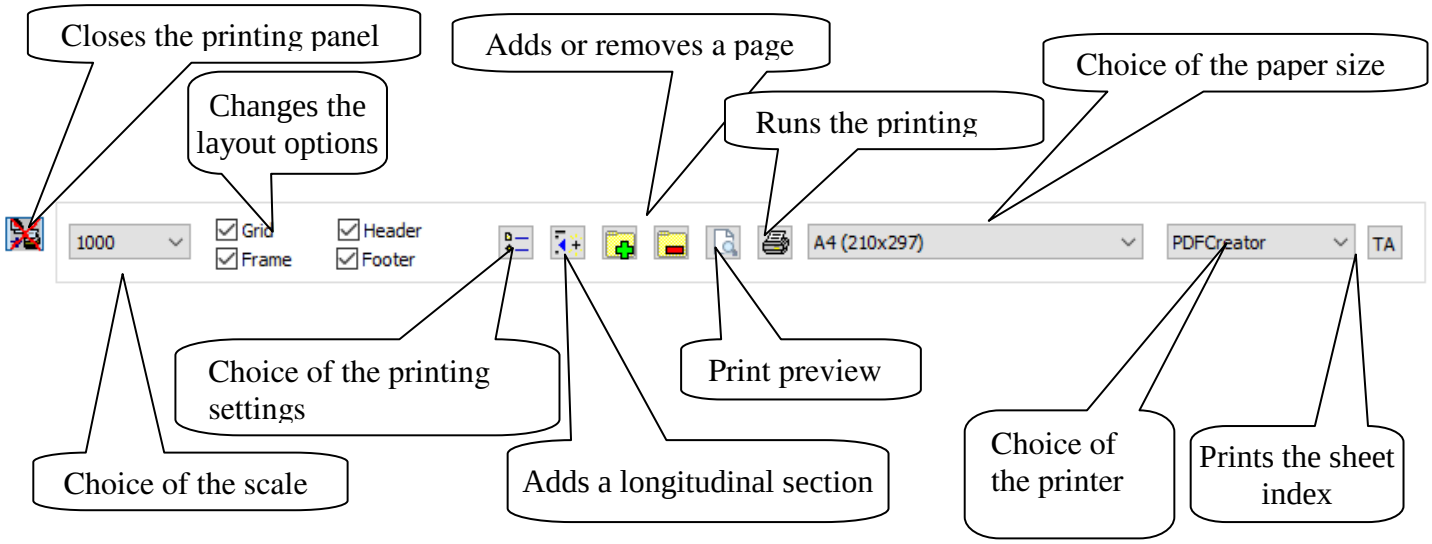
If you left-click in the map, a window appears showing the coordinates of the point marked with a green cross. The default designation is ‘Surface points nn’, where nn is the number of surface points already recorded. You can change this designation and add the altitude. Click on the ‘Add to surface points’ banner to save it. If you have a map set up as a background, this allows you to digitise remarkable points.

Features of the sections window

You can display an absolute elevation grid with the button  or a relative one by pressing the button  . In this case the reference point is the entrance of the cavity.

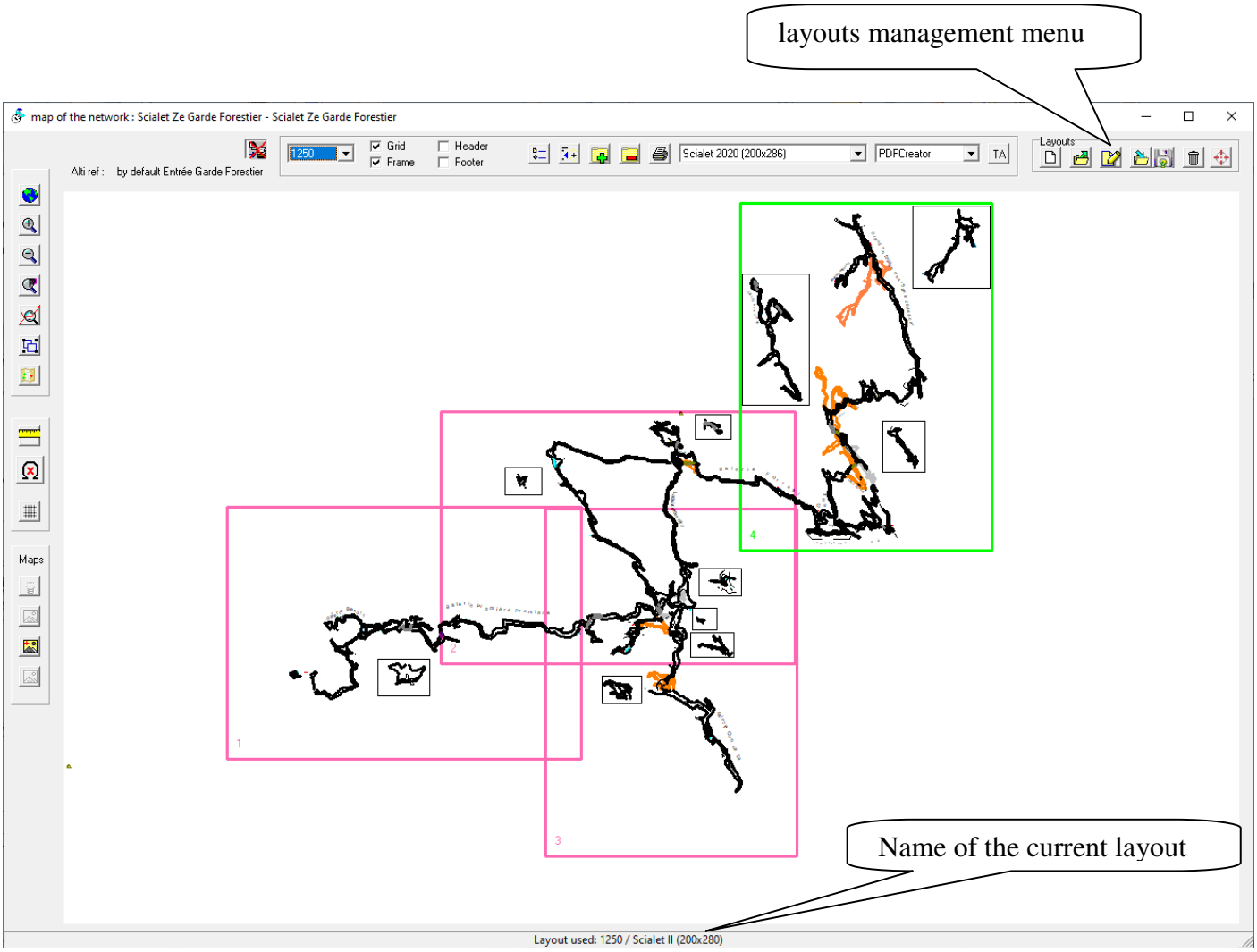
Printing

This is made from the viewing window of the topography by pressing the button  . This displays the printing panel and the layouts management menu



You can use the button  to create a new page, and the button  to delete the current one.

The software calculates the area of pages that will be printed according to the printing scale selected and the paper size.



The printed pages areas appear in purple on the map. That of the current page is green. To select a page, left-click the mouse while holding the ctrl key. To move a page, position the mouse pointer in the inside, hold the ctrl key and move the mouse while holding the left mouse button down. You can also change the sheet orientation (horizontal or vertical) by a right mouse click on the page while holding the ctrl key. When creating a new page, it is inserted after the current page and gets the following number. Other following pages are renumbered.

In the same way deleting a page applies to the current page.

The numbering of pages is made automatically. It is possible to renumber a page after having activated it, by pressing the "N" key while holding the ctrl key down. Then choose the number of the page in the list of the numbers. Other pages are renumbered so that every page carries a unique number.

You can choose the printing options by checking the appropriate boxes:

- the grid.
- a frame around each page
- information in the header
- information in the footer

The button  gives access to the layout options: you can select the type of pattern (lines, fillings, symbols or writing) you want to hide when printed.

Moreover, it is possible to force the display of altimetric writings in absolute or relative and to choose the reference entrance for cavities with several entrances. This applies to altimetric writings created with the function Za or Zr of the screen of drawing. This does not modify the drawing, it is only a displaying option which applies to the current layout.

In cavities with several entrances, this button also allows to choose the reference entrance for the differences in height. This one is displayed above on the left of the screen (under the list of cavities if is visible).

When there are several cavities in the network, and for the display of the plan, the choice of a reference entrance is proposed only if the cavity on which you work contains several ones. The active cavity is the one which is shown in the main screen. His name is indicated at the head of the form, following the name of the network

One or more longitudinal section can be inserted into the drawing of the plane with the button  . You choose from the list of cavities and sections the one we want to add. You can choose how his altimetry will be displayed, regardless of the rest of the cavity, and you can also add a legend. The selected section is placed above the survey shots of the plan it concerns. It must then be moved by holding the left mouse button pressed while holding the ctrl and shift buttons pressed.

The options for one of these sections can be adjusted by double-clicking left, while holding the ctrl and shift buttons down.

To remove a section, you have to make a right click, while holding the ctrl and shift buttons down.

If you have multiple printers, you can choose the one you print. This also allows for PDF output if a PDF software is installed such as PDFCreator, for example, which acts as an additional printer.

Available paper sizes depend on the selected printer. If you has an A0 plotter, nothing forbids making prints in this format.

You can create a personalized paper format by choosing the first line: "New format". It is then necessary to enter the dimensions of the format and its name. If you use a format created so, you can rectify his characteristics with the touch Ctrl + F. Watch out, these modifications apply to all the layouts which use this format.

You can preview before printing with the button  .

When the layout is satisfactory, the button  starts printing. All the objects displayed in the drawing will be printed.

It is possible to print in a JPG format file (JPEG). You must check the "print to file" box of the printing dialog. The software creates as many files as there are pages to print. They are named with the name of the cavity followed by prn, the print size and page number.

For example printing the first page of the plane of the cavity "Waterfall Cave" in 1/500 scale will be called "Waterfall Cave prn 500-1.JPG ".

The button  allows to print the sheet index of the pages of the layout. This opens a new window where the drawing is shown with the visualization of pages and a rectangle showing the right-of-way of the page of the sheet index. A scale by default is calculated who allows to include all the pages of the layout.

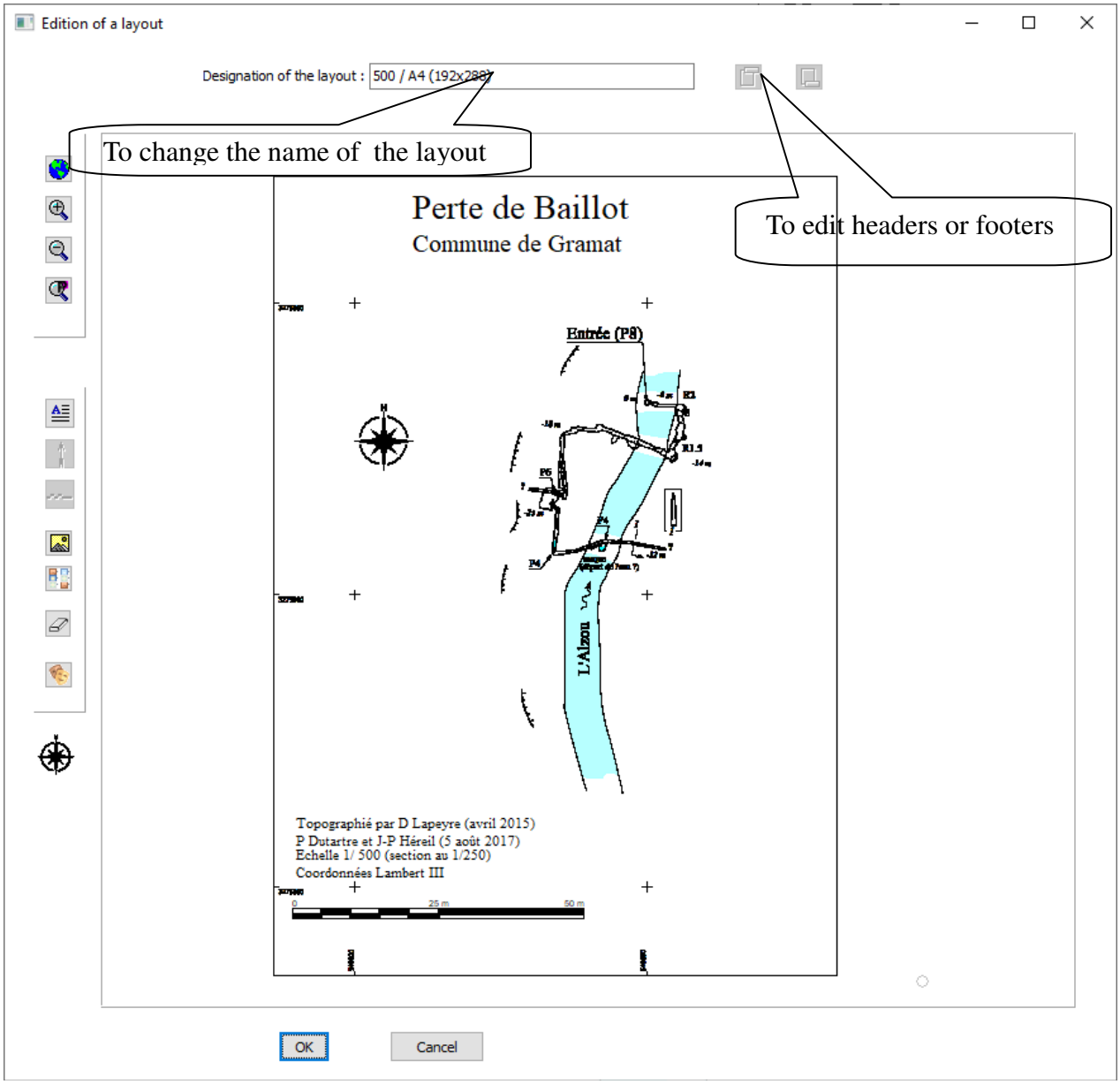
It is possible to change the scale, the format of the printed page and to move the position of the sheet index in the same way as you move a page in the layout

The **layouts management menu** allows you to store and manage multiple layouts

-  To **create a new layout** with the settings displayed on the screen.
-  To **load a layout:** select this option to use an existing layout. If the number of layouts is greater than 10, you can choose the sort order of the list of layouts either in order of creation or alphabetically. The designation of the active layout appears in the lower band of the screen.
-  To **edit layout:** allows to add to the active layout one or more cartridges, a north arrow, a scale bar, a header and a footer. See further "Edtiting a layout."
-  To **save a layout:** saves changes of the active layout.
-  To **save as a layout:** saves the active layout by changing its appellation.
-  **Import layouts:** opens a Topo Calc'R file to import layouts: after opening a file, you must select the layout or layouts you want to import into the current file. All the information contained in the imported layout is copied except the list of cavities to be printed and the list of vertical sections for layouts that concern the plane: in the imported layout, all cavities will be printed and there is no vertical section. You may then need to edit the layout to adapt it to the current network.
-  To **delete a layout:** removes the active layout.
-  To **refocus a layout**: unlike the rest of the drawing, the page layout is not related to topography. When changing the coordinates of a cavity entrance, the layout can be very far from the drawing. This button brings it back to the mouse location. You may have to do several successive operations to find the right position, but this avoids having to move all the pages one by one.

Button  closes the printing panel.

This function displays the following screen:



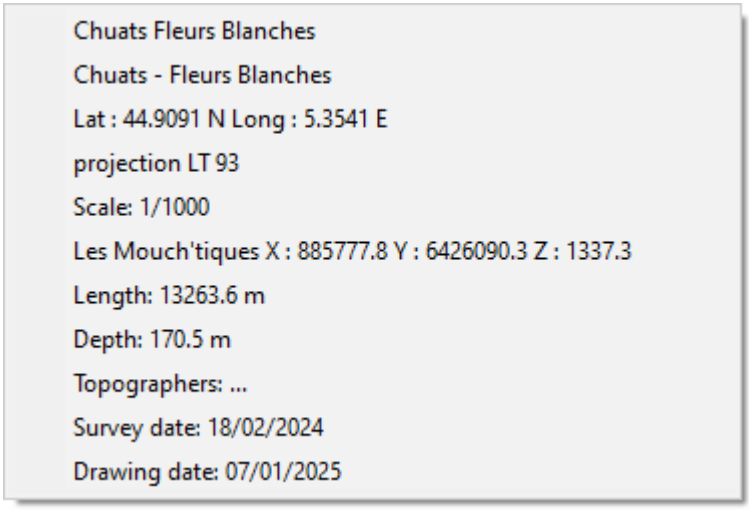
The toolbar buttons allows to include and position various graphical objects:

- to insert text. This is first entered in a text editor that allows you to define attributes (size, color, font, ...) then positioned using the mouse. We can also add information from the topographical survey (see below).
- creates a scale that must be positioned with the mouse. Its size, calculated according to the printing scale, must be indicated during creation.
- to insert images in the layout. When you click on this button, you can open an image file. When it is loaded, you can position it with the mouse.
- inserts the list of patterns and symbols used. In the window that appears, select the motifs and symbols to be included in the list. You can also enter a title. The list is then positioned and managed in the same way as an image. To correct it, double-click on it.

-  erases any of the previous elements.
-  switches to mask management mode.

These elements relate only to the first page to be printed. They can be moved by clicking the mouse and holding the ctrl key. To delete, first click on the eraser, then click the item to be deleted

Text editing: information from the topo survey can be added to the text by right-clicking in the text editor. This can include the name of the network, the name of the cavity, the coordinates of the entrance in WGS, the name of the projection, the scale, the coordinates and designation of the entrance, the development, the depth, the name of the surveyors, the date of the survey (last survey carried out), the date of the drawing.



To select an item, simply click in the list, and the item will be copied into the text editor at the cursor position if it is an empty line, or on the previous line if it is not.

For topographers, you need to choose from the list that appears by ticking those you want to include.

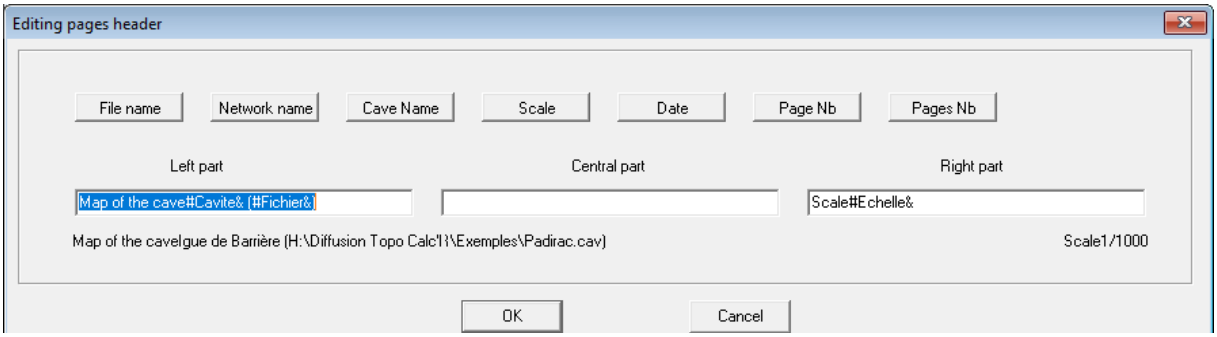
Unlike the survey information inserted into the drawing, this information is not updated if it is modified. This must be done each time the topo is edited.

To edit text, left-click on it, that reopens the text editor.

You can put only one north arrow and one scale. The length of the horizontal graphic scale can be modified by double-clicking on it.

The size of an image or of the list of patterns can be changed as follows: while holding the Ctrl button pressed, the mouse is placed above the image and the mouse wheel is rotated. With a double-clic on its position you can add a frame around or choose another image. The images are not saved in the file of the network. Its only a link to the image file. If this one is deleted or moved, the image cannot be displayed and there is a dotted green rectangle at its place. In this case, either delete it or search the file by double-clicking as explained above

Buttons  and  respectively allow to manage a header and a footer. They will be printed on the top and bottom of the canvas and apply to all pages. They contain either a text entered by the user, or elements that will be updated automatically by the software, such as file name, print date, page number, ...

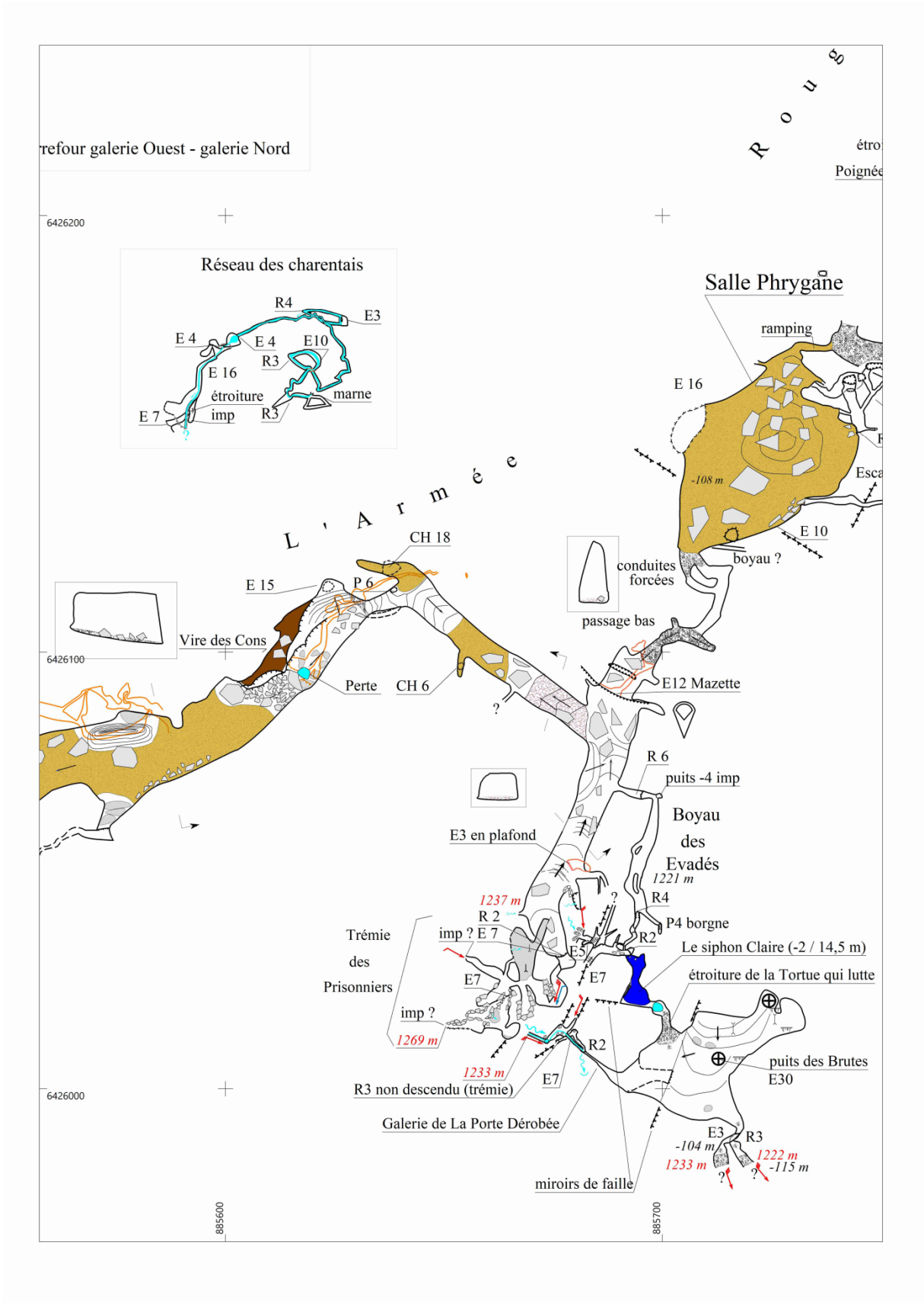


The input window comprises three zones: the first concerns the text that will be printed on the left, the second the text printed in the centre and the third for the text on the right.

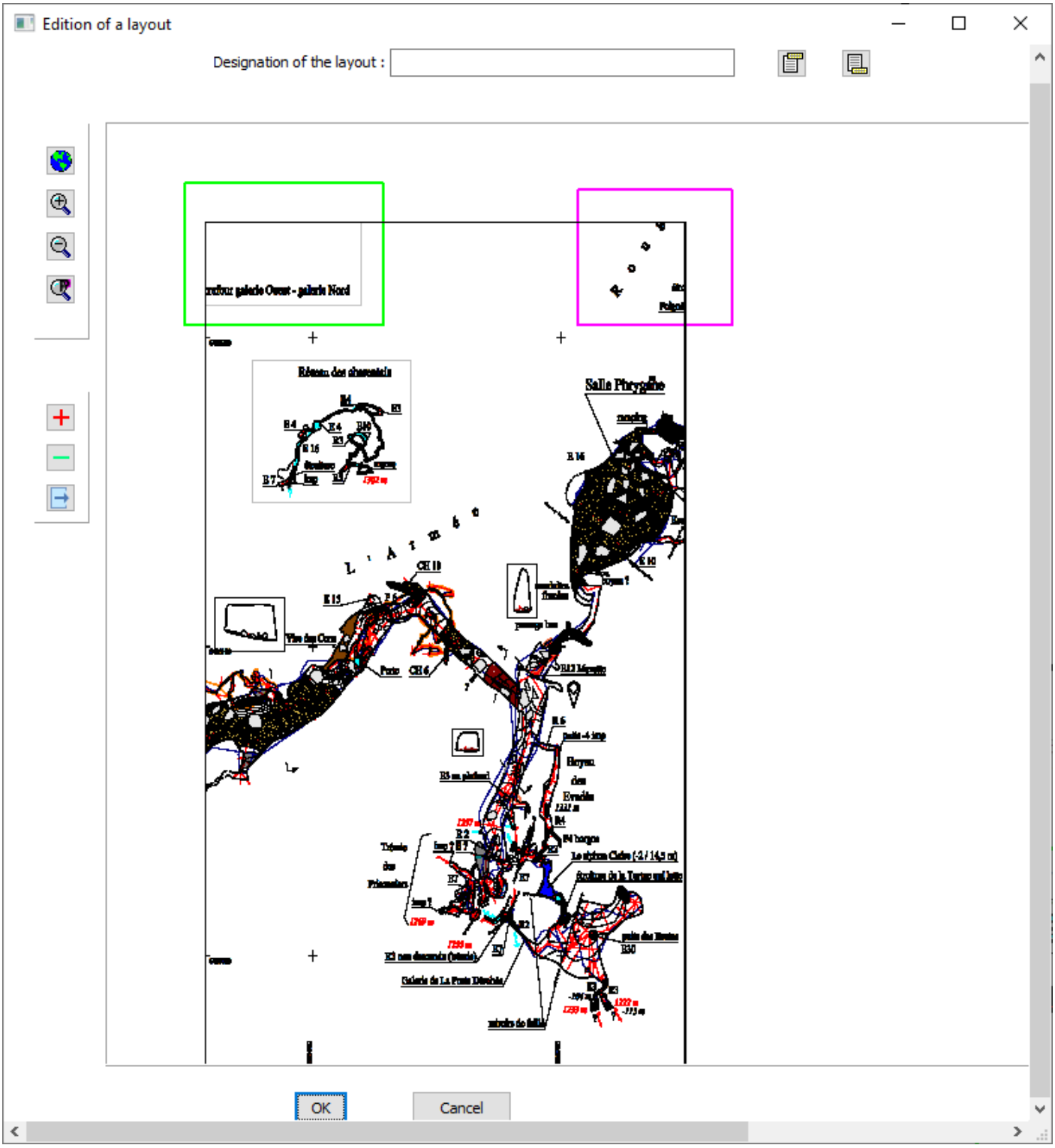
Clicking a button on the top adds to the cursor position one element updated by the software. It appears as codified, for example "#File&" for the filename. A visualization of the printed line appears below the edit box.

Masks management

This function allows you to create masks to hide part of the drawing. This is especially true for large networks where only a part of the printing is desired. For example in the drawing below, the writings and lines located in the upper left and right do not concern the printed part, but it is difficult not to make them appear without modifying the drawing.



Masks can be placed in the right place: after clicking the button  of mask management a new window appears :



The masks are materialized by green rectangles. The one that is active is in fuchsia. You can move them in the same way as the pages in the layout: by holding down the ctrl button and moving the mouse with the left button pressed. You can change their size with the mouse positioned on one side.

The button  creates a new mask. The button  removes the active mask. Exit masks management with the button  . When you return to the editing screen of the layout, the drawing is erased in the mask grip. If a mask overflows the print area, only the part inside the print area is hidden. The frame is not touched.

For the planimetric layouts

The button  below the tool bar shows the last selected north arrow. A click on it gives access to the list of arrow templates. These, other than the first two that are set by default, can be created, modified or deleted from the main window symbol management menu (see symbol management). Once you have chosen the desired model, you create the arrow with the button  .If the arrow has variable text (with dashes _), it is a reference to the magnetic north and the year of the survey session that will replace the dashes must be indicated.

You can put only one north arrow. Its size can be modified in the same way as an image with the mouse wheel.

Particularity of altimetric layouts

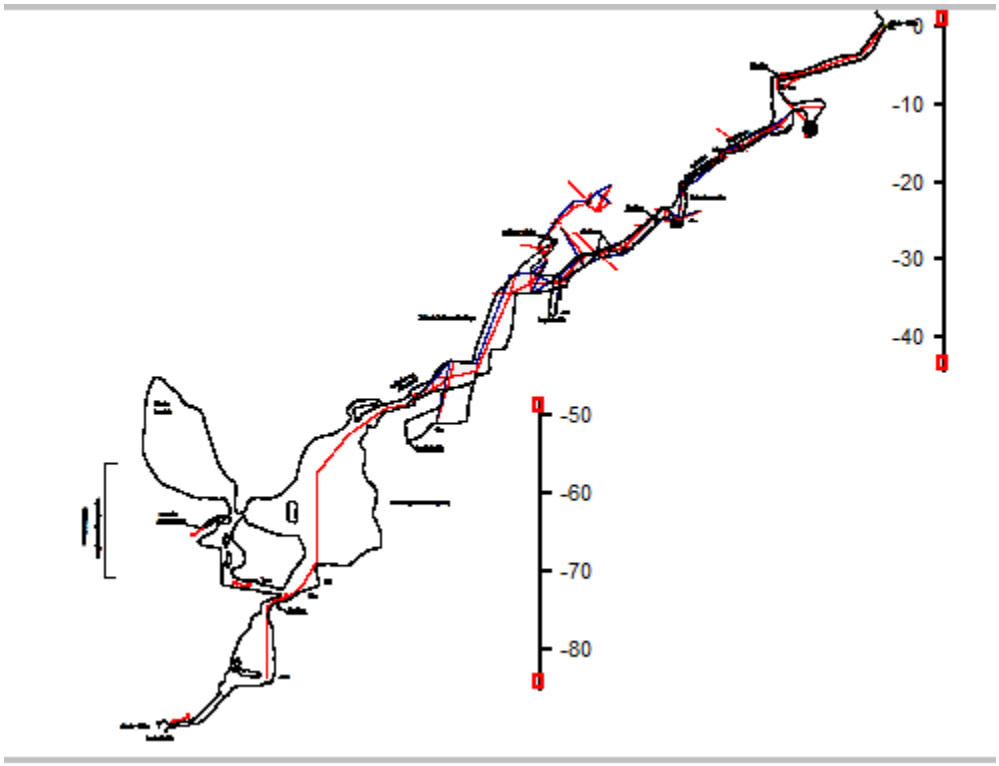
There is no button to insert a north arrow in the altimetric layouts. However you can add one or more altimetric scales with the button  .

When you create the first scale, you must indicate its step and it displays absolute altitudes or differences in height from the entrance.

Then you must position the scale with the mouse. The values are automatically displayed on the scale following its position.

You can create so many scales as you want. But the steps and the type of altitude are the same for all the scales of a layout.

As the others elements of the layout, each scale can be moved by clicking on it while holding ctrl key down. When you put this key down, two red rectangles appear at the extremities of the each vertical scale. By clicking upon one of them and moving the mouse you can lengthen or shorten every scale.



When Ctrl key is down, a right click on a scale toggles the display of the numbers (on the right or on the left of the scale).

A double click on a scale re-open the creation menu, so you can change steps and type of altitude.

Export to SVG

The button 

generates a drawing file in SVG format. This is a format used by many graphics programs, especially the drawing software Inkscape, equivalent free software Adobe Illustrator. TheWeb browsers also allow you to view drawings in SVG.

When viewing the map, the file created concerns all cavities; for sections, it concerns only the displayed cavity.

Unlike files generated using the SVG export function in the main menu, it has 6 separate layers that can be displayed together or separately in Inskscape: this is the grid, the survey path, the designation of points, of the galleries envelope, the drawing and the texts.

Managing rasters

Images (or raster) can be inserted in background after calibrating files containing those images. It can be a scanned map, orthophoto or any image.

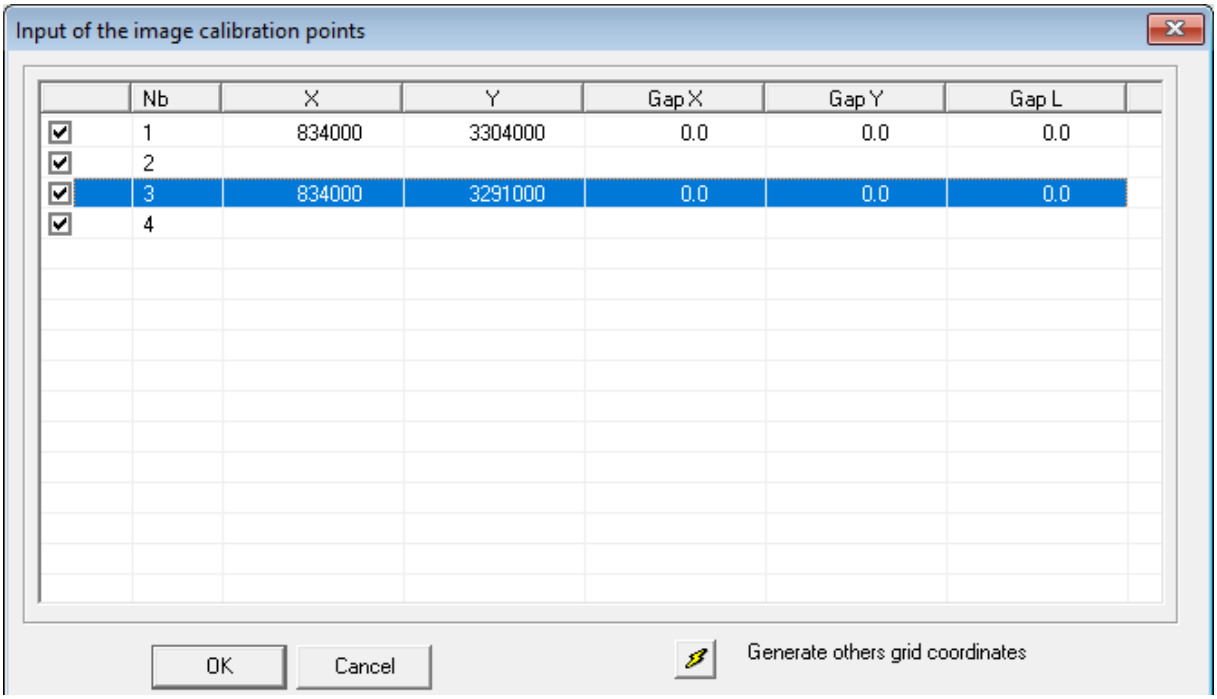
The management of these rasters is made with the following buttons:

	Shows or hides a raster
	Selection of the raster to display
	Addition of a raster (see below calibration)
	To remove a raster
	The position of the slider is used to vary the opacity of the background raster

When you want to add a raster, you must first select the file that contains it. Once the file is opened, you must calibrate it ie designate several points (minimum two) whose coordinates are known. The operation of this window is the same as the addition of a picture for digitizing or a note (see "Digitalisation of a scanned cave survey" or "notes management").

When the desired number of calibration points (at least two) have been identified, the window can be enabled.

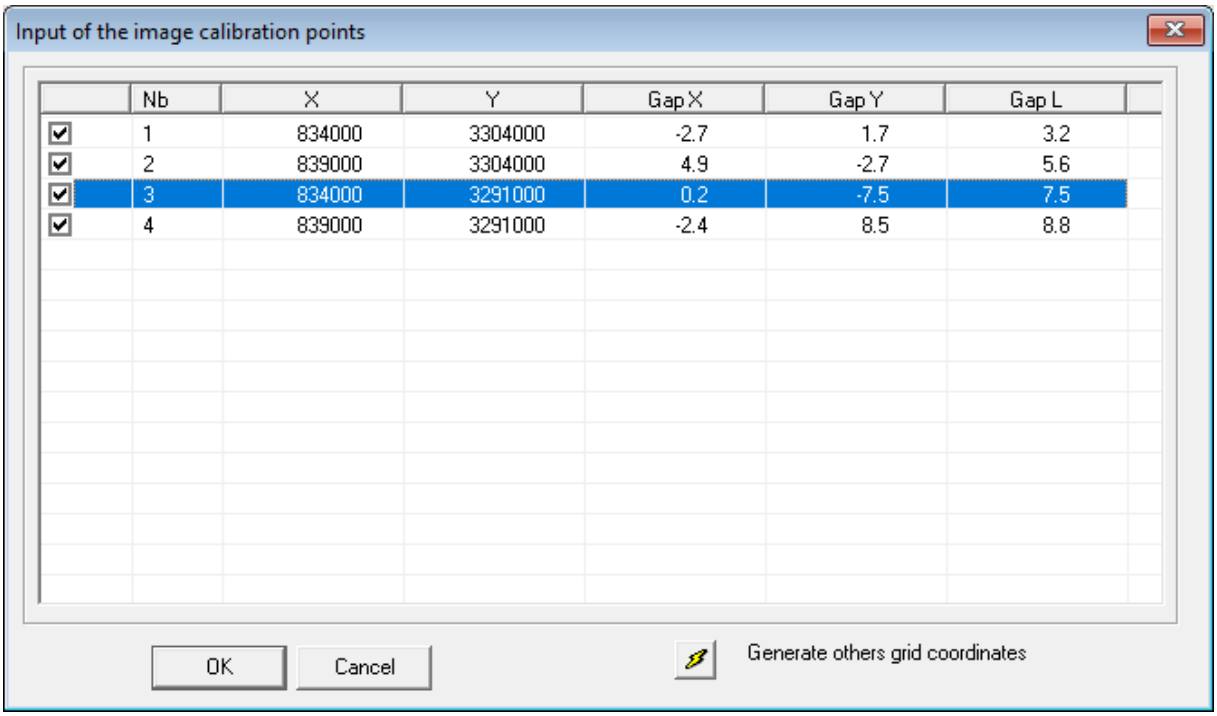
You would then enter the coordinates of the calibration points. The following window appears:



You must double click on a point line to enter its coordinates values.

If the calibration points are grid crosses, when two points have been entered, the button  generates the coordinates of the other calibration points. However, it's better to control the rounding. Depending on the accuracy and the position of points, some of them may not correspond to a cross grid coordinates (rounding down, instead of higher, for example).

Right click gives a blank line.



The software calculates the calibration of the image by Helmert adjustment. When there are more than two calibration points having known coordinates, it calculates the gaps with the theoretical coordinates of the point. Theses are displayed in three columns on the right. This gives an idea of the quality of the control points and of the pointing. In the above example, which was carried out on a card at 1/25000, the differences are quite correct, given the accuracy of

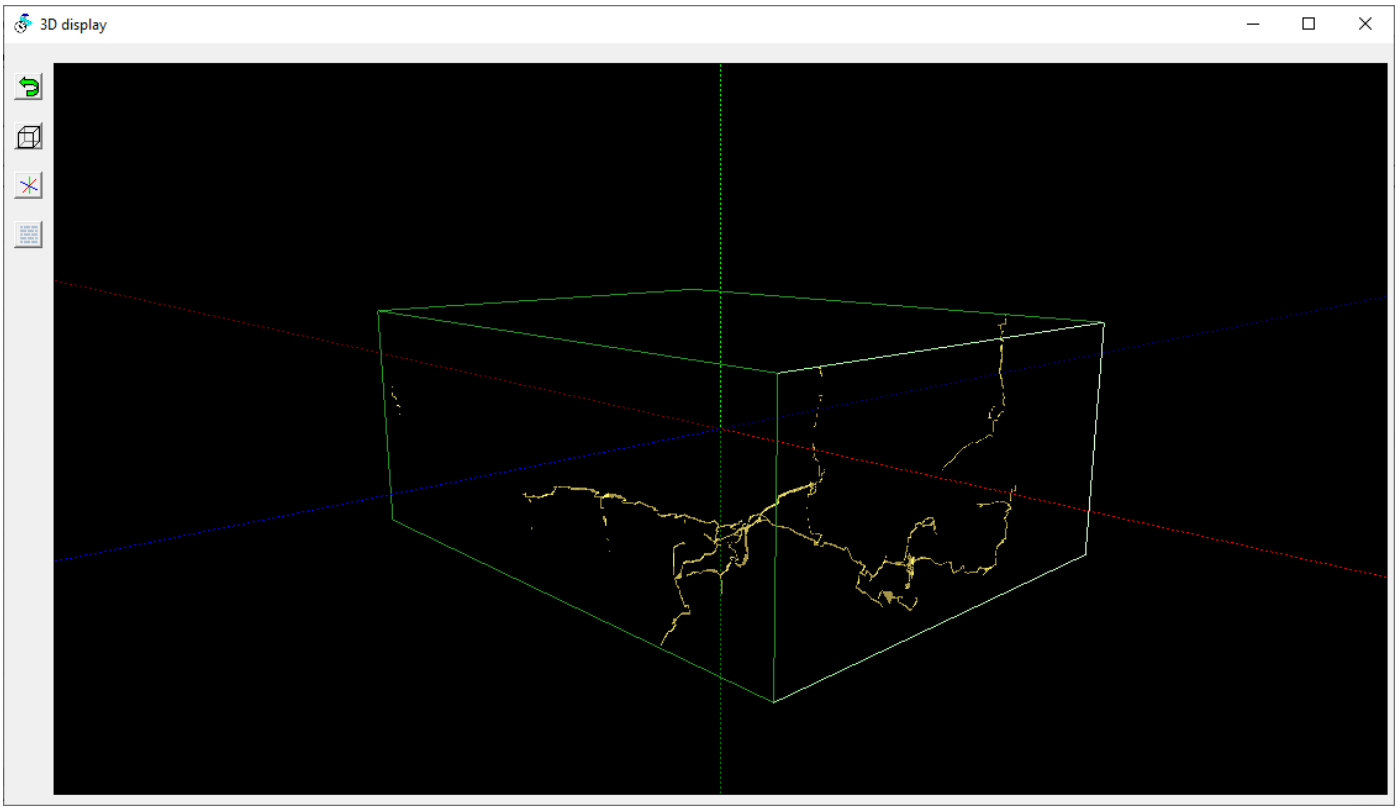
the map. It is also possible to neutralize a calibration point by unchecking the box at the beginning of its line. It shall not come into the calculation.

When the calibration is right, the validation of the window inserts the image in the background of the network drawing.

Names and calibration parameters of the images are saved in the network file. It is not necessary to repeat the calibration every time. During the first display of an image or when changing, the display period can be quite long, because the software must reposition. This delay is proportional in the size of the image.

3D visualization

You reach it from the main menu with the button  . The screen appears as below. The display concerns all of the cavities of the network. Only the survey shots which contain indications of width and height appear in the view.



A parallelepiped realizing the extremities of the network in 3 dimensions is displayed around the network. He can be masked or shown by pressing on the button  .

In the same way coordinate system can be shown or masked with the button  . The blue axis represents the direction West to East, the red one the direction South to North and the green the vertical line.

You can also display or hide the gallery walls with the button  . If they are hidden, only the survey and skin shots are displayed.

You can zoom with the thumb wheel of the mouse. To revolve around the view, it is necessary to move the mouse by holding left button down. If you move it by holding the right button down, you move the view in the direction of the movement of the mouse. This function can give puzzling results because the movement is made with regard to the centre of display which is itself moved by zooms and pivoting. If you are lost, you can return to the initial view with the button  .

Displaying in Google Earth

With button  you can display the network in Google Earth if the software is on your computer and the kml files are associated to it.

License to use

Topo Calc'R is provided as Freeware for private non-commercial or educational use, including non-profit organization.

You are granted the right to use and to make an unlimited number of copies of this software.

This software is provided "as-is". No warranty of any kind is expressed or implied. The author will not be liable for data loss, damages, loss of profits or any other kind of loss while using or misusing this software.

Thanks

The software uses among others the library "**Convertisseur"** written by Eric Sibert for coordinate conversion **(http://eric.sibert.fr/article80.html).**

Anomalies - Suggestions

Anomalies encountered can be reported by email to the following address: topocalcaire@gmail.com. Eventually attach the files that are problematic.

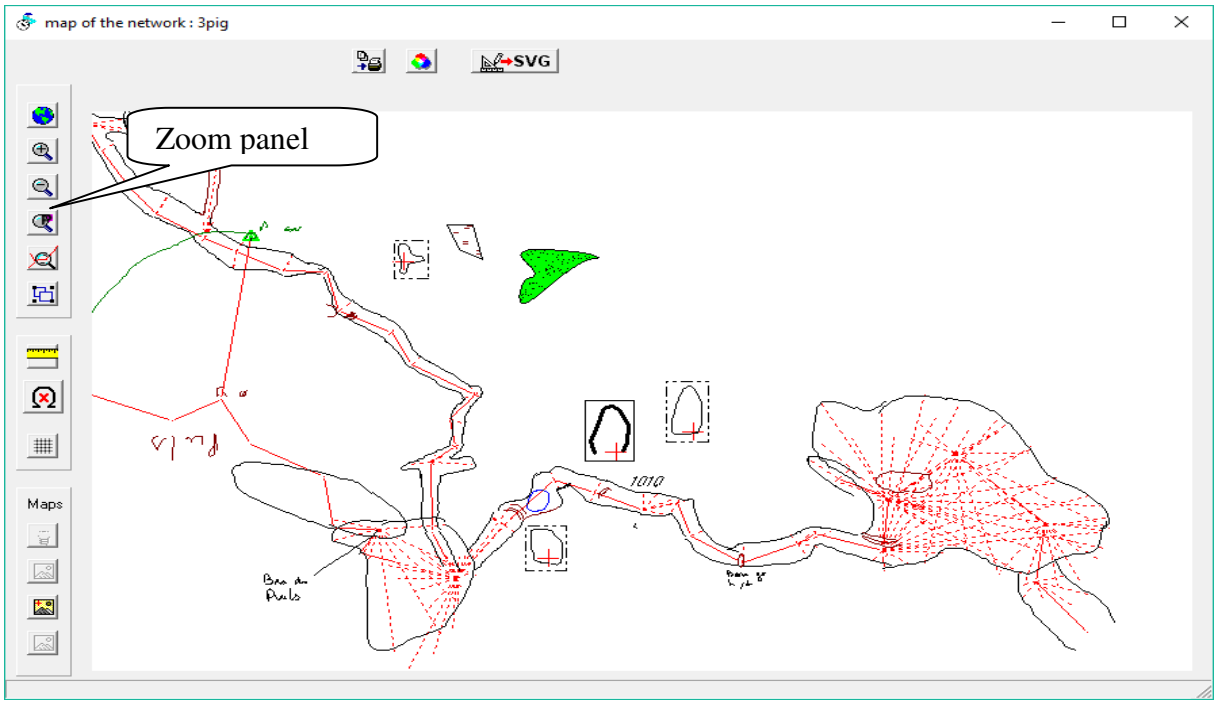
In the same way suggestions and comments are always welcome.

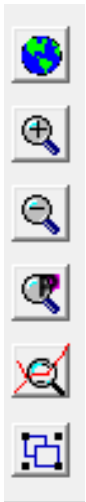
Graphic screens presentation

All graphics displays (drawing or visualization - plan or section) have the same navigation features:

- Zoom + and - with the mouse wheel.
- Moving the drawing by holding the right mouse button.
- Zoom window: right mouse click to define the first corner of the window, then another right click to the opposite corner click. You can stop this with the Esc key. This type of zoom does not work when the rule is active

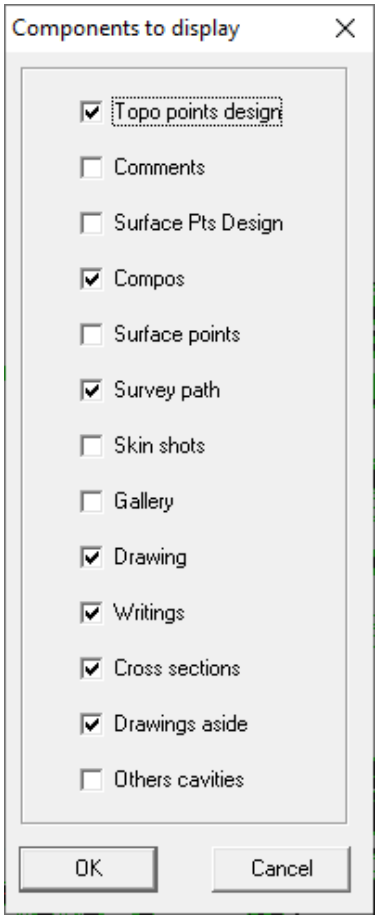
The zoom panel (at the top left of the screen) can also make zoom:





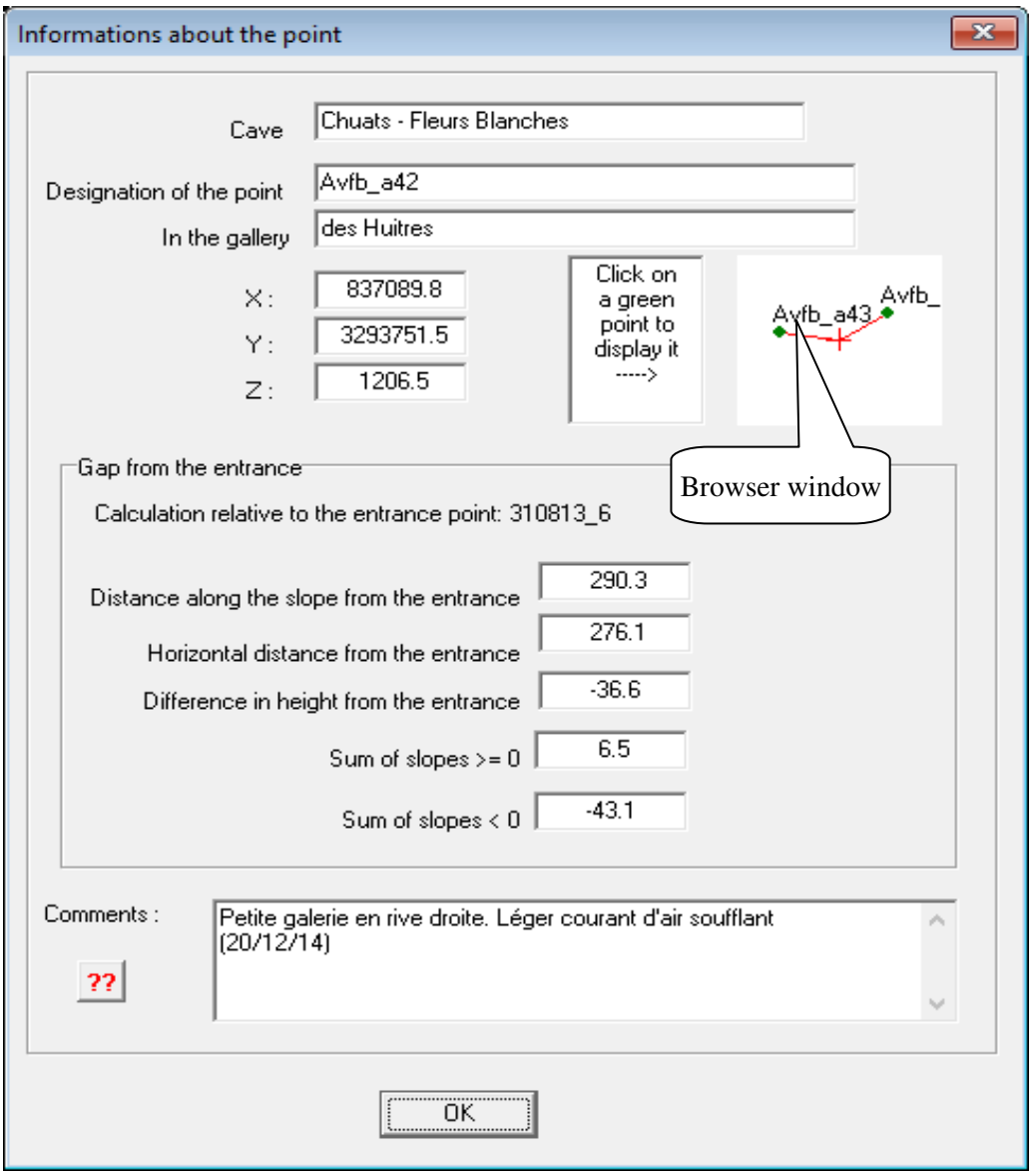
- Overall Zoom
- Zoom +
- Zoom -
- Recall previous zooms (the last 4 zooms are saved)
- Zoom on a gallery or a shot
- Select objects to display (see below)

The graphical windows are used to display various items:



- survey points designation.
- Comments. They are displayed following the designation of the points or the skin shots
- surface points designation.
- compounds: these are all survey points, the points that make up the envelopes galleries and the ends of lines or polylines of the drawing. They are represented by green crosses. The design being vector-based, all these points allow to "hang" drawn elements.
- Surface points (triangle surrounded by a circle).
- Topographic path calculated from the data entered (red line in the figure above).
- Skin shots (red dotted line in the figure above).
- Galleries envelopes calculated from their dimensions (dark blue lines).
- Elements of the drawing (lines of wall, water, symbols ...)
- Writings.
- Cross-sections
- Drawings aside
- In the drawing window of the plane, you can also see the drawing of the surrounding cavities, if any

A left-click on a survey point displays the topographic data of this point. (the point must be in the mouse catching radius that is of 1 m by default).



In the windows which shows the data of a point, you can display the previous or the next points by clicking in the browser window on one of the points displayed in green. If the points are very close, the window can be enlarged with a right click of the mouse (right click to close it). On the main drawing, the current point is surrounded with a red circle, If the button ?? appears, clicking on it displays the possibilities of continuation at this point.

The ruler tool (button) measures a distance and an angle on the graphics window: make a first left-click for the beginning of the measure, and a second for the other end. The angle and the distance appear along the measurement line.

!! the zoom window does not work when the rule is enabled.

If the file has been imported from an electronic pad the drawing done with this software appears underlay. You can hide or display it with icon .

Installing the software

To install the software, simply run the installer TopoCalcR v *nnnn* English Setup.exe. (where nnnn is the version number).

Files generated by the software

The software generates files ".cav" that contain all the data in a network, as well topographic data as drawing.

For each file "cav" a configuration file "cfg"is created. This file stores the list of notes mainly used for drawing and their calibration, the list of SVG files, the files being digitized. If this file is destroyed, you will have to redo the calibration of the different documents but the drawing and the topographic calculations will be retained.

When recording a cav file, if the file already exists, a copy before modification is created. It has the extension "$$$ Cav" This allows to recover data before modification.

The software also generates a file "Topo Calc'R.ini" that stores recently opened files.

Software configuration

The menu File / Configuration allows to choose the input range for the survey data and the file of patterns, symbols and fonts which will be used by default when you will create a new network.

You can also choose in which part of the earth you are working to use the systems of coordinates of this zone. If no area matches, choose “other”; this allows the UTM projection to be used with the WGS 84 geodetic system.

The measurement with topofil can also be activate if you use this device.

The number of decimals places for display or printing coordinates may be choose between 0 to 3. This value has no effect on the precision of the calculation. No matter how many decimals are displayed, the coordinates are memorized and used in calculation with the same precision

You can choose to have the declination calculated automatically: see entering a survey session.

You can also personalize the drawing of the survey path, of the skin shots, of the envelope of the galleries and the drawing of the surface points, and the colour of the watermarks.

The direction of the zoom with the mouse wheel can be inverted according to the preferences of the user.

All these values are saved in the ini file.

The software is provided with a file patterns, symbols and fonts named “basic patterns V3-6.mtf” which can be used as default patterns library as well as a few examples. These files are located in the software's documents folder (by default Documents\TopoCalcR)..

Observed anomaly : On some screens, the input dialog boxes do not appear correctly, they are truncated. To correct this, go to Windows settings and set the screen configuration to 100%:

Procedures for the calculations

Calculations of the loops' adjustments of one or more cavities are carried out according to the classical method used in topography for the adjustment of paths (see for see for example the IGN/ENSG online course chapter VI : https://cours-fad-public.ensg.eu/pluginfile.php/1343/mod_resource/content/1/Topo3.pdf). It is detailed below. Adjustment by the least squares is not applied because it results in uniform deformations throughout the cavity, both on the correct loops and on those with significant deviations.

The topographic survey is broken down into paths: a path is defined as a set of verts forming a broken line whose angles and length of sides have been measured to determine the coordinates of each of its vertices.

Adjustments are calculated first in planimetry, then in altimetry.

Planimetric adjustments

For each path the following method is applied: all distances are reduced horizontally. Wee assuming that the coordinates of the points of departure (Pd) and of arrival (Pa) are known. A path calculation is performed from the point of departure to the point of arrival. This gives a measured point of arrival (Pm)

The azimuth (Gc) between Pd and Pa is then determined and that (Gm) between Pd and Pm. The gap Gm-Gc called closing gap gives the error of azimuth (eg). It represents the total direction error made on all the measures of the path.

Similarly, the calculated distance (Dc) between Pd and Pa and the measured distance (Dm) between Pd and Pm are determined. Wee obtain the gap in distance Ed = Dm-Dc.

adjustment is then done by removing the direction error from each path angle and applying a Dc/Dm correction to each distance measurement.

Altimetric adjustments

In the same way that the distance gap in planimetry is calculated, we calculate the difference in altitude between the calculated point and the measured point. If Dnc is the difference between Pc and Pd and Dnm between Pm and Pd, a correction Dnc/Dnm is applied to the difference between two consecutive points.

Application to every cavity

If several cavities are connected by junction points, they are treated as a single cavity.

The software first looks for whether there are multiple entries or adjustment points: these are points that are not entries but whose coordinates are known with an accuracy equal to or greater than that of an entry. They are usually obtained by surface detection of an electromagnetic beacon placed in the cavity. They are treated as an entry into the calculations.

If there are multiple entries, the software calculates the paths between the entries. If there are more than two, he tests which order of calculation of these paths gives the best result. Once determined, paths are calculated and adjusted. When a path has been adjustted, the coordinates of its points are set and they can serve as a starting point or an arrival point for other paths.

Loops that do not have an entry as a starting point or arrival point (internal loops) are then calculated. Paths are created for each branch of the loop that starts from the common starting point and ends at the common finish point. The coordinates of the point of arrival are determined by making the weighted average of the coordinates determined by the calculation of each branch.

The weighting applied is a function of the precision of the coordinates obtained from each branch. This precision is calculated with the length of the branch from the starting point and the degree of precision of the survey (see precision degrees). The formulas are available in the article I posted online on precision of a caving survey (not yet translated in English).

For example, in a two-branch loop, if Pm1 and Pm2 are the measured arrival points for each branch, the coordinates of the calculated arrival point are given by the relationships:

PcX = (p1xPm1X+p2xPm2X)/(p1+p2)
PcY = (p1xPm1Y+p2xPm2Y)/(p1+p2)
PcZ = (p1xPm1Z+p2xPm2Z)/(p1+p2)

p1 and p2 being the precision of the pm1 and Pm2 points relative to the Pd point, either(1/(Erm-Erd)

Erd and Erm being the theoretical errors on the Pd and Pm points

From these calculated coordinates, we can compensate each branch, as explained above. Introducing precision helps to favour short branches and/or those made with the best precision.

Internal loops are calculated one after the other in topographical order.

Versioning

Number	Date Released	Changes
Version 3.06.11	05 march 2025	Correction of anomalies
Version 3.06.10	26 february 2025	Correction of anomalies
Version 3.06.9	20 february 2025	Correction of anomalies When you enter or delete a junction in the junction management screen, the window is no longer closed but simply redrawn. You can continue to enter or delete junctions
Version 3.06.8	10 january 2025	The coefficients of the IGRF14 model have been published and integrated into the software. The automatic declination calculation is once again correct
Version 3.06.7	07 january 2025	Message indicating the limit of the automatic calculation of the declination at 31/12/2024 Calculation of gallery dimensions if you create skin shots in a digitisation process
Version 3.06.6	12 december 2024	Ability to choose the items to be exported in kml files Option not to export surface points in GPX files Correction of anomalies
Version 3.06.5	27 november 2024	Correction of anomalies
Version 3.06.4	18 november 2024	The size of symbols with a fixed dimension is drawn more precisely
Version 3.06.3	5 november 2024	Correction of anomalies
Version 3.06.2	3 november 2024	Correction of anomalies
Version 3.06.1	1 november 2024	Correction of anomalies
Version 3.06.0	27 october 2024	Multiple selection of surface points. Surface points can be sorted by column heading.. Possibility of omitting the date of a session (date not entered)

		You can also search for text in the list of shots in the gallery names. New feature category: slope hatching New texture category: pebbles As well as altitudes, you can enter the distance from the entrance or the station identifier in the drawing. Comments on the skin shots can be displayed in the drawing You can vary the transparency of the background images Section of several cavities Save points clicked on the map In a collage layout of survey information
Version 3.05.3	13 march 2024	Correction of anomalies.
Version 3.05.2	31 january 2024	Correction of anomalies.
Version 3.05.1	16 january 2024	Correction of anomalies.
Version 3.05.0	10 january 2024	Possibility of individualize the end of a gallery, from a shot (see right-click menu). In horizontal writing, ability to put a writing on several lines and align it left, centred or right When printing, in a layout you can hide patterns that will not be printed Correction of anomalies.
Version 3.04.1	12 december 2023	Correction of anomalies.
Version 3.04.0	26 october 2023	Export to SVG format with script to zoom in Internet browsers.
Version 3.03	21 september 2023	Possibility to set the calculation of the declination as automatic (see software configuration and entry of a survey session). In the statistics, added a visualization of the list of survey sessions with the length recorded per session and the number of shots In the layouts: • Adding the preview before printing • Ability to create masks to hide part of the printed drawing.

Version 3.02.2	2 july 2023	Added a button in the drawing screen to hide watermarks.
Version 3.02	10 may 2023	Grouping Oriented sections with Expanded sections. Ability to rename points.
Version 3.01.1	15 april 2023	Initial release version 3 For changes and anomalies corrected in previous versions, see Version 2 Operating Instructions

List of anomalies corrected

Number of the version in which the anomaly has been corrected	Description of the anomaly
3.06.11	• Not all text corrections are recorded. • In rectification, the type of writing displayed does not correspond to the type of writing selected.
3.06.10	• When the size of a fixed-size symbol is changed, the design of all symbols of this type is modified • The drawing and gallery envelopes no longer appeared in the Google Earth display
3.06.9	• Loop calculation anomaly when points are located in different cavities
3.06.6	• Pattern and symbol selection anomaly when there are several categories • In graphics screens, zooming with the mouse wheel is now centred on the point where the mouse cursor is located. • Some cavities could not be exported in GPX files
3.06.5	• Pattern file read error when creating a new network • When you create a new gallery by creating a shot, it does not appear in the list of galleries.
3.06.3	• Incorrect declination calculation when entering a bearing. On the other hand, automatic declination calculation is correct
3.06.2	• Anomaly in the default import of pattern and symbol files when creating a network
3.06.1	• Error saving cav file if there is a drawing document from an electronic topo notebook

3.05.3	• Error message for choosing or changing a design pattern or writing if the undefined category is empty.
3.05.2	• Following a change in the SVG file format, SVG files generated by TopoDroid are no longer automatically imported with the survey data.
3.05.1	• Error in displaying relative altitudes in developed longitudinal sections when the cavity has several entrances.
3.05.0	• Impossible to create a vertical scale in the layout of a longitudinal section. • Mouse wheel causes 3 successive zooms instead of one. • Impossible to create a vertical scale in the layout of a longitudinal section • Mouse wheel now zooms 3 times instead of once • The position of the North arrow in the printouts is no longer offset from the screen view
3.04.1	• When the software is opened by clicking on a cav file, there may be a display bug when viewing the plan if a map is displayed in the background • Skin shots remain displayed in cross sections when hidden in main drawing
3.04.0	• 1st release of version 3 in English