

FilChaudNX

by CNCFAB.fr

2D AND 4 AXIS CNC HOT WIRE CUTTING SOFTWARE



Users Guide of the

- 4 AXIS WINDOWS
- MACHINE AND MATERIAL PARAMETERS WINDOWS


Thanks to the magic of the Internet 🙏, this document has essentially been automatically translated. I haven't had time to check everything, and I don't necessarily master all the words in English, so **if you see any corrections to be made in the manual or software**, please don't hesitate to e-mail me at :

contact@thefrenchcnhotwireguy.top

If you want to know more about me and my path with CNC hot wire cutting (it's been a long one), feel free to check

<https://thefrenchcnhotwireguy.top>

I will try to share some informations in english (and yes, I'm french 😊).

Please RTFM, and the presentation / limitations / installation instructions of the software. And clic on the  marks all over the software to see some useful explanations.

Summary

This notice (and therefore the summary below) is structured as follows:

Chapters 1 to 5: Presentation, principles, download and installation of the software

Chapters 6: 2D design and cutting (reference to the FilChaud2D instructions)

Chapter 7: Design of 4-axis projects (no need to have a machine)

Chapter 8: Setting up a machine

Chapter 9: Calibration of a material

Chapter 10: Cutting a 4-axis project

Chapter 11: Video resource links and project sharing

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1 Presentation

FilChaudNX is software designed by Renaud Iltis / CNCFAB to control its CNC hot wire cutting machines (MC4X, MiniCut2D+, custom machines, etc.).

More generally FilChaudNX can be used to direct control any machine equipped with the IPL5X interpolator, or to generate Gcode “G93 based” for GRBL. (G94 is 🐈 for 4 axis hot wire cutting).

FilChaudNX is a pay software, at the sexy price of 69€. Its license must be acquired from Renaud Iltis (all information in english on the site <https://thefrenchcnchotwireguy.top>, or in french on <https://cncfab.renaudiltis.com>

You only need the licence to launch a direct cut or export a Gcode file, all the other functionalities of the software are available for free. So, you can test extensively the software for free, and you can prepare your projects on non licensed versions of the software.

I spent years to develop this software and the price is not high, so please don't try to overrule my licence system, karma is watching all of us 😊

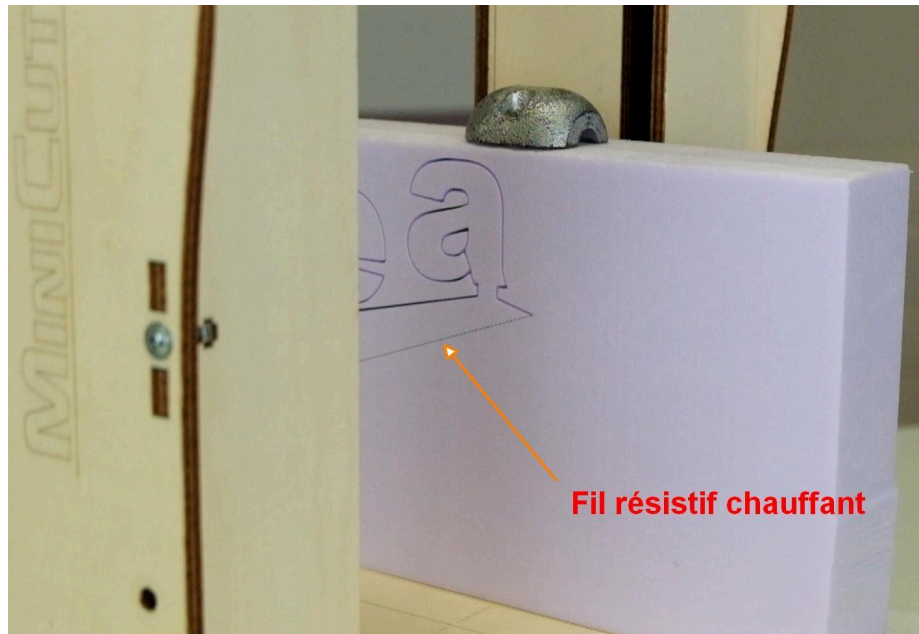
FilChaudNX only works on “real PC” under Windows operating system, 32 or 64 bits, from XP to 11. It's not working on 2-on-1 hybrid tablet-PC such as Microsoft Surface, Asus Zenbook Flip...

By the way, yes FilChaudNX interface looks a little old school, I know, but hey, you want to cut some projects or what ? Because it works damn fine !

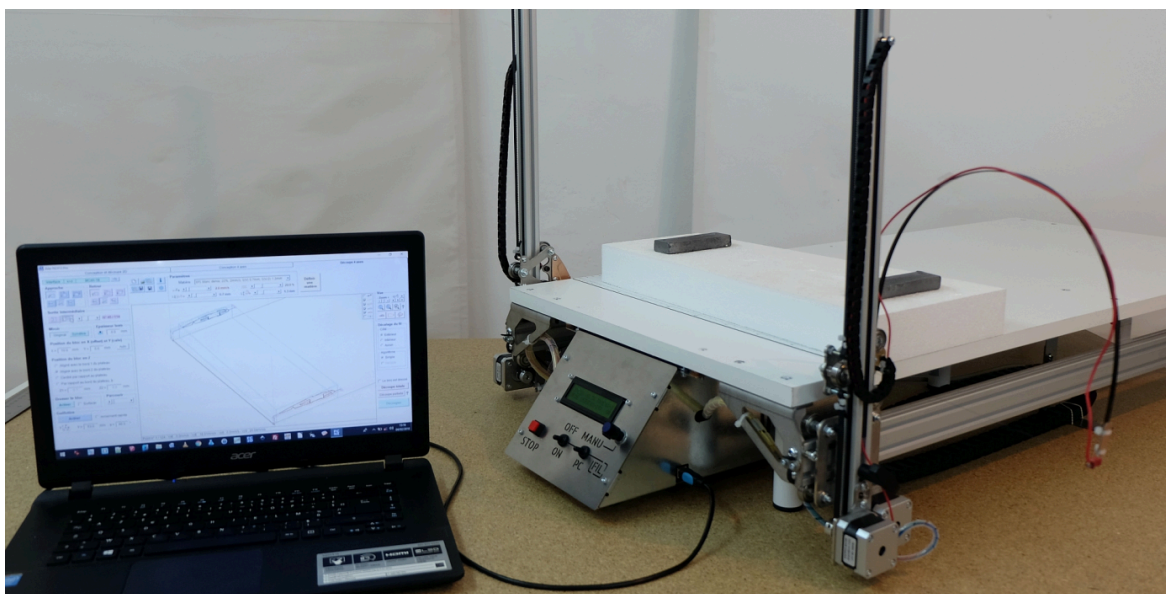
By the way 2, feel free to share your projects on <https://cncpartage.fr>, a little website that I made with other guys some years ago.

2 Principle of CNC hot wire cutting with FilChaudNX

A resistive heating wire is driven through polystyrene by a machine (a CNC hot wire) and melts the material:



Direct control in FilChaudNX : the machine is controlled using the FilChaudNX software installed on a PC computer which is itself connected to the machine by a USB cable:



When the heating is correctly adjusted, the wire does not touch the polystyrene which becomes gaseous before contact.

Thanks to the calibration of the material, FilChaudNX shifts the wire so as to take into account the width of the kerf of the wire in the material (which depends on the heating and the speed of the wire). This allows you to obtain a final part with the right dimensions.

For export Gcode from FilChaudNX, you just have to check the “Export Gcode” field above the “Cut” button and, the text of the button changes to “Export” :

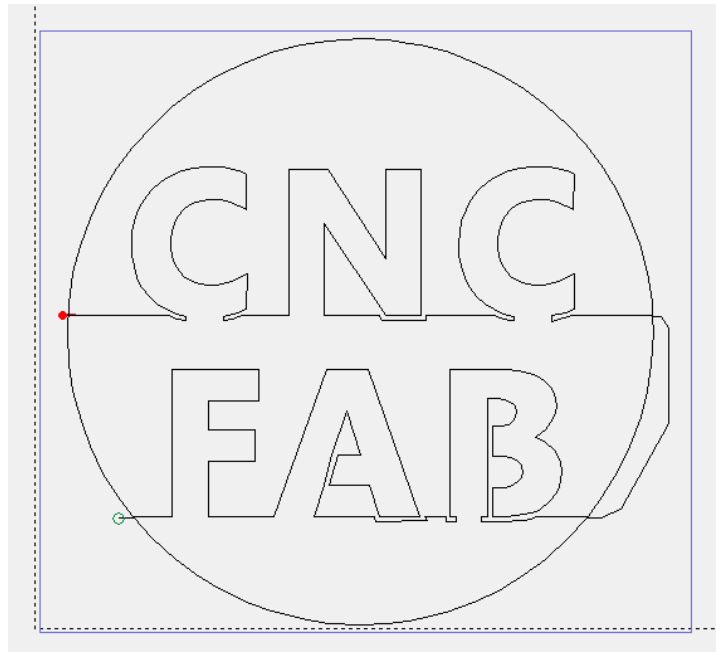


Of course you must set the software with the actual dimensions of your machine to obtain the correct Gcode file (X Y U Z axis).

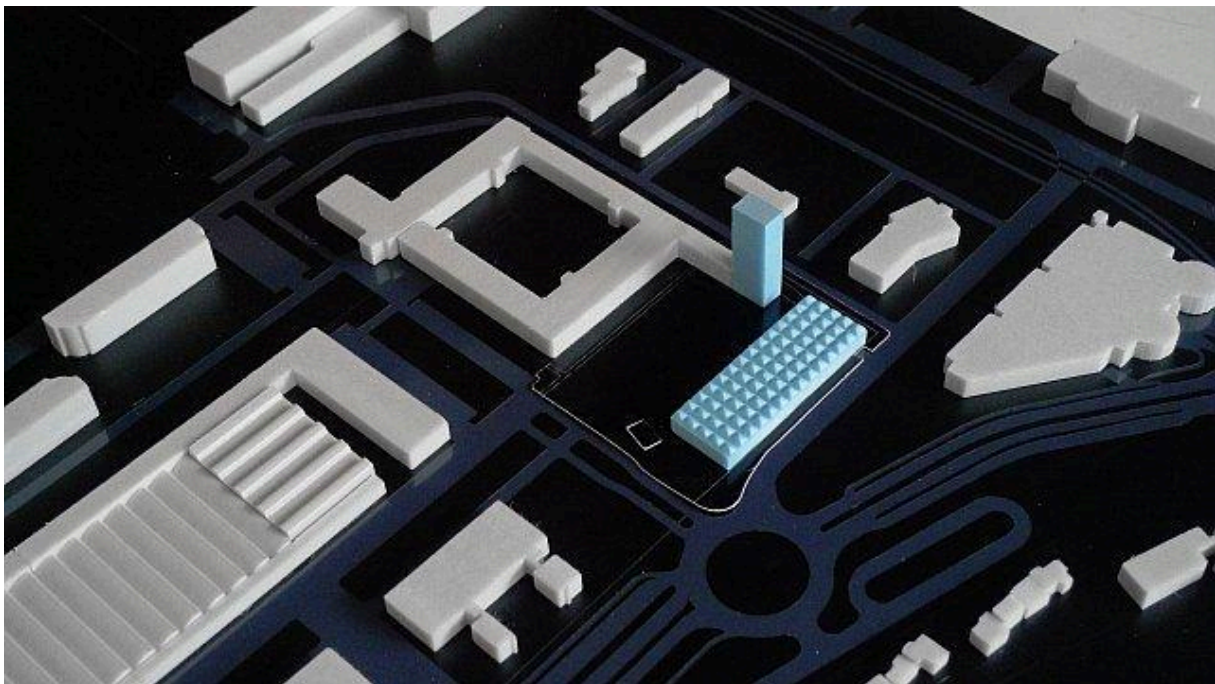
3 Number of axis

3.1 Principle of 2-axis (or 2D) cutting

Both ends of the wire follow the same path. The project design is simple because you only need to define the displacement of one end of the wire:



This cutting method is the one most used by professionals: lettering, town planning models, packaging, Depron cuts... the applications are numerous and the implementation is very quick. FilChaudNX manages this mode in a specific "2D design and cutting" window.

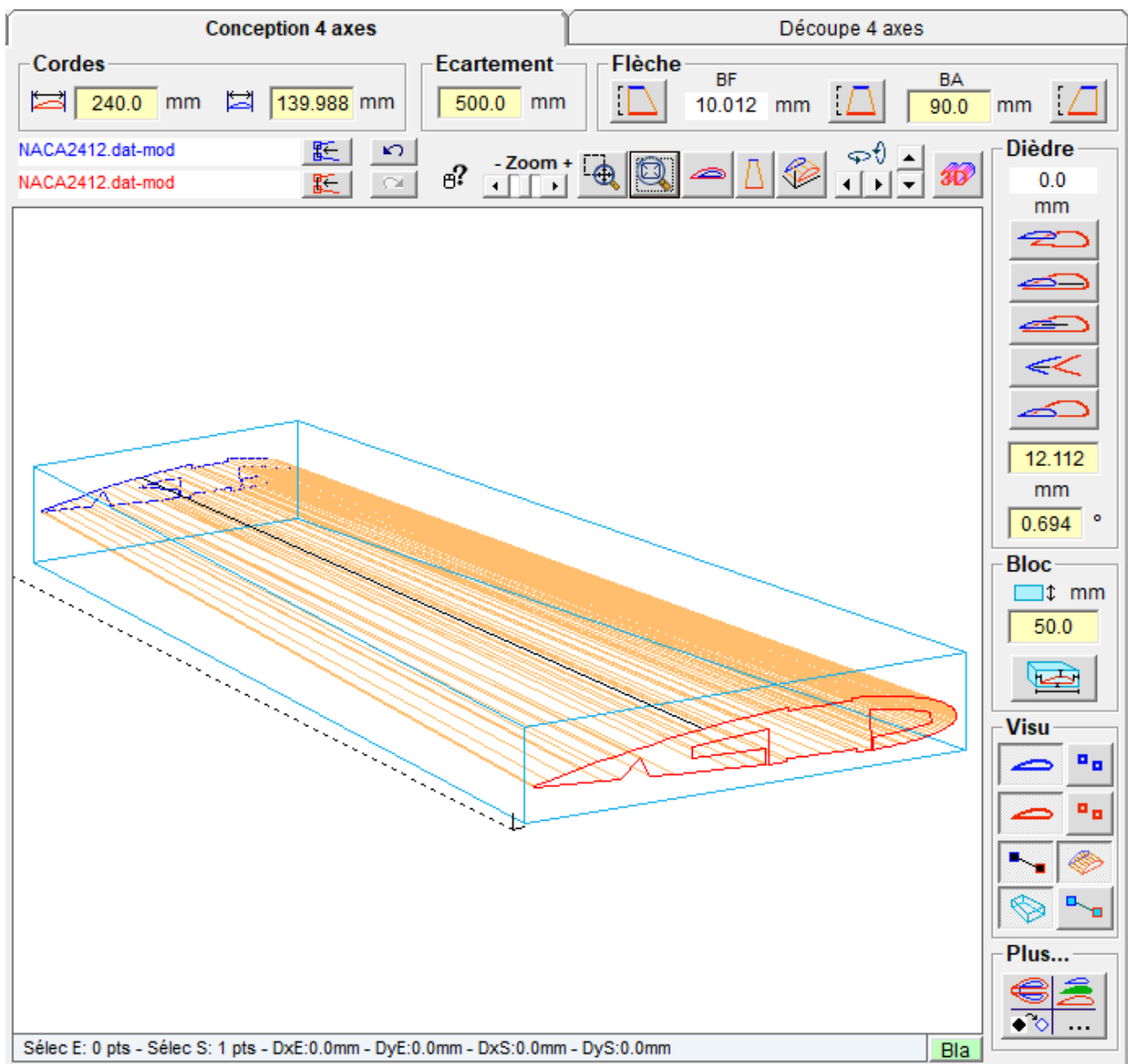


3.2 Principle of 4-axis cutting

The two ends of the wire follow different trajectories. The project must define these two trajectories, their relative position (the swept and the dihedral) and their position in the block of material (the raw material).

This cutting method is mainly used in aeromodelling to make trapezoidal wings. More generally it allows you to make complex conical shapes, the FilChaudNX synchronisation tool allowing you to travel a completely different path at each end of the wire. To obtain a result consistent with the drawing, it is necessary to carefully take into account the radiation as a function of speed variations, which FilChaudNX allows with its variable offset algorithm.

The 4-axis design is done in the tab "4 axis design", the cutting in the "4 axis cutting" tab :

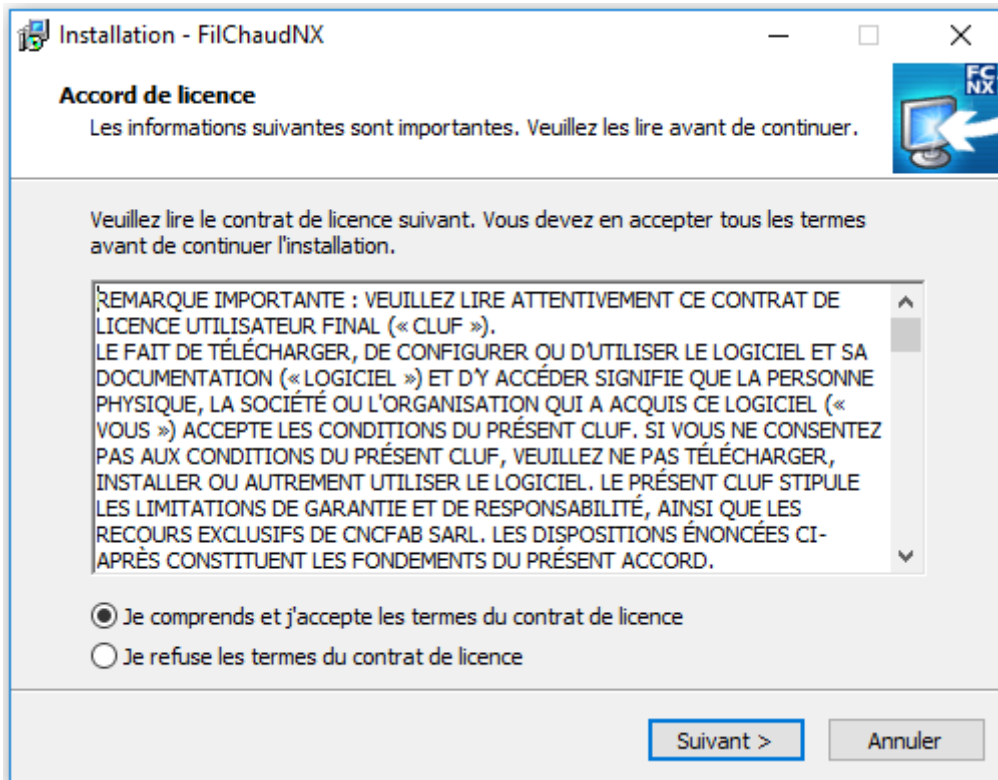


4 Download, installation and licensing

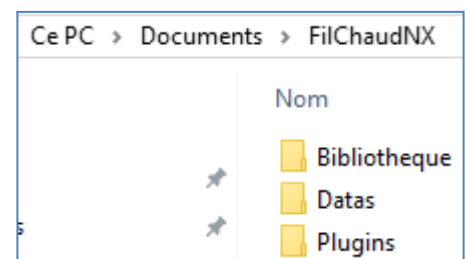
4.1 First installation

Download the complete FilChaudNX installer from the site thefrenchcnchotwireguy.top or from cncfab.renaudiltis.com

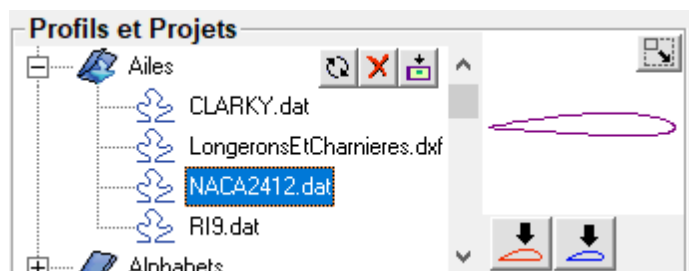
Double-click the executable file to launch the installer. The installation steps are classic:



The installer will create a FilChaudNX folder in the Windows "My Documents" folder, which will contain the following subfolders:

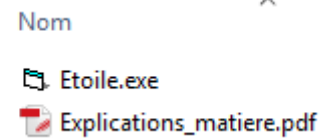
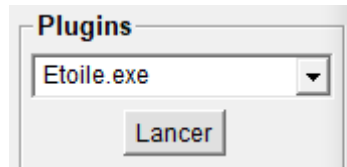


- **Library:** this is the folder in which you must put the profiles and projects to see them appear in the FilChaudNX viewer:



- **Data:** this folder contains the **FilChaudNX.ini** file in which the characteristics of the machines and materials are stored as well as any help files.

- **Plugins:** you can put any executable program or document in this folder. It will appear in a drop-down list and can be launched directly from



FilChaudNX. This allows you to launch additional programs to, for example, automatically create certain profiles. An example of star profile creation software is provided with the installation.

4.2 Known installation issues and solutions

If an error window indicates that the **vb6fr.dll** file has not been found, **copy it from C:\Program Files\FilChaudNX and paste it into C:\Windows\SysWow64** for 64-bit versions of Windows.

On older machines (e.g. XP), you need to ensure that FilChaudNX can communicate with DLL files written in Visual C++ 2008. To do this, you need to install the [Microsoft Visual C++ 2008 \(x86\) Redistributable Package](#).

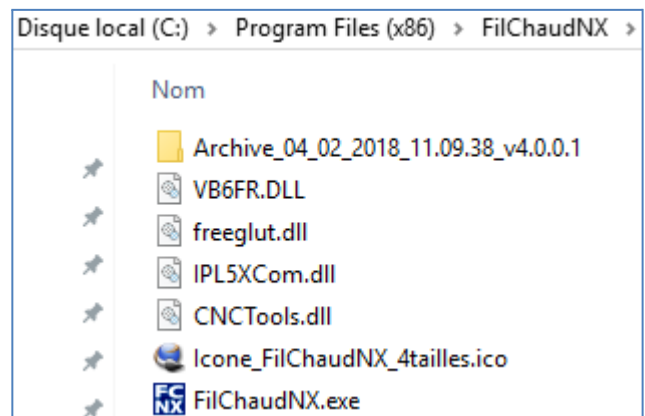
4.3 Update

To perform an update, you must download the FilChaudNX update installer from [thefrenchcnhotwireguy.top](#) or [cnfab.renaudiltis.com](#).

Double-click the executable file to start installing the update. The installer will first create a folder in which it will archive the old version of the FilChaudNX.exe file, with the date, time and version number.

(So if the new version doesn't suit you, it will be easy to go back to the old one.)

It will then copy the new file to the Program Files\FilChaudNX folder.

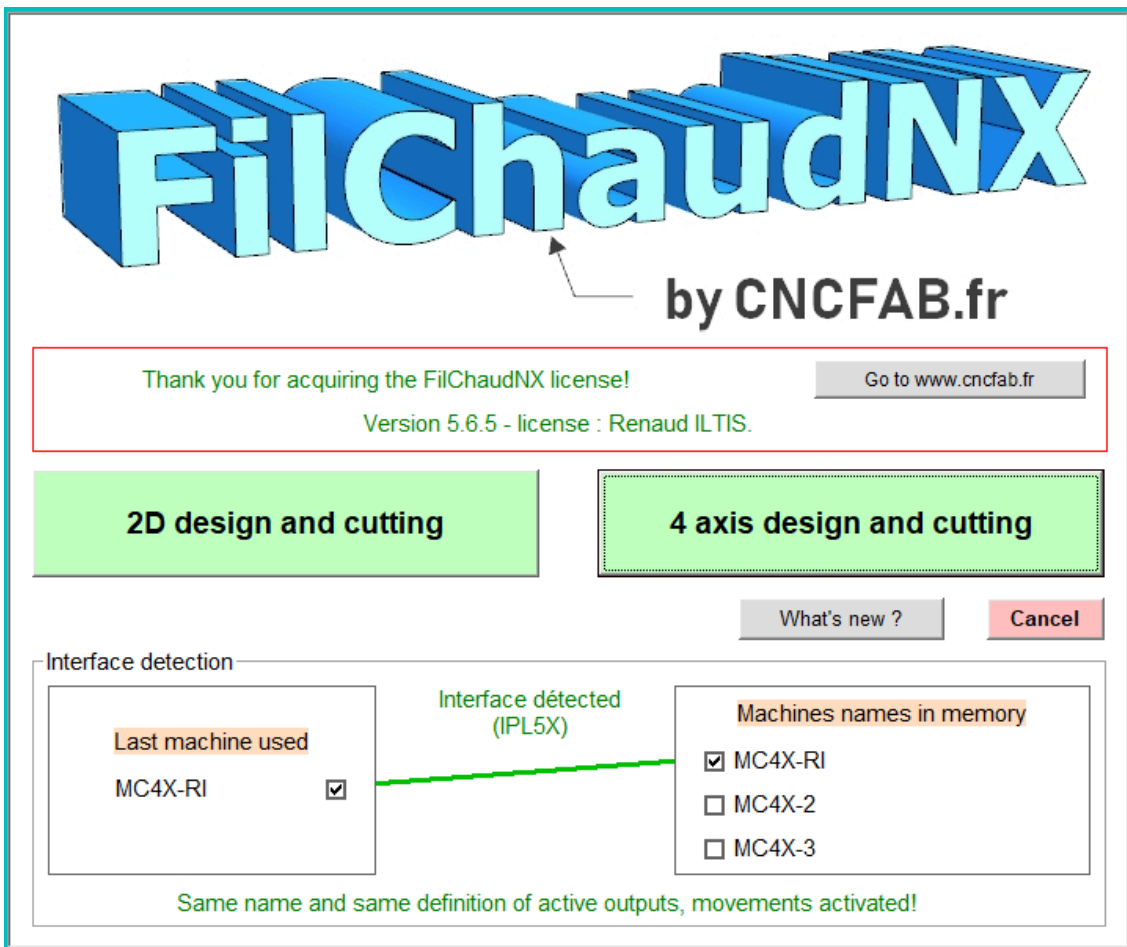


4.4 Licence

The licence is needed to activate the final cutting or Gcode export. It is purchased from CNCFAB (see the websites thefrenchcnchotwireguy.top or cncfab.renaudiltis.com) or is included in the CNCFAB machine kits or the CNCFAB online formations. It is a personal and nominative licence.

5 Opening FilChaudNX

Launch the software with the Windows Start menu, optionally create a shortcut. The “splash-screen” shows up.



The home screen shows you the version number. If there is a licence, it is also displayed. The “What’s new?” button » allows you to see changes since the last version (for example new features).

If an IPL5X-type interface is detected, FilChaudNX searches for a correspondence between the tables contained in the interface's memory and the last table used in the software. If it finds it, it activates cutting, otherwise you will have to go through the settings window to rewrite the table in the interface and thus activate cutting.

With no IPL5X-type interface detected, you can only export the Gcode of the projects.

When the splash-screen appears, a simple press of the Enter key on the keyboard (or a click on OK) launches the display of the 4 axis window. You can also click on the “Cancel” button to exit FilChaudNX.

6 Using 2D design and cutting

The 2D design and cutting window is inherited from my first "FilChaud2D" software.

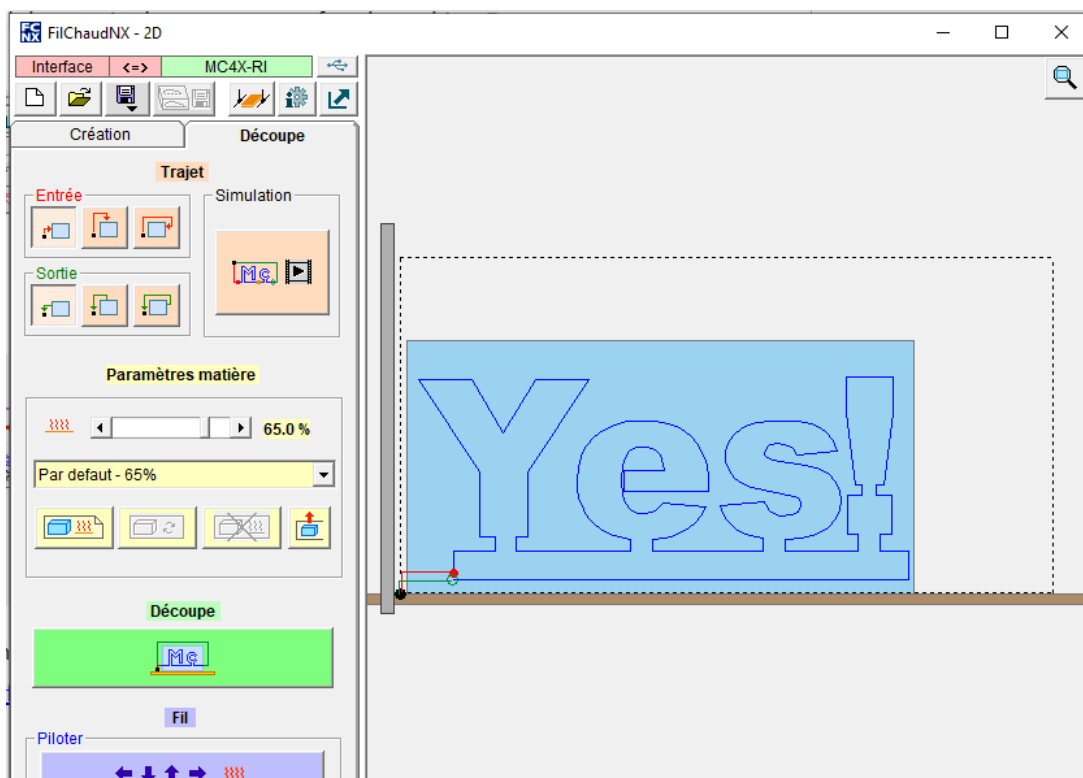
This part of the software is described in a separate manual, so as not to overload the present document.

I invite you to discover later the original features of this part of the software, which is extremely easy to use for lettering or introducing children to digital fabrication.

The basic principle is to set the speed to 4mm/s and the kerf to 1mm. All you have to do is adjust the heating (to obtain a 1mm wide kerf at 4mm/s).

The “Expert” mode allows you to change these values for each cut, but it’s not recommended.

These values can be modified for all the cuts in the parameters of each machine.

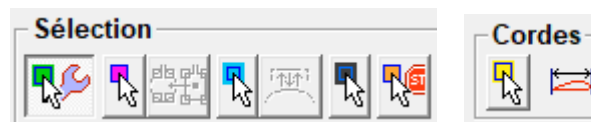


The instructions for use of the 2D window are downloadable from the websites thefrenchcncnotwireguy.top or cncfab.renaudiltis.com.

7 4-axis design

7.1 General principles

- FilChaudNX manages the 2 trajectories of the 2 faces of a cut from the points constituting these trajectories. One of the trajectories is called the Root (in red in the software), the other is called the Tip (in blue in the software). These terms come from aviation and allow a clear designation of each.
- In the rest of this document, we will speak of path to designate a series of segments and project to designate all the parameters of the cutting (the project includes the two paths of Root and Tip, but also the block, the position in the block, margins, etc.). The term profile will be reserved for aircraft/glider wing profiles.
- Any added element (a spar for example) is transformed into points on each face and then we can modify, move, delete, add points. The element that is added is integrated into the list of points. You can undo up to 40 actions to go back.
- For a project to be cut, the 2 trajectories must have the same number of points which correspond to the successive points of passage of the wire.
- Each point can be selected or deselected. There are 6 selection modes which each correspond to a different operation on the project. To switch from one mode to another, click on the buttons representing a mouse pointer:

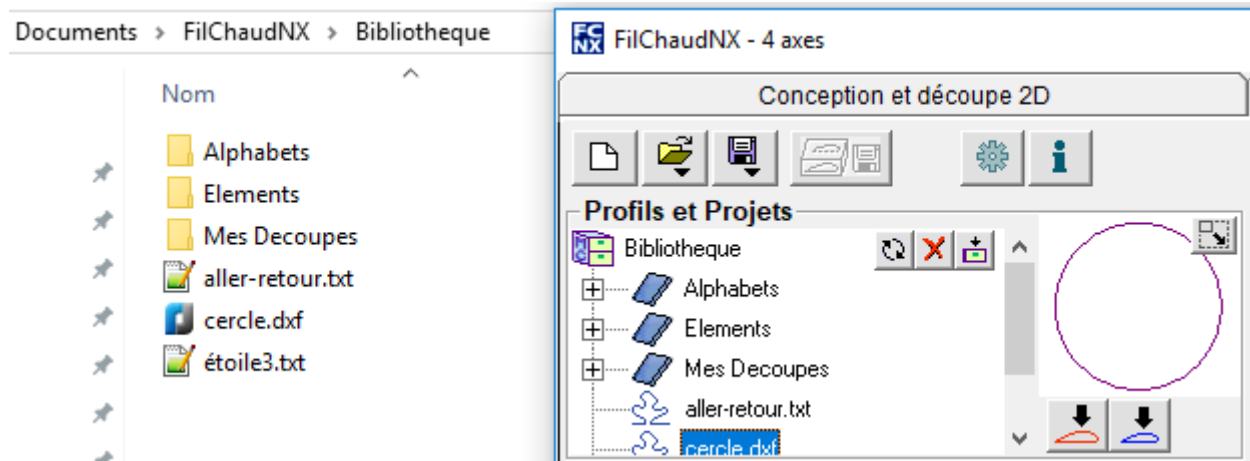


1. The first mode (green) allows you to work on the points: moving, adding, etc.
2. The second mode (purple) allows you to perform an alignment on a virtual point (center of a circle, etc.) or real point (vertex).
3. The third mode (blue) allows you to synchronise the two trajectories.
4. The fourth mode (black) allows you to set junction paths without offset
5. The fifth mode (orange) allows you to add break points (stop and wait while cutting).
6. The sixth mode (yellow) allows you to define – if necessary – the points which are part of the wing profile (which are affected by the values of chord, sag, dihedral, and position in the block).

A point can be selected in one mode and deselected in another mode, this is not a problem, it will change color depending on the mode. (The remainder of this notice will allow you to fully understand this principle.)

7.2 File management and preview

During installation, a “FilChaudNX” folder is created in the “Documents” folder of the PC user. This folder itself contains a “Library” folder (without accent!) whose contents will be scanned and displayed when FilChaudNX is launched in a viewer integrated into the software:



It is therefore advisable to store all your files (profiles and projects) in this library, so they will be easy to browse and use in your projects.

Noticed :It is possible to choose another location for the “FilChaudNX” folder, to do this press the button



7.2.1 Types of profile files

A profiles file is a file that contains trajectories made up of geometric entities (arcs, segments, splines) or points. When there are several paths in a file, FilChaudNX allows you to select the one or those that the user needs.

- **The recommended profile file type for FilChaudNX is DXF.** It is a format that can be produced by a large number of free (Inkscape, Draftsight, Nanocad 5, SketchUp Make, etc.) or paid drawing software (Autocad, Solidworks, etc.).
- FilChaudNX also manages the opening of .dat files (wing profiles) and .plt files (plotter).

FilChaudNX can also open text files (.txt) which follow the structure described below. This feature allows budding programmers to easily create their own profile drawing software for use in FilChaudNX.

Important explanations on .DXF files:

1. The nature of DXF files makes it impossible to guarantee the number of points on a path. If you absolutely must preserve a given number of points, you need to use a .dat or .txt file format (see below).
2. Curved geometric DXF entities are divided into 100 segments by FilChaudNX, whatever their size. So if you have a very large circle, or a very large curve, facets may appear that will be visible when you cut.

The solution is to divide the entity in the CAD software before exporting the DXF. If you divide your circle into 4 arcs, each arc will have 100 segments and you'll end up with a circle of 400 segments. Or use polylines.

(FilChaudNX will automatically weld the entities to obtain a complete path).

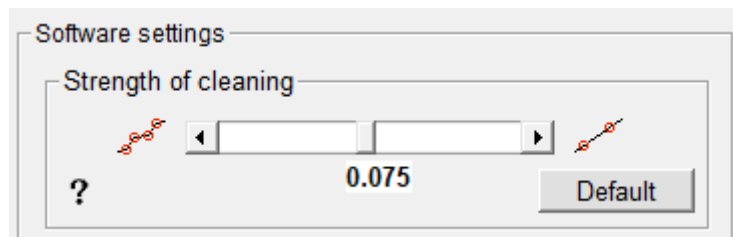
3. For the same reason, a small circle would have 100 segments, making the points very close together. This is not good in hot-wire cutting, as the wire offset algorithm can generate errors when the points are too close together.

To avoid this problem, FilChaudNX has a built-in function to clean up points that are too close together.

The strength of this cleaning can be set in the software settings window :



So if too many points are removed from your DXFs, you need to lower the cleaning force.



The .dat files are standard airfoil format.

FilChaudNX has its own **simple .txt format** :

NameOfPath1 (The line must start with a letter)

x1:y1 (coordinates of the first point of Path1, separated by “:”)

x2:y2 (the decimal separator is the point)

x3:y3

...

NameOfPath2

x1:y1 (coordinates of the first point of Path2)

X2:y2

x3:y3

...

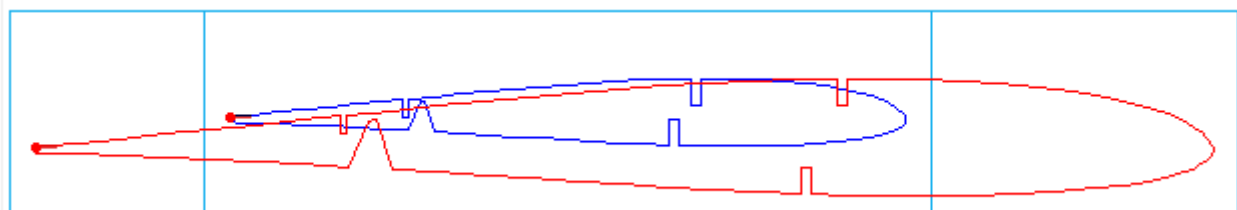
... (a path can be opened, to close it you must put the first point back at the end)


7.2.2 Types of project files

- **Projects saved with FilChaudNX are saved in .fnx format.**
- FilChaudNX also knows how to open .cpx files from Complexes software and .fc files from RP-FC software.

7.2.3 Using the File Viewer

The button at the top right is used to enlarge the file visualisation thumbnail:



When the window is enlarged, the enlargement button changes appearance and allows you to return to the thumbnail 

Here is the description of the other zones and buttons:



1. Tree of files in the "Documents/FilChaudNX/Library" folder, click on the name of a file to select it.
2. Button for refreshing the file tree (if adding a file using Windows Explorer for example).
3. Button for trashing a file (you can always restore it from the Windows trash).
4. Button for importing a file into the library (for example a file located in the Windows Downloads folder).
5. Import button for the selected path, on the red side (Root).
6. Import button for the selected path, on the blue side (Tip).
7. Import button of the selected complete project.

7.3 Creating or importing a project

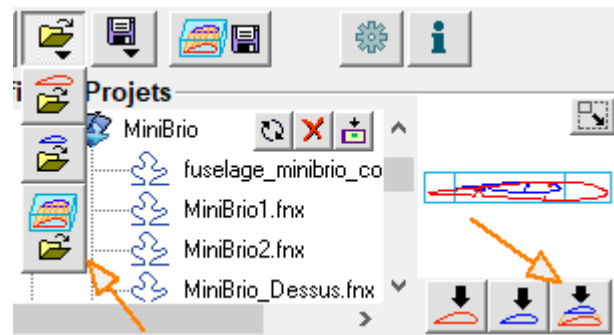
If a project is already displayed on the screen, you must first delete it using the New project button:



Creating a project begins by importing two paths: one on the Root side and one on the Tip side. The names of the files used are displayed above the 3D window:



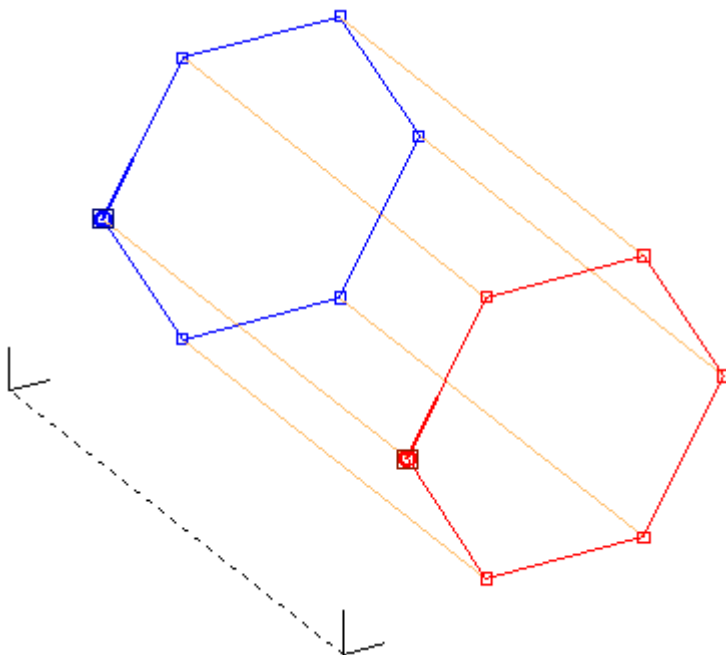
You can also start from an existing project, either by loading it from the viewer with the Import project button, or by using the open project file button if the file is not in the FilChaudNX Library folder:



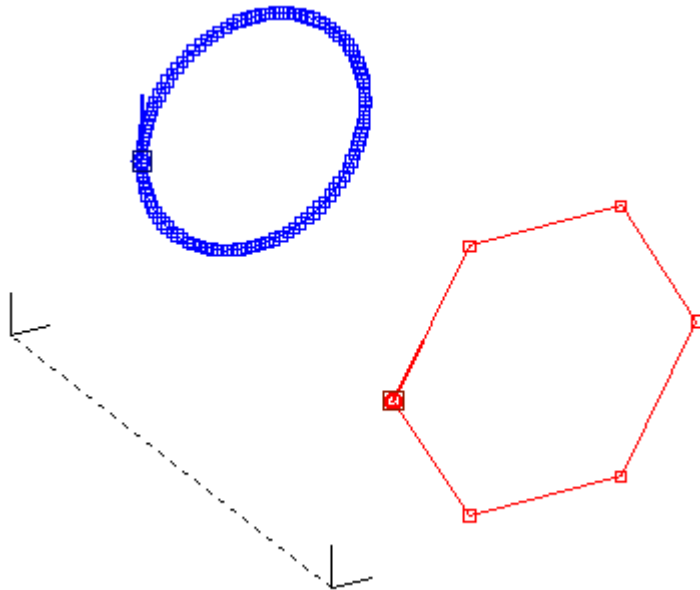
7.3.1 Import a path from a Library file containing a single path

To create a cut, import a path with button 5 or button 6 (after selecting the file in the Library).

The first time this path is duplicated on the other side:

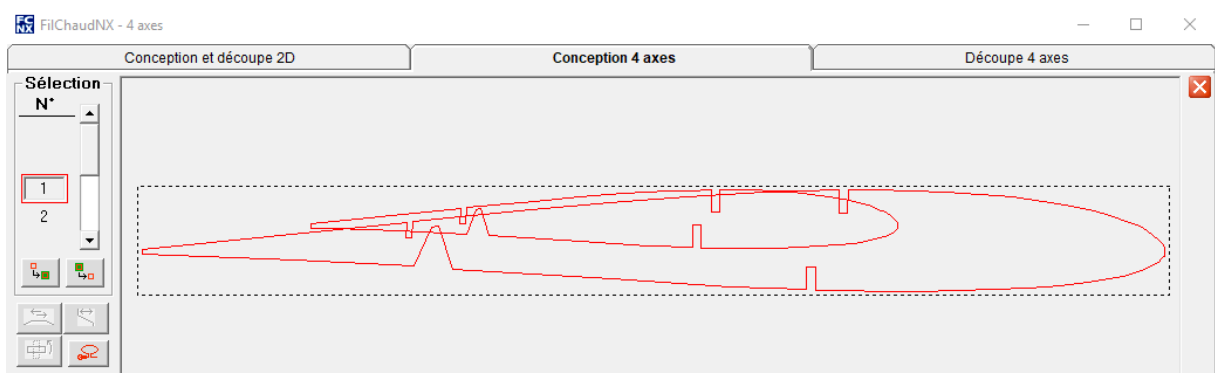


If you want a different path on one side, simply import it with the corresponding button, it will replace the first path. (This operation is reversible with the Undo button.):

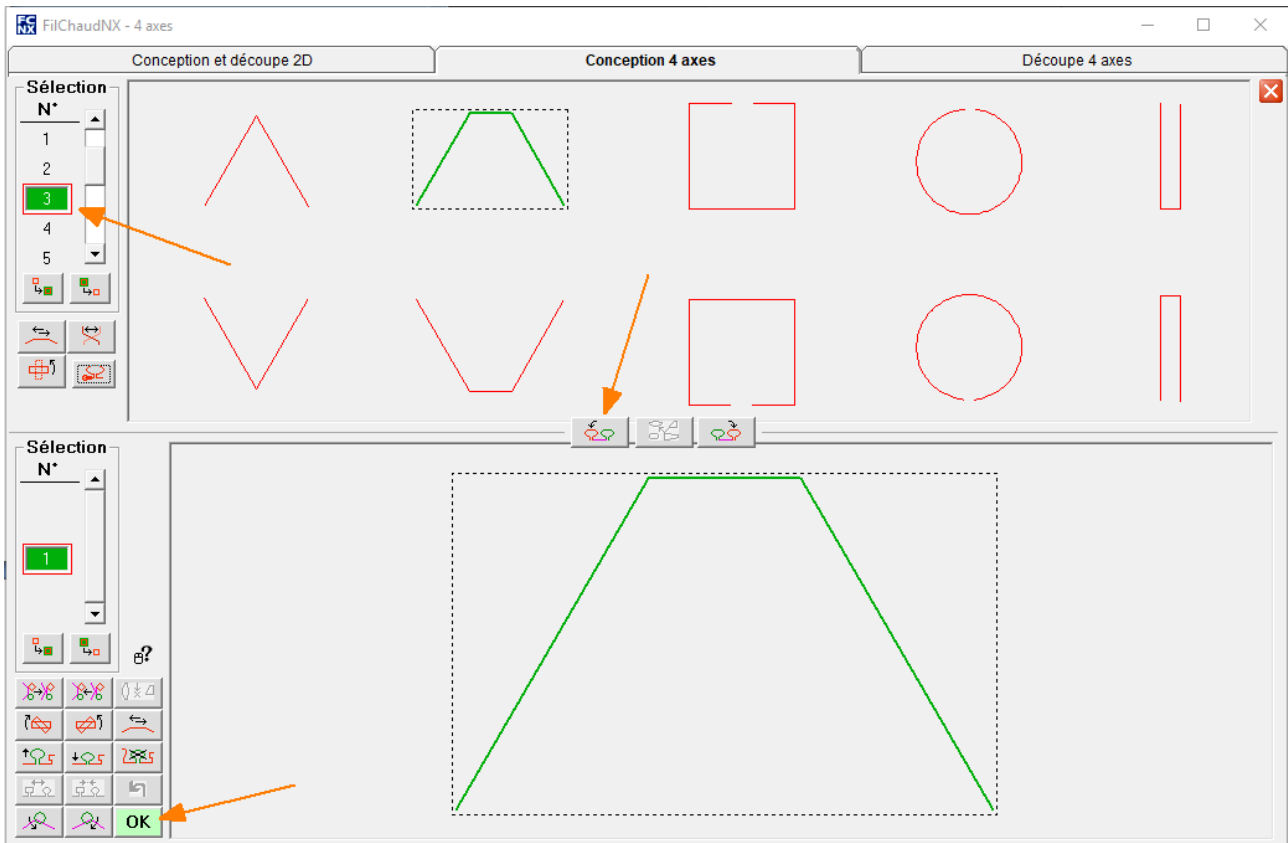


7.3.2 Import a path from a Library file containing several

If you request the import of a path (buttons 5 and 6) from a (selected) file which contains several, a choice window appears. For example, if you import a path from a .fnx file, you will have to say whether you want the Root Path or the Tip path. In the case of a lettering file, you will need to choose the letter(s):



The selection is made by clicking in the counters on the left or in the figure. Then use the transfer buttons to copy the path to the bottom window. This window allows a certain number of path preparation operations or association of several paths. These operations can also be done in the main FilChaudNX window, you will generally simply click on OK to import the path.



Above: selection of path no. 3, then movement in the bottom frame, then validation with OK.

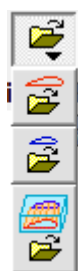
7.3.3 Import a complete project from the Library

Button 7 allows the import of a complete project from .fnx, .cpx or .fc files, selected in the viewer tree.

Please note, the .fnx (FilChaudNX) format will be the most complete.

7.3.4 Import from files not in the Library

The button marked with a small yellow folder provides access to the buttons for importing profiles from any location on the computer:



Import a path on the Tip side

Import a path on the Root side

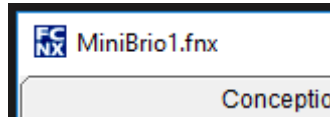
Import a project (.fnx, .cpx, .fc)

7.3.5 Saving the project file

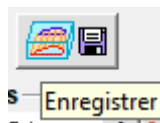
As soon as you have started working on a project, you must save it as a .fnx file using the Save Project button:



Once the project has been saved, its name appears in the title of the FilChaudNX window:

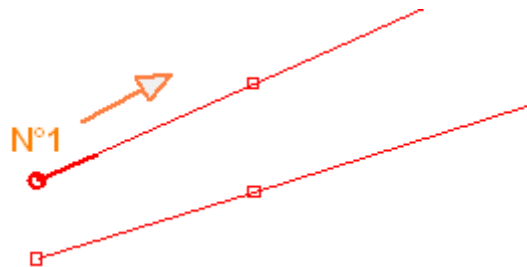


You can then make regular backups by clicking on the Save button or with the keyboard shortcut Ctrl+S:

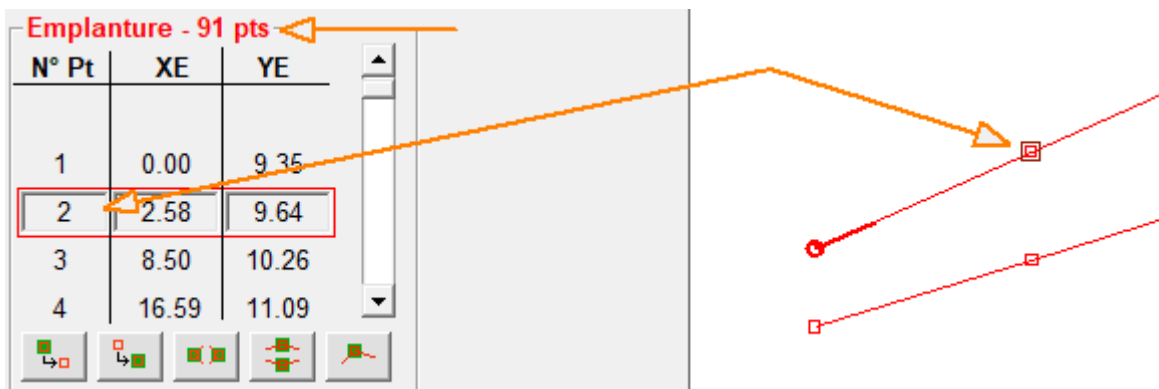


7.3.6 Points (numbering, coordinates), direction, and closure of a path

The first point of a path is represented by a thick line circle. This circle is provided with a thick line segment which represents the direction in which the movement will take place:



Each point on a path is numbered. The first point is #1. The counters located on the left of the figure give the total number of points and frame the number of the current point which is represented by a black square on the 3D view.

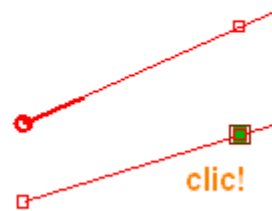


The counters (one for the Root, one for the Tip) also display the X and Y coordinates of each point (in mm).

To put a counter on a given point, you can use the counter scroll bar, or click on the point in 3D view (which is often faster). In this case, the point is selected at the same time and you will have to click a second time to deselect it (see below):

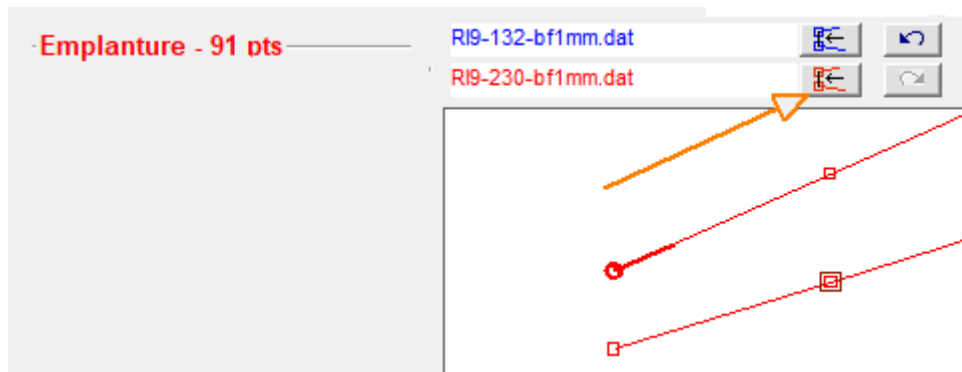
Emplature - 91 pts

N° Pt	XE	YE
88	16.63	7.75
89	8.55	8.04
90	2.59	8.24
91	0.00	8.35



If we import a path which is not closed (that is to say the first point and the last point are not overlaid), we can ask the software to close it by clicking on the button located to the right of the file name :

Example below with a wing profile whose trailing edge has been thickened by spreading the curves:



After pressing the button, point no. 92 was created, identical to point no. 1:

Emplature - 92 pts

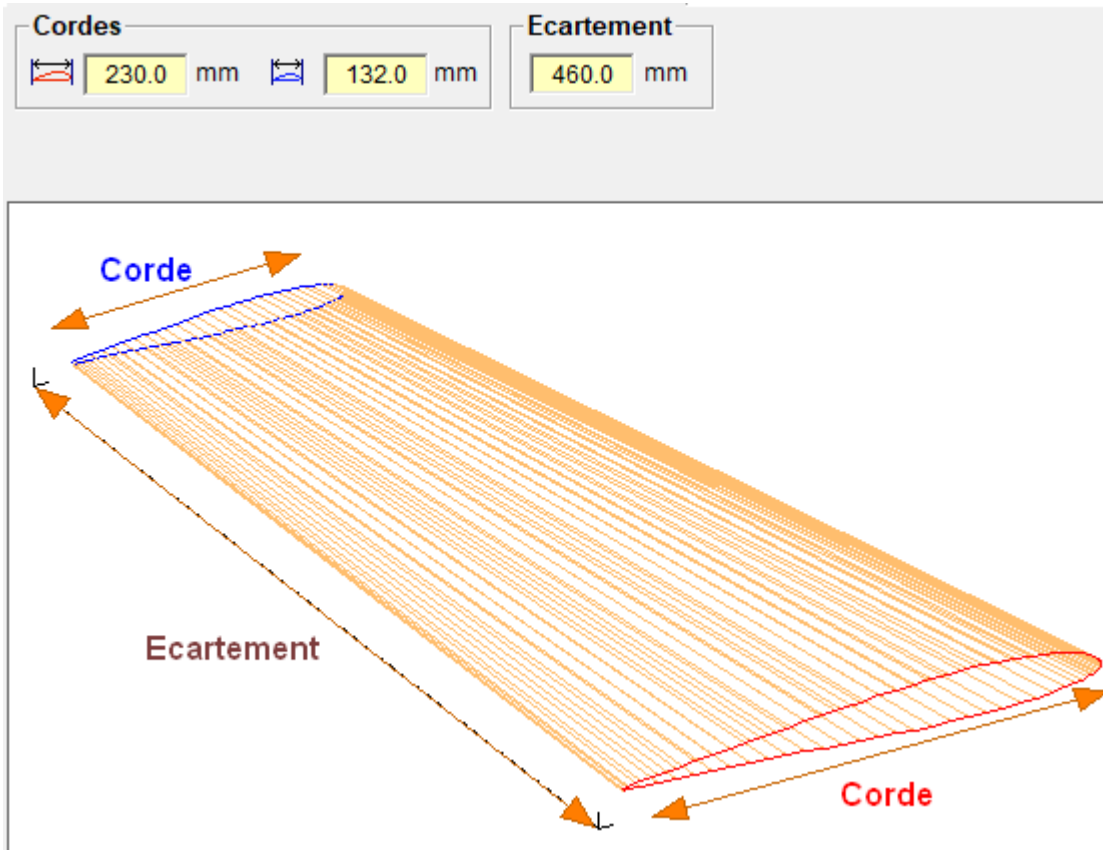
N° Pt	XE	YE
90	2.59	8.24
91	0.00	8.35
92	0.00	9.35

In the case of wing cutting it is important to close the paths (or profiles) to have a clear delineation of the trailing edge.

7.3.7 Chords, swept, dihedral, spacing

Once the paths have been imported, you must first check their dimensions using the Chords frame which gives the horizontal dimension (X axis) of the two paths.

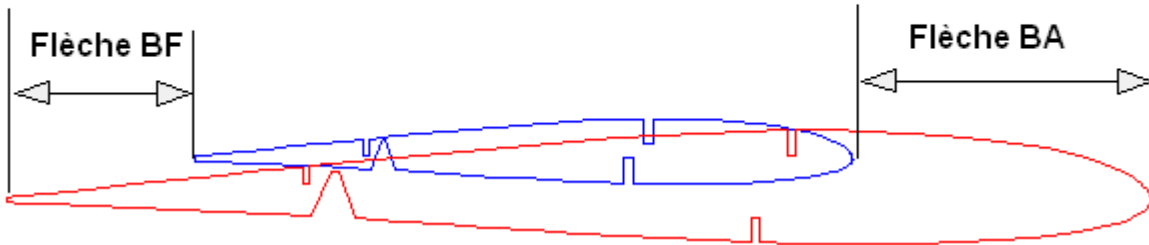
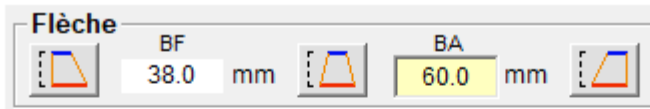
Modify the values if necessary (especially in the case of .dat files).



The Spacing frame gives the distance between the Root face and the Tip face. For a wing, this is the length of the wing panel.

Tip: it is sometimes interesting to keep a small Spacing value while working on the paths, to more easily visualise the entire project, and to only put the final value at the end, just before cutting .

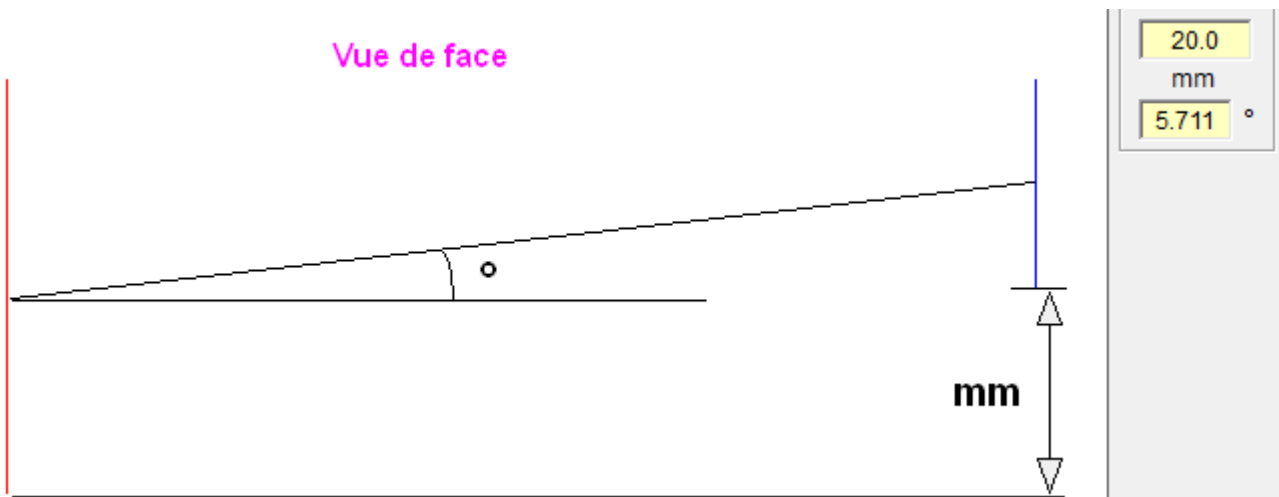
The swept frame allows you to give the horizontal position of one side in relation to the other. Only the BA (LE) value can be changed, the BF (TE) value is automatically recalculated:



The three buttons automatically give the extreme values or the average value.

The dihedral frame allows you to give the vertical position of one side in relation to the other.

- The value in mm corresponds to the distance from the underside of the profiles (in aeromodelling, this is the wedge to put under the tip).
- The value in degrees (°) corresponds to the angle made by the midpoints of the paths, relative to the horizontal (in aeromodelling, it is the dihedral in degrees), see the image below:



The 5 buttons have the following meanings:

- | | |
|--|--|
| | 1. Align the extrados (the top) |
| | 2. Align the leading edges (rightmost point) |
| | 3. Align the middles |
| | 4. Align trailing edges (leftmost point) |
| | 5. Align the intrados (bottom) |

7.3.8 Alignment of virtual or real points (center of circle, vertex, etc.)

Selection mode for alignment (see 7.1) allows you to align the Root and the Tip on virtual or real points:



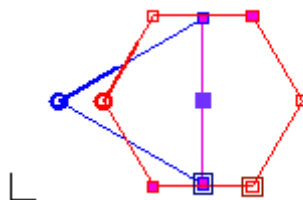
Simply select one or more points to see the center of gravity of the selected points appear on the figure:

Saumon - 4 pts		
N° Pt	XS	YS
1	100.32	209.17
2	143.74	234.25
3	143.74	184.10
4	100.32	209.17

Emplature - 7 pts		
N° Pt	XE	YE
3	70.00	194.71
4	85.00	168.73
5	70.00	142.75
6	40.00	142.75

Control panels:
Déplacer: X: 0.0 mm, Y: 0.0 mm
Etirer: X: 100.0 %, Y: 100.0 %
Tourner: 0.0 °
Décaler: 0.0 mm

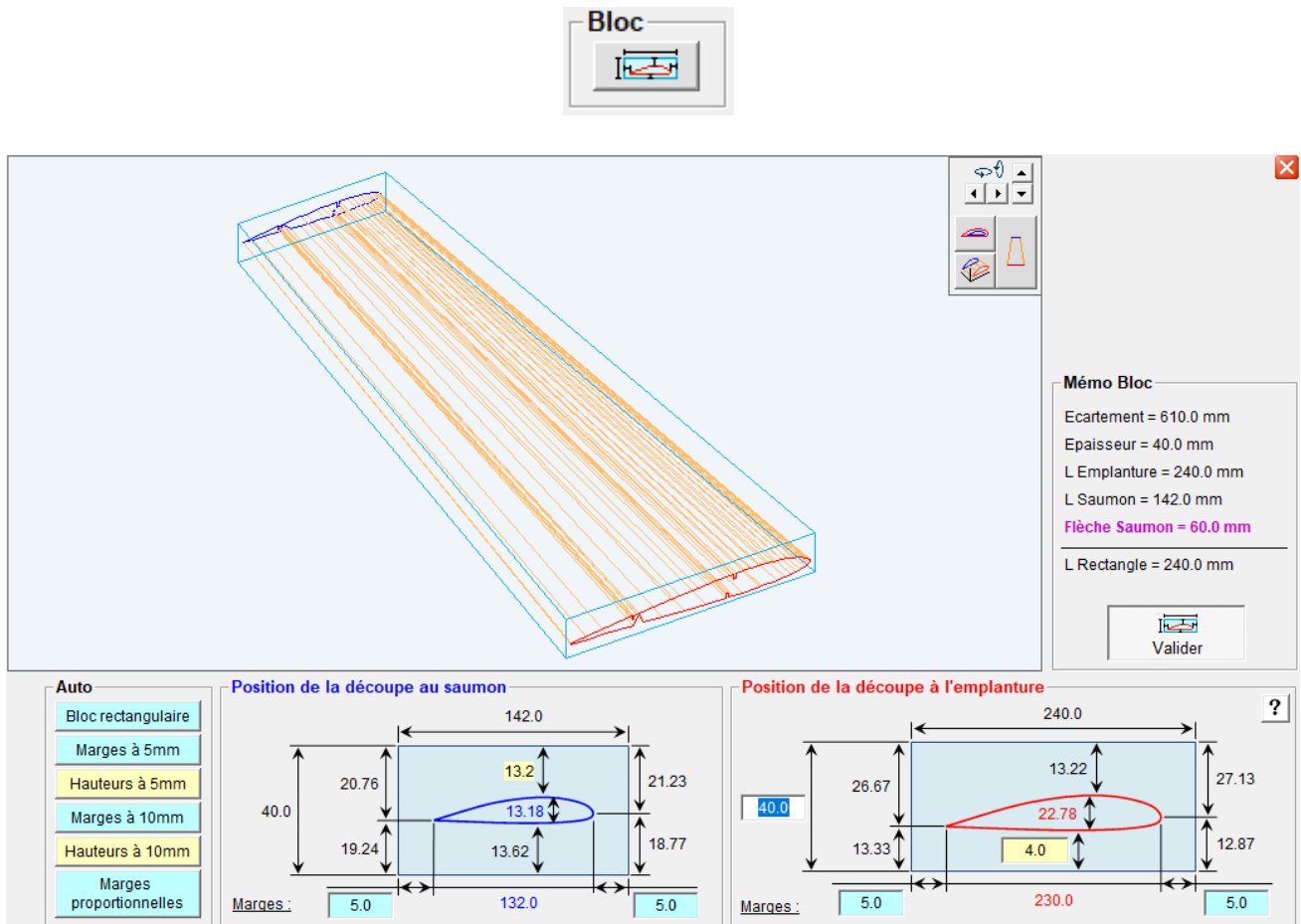
Then simply click on the alignment button to make the centers of gravity coincide:



This tool is particularly useful when making fuselages from couples. (The entire path is moving, the tool can't be applied on only some points)

7.3.9 Block dimensions (raw)

The Block frame button gives access to the complete block definition window:



The only values that can be modified are the margins, the thickness of the block and the vertical position of the project in the block. All other values are recalculated from these elements.

For example, if you want to use a block whose dimensions you already have, you have to play with the margin values to obtain the desired dimensions.

The buttons in the "Auto" frame allow horizontal (light blue buttons) and vertical (yellow buttons) adjustment of the block in relation to the project.

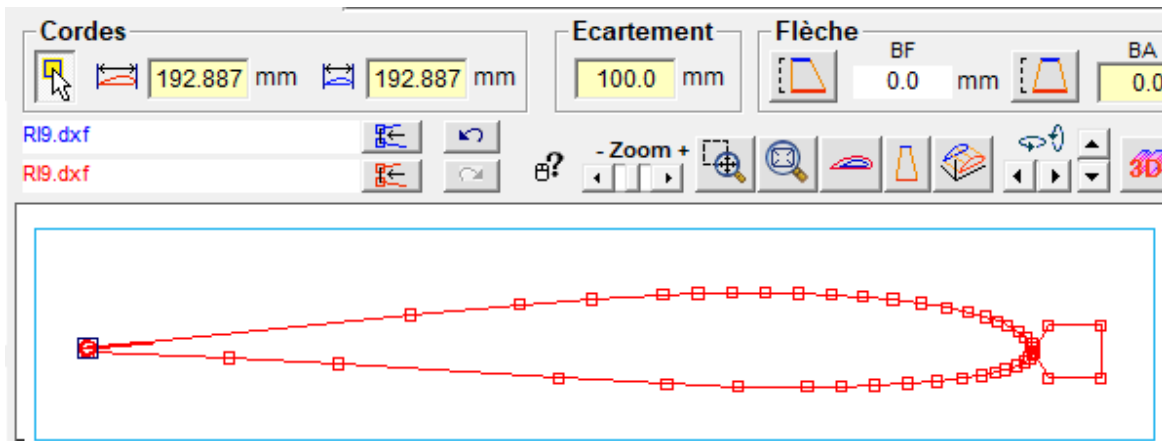
Please note, the drawings of the two bottom frames (with the dimensions) do not change when you change projects, they are simply explanatory diagrams. Only the numerical values change.

Please note, as the dimensions of the block depend on the dimensions of the project, the complete definition of the block must be checked just before cutting.

Once the block has been defined, pressing the button in the Validate frame allows you to return to the 4-axis design window.

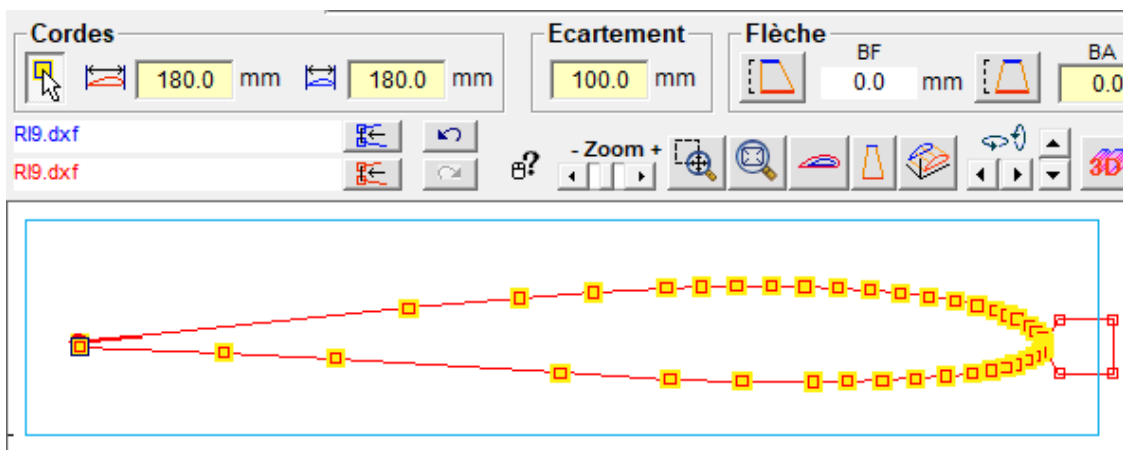
7.4 Paths that go outside the main block or profile

When using paths that go outside the main block or profile, the deflection, dihedral and block margin values may become false. To avoid this, we use the 6th selection mode which allows us to define the points which are part of the profile (selected in yellow) and those which are not part of it (not selected). Example below with the creation of an X exit at the leading edge of a 180mm chord wing with block margin at 10mm.

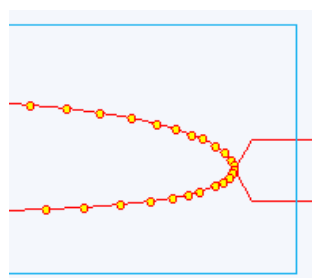


We see that the length of the exit at the leading edge (12.887mm) has been added to the chord and that the margin of the block has been added again on top.

By selecting the profile in yellow, we correct this:



If defined, the yellow dots are also visible in the block definition window:



7.5 visualisation tools

7.5.1 Zoom, move and rotate the view

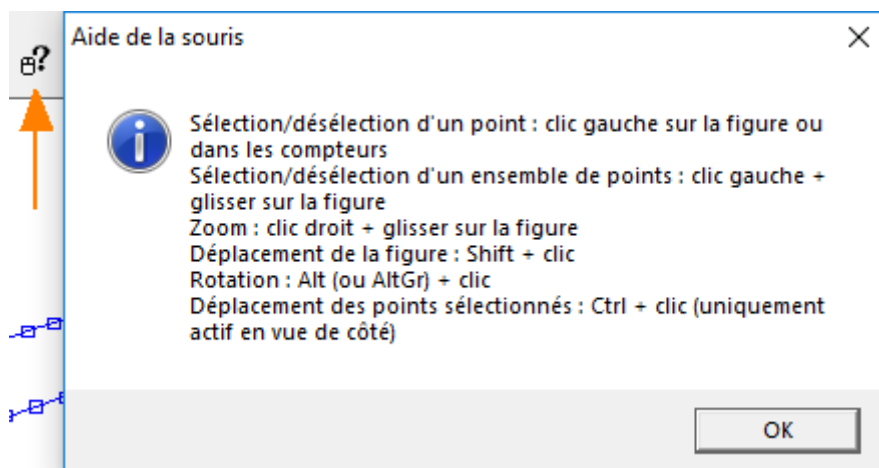
The toolbar located above the 3D view allows the following operations:



1. Enlarge or shrink the current view
2. Make a zoom window on a particular location with the left mouse button
3. Fit project to window (resets zoom)
4. Side view (from the Root face)
5. Top view
6. Perspective view
7. 3D view rotations
8. Displaying a 3D view with surfaces

Moving the figure is only possible with the mouse (see below) by pressing the Shift key (= Shift) at the same time.

Some operations can be performed with the mouse buttons associated with the keyboard buttons. Click on the mouse help icon to display the list:



Note: pressing the Ctrl key before left clicking + dragging with the mouse allows you to move the selected points (the software automatically switches to side view).

It's a useful feature in a lot of situations.

7.5.2 Segments, points, wire, block, surfaces

The Visu frame located on the right allows you to hide/display certain elements to facilitate work on the figure:



1. Show/hide segments on the Tip side
2. Show/hide points on the Tip side
3. Show/hide segments on the Root side
4. Show/hide points on the Root side
5. Show/hide the wire (see further)
6. Show/hide surfaces (the same number of points is required on both sides)
7. Show/hide the material block (defined in the Block window, see later)
8. Show/hide the travel direction of all segments

7.6 Point selection methods

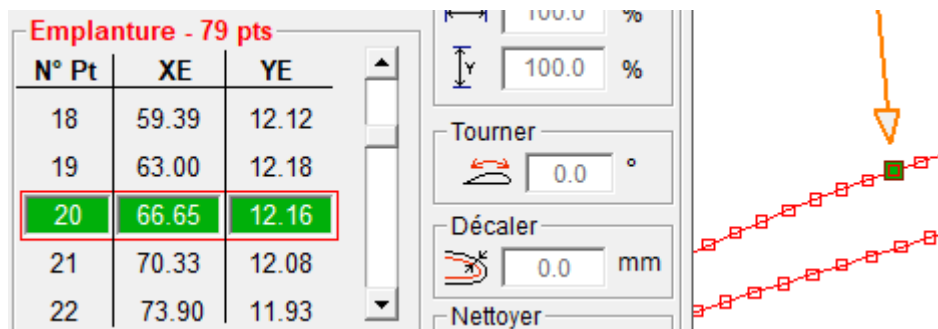
These methods are valid regardless of the selection mode in which we find ourselves (see 7.1).

Choosing a point with the mouse toggles its state : a point that is not selected is selected and a point that is selected becomes unselected.

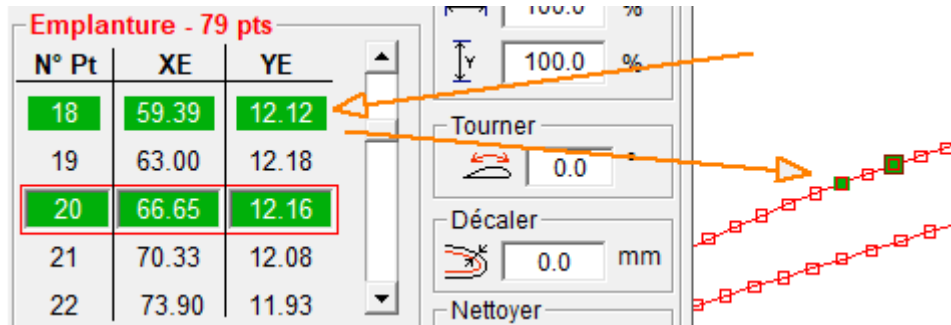
A selected point appears colored in the 3D view and in the counter (the color changes depending on the selection mode, see 7.1).

To select/deselect a single point, you can

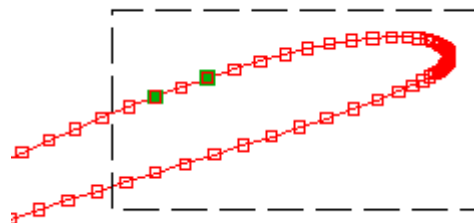
- Click on it in the 3D view which moves the counter which is placed on this point:



- Click on it in the counters:



To select/deselect a group of points, draw a box around it with the mouse and left click + drag:



In the example above, the two points already selected become unselected. All other points in the frame become selected.

Furthermore, the counters each have 5 automatic point selection buttons which each work only for the counter considered:



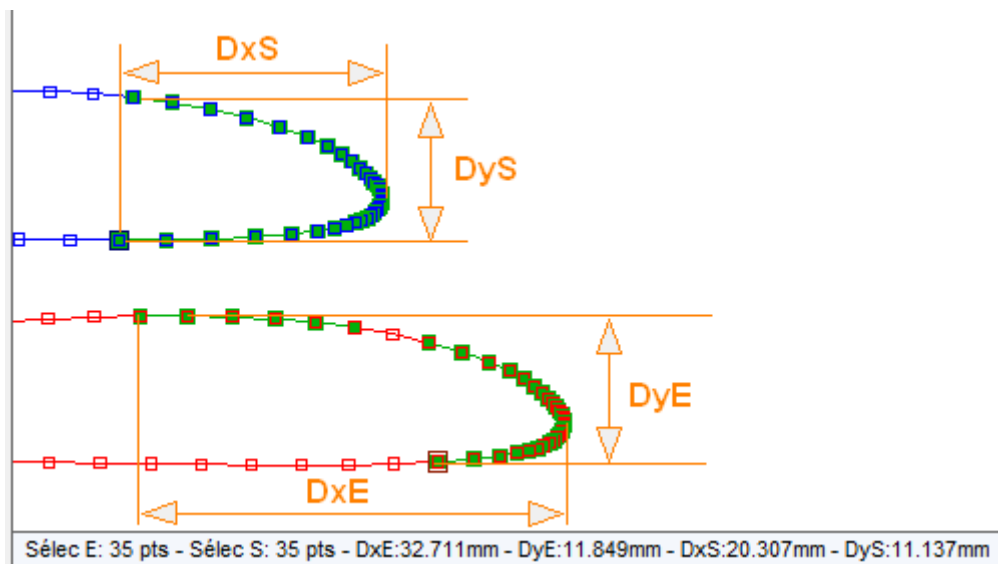
1. Deselect all counter points
2. Select all counter points
3. Select the leftmost point and the rightmost point (Xmin and Xmax) of the counter
4. Select the topmost point and bottommost point (Ymin and Ymax) of the counter
5. Select all points that are vertices of an angle greater than 30° in this counter

There are also two keyboard shortcuts that affect the entire project:

- The Escape (or Esc) key deselects all points in the project
- The Ctrl+A combination selects all points of the project

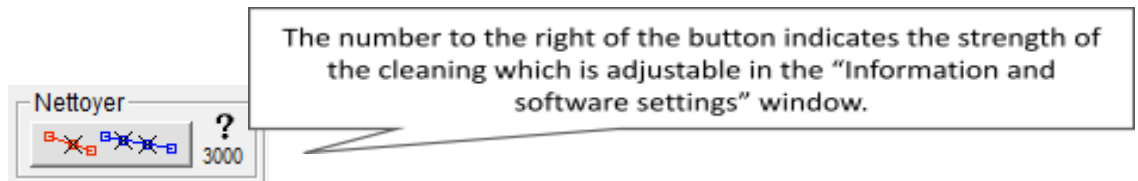
7.7 Number of points and size of the selection

The status bar at the bottom of the representation window gives the number of points selected and the horizontal and vertical dimensions of the selections:



7.8 Cleaning tool (very important!)

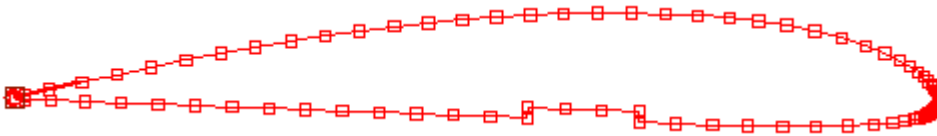
The Clean button will remove double points and any points that are “almost” aligned:



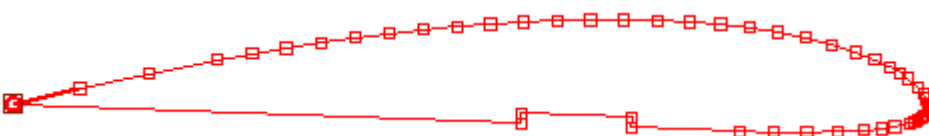
It is very important to clean the paths before starting a cut because the aligned points are of no use and can create problems calculating the wire offset when switching to the cutting tab, especially when you have a large number of points .

Please note, cleaning should only be applied once the paths are of the final dimensions (with the correct ropes).

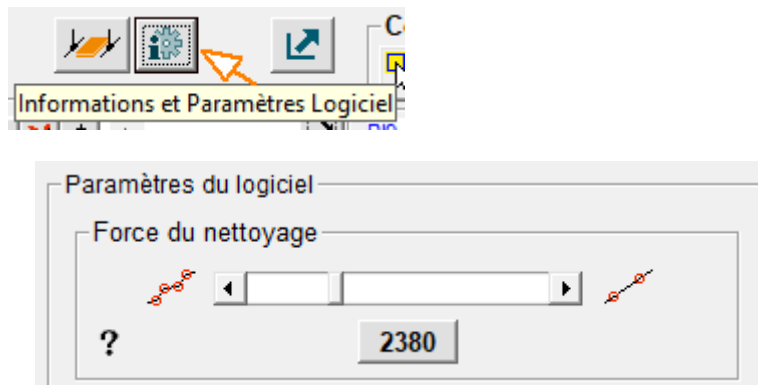
Before cleaning, 81 points:



After cleaning, 53 points:



Cleaning is automatically applied to DXF files when opened (because these are files which can generate a lot of unnecessary points). If the cleaning has removed too many points, you can modify its strength by clicking on the button accessing the “Information and software parameters” window:

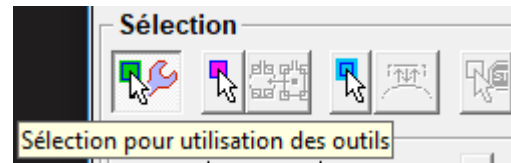


The button text indicates the current cleaning force value. Pressing the button returns to the default value.

7.9 Editing tools

Once the paths have been imported, FilChaudNX has tools allowing you to modify the project: addition or deletion of points, movements, rotations, offset (formwork), addition of stringers, recesses, etc.

For the modification tools to be active, the Selection button for using the tools must be pressed in the “Selection” frame:



7.9.1 Undo / redo (Undo / redo):



During modifications, FilChaudNX memorizes the successive states of the project which allows you to go back by clicking on the Undo button or using the keyboard shortcut Ctrl+Z.

FilChaudNX memorizes up to 40 successive states. The Undo and Redo buttons allow you to go from one state to another.

7.9.2 Tools that work without a selected point

When no points are selected, 4 tool buttons are active. They then apply to the entire project:



1. Vertical symmetry (of horizontal axis).
2. Horizontal symmetry (vertical axis), useful especially after importing a .cpx project whose X axis is inverted.
3. Reversal of direction: if the wire travels in the wrong direction.
4. Swap the root and tip profiles (mirrors the entire wing)
5. Change the first point: to apply this tool, you must first scroll through the counters to put the new first points in the central frames of the counters (in the 3D figure, it is the black square).

Example for tool 5, before applying :

Saumon - 7 pts

N° Pt	XS	YS
3	366.38	133.18
4	336.38	133.18
5	321.38	159.16
6	336.38	185.14
7	366.38	185.14

Emplantation - 4 pts

N° Pt	XE	YE
1	373.09	184.23
2	373.09	134.09
3	329.67	159.16
4	373.09	184.23

Toolbar: Etirer (100.0%), Tourner (0.0°), Décaler (0.0 mm). Diagram: Blue polygon with 7 points, red triangle with 3 points. Orange arrows indicate mapping from table to diagram.

After applying, points n°5 and n°3 became points n°1:

Saumon - 7 pts

N° Pt	XS	YS
1	321.38	159.16
2	336.38	185.14
3	366.38	185.14

Emplantation - 4 pts

N° Pt	XE	YE
1	329.67	159.16
2	373.09	184.23
3	373.09	134.09

Toolbar: Etirer (100.0%), Tourner (0.0°), Décaler (0.0 mm), Nettoyer. Diagram: Blue polygon with 7 points, red triangle with 3 points. Orange arrows indicate mapping from table to diagram.

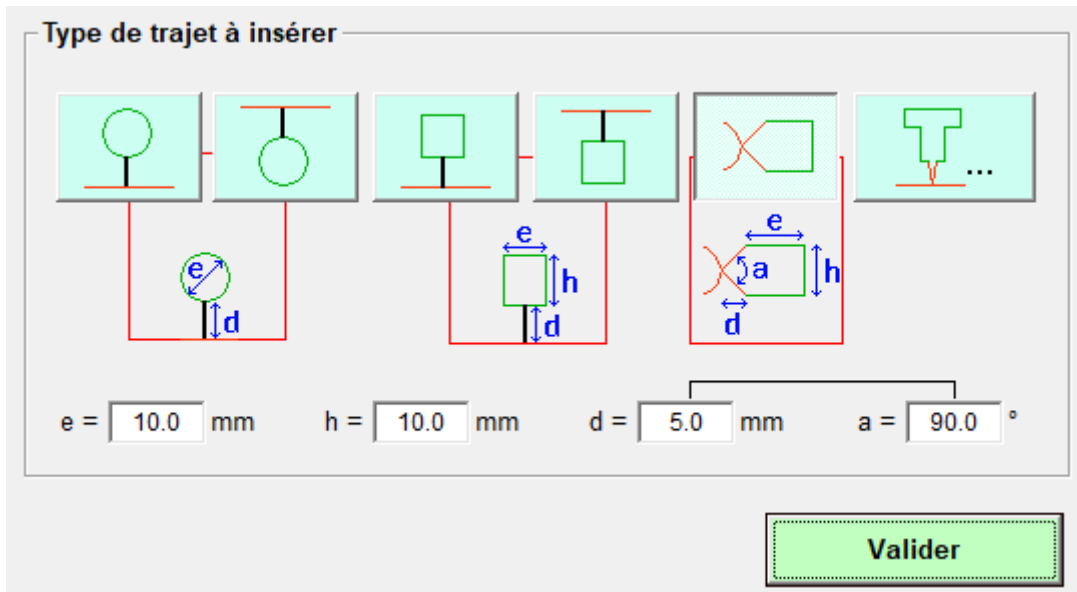
7.9.3 Tools that work on a selection of points

7.9.4

7.9.4.1 Spar or freeform insertion:



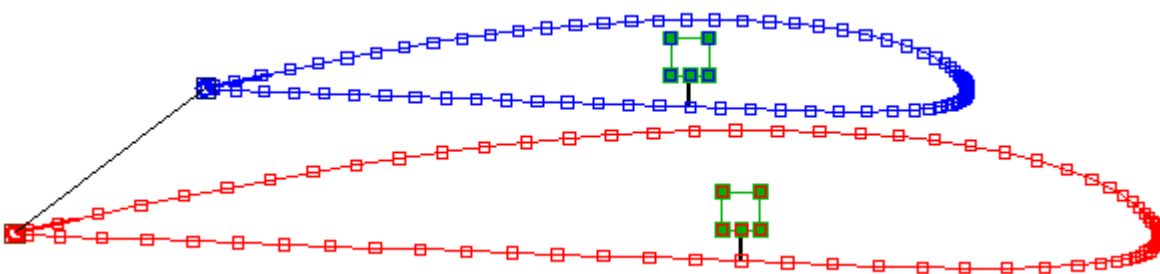
This tool activates when a point is selected on either side. It opens a window for choosing the shape to insert:



You must click on the shape button, give its dimensions in the bottom frames and click on Validate.

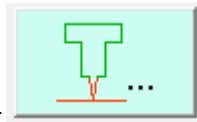
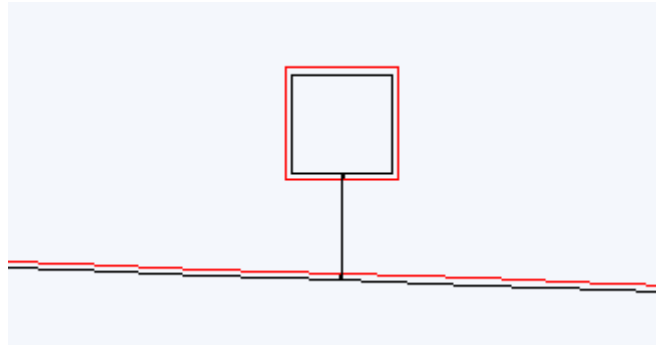
Selecting the 5th shape (exit at the leading edge in X) brings up the box allowing you to enter the angle (the values d and a are linked, if you change one, it modifies the other).

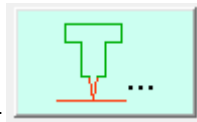
The inserted shape is automatically selected and can be moved using the mouse (left button) while holding down the Ctrl key (see 7.4.1).

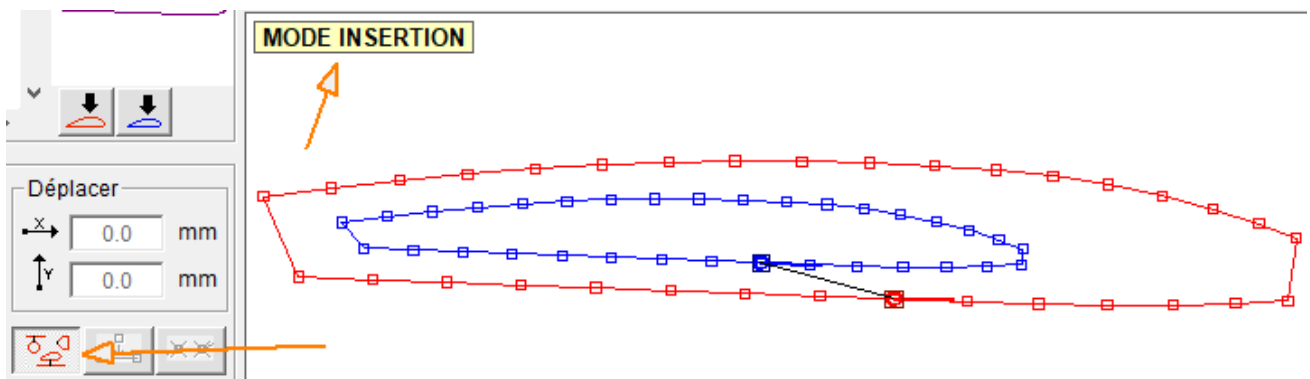


The segment connecting the inserted shape to the initial shape appears in thick black, which means that it is a joining path which will not be offset during cutting (the wire will pass in the same place

on the way out and back, see the dedicated selection mode later in the instructions). We can also see the absence of offset in the visualisation of the cut:

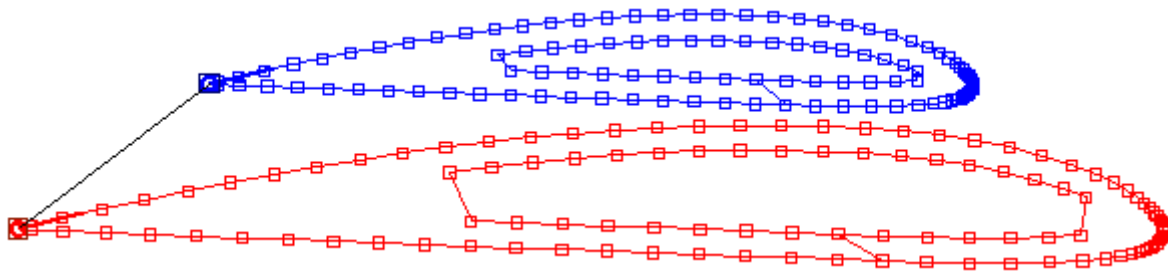


The 6th button -  - allows you to open an empty FilChaudNX window in insert mode, which allows you to create a personalised path to insert into the initial project.



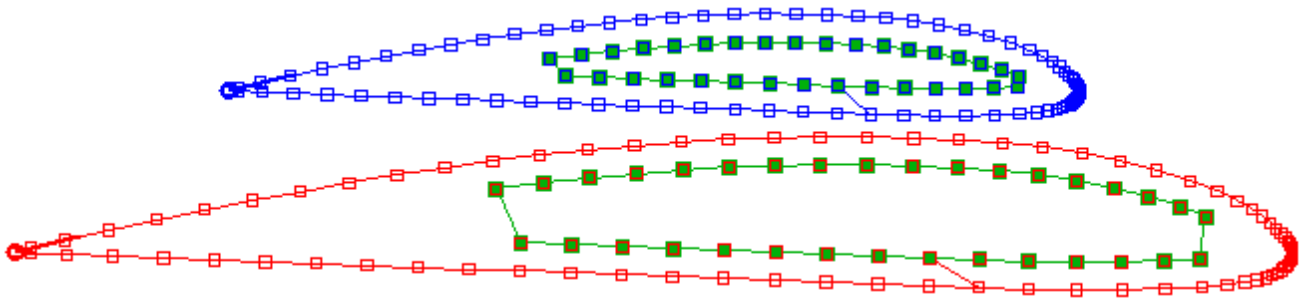
Noticed :for a recess as above/below, you must reverse the direction of rotation and change the first point.

Simply click again on the insert button to finalize the operation:

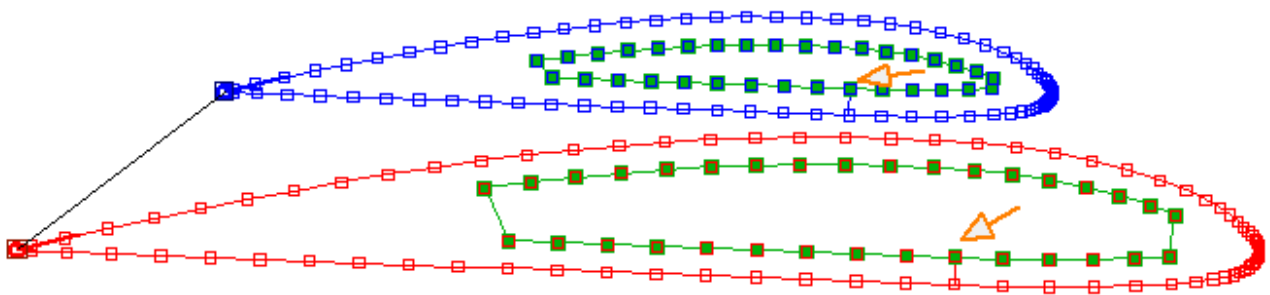


7.9.4.2 Partial renumbering:

The total renumbering has already been presented to the 7.8.2, but we can also renumber just part of the project. In the example above, we see that the first point of the recess would have to be changed. To do this, we select the sequence of points to be renumbered and we put the counters on the one which should become the first point of this selection:



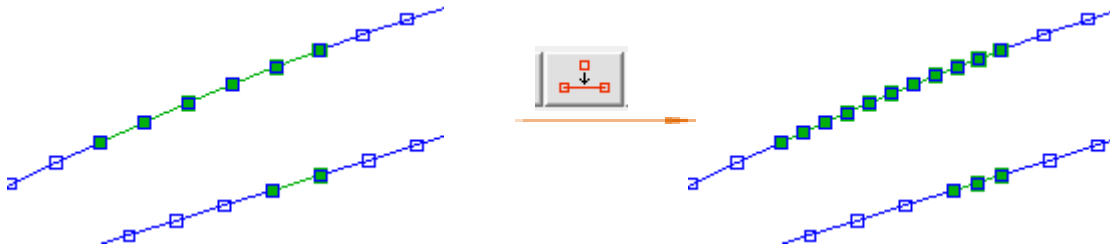
After pressing the renumbering button, the first point of the selection has changed:



7.9.4.3 Point insertion:



When pressing this button, a point will be inserted in the middle of any selected segment:



7.9.4.4 Point deletion:



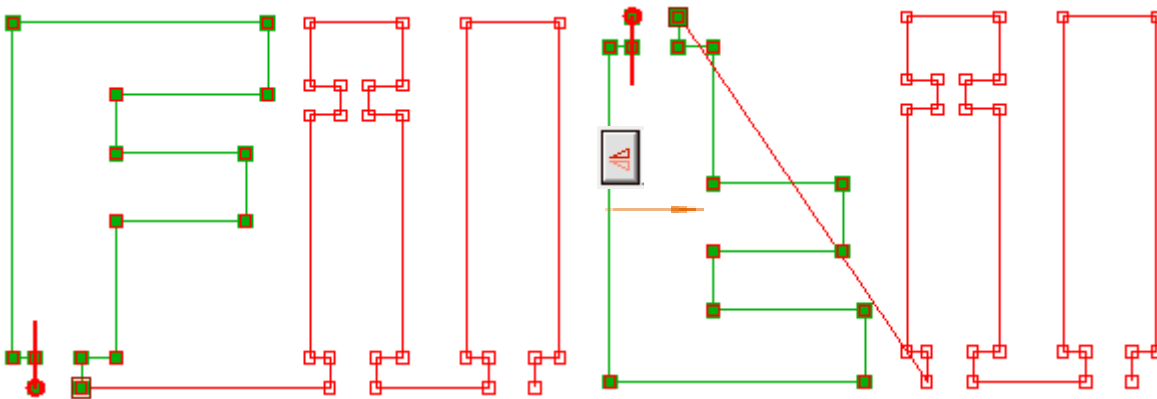
When pressing this button, all selected points will be deleted.

Noticed :pressing the Del key on the keyboard produces the same effect.

7.9.4.5 Horizontal axis symmetries:



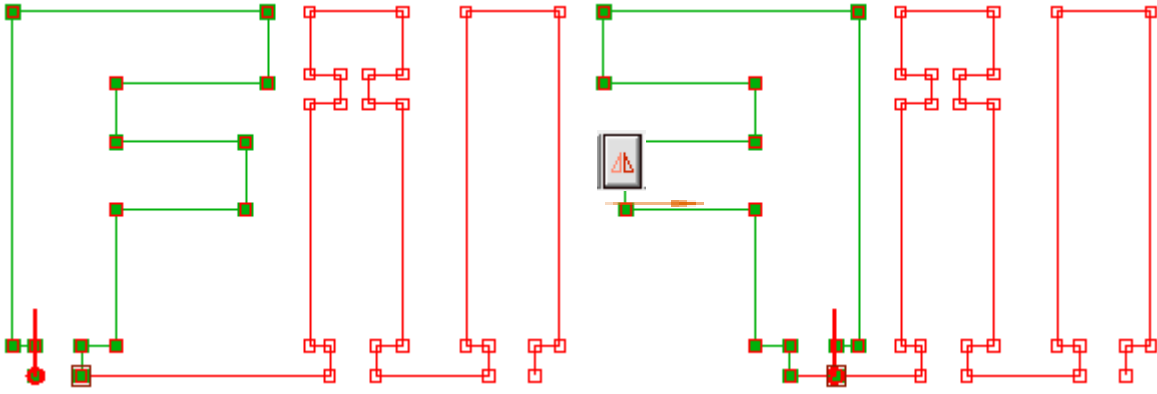
When pressing this button, all the selected points will be moved along a horizontal axis symmetry (vertical mirror):



7.9.4.6 Vertical axis symmetries:



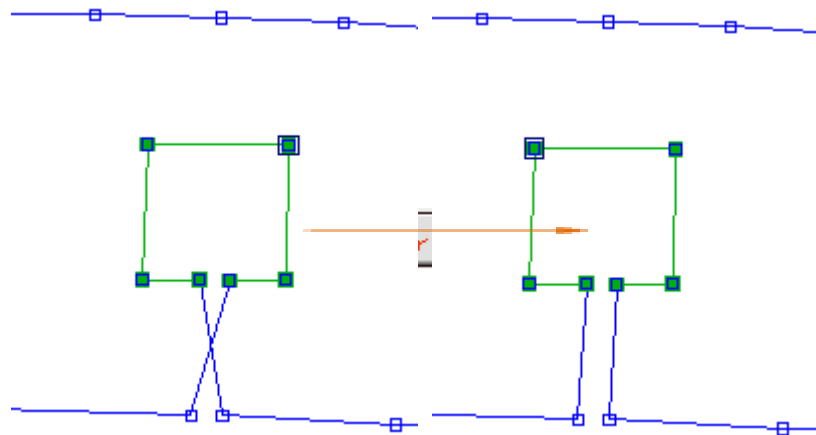
When pressing this button, all the selected points will be moved following a vertical axis symmetry (horizontal mirror):



7.9.4.7 Partial reversal of direction:



Pressing this button reverses the direction of travel of all selected stitch sequences. Often useful when inserting recesses (which must run counter to the outer path).

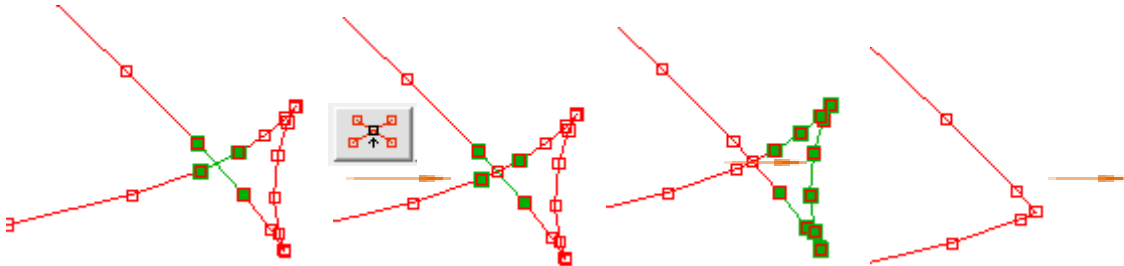


7.9.4.8 Creation of intersection:



Pressing this button will create an intersection point between the selected segments (if there is an intersection):

Example: when creating an offset for the formwork of a wing (see the Offset tool later), there may be a crossing at the leading edge. Creating intersection points allows you to remove excess points:



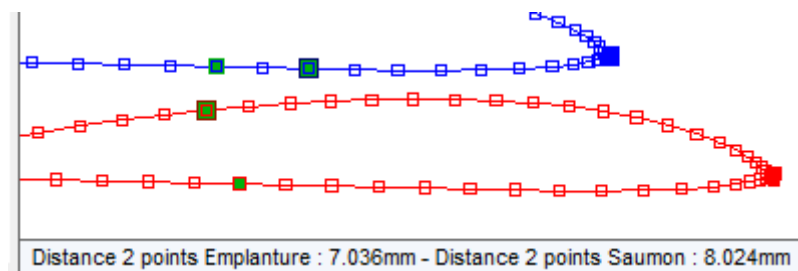
7.9.4.9 Measuring the distance between two points



This tool gives the distance between two selected points in the following cases:

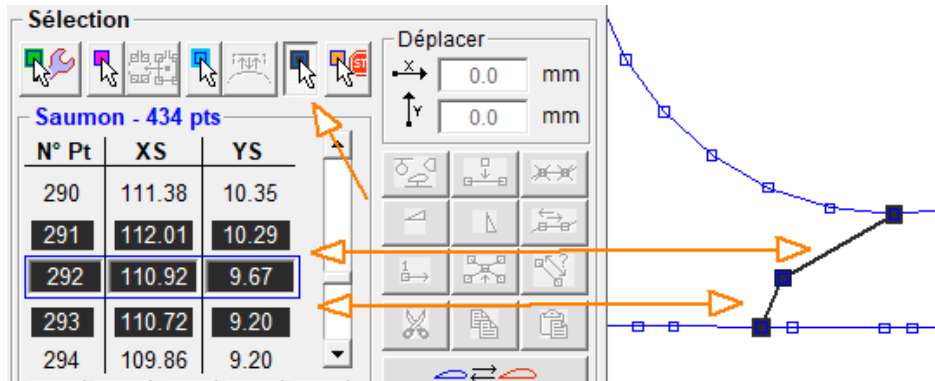
- 2 points are selected on the Root side
- 2 points are selected on the Tip side.
- 2 points are selected on the Root side and 2 points on the Tip side
- 1 point is selected on the Root side and 1 point on the Tip side.

The measurement appears in the frame at the bottom of the view:



7.9.4.10 Creation of path without cutting offset (junction path):

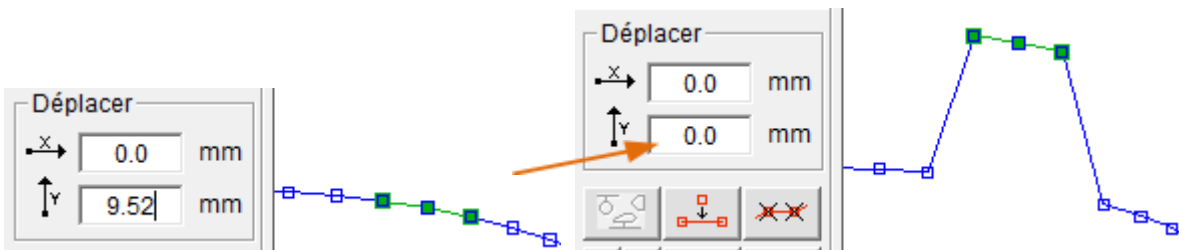
The selection of junction paths is done using the 4th selection mode:



This tool undoes the cropping offset on all selected thick black segments. This tool is useful when creating spars and recesses, so that the wire passes in the same place on the outward and return path leading to the spar or recess. Be careful to select the outward and return paths carefully.

7.9.4.11 Moving points by value:

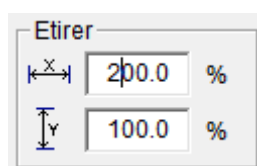
The Move frame allows you to move the selected points precisely by entering the value and validating with the Enter key or the Tab key:



7.9.4.12 Stretching a selection:

The Stretch box allows you to apply an enlargement or reduction factor to the entire selection, expressed in percent (%).

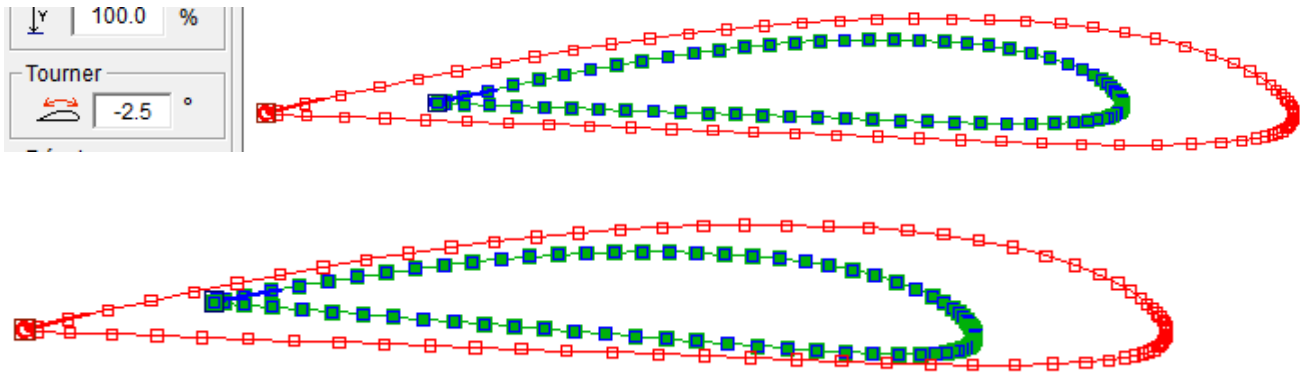
For example, to double the size of the selection, we will apply 200% along X then 200% along Y with validation using the Enter key or the Tab key.



7.9.4.13 Rotating a selection (twisting):

The Rotate frame allows you to apply a rotation to the entire selection, expressed in degrees. Rotation is negative clockwise and positive counterclockwise.

In the case of a tip twist for a wing, we will select all the tip before applying the rotation (validation by Enter or Tab key):



Warning: in the case of twisting, apply the twist at the last moment, just before cutting, because it slightly changes the displayed value of the tip rope.

7.9.4.14 Shifting a selection (for formwork):

The Offset box allows you to apply an offset to the entire selection. This is used, for example, to take into account the thickness of the formwork (partial formwork is therefore possible) or to create the plate for a spar flange:



For total formwork of a wing, you will need to select everything (shortcut Ctrl+A) before making the offset. It will then be necessary to remove the excess points at the trailing edge and at the leading edge (see 7.8.3.8)

7.9.4.15 Cut, copy, paste:



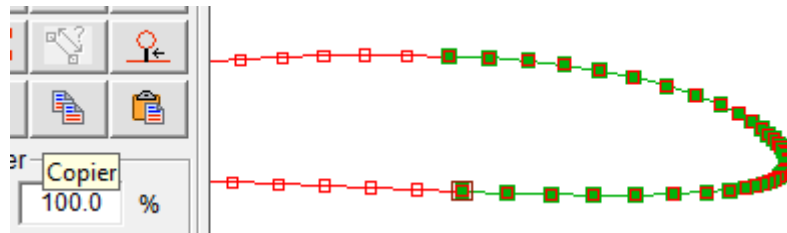
These three tools are the same as in all Windows software and are accessible with the same keyboard shortcuts: Ctrl+X, Ctrl+C and Ctrl+V.

- **Cut:** deletes the selected points, but keeps them in memory for use with the Paste tool.
- **To copy:** copies the selected points into memory for use with the Paste tool.
- **Stick:** inserts the sequence of points into memory on any newly selected point. (After pasting, use the Ctrl key and left click to move the pasted points.)

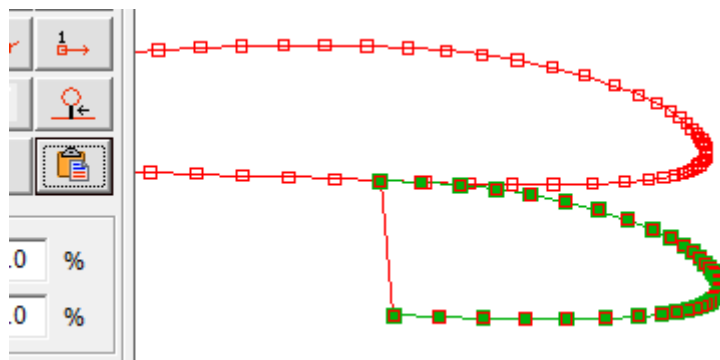
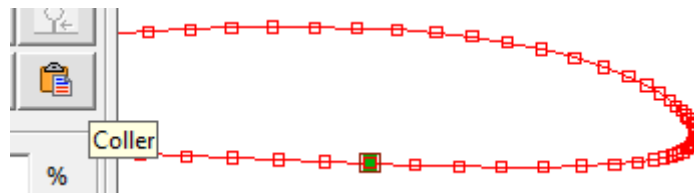
These tools allow, for example, to duplicate a cut that you want to make several times, or to work only on half of a symmetrical project which you will then duplicate (you will then have to use the symmetry, renumbering and renumbering tools). travel to reconstruct the complete project).

In the example below, we use it to make a recess in the leading edge of a wing:

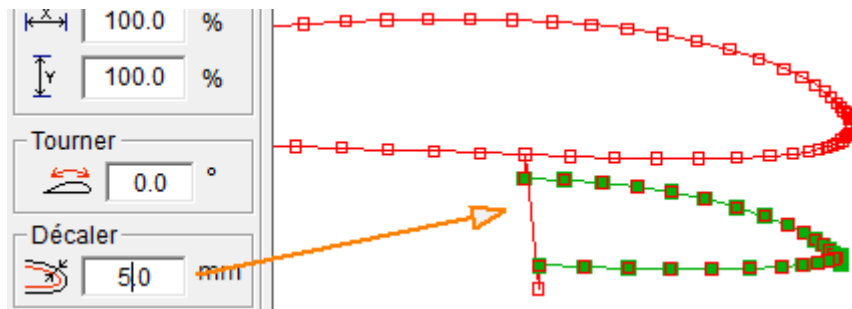
- We copy the part concerned:



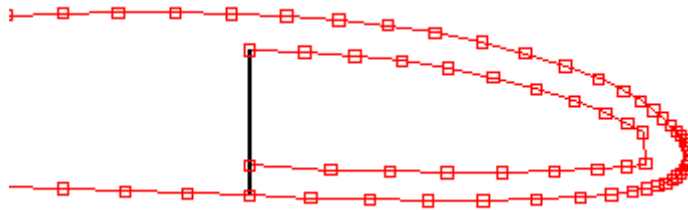
- We glue it to the location of the wire entry:



- We use the Offset tool to give the thickness of material that will remain (5mm in this example) and we validate:



- We use the different tools seen previously to remove excess points, rotate the recess in the right direction, center the recess and define the junction paths:

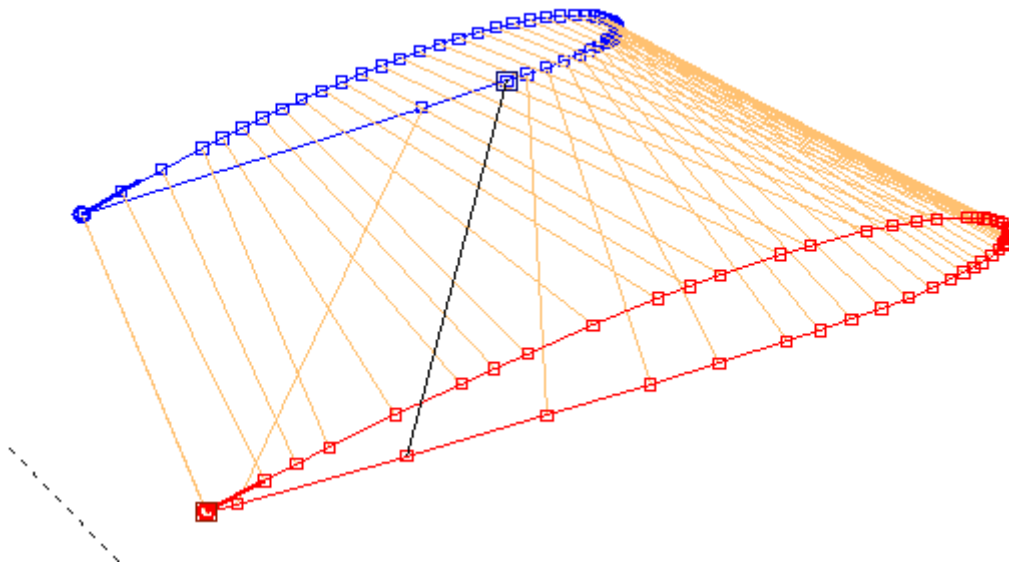


7.10 Root and Tip synchronisation

7.10.1 Principle

- For hot wire cutting to work, you need the same number of points at the Root and the Tip. The wire will pass through the points of the same number at the same time.
- Furthermore, the wire must pass at certain characteristic points at the same time on both sides. These points are called synchronisation points.

Example of a cut that has the same number of points on both sides but is not well synchronised:



As there are the same number of points (50), cutting is possible, but we can clearly see that the distribution of points is not good, and as a result the wire will become completely slanted at the end of the cutting .

To correct this we will first define the cutting synchronisation points.

7.10.2 Choosing synchronisation points

In the example above, the wire must pass the leading edge (the rightmost point) on both sides at the same time. This point is therefore a synchronisation point. The first and last points are also automatically synchronisation points (there is no need to select them). In this simple example there will be a single pair of synchronisation points, but you can put as many as you want, always in pairs, it depends on the project.

We enter the synchronisation points selection mode (see 7.1):



And we click on the synchronisation points, on both sides (here, the rightmost point), in the counters or in the figure:

32	149.97	3.78
33	150.00	3.51
34	149.98	3.24
35	149.90	2.97

Emplanture - 50 pts		
N° Pt	XE	YE
25	179.44	9.44
26	179.88	8.47
27	179.98	8.01
28	179.95	7.11

Etirer
X: 100.0 %
Y: 100.0 %

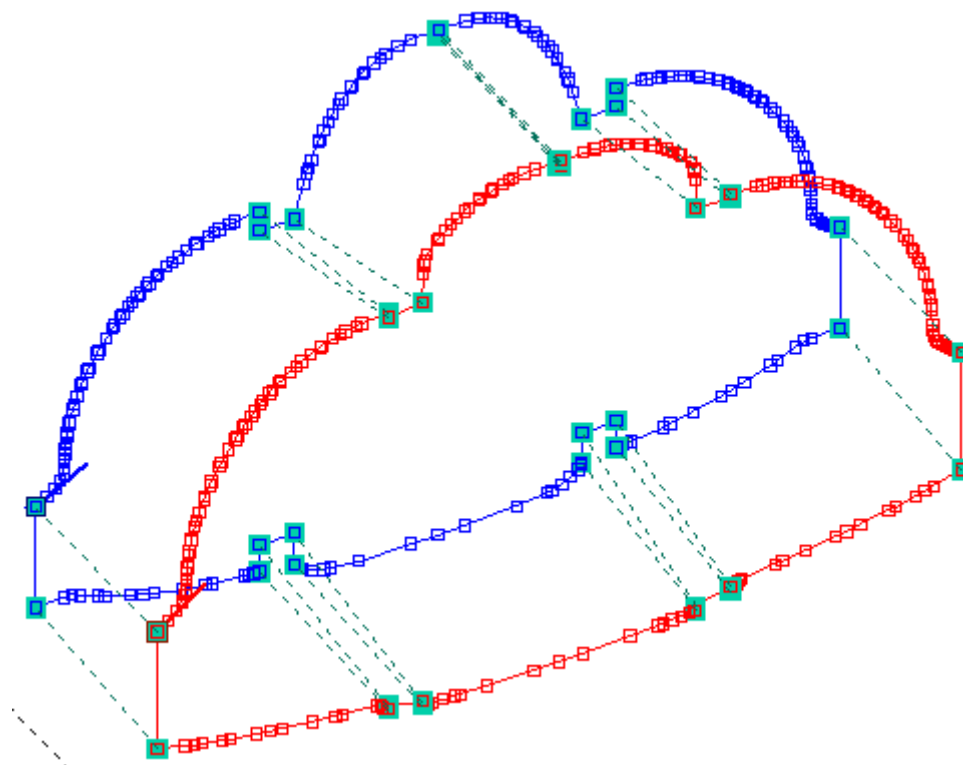
Tourner
0.0 °

Décaler
0.0 mm

It is in your best interest to display a line connecting the synchronisation points (which always come in pairs) by activating the last button in the Visu frame:



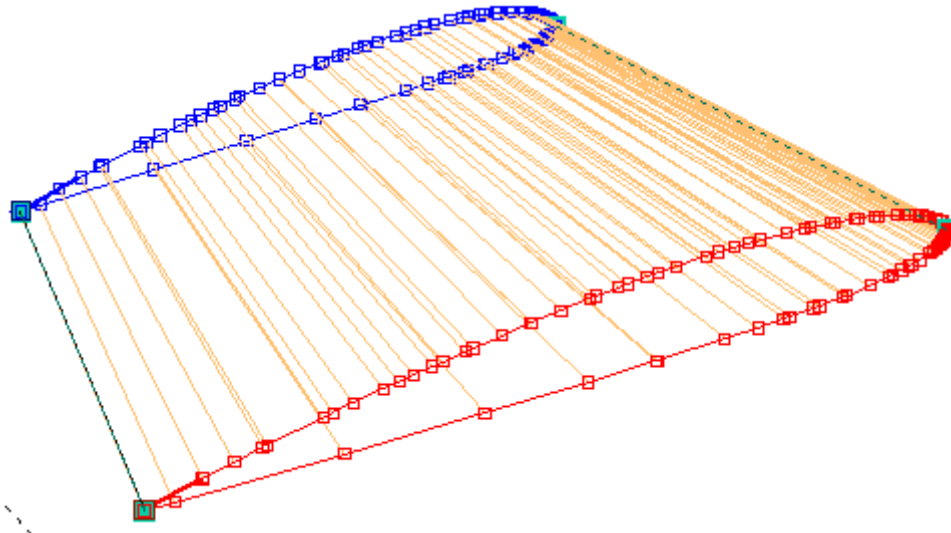
This allows you to control your work when there are many synchronisation points like in the example below:



7.10.3 Applying synchronisation and synchronous cleanup

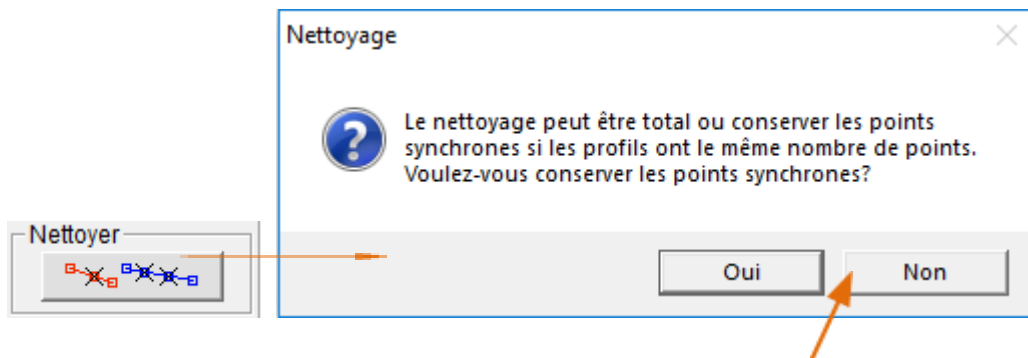
Once the synchronisation points are defined, simply press the Optimal synchronisation button:

Here is the result in the wing example:

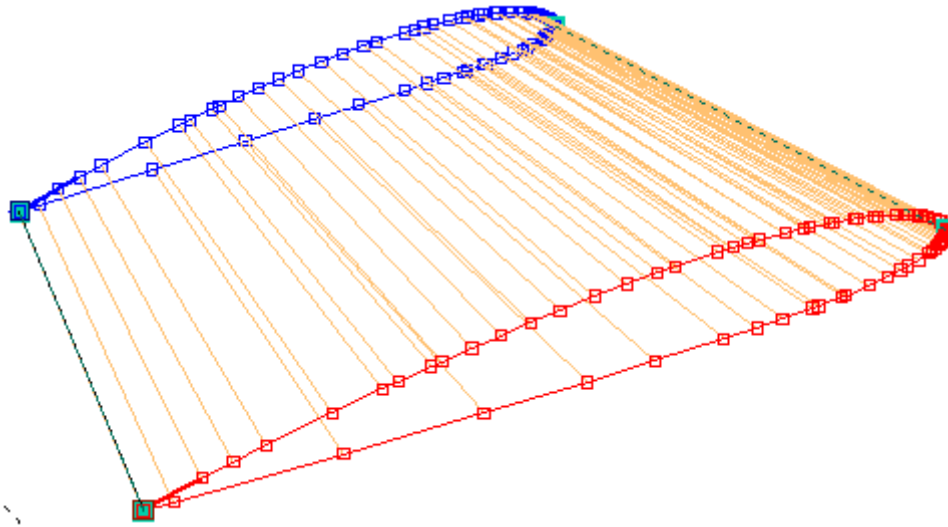


We see that the wire will move regularly, without much angular variation between two positions.

The synchronisation, however, created many points, we went from 50 to 97 points. This can be improved (we try to have as few points as possible, see 7.7) by applying synchronous cleaning:



We thus go down from 97 to 72 points while remaining synchronised:



Timing is essential when making complex cuts. Take the time to do it properly, this guarantees quality cuts.

7.11 Stopping points

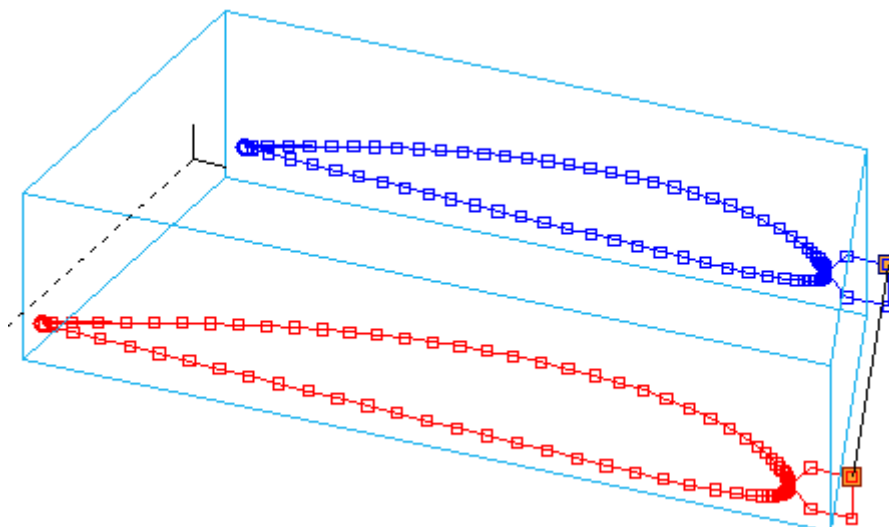
It is possible to define pairs of stopping points when there are the same number of points at the Root and the Tip.

Stop points indicate that cutting should stop at that location until the user restarts the movement. They must be placed just before cutting.

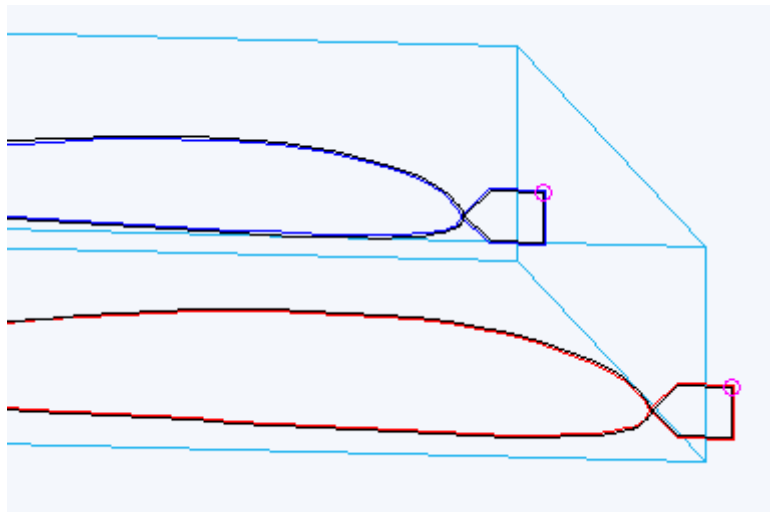
To do this, you must switch to Stop Point Selection Mode (see 7.1):



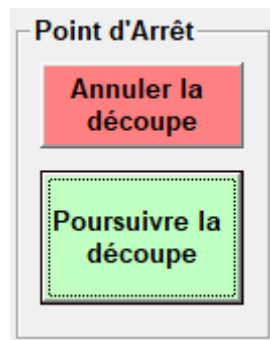
When you set a stop-point, its counterpart is automatically selected:



The stopping points are represented by a pink circle on the representation of the cut:

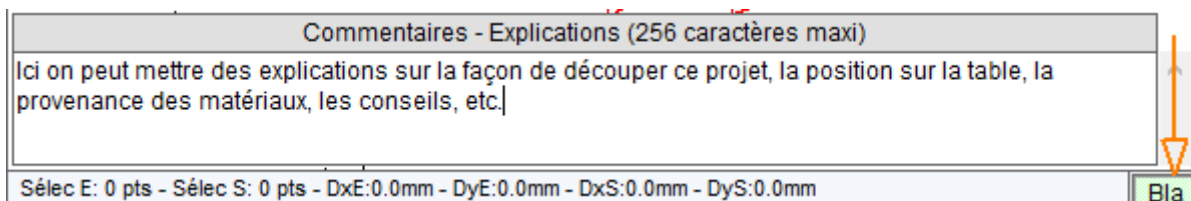


When the stop-point is reached during cutting, cutting stops and the software waits for the user to restart it by pressing Enter or clicking on the green button :



7.12 Enter a comment

Pressing the "Bla" button gives access to the comment entry frame:

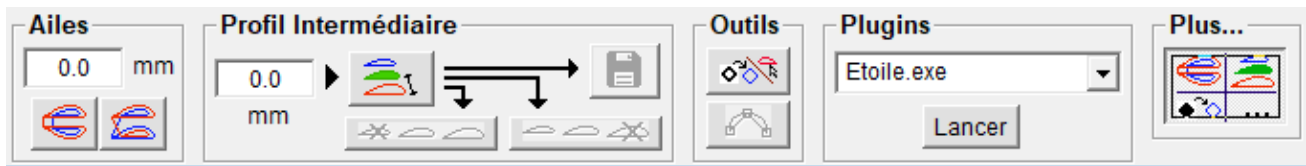


The button is gray when there is no comment and green when there is one. The comment is saved in the project's .fnx file.

It is advisable to comment on the files when you want to share them, this allows you to specify the conditions and cutting tips.

7.13 Additional tools


Pressing the button on the More... frame allows access to the following tools:

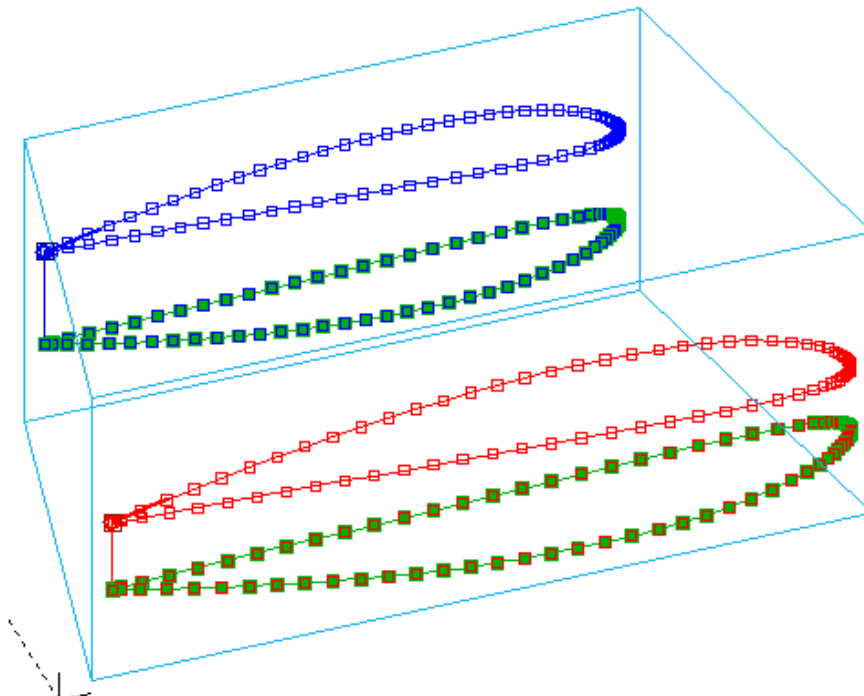


1. Cut two wings from the same block.
2. Cut a wing wider than the table.
3. Vectorize an image / create a profile (spline) from an image.
4. Smooth a segment with a spline.
5. Launch external software.

7.13.1 Cut both wings from the same block

When cutting a wing, if the block is thick enough you can cut the left wing and the right wing from the same block. To do this, simply enter the distance you want to keep between the two wings and click on one of the duplication buttons.

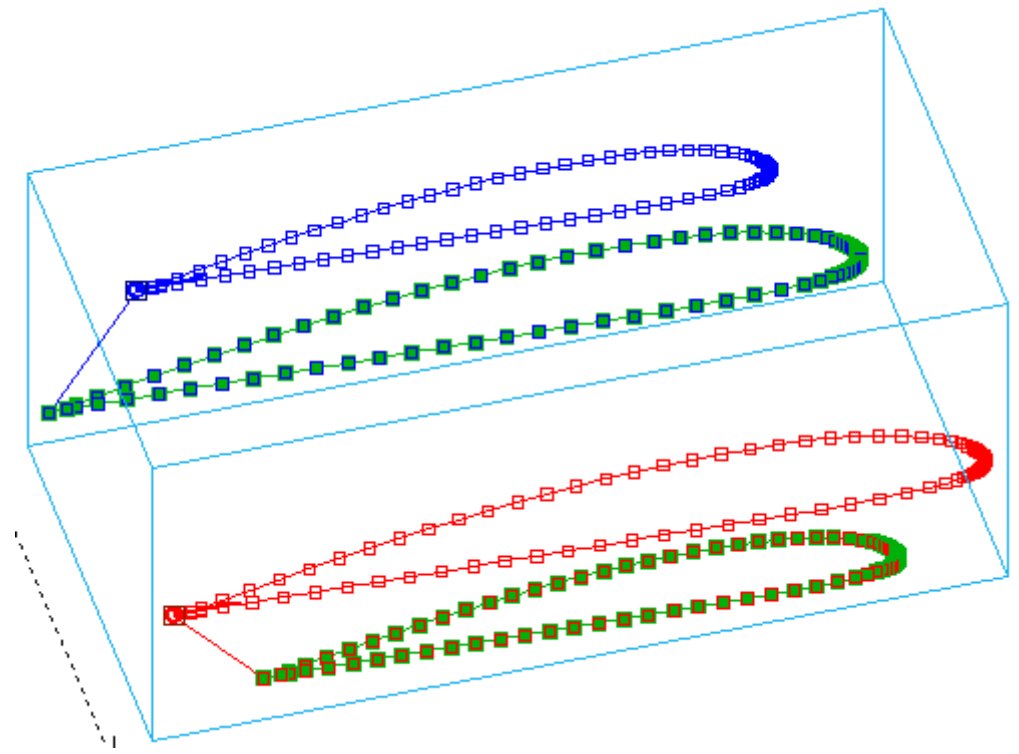
The first button mirrors a horizontal plane: 



Remarks :

- The duplicated wing is automatically selected, making it easy to move.
- The bottom wing is cut in the opposite direction to the top wing.

The second button places the two wings one on top of the other:



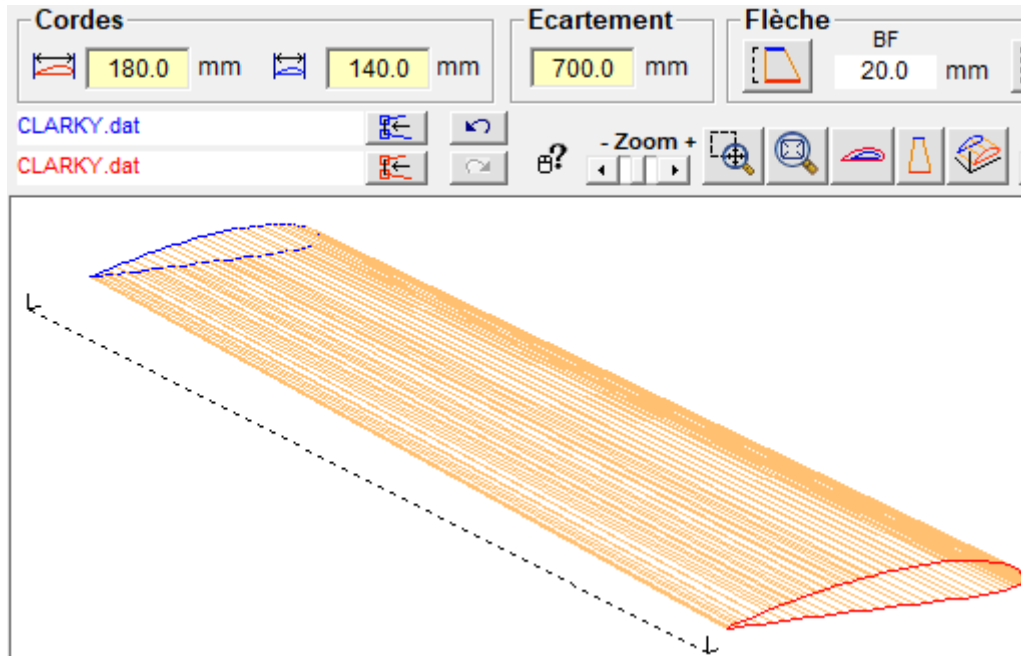
Remarks :

- The two chord values become identical, this is normal since the total horizontal dimension (along X) is the same on both sides (Root and Tip).
- The software adds a small clearance segment at the start and end of the cut which means that the chord indicated in the software is increased by 4mm, but this does not change the chords of the wings.

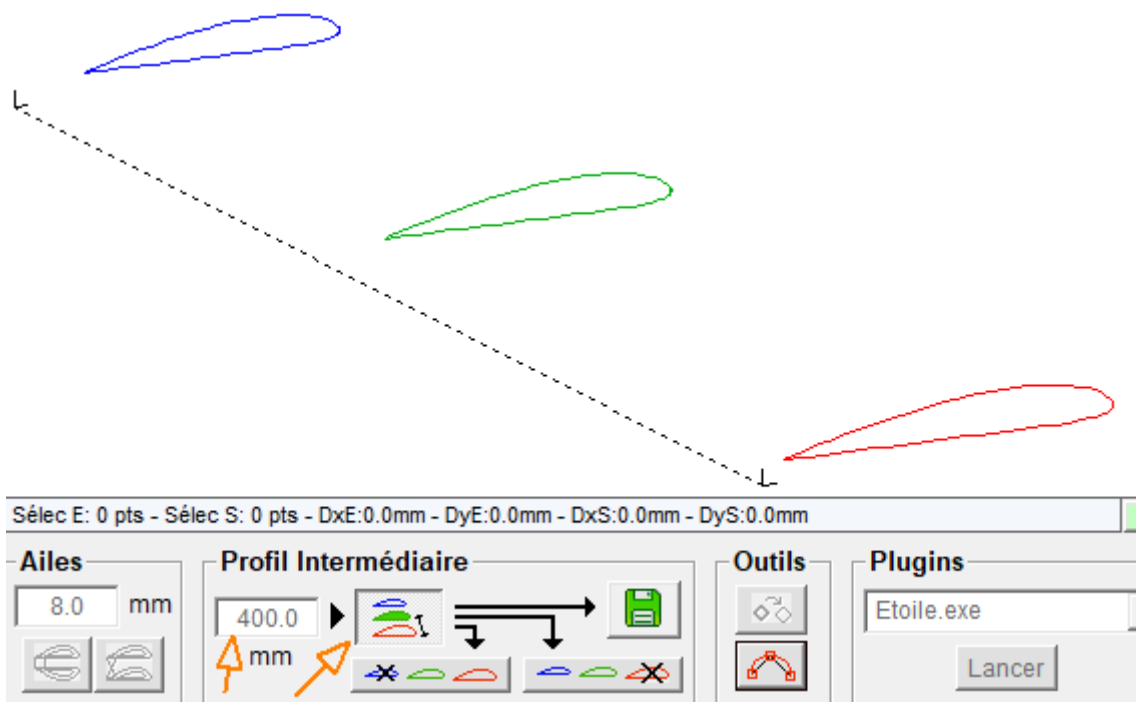
7.13.2 Cut a wing wider than the table

If your table top is, for example, 560mm wide and you want to cut a 700mm wing, you will have to cut it in two sections. The method is as follows:

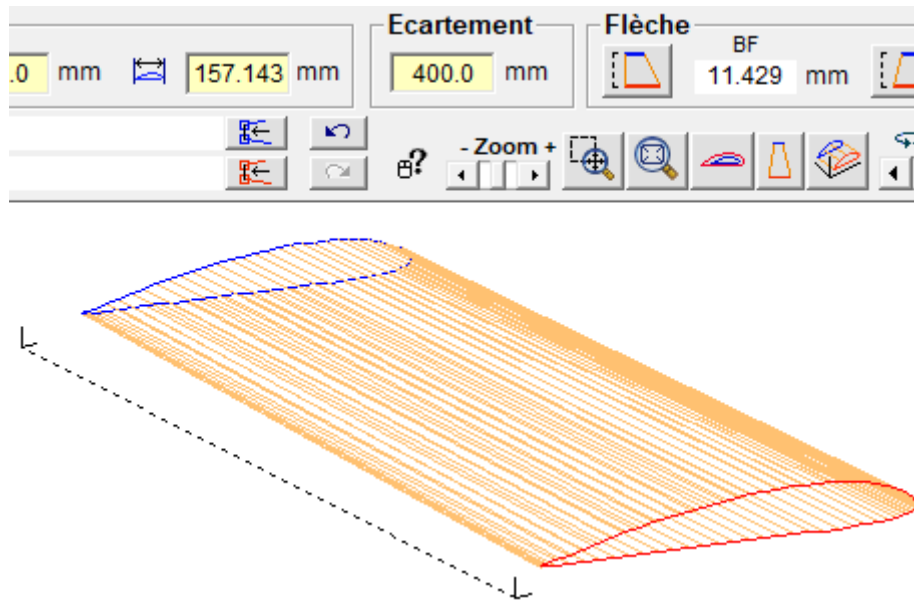
1. Define the wing to its final dimension (700mm spacing) and save the .fnx project:



2. Indicate the distance between the Root and the cut (here we choose to cut 400mm from the tip, which will make a section of 400mm and a section of 300mm) and click on the Intermediate Profile button, the profile appears in green in the figure :

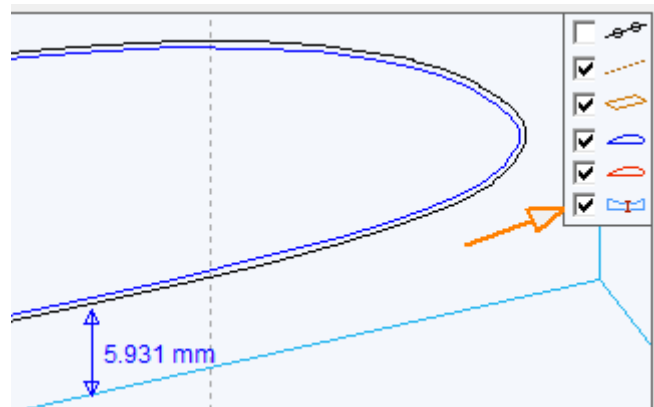


3. We then have three choices: export the profile (in .dxf or .dat), keep the first part of the wing, keep the second part of the wing. First, click on the first button, allowing you to keep the first part of the wing (on the Root side):




The spacing change to 400 and the Tip profile was replaced by the intermediate profile (with another chord value).

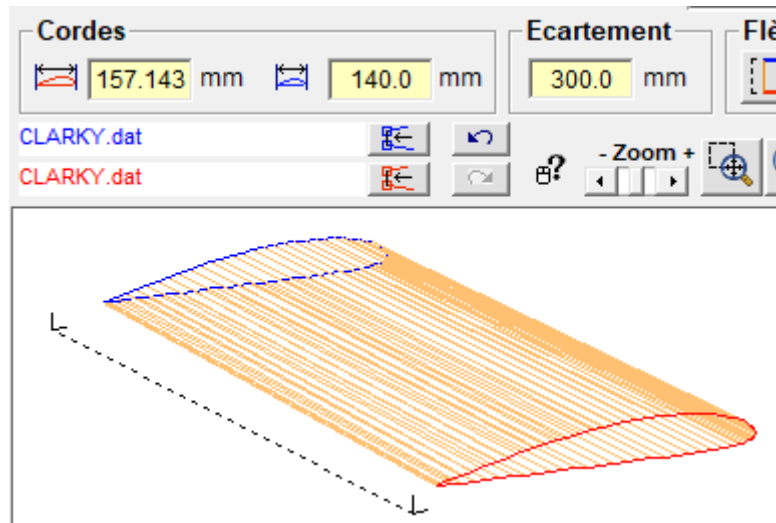
4. In the “4-axis cutting” tab, choose the cutting material then display the height of the cut and note the value on the Tip side in the project comments:



Commentaires - Explications (256 caractères maxi)
Hauteur de la dépouille au Saumon du premier tronçon : 5.931mm

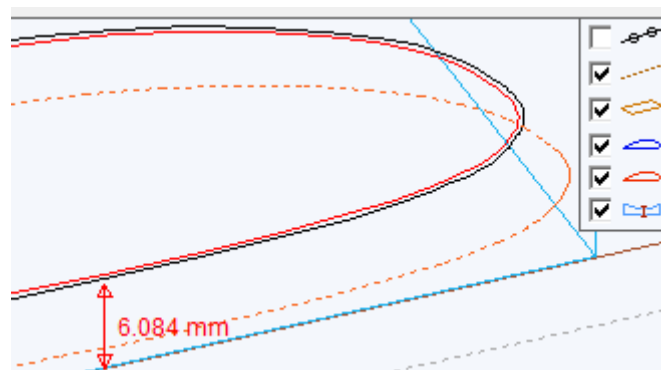
5. Save and cut this first section.

6. Use the Undo button to return to the entire wing: 
7. Reactivate the intermediate profile and click on the second button to keep the second part of the wing:



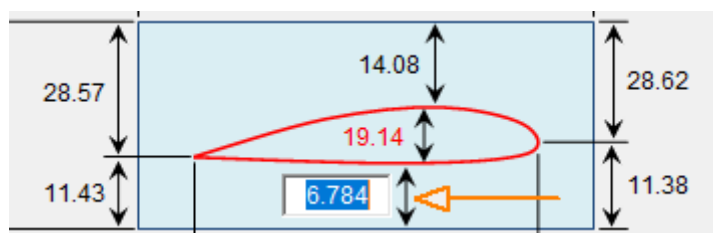
The spacing change to 300 (700-400) and the Root profile was replaced by the intermediate profile (with another chord value).

8. In the “4-axis cutting” tab, display the height of the clearance on the Root side:



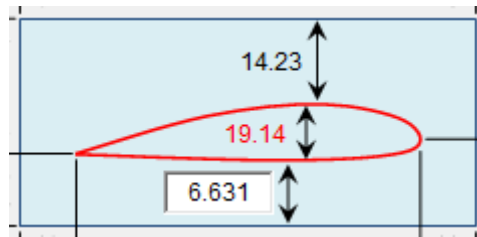
To be able to easily glue the two wing sections together, this value must be identical to the previous one, taken from the tip of the first cut. We will therefore correct the position in the block to obtain the value of 5.931mm found at point 4. The difference is $6.084 - 5.931 = 0.153\text{mm}$.

9. Open the positioning window in the block:

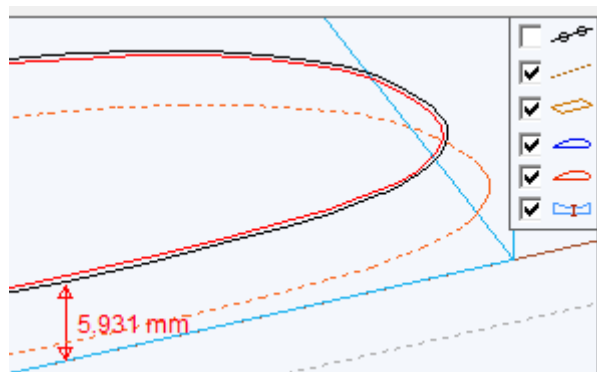


10. To lower the cutout in the block, we must reduce the height under the tip by the previously calculated value:

$$6.784 - 0.153 = 6.631\text{mm}$$



11. We validate and return to check the value in the cutting tab:




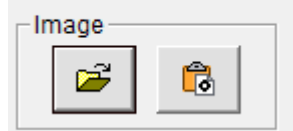
12. It's okay, we can save this second section (remembering to change the name) and cut it. All that will remain is to glue the two cutouts together to obtain the 700mm wing you are looking for.

7.13.3 Vectorize an image:

Pressing the button  in the vectorization window.

Importing an image is done in the Image frame:

Import the image contained in the  **Vectoriser une image** will favor the use of this method (see below).



Import an image from a .jpg or .bmp file

The vectorization tool integrated into FilChaudNX works with any image on a white background with good contrast. The color of the trace does not matter, it will be converted to black and white anyway with sensitivity adjustment by the user.

Advice :

You should not use an image that is too large in number of pixels., this unnecessarily slows down the calculations and the result is not well smoothed. Generally an image of the order of 900 to 1000 pixels on the largest side gives good results.

The easiest way is to display it in full screen on the computer and use the “ImpEc” keyboard key which will take a screenshot and save it to the Windows clipboard.

Example :search on the Internet with the keywords “castle silhouette”

I found the following image that interests me:



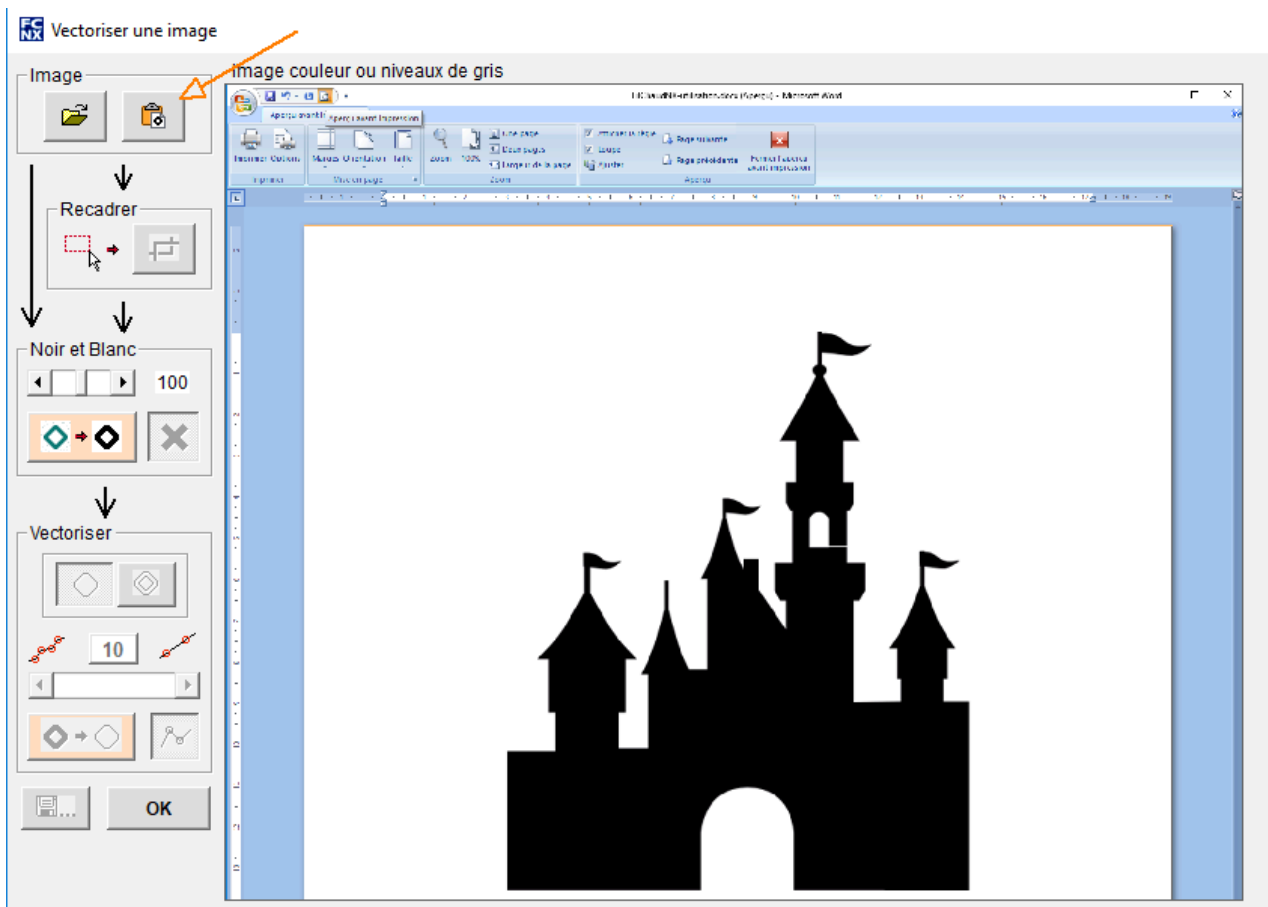
Credit: designed by Freepik from www.flaticon.com

Problem, it is in .png format which is not taken into account by FilChaudNX and the browser does not represent it on a white background. No problem, I copy it with the right click and paste it into a word processing software (Word, OpenOffice, etc.).

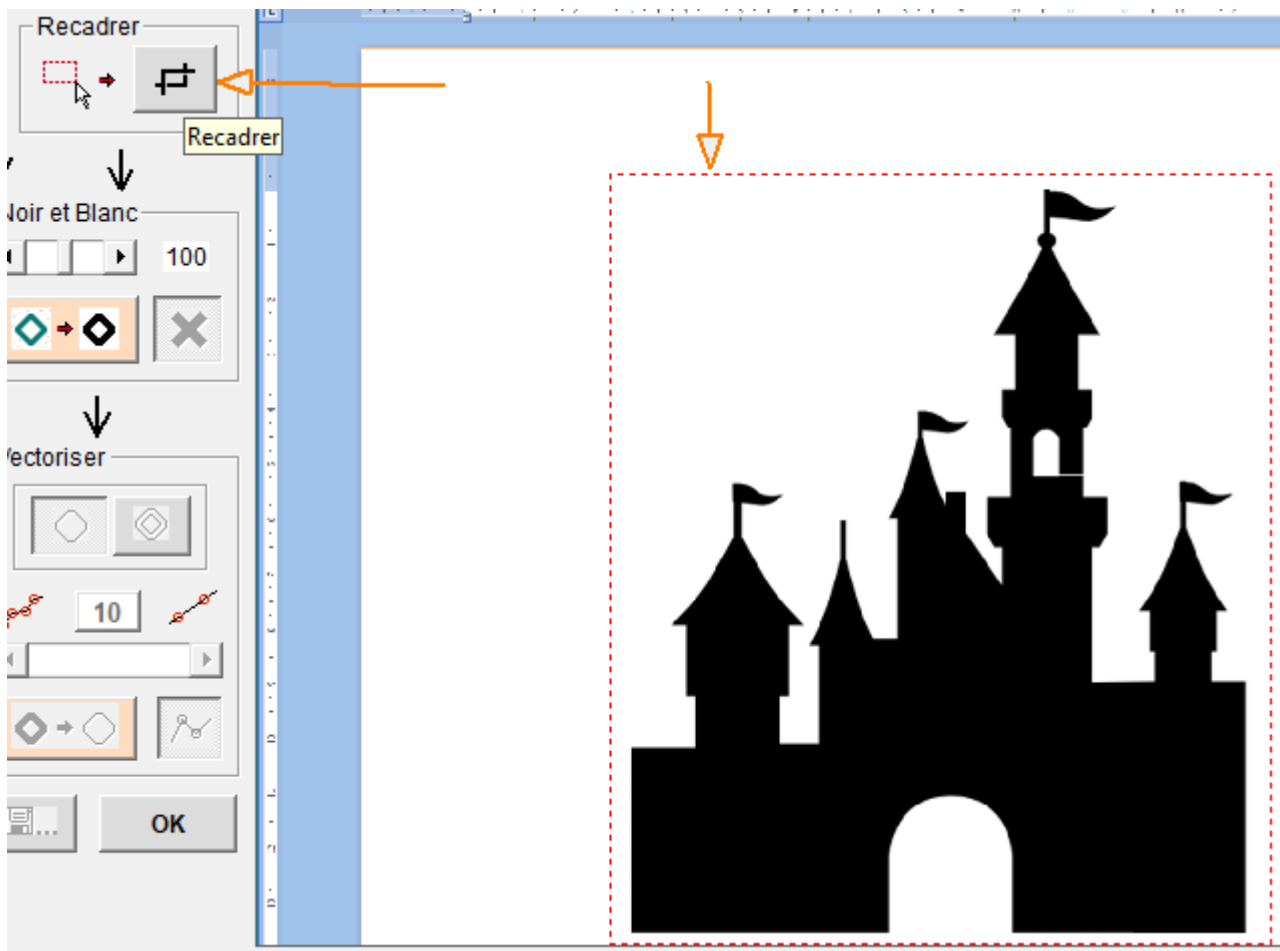
As I also want to cut out the small window, I add a white line with the drawing tools of the word processing software:



I then do a print preview and press the screenshot key on the keyboard (ImpEcr or PrintScreen) and paste the image into FilChaudNX:



I draw a frame around the image with the mouse to crop it and I click on the crop button:



The image is now well framed, but it is not yet black and white (even if it appears black and white, it is a color image).

So I use the Black and White framework to convert it into two colors. The slider allows you to modify the sensitivity of the tool to different colors.

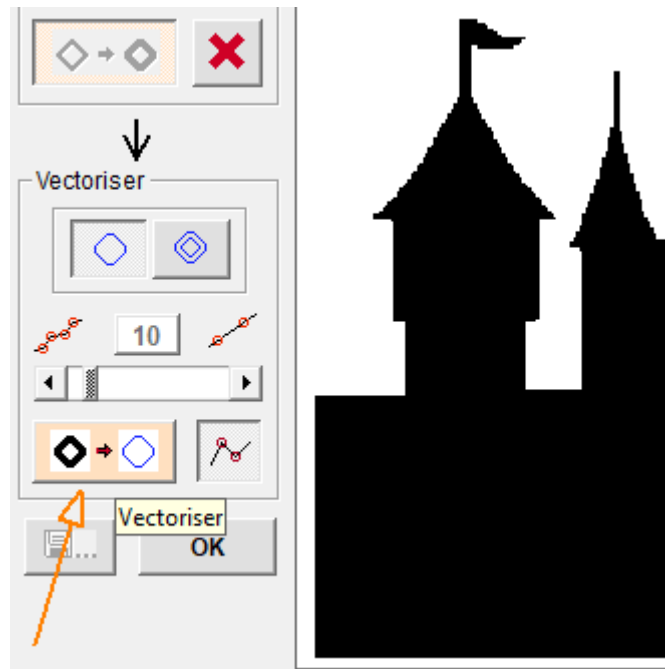
I press the transform button:



and if the result is not suitable, the cancel button allows me to start again:

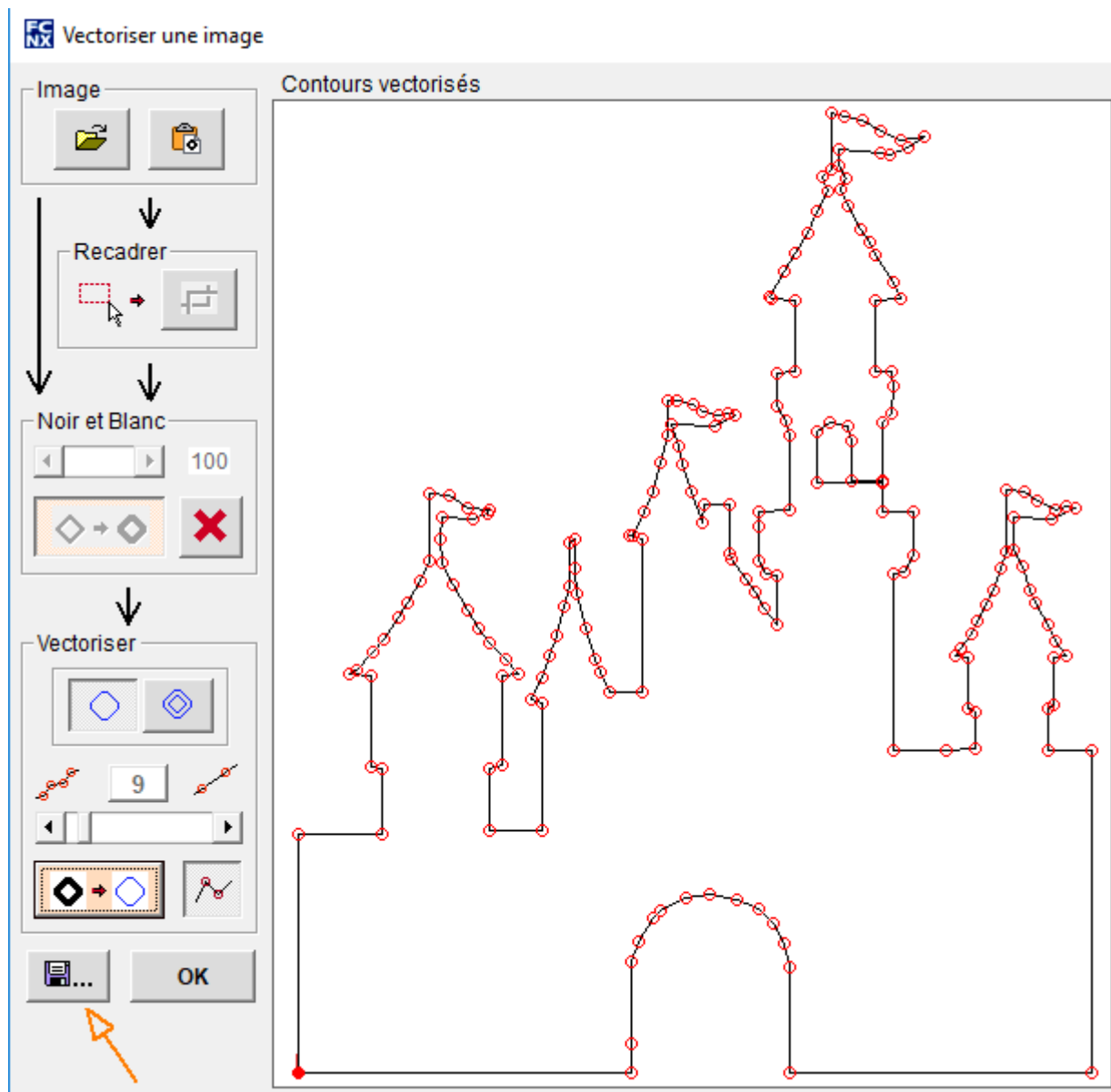


My image is in black and white, this can be seen in the contours which are a little jagged, I can now vectorize it (= convert it into a path) using the Vectorize button:

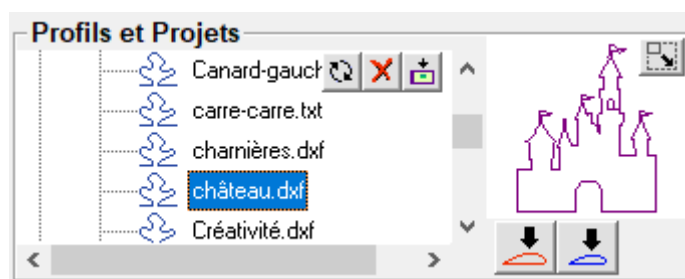


Here too, I have a slider which allows me to adjust the number of stitches (you don't need too many in hot wire). If there are too many or not enough points, simply move the cursor and click again on the vectorization button.

And that's the job, you can now save the path in the Library in .dxf format by clicking on the save button:



We exit the window using the OK button and the file is available in the Library (if you have taken care to save it, otherwise it is lost):



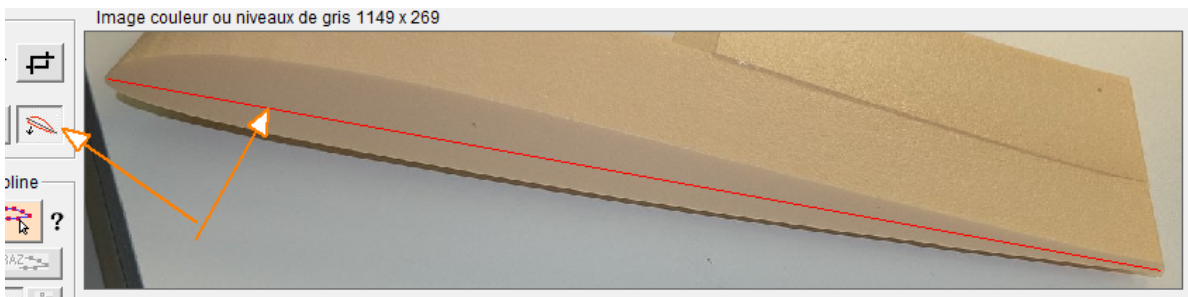
7.13.4 Create a profile (spline) from an image

This tool allows you to recreate a very smooth profile from a photo or a scan.

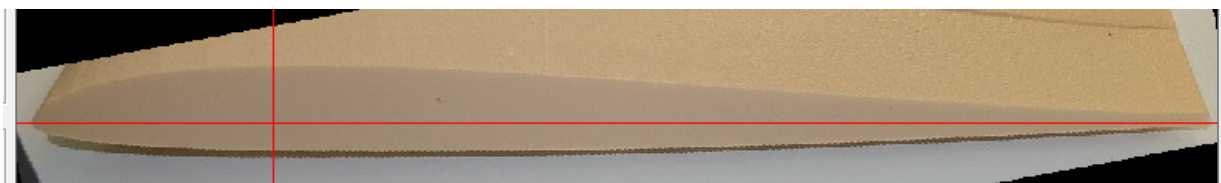
Refer to 7.13.4 for image import and cropping. The tools below allow preliminary work on the image:



1. Vertical axis mirror
2. Horizontal axis mirror
3. 90° counterclockwise rotation
4. 90° rotation in timeless mode
5. Fine rotation: to make the wing chord perfectly horizontal, select this tool and draw a segment on the figure (left click + drag) going from the leading edge to the trailing edge:



The profile of the photo is now perfectly horizontal:

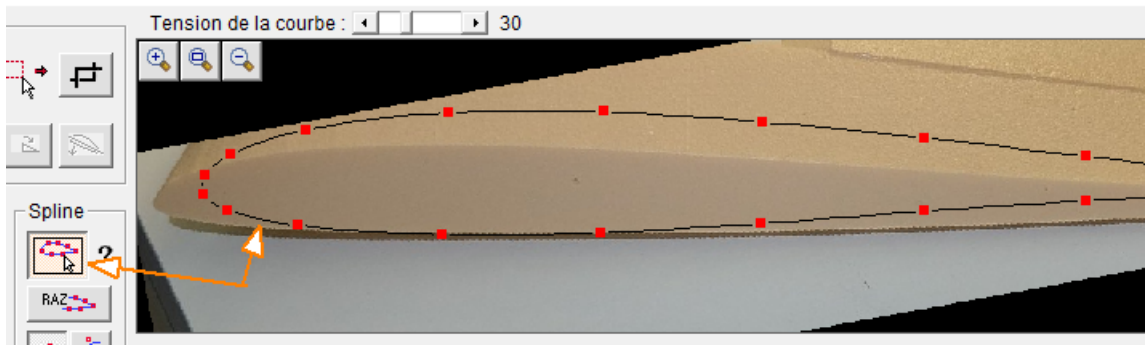


Note 1: the photo of the example is not well taken (but I only had that on hand when writing the instructions), it would have been necessary to take it perfectly in the axis of the wing so as not to flatten the profile.

Note 2: This tool is also a great tool for reproducing the profile from a paper plan (vectorized for taking a photo).

Note 3: avoid framing tightly when taking the photo, because camera lenses create distortions at the edges of the frame.

Once the image is well positioned, press the button to reveal the curve:



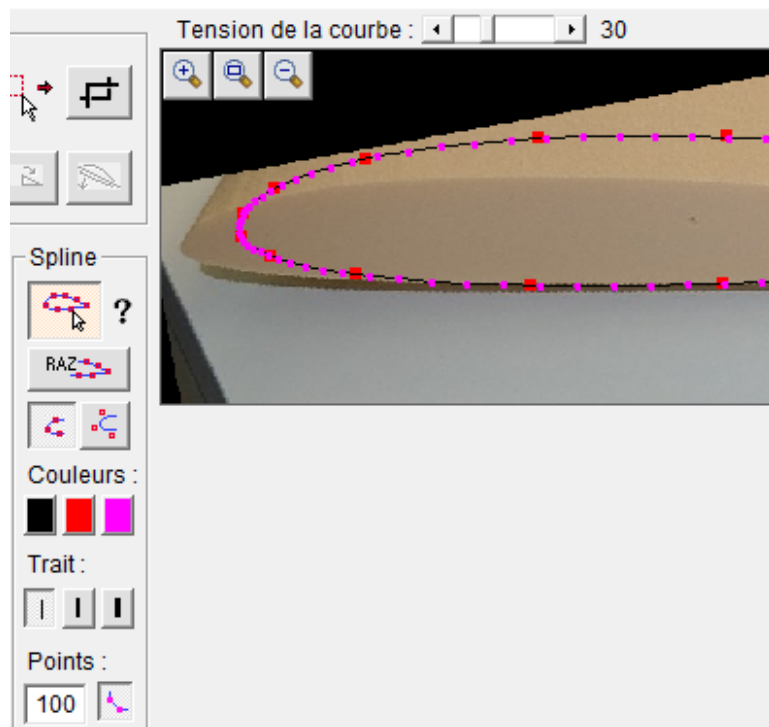
The control points of the curve are adjusted on the image using the mouse (left click). The right mouse button allows you to add or remove control points.

The zoom buttons located at the top of the image allow you to work with precision.

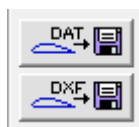
The curve tension adjustment located above the image allows you to modify the roundness of the curve.

The representation options are:

1. Tool Reset
2. Choice of spline type
3. Choice of colors for the graphic representation (to have the right contrast in the figure)
4. Choosing the line thickness of the curve
5. Choice of the number of points of the final file
6. Display on the curve of the points of the final file



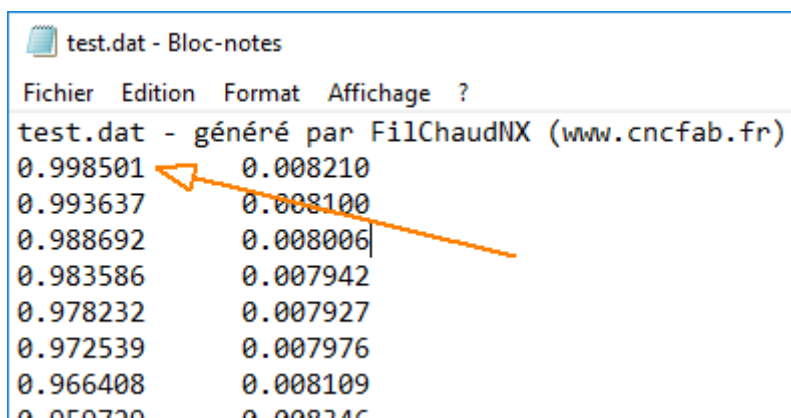
The resulting profile can be exported in DAT or DXF format with the following buttons:



Noticed :

Using the DAT files obtained with this tool may cause problems with the Tracfoil software (which is used to trace ribs). Indeed, this software absolutely wants the first X coordinate of the DAT file to be 1.000000.

To solve this problem, simply edit the file with notepad and modify the first value:

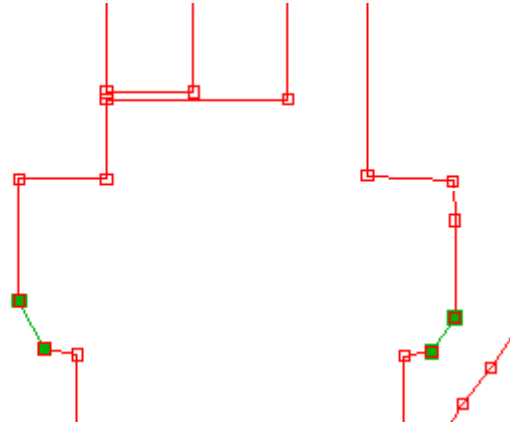


Above, replace 0.998501 with 1.000000 and save: the file will be accepted by Tracfoil.


7.13.5 Smooth a segment with a spline

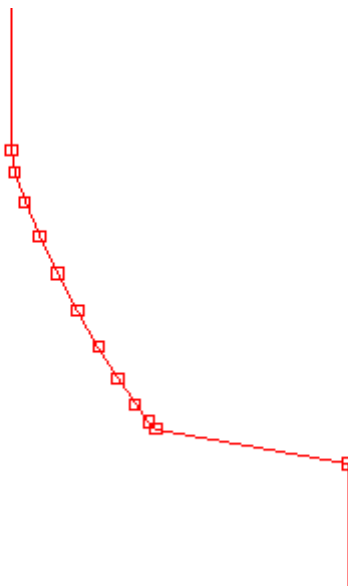
If a segment creates a cut that is a little too “steep”, with marked angles, we can correct this:

- Select the segment concerned. Example with the sides of the tower from the previous example:



Please note, the segment which precedes the selection and the one which is just after the selection are important, they are the ones which give the tangent to the curve:

- Click on the smoothing button: 
- The segment is now replaced by a curve that is tangent to the previous segment and the next segment:

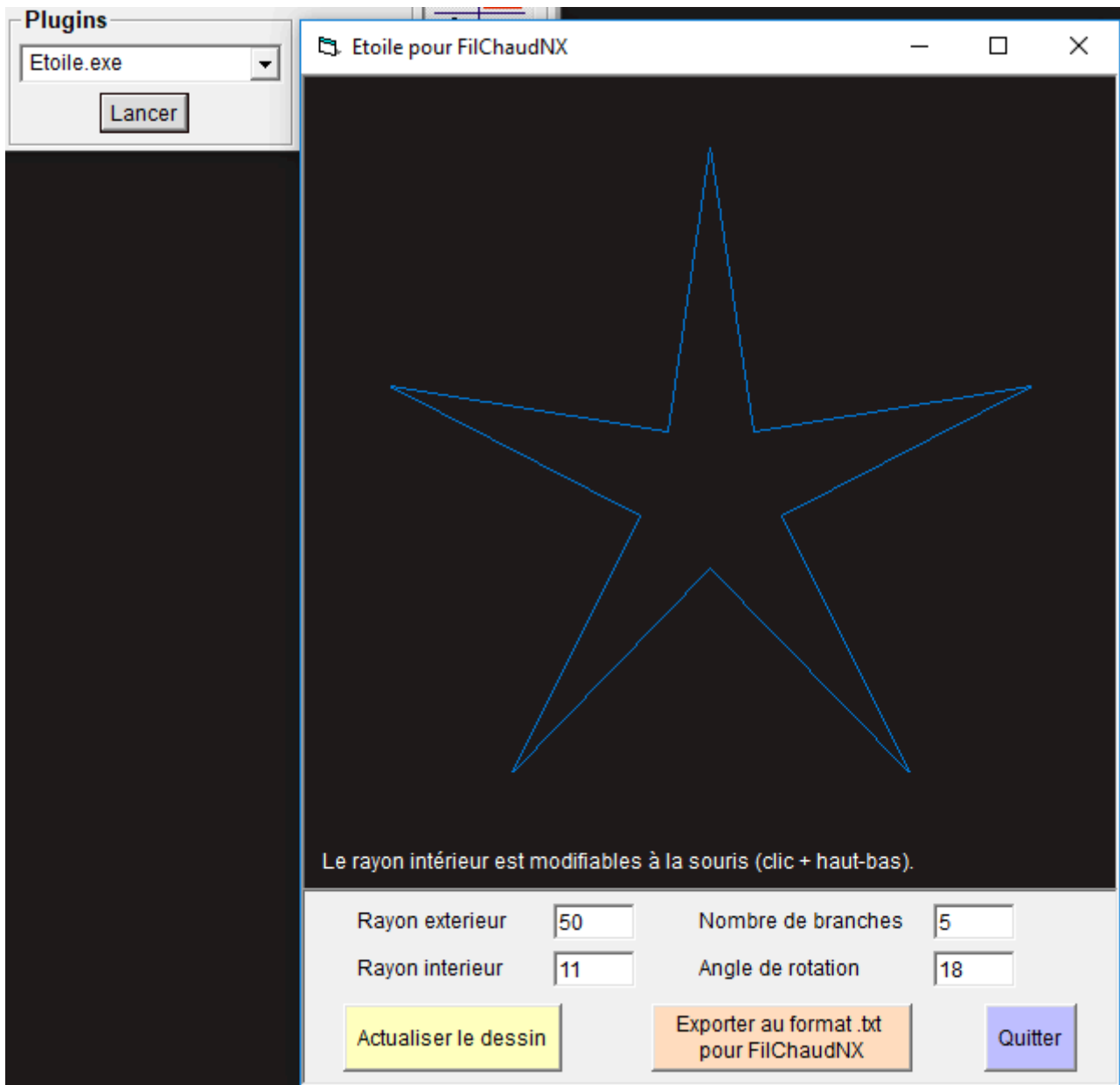


Please note, this is a “light” smoothing tool and cannot be configured. If this smoothing is insufficient, this means that the path source file must be directly modified with vector drawing software.

7.13.6 Launch external software

The Plugins frame lists all the programs present in the Documents/FilChaudNX/Plugins folder (see4.1). You can select any program in the drop-down list, click on Launch and FilChaudNX will try to launch the file. If a program is associated with the file, Windows will launch it (example: an .xlsx file will launch Excel).

FilChaudNX is installed with a program that serves as an example, Etoile.exe:



This little program allows you to draw a configurable star and export this path to the Library in .txt format for FilChaudNX (see7.2.1).

This feature is intended for users who want to create personalised path creation tools.

8 Setting up a machine

Access to machine parameters is done by clicking on the button.



8.1 Where are the settings stored?

The software saves the parameters of the different machines entered by the user in the FilChaudNX.ini file which is located in the “Documents/FilChaudNX/Datas” folder.

When closing the software, the name of the machine in use is saved. So at the next opening, the software knows which machine to take into account among all those read in the FilChaudNX.ini file.

FilChaudNX is designed to work with the IPL5X interface card (CNCFAB machines are based on this card). To function, this card needs to know a certain number of parameters of the machine in use. For this purpose, it has 3 permanent memories (the information is not lost when the interface is unplugged).

When configuring a machine in FilChaudNX, we will choose the memory in which we want to write:

Choix de la mémoire à utiliser dans l'interface USB :

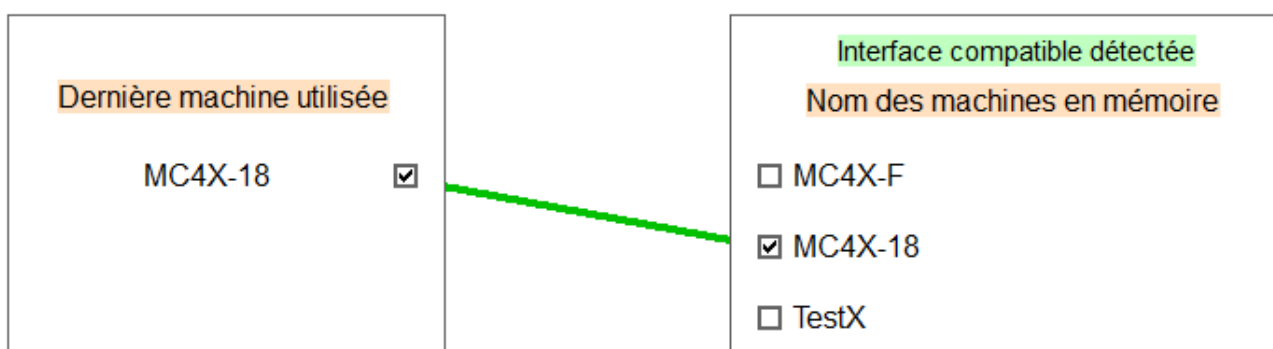
n° 1 : -----

n° 2 : -----

n° 3 : -----

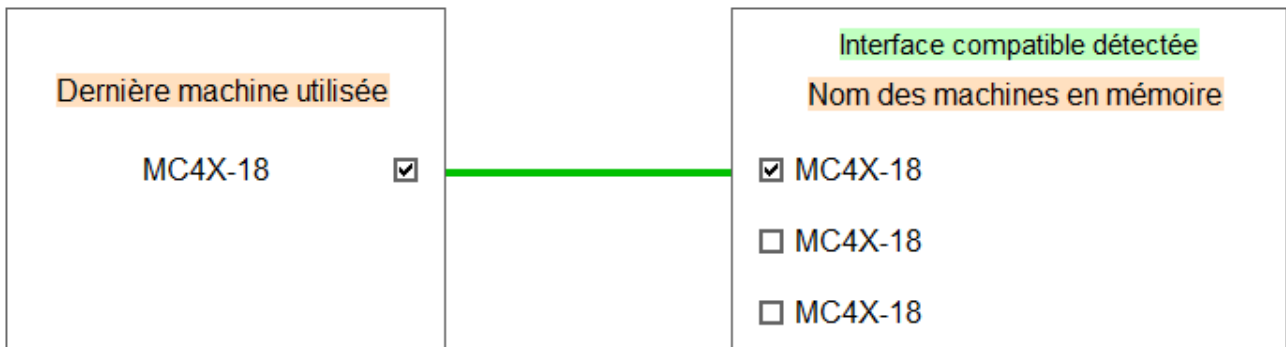
When the parameters are validated, they will be written both in the IPL5X interface and in the FilChaudNX.ini file.

The next time you open the software, FilChaudNX will compare the information in the .ini file and that contained in the interface. If it finds a match with one of the three interface memories, it will take it into account and activate cutting:



Même nom et même définition des sorties actives, découpe activée!


If you have only one machine, you can save it in the three IPL5X memories to make it look nicer ☺



Même nom et même définition des sorties actives, découpe activée!

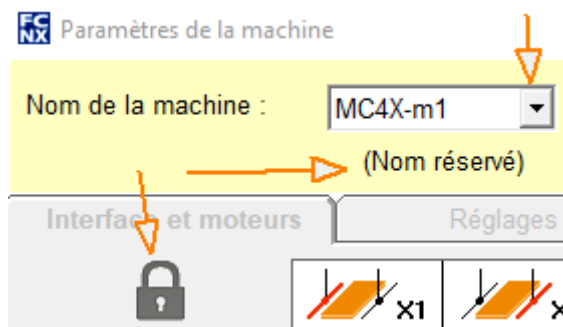
If the software does not find a match (both on the name and on the definition of the outputs), it will still launch, but direct cutting will be disabled (you can still export Gcode).

8.2 Configure a new machine

You can configure a machine at any time with the Machine Parameters button : .

8.2.1 Duplicate a template

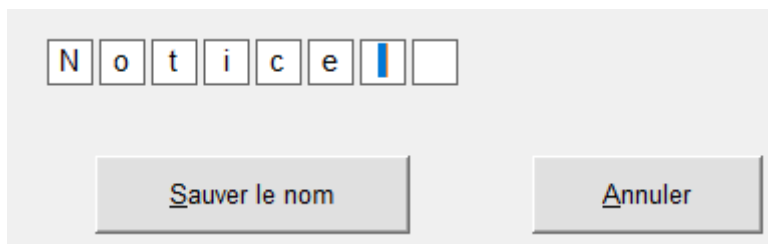
The configuration starts from a model provided in the software. The name of this model is displayed in the drop-down list. It cannot be modified directly, there is the mention “Reserved name” and a padlock on the parameters frame:



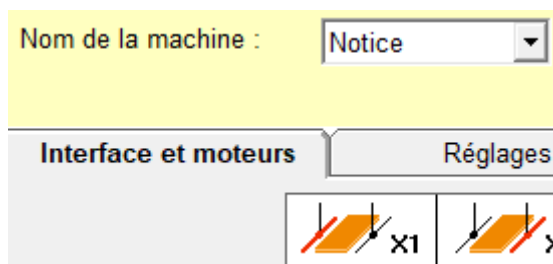
We will duplicate the model by clicking on the New machine button from these parameters:



The window that opens allows you to enter the name of the new machine:

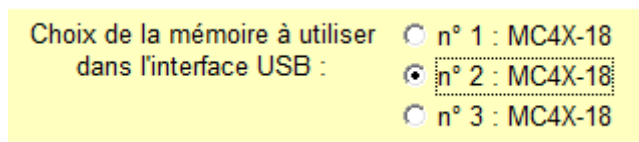


After validation, the machine is selected in the drop-down list and the padlock has disappeared, you can modify the parameters from the model:

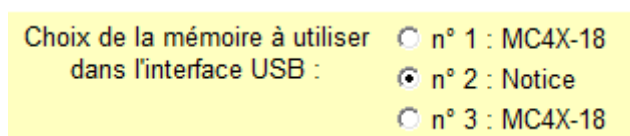


The same operation is possible from a table that the user has created (which then serves as a model).

If you have a connected interface, you can now choose the memory in which to write your table:



When validating the parameters, they will be written to the interface memory and the name will appear in the list:



8.2.2 The different parameters

8.2.2.1 Tab 1: Interface and engines (for IPL5X interface)

Interface and engines	Settings		Parameters	
	X1	X2	Y1	Y2
Dir output Change	Out 4 <input checked="" type="checkbox"/>	Out 6 <input type="checkbox"/>	Out 8 <input checked="" type="checkbox"/>	Out 10 <input type="checkbox"/>
Step output Invert signal	Out 3 <input type="checkbox"/>	Out 5 <input type="checkbox"/>	Out 7 <input type="checkbox"/>	Out 9 <input type="checkbox"/>
step / motor rev	400	400	400	400
microstep driver	1 / 32	1 / 32	1 / 32	1 / 32
mm / rev	40.0	40.0	40.0	40.0
<input checked="" type="checkbox"/> Invert motor ON/OFF signal				

X1, X2, Y1, Y2 : name of the different axis of the machine.

Dir outputs: choose for each axis which of the 10 outputs of the IPL5X interface emits the direction signal of the stepper motor which controls this axis.

Change meaning: check or uncheck to reverse the direction of movement of the axis considered

Outputs Steps: choose for each axis which of the 10 outputs of the IPL5X interface emits the step signal from the stepper motor which controls this axis.

Invert signal: check this box if the motor control electronics require a reverse step signal (very rare).








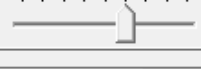


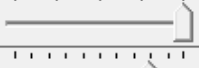

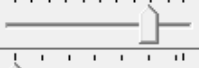


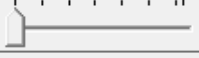
step/motor revolution: indicate for each axis the number of steps per revolution given by the motor manufacturer.

microstep driver: indicate for each axis the resolution to which the motor control driver is set (usual values: 1, 2, 4, 8, 16, 32)

mm / revolution: indicate for each axis the reduction ratio of the drive system (what is the displacement of the carriage in millimeters when the motor axis makes one revolution?)

Invert motor ON/OFF signal: to be checked or unchecked depending on the motor control electronics to control the switching on or off of the motors (checked for StepStick, Pololu, DRV8825 type drivers).

8.2.2.2 Tab 2: Settings (IPL5X interface)

Interface and engines	Settings	Parameters	Spacings	Pr
	 X1	 X2	 Y1	 Y2
 Vmax without acceleration		<input type="text" value="40.0"/>	mm / s	
 Vmax with acceleration		<input type="text" value="80.0"/>	mm / s	
 Acceleration	<input type="text" value="6"/>			
 Frequency interpolator	<input type="text" value="50 kHz"/>			
 Maximum wire heating:	<input type="text" value="80 %"/>		 Preheating time (s)	<input type="text" value="2"/>
 <input checked="" type="checkbox"/> Motors auto OFF, delay	<input type="text" value="1 s"/>		The limitation of the heating makes it possible the wire when it is short	

Explanations on speeds:

Hot wire cutting needs a constant speed to give a good result. The most important parameter is therefore “Vmax without acceleration” which will give the maximum speed that we can ask of the carriages. CNCFAB machines allow high speed without acceleration, which allows all types of cutting (because the speed at the carriage level can be much higher than the speed required in the material in the case of complex cuts).

If we gradually increase the speed of a stepper motor that is already running at Vmax without acceleration, we can make it run even faster and thus reach Vmax with acceleration.

In FilChaudNX, speeds with acceleration can only be used for manual movements outside of material (interesting with very large machines).

Settings :

Vmax without acceleration : maximum speed in mm/s that can be requested from the motor immediately without it stalling (take a little margin, indicate 40 if your tests give 50 for example).

Vmax with acceleration : maximum speed in mm/s that can be requested from the motor by making it follow an acceleration ramp whose slope is defined between 1 and 9 by the Acceleration parameter just below.

Interpolator frequency : setting the smallest time unit used to send signals. The higher the frequency, the smaller the unit of time; current motor control drivers support a frequency of 50kHz which is the value to generally remember (for information, the MM2001-HL which is a fairly old card only supports 30kHz).

Maximum wire heating : clamping of the PWM controlling the heating of the wire (between 0 and 100%) to avoid melting the short resistive wires; to be adjusted so that the maximum heating just begins to change the color of the wire (slightly red).








Preheating duration : waiting time in seconds before the start of a cutting movement, to allow time for the wire to heat up.

Auto motors OFF, delay : the check box allows the activation of powering off the motors at the end of a movement, the delay in seconds (from 1 to 127s) allows you to define a delay before powering off, duration during which the motors remain under tension, immobile.

Remarks :

- When the motors are powered on, it is not possible to move them by hand and they can heat up if left like this for too long.
- When the motors are no longer powered, the position is not maintained which can be a problem in certain situations (manual cutting for example). It may then be interesting to temporarily deactivate the auto OFF parameter, which can also be done directly in the manual control or material definition windows.

8.2.2.3 Tab 3: Parameters (All machines/interfaces)

Interface and engines		Settings		Parameters	
	Stroke X (mm)	<input type="text" value="980.0"/>		Stroke Y (mm)	<input type="text" value="505.0"/>
	<input type="checkbox"/> Take into account the thickness of a rotary table (see next tab)				
	Wire/tray margin (mm)	<input type="text" value="1.0"/>		Wire/block margin (mm)	<input type="text" value="20.0"/>
	Default position of the block relative to the origin (mm)				<input type="text" value="10.0"/>
	V fast (VR) (mm/s)				<input type="text" value="20.0"/>

Stroke X : useful travel of the horizontal axis of the machine.




Course Y : useful travel of the vertical axis of the machine.

Wire/table margin : margin below which the wire cannot descend when cutting, this prevents the wire from catching or marking the table.

Thread/block margin : margin between the block and any wire bypass paths

Position of the block relative to the origin : default position of the material block along the X axis and relative to the origin ; this value can then be adjusted in the case of 4-axis cutting.

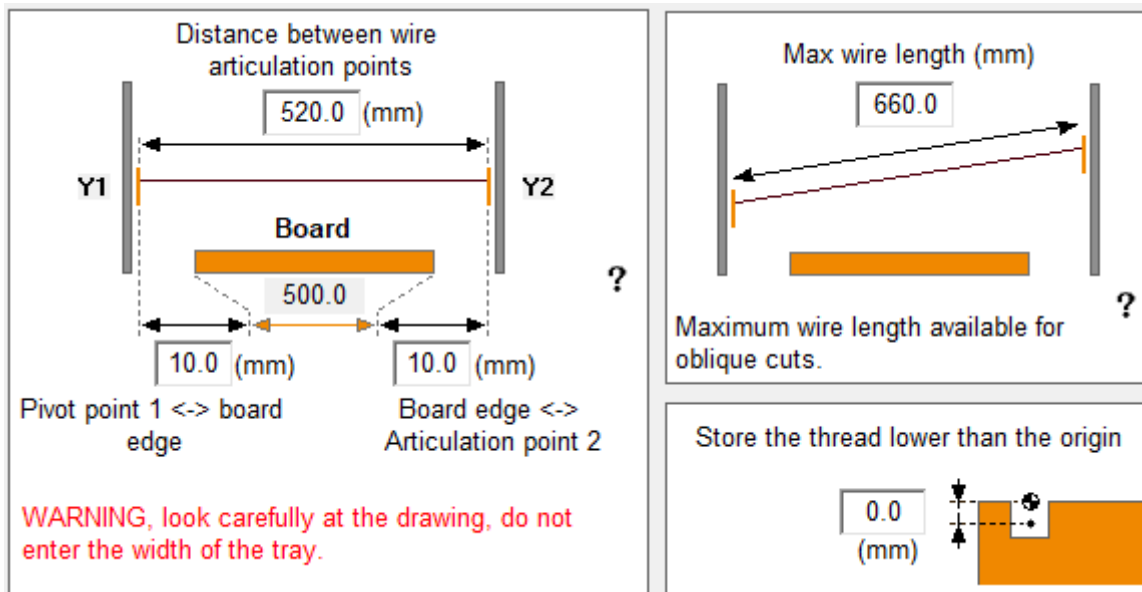
Fast V : speed chosen in mm/s of movements outside the material during an automatic procedure (cutting, storage, homing, etc.). Not to be confused with maximum speeds which may be higher.

	V cut (VD) (mm/s)	<input type="text" value="4.0"/>		Wire heating (CH) (%)	<input type="text" value="65.0"/>
	Kerf at (VD;CH) (mm)	<input type="text" value="1.0"/>	<u>4 axis</u>	Kerf at (VD/2;CH) (mm)	<input type="text" value="2.0"/>

V cutting, wire heating : default cutting settings

Kerf at (V; CH), Kerf at (VD/2; CH) : default kerf settings

8.2.2.4 Tab 4: Spacings



Look carefully at the diagrams:

Y1 - Y2 : distance in mm between the inside face of the left and right wire holders.

Y1 – Board : distance in mm between the inside face of the left wire holder and the left side of the plate.

Board – Y2 : distance in mm between the right side of the plate and the interior face of the right wire holder.












These measurements must be carried out carefully, they determine the precision of the cutting.

The width of the tabletop (in gray) is calculated from the measurements and allows them to be checked. For example, if your plate measures 500mm wide and the software tells you 501mm, this means that you have 1mm of error in the measurements.

Maximum wire length : available wire length; allows FilChaudNX to control that the 4-axis cutting will not exceed the possibilities of the wire in terms of length (when the carriages are not facing each other).

Store the wire lower than the origin : it is possible to store the wire in a groove in the top of the plate, which allows the polystyrene blocks to slide across the table without snagging the wire (very practical!) ; indicate here how many mm the wire is stored below the origin.

8.2.2.5 Tab 5: Procedures

	Wire cleanup :		Heating value (%)	<input type="text" value="80"/>	
	Offset (mm)	<input type="text" value="30.0"/>		Waiting (s)	<input type="text" value="6"/>
<input type="checkbox"/> Activate the 2 loops of switches					
Procedures that can only be used in 2D Cutting:					
<input type="checkbox"/> Activate origin detection by switches					
	Distance Inter <--> O. (mm)	 X1	 X2	 Y1	 Y2
	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
<input type="checkbox"/> Enable automatic storage					
	Next X (mm)	<input type="text" value="900.0"/>		Next Y (mm)	<input type="text" value="500.0"/>

Wire cleanup : these parameters are applied when pressing the Wire cleaning button available in the 4-axis cutting part of the software ; cleaning consists of heating the wire (cleared from the table) and passing a cloth over it to remove the residue of melted polystyrene.

Heating value : heating to be applied for cleaning (classically 100%, it will be limited according to the maximum heating value of the wire in Tab 2).

Offset : vertical travel distance of the wire to clear it from the table for cleaning.

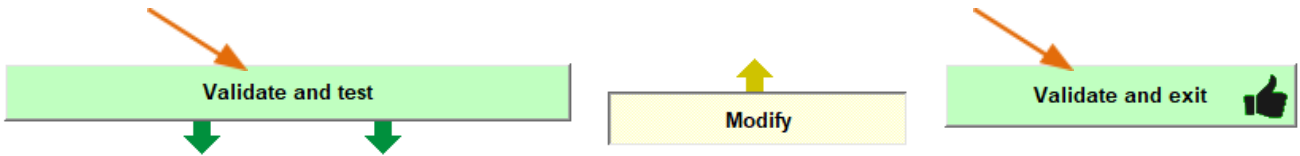
Waiting : time delay in the high position (for passing the cloth) before the wire returns to its initial position.

Activate the 2 loops of switches : the IPL5X interface has two inputs to which normally closed loop switches with ground can be connected ; if the switches are activated, movement and heating are cut off when one of the two loops opens.

Procedures usable only in 2D Cutting : procedures currently reserved for certain CNCFAB machines, see their configuration instructions.

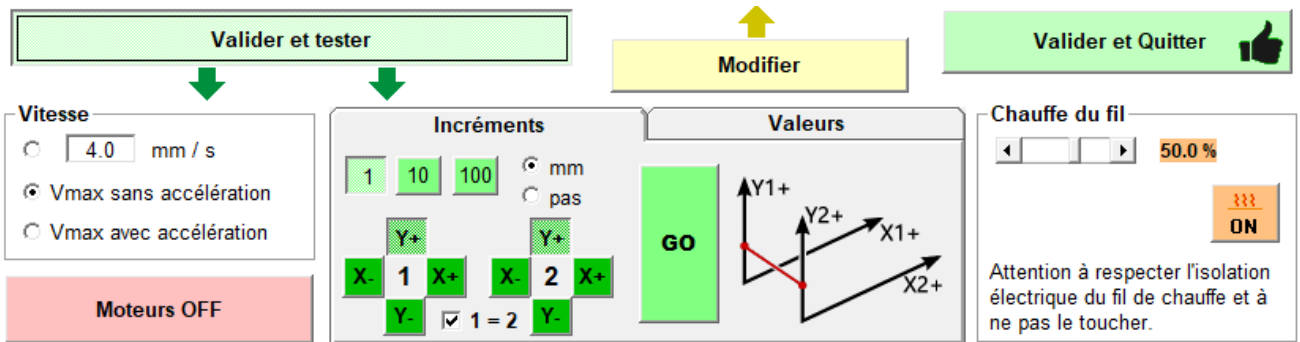
8.2.3 Save settings

The two green buttons trigger both the saving of the parameters in the FilChaudNX.ini file and their writing in the IPL5X interface of the machine (if there is one) :



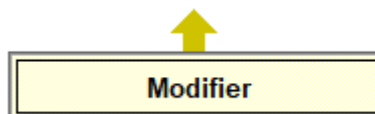
8.2.4 Test settings

Setting up a new machine often requires trial and error, whether for signal outputs or maximum speeds. With FilChaudNX and an IPL5X interface, it is very simple to test the change of a value, simply click on Validate and test, which will update the parameters and activate the manual control area of the machine located under the parameter tables:



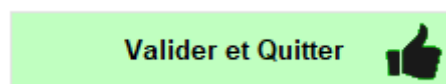
The use of this area is self-explanatory, it contains all the necessary texts and diagrams. Activating this area deactivates the settings area (a padlock appears).

To return to the settings area, click on the Modify button:



8.2.5 Validate settings

Validation is done using the Validate and Exit button which closes the window:



9 Calibration of a material

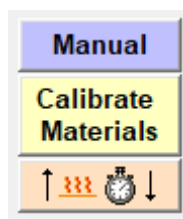
Calibration allows you to define the cutting conditions to obtain parts cut to exact dimensions. This is therefore an important step that must be carried out for each new material used (which will be saved in the materials database).

9.1 Calibration for 2D cutting

Refer to the instructions for use of the FilChaud2D software.

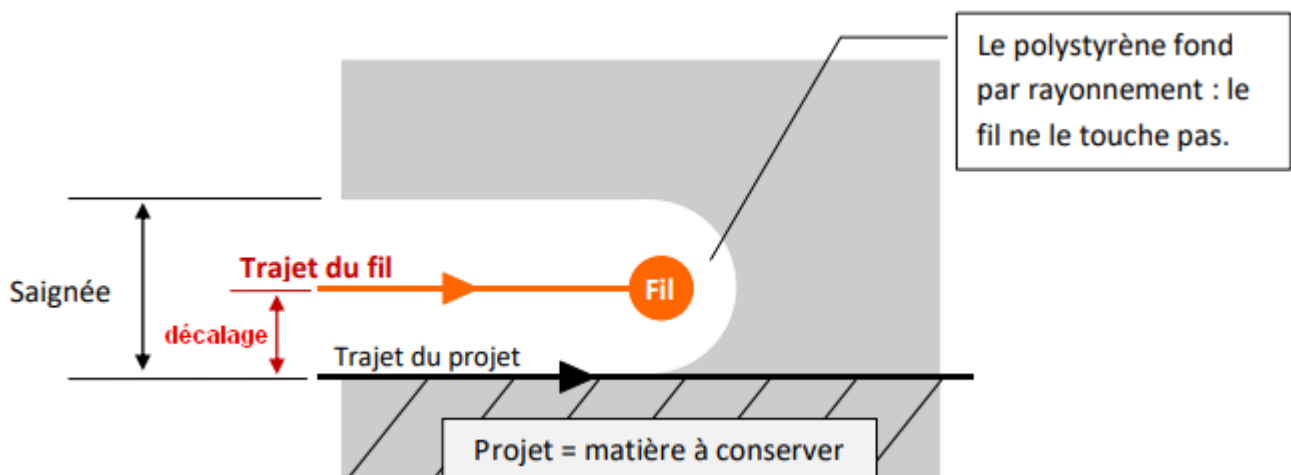
9.2 Calibration for 4-axis cutting

The material calibration window is accessible via the yellow Calibrate Material button on the 4-axis cutting tab:



9.2.1 Principles

- The wire melts a kerf of material in its path. When we are careful not to go too fast, the wire does not touch the material, which vaporises beforehand (we speak of cutting by radiation). It is also necessary to shift the wire by half the kerf width to obtain the final dimension:



- When cutting, the user sets a cutting speed. This speed is a maximum speed in the material, but there will be certain segments which will be cut at a lower speed (but with the same heating, therefore a wider kerf!). FilChaudNX manages this very well, using a simple calibration procedure and a powerful variable offset algorithm.

9.2.2 Method

Calibration consists of the following operations:

- choose a cutting speed,
- determine the heating for this cutting speed,
- measures the kerf of the wire at this heating and this cutting speed,
- measure the kerf of the wire at this heat and half the cutting speed,
- save these values by associating them with a name.

This operation is carried out using a small block of the material to be calibrated (see the suggested dimensions below).

A demonstration video is available here : <https://youtu.be/9ghv3P23k6k>.

9.2.2.1 Choose a speed

In FilChaudNX, you calibrate a material for a given cutting speed, you must therefore choose the cutting speed before starting to calibrate (no “heating line” as in other software, this unnecessarily complicates the calibration).

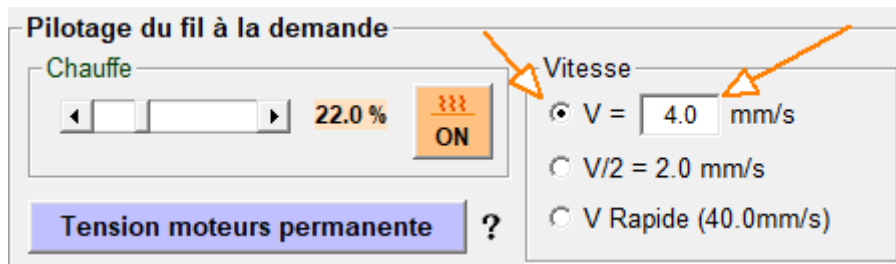
Some common values for your beginnings :

- expanded polystyrene, classic cut: 4mm/s
- expanded polystyrene, precise cut: 2mm/s
- lightweight expanded polystyrene, quick cut: 6mm/s
- extruded polystyrene (styro), classic cut: 3 to 4mm/s
- extruded polystyrene (styro), precise cutting: 1.2 to 1.5mm/s
- depron: 4mm/s
- EPP: 2-3mm/s

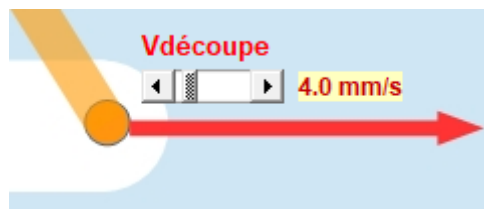
So, if we want to test different speeds for the same material, we will have to do a calibration by speed, with an appropriate title, for example “Rapid Expanded” and “Precise Expanded”: (Avoid titles that are too long, there is no no space!)

EPS blanc dense
 Expansé Rapide,
 Expansé Précis, 5

Enter the chosen cutting speed in the Speed section of the “Calibration procedure” frame:



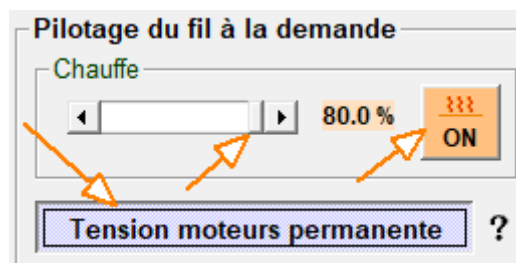
Also indicate the chosen speed in the frame “Display and create materials” by moving the cursor:



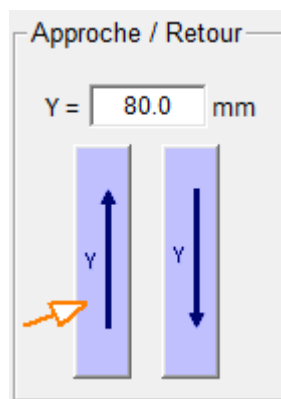
9.2.2.2 Determine the heating

The heating will be determined dynamically during a cutting movement.

Engage the Permanent motor voltage button for the duration of the calibration. Set the heating to maximum (restricted by the parameters) and heat the wire by clicking ON:



Bring the wire up close to the top of the block of material using the Approach/Return frame. The input field allows you to enter the value of the displacement based on the dimension of your block. For example, go up to 80mm high for a 90mm high block by clicking on the upward swept:

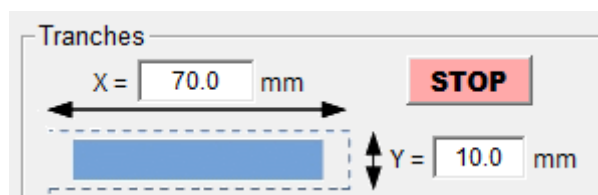


Set the machine's heating switches to PC (or Auto) and ON.

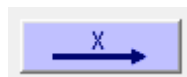


From this position, use the "Slices" frame to make horizontal movements slightly larger than the width of the block. For example, for a block 60mm wide, you can move it by 70 or 80mm.

As it will take several passes through the material, we take the opportunity to define a height between two passes (back and forth), for example 10mm:



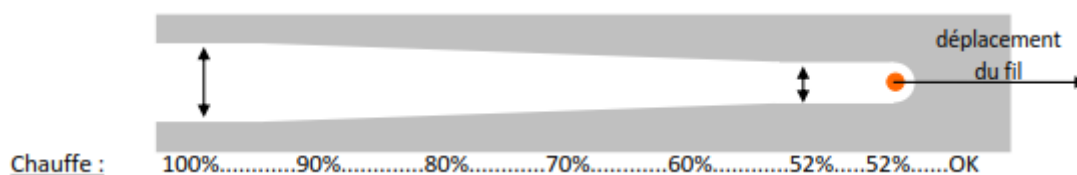
Then use the movement button to the right to pass the wire through the material:



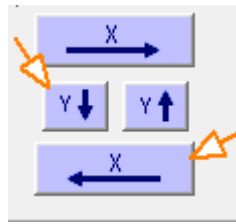
While the wire is moving, reduce the heat with the heating slider:



The kerf of the wire into the material will decrease at the same time as the heating decreases, visually monitor this reduction and stop lowering when the kerf is around 1mm or a little less (the wire must not drag the material):



If one passage is not sufficient, make a second one in the other direction using the arrows in the “Slices” frame :



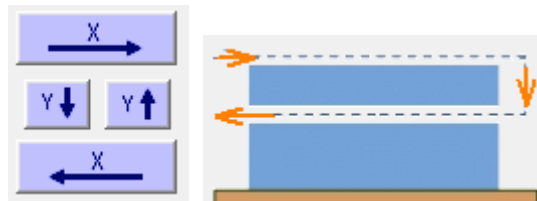
Once the heating has been defined, this value will be kept for the rest of the calibration.

The heating value is automatically updated in the “Display and create materials” frame:



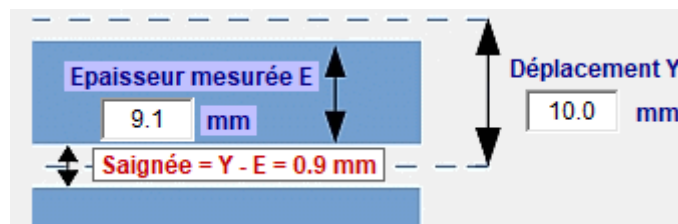
9.2.2.3 Measuring wire kerf at cutting speed

Use the movement buttons in the Slices frame to move up, down and back:



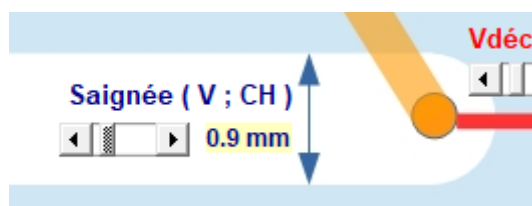
Measure the thickness of the slice thus obtained. (Using a calliper for example.)

The kerf value is the difference between the requested vertical movement and the measured thickness. This calculation can be carried out in the Wire kerf calculation framework. Example: I request a vertical displacement $Y=10\text{mm}$ and I obtain a slice with a thickness of 9.1mm :



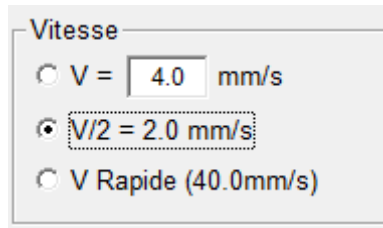
The kerf value is $10 - 9.1 = 0.9\text{mm}$ for the chosen cutting speed (4mm/s at the start of the example).

Enter the kerf value in the “Display and create materials” frame, by moving the cursor:

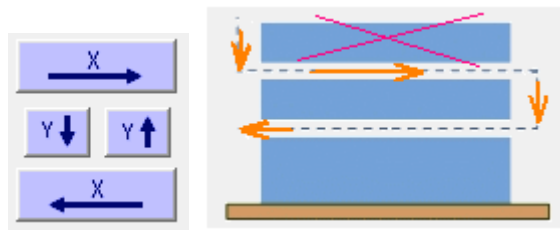


9.2.2.4 Measure wire kerf at half cutting speed

Always keep the same heating and select V/2 in the Speed frame :

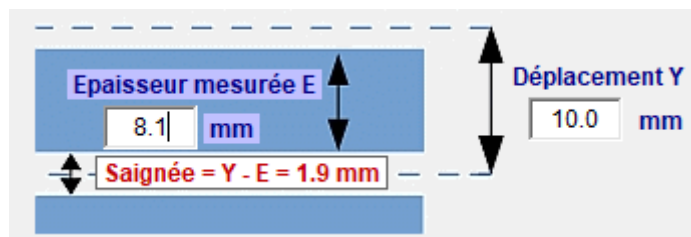


Cut a slice of the block again, leaving an unused slice on top of the block:



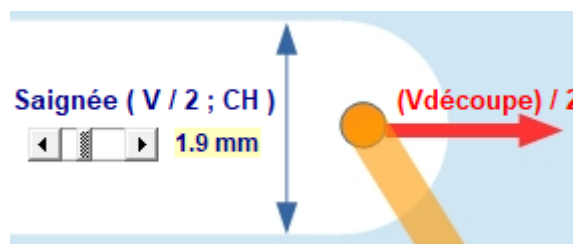
Measure the thickness of the new slice thus obtained. (Using a calliper for example.) As we go slower, it will be thinner.

The kerf value is the difference between the requested vertical movement and the measured thickness. This calculation can be carried out in the Wire kerf calculation framework. Example: I request a vertical displacement $Y=10\text{mm}$ and I obtain a slice of thickness 8.1mm :



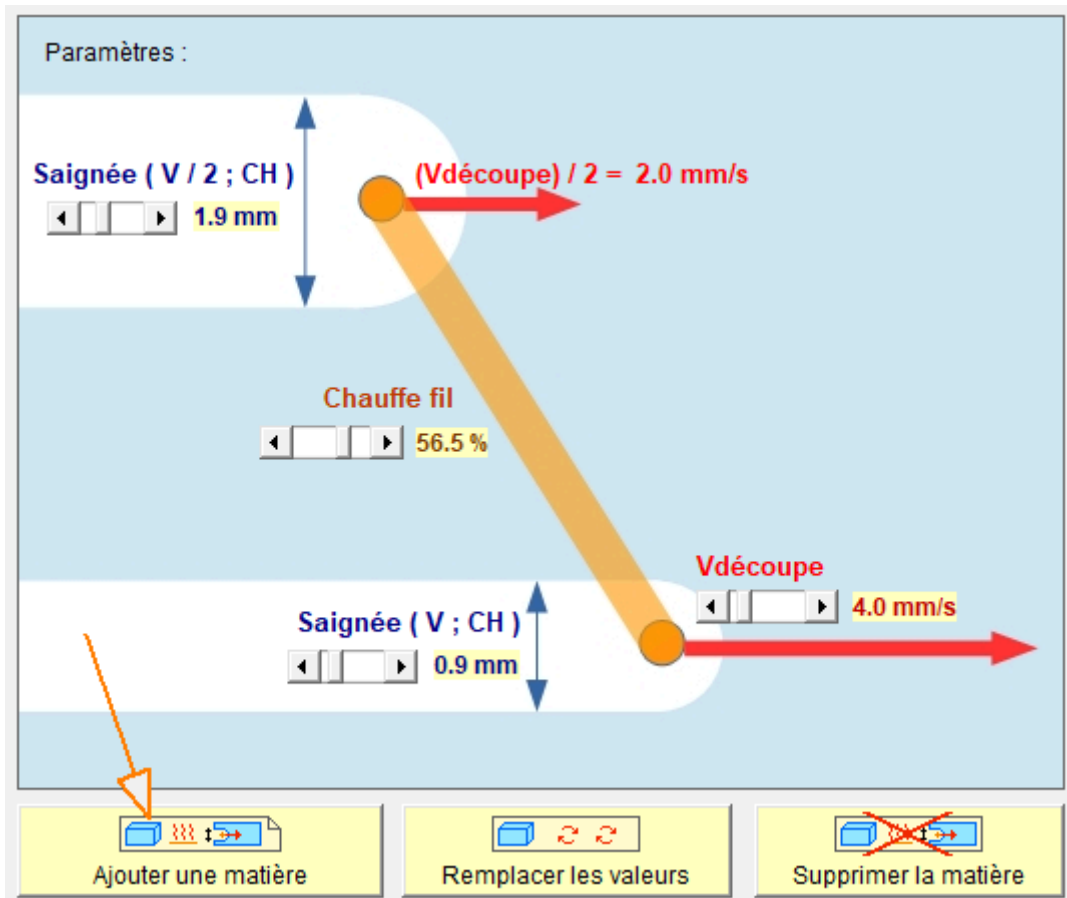
The kerf value is $10 - 8.1 = 1.9\text{mm}$ for half the chosen cutting speed (4mm/s at the start of the example, so half speed of 2mm/s).

Enter the kerf value in the “Display and create materials” frame, by moving the cursor:

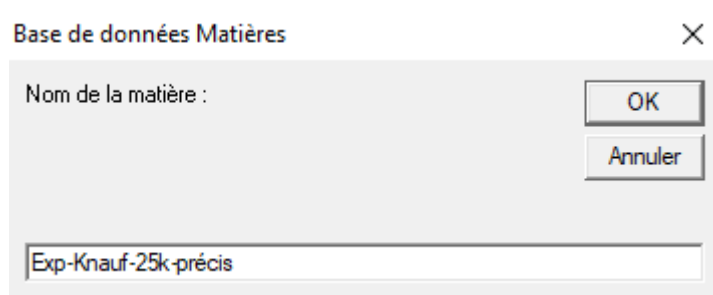


9.2.2.5 Saving new material

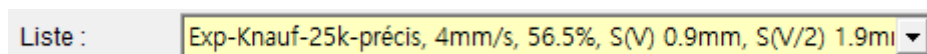
Check all the values previously entered on the frame and click on the first yellow button :



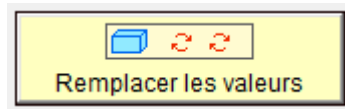
Enter a short but explicit name to easily find the material in the list:



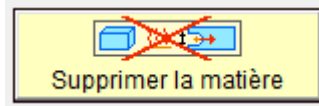
The new material thus created appears in the drop-down list with all the parameters:



To modify a parameter of a material, you must first display it in the list, then modify the parameter with the cursors and finally click on the Replace values button:

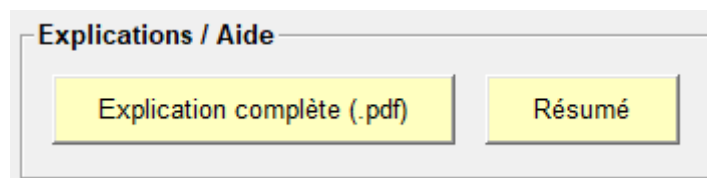


To delete a material, you must first display it in the list and then click on the Delete material button:



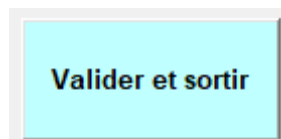
9.2.3 Help

To find these explanations without wasting time, they are available in the software in long or short version using the buttons in the "Calibration help" frame:

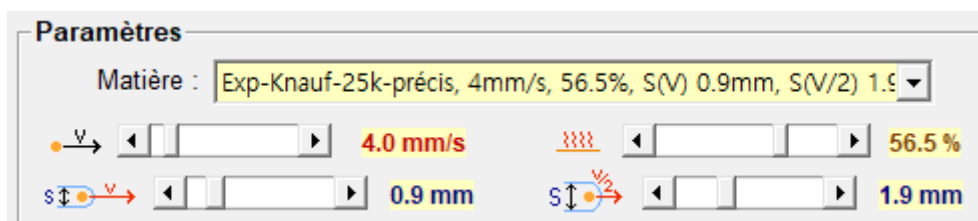


9.2.4 Exit window

The material definition window is exited using the Validate and quit button:

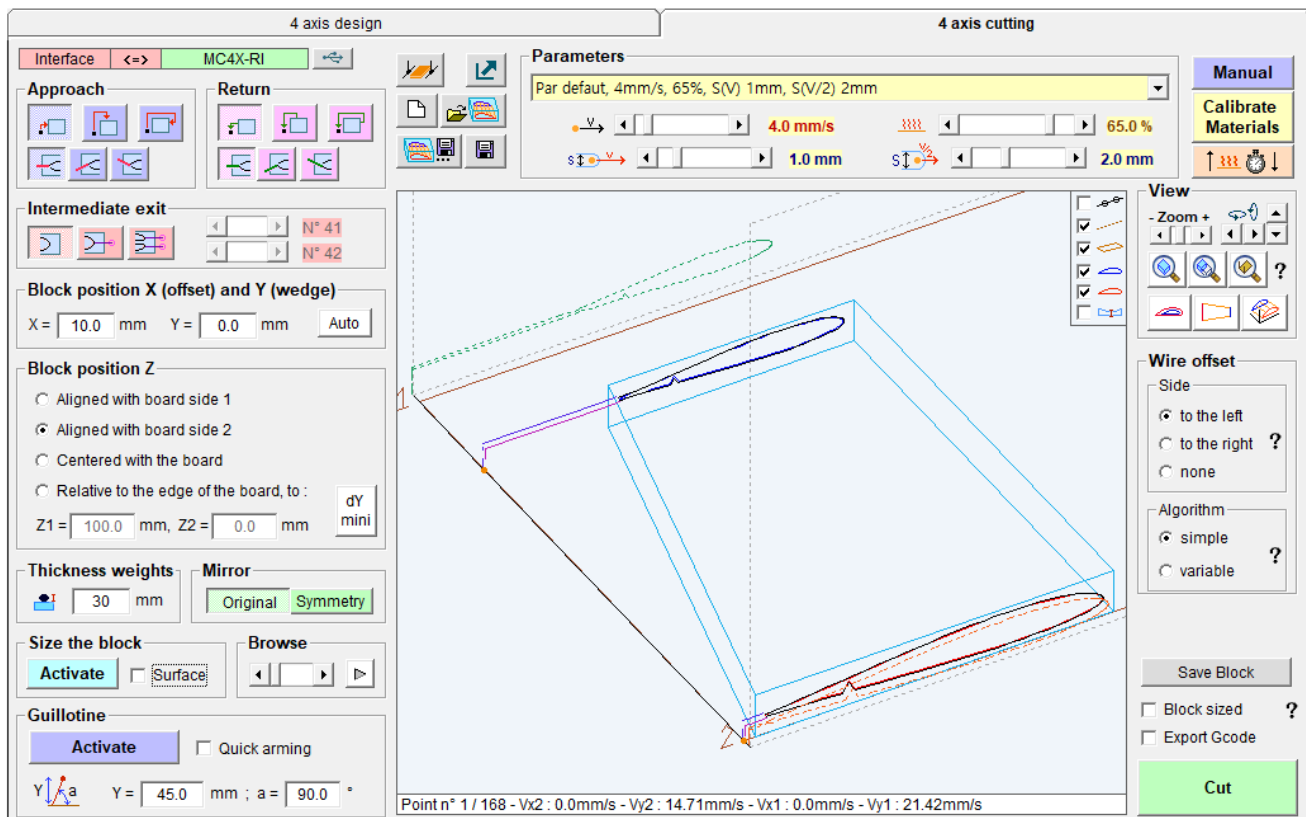


The list of materials in the cutting window is also updated:



10 Cutting a 4-axis project

Preparation for cutting is done in the 4-axis cutting tab:



10.1 visualisation tools

The perspective view has check boxes allowing you to display or not elements:

- | | |
|-------------------------------------|---|
| <input type="checkbox"/> | 1. The points of the cutting wire trajectory |
| <input checked="" type="checkbox"/> | 2. Project profiles, Tip and Root |
| <input checked="" type="checkbox"/> | 3. The machine plate |
| <input checked="" type="checkbox"/> | 4. The plans of the carriages, the trajectories of the wire holders |
| <input type="checkbox"/> | 5. The thicknesses of the remains (see further) |

The zoom and rotation tools are essentially identical to those in the 4-axis Design tab, with the addition of re-centering on a point by simply left clicking.

The Vue framework provides three tools for adjusting the perspective view:

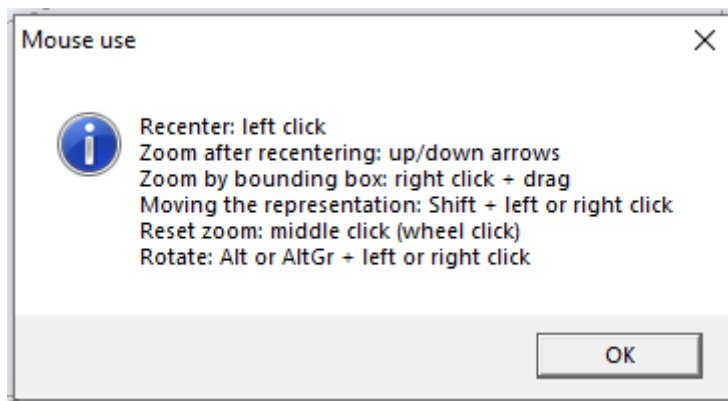
Adjust to cutout at block level



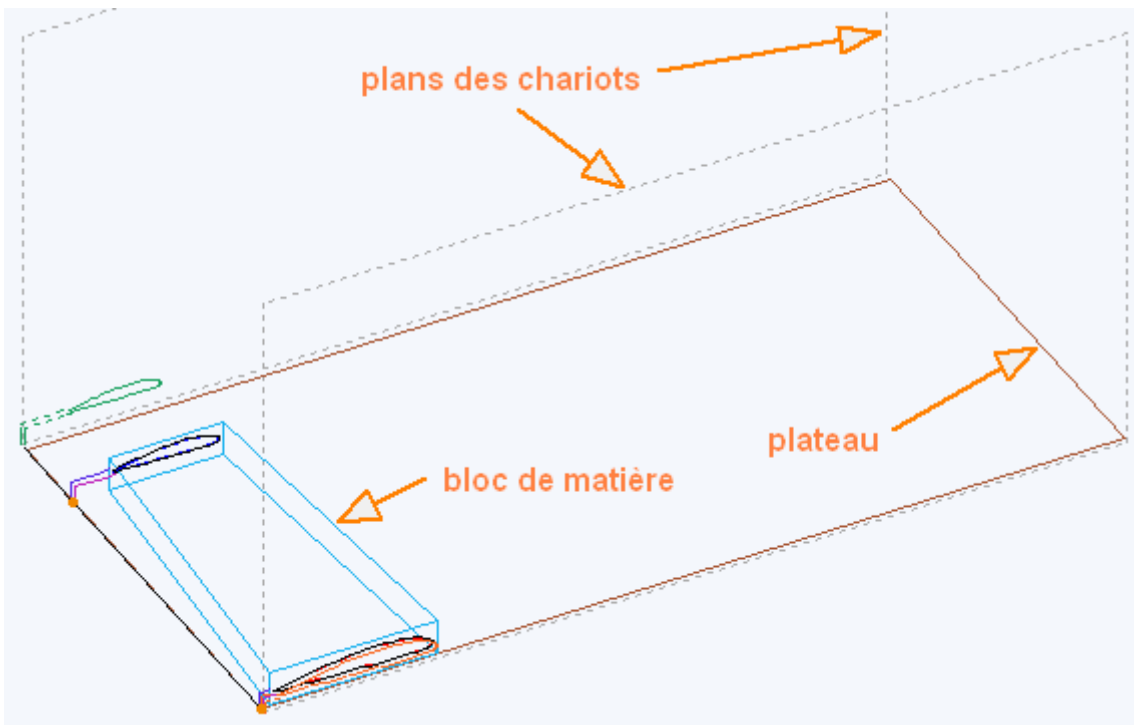
Adjust to cart trajectories

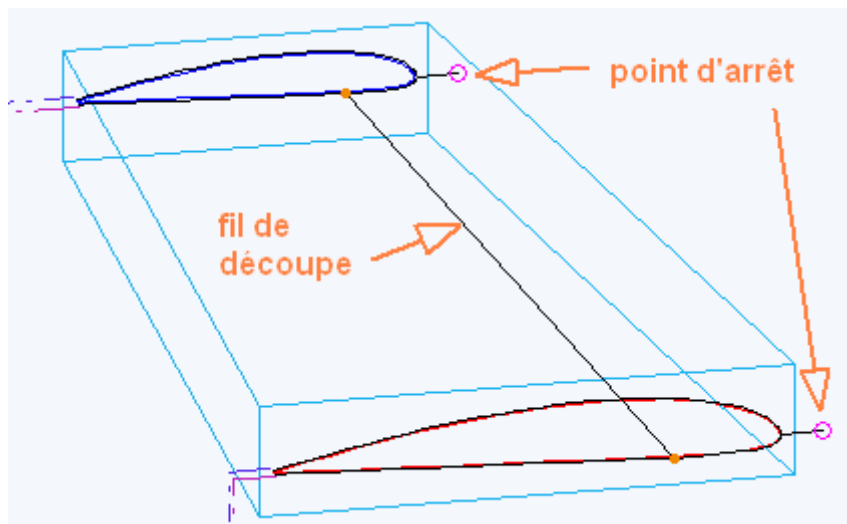
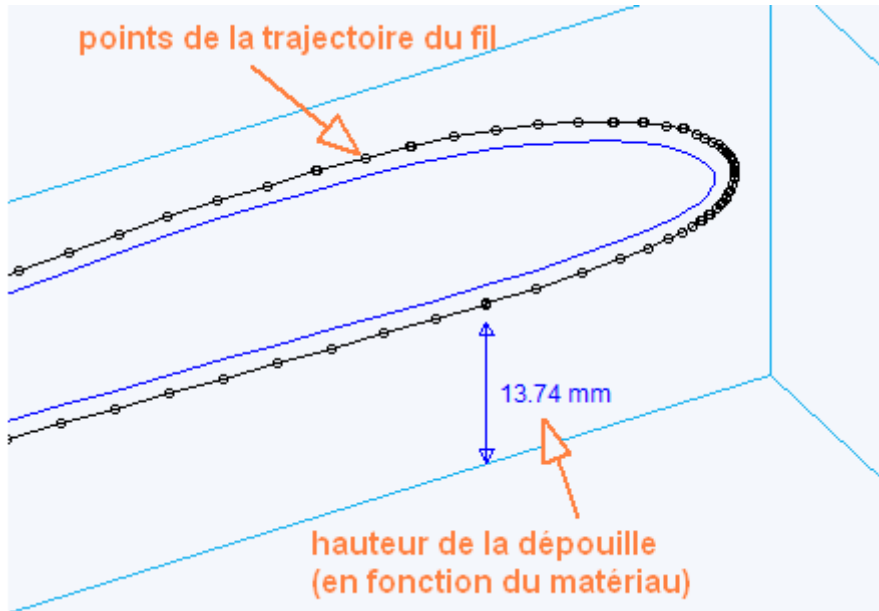
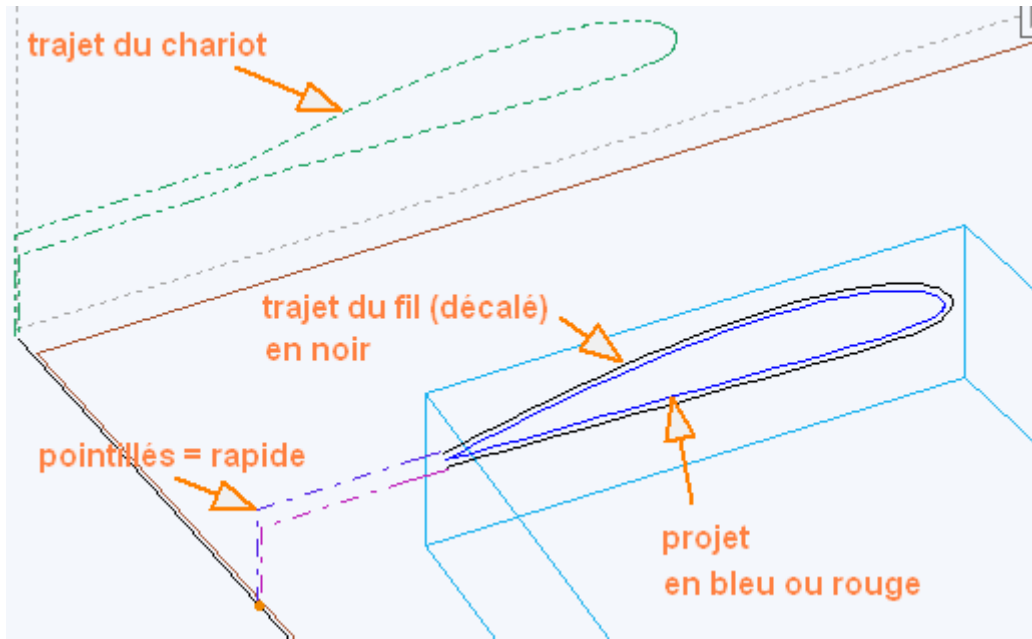
View the entire machine

A mouse click on the question mark displays a memo on how zoom works :



10.2 Perspective view elements (in french, sorry 😊)





10.3 Cut parameters

When you activate the 4-axis cutting tab, the cutting is immediately calculated with the material and cutting parameters selected and the 3D visualisation is updated automatically.

Modifying a parameter automatically updates the visualisation, FilChaudNX therefore always represents what corresponds to your project and your parameters: points, positions, synchronisation, machine parameters, material parameters and cutting parameters.

If something does not correspond to your expectations, whether on the screen or once the cutting has been carried out, the cause is above all to be found in what you have provided as information to the software (project, placement of points, parameters of the machine, calibration of the material, positioning of the block on the plate, etc.).

10.3.1 Approach and return parameters

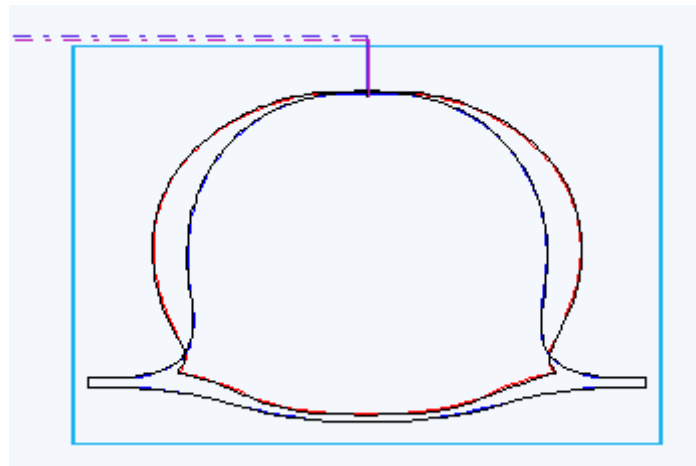


1. Approach from the left
2. Approach from above
3. Approach from the right, going around the block from above
4. Return from the left
5. Return from above
6. Return to the right by going around the block from above

Approach trajectories take the following into account:

- The margins defined in the machine parameters (for passage above the block)
- The thickness of any weights placed on the block to immobilize it and the height of which is given in the “Thickness weights” frame (see further)
- The “Box sized” checkbox, at the bottom right of the cutting window (for horizontal approach in fast or slow, see further)

Example of use : a symmetrical pair of fuselage can be cut starting from the top

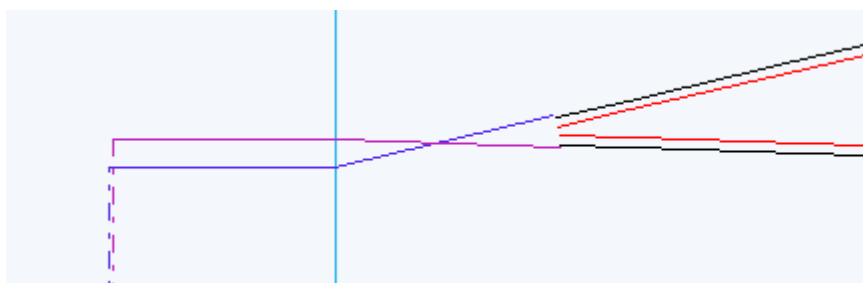


In the case of an approach or return from the left, we also have the possibility of choosing the angle with which we arrive:



1. The left margin of the block is crossed horizontally during the approach
2. The left margin of the block is crossed parallel to the first segment during the approach
3. The left margin of the block is crossed parallel to the last segment during the approach
4. The left margin of the block is crossed horizontally when returning
5. The left margin of the block is crossed parallel to the first segment when returning
6. The left margin of the block is crossed parallel to the last segment when returning

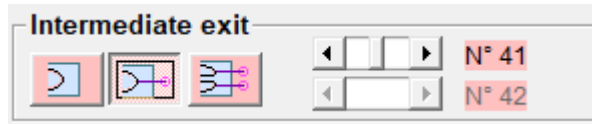
Example of use : using buttons 2 and 5, you can cross the entry and exit trajectories when cutting a wing profile, which allows you to obtain a clean trailing edge:



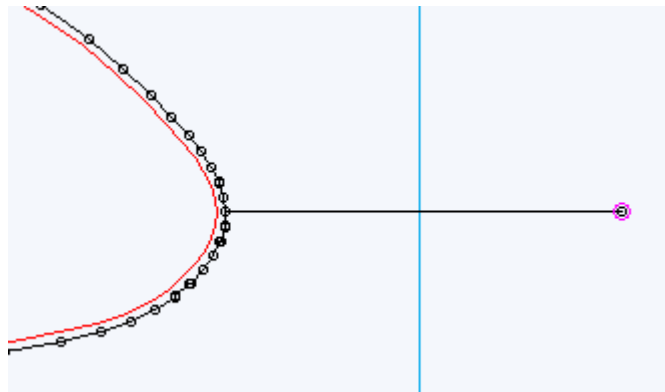
10.3.2 Intermediate exit

Thanks to the “Intermediate exit” frame it is possible to automatically add one or two exit trajectory from the block to the right with a stopping point then return to the cut.

- Enable the horizontal exit button:



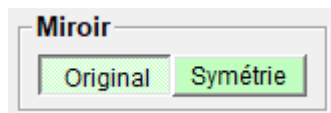
- Then use the slider(s) to specify the location of the output(s):



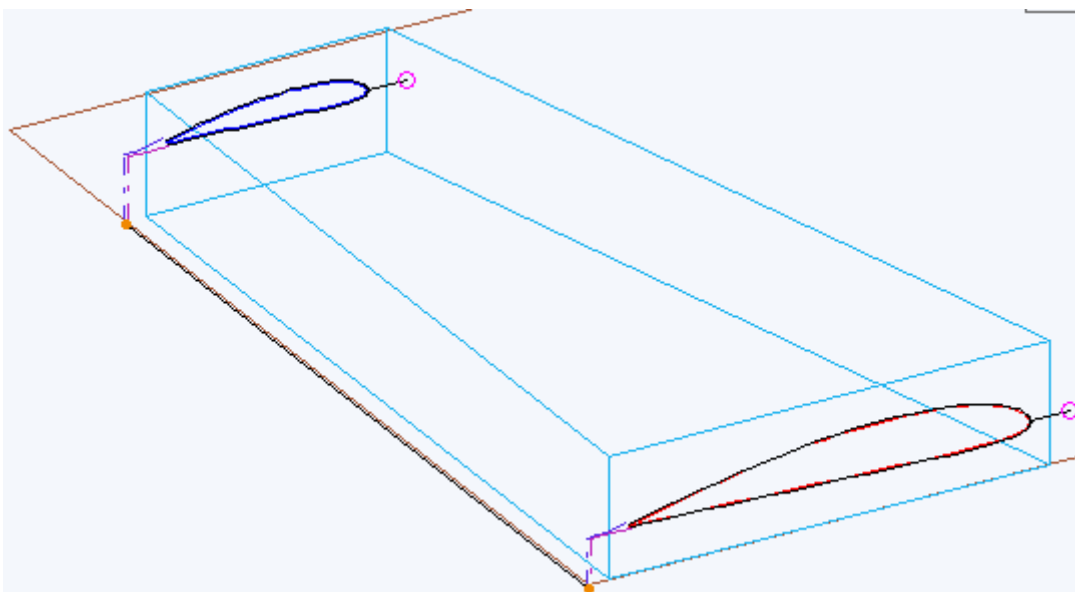
This function allows for example to separate the cut into two parts (but there will be a small mark on the cut core, where the wire comes out and enters).

10.3.3 Left wing or right wing

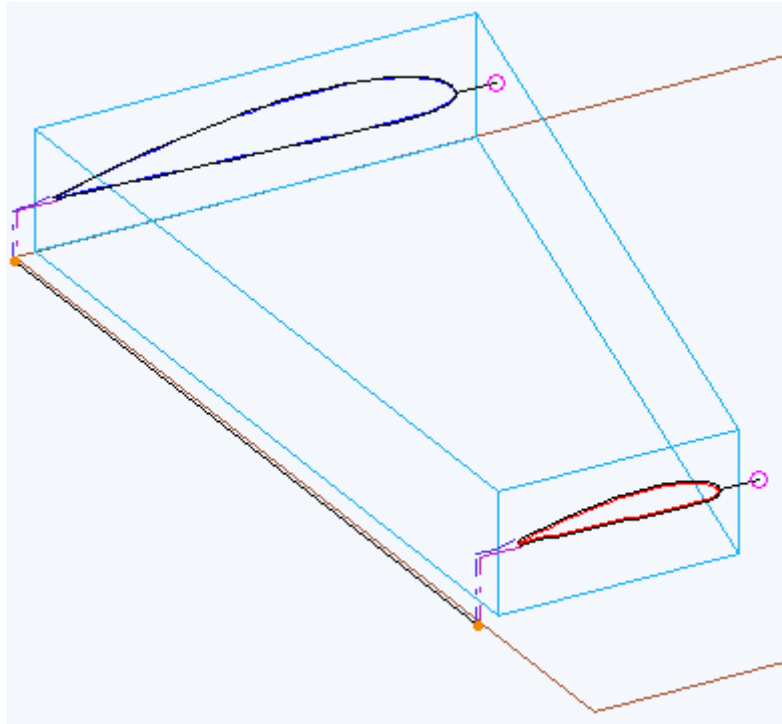
The Mirror frame allows you to cut a symmetrical project, which is useful in the case of trapezoidal airplane wings:



- When Original is selected, the cut is the same as the project in the “4-axis design” tab:



- When Symmetry is selected, the Root and Tip paths are swapped (and the position of the block on the table is modified, see later).



10.3.4 Ballast thickness

When cutting with a hot wire, it is strongly recommended to place weights on the polystyrene block to keep it perfectly still and prevent the shape from deforming during cutting.

It is necessary to enter the thickness of these weights in the “Thickness weights” frame so that the trajectories take them into account in the movements above the block (Approach / Return from the top or from the right, Squaring).

The height of the ballasts will be added to the block margin already defined in the machine parameters. (There is no need to take an additional safety margin if you already have a block margin, enter the exact thickness of the ballasts).

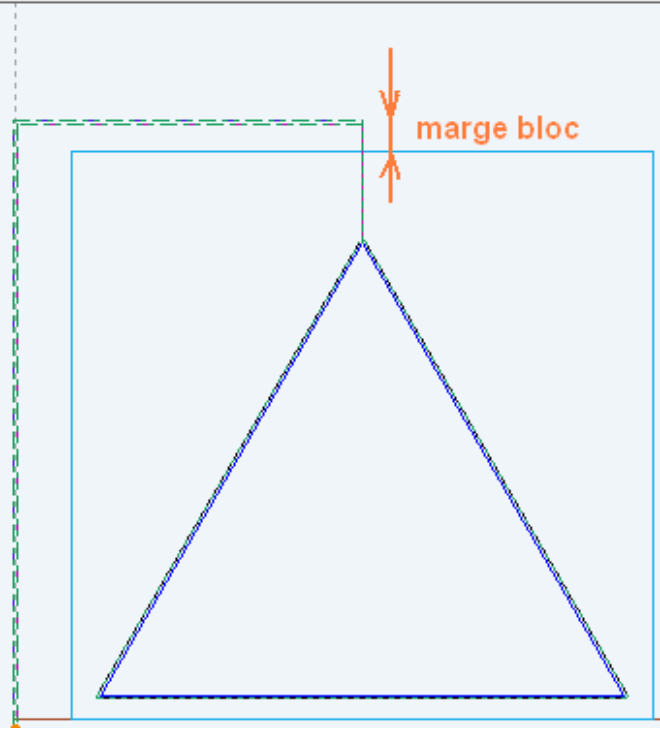
Be careful when entering/exiting from above not to put the weights in front of the entry/exit points(see example below).

Approche

Retour

Example :entry from the top with the ballast thickness at zero.

Epaisseur lests
 0.0 mm

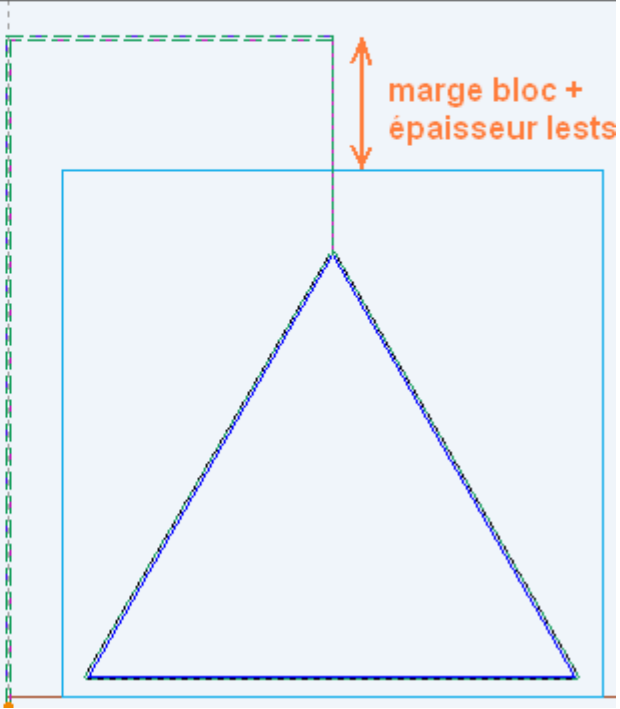


Approche

Retour

The same cut with the weight thickness at 20mm:

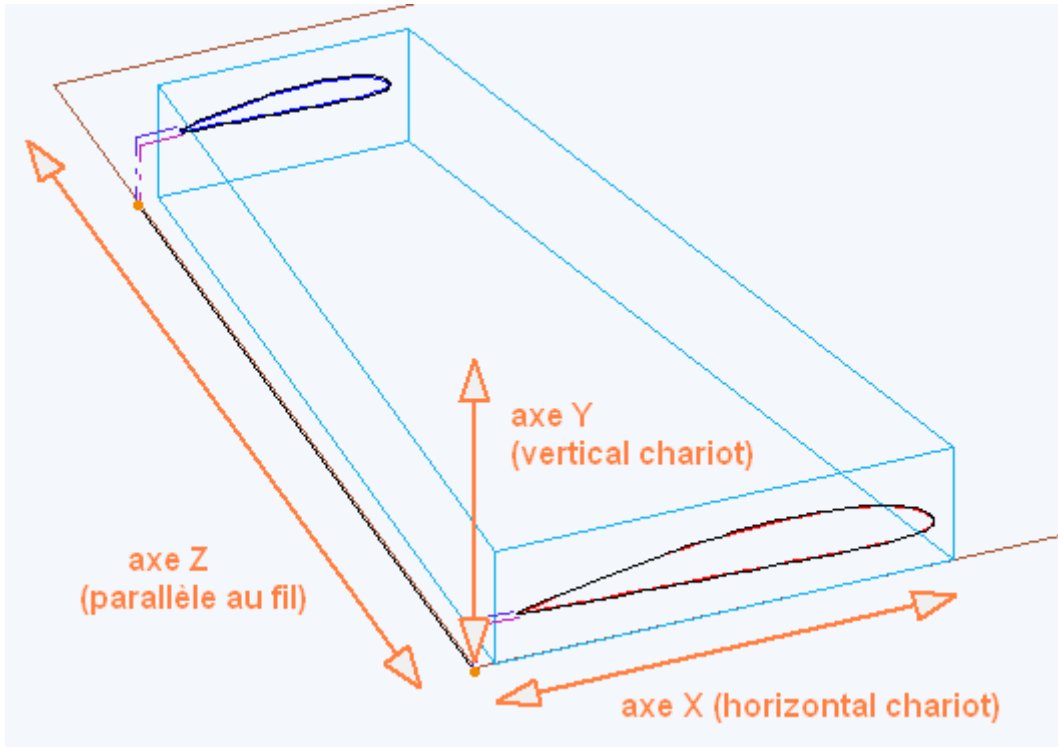
Epaisseur lests
 20.0 mm



10.3.5 Position of the block on the table

10.3.5.1 Position Settings

The block is positioned along the following 3 axis:

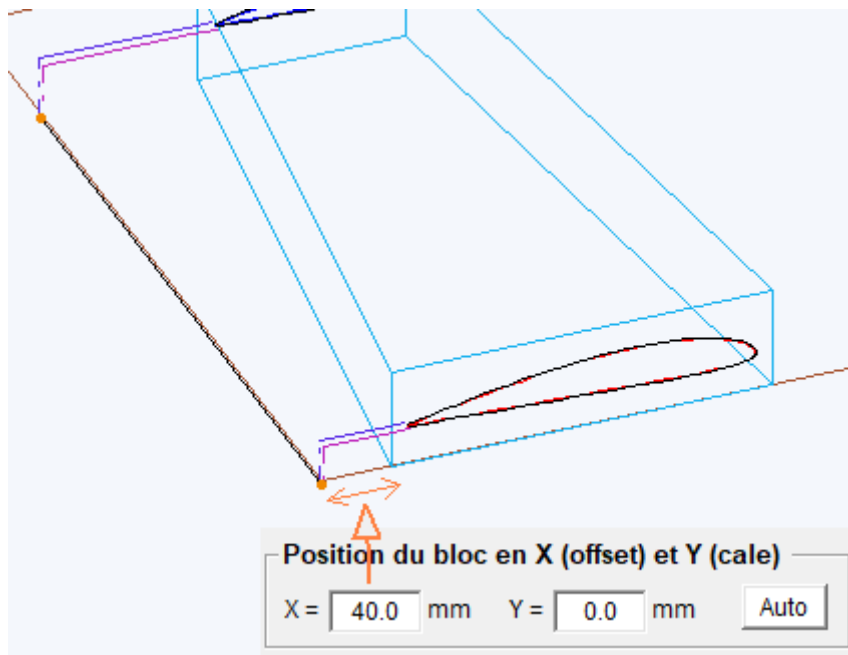


The position along these axis is managed in two frameworks:

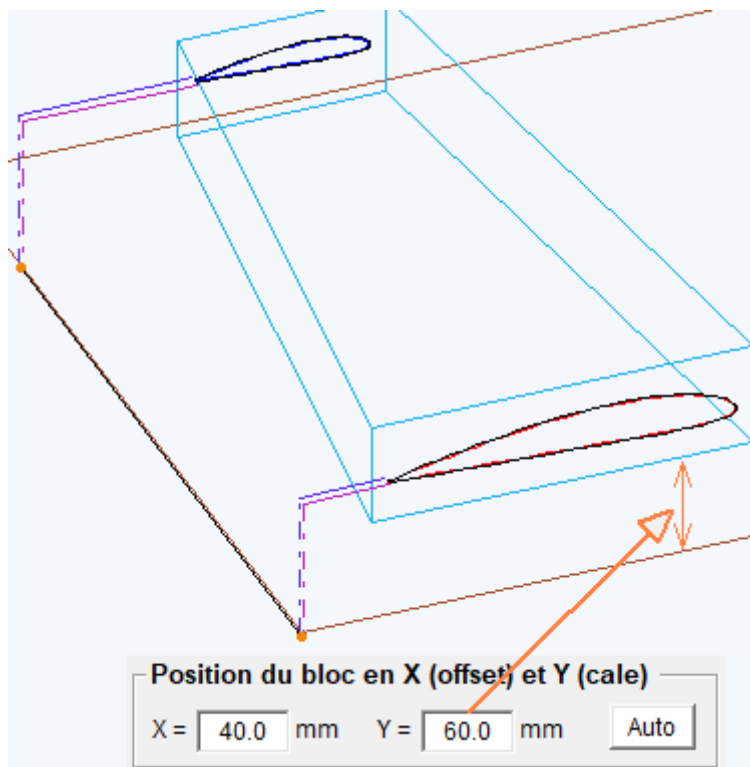
- The frame “Block position X (offset) and Y (wedge).”
- The frame “Block Position Z”.

The position of the block on the table will have an influence on the movements of the carriages and the precision of the cutting. We will always choose the position which minimises movements and which maximises precision (explanations later).

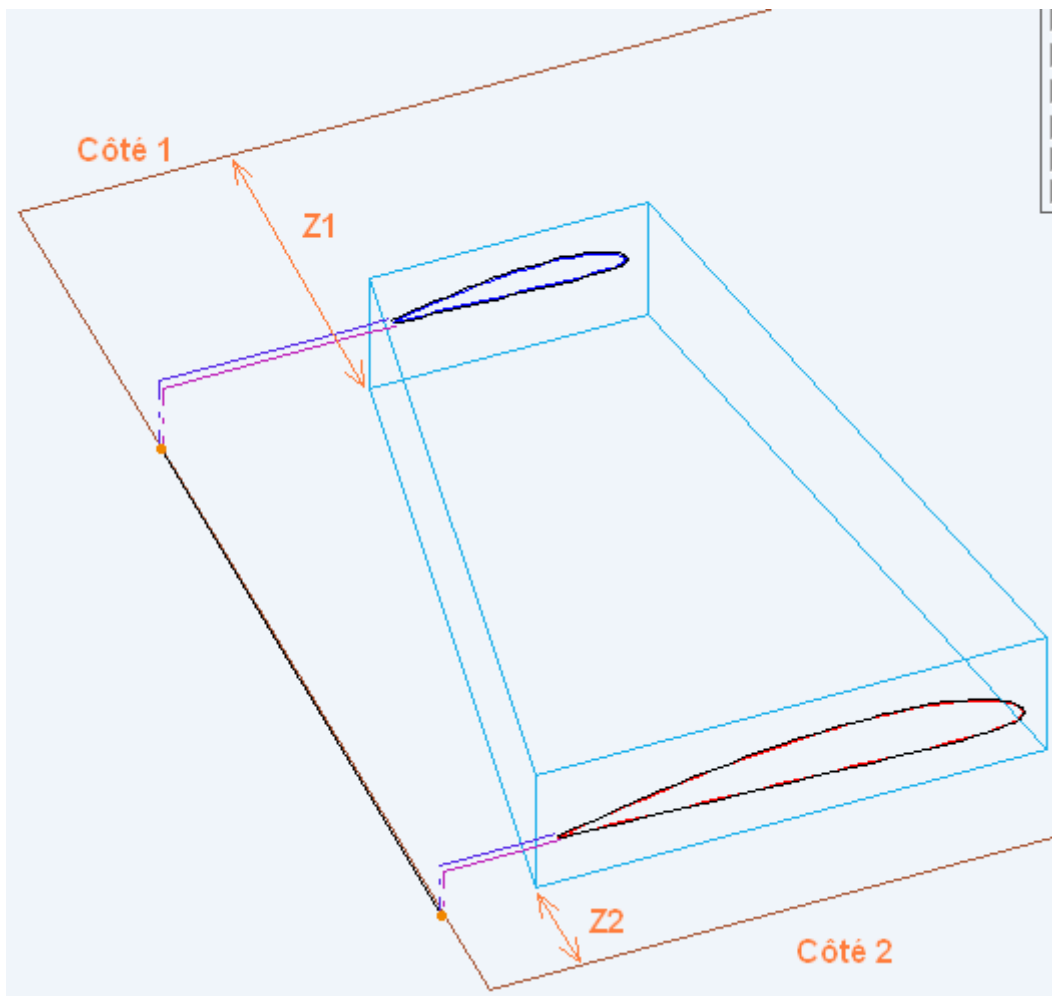
The position of the block in X represents the horizontal distance from the origin of the point closest to the origin:



The position of the Y block represents the vertical distance from the bottom of the block to the plate. It is worth zero when the block is placed on the plate. When you put the block on a block, it is equal to the thickness of the block.



The Z position represents the positioning relative to the sides of the board:



The preferred position is alignment with the edge of the plate on the side of the largest cutout because this is generally the most precise position:

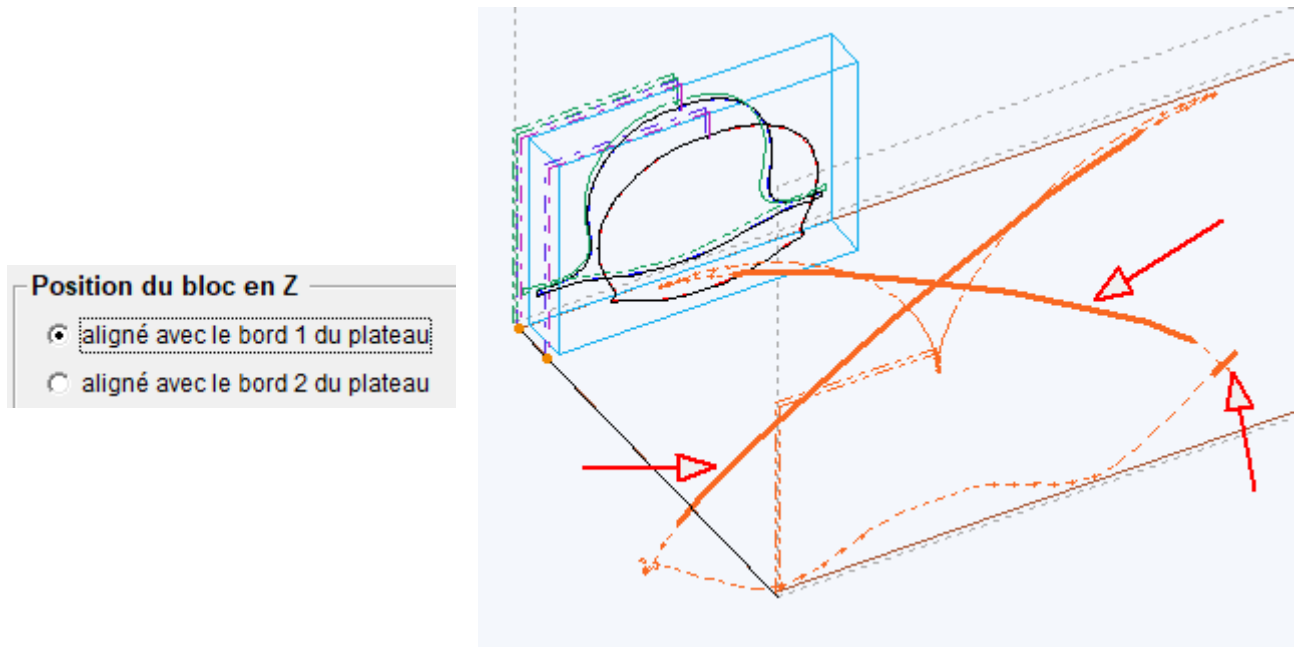
Position du bloc en Z

- aligné avec le bord 1 du plateau
- aligné avec le bord 2 du plateau
- centré par rapport au plateau
- par rapport au bord du plateau, à :

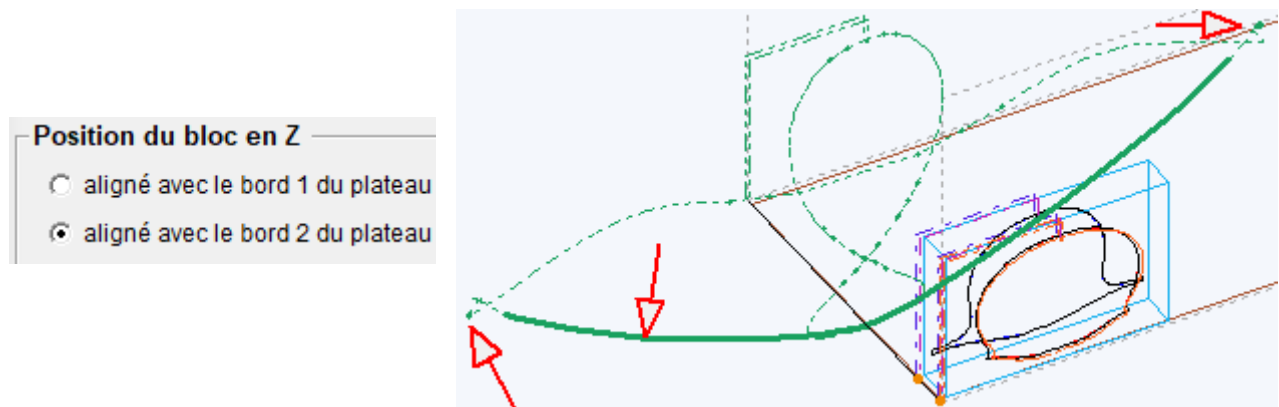
Z1 = mm Z2 = mm

10.3.5.2 Speed control

Exceeding speeds: when the carriages have to go too fast to carry out the cutting, the path appears in bold, as in the example below (exceeding V_{max} without acceleration at the carriage to respect $V_{cutting}$ in the material):



If we try to put the block on the other side of the board, we still have a problem with overspeeding:

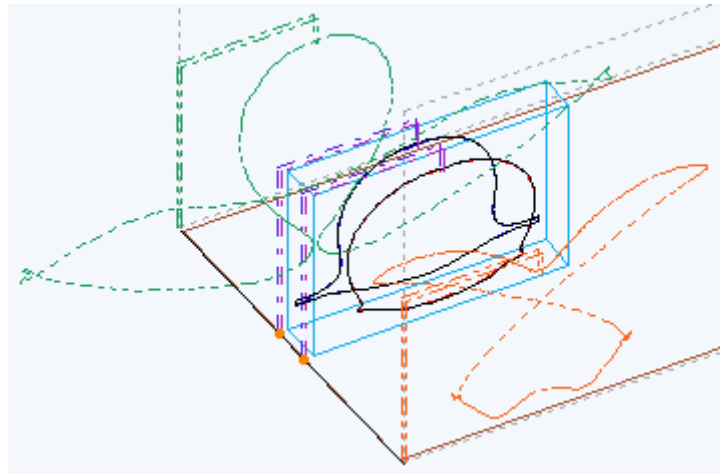


In such a case, it is necessary to adopt an intermediate position which will balance the speeds and movements between the two sides.

Position du bloc en Z

- aligné avec le bord 1 du plateau
- aligné avec le bord 2 du plateau
- centré par rapport au plateau
- par rapport au bord du plateau, à :

Z1 = mm Z2 =

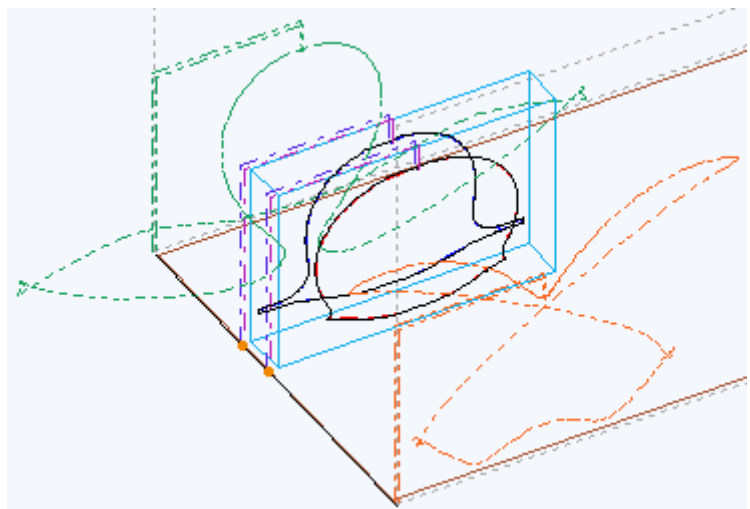


We have solved the speed problem, but the Z1 and Z2 values will be complicated to measure precisely on the plate to position the block. We can therefore improve things by moving slightly closer to the side which has the longest trajectories to have a rounded value, easy to measure on the board:

Position du bloc en Z

- aligné avec le bord 1 du plateau
- aligné avec le bord 2 du plateau
- centré par rapport au plateau
- par rapport au bord du plateau, à :

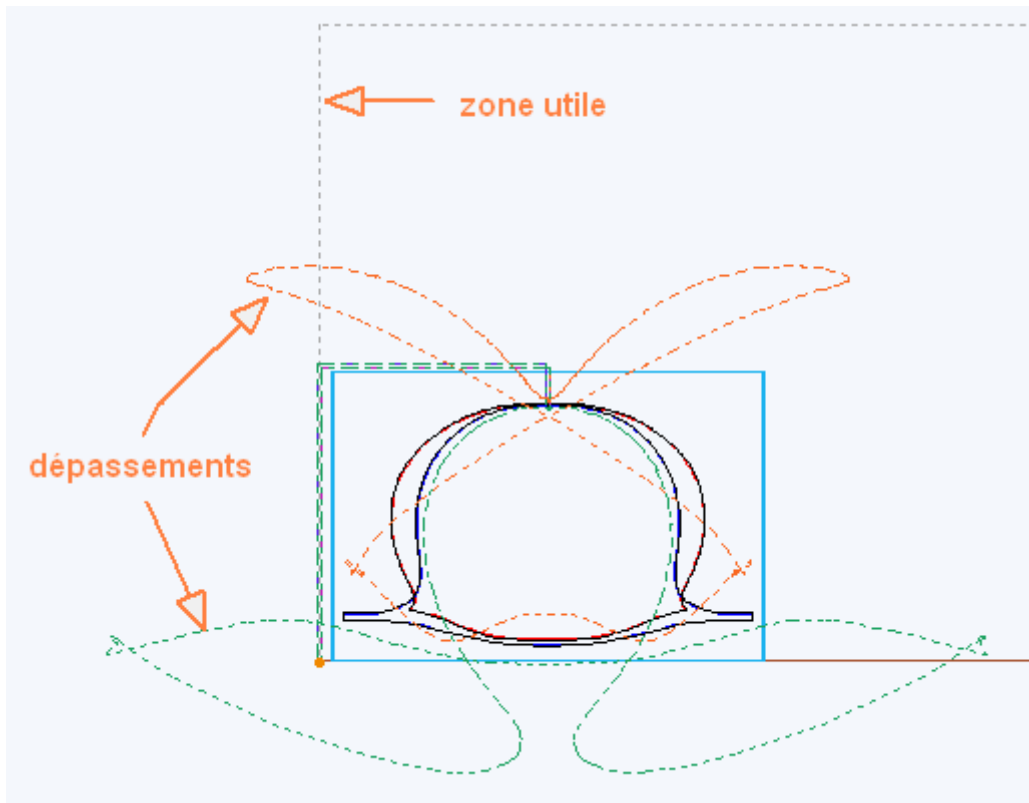
Z1 = mm Z2 =



10.3.5.3 Overrun control

The control of the overtravel is visual: we put the representation in side view and we ensure that the trajectories of the carriages remain within the dotted frames which delimit the useful area of the machine.

If the trajectories are exceeded, we see if it is possible to correct by adding offset in X and/or a shim/wedge in Y:



First, you can press the Auto button and see the proposed values which are minimum values:

Position du bloc en X (offset) et Y (cale)

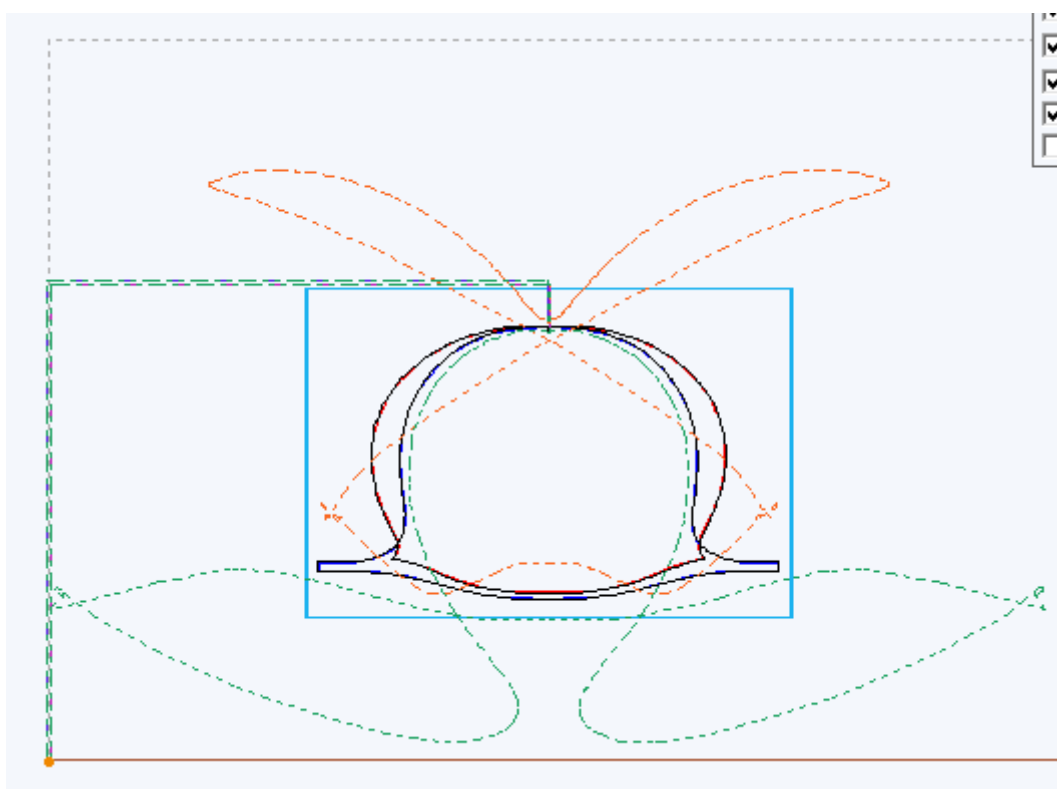
X = mm Y = mm

Then we will seek to optimize:

- We will round the value in X to the next ten to make it easy to measure on the board.
- The value in Y corresponds to a shim/wedge, so we will match it with what thicknesses of material we have available to make a shim. Here we will, for example, place the cutting block on a 100mm thick plate.

Position du bloc en X (offset) et Y (cale)

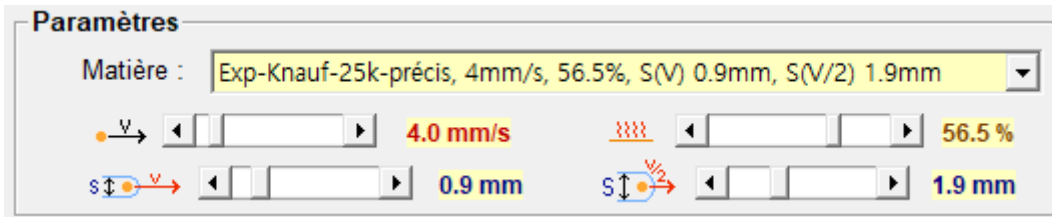
X = mm Y = mm



That's it, now the speeds and strokes of the movements are within the limits of the machine.

10.3.6 Material and Wire Offset

The choice of material is made using the drop-down list in the “Parameters” frame:

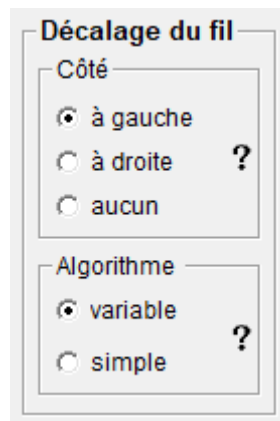


The speed, heating and kerf values of the selected material are displayed just below and can be modified before cutting to be able to make adjustments without having to recreate a material.

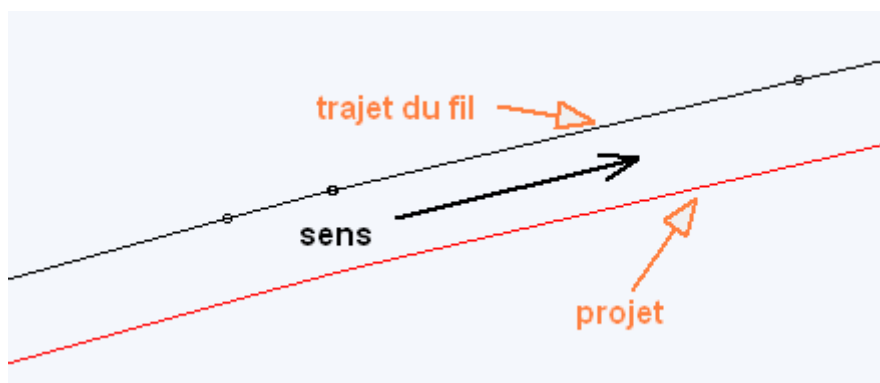
You may want to do a test with a slightly different speed or kerf and adjust the material only when the right value is found.

The heating can be modified during a cutting (if direct control with IPL5X) : it is common to have to modulate it depending on the temperature of the room (winter/summer).

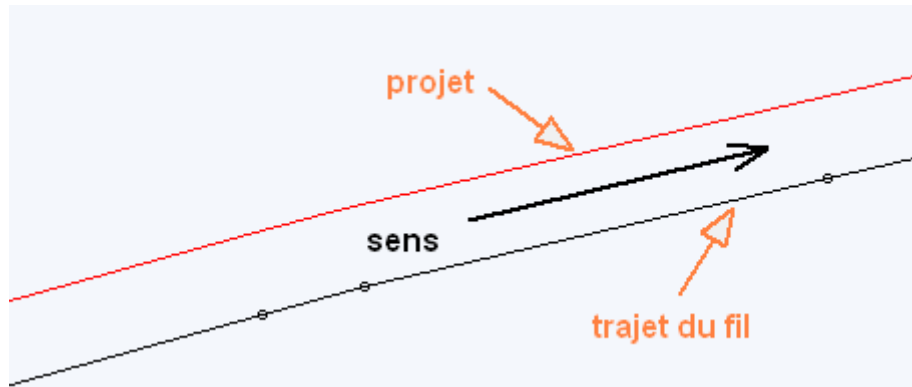
The choice of wire offset is made in the Wire offset box:



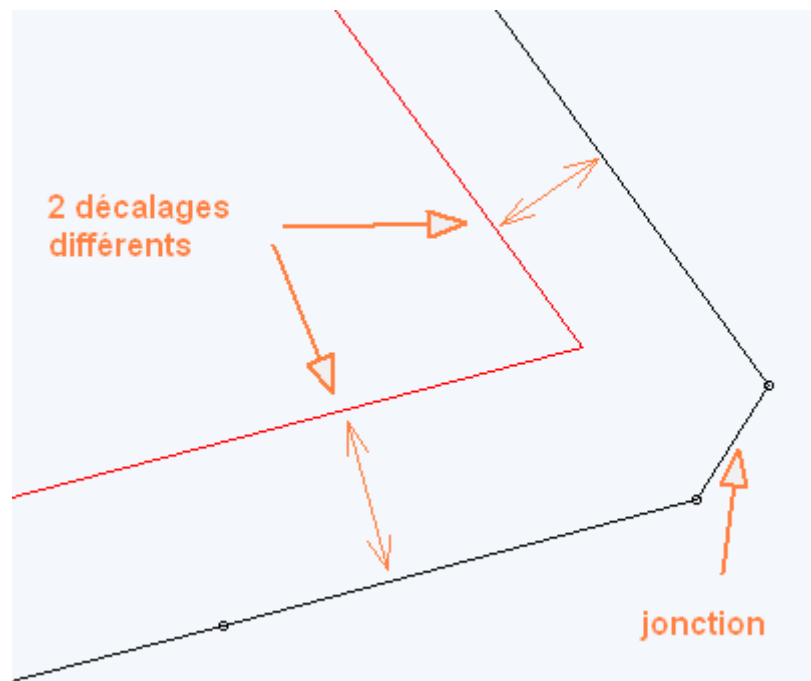
- The left side offset means that when it advances, the wire is to the left of the project outline, this is the most common case:



- The right side offset means that when moving forward, the wire is to the right of the project path:



- When you choose “no offset”, the trajectory of the wire will be on the outline of the project.
- The Variable Algorithm will allow the speed of each segment to be taken into account for the calculation of the offset and will connect the offsets of different values. It is a powerful algorithm, developed especially for FilChaudNX and it is the one that should be chosen as a priority.

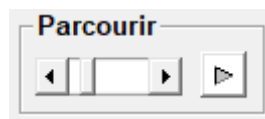


Remarks :

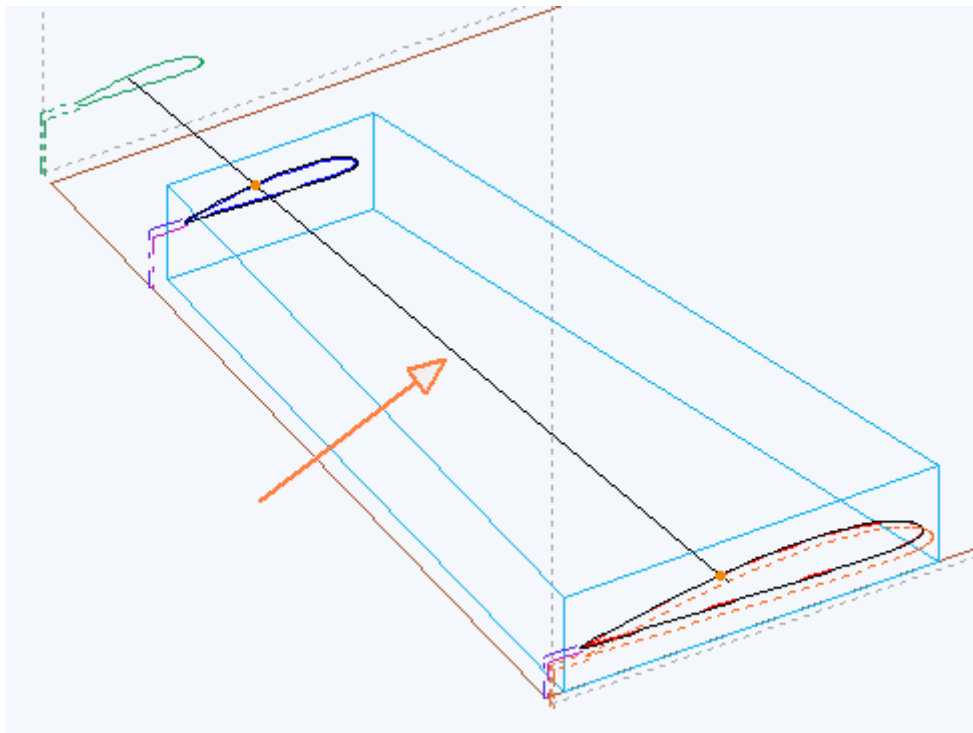
- The variable offset handles back and forth perfectly.
- The variable offset creates 2 trajectory points for 1 project point, this is completely normal and does not pose any cutting problems.
- The Simple Algorithm uses a uniform offset value that does not take into account the speed of each segment. It is there only as a backup solution in case the variable algorithm does not work. If your projects are well designed, you should never have to use it.

10.4 Cutting simulation

The “Browse” frame allows you to see the movement of the wire.

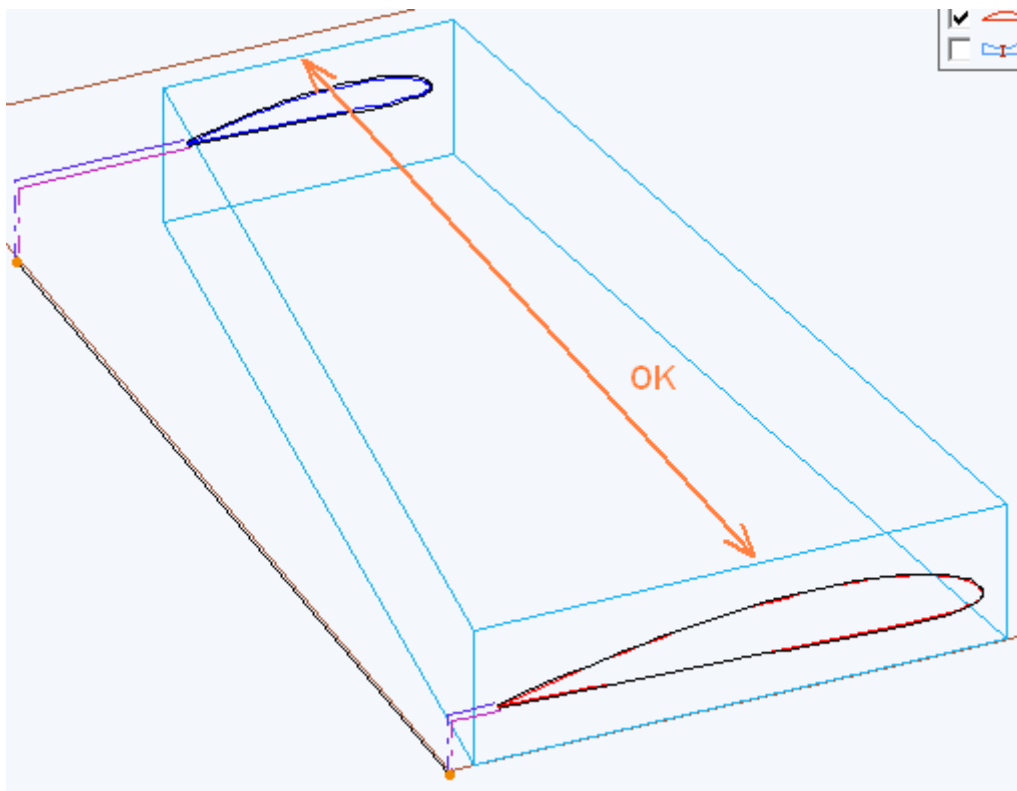


The slider allows manual movement while the button initiates automatic movement.



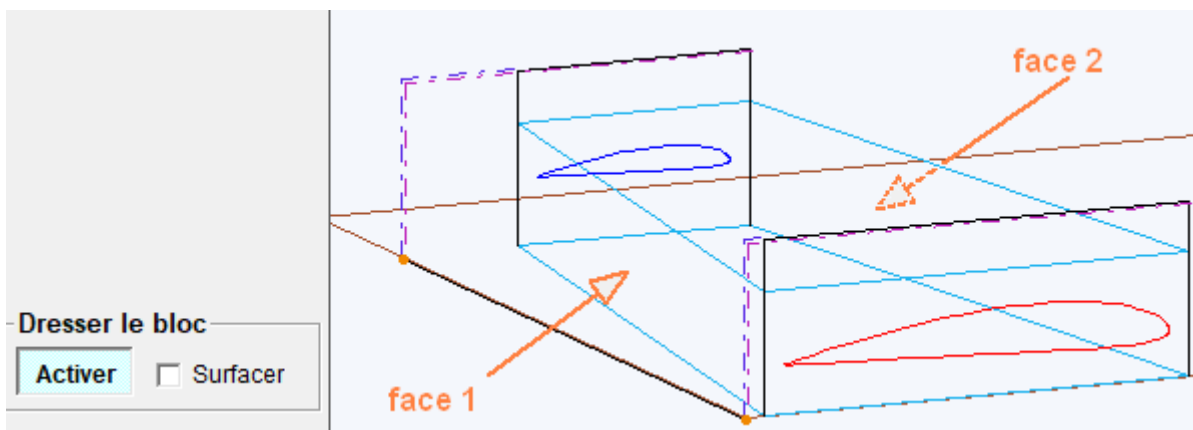
10.5 Dressing and surfacing the block

When a block is placed on the table to be cut, it must already be the correct width (which corresponds to the Project Spacing). We will see later the Guillotine tool which allows you to cut the big blocks in smaller ones.



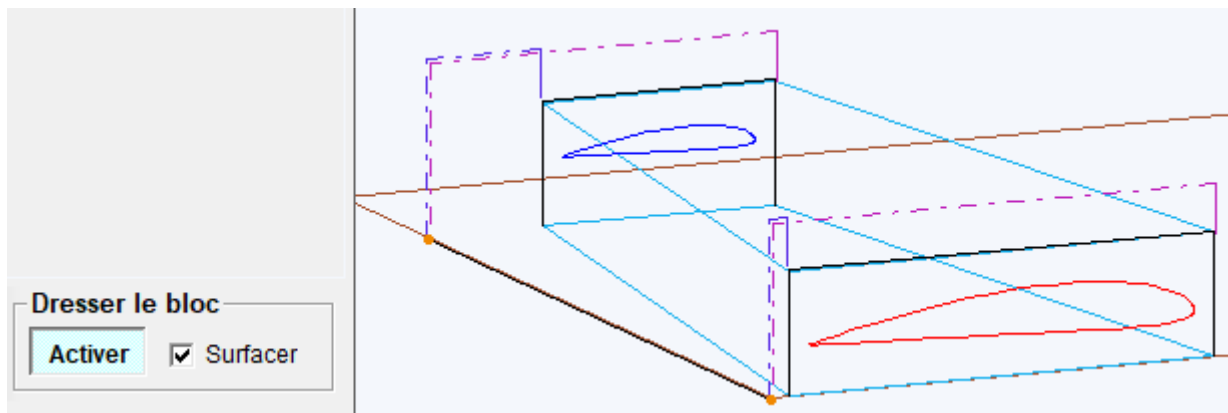
The “Size the block” frame also allows you to bring 2 or 3 other faces to the right size depending on the project parameters:

- By pressing the Activate button, the trajectories of the current project are saved in memory and replaced by the block sizing trajectories, which will bring the remaining vertical faces to the correct dimensions.



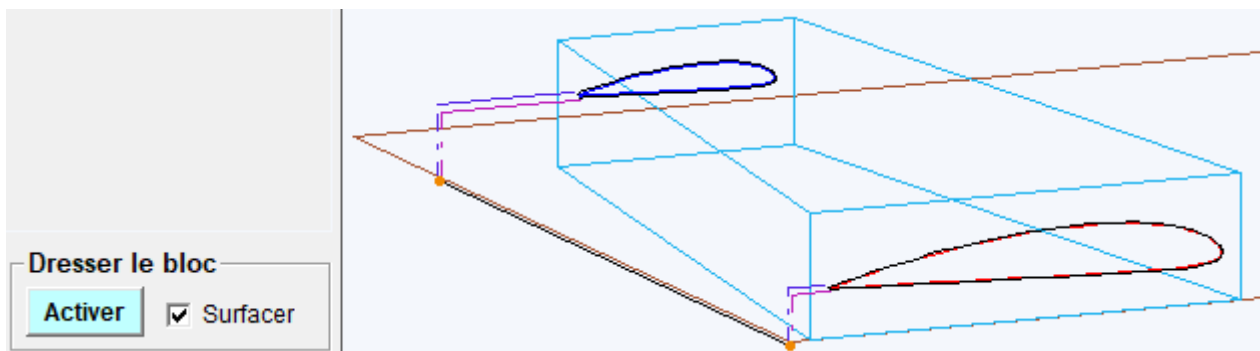
This sizing can then be **cut like a classic project** (see further).

- By adding the Surface checkbox, the top of the block is also brought to the correct height during the outward path. The return path is always made at clearance height (block thickness + block margin + ballast thickness):



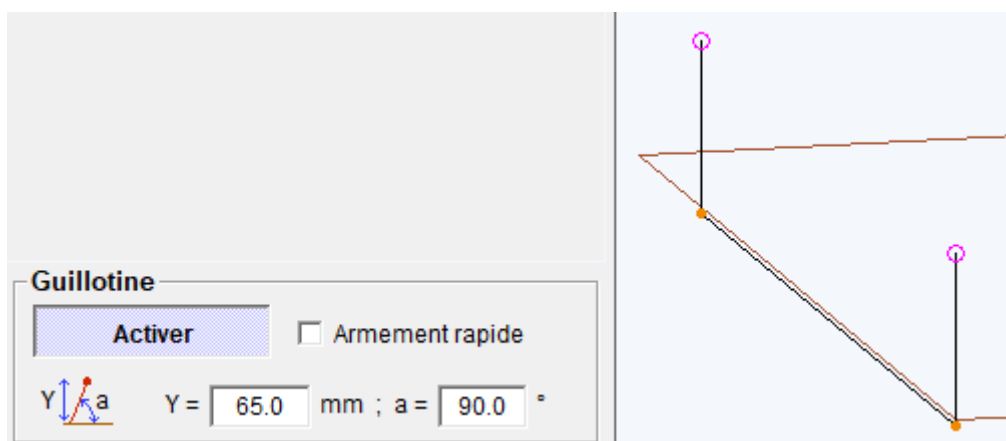
Here again, all you then need to do is start the cutting.

- When we click on the Activate button again, we find the project trajectories:



10.6 Using the guillotine

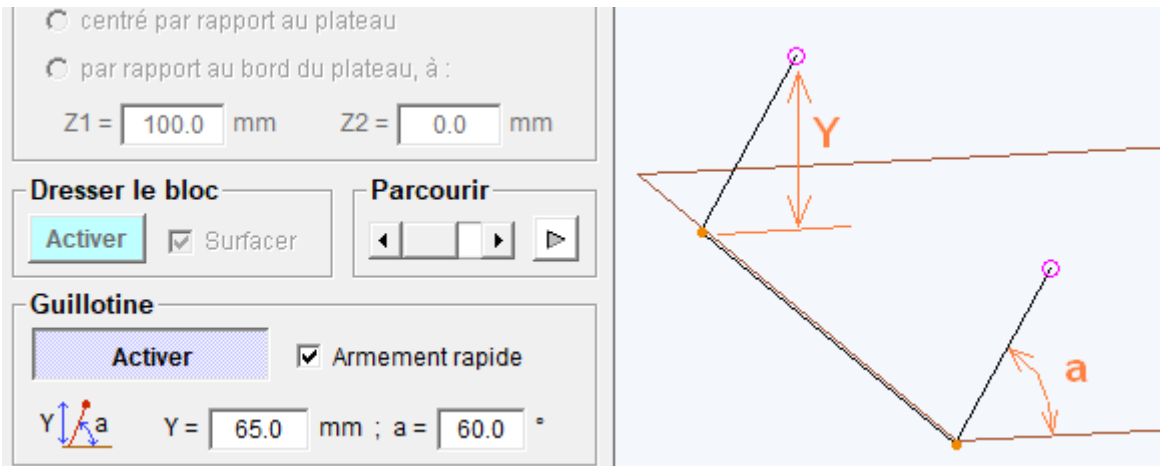
The guillotine works in the same way as the block dressing, it is activated using the button on the Guillotine frame and its path appears in place of the project (being kept in memory).



The upper position is at a stopping point, the user will therefore have to validate to create the descent movement.

The “Quick arming” check box allows the upward movement to be carried out quickly.

The Y parameter gives the height to which the wire will rise, the parameter “a” gives the angle of the trajectory relative to the horizontal:



The above values therefore allow for example to make a 60° cut in a 60mm thick plate with a 5mm margin to be able to pass the plate under the wire without any problem.

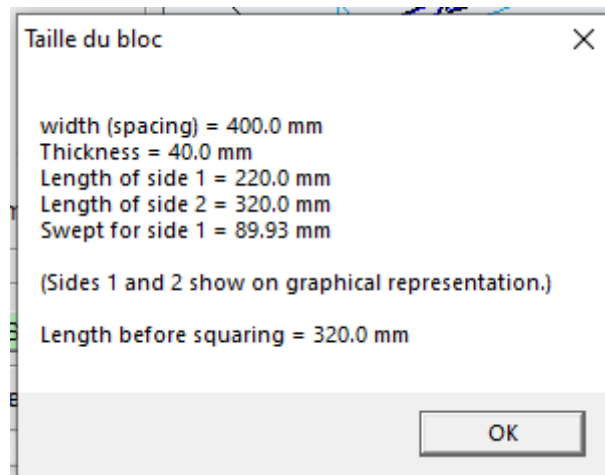
The cutting is launched like a project cutting(see below).

10.7 Direct cut or Gcode export

Direct cutting or Gcode exporting is started from the check box and the buttons at the bottom right of the FilChaudNX window :

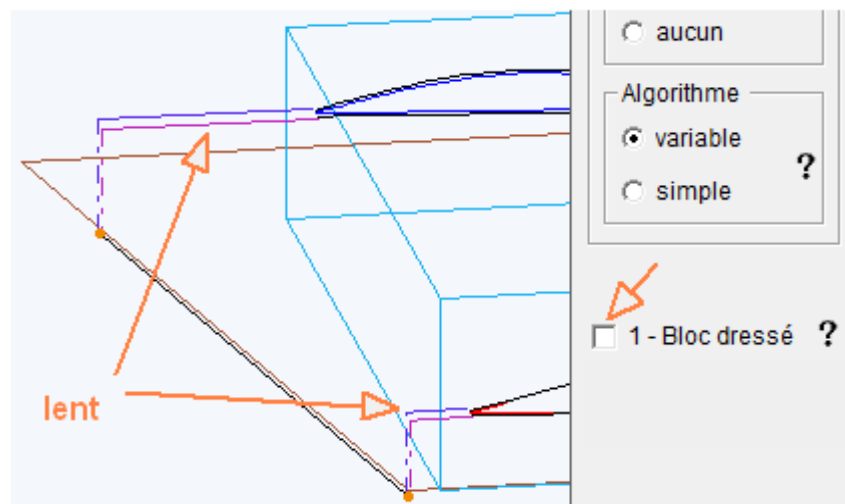


1. **Reminder** : show the size of the block

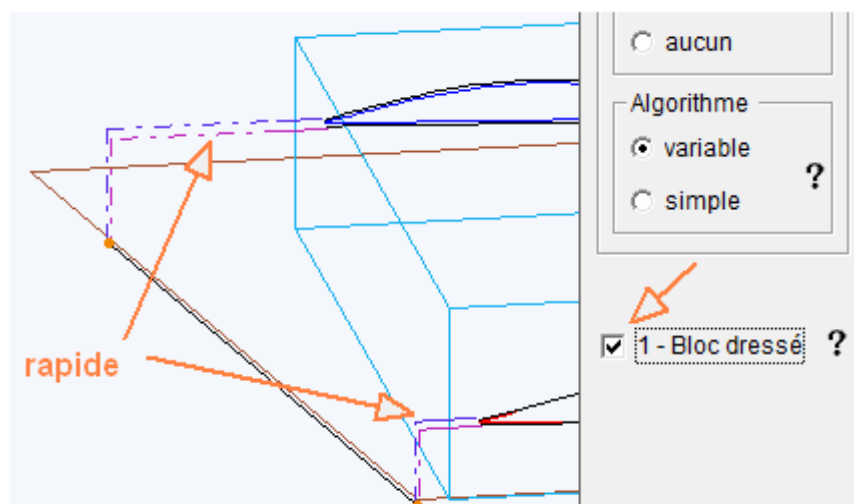


2. **Block sized** : if the checkbox is checked, the horizontal path to the block will be done quickly, if it is not checked, the software does not know if the block has been sized and assume that it's a rectangular block, so the wire will advance horizontally at slow speed (but be careful, the vertical path above the origin is always fast):

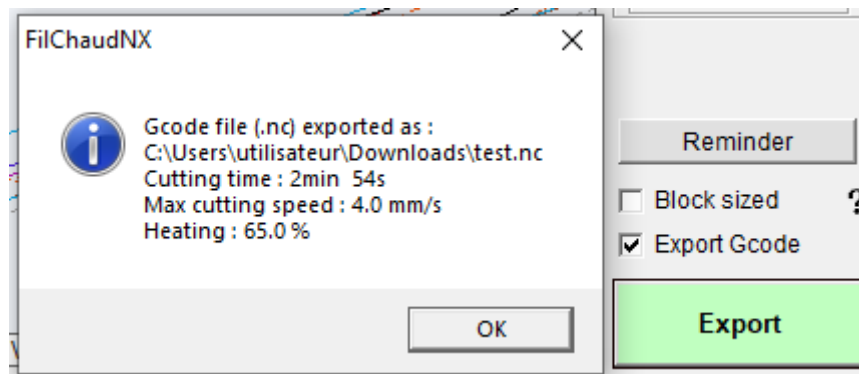
Box not checked:



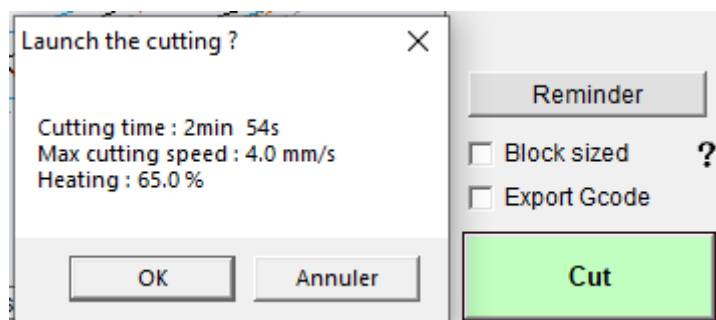
Box checked:



3. **Export Gcode** : you must have a licensed version to check this box. Then the “Cut” button will change to “Export” and you will be able to export the Gcode and see the duration of the cut.

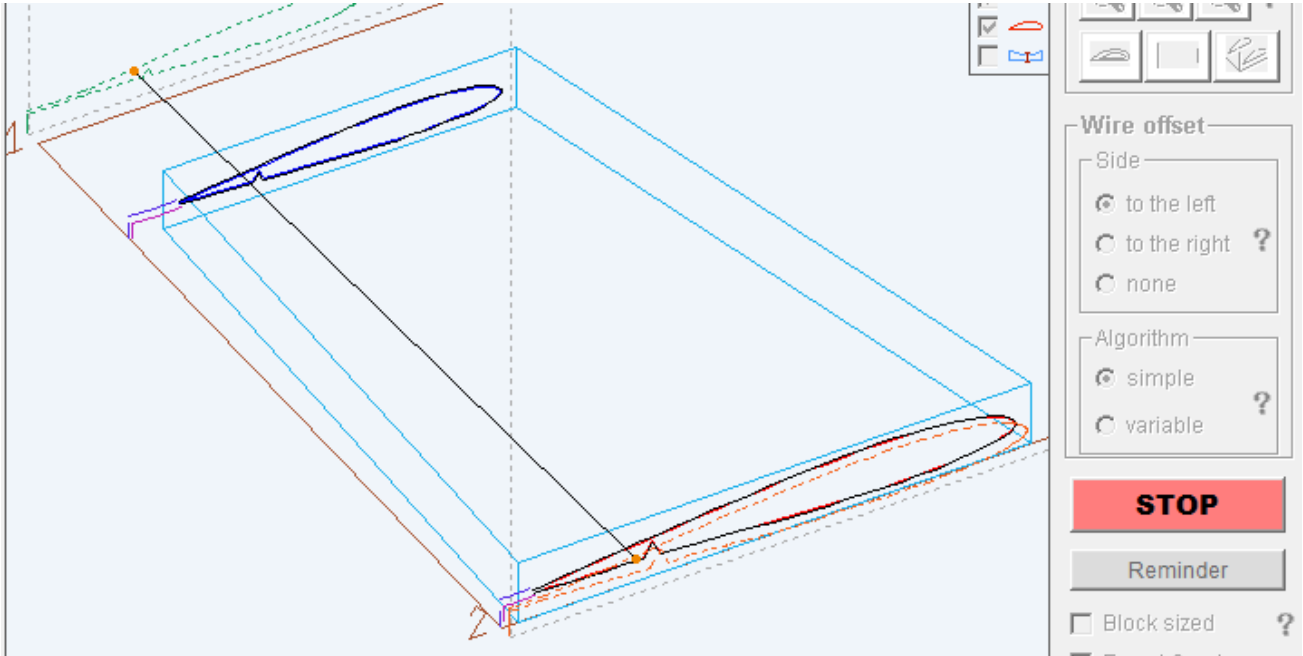


4. **Direct Cut**: you must have a licensed version and an IPL5X interface connected to launch the calculation with the “Cut” button and then the cut with the “OK” button.



10.8 Stop a cut

Pressing the red STOP button or the emergency stop button of a CNCFAB machine or the Prog/Stop button of the IPL5X interface stops and cancels cutting.

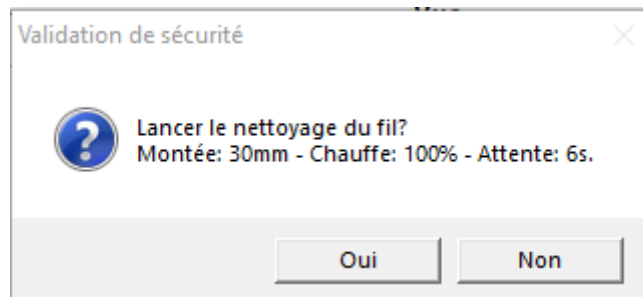


10.9 Clean the wire

To clean the wire before or after cutting, use the button:



A validation window summarizes the cleaning parameters:



The procedure begins: raising the wire, heating for the requested duration, lowering. The remaining time in the upper position scrolls in the status bar at the bottom of the screen:

Nettoyage du fil : 100.0% - 4.8s

Wipe the wire with a cotton cloth when the wire is in the up position.

And that's it for today. I will publish more informations and tutorials, but it will take some time 😊

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