TpacadNt

Version 2.2.0

TpaCADNT

tPa

Tecnologie e Prodotti per l'Automazione

Table of contents

1   Nesting of programs

If the Nesting functionality is enabled, the main menu shows one additional tabulation that is active also when the cad program is closed.
The *Nesting* functionality adds a tabulation to the main menu, so that this one is active when the cad program is closed.

To start the Nesting functionality, select the **Enable Nesting** : this command enables the entries of the associated menu and makes the associated section visible.

To close the Nesting functionality, select the **Close Nesting** command .

The Nesting functionality cannot be activated in *Draw environment* is running

The Nesting functionality is activated only after checking some conditions.

First of all, a check of the validity of the technology is made that will be used for the development of cutting paths of the panels. Cutting technology can be assigned as follows:

- by showing a global technology (see: Nesting Configuration); or
- by programming a setup working in the file used as a template for creating nesting panels (see below, in the **Prototype of nesting panels**)

The cutting technology determines the setup working to be used and all the appropriate technological assignments: machine, group, tool, speed, properties. More specifically, a tool positive number and a >10.0*epsilon diameter must be assigned.

Only if you enable the Demo functionality, the failure of the technology check does not block the activation of Nesting since this functionality excludes the generation of cut paths.

If the technology fails, Nesting cannot be further activated. The error situation is highlighted by the message: "Selecting a functionality requires the assignment of a valid technology for the cut profiles"

An alert, instead, can concern the management of the labels, when a valid layout is not assigned for their generation. In this case, it is an alert and not an error: continuing on track, the management of the label will not be active.

If the Nesting functionality is active, the TpaCAD graphic interface appears as modified:
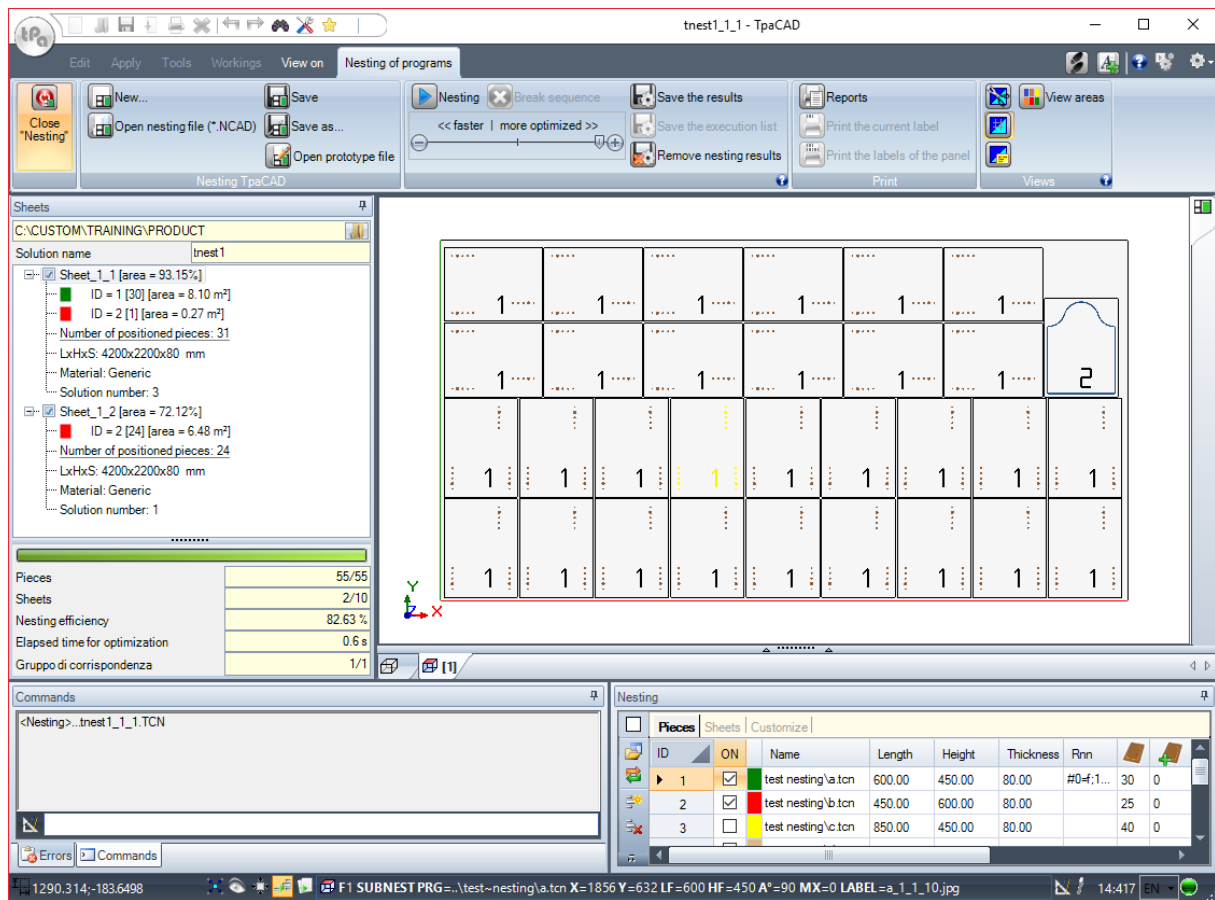
The tabulation of the menu shows 4 groups of commands:

- **TpaCAD Nesting**: groups together the commands to manage a Nesting program (New, Open,…). A Nesting program is a XML format file with (.ncad) extension. The figure shows that the program called tnest1.ncad is open: the program is assigned in the Nesting section in the area already used for the assignments of a piece program.
- **Nesting**: a second group includes the commands to run a nesting program: calculation of positions, record of nesting panels, creation and storage of the execution list. The figure shows that a nesting solution was already required with a solution two panels.
- **Views**: commands of graphic option for the panels of nesting. The figure shows the first panel produced, where the options to view the rectangle of each positioning, the workings applied and the numeric IDs of the pieces have been activated.
- **Print**: creation and storage of the Report file or label print.

The section of Nesting is made of three pages to assign:

- **Pieces** : list of the pieces for which the positioning is required
- **Sheets**: list of the panels (Sheets) on which the positionings can be carried out.
- **Customize**: selections and settings to customize the nesting procedure.

The information of this section constitute a Nesting program and are are stored in files with (. ncad) extension.

On the left of the graphic area the field for the final panels (tcn files) is provided:

- click to choose where to create the folder for the solution.
- **Name**: sets the name of the solution and of the nesting program (.ncad file). A folder with the assigned name is created in the folder selected above into which the panels of the solution (TCN

format programs) are stored. The name of the panels is determined by a common matrix given by **Name**. The name of a project is important, because it matches also a specific folder where the results of the solution of a nesting are stored. Each new storage deletes first the files contained in the folder, so as to ensure that they do not mix registrations corresponding to different solutions: if you are prompted to differentiate your saved files, it is therefore necessary to create solutions with different names.

- The intermediate zone contains a tree view for displaying the manufactured panels. The solution in the figure is provided for two panels:
  - the active node in the list corresponds to the Panel represented in the graphic area;
  - any expansion of the node provides the information for each type of the applied piece (numeric ID and colour, as assigned in the *section of Nesting*)

- The lower part of the area shows cumulative information on nesting solution:
  - pieces placed on the total required
  - panels used on the total available
  - overall efficiency of nesting, with the ratio of the area used for the area used for the placements and the total area of the panels used.

1.1   Overview

The *Nesting of programs* functionality, available in TpaCAD, places a list of pieces inside one or more panels (or Sheets), maximizing the number of the panels needed and compacting the individual placings. The pieces to be positioned can be programmed in TCN format or rectangular geometries. Furthermore, this functionality helps cutting the surplus.

The result of a *Nesting* is the storage of the list of panels that match the position required; each panel is a program in TCN format that applies cutting profiles of the various placements and possibly programmed workings in original pieces. Below, the term *solution* will identify the set of TCN panels recorded after a *Nesting*.

In the case of original pieces in TCN format and positioning of programmed workings, the only working on top face are applied. The placement of the TCNs does not examine the programmed workings, but the only original or modified sizes of each TCN program.

Ancillary functionalities concern the management of Labels, Report files and execution list.

The use of the functionality of *Nesting of programs* needs a specific activation from HW key and an activation in configuration of TpaCAD. Enabling the functionality is independent of the level of the TpaCAD program (Essential, Base or Professional).

2   Project of Nesting (*.ncad)

The solution of a Nesting begins with writing a program/program of nesting: as already mentioned, it is a file in XML format, recorded with (.ncad) extension.

In the menu we find the usual commands to manage the files here specialised for a (.ncad) program:

- **New**: a project of nesting is created starting from a prototype program (NESTCAD.NCAD, in the folder: tpacadcfg\custom\nesting).
  The start of a nesting functionality opens a new project:
  a progressive name is given (examples: "tnest1", "tnest2",..) to the project .

- **Open nesting file (*.NCAD)**: opens an already stored nesting program. When the Nesting functionality is activated, you can also open a nesting project by dragging a (.ncad) file, for example from Windows Explorer and dropping it inside the TpaCAD workspace.

- **Save**: save the program now open. If the program is new, the **Save as command** is called.

- **Save as**: saves the program now open, where it is possible to assign the name of the file and its place. If the program is new, the default folder (product\nesting) appears for the storage.
  In the event of storage and change of the project name and if some results of the nesting (nesting panels, labels, execution list, report) are already archived, you can confirm their deletion. However, you will need a new record, having changed destination folder and names.

- **Open prototype file**: opens the (NESTCAD.NCAD in the: tpacadcfg\custom\nesting) prototype program, creating it, if it does not exist.
  Nesting prototype project assigns the list of panels and the page of the customisations. The page of the list of the parts, instead, does not appear.

Let us now examine in detail the Nesting section.

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Below, the effect for the selection of **Direction** and **Starting vertex** :
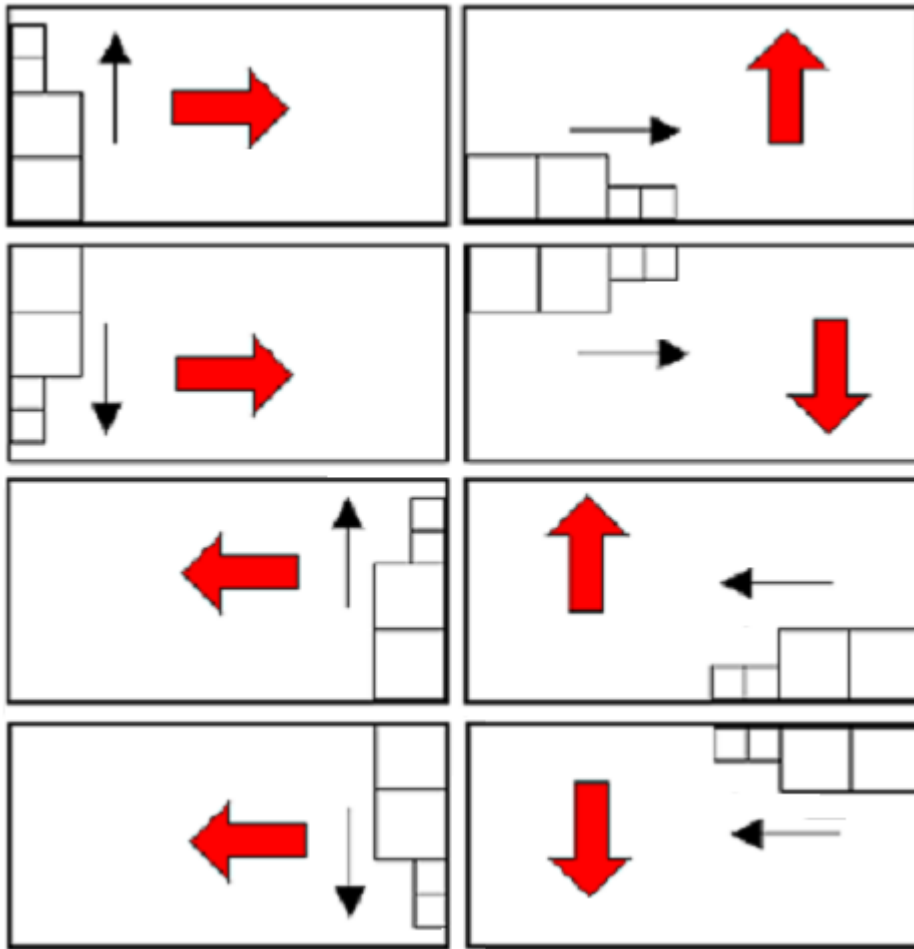
Error situations are highlighted on the corresponding row in the table, as shown in the figure and in the area of the errors of the application program.

Detected error situations correspond to lines enabled by:

- Program not recognised as valid (non TCN format file - macro typology)
- Unit of measurement of the program not equal to that of the project
- The dimension of the length and/or height is less than 20.0 mm
- The thickness of the piece programmed is less than 10.0* epsilon.

Further general evaluation are added to the diagnostic situations concerning a line programming:
- No lines of a piece (TCN or rectangle) seem to be enabled
- No lines of panels seem to be enabled

The occurrence of one of the situations listed here does not require the solution of nesting and the user is alerted by a message.

2.1   Menu

In addition to the three already mentioned pages, this section has a local menu which is active by selecting the first two pages:

☐	It switches the assignment of pieces like TCN programs or like rectangular shapes: • active selection of the Pieces: the first page is headed with **Pieces** • otherwise, the first page is headed as **Rectangles** The active selection is an information of the Nesting program and, as such, is stored in a (.ncad) file. The placement of TCN programs can determine the execution, in the nesting panels, of the program workings themselves, while it does not occur in the event of rectangles. The references after the execution of the workings are generic and valued according the actual assignment of the single project. The command availability is assigned according to the **Nesting configuration.**
	Opens a multiple selection window of programs to insert directly several lines in the page of **Pieces.** You can select a list of piece programs (TCN format) or import files in a different format (for example: DXF). In this second event, the files are converted first into TCN format and later are automatically added to the list of the pieces to nest. Situation of failed conversion are reported in the same context of the command execution.
	It restores the original settings of the piece programs (TCN format). The settings that can be restored relate to: • dimensions (LxHxS) and units of measure: they are assigned to the original values of the program • 'r' variables: each external assigned is reset.
	Inserts a row in the table of the page, copying the current line
	Deletes the selected rows or the current row
	Deletes all the rows of the table
	Moves the current row to the previous of to the following position in the table

2.2   Pieces

Pieces : a row of the table assigns a TCN program. It is possible to assign up to 100 rows.

ID	Progressive number automatically assigned and used as an univocal identifier (ID) of the table line
ON	Check the box to enable the use of the line. Select the cell of column header to change the box of all the rows in the table (if there are some rows selected, the change is limited to these).
	The column is managed automatically and couples an univocal colour with the table line.
Name	identifies the TCN programs: a click on the cell opens the window to select the program If you assign a *Description* for the TCN program, this description is displayed in the the lower field of the page at the current row in the table.

Length	Length of the program (original of the TCN file or modified)
Height	Height of the program (original of the TCN file or modified)
Thickness	Thickness of the program (original of the TCN file or modified)
Rnn	A click on the cell opens the window to assign the <r> public variables of the program.
Available quantity	Quantity to place: set a positive value (>=0) not greater than 500
Maximum quantity	A value greater than the previous one assigns the maximum usable quantity (not greater than 500): (Maximum quantity) – (Available quantity) = quantity that can be used to fill up the assigned panels, only after having placed the available quantities of all the piece types.
Quantity used	The column is managed automatically and shows the quantity actually used after the Nesting solution.
Rotation	Select the check box to enable the placing of the piece also with 90° rotation. If the check box is not selected, the piece can be placed only like it was originally positioned. Select the cell of column header to change the box of all the rows in the table (if there are some rows selected, the change is limited to these). Rotation limits of a piece may result from: • workings to carry out (if the nesting applies the workings). If, for example, a program requires the execution of a sawing work, any rotation of the placement will not be applied; • valuation of panel material (presence of wood grains, ..).
Mirror	Select the check box to require the execution of the piece in mirror mode along the horizontal axis. Select the cell of column header to change the box of all the rows in the table (if there are some rows selected, the change is limited to these). The selection does not influence the Nesting solution, but the execution of the programmed workings in the TCN program.
Material	Select the material of the panel with which the placements can be associated (default selection: Generic)
Colour	Select the colour of the panel with which the placements can be associated. Select the cell of column header to change the box of all the rows in the table (if there are some rows selected, the change is limited to these).
Priority	Pieces with higher priority take precedence in the nesting solution (default value: 0; maximum value: 100)
Program with working in other faces	This information is compiled automatically: the selected box shows that in the original program the workings are programmed in faces other than the face of nesting (upper face)
Excluded workings	The information is automatically filled in and is significant after the solution of the Nesting: the checked box shows means that some workings of the program have been excluded in the solution of the Nesting.

|	The column is only visible if the configuration of the Nesting assigns some workings that can be excluded.

- **Rectangles**: a table row assigns a rectangle geometry. It is possible to assign up to 100 rows.

ID	Progressive number automatically assigned and used as an univocal identifier (ID) of the table row.
ON	Check the box to enable the use of the line. Select the cell of column header to change the box of all the rows in the table (if there are some rows selected, the change is limited to these).
	The column is managed automatically and couples an univocal colour with the table line.
Name	Identifier name assigned to the line automatically
Length	Length of the rectangle
Height	Height of the rectangle
Available quantity	Quantity to place: set a positive value (>=0) not greater than 500
Maximum quantity	A value greater than the previous one assigns the maximum usable quantity (not greater than 500): (Maximum quantity) – (Available quantity) = quantity that can be used to fill up the assigned panels, only after having placed the available Quantities of all the piece types.
Quantity used	The column is managed automatically and shows the quantity actually used after the Nesting solution.
Rotation	Select the check box to enable the placing of the piece also with 90° rotation. If the check box is not selected, the piece can be placed only like it was originally positioned. Select the cell of column header to change the box of all the rows in the table (if there are some rows selected, the change is limited to these).
Material	Select the material of the panel with which the placements can be associated (default selection: Generic)
Colour	Select the colour of the panel with which the placements can be associated. Select the cell of column header to change the box of all the rows in the table (if there are some rows selected, the change is limited to these).
Priority	Pieces with higher priority take precedence in the nesting solution (default value: 0; maximum value: 100)

The figure shows the effect of the **Rotation** and **Mirror** effect in 4 possible cases:
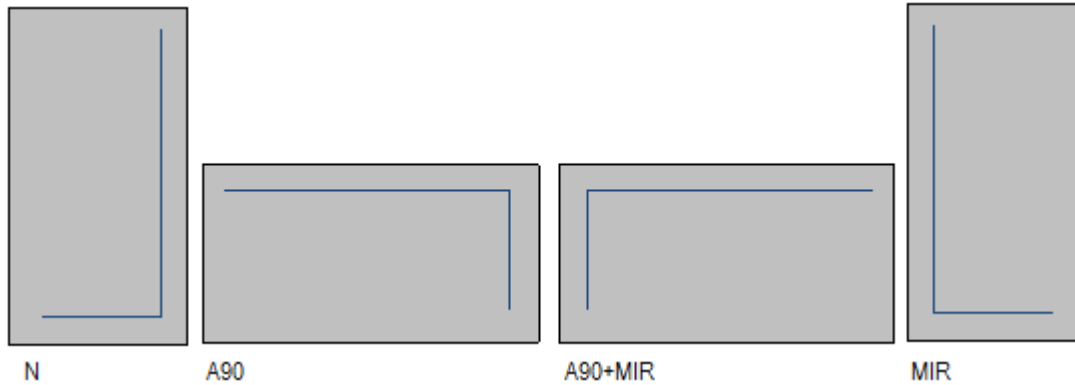
Case 'N': normal placement

Case 'A90': rotated placement

Case 'A90+MIR': rotated and mirrored placement

Case 'MIR': mirror placement

2.3   Sheets

- The page **Sheets** assigns the list of the panels (Sheets) on which the placements can be carried out. It is possible to assign up to 100 rows.

| ID	Progressive number automatically assigned, used as an univocal identifier of the panel.
ON	Select the check box to enable the use of the panel. Select the cell of column header to change the box of all the rows in the table (if there are some rows selected, the change is limited to these).
Name	Identifier name assigned to the line automatically
Length	Length of the panel
Height	Height of the panel
Thickness	Thickness of the panel
Available quantity	Quantity of the avabilable sheets: set a positive value (>=0) not greater than 100
Quantity used	The column is managed automatically and shows the quantity actually used after the Nesting solution.
Material	Select the material of the panel (default selection: Generic)
Colour	Select the colour of the panel. Select the cell of column header to change the box of all the rows in the table (if there are some rows selected, the change is limited to these).
Priority	Pieces with higher priority take precedence in the nesting solution (default value: 0; maximum value: 100)

2.4   **Customizations**

- The page **Customize** sets and customizes the nesting procedure

Order reference	This setting shows a reference to the customer and/or to order and or to the order number.
Product	This setting may show a reference to the product and/or model.
Unit	Unit of measure of the generated panels: [mm] or [inch] In the event of the placement of TCN programs, the measure set must be the same for all the programs used.
Tool diameter	Diameter of the tool for the execution of the cut profiles: the field is set for information purposes and cannot be changed.
Margins	Node that groups together the assignment of the margins to apply. All fields assign a value >=0
Left Right Upper Lower	Waste margins of the panels
Internal	Distance added to the diameter of the technology in order to determine the actual distance of the pieces placed.
Direction	Select the feed direction for the placements, choosing between the following available options: • Horizontal (in the figure: cases on the right, horizontal red arrow) • Vertical (in the figure: cases on the left, vertical red arrow)
Starting vertex	Select the starting vertex for the placements, choosing between the following available options: • Left-Lower (in the figure: cases on the first row) • Left-Upper (in the figure: cases on the second row) • Right-Lower (in the figure: cases on the third row) • Right-Upper (in the figure: cases on the fourth and last row)
Apply priority of the pieces	Select to apply the priority values set for the pieces (TCN or rectangles). If the entry is not selected, or if all the panel types have the same priority, the pieces are used by ordering by height or length in descending order, based on the method chosen for the direction of the placements.
Apply priority of the Sheets	Select to apply the priority values set for the panels. If the entry is not selected or if all the types of panel have the same programmed priority, the panels are used in the same order as in the list
Check material correspondence	Select to apply the material correspondence: a piece is placed only on a panel where the same material is set.
Check colour correspondence	Select to apply the colour correspondence: a piece is placed only on a panel only where the same material is set.
Check thickness correspondence	Select to apply the thickness correspondence: a TCN program is placed only on a panel only where the same thickness is set. If the entry is not set, the single placements inherit the thickness of the panel automatically. The selection is irrelevant in case of placement of rectangles.
Apply original workings	Select to apply the workings of the original TCN panels.

	The selection is irrelevant in case of placement of rectangles.
Cut profiles	Delete the section to not apply the cut profiles (including scraps) to the created pieces. The selection is irrelevant in the case of positioning of rectangles.In this case cuts are always applied.

3   Nesting solution procedure
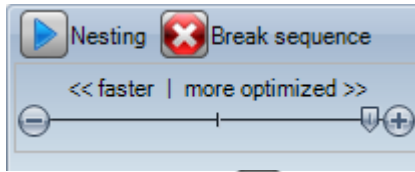
Select the **Nesting** [▶] button in the menu to start the optimisation of nesting. Starting the procedure deletes each result already calculated, but not the files for the previous results.

You can stop by cancelling the calculation procedure by selecting **Break sequence** [✖].
The << faster | Max . Optimiser (try more) >> status bar controls the optimisation speed: more evaluations require a longer calculation time. The bar has four positions: from left to right, each one matches an higher optimisation level.

At the end of the procedure you can access and store the results, if they are definitive.
Let us now examine more specifically the cases which may arise, based on how you have set the program to the Nesting section.

3.1   Correspondence groups

A correspondence group is the set of pieces and panels that can be grouped in a separate solution.

Nesting program can lead to identify multiple groups of correspondence as a result of the application of correspondence filters.

Specifically: material, colour, thickness.

In the event that multiple sets of correspondence are identified, an *independent solution* runs for each group.

In the following paragraphs, entries like

<p style="text-align:center">single piece or multiple piece</p>

<p style="text-align:center">single panel or multiple panel</p>

<p style="text-align:center">best solution</p>

<p style="text-align:center">step-by-step solution</p>

<u>are</u> always to be interpreted as associated to a single correspondence group.

3.2   Multiple pieces and multiple panels

More than one line is enabled in both the list of the pieces and the list of the panels. The **Available quantity** of the pieces and of the panels must be strictly positive (>0).

The procedure places the pieces onto the fewest panels available. If the procedure has placed the available quantity of parts and for some of them a **Maximum quantity > Available quantity** is set, the placement fills up to the maximum limit, up to the maximum value set, the panels already used.

3.3   Single piece and single panel

One line only is enabled in both the list of the pieces and the list of the panels. According to the needs, you can select from specific optimisations:

- Available quantity of the pieces=0, Available quantity of the panels=0: the procedure places the greatest number of pieces on 1 panel.
- Available quantity of the pieces=0, Available quantity of the panels>0: the procedure places the greatest number of pieces on the number of the available panels.

- Available quantity of the pieces>0, Available quantity of the panels=0: the procedure calculates the number of the panels needed for placing the number of the pieces. If a Maximum quantity>Available quantity is set for the piece, the placement fills the panel up to the maximum limit, up to the maximum value set, reaching the maximum value set.
- Available quantity of the pieces>0 Available quantity of the panels>0: the procedure places the number of pieces on the lowest number of the available panels. If the procedure has placed the available quantity and if for some of them a Maximum quantity>Available quantity is set, the placement fills up to the maximum limit the panels already used, up to the maximum value set.

3.4   Multiple pieces and single panel

In the list of the pieces there is more than one enabled line, while in the list of the panels there is one only enabled line. The *Available quantity of pieces* must be strictly positive (>0).

According to the needs you can select from specific optimisations:

- Available quantity of the panels =0: the procedure calculates the number of the panels needed for placing the total number of the pieces.
- Available quantity of the panels >0: the procedure places the number of pieces on the lowest number of the available panels.

In both cases: if the procedure has placed the available quantity of the pieces and if for some of them a Maximum quantity>Available quantity is set, the placement fills up to the maximum limit the panels already used, reaching the maximum value set.

3.5   Criteria and filters applied

The Nesting procedure applies evaluations and filters, some of them are fix and other ones are variable according to the settings of the project. The filters relate to

Material for the panels	If the selection of **Check material correspondence** is active: only the pieces with the same selected material are placed on the panel.
Colour of the panels	If the selection of **Check colour correspondence** is active: only the pieces with the same selected colour are placed on the panel.
Thickness of the panels	If the selection of **Check thickness correspondence** *is active:* only the pieces with the same assigned thickness are placed.

Evaluations relate to:

Priority of the pieces	If the selection of **Apply priority of the pieces** is active: the placement of the pieces privileges those that assign a higher priority
Apply priority of the Sheets	If the selection of **Apply priority of the sheets** is active: the use of the available panels privileges those that assign a higher priority
Criterion for sorting the pieces	The selection is done at the level of the configuration and, combined with the previous selections, contributes to the definition of how to prepare the liest of pieces to be placed. There are four options for the selection and the choice is made according to the specific production needs (see chapter: ***Nesting configuration->Nesting options***)

The limit situation that the set of all evaluations can determine is the inability to produce a result: in this case you will need to change some settings and/or activations, in order to produce usable results.

3.6   Best solution

The procedure of Nesting is inherently a recursive optimization procedure, which aims to determine the "best result": in some cases it can be rated as an excellent result, in others only as a good result, since the best result ever does not generally exist.

The way to get the result of nesting is to perform a set of different nesting cycles, changing some choices in procedures, in order to obtain different solutions.
We reaffirm that the set of filters and selections indicated in the preceding paragraph shall determine the preconditions for the implementation of the various cycles of nesting, affecting from the beginning the obtainable solutions.
The selection of **Criterion for sorting the pieces**, combined with to the status of the scroll bar

<< faster | Max . Optimisation (try more) >>

condition also the number of the activated nesting cycles. Because every cycle is characterized by different choices, such a cycle corresponds to a different kind of procedure.

The comparison between the solutions leads to choose that found to be the best one.
The iterative procedure is performed in succession to each sheet, in order as required by various selections, up to total placement of the pieces or to the total use of the sheets.

As a last point we want to define what determines the choice between two different solutions for a particular sheet. General outline:
- the greatest area of placements is privileged. A solution providing pieces that occupy the 93.0% of the sheets is better that one determining a filling of the 88.00%. In the case of equal amount of occupied area:
- it is privileged the solution that gives priority to the placement according to the selected direction: along the Y axis in the case of Horizontal direction, along the X axis in the case of Vertical direction. In the case of equal placement:
- it is privileged the "most ordered" solution (the valuation is based on the comparison of the off-cuts within the overall rectangle of the placed pieces). If no choice is possible:
- additional evaluation criteria are applied to the grid of the piece disposition, as well as to the number and sizes of the placed pieces and of the internal off-cuts.
Each above mentioned point
1. is applied with a relevance that varies according to the configuration options related to the comparison of solutions (see: Nesting configuration);
2. is applied with one or more margins of tolerance, partly fixed and partly adapted to the specific project of nesting, in order to permit the combined evaluation of the largest number of solutions. An example: the comparison between the areas of placements is not absolute (92.7<93.0) but applies a tolerance area estimated according to the minimum size of the pieces to be placed, as well as to the diameter of the milling cutter and the internal overall dimension.

The evaluation of some points is conditioned by:
- the assignment of the project (see: direction of the Nesting);
- criterion for sorting the pieces.

3.7   Step-by-step solution

In determining the solution of a nesting you can activate a step by step procedure, which allows the operator to choose his own best solution.

Let us see in summary what that is.
You must still perform a first full automatic nesting: let us take again the example already proposed solution corresponding to two panels, as shown in the tree structure of the next chapter.

The solution of each panel is the result of previous discarded solutions:
- the first solution found corresponds to the limit: this is the first choice
- more generally, it corresponds to a following choice, for example the third one.

This information is given in the node matching the panel, as **Solution number** (example: 1 or 3):
- if 1, you cannot require a step-by-step solution for the panel.

It is assumed that the solution of automatic nesting is **Solution number:**
- 3 for the first sheet

- 1 for the second sheet.
A. Take a position on the first node of the first sheet and require a nesting solution. A window appears, as follows:
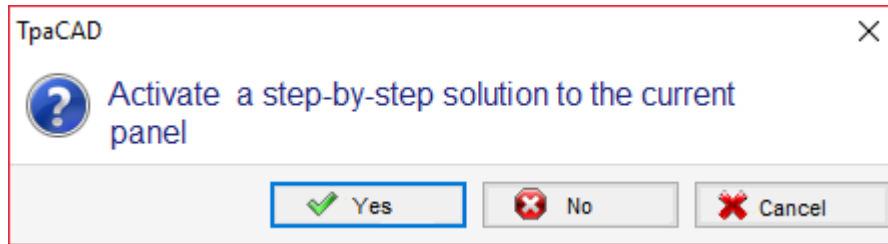
A. To confirm, select **Yes**

The procedure of Nesting starts requiring:
- for the first sheet the choice of the first solution found
- for the following sheets, the procedure is carried out without constraints.

The nesting solution now shows
- **Step-by-step solution** =1, for the first sheet
- **Solution number** =1 or greater for the second sheet.

Now it is possible

1. to apply for an advancement of the step-by-step solution for the first sheet, choosing the second of the original three solutions found. To do it:
    - keep the selection on the node of the first sheet;
    - apply again for a nesting solution and confirm the new window on **Switch to the next solution of the current panel**;
    - at the end, value the situation from the beginning;

2. to keep valid the solution found for the first sheet and activate a step-by-step solution for the second sheet (only if the **Solution number** is greater than 1). To do it:
    - move the selection to the node of the second sheet,
    - apply again for a nesting solution and confirm the new window on **Switch to the next solution of the current panel**;
    - at the end, value the situation from the beginning;

3. to reset to the nesting automatic solution. To do it:
    - apply again for a nesting solution and confirm the new window on **Delete all**;
    - at the end, value the situation from the beginning;

4. keep valid the overall solution found and save the results of the Nesting.

As you can see, the step-by-step procedure:
- is activated for the solution of each individual sheet;
- influences the solution of the following sheets;
- is indipendent for each group of correspondence.

4   Nesting results

At the end of the procedure for *Nesting* you can see the results. WARNING: The solution of nesting does not automatically determine the storage of the results.

Continuing with the example already mentioned the solution corresponds to two panels, both of the same type, as shown in three structure in the figure:

- each main node corresponds to a panel, indicated by the name "Sheet_(id)_(item)" where:

    - (id) is the univocal ID of the panel (here: 1);

    - (item) is the progressive number of the panel (here: (1, 2).

- Each sheet reports the percentage of the useful area occupied by the positioned pieces: the useful area of the Panel excludes the outer margins, while the area of a placement includes the area of the piece (length * height) but not the internal margin set for the project and the overall dimension of the cut paths.

- The expansions of a main node correspond to the types of the pieces applied

    - colour and ID correspond to the line of the piece in the section of Nesting;

    - the numbers in square brackets show the quantity used for the panel.

Each main node has an enabling case:

- the case in assigned as not selected (and cannot be changed), if the panel shows some errors. A typical error situation is, for instance, the result of the rotation of a piece that programs a SAWING WORK;

- without an error report, the selection can be disabled manually.

Only panels that correspond to enabled nodes are useful for the solution.

Error or warning situation are highlighted by an icon on the node:

- in case of a error

- in case of an alert.

The selected node in the list corresponds to the panel represented in the graphic area.

If the solution has identified several Groups of correspondence, a grey line separates the nodes in a group from the next.

4.1   Error situations

Particular situations, usually divided into three categories (errors, serious warnings and reports) can be diagnosed for a panel.

If an error occurs, the panel is excluded from the solution.

Cases of error:
- compilation errors of the TCN program, independent from the nesting procedure (example: use of an invalid working);
- request for rotation of a TCN program with SAWING work or
- request for mirror application in some cases.

Cases of **serious warnings**:

- all serious WARNING situations (while running they become ERRORS);
- error due to the application of Tool compensation.

Because of *serious warnings,* if they are not detached a posteriori, it is effectively impossible to machine the panel.

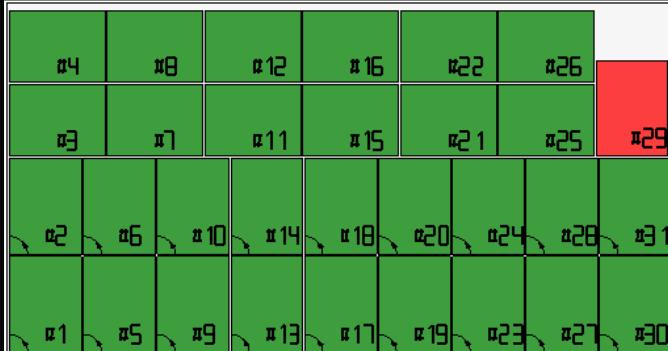A special case of an warning situation is the execution of workings outside the application area of a single program.

4.2   Representation of the panels

The representation of the panels is standardized and targets the Nesting functionality.
The graphic representation of the current panel is determined by the options selected in the menu. The three figures below show the remarkable number of cases:

View areas: OFF

Cut profiles: OFF

Identify the pieces: ON

Labels: ON

For each piece following items are represented:

- overall rectangle;

- the associated workings (in the event of TCN program only);

- Identifier number (ID) of the piece;

- Representation of the *Label-BARCODE* working (programmed or added in the TCN).

View areas: OFF

Cut profiles: ON

Identify the pieces: ON

Labels: OFF

The cut paths are added to the previous case: the red colour of the lines indicates the programming with feed-through depth.

The figure highlights the current working on the placement left below) Click on a placement to move the current working:

- on the status bar the geometric information on the placement are displayed.
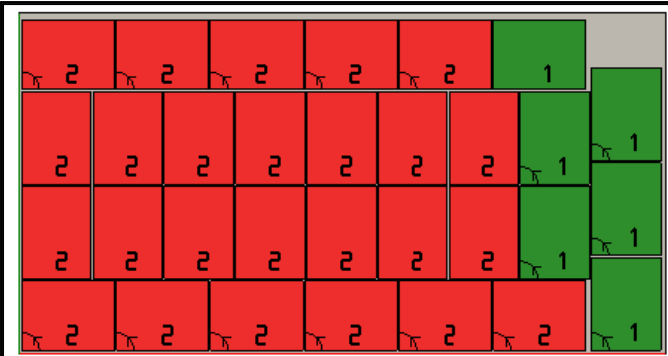
	• **View areas**: ON • **Identify the pieces**: ON • **Labels**: OFF For each piece following items now are represented: • the overall rectangle filled with the colour associated with the piece (the same colour in the sub-node for the piece typology); • accessorial graphics to indicate the rotated and/or mirrored placement of the piece (in the picture: the indications are related to some pieces rotated to both typologies); • the Identifier number (ID) of the piece. The selection relating to the **Cut profiles** is irrelevant
	• **View areas** : ON • **Identify the pieces**: OFF • **Consecutive numbers of the pieces:** ON • **Labels**: OFF The representation is similar to the previous one, and changes the meaning of the numbering on the individual placements (example: "#12"): • now the numbering is univocal on the panel and corresponds to the consecutive numbers of the placements. The option **Consecutive numbers of the pieces** is available in the menu, if the optimisation is not applied while creating the labels (see chapter: *Nesting configuration*). In this case for each single placement, a file corresponding to the label to be applied to the piece is created and recorded and the same label may include the information of the *consecutive number of the piece*, as well as the graphic information of the placement itself on the sheet. The selections **Consecutive numbers of the pieces** and **Identify the pieces** are mutually alternative: the selection of one of those automatically disables the other.

The graphic representation is kept flat and the interactive rotation commands of the piece are disabled. La tabulation of the **View on** menu remains active and it is possible to customise the view. More specifically, it is possible to:

- change the perspective of the view by selecting the following commands: View from the top, view from the front...;
- apply tool compensation;
- change the selections of the overall dimensions.

The graphic representation of the applied workings exclude the display of particular visual elements, such as:
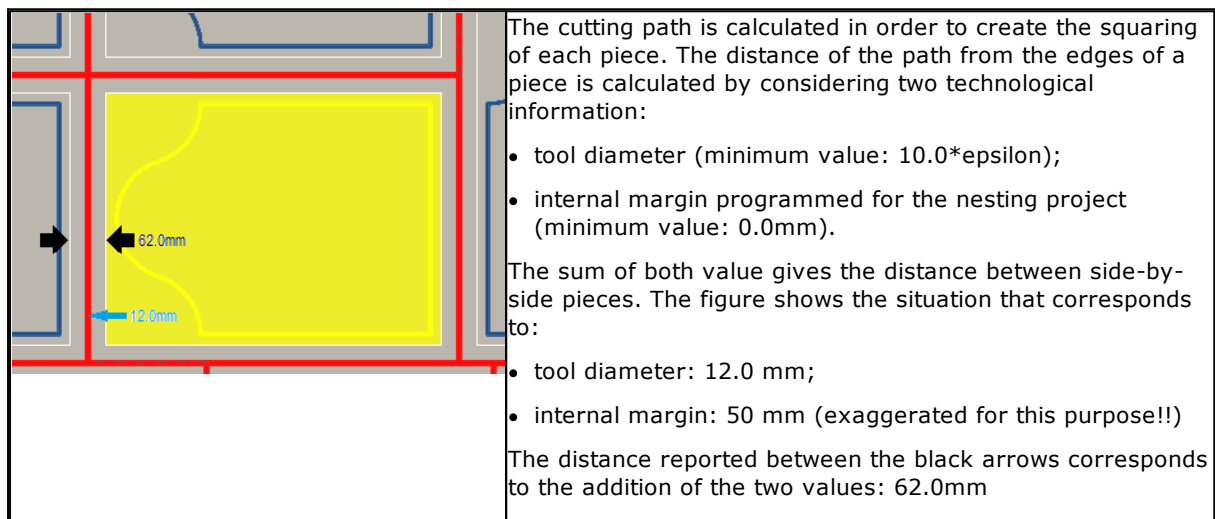
- arrows of profiles and extreme points on the segments
- 3D graphic overall dimensions
- original profiles in compensation.

4.3   Cut paths

The cut paths are automatically inserted and can be separated in a path with a rectangular development around each piece, or optimised in one only path according to the **Nesting configuration**.

Optimization consists of the performance of a single cutting profile with a maximum reduction in direction changes and deletion of the repeated strokes. Cut strokes geometrically separated are connected with movements performed in the air, over the workpiece.

The paths are represented in a custom colour.

The cutting path is calculated in order to create the squaring of each piece. The distance of the path from the edges of a piece is calculated by considering two technological information:

- tool diameter (minimum value: 10.0*epsilon);
- internal margin programmed for the nesting project (minimum value: 0.0mm).

The sum of both value gives the distance between side-by-side pieces. The figure shows the situation that corresponds to:

- tool diameter: 12.0 mm;
- internal margin: 50 mm (exaggerated for this purpose!!)

The distance reported between the black arrows corresponds to the addition of the two values: 62.0mm

The cut path(s) can be carried out in the queue to the workings or before, leading the program, always according to the **Nesting configuration**.
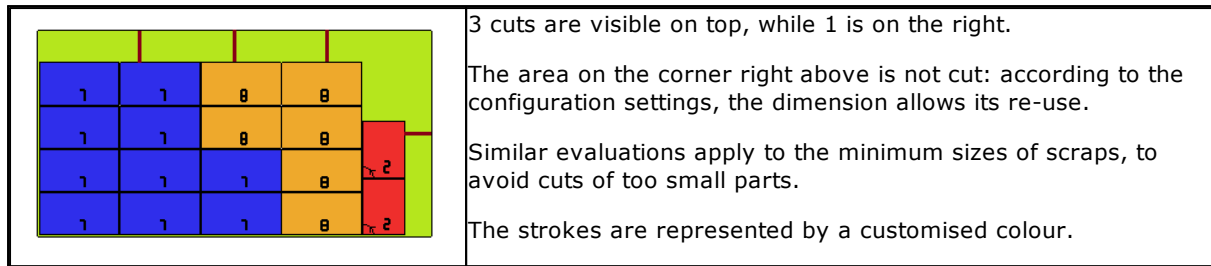
4.4   Cut of the scraps

The cuts of the scraps are generally treated as cut path(s), to facilitate the removal of the parts of the panels not used to place the pieces.

Also these elements are automatically inserted after a specific activation.

Cut profiles of the scraps are performed in the queue to other workings, the technology used is the same of the cut profiles of the piece and the single strokes are joined in one only profile programmed with movements performed in the air, over the piece.

The fragmentation of the scraps values the dimensions of the parts without placements, positioned along both the sides of the panel opposite the starting vertex of the placements. The figure shows a panel where the residual area is highlighted in green (above and on the right side):

3 cuts are visible on top, while 1 is on the right.

The area on the corner right above is not cut: according to the configuration settings, the dimension allows its re-use.

Similar evaluations apply to the minimum sizes of scraps, to avoid cuts of too small parts.

The strokes are represented by a customised colour.

4.5   Labels

Also the label management is conditioned by a specific activation.

In the case of TCN nesting of pieces, the programs themselves may already have scheduled a Label-BARCODE working, as defined in TpaCAD environment. If the label is already programmed or in the case of nesting of rectangles, the working is automatically inserted.

In the case of nesting of rectangles, the insertion is in the centre of the piece.

In the case of program, the insertion point avoids areas affected by workings.

The working of labels, available in the TpaCAD environment, may show some changes, compared to the base working and according to the specific needs of a product application.

The programming of the **Label-BARCODE** working is searched only in the main level of the placed programs, excluding calls in subprograms. In the case of multiple schedules of the **Label-BARCODE** working, only the first is considered.
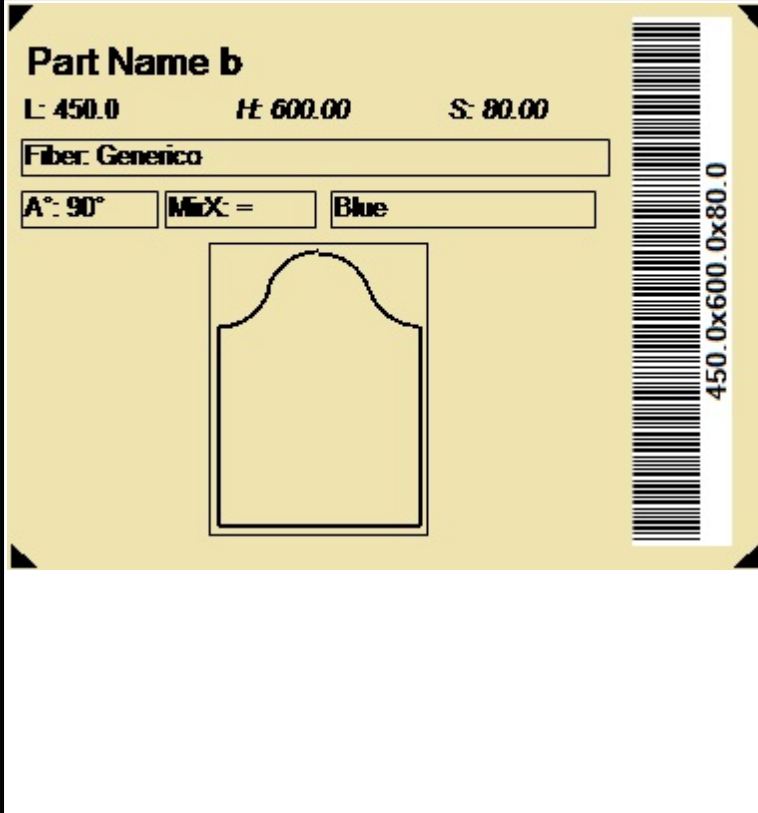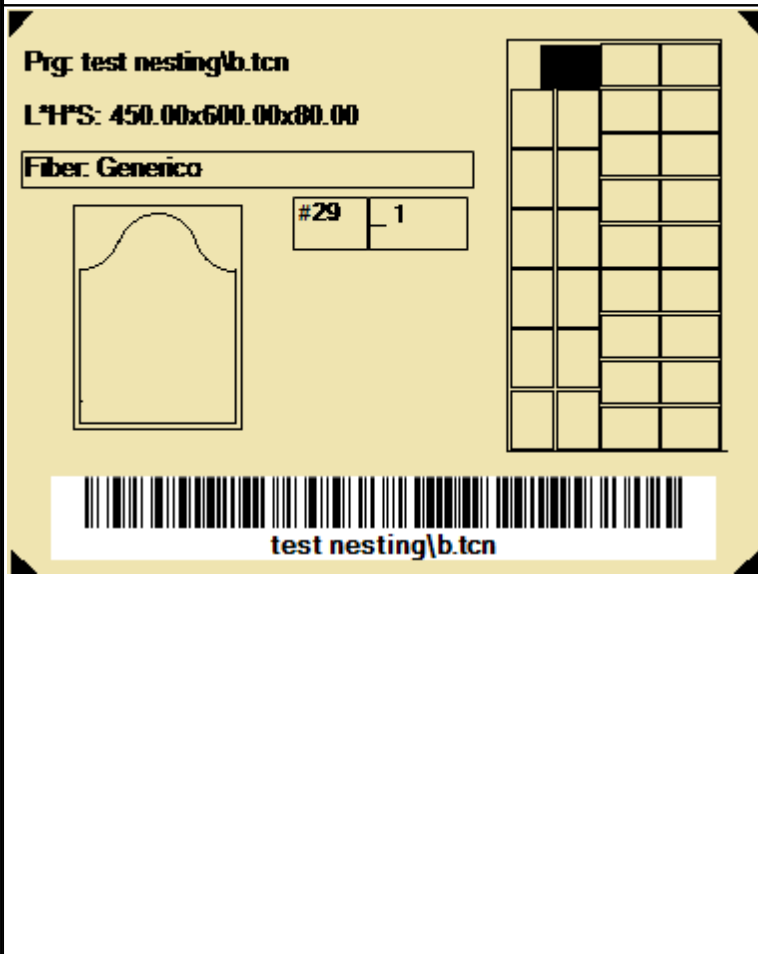
The **Label- BARCODE** are completed by adding some information:

- File search path to save the label associated with each individual placement: this is an image file, of managed extensions (*.jpg; *.png; *.bmp). The files of the labels are created during the execution of the **Save the results** command;
- specifications of placing: positions of the label application (assigned in case of automatic insertion), rotation and mirror (as assigned by the procedure of nesting).

The **Label-BARCODE** programmed workings may be interpreted during the execution of the nesting panels, for the automatic printing of the labels and their following application on the single pieces cut from the nesting panels.

The format of the labels and the include information are defined at the level of **Nesting configuration**.
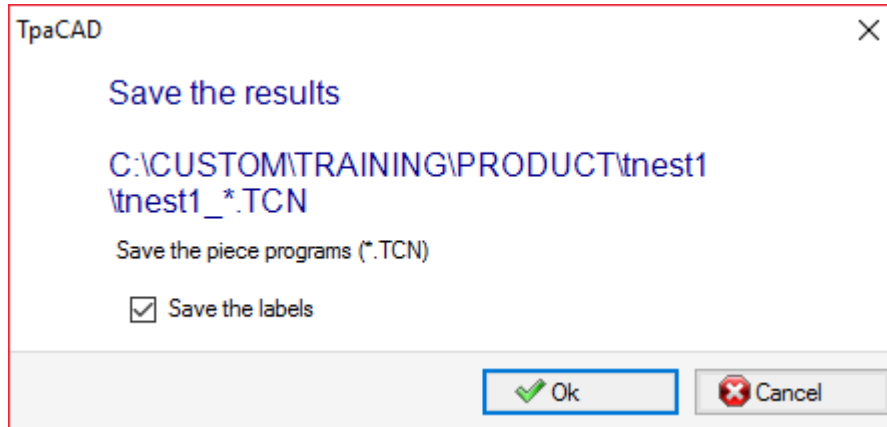
The creation of the files for the labels can be optimised, i.e. only different labels are created or you can record a file for each placement. the method of operation is determined during the *Nesting configuration* .

Part Name b

L: 450.0   H: 600.00   S: 80.00

Fiber: Generico

A°: 90°   MirX: =   Blue

450.0x600.0x80.0

The image shows an example of a label generated by an **optimised** procedure. The image shows following information:

- *program name* : in this case "b" (field title: "Part Name")
- single *dimensions* of the placement: "L" (length), "H" (height), "S" (thickness)
- *dimensions* as one (LxHxS in the barcode)
- *material of the sheet* : in this case "Generic" (field title: "Fiber")
- *transforms* of the placement: rotation and mirror ("A°", "MirX")
- *colour of the sheet* : in this case "Blue"
- *graphic representation of the placement* (pane with applied working).

None of the information given is specific to the single sheet or to the single placement in the sheet.

Prg: test nesting\b.tcn

L*H*S: 450.00x600.00x80.00

Fiber: Generico

#29 | 1

test nesting\b.tcn

The image shows an example of a label generated without a **optimised** procedure.

The image shows some information similar to the previous case and other specific to the single sheet or to the single placement. More specifically:

- *consecutive numbers of the pieces* : in this case "#29" ("#1" correspond to the first consecutive number, "#2" to the second, etc.);
- *consecutive number of the sheet* : in this case the value "1" appearing on the right side of the previous field ("1" corresponds to the first panel of the solution; "2" to the second, etc.);
- *graphic representation of the placement on the sheet* (image appearing on the right side of the label) : the rectangles correspond to all the placements on the sheet and the black pane highlights the current placement.

The use of specific fields of the single sheet or of the single placement forces the creation of the labels by means of a non-optimised procedure.

5   Save the results

The **Save the results** command records the TCN files of panels and labels.

The open window shows the information of the folder in which the results were saved.

- "C:\training\product" is the path selected for the *solution.*

- T"tnest1" is the name assigned to the solution.

→ "C:\training\product\tnest1" is the folder created to record the files of the solution.

- **Save the labels**: keep the case active to generate and save also the files for the images of the labels.

The files of the labels are saved in a dedicated sub-folder. "C:\training\product\tnest1\label".

As already mentioned, the creation of the files for labels can be optimised or can record a file for each placing. The type of operation is determined during the *Nesting configuration*.

The creation of the files for the labels is optimised, that is different labels only are created.
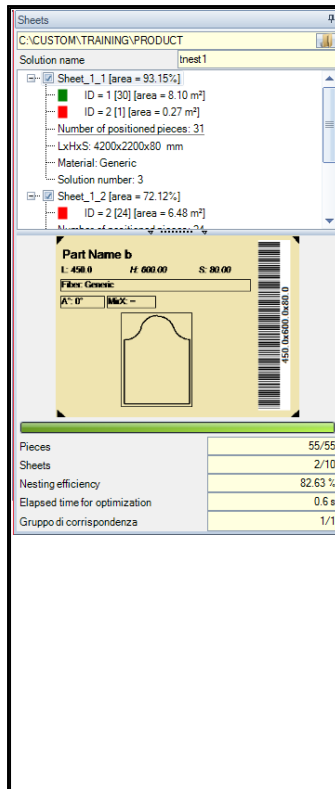
Before the command execution, you can choose to delete all the files already saved for the solution: the deletion removes all the files in the solution folder, including records of previous save processes.

If, instead, you choose not to delete the previous solutions saved, the new files are saved in a folder that is created in the root folder of the solution: the name given to this new folder is univocal and is obtained by using the date and time, so that multiple folders can be displayed in an orderly way.

Example: "C:\training\product\tnest1\2016-04-17T14.29.09".

After execution of the command and if at least one elaboration has been made, the location assigned for *. TCN storing programs is set as the last open for the next time you open the program.

The panel saving process (*.TCN) may include also the optimisation of the panels themselves: in this case you can manage specific warnings.

Sheets	
C:\CUSTOM\TRAINING\PRODUCT	
Solution name	tnest1
☑ Sheet_1_1 [area = 93.15%]	
■ ID = 1 [30] [area = 8.10 m²]	
■ ID = 2 [1] [area = 0.27 m²]	
Number of positioned pieces: 31	
LxHxS: 4200x2200x80 mm	
Material: Generic	
Solution number: 3	
☑ Sheet_1_2 [area = 72.12%]	
■ ID = 2 [24] [area = 6.48 m²]	
Part Name b	
L: 450.0 H: 600.00 S: 80.00	
Fiber: Generic	
A°: 0° MaX: –	
Pieces	55/55
Sheets	2/10
Nesting efficiency	82.63 %
Elapsed time for optimization	0.6 s
Gruppo di corrispondenza	1/1

Going back to the example already shown for the solution:

- 2 panels are saved corresponding to as many main enabled nodes.

- As already mentioned: panels with errors cannot be saved;
  - colour and ID correspond to the line of the piece in the section of Nesting;
  - numbers in square brackets show the quantity used for the panel.

It is clear that it is now possible to see the label recorded for each placement of the current panel: change the current working by clicking in the area of graphics, to see how the image loaded for the label changes.

Panels (files. TCN) are recorded with:

- direct application of TCN working programs;
- insertion of the Label-BARCODE working or integration of the setting, if already available;
- insertion of the cut profile(s) of the pieces and of the scraps.

Without cutting path optimization, programming does not apply directly the tool compensation: the tool diameter is read while running each rectangular cutting path and must match the value that was used.
The optimised path instead is directly programmed by the application of the tool compensation.

Opening a panel of the solution can be requested in the TpaCAD environment, after closing the operational environment of Nesting. A clarification is however due. The representation of a panel in normal functionality of CAD does not reflect that provided in the Nesting operations: the selections to display areas or cutting profiles or piece identifier of the Nesting functionality remain peculiar aspects of Nesting.

6   Prototype of nesting panels

The panels of the solution (TCN files) are created by means of a prototype file: PIECE_SHEET.TCN, in the "tpacadcfg\custom\nesting" folder. If the file is not found, the prototype file of the TCN (PIECE.TCN, in the "tpacadcfg\custom" folder) prototype file is used.

To open and change the prototype file, select in the menu of the **Open prototype file** command from the **Application** menu. More specifically, the prototype file allows the initialisation of

- 'o', 'v' variables;

- custom sections (example: Optimisation settings).

The program can also assign the technology to be used for cutting paths of the panels, if not otherwise identified (see: **Nesting configuration**). In that case, you must program a setup working in the upper face (make 1): the cutting profiles of pieces and scraps will begin with a copy of the process.

7   Save the executive list

This command saves the file corresponding to the executive list of the panels, created by the previous command.
The format of the file is XML and its extension is (.XMLST), as required by WSC application program.
For the functioning of the WSC program, please read the specific documentation.

8   Remove nesting results

The command removes the results recorded for the current solution. The deletion removes the available files of the solution folder and may concern also the files relating to previous save processes.
If for the current project no nesting solution was required, you will be able to confirm resetting the solution folder and deleting files that match the previous save processes. Otherwise, you can confirm the deletion of the last saved file or files of the entire history concerning save processes of solutions.
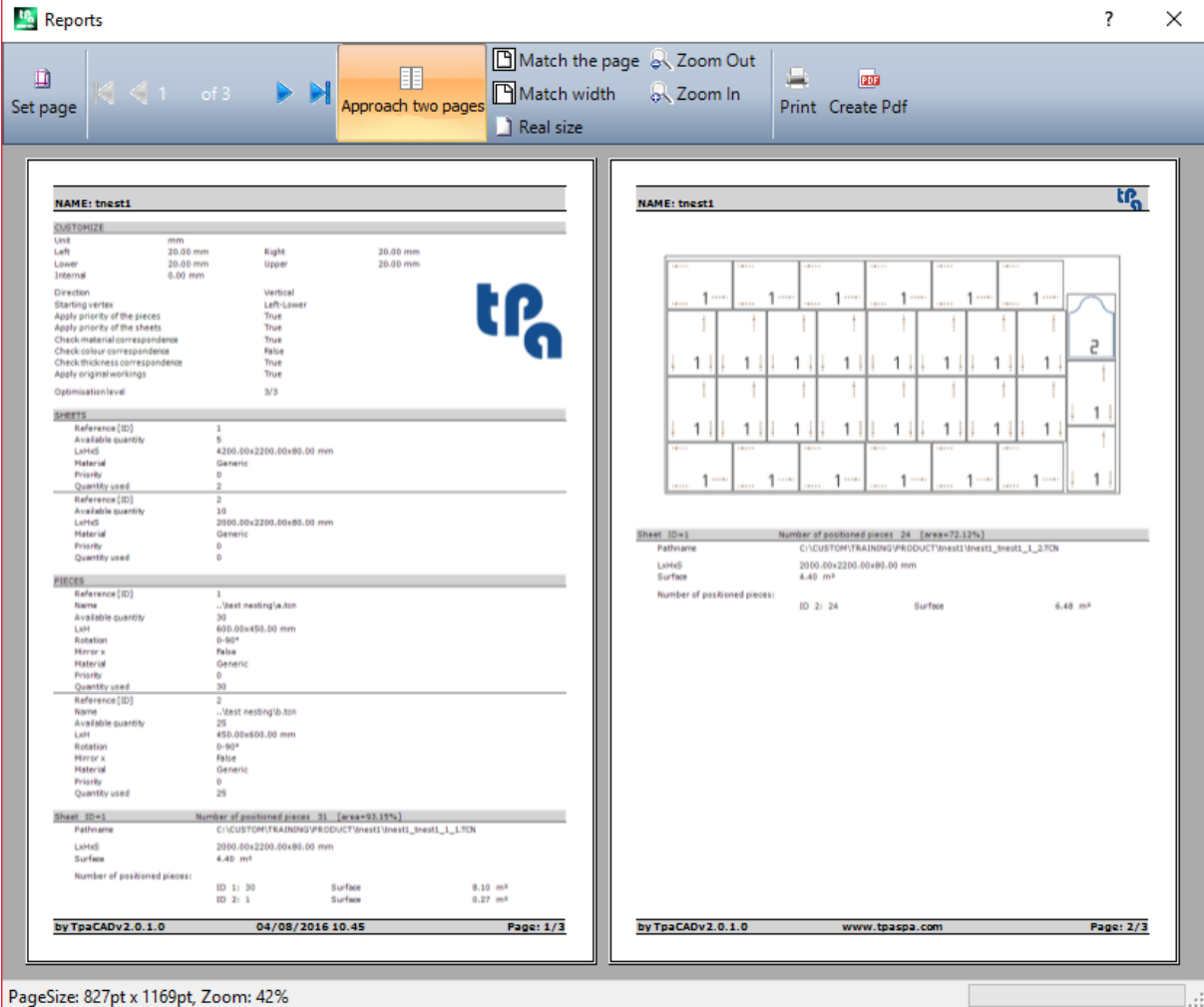
Executive list and report file, only if saved in correspondence of the current solution, are deleted as well.

9   Nesting report

When the nesting results are displayed, it is possible to select **Reports** [icon] to generate a detailed report.

A window shows the report preview:

The report contains the information on:
- nesting project: list of the pieces and of the panels, nesting parameters;
- the characteristics of each panel of the solution, including the representation of the layout. The layout of each single panel is generated by the following settings:
  View areas= OFF;
  Cut profiles= OFF;
  Identify the pieces= ON (if *Optimisation of the creation of labels* is not applied, otherwise it is OFF);
  Consecutive numbers of the pieces= ON (if *Optimisation of the creation of labels* is applied, otherwise it is OFF);
  Labels= OFF.

 The window shows the usual commands of a preview window, where it is possible to:
- change page settings;
- change the zoom (from the menu of by means of the mouse through (CTRL+Mouse wheel)):
- scroll the pages and select the criterion for the arrangement of the pages.

It is possible to print the report by selecting the print module.
More specifically, it is possible to convert and to save in a PDF document by selecting a conversion module installed for this purpose on the device.
The maximum number of the pages for a report is 150.

10   Print labels

To print directly the labels the following two commands are available:

- **Print the current label**: prints the label of the current placement, that is, the label matching the display in the area of the results.
- **Print the labels of the panel**: prints the labels of all placements of the current panel. In the case of the same label for several placements, the print process is repeated for all the occurrences needed.

Selecting one of the print command, a confirmation window appears. If assigned in configuration, the window shows the printer already selected to print the labels, where it is possible to change the selection. Each label is printed on a new page.

11   Nesting configuration

Nesting configuration command is available in a menu with a ⚙ closed program and at a level, as set in **TpaCAD configuration**.
The settings for the dimensions to use match the **Unit of measure of the configurations** , in [mm] or [inch].

11.1 General options

<u>Pieces</u>: block of the settings concerning the assignment of the pieces for a **Nesting project.**
- **Enable**: defines the piece selection mode. There are three options available:
  - **Pieces + Rectangles**: it is possible to choose TCN programs or rectangles.
  - **Pieces** : it is possible to select TCN programs only.
  - **Rectangles**: it is possible to select rectangles only.
- **Assign the TCN file dimensions (LxH)**: the checked box enables the change of the original dimensions (length, height) of the TCN programs. The selection is irrelevant in case of assignment of pieces like rectangles.
- **Assigns the thickness of the TCN files** : the checked box enables the modification of the original thickness of the TCN programs. This selection is irrelevant in the case of assignment of pieces as rectangles
- **Assign "r" variables**: the checked box enables the change of public "r" of TCN programs and the control of the associated column. The selection is irrelevant in case of assignment of pieces like rectangles.
- **Assign priority**: the checked box enables the assignment of the piece priority and the control of the associated column.

<u>Sheets</u>: block of settings concerning the assignment of the panels for a **Nesting project.**
- **Assign priority**: the checked box enables the assignment of the panel priority and the control of the associated column.
- **Assign colour**: the checked box enables the assignment of the colour of the panels and the control of the associated column. The activation is applied both to the pieces and the panels.
- **Material**: this entry matches the list of no more than 50 entries, to identify the same number of characterisations for the panel type, generically identified as Material. The additional entry on the top of the list correspond to the assignment by default: if there is not any additional element in the list, the assignment of the material will be disabled, The setting is applied both to the pieces and the panels

11.2 Exclusions

- **Excluded workings:** this table assigns the list of the workings to be excluded in the development of the Nesting. This table lists the only complex workings (codes of macro) that cannot be exploded: please, check the workings to exclude. Excluding the workings enables you to view the column of Excluded workings in the list of the Pieces for a Nesting project.

- **Closed profiles on xy plane and feed-through in (Pi,Pe)**: select the field to exclude closed profiles on xy plane and with feed-through depth on the starting point and on the end point of the profile. A profile is calculated net of any entry and/or exit segments, programmed on the setup.

- **Closed profiles on xy plane and feed-through at least in one section**: select the field to exclude closed profiles on xy plane and with feed-through depth on at least one endpoint of the profile segment (i.e., the overall measure of the depth along a segment calculates the endpoints only). A profile is calculated net of any entry and/or exit segments, programmed on the setup.

- **Property**: property assignments to be searched: (examples: "L=1", "M=250"). If the field is not assigned, the research does not apply to the properties of a working; otherwise, while developing the nesting, any type of workings are excluded that verify the correspondence on the properties marked by a positive value; a profile is always calculated on the setup. The field must assign the items separated by space, where each item is called with the property name (L for Layer, then: O, M, K, K1, K2) followed by the associated value (for the K1 and K2 fields the "K1=.." form is obligatory). B (construct) and C (comment) field assignments are excluded and the assignments must be numerical. Any filter is cumulative of all the properties assigned with positive values. Examples:

· "L4 M5000" the exclusion of a working must check the numerical correspondence with two properties
· "L0 M5000" the exclusion of a working checks the numerical correspondence with the property
M=5000, while the one with the property is filtered, because it is assigned with value 0.

All the mentioned exclusion conditions are individually applied: you only need to check a condition to exclude a working.

11.3 Nesting options

- **Sorting of pieces**: it defines how to sort the pieces, while preparing the list to place. Four options are available:
    - **big pieces first**: it sorts by decreasing area;
    - **according to the direction**: it sorts by decreasing values of the size matching the direction of the nesting, as assigned on the single nesting project:
        a) if the direction is horizontal, it sorts by decreasing height;
        b) if the direction is vertical, it sorts by decreasing length;
    - **combined (area and direction)**, it applies sortings that can combine the two previous criteria. The selection can determine an increase of the number of iterations that a nesting solution is able to perform;
    - **little pieces first**: it sorts by increasing area.

- **Compare the solutions of a sheet**: group of settings used during the comparison of possible solutions, in order to determine the "best solution"
    - **Maximize the area occupied by the placements**: select this entry to give priority to the solution that maximize the area concerning the placements. Making reference to the figure:
    Ai indicates the area concerning the rectangular placements; it is enclosed by the limit coordinates of the placements. The difference between the Ai area and the area of all the placements corresponds to the area of the *offcuts inside* the nesting
    Ae indicates the area outside the placements and corresponds to the area of the *offcuts outside* the nesting

    The principle of maximising Ai area does not applies absolutely, but it is mediated in the area of the smaller piece and in the following principles.
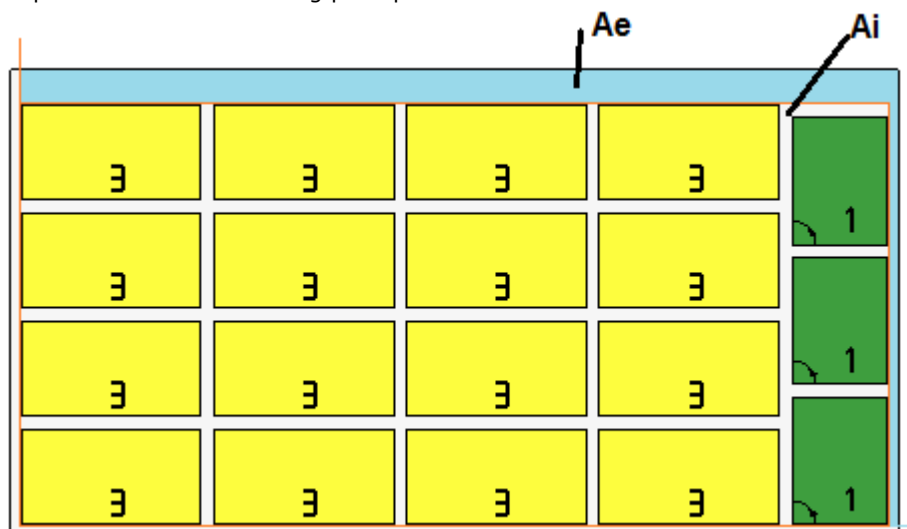
    If the field is not selected, the criterion of comparison of the areas concerning the placement is not excluded, but it is applied with less relevance.

- **Maximizes the orderly arrangement of placements**: select this item to give priority the "more orderly" solution: this evaluation is based on a comparison of offcuts (Ai area), of grid arrangement of the placements and of the number of the pieces.

Also in this case, if the field is not selected, the criterion of comparison is not excluded, but it is applied with less relevance.

- **Max. offset value of the offcuts inside the placements (%)**: set the maximum permissible offset value for the internal offcuts, now calculated as a percentage with respect to the A̲i̲area. The field accepts values in the interval (1 and 50). The use of the value is not absolute: coupled to one or to both criteria, may determine the choice of one of two solutions.

The remaining entries of the page set how a panel of the solution ("TCN file ") is defined.

- **Apply:** defines what to include in the composition of the panel, in case of placement of TCN programs. There are three options available:
    - **Workings+Cut profiles**: the workings of the original piece and the cut profiles
    - **Cut profiles**: cut profiles only
    - **Edit**: choice is possible in the unit of customization of the Nesting program ("".ncad" file).

- **Create a folder per solution**: the selected case requires the creation of a folder to store the solution. This box is selected and cannot be changed.
- **Optimize**: the selected case requires the execution of the optimisation of the panels, in the same context of their record. The application of the selection is conditioned by the actual availability of an optimisation module.

11.4 Cut profiles

Page to set the cut profils:

- **Global technology (tec\..)**: select an entry of the available global technologies to be used to carry out the cut profiles. If there is no assignment, the technology must be assigned in the (.TCN) nesting prototype file. The cut profile(s) of the pieces will begin with a copy of the working.
- **Insert cuts on the head**: the checked box requires the insertion of cut profiles before the workings of the pieces. The selection only affects only the case of TCN program placement.
- **Feed-through Z**: set the feed-through position assigned to the cut profiles. The sign is not significant because a depth beyond the thickness of the panel is calculated anyway. The minimum value is 0.0, the maximum value is 99. Example: 1.5 value → the cut profiles set a working depth equal to the thickness of the slab + 1.5. If the thickness of the slab is 30 mm, the execution depth will be calculated a -31.5 mm.
- **Interpolation speed**: set the programmed speed along the cut profiles.
- **Colour**: select the colour for the representation of the profile(s).
- **Cut of rectangle**: setting block relating to the application of non optimized cut profiles
- **Counterclockwise rotation:** select to develop the cut profiles in counterclockwise direction.
- **Cutting setup on one side** : select this option to develop the cut profiles with a setup point positioned along one side of the cut perimeter

Optimise paths: block of the settings concerning the optimisation of the cut profiles
- **Enable**: select to enable the optimiser. Optimization consists of the performance of a single cutting profile with a maximum reduction of the repeated strokes. For further details, see the next field. If the selection is not active, for each piece a path of separated cut is carried out with rectangular development. The activation is forced as active, if no working is available: [CUTRECT] Cut of rectangle.
- **Maximum movement over the piece** : set the maximum displacement yo can perform over the piece, without interrupting the profile. Minimum value is 0.0 mm. This setting will lead to the cutting profile fragmentation into multiple separate profiles. The benefit of separate profiles may be that the profiles can be joined to each other with non interpolated (and therefore faster) movements.
  If you set a great value (example: 100000) the optimized profile will be unique and the segments geometrically separated are joined by movements over the piece.
  If you set a lower value (example: 200.0) the profile will be split up into multiple profiles when the joining segment is longer than the set value.
  Set value to 0.0 to break up the profile at each joining segment.
- **Clearance Z**: set the rise position of the joining strokes carried out above the panel. The minimum value is 1.0 mm.
- **Speed of movements over the piece**: set the speed programmed along the strokes carried out over the panel.

Apply Z feed: block of settings concerning the development of the cut profiles on more passes and the following feeds of the work depth.

- **Enable**: select to enable the application of following passes
- **Maximum feed**: set the maximum depth of each pass (minimum value: 3.0 mm). The actual value of a pass is automatically recalculated, in order to homogenise the passes in the piece and for a maximum number of passes that, if the path optimisation is active, is set at 5. Example: thickness of the slab 30.0 mm, maximum feed 12.0 mm, feed-through Z 1.5 mm: the first pass is at Z-10.5, the second at Z-21.0, the third at Z-31.5

Apply connectors to profile: group of settings to develop connectors while executing the cutting profile at the final depth. The application of connectors is not meaningful and is not implemented in the case of non-optimized cutting paths and project paths whose internal margin set is null.

- **Enable**: select to enable the application of connectors
- **Number of connectors**: set the number of connectors to distribute on a cutting profile, if it is not optimised. The field can only accept values between 2 and 50. If the optimisation of the path is active, the setting is not significant.
- **Distance of succeeding connectors**: sets the linear distance of succeeding connectors (minimum value : 30.0 mm). If the optimisation of the path is not active and if the **Number of connectors** is greater than 2, the distance set here can be recalculated in order to distribute at least the number of the connectors required.
- **Length of connectors**: sets the length of the connector (in the XY plane of the sheet)
- **Residual thickness**: sets the thickness left by the tool in the executed piece
- **Tool compensation**: select to apply the external compensation of the tool (each connector is generated as large as the tool diameter).

Cut of the scraps: block of the settings concerning the development of the cut profile of the scraps. The technology used is the same of the cut profile of the pieces.

- **Enable**: select to enable the development of the cuts.
- **Colour**: select the colour representing the profile(s).
- **Feed-through Z (+/-)**: set the value of the lowering Z beyond the thickness of the panel and carrying the scraps. The sign is now significant: the value set is added with the sign at the depth that corresponds to the thickness of the panel. Examples: value 2.5 → the strokes leave a residual thickness of 2.5 mm; value -2.5 → the strokes are performed as 2.5 mm feed-through strokes (the examples apply in reverse in the case of depth programmed positive when enters the piece). At the most, it is possible to assign a 5.0 mm feed-through Z, while the value of residual thickness is valued in comparison to the thickness of the panels.
- **Cut the edge**: select to cut until the edges (a stroke reaches the edge and the overall dimension of the tool exceeds the radius). If this entry is not enabled, the cuts stops before the edge and leave some residual material (1.0 mm).
- **Minimum length**: minimum dimension of one scrap, measured along the outer edge of the cut (minimum value: 30.0 mm).
- **Maximum length**: maximum dimension of one scrap, measured along the outer edge of the cut (minimum value: 50.0 mm).
- **Minimum width**: minimum size of one scrap, measured along the development of the cut (minimum value: 30.0 mm).
- **Maximum width**: maximum dimension of one one scrap, measured along the development of the cut (minimum value: 50.0 mm).

Cut profiles of the scraps are separated developments: a cut corresponds to a profile.

The figure shows a panel with two cuts in each of which the direction of the application of the length L) and height parameters appears (H).
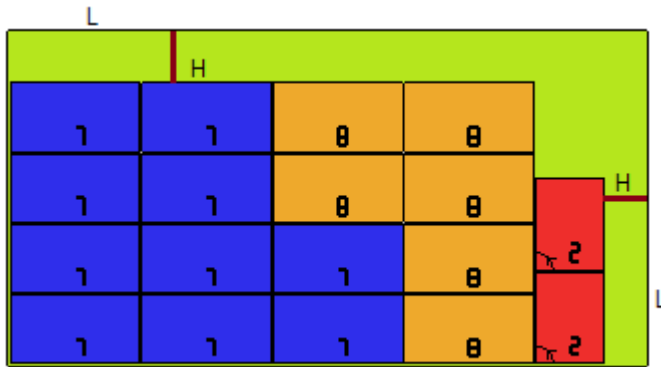
11.5 Advanced activations

- **Step-by-step solution** : select to enable the functionality of step-by-step solution. When the selection is active, you can proceed to determine the nesting project solution through successive evaluations of all the solutions found, in order to choose manually the best one.
- **Save the execution list**: select to enable the **Save the execution list** menu command (save a ".XMLST" file for the WSC application program).
- **Reports**: select to enable the **Reports** command menu.
    - **Select printer (PDF)**: select one of the listed printers as the printer to use to print the report in PDF format.
- <u>**Labels**</u>: block of the settings relating to the label control.
    - **Enable**: select to enable the label control. The activation is forced as active, if the [BARCODE] Barcode *working is not available.*
    - **Label layout**: click the icon ⊡ to open the window where the XML extension files, stored in the (tpacadcfg\custom\nesting) configuration folder, are shown: the operator is requested to select a file in the assigned folder. The file must match a configuration file for the labels. It is also possible to assign a name of non-existing file: closing the window with confirmation, the file itself is created. The actual management of the labels requires the assignment of a file for a valid layout, in the terms mentioned below.
    - **Background image**: click the icon ⊡ to open the window where the image files, stored in the (tpacadcfg\custom\nesting) configuration folder, are shown: the formats that are recognised as valid are *.PNG, *.JPG, *.BMP and the operator is requires to select a file in the assigned folder. The selected image is used as background image of the label layout. It is an unnecessary selection.
    - **Label Wizard**: opens a window in the label configurator, opening the file assigned in the **Label layout** (see following paragraph).
    - **Select printer** : select one of the listed printers as a predefined printer to be used for the labels.
    - **Optimize the creation of the labels**: select to require the record of the minimum label number. The optimisation procedure records one only label for all the similar applications of a program. This selection is available only if the optimised procedure can be applied according to the layout defined for the label (see next paragraph).
    - **Create the image of the rotated label**: select, if the mechanical positioning of the labels on the sheets does not allow their rotation, so as to require the storage of the labels (image file). This selection is significant only if square labels are assigned (with the same dimension of height and width).
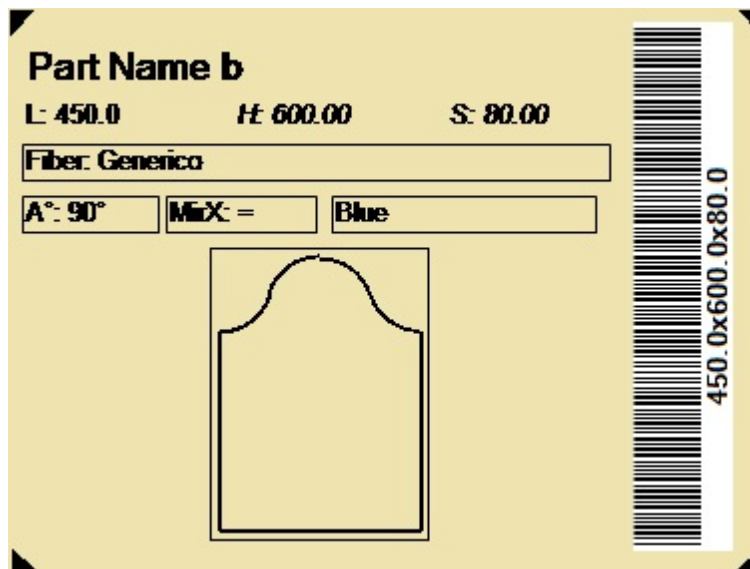
11.6 Configurator for labels

The window defines the layout of the labels in accordance with the selections made to the entries:
- **Label layout**
- **Background image**

The figure shows the case on a layout already assigned, loading a background image:
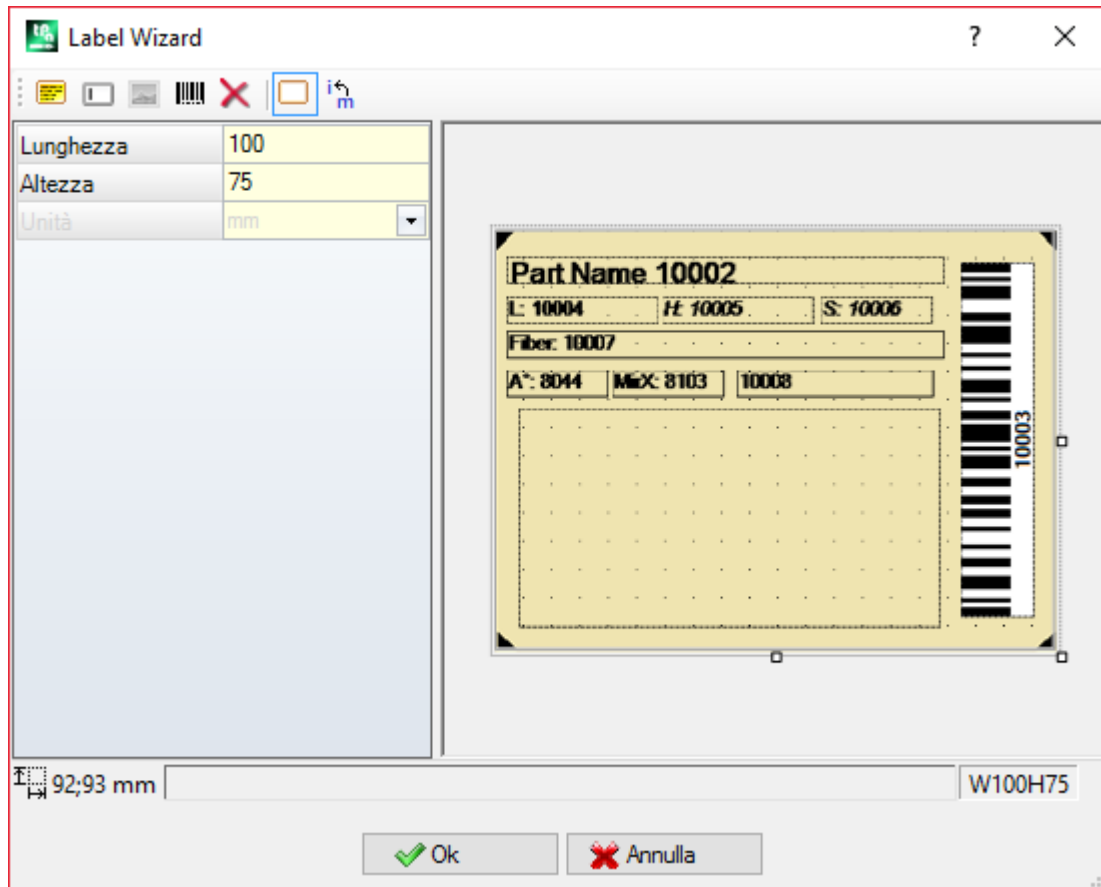
The figure is an example of a label created by the application of the layout provided:

A label layout corresponds to the insertion of the fields of selected type among text piece preview, barcode. Each field has:
- a localisation within the area of the label: position (X,Y) and dimensions (Length, Height), in unit of the label ([mm] or [inch]);
- the possibility to be surrounded by an edge;
- a characterization relating to the information to be represented (ID);
- selections added according to the field type.

The minimum dimension of a field corresponds to 10x10 pixels.
Each field produces an image to be placed in the label.
The IDs can be selected in a list of significant values; ID=0 corresponds a non assigned value. List of the value:

ID_ORDER	shows the project information that corresponds to the Order Reference (example: name of the customer and/or order and/or order number)
ID_PRODUCT	shows the information of the project corresponding to the Product (e.g.: product and/or model)
ID_IMAGE	requires the graphic representation of the single piece with the applied workings
ID_SHEET_IMAGE	requires the graphic representation of the sheet with all the placements and highlights the placement of the current piece [*note 1*]
ID_NAME	shows the name of the TCN.file corresponding to the single placement
ID_DESCR	shows the comment of the TCN file corresponding to the single placement
ID_LxHxS	shows the dimensions of the placed piece in the format Length x Height x Thickness (in the example: 600x450x80)
ID_LxH	shows the dimensions of the placed piece in the format Length x Height
ID_L	shows the length of the piece (in the example: 600)
ID_H	shows the height of the piece (in the example: 450)
ID_S	shows the thickness of the piece (in the example: 80)
ID_ROTATE	shows the indication of the placed rotated piece (in the example: 90°.)
ID_MIRROR	shows the indication of a piece to be made mirrored (in the example no:
ID_FIBER	shows the indication of the material for the panel (in the example: "Generic")
ID_COLOR	shows the indication of the colour for the panel (in the example: "Blue")
ID_SHEET_ID	shows the identifier (ID) of the sheet [*note 1*]
ID_SHEET_COUNT	shows the consecutive number of the sheet ("1" corresponds to the first number of the solution; "2" to the second, etc) [*note 1*]
ID_ROW_COUNT	shows the consecutive number of the current placement (on the sheet) [*note 1*]
LABEL_*	shows the value of the parameter corresponding to the **Label-BARCODE** working of the single placement. The entry in the list consists of "LABEL_name", where (name) is the ASCII parameter name
NONE (=0)	corresponds to a not assigned ID: it can be used in the field type "Text" to show a fixed text.

[note 1] the use of this field forces the creation of the labels by means of a non optimised procedure.

🟨	It sets the dimension of the label, in unit [mm] or [inch]. In the figure: 100*75 mm. Minimum dimension: 20 x 20 pixels (1 mm corresponds to 3.78 pixels, that is 1 pixel corresponds to 0.265 mm). A background image is loaded until it reaches the maximum dimension of the label.
▢	Select to insert a "Text" file. The type is selected in the ID list. Additional selections of the filed: • Title: text to use as a field header • Default value: text to show as a value, if the field is not found • Position: alignment of the overall text (Title & Value) in relation to the overall rectangle of the field 	TopLeft	TopCenter	TopRight	 	BottomLeft	BottomCenter	BottomRight	 • **Font**: writing font • **Font height**: in pixel units (minimum: 5) • **Colour**: writing colour of the text

	• **Bold, Italic, Underline**: selections for the font • **Rotation**: specifies the rotation of the field and the axis used to turn the representation upside down (see: "Barcode") In the field preview the text corresponding to "*Title: Default value*" appears; if a Default value is not assigned, a numerical value value of the ID appears. Alternatively, the Default value can be used to assign a formatting or a conditioning of the field. Formatting The recognition arises with first character = ' # ' (character: hash). The formatting concerns the information of decimal (double) or integer or string type number. A numerical example is one of piece dimension (ex: ID= ITEM_L). It is possible to assign a formatting for the fields with ID: • ITEM_LxHxS, ITEM_LxH, ITEM_L, ITEM_H, ITEM_S • LABEL_*. Examples of valid formatting ('#' is è omitted): "D6" formats an integer value on 6 digits (example: 12 →"000012") "F01" formats an integer value on 1 digits (example: 1234.678 →"1234.6") "F03" formats a double value on 3 decimal digits (example: 1234.678 →"1234.678") If the assignment is not valid, proceed with equal formatting without any warning. A <u>string</u> example is the comment of the TCN file (ID_DESCR) It is possible to assign a formatting for the fields with ID: • ID_DESCR, ID_ORDER, ID_PRODUCT • LABEL_*. The formatting action is valid if: "#n", with n= positive number = maximum number of given characters. Characters exceeding the maximum given length are deleted. Conditioning The recognition arises with first character = '?' (character: question mark) and can lead to the exclusion of the field in the label. You can apply the recognition in the event of TCN program Nesting only. Recognized characters (after '?') are: 's'= must verify that in the original progra there are workings programmed in faces other than the face of nesting (upper face) 'r'= must verify that the workings of the program were excluded in the solution of the Nesting '&'= is applied in a *logical and"* condition of all the given conditions: only if all the conditions are verified, the field is given in the label. Otherwise, a *"logical or"*condition is applied..
	Select to insert a "Graphics of the single piece" field. The type is ID=ID_IMAGE and in the layout of the label it is possible to assign one only field of this type. The field assigns: position (X,Y), dimensions (Length, Height). The field requires the graphic representation of the workings applied to the piece; like in the figure: the profile of a door rotated 90°.
	Select to insert an "Overall graphics of the sheet". The type is ID=ID_SHEET_IMAGE and in the layout of the label you can assign one only field of this type. This field assigns position (X,Y), dimensions (Length, Height), rotation. This field requires the graphic representation of the sheet with all the placements and highlights the placement of the current piece.
	Select to insert a "Barcode" file. The type is selected in the ID list. Additional selections of the filed: • **Code**: select a code in the list (for the description of the different types of barcodes, please read the specific documentation) • **Default value**: text to show as a value, if the field is not found • **Display text**: select to view also the representation in text format. • **Position**: position of the text with respect of the barcode (when *Display text* is selected) • **Rotation** : below the visual effect in accordance with the selection made (in all the examples also the text is displayed, with alignment by default "BottomCenter" <table><tr><td>RotateNoneFlipNone</td><td>RotateNoneFlipXY</td></tr></table>

	RotateNoneFlipX • RotateNoneFlipY • Rotate90FlipNone • Rotate90FlipXY • Rotate90FlipX • Rotate90FlipY A "Barcode" field will be actually shown in the label only if the corresponding value is assigned: so, you need to select a significant ID.
✗	Select to delete the current field
▭	Select to view an edge around each field, regardless of the import *Edge* of the field itself
	One only of the buttons is displayed, according to the programmation unit of the label: • unit [mm]: converts in [inch] • unit [inch]: converts in [mm]

The layout is recognised as valid for the composition of the label files, if:
- the dimension of the label is almost 20 x 20 pixels;
- valid fields are assigned, that is:
  - with a minimum dimension 10 x 10 pixels;
  - with ID assigned as significant (>0), or
  - with ID=0 and **Title** and/or significant **Default value** .

12   Nesting in Demo mode

In the Demo mode the Nesting functionalities can be valued without saving the panels and the labels.

The representation of the panels excludes the development of the cutting paths.