NUMERIČKI UPRAVLJANE MAŠINE U OBRADI DRVETA

B SOLID

CRTANJE PREDMETA OBRADE

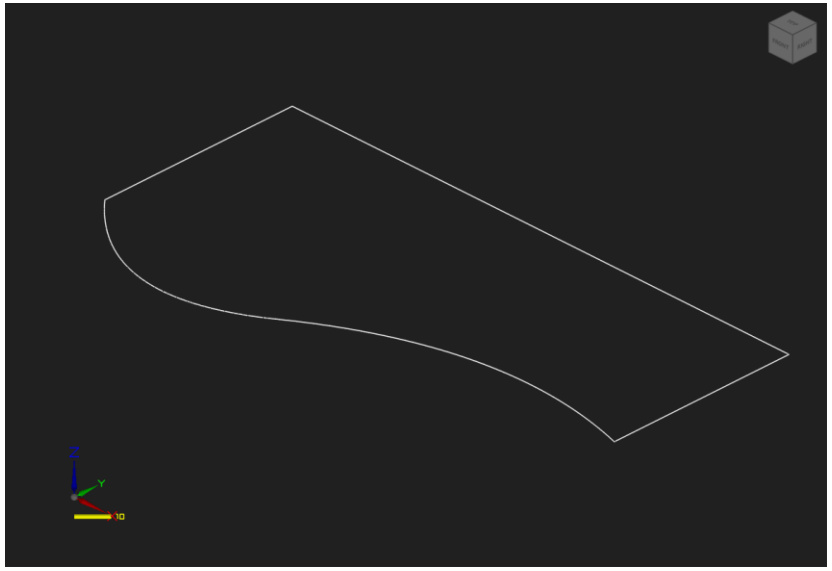


Figure 1

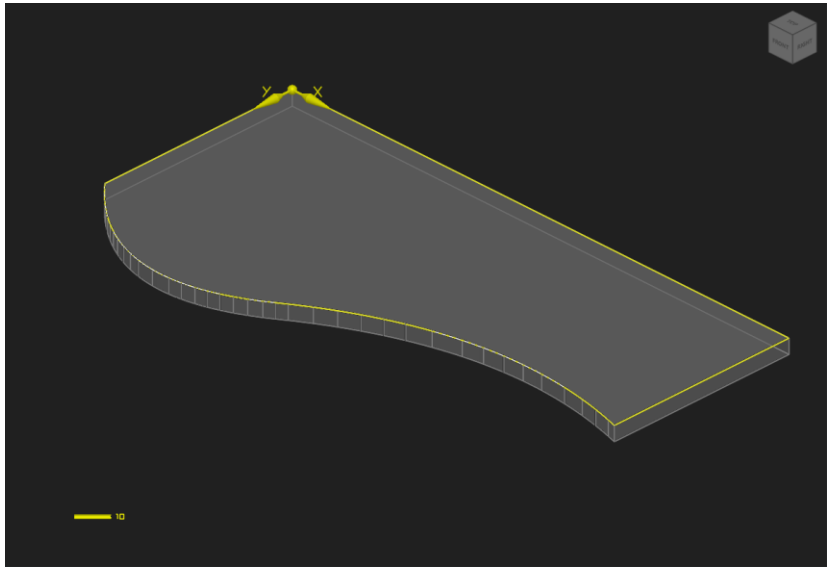


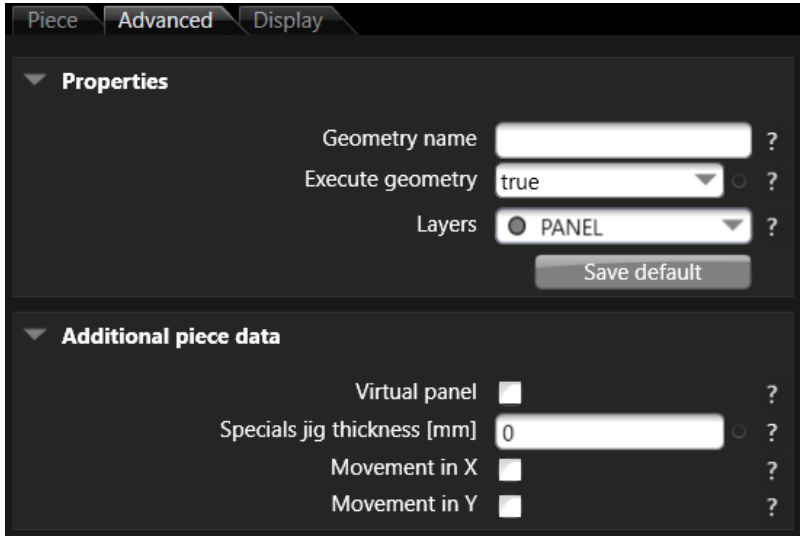
Figure 2

Starting from a 2D geometry (*Figure 1*) drawn in the space it's possible to create the piece shape (*Figure 2*) by clicking on . button or directly picking the shape

With Piece thickness [mm] parameter user can select the desired piece thickness.

CAD/CAM - Piece creation

Advanced: this tab allow to specify advanced parameters for piece creation.



Geometry name: it allow to specify the geometry name.

Execute geometry: it specify custom rules for geometry execution.

Layers: it allow to associate the geometry with a layer.

Virtual panel: it allow to specify whether or not the panel should be considered virtual (*Figure 1*); if enabled (*Figure 2*) it is used only to simulate machinings in bSolid simulation area.

Special jig thickness [mm]: it allow to specify the thickness of the special jig used for the piece machining.

Movement in X: it allow the movement of the origin along X-axis.

Movement in Y: it allow the movement of the origin along X-axis

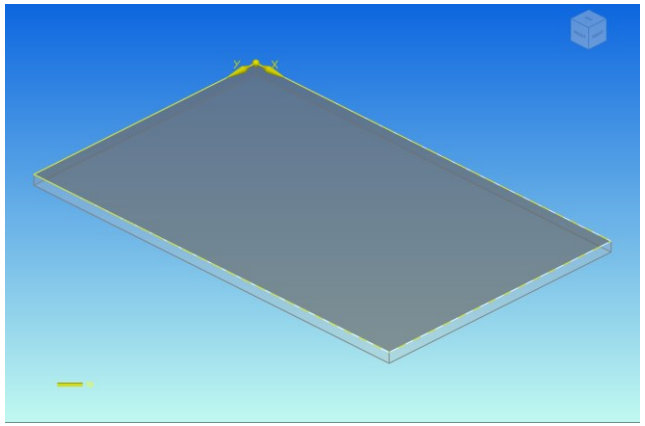


Figure 1

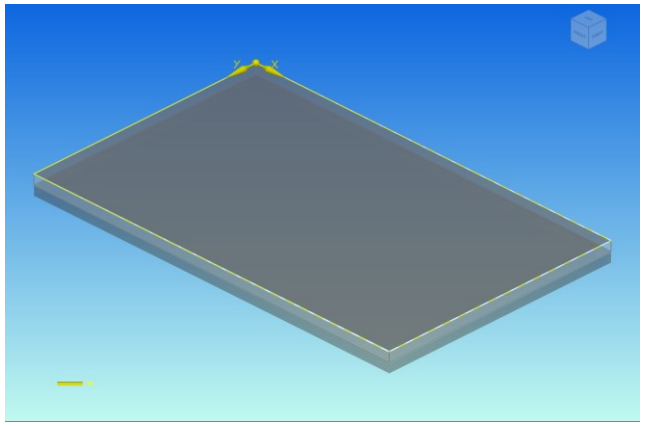
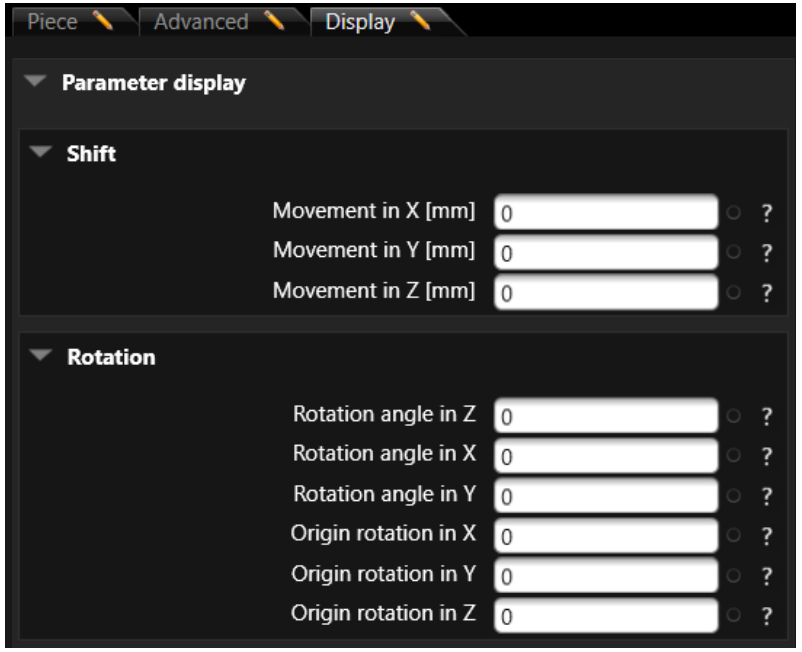


Figure 2

CAD/CAM - Piece creation

Display: this tab allow to specify advanced parameters for piece creation.



Movement in X [mm]: it specify custom rules for geometry distance in X from the reference corner A to the centre of the grid, for moving the piece (*Figure 1*).

Movement in Y [mm]: it specify custom rules for geometry distance in Y from the reference corner A to the centre of the grid, for moving the piece (*Figure 1*).

Movement in Z [mm]: it specify custom rules for geometry distance in Z from the reference corner A to the centre of the grid, for moving the piece (*Figure 1*).

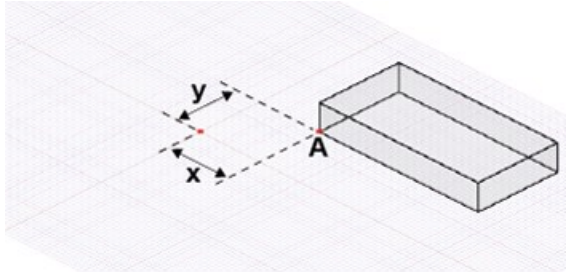


Figure 1

Rotation angle in Z: it specify the angle for rotating the piece around the Z axis (*Figure 2*).

Rotation angle in Y: it specify the angle for rotating the piece around the Y axis (*Figure 3*).

Rotation angle in X: it specify the angle for rotating the piece around the X axis (*Figure 4*).

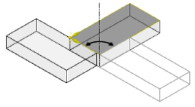


Figure 2

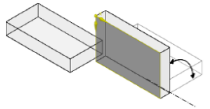


Figure 3

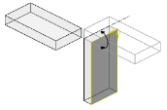


Figure 4

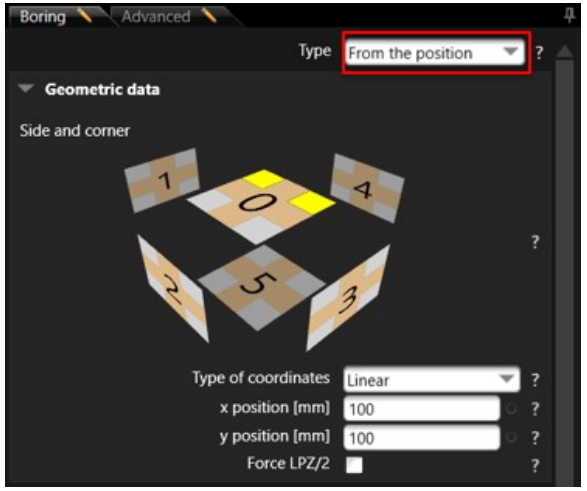
Origin rotation in X: it specify X coordinate for establishing the point around which the piece should be rotated.

Origin rotation in Y: it specify Y coordinate for establishing the point around which the piece should be rotated.

Origin rotation in Z: it specify Z coordinate for establishing the point around which the piece should be rotated.

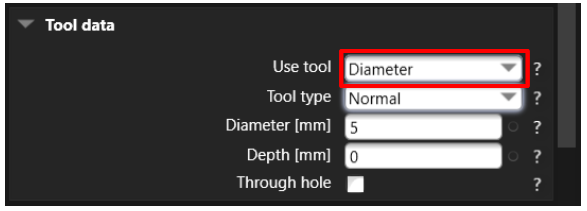
Machinings

Boring - From the position



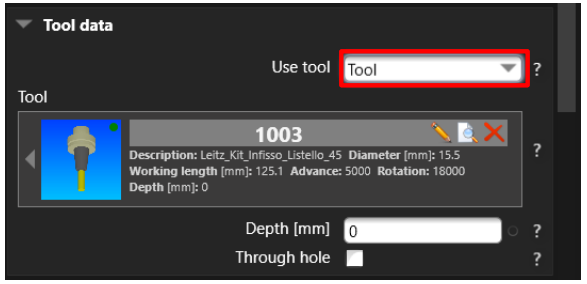
Geometric data:

- **Type of coordinates**: Linear and Angular; Linear coordinates require the user to specify x and y position of the boring while angular require the user to specify the angle and the y position.
- **Force LPZ/2**: if checked, it force the boring to be performed at LPZ/2 avoiding the user to writing formulas (it works on vertical and custom faces, except for inclined faces).



Tool data (Diameter)

- **Use tool**: it allow to select the tool type (Normal, Spear-shaped drill, Countersunk, NormalG, End mill and Profiled), the diameter (it raise an error in case the proper tool with a specified diameter is not found), boring depth and specify if the hole is through or not.

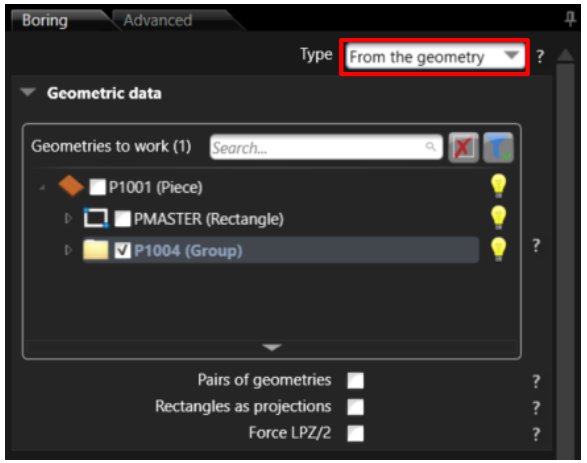


Tool data (Tool)

- **Use tool**: it allow the user to select the tool to be used for boring machining, boring depth and specify if the hole is through or not.

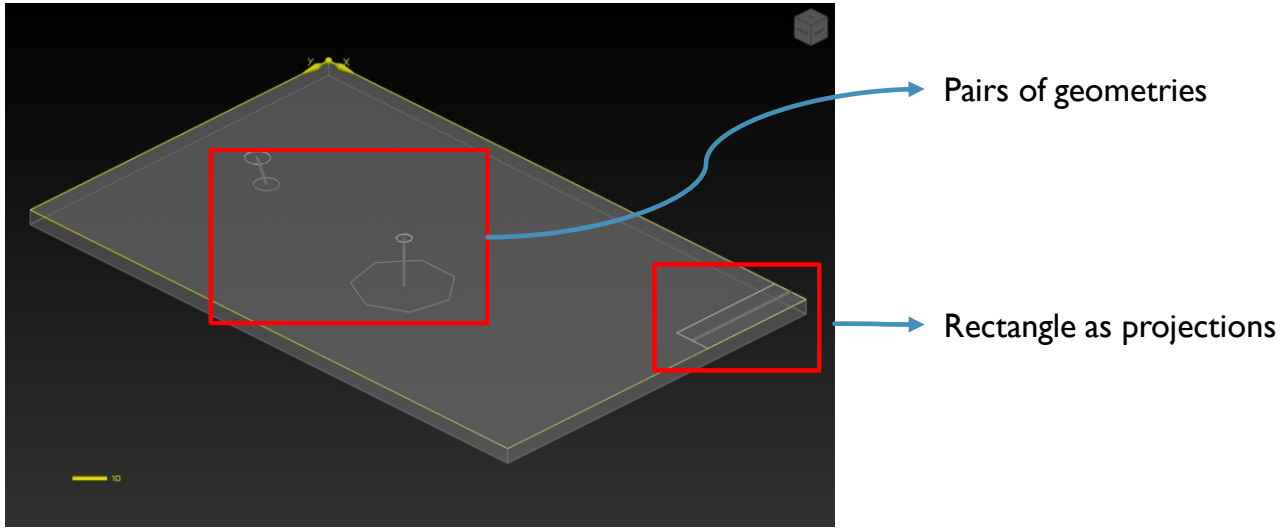
Machinings

Boring - From the geometry



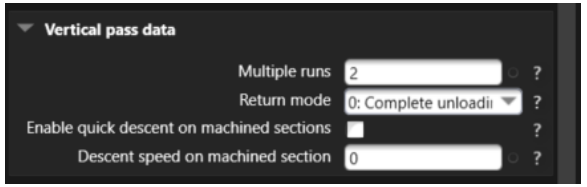
Geometric data:

- **Pairs of geometries**: it allow to select two geometries (at different Z level) and create a boring milling across the barycenter of both geometries.
- **Rectangle as projections**: if checked, it allow to create a boring machining along the created rectangle which can be moved along Z.



Machinings

Boring - Vertical pass data



Vertical pass data:

- **Multiple runs**: it identify the number of machining to be performed until the depth has been reached.

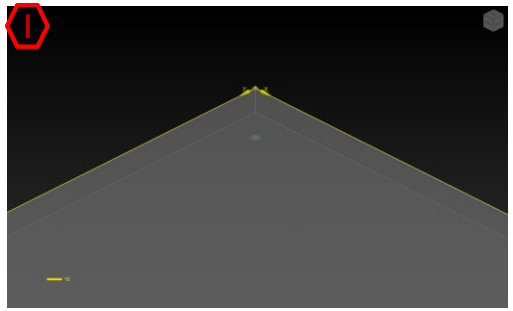
- **Return mode**: it specify how the tool emerges from the piece in order to expel the chips:
  - **0: Complete unloading**, the tool emerges from the piece and moves back to its initial position.
  - **1: Partial unloading**, the tool emerges from the piece and moves back to the working position of the previous step.
  - **2: Unload at user defined position**, the tool emerges from the piece and moves to the position defined in the Unloading position data field.
- **Enable quick descent on machined sections**: if checked it enable quick speed descent on machined sections.
- **Descend speed on machined section**: if allow to specify a custom descent speed (* Enable quick descent on machined sections must be disabled).

Machinings

Boring - Repetition data

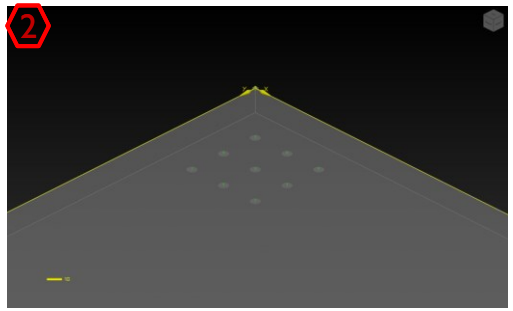
Repetition data

1 — Repetition type: 0: None



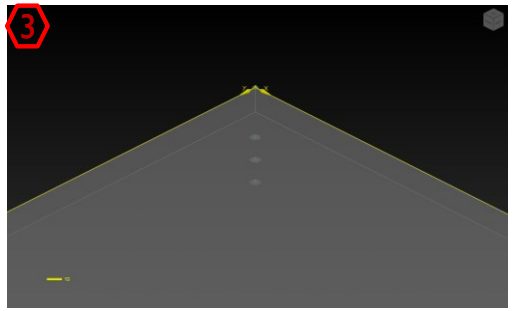
Repetition data

2 — Repetition type: 1: Matrix
Number of repetitions in X: 3
Number of repetitions in Y: 3
x step [mm]: 32
y step [mm]: 32



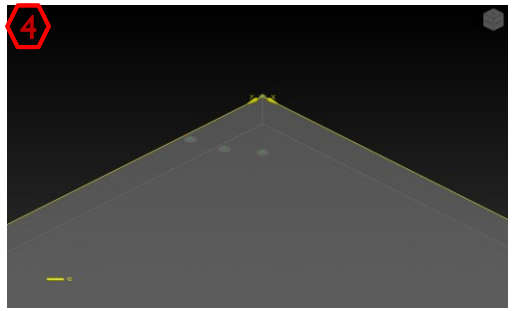
Repetition data

3 — Repetition type: 2: Linear
Angle: 45
Number of repetitions: 3
Step [mm]: 32



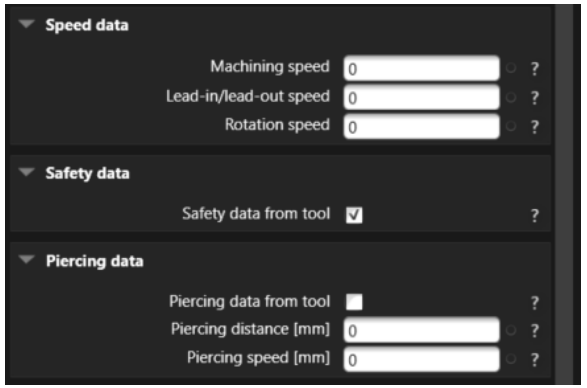
Repetition data

4 — Repetition type: 3: Circular
Centre circle X [mm]: 0
Centre circle Y [mm]: 0
Number of repetitions: 3
Angular step: 20



Machinings

Boring - Speed, safety and Piercing data



Speed data:

- **Machining speed**: it set the advance speed of the tool during the machining operations.
- **Lead-in/lead-out speed**: it specify the speed at which the tool moves when performing lead-in and lead-out operations.
- **Rotation speed**, it specify the tool rotation speed (rpm).

Safety data:

- **Safety data from tool**: if checked, it allow to import safety data directly from the tool.

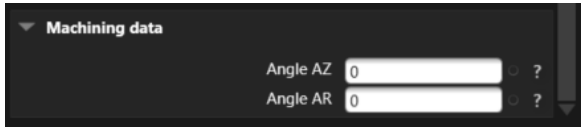
Piercing data:

- **Piercing data from tool**: if checked, it allow to import piercing data directly from the tool otherwise user can insert piercing speed and distance *.

(* Enable quick descent on machined sections must be disabled).

Machinings

Boring - Machining data



Machining data:

- **Angle AZ**: it specify the tool tilt angle in relation to the geometry drawn on the upper face of the piece *(Figure 1)*.
- **Angle AR**: if specify the tool rotation angle (i.e. the rotation angle of the spindle axis on the XY plane) *(Figure 2)*.

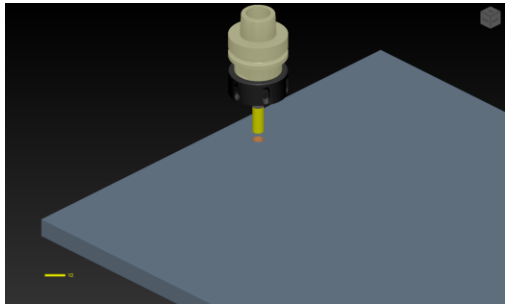


Figure 1,
AZ Angle: 0°

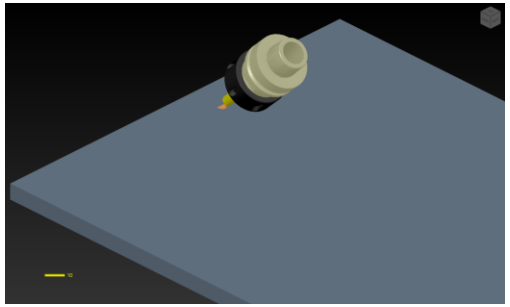


Figure 1,
AZ Angle: 45°

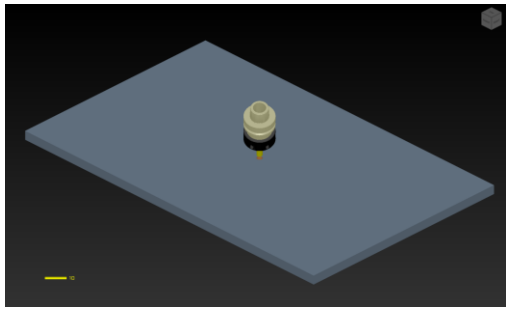


Figure 2,
AZ Angle: 20°
AR Angle 45°

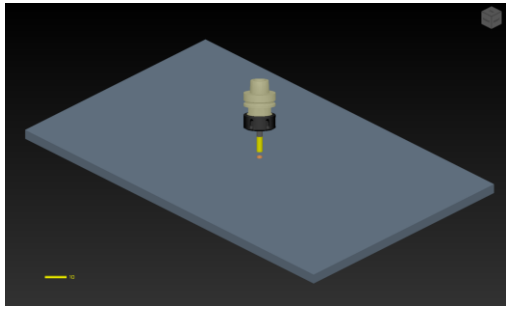


Figure 2,
AZ Angle: 20°
AR Angle 225°

Machinings

Boring - Advanced data (Overview)

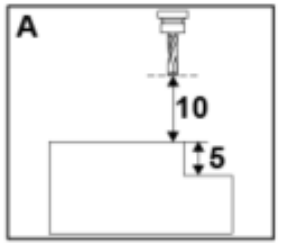


Figure 1,
Safe descent on channel field enabled

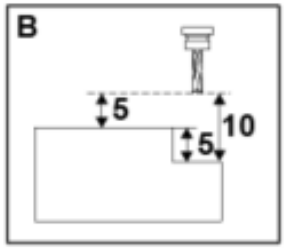


Figure 1,
Safe descent on channel field disabled

Properties:

- **Name, Execute machinings and Layers**: as previously described.

Additional machining data

- **Optimizable:** if not selected, the machining operation is not optimized and is performed respecting the position indicated in the programming rows (an orange circle will appear in correspondence of the machining timetable).

- **Safe descent onto recess**: it enables or disables the calculation of the tool safety position (i.e. 10 mm) starting from the surface obtained from a channel, but only if a value has been specified in Recess Z data field (i.e. Recess Z [mm]: 5)
(Figure 1).

- **Spindle forcing:** used to indicate the ID code of the spindle to be used for the boring.

Machinings

Boring - Advanced data (Overview)

Additional machining data:

- **Type of positioning:** used to choose how to position the suction hood during the machining operation:
  - **By position**, suction hood can be set from 0 to 6, where 0 means that the suction hood height is managed automatically and 1 to 6 range allow the user to position it manually.
  - **By distance from piece**, is the distance from the piece surface for positioning the suction hood (Distance from piece field).
- **Floating**: it enables or disables the use of the copier or other similar devices.
- **Presser**: it enables or disables the use of the presser.
- **Blower**: Enables or disables the use of the blower to clean the piece whenever the copier or presser is used.
- **Chip cleaning blow**: it enables or disables the use of the blower on the piece, to remove chips left behind during machining operations.

Machinings

Boring - Advanced data (Overview)

Additional machining data:

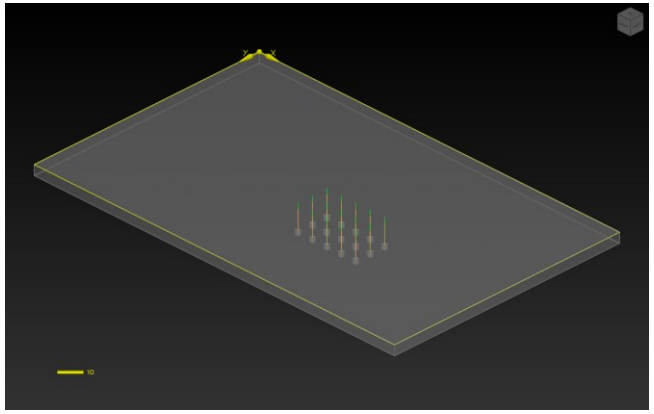
- **AirTool**: it enables or disables the cooling of the inner part of the tool during the machining operation.
- **AirJet**: it enables or disables the cooling of the tool bit during the machining operation.
- **Ioniser**: it enables or disables the cleaning of the tool bit during the machining operation (ionised air).
- **Lubrificator**: it enables or disables the lubrication of the tool during the machining operation.
- **Maintain deflector**: if checked it disables the depositing of the deflector in the magazine during the tool change operation.

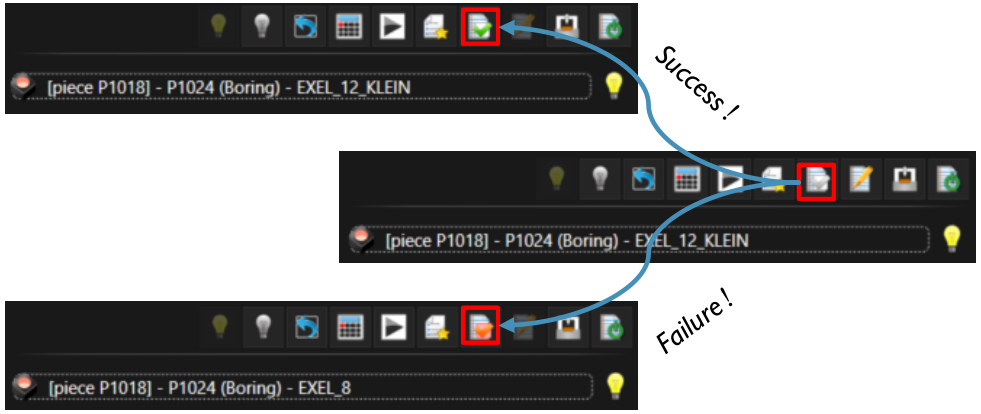
Optimizer and Global parameters

Optimize

Optimise button is used to check whether machining operations can be executed or not on the machine; it's essential an essential step in order to perform real time simulation.

As example let's suppose to have 9 boring machinings to be optimized and then simulated.



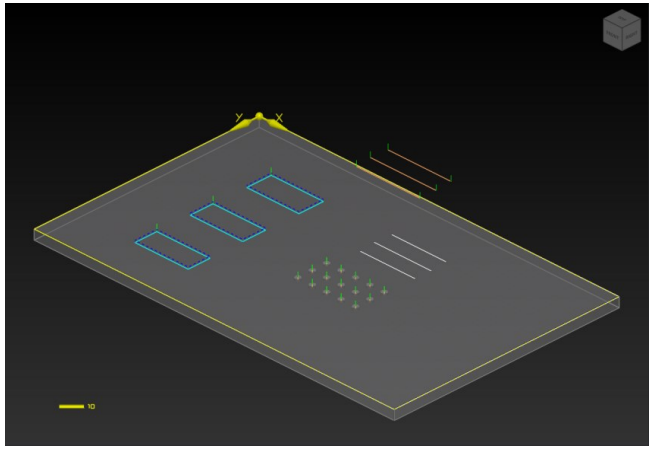


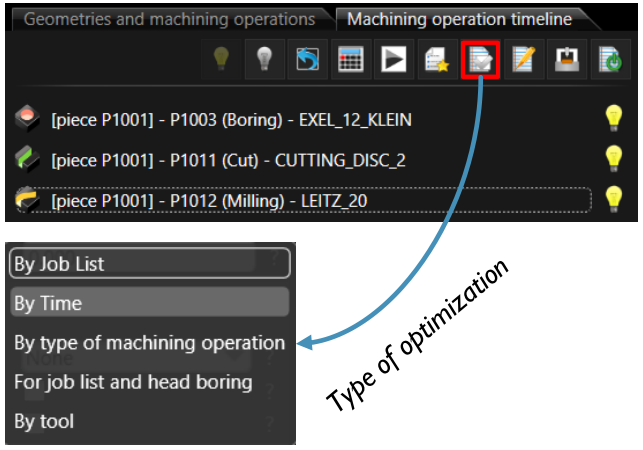
Optimizer and Global parameters

Global parameters

Global parameters button allow to specify the type of optimization to perform in order to execute machinings.

Furthermore, advanced options and features can be configured according to the chosen optimization type.





5 types of optimization:

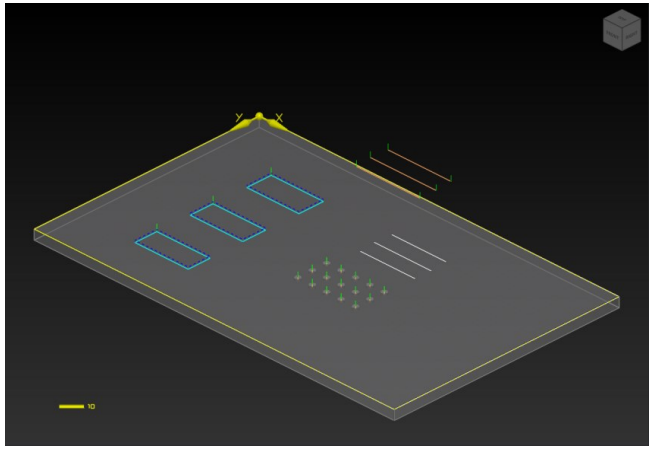
- By Job List
- By Time
- By type of machining operations
- For job list and head boring
- By tool

Optimizer and Global parameters

By Job List

This specific optimization type is used to arrange the machining operations in order, following the sequence indicated in the source program.

In the example (*Figure 1*) machining operations are executed following the order specified on "Machining operation timeline" (1, 2 and then 3)



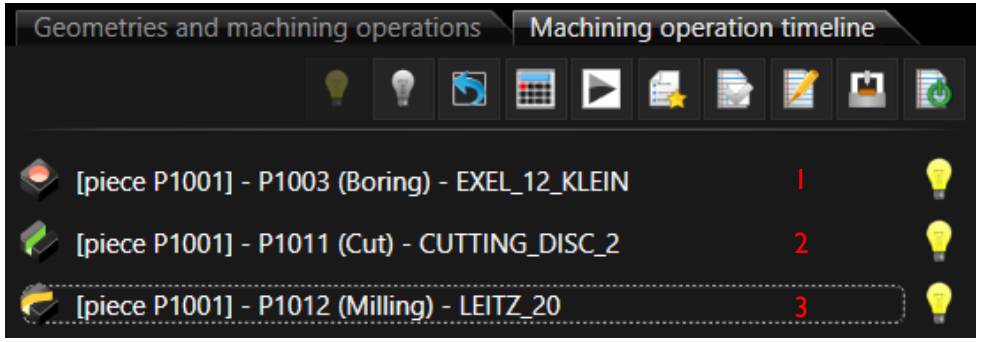
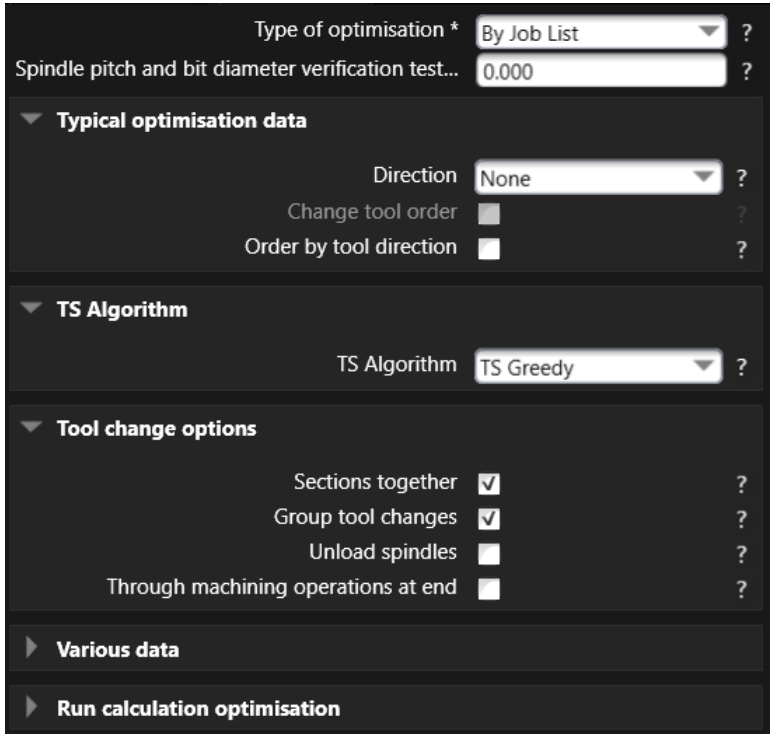


Figure 1,
By Job List

Optimizer and Global parameters

By Job List - Advanced Options



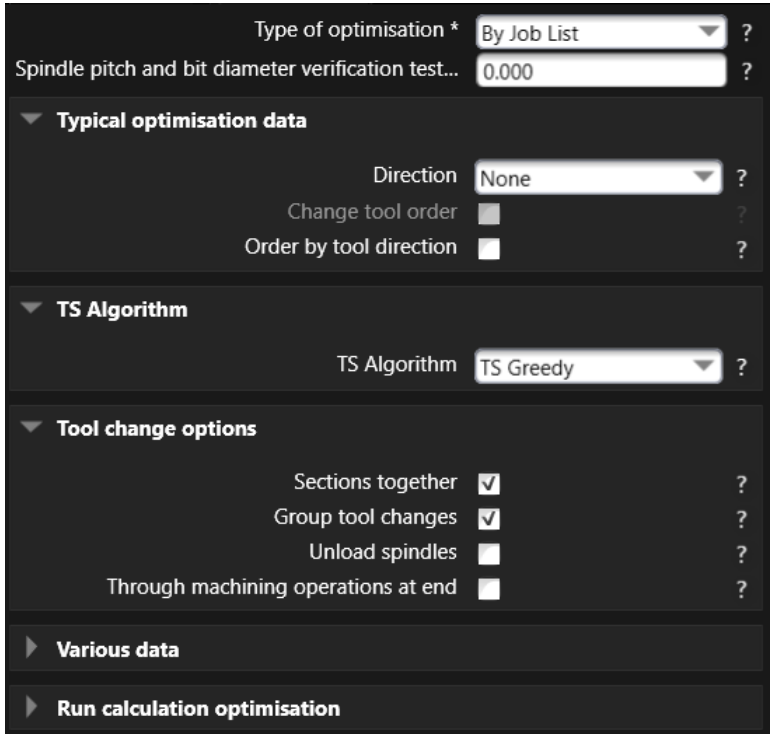
Typical optimisation data:

- **Direction**: it specify the type of arrangement based on the direction:
  - **X+**: it forces the optimiser to arrange boring operations so that the processing centre always moves in the positive X direction.
  - **X-**: it forces the optimiser to arrange boring operations so that the processing centre always moves in the negative X direction.

- **Change tool order**: if checked, the optimiser is authorised to group together, where possible, the machining operations that use the same tool *(this field can not be modified while using "By Job List" optimisation)*.

Optimizer and Global parameters

By Job List - Advanced Options



Typical optimisation data:

- **Order by tool direction**: if checked, the optimiser is forced to group together boring operations according to their working direction.

TS Algorithm:

- **TS Algorithm**: used to choose the type of path optimisation algorithm to be adopted by the CAM (TS Greedy, TSP).

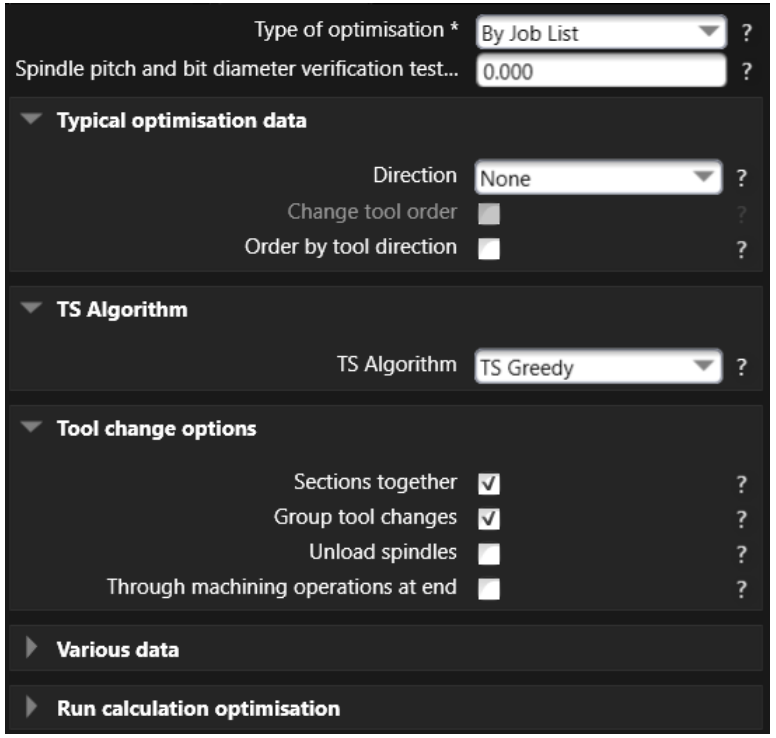
Tool change options:

- **Selections together**: it enables or disables the grouping of the tool change operations.

- **Group tool changes**: it enables or disables the grouping of the tool change operations.
- **Unload spindles**: if checked, the tool change device is forced to take the tool out of the spindle at the end of the programmed machining operation.

Optimizer and Global parameters

By Job List - Advanced Options



Tool change options:

- **Through machining operations at end**: if checked, the optimizer first carries out the non-through machining operations and then the through machining operations.

TS Algorithm:

- **TS Algorithm**: used to choose the type of path optimization algorithm to be adopted by the CAM (TS Greedy, TSP).

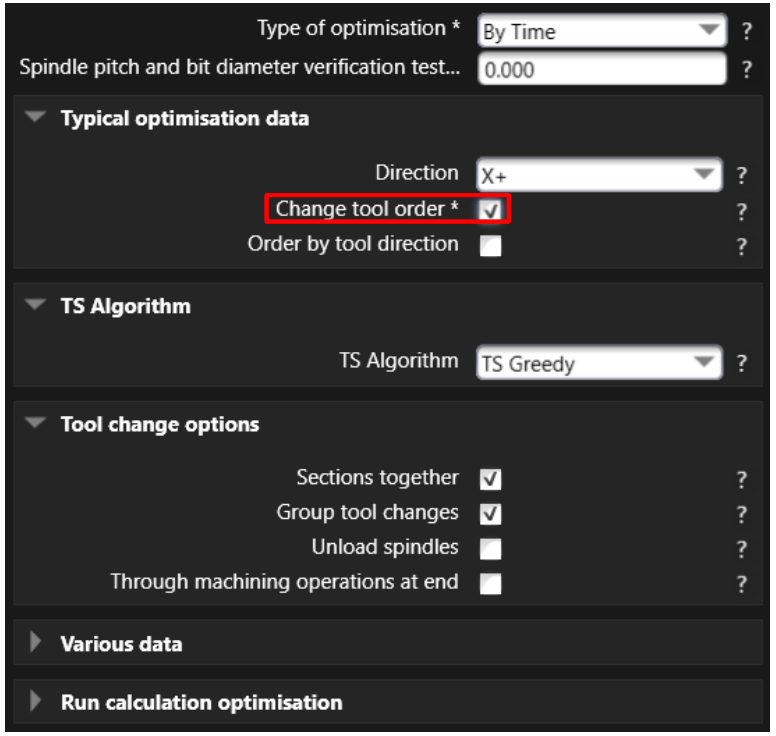
Tool change options:

- **Selections together**: it enables or disables the grouping of the tool change operations.

- **Group tool changes**: it enables or disables the grouping of the tool change operations.
- **Unload spindles**: if checked, the tool change device is forced to take the tool out of the spindle at the end of the programmed machining operation.

Optimizer and Global parameters

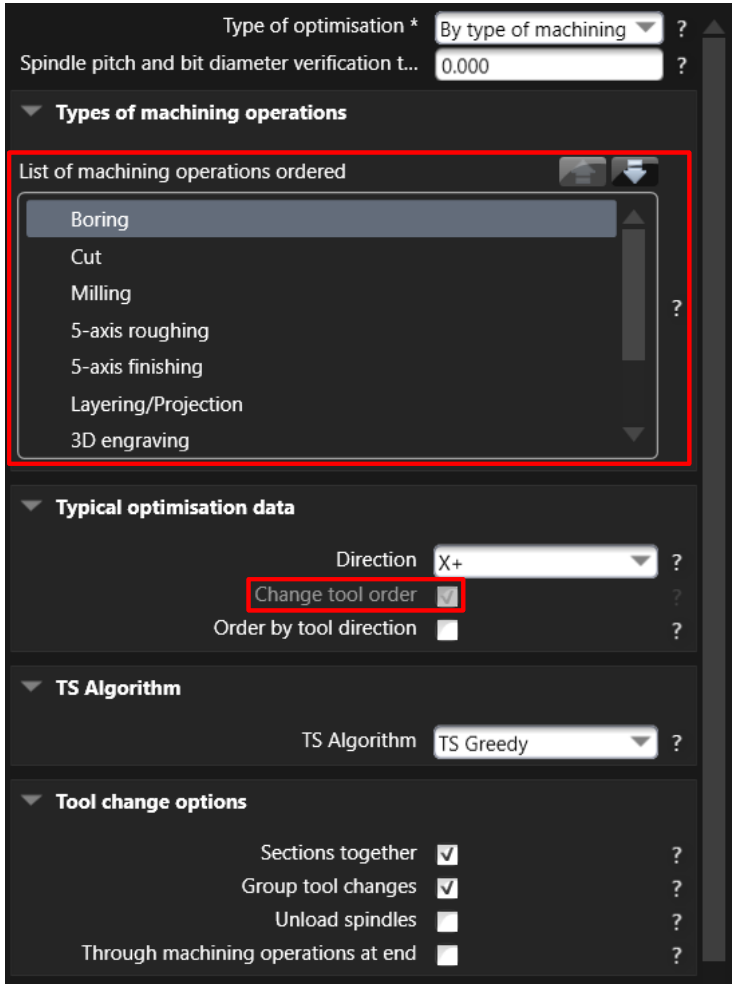
By time - Advanced Options



Same settings as "By Job List" optimisation except for "Change tool order" field (*this filed is enabled using "By time" optimisation*).

Optimizer and Global parameters

By type of machining - Advanced Options

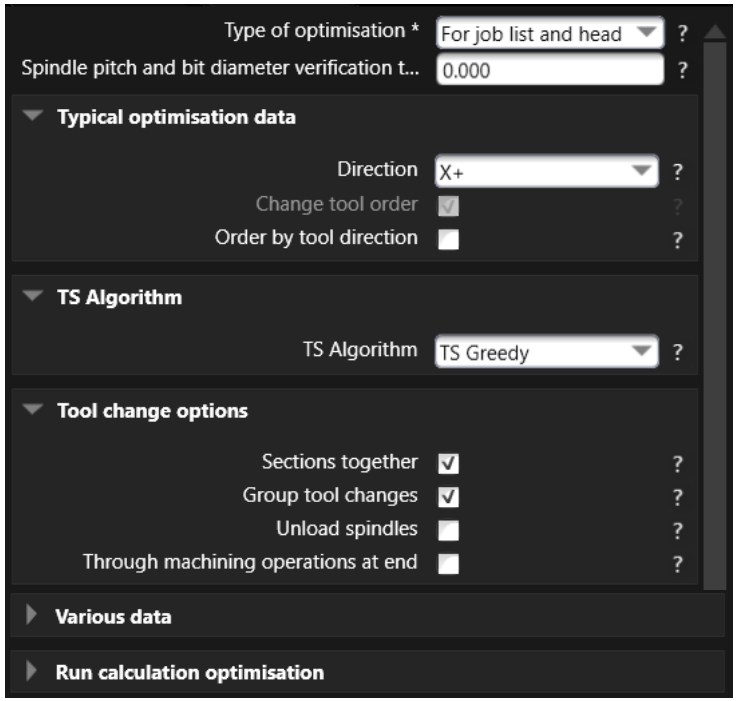


By choosing "By type of machinings" type of optimisation user will be able to choose preferred machining order (i.e. first all boring machinings, secondly cut machinings,…).

** Change tool order field can not be modified while using "By type of machinings" optimisation.*

Optimizer and Global parameters

For job list and head boring - Advanced Options

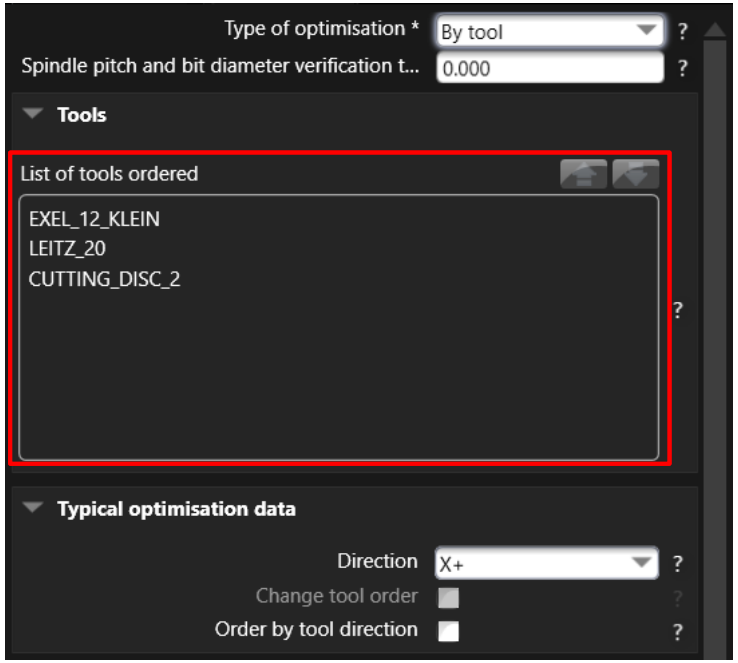


"For job list and head boring" type of optimisation is used to prioritise the boring operations that can be optimised, grouping them together at the start of the program or with the non-optimisable operations so as to make the least possible number of descents.

** Change tool order field can not be modified while using "By type of machinings" optimisation.*

Optimizer and Global parameters

By tool - Advanced Options



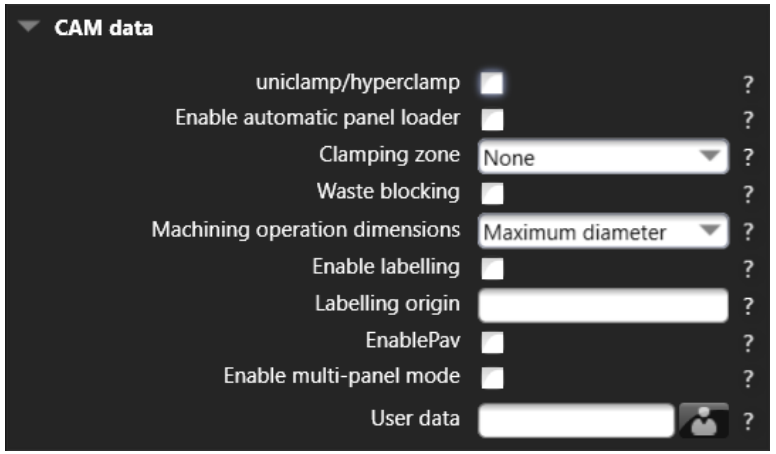
"By tool" type of optimisation is used to prioritise the machining operations, following the tool sequence defined in the Tools section (i.e. first all the machinings using "EXEL_12_KLEIN", secondly all the machinings using "LEITZ_20",…).

.

** Change tool order field can not be modified while using "By type of machinings" optimisation.*

Optimizer and Global parameters

Cam default

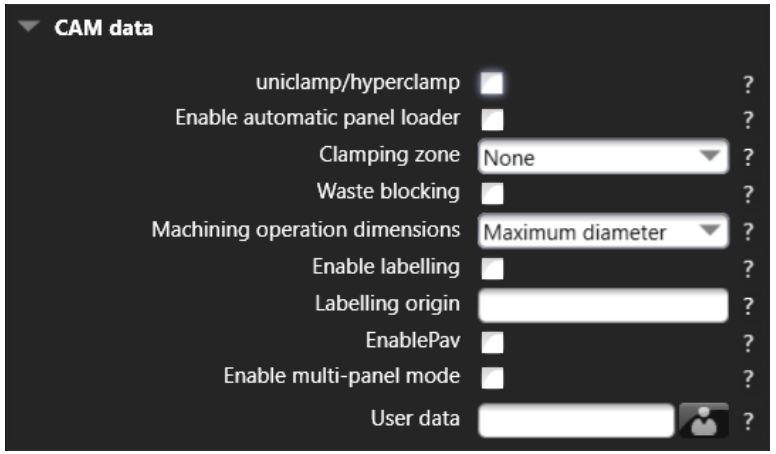


CAM data:

- **Uniclamp/hyperclamp**: it enables or disable the use of the clamps to lock the piece; to use the suction cups, box must be disabled.
- **Clamping zone**: used to select a configuration among the ones on the list.
- **Waste blocking**: it enables or disable the locking of the piece areas considered as waste.
- **Machining operation dimensions**: used to define the type of check on the tool dimensions in order to avoid collisions.
- **Enable labelling**: it enables or disables the creation of the ISO code for the labelling operations.
- **Labelling origin**: it allow to specify the reference origins of the labelling device.
- **Enable PAV**: it enables or disables the semi-automatic positioning of the work table objects every time the ISO code is generated, without having to click on the related button of the "Piece in the machine" nvironment.

Optimizer and Global parameters

Cam default



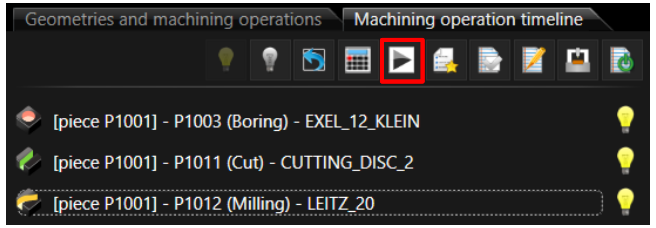
- **Enable multi-panel mode**: it enables or disables the possibility to machine several pieces with the same program.
- **User data**: it allow to customized advanced user data and parameters.

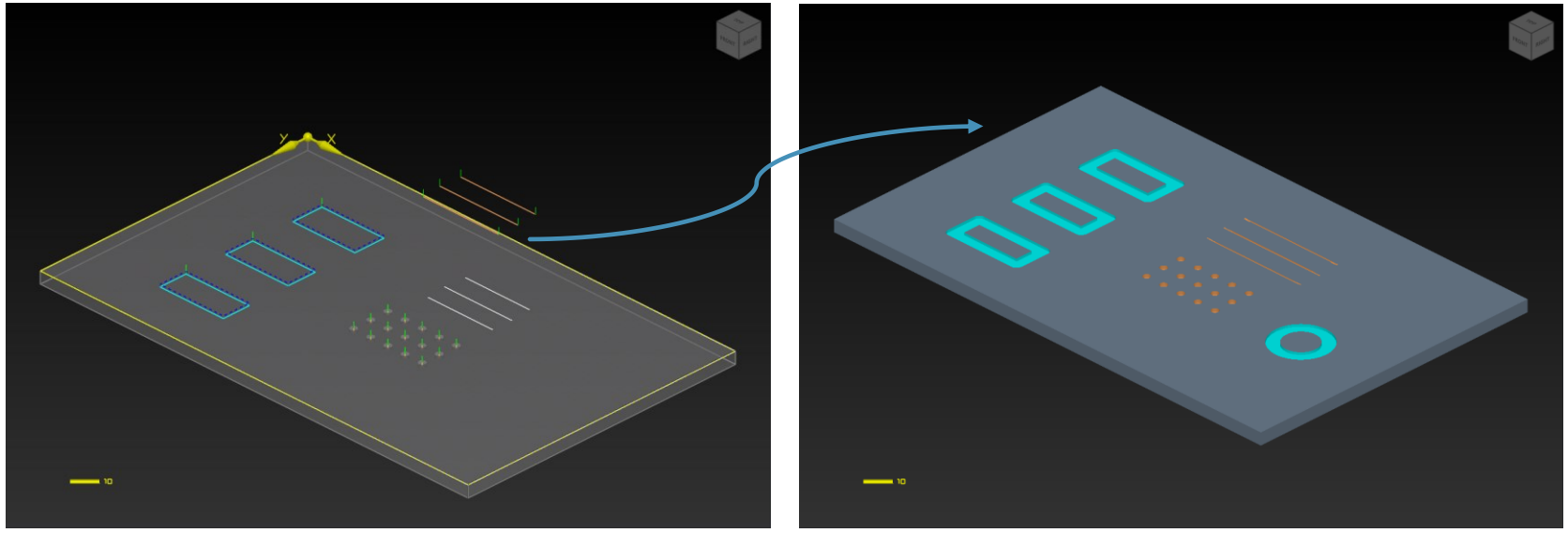
SIMULACIJA OBRADE

CAD Simulation

CAD simulation button allow to simulate machinings on CAD/CAM environment.

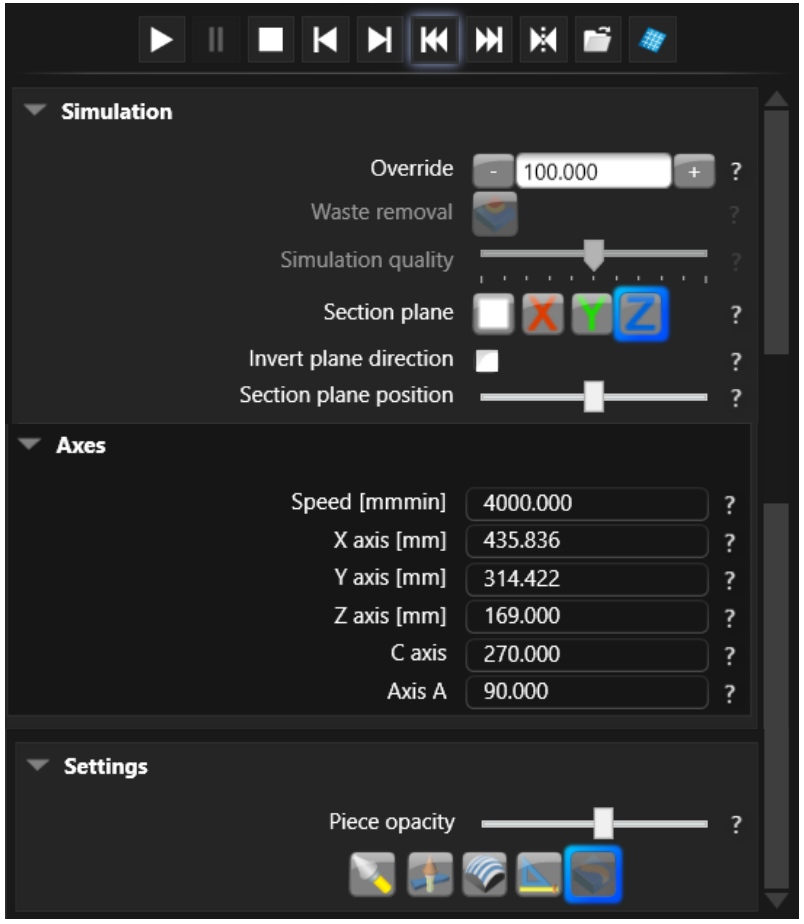
CAD simulation allow the user to slow down, speed up, pause and stop simulation speed, see detailed axes movements and more.





CAD Simulation

Machining operation simulation



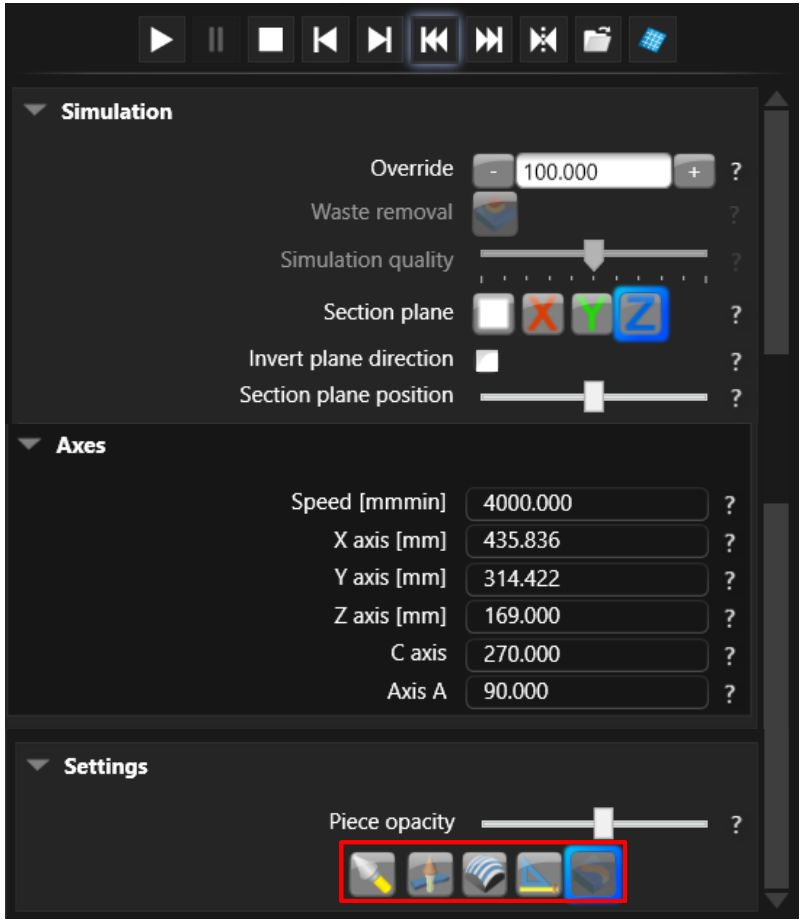
List of command used to start, pause and stop simulation; furthermore is possible to skip simulation to previous or next machining operation or go straight to the end of the simulation.

Simulation:

- **Override**: it enables the user to slow down (lower value) or speed up the simulation speed (higher value).
- **Waste removal**: if enabled, it allow to eliminate waste during the simulation (in real time).
- **Simulation quality**: it allow to decrease or increase simulation quality.
- **Invert plane direction**: it enables or disables the reversal of the table section.
- **Section plane position**: it allows to see more or fewer parts of the sectioned piece (X,Y, Z).

CAD Simulation

Machining operation simulation



Axes:

- **Speed**:Axis interpolation speed during the simulation.
- **X axis**: it specify the x position of the point where the tool is located during the simulation.
- **Y axis**: it specify the y position of the point where the tool is located during the simulation.
- **Z axis**: it specify the z position of the point where the tool is located during the simulation.
- **C axis**: the rotation of the C-axis during the simulation.
- **Axis A**: the tilting of the A-axis during the simulation.

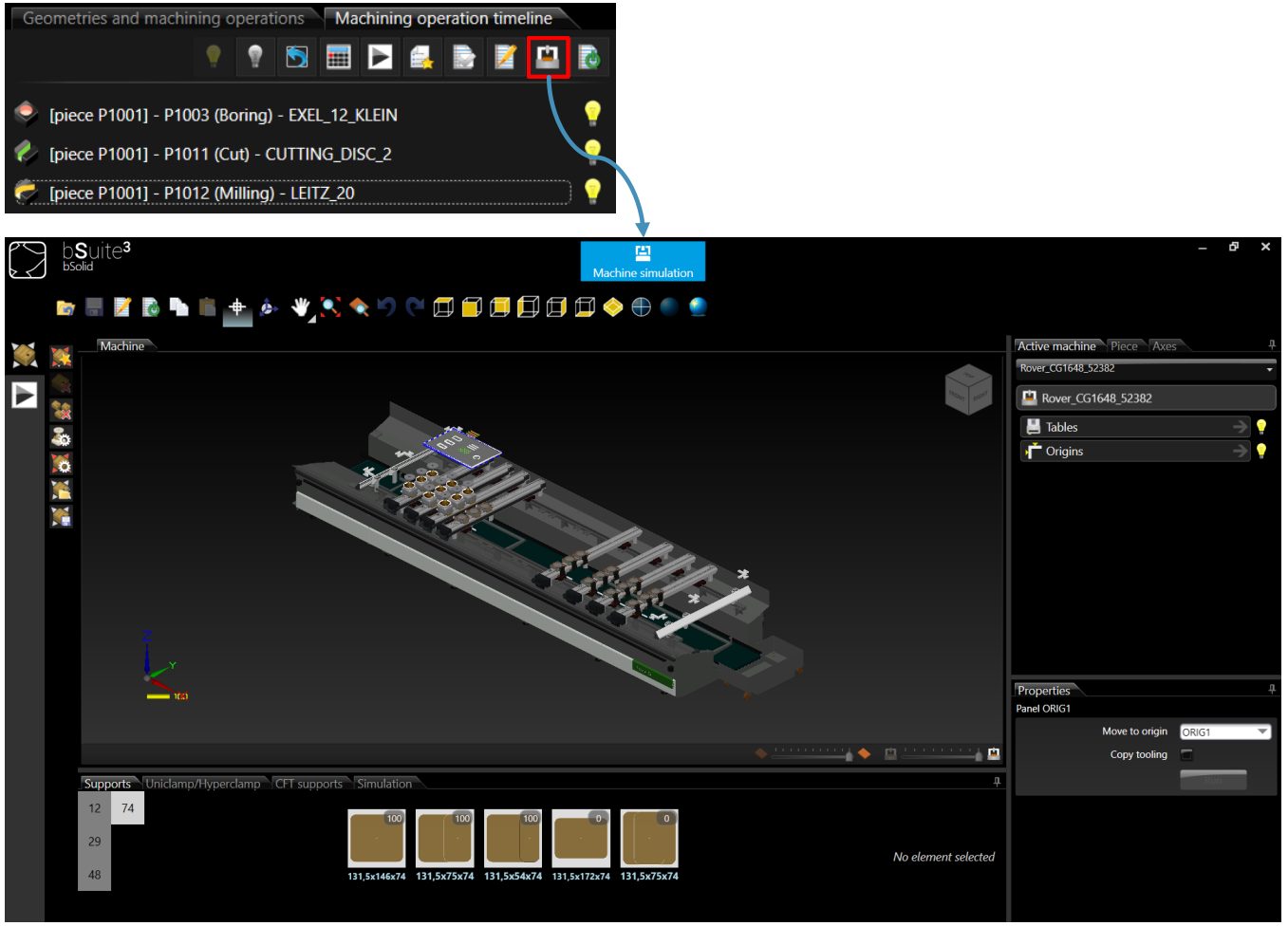
Settings:

- **Piece opacity**: it allow to select the piece opacity while simulating.

These buttons (red rectangle) are used to show/hide the tool during machining and highlight geometries or machining layers.

Machine Simulation

Machine simulation button allow to simulate machinings in a real time environment and highlight potential collisions.

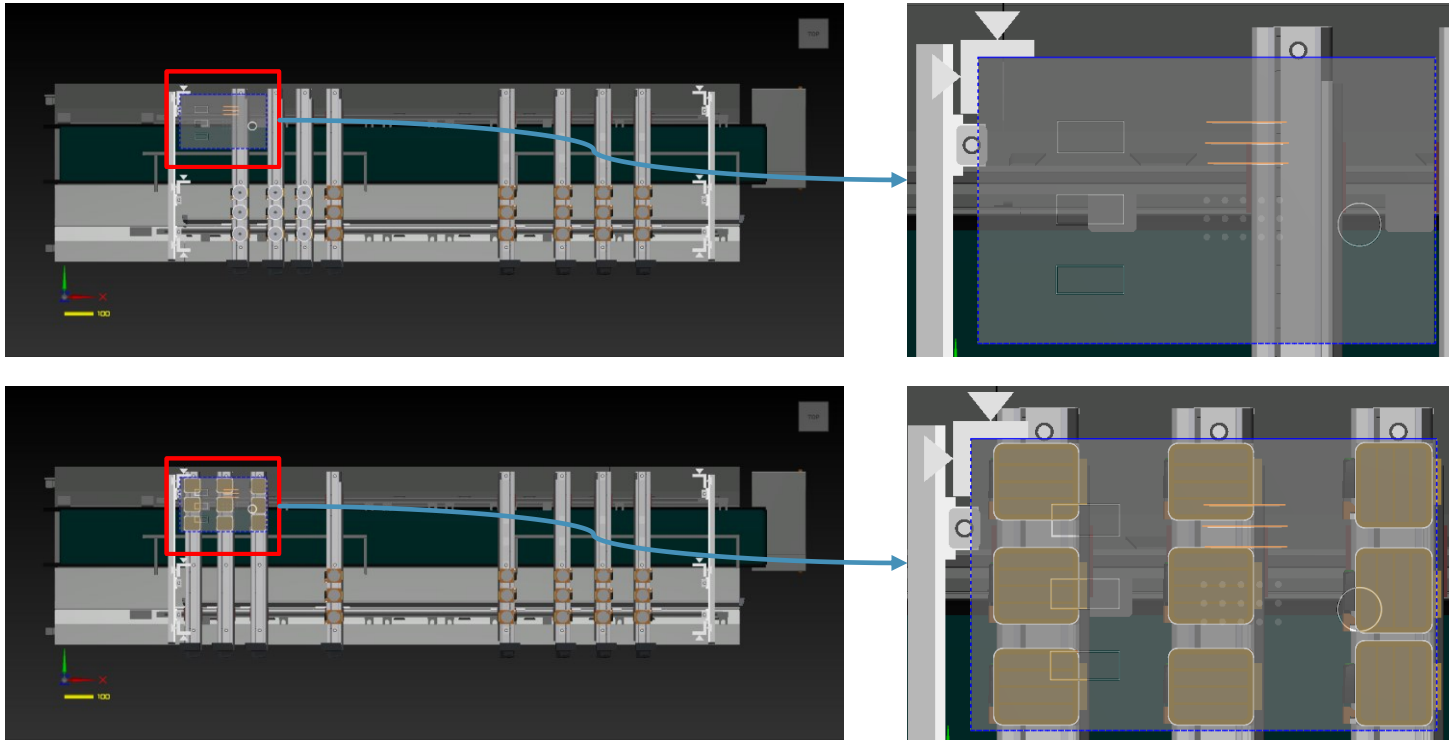


Machine Simulation

Table Display

Position the supports automatically allow the user to automatically position supports, without moving them manually *.

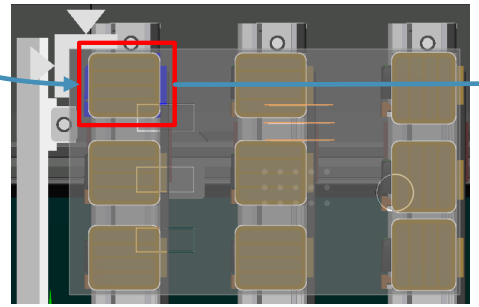
* The user can always adjust supports manually / this feature, in particular conditions, will not be able to position supports automatically and will be required to do so manually.

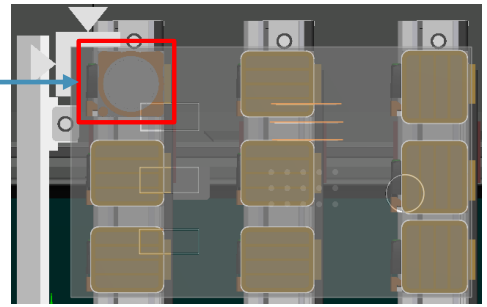


Machine Simulation

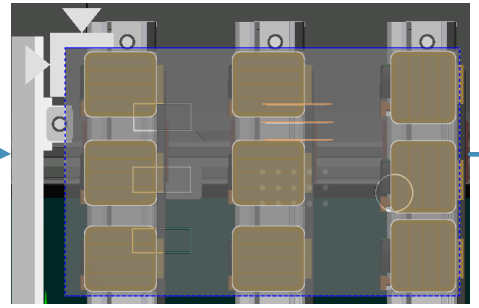
Table Display

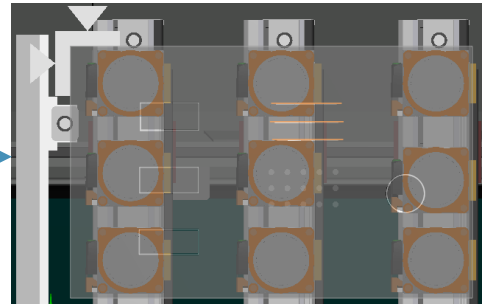
Remove selected supports (DELETE) allow the user to remove one or more selected supports (blue highlight).





Remove all supports (SHIFT+DELETE) allow the user to remove all supports.





Machine Simulation

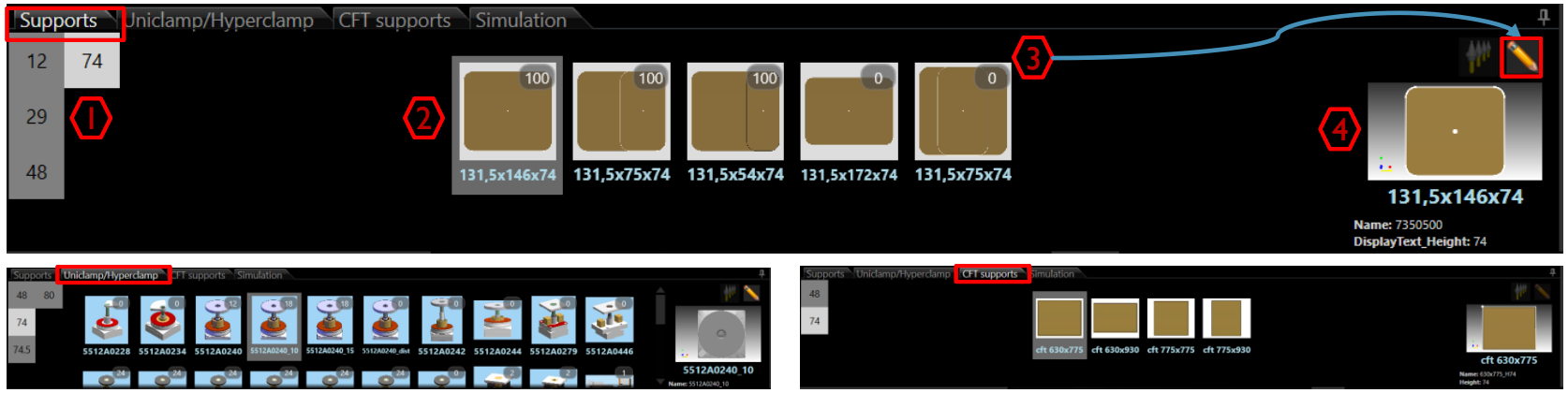
Table Display

This four commands allow the user to:

- Open the advanced configuration parameters for semi-automatic clamp positioning.
- Open the advanced configuration parameters for semi-automatic supports positioning.
- Open a previously saved tooling configuration.
- Export (save) the current tooling configuration in order to be reused.

Machine Simulation

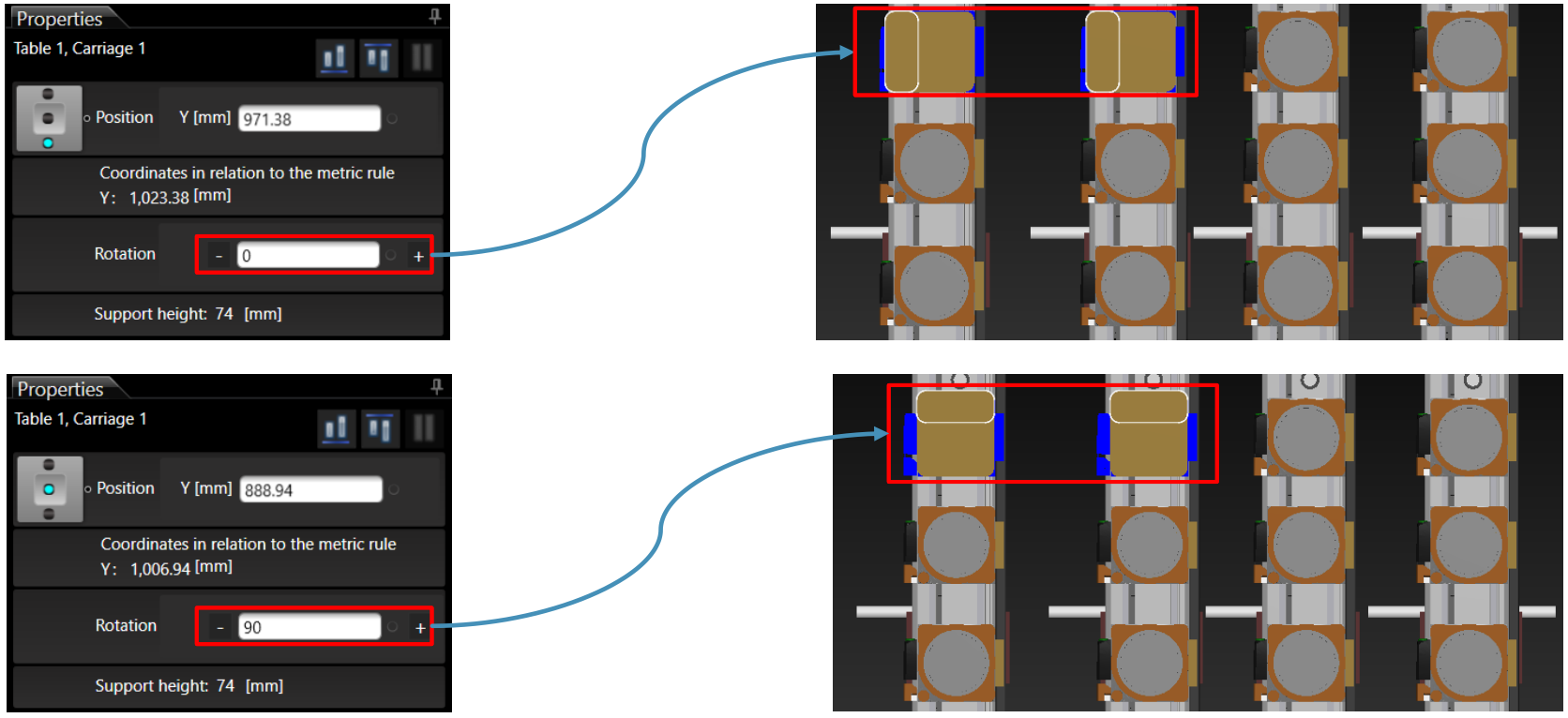
Table Display



1. **Thickness**: it allow the user to filter supports/clamps/CFT supports by thickness.
2. **Support**: it allow the user to select the support/clamp/CFT support to be tooled on the machine.
3. **Quantity**: it allow the user to select the quantity related to selected support/clamp/CFT support (pencil).
4. **Preview**: it allow the user to see an interactive preview of the selected support/clamp/CFT support.

Machine Simulation

Table Display



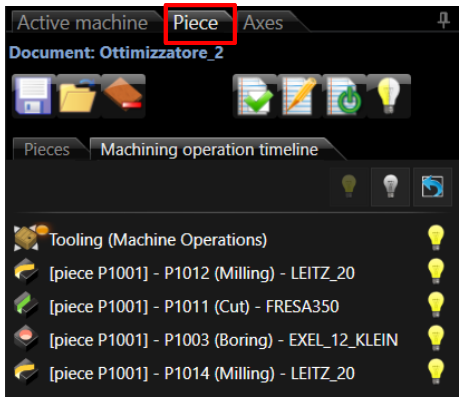
Properties tab allow to manually set the position of table and carriages; furthermore user can specify a rotation value related to installed supports.

 **Align with the highest position** and **Align with the lowest position** buttons allow the user to align couple of carriages.

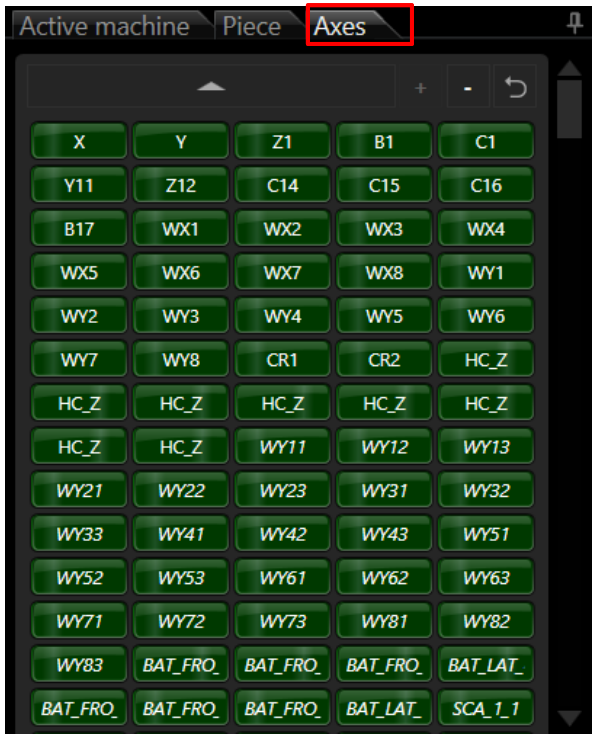
Machine Simulation

Active machine, Piece, Axes

Active machine tab contain all machine's elements (i.e. tables, origins, carriages, supports,…) which can be browsed in detail by the user.



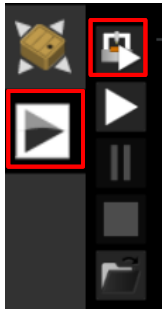
Piece tab allow to switch on/switch off piece machinings (light bulb), optimize the program, generate the program for machine execution (ISO) and, finally, send the program to the work list.



Axes tab allow to see axes movements during machine simulation.

Machine Simulation

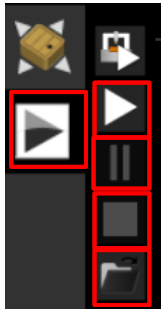
Simulation



Process simulation is used to process the machining program to generate the file with ISO extension, so that it can be executed on the machine.

Process simulation will also calculate the time needed to perform the machinings *.

* The calculated time is not just an estimation but it represent the real time needed to perform the machinings: this is due to the fact that the software communicate with an instance of the machine's numeric control !.



Reproduce is used to reproduce the simulation.

Pause is used to pause the simulation.

Stop is used to stop the simulation.

Load .iso/.biso from file is used to load a previously saved .iso/.biso/.CNI program and simulate it.

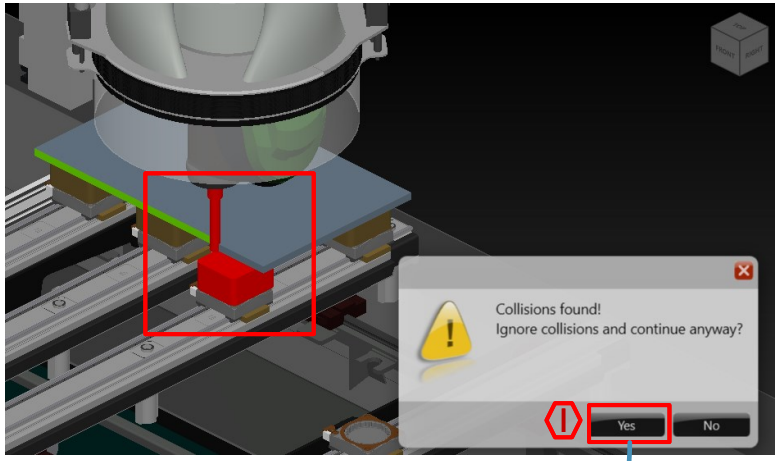
Machine Simulation

Simulation

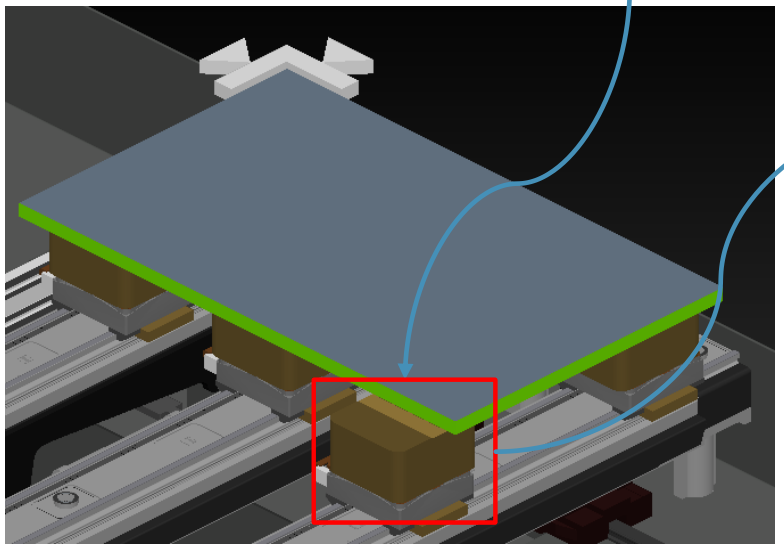
1. **Speed**: it allow the user to slow down or speed up the simulation (x1 means real time simulation).
2. **Collision control**: if checked it alert the user if a collision occurred.
3. **Waste removal**: it allow the user to select whether to have waste removal in real-time, during pauses or not having it at all; in order to perform it, material removal field must be checked.
4. **Repetitions**: it allow to repeat (loop) the machine simulation.
5. **Material removal**: if checked, it allow the waste removal.
6. **Quality**: it allow to select the simulation overall quality.
7. **Hide pieces**: it allow to run the simulation hiding the piece.

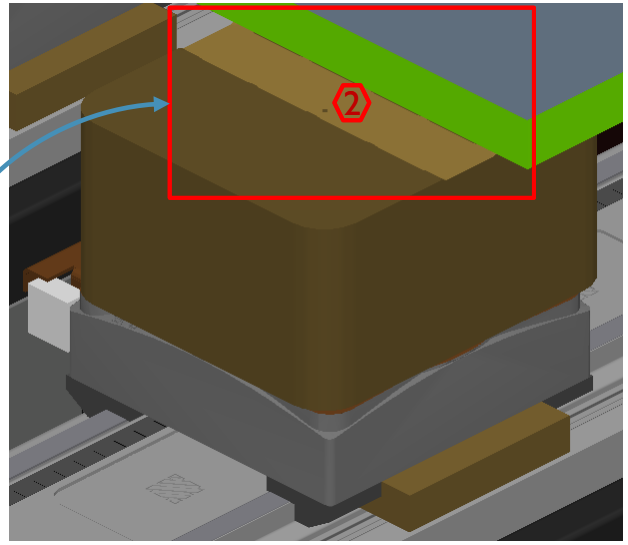
Machine Simulation

Collision control



If a collision has been found user has the possibility to decide whether to continue or stop the simulation; if continuing with the simulation (1), all the machinings will be executed until the program end and user will be able to see all the damages that have been done (2).

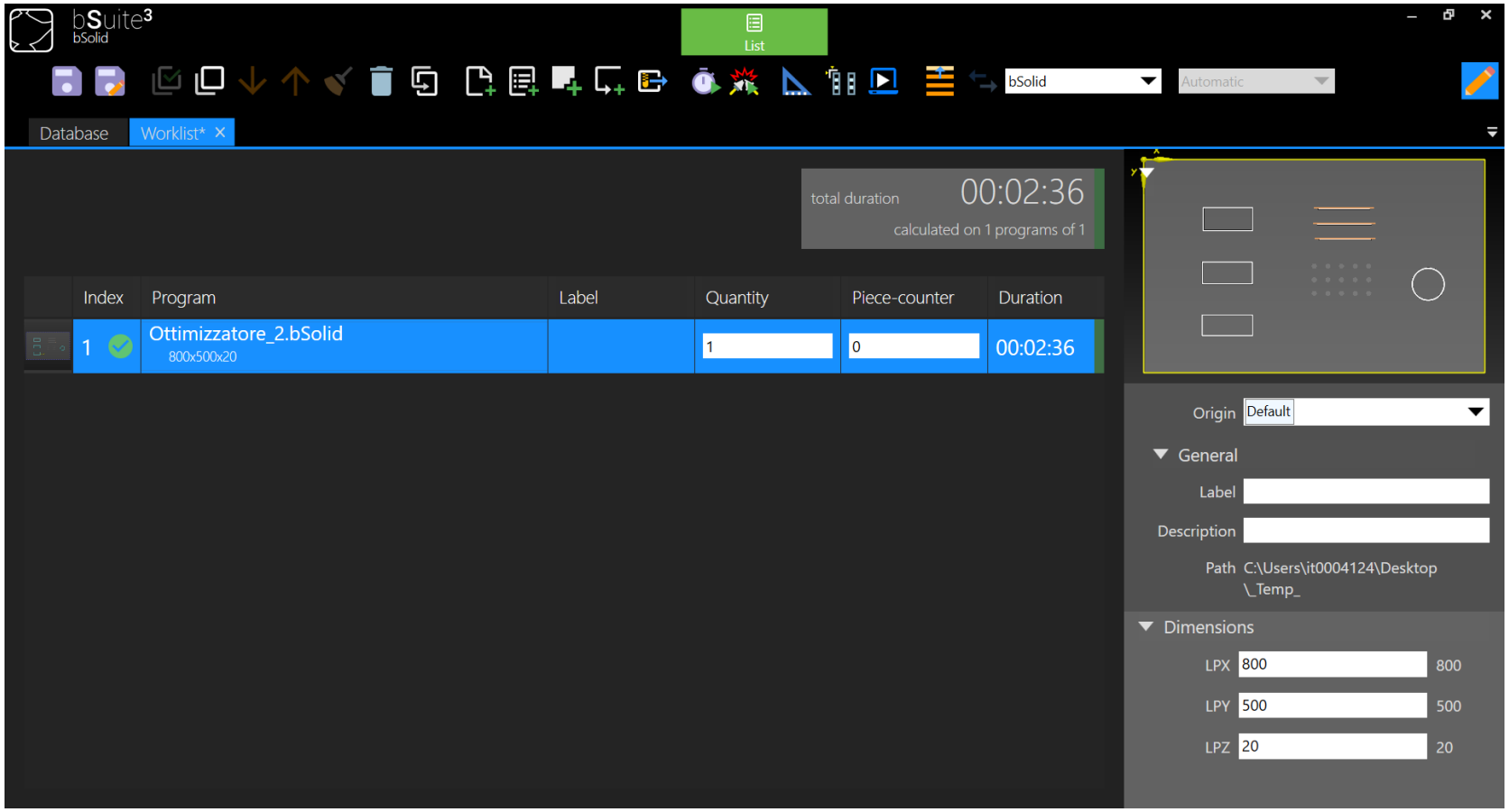




Worklist

Program in worklist

Program in worklist: With this butt[icon] user will now be able to send the program to the worklist.



Worklist

Toolbar

1. **Save the work list**: command used to save the work list when changes have been made.
2. **Save the work list as…**: command used to save the work list with a different name.
3. **Select all**: command used to select all the work list rows.
4. **Deselect all**: command used to deselect all the work list rows.
5. **Move down**: command used to move the selected row(s) down than the following one.
6. **Move up**: command used to move the selected row(s) up than the previous one.
7. **Reset piece counter**: command used to reset to 0 the piece counter for the selected row.
8. **Delete**: command used to delete selected row(s).
9. **Copy**: command used to copy the selected row(s) at the end of the work list.

Worklist

Toolbar

1. **Add program**: command used to add a program in the worklist (.bSolid, .bosi, .cix, .iso, .bpp, .dxf, .bcix)

2. **Add worklist**: command used to add a new worklist in the current worklist (.wlist, .bwkl, .dat, .ewlist).

3. **Add stop**: command used to add a stop command at the at the end of the worklist.

4. **Add skip**: command used to add a skip command choosing the program you want to skip.

5. **Export worklist and programs**: command used to zip and export programs and worklist (.ewlist)

6. **Calculate times**: command used to calculate execution time of selected program(s).

7. **Calculate collisions**: command used to check program collisions.

8. **Open in CAD area**: command used to open the program in the CAD area.

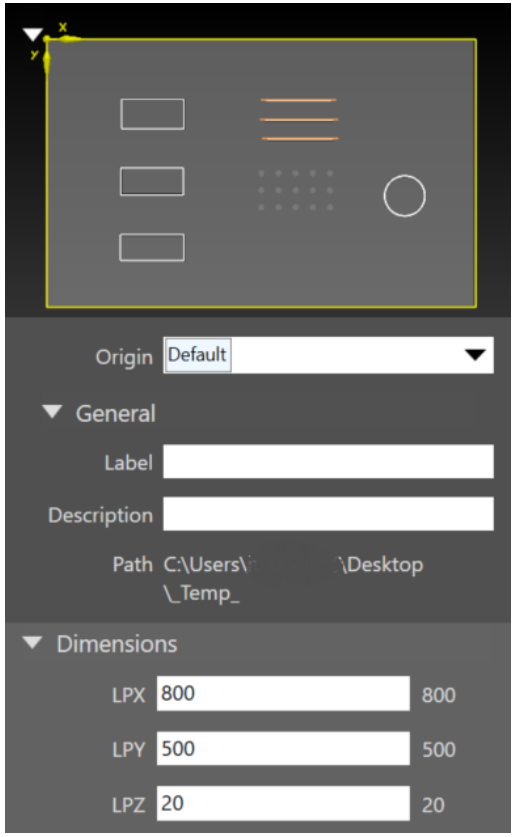
Worklist

Toolbar

1. **Open in Tooling**: command used to open the program in the tooling area.
2. **Open in simulation**: command used to open the program in the machine simulation area.
3. **Enable self-extinguishing mode**: command used to enable the work list in self-extinguishing mode (after completion the program is deleted from the worklist)
4. **Convert program**: command used to convert the selected program in the desired format (.bSolid, .iso, .cix, .bcix, .dxf, .stl, .wmf)
5. **Program extension**: command used to select the extension format for the converted program.
6. **Details**: command used to show/hide details about selected program.

Worklist

Details

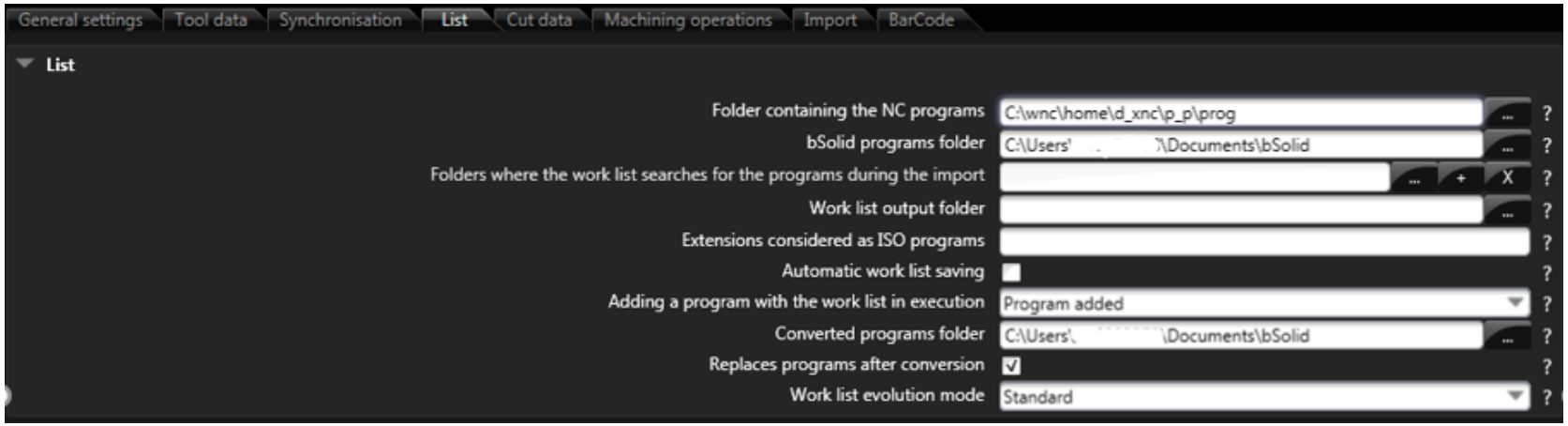


The preview area allow the user to interact with the piece before being sent to the machine.

- **Origin**: list of origin in which the piece can be positioned.
- **Label**: user can add optional label text to the program.
- **Description**: user can add optional description text to the program.
- **Path**: path in which the program is contained.
- **LPX**: user can dynamically change the X dimension of the piece.
- **LPY**: user can dynamically change the Y dimension of the piece.
- **LPZ**: user can dynamically change the Z dimension of the piece.

Worklist

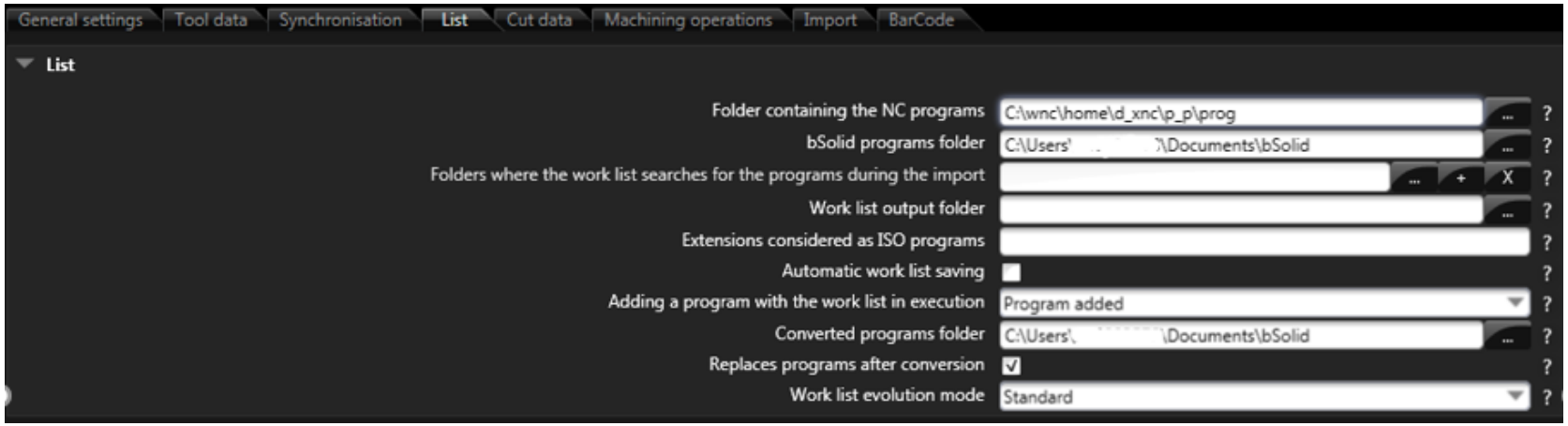
Settings



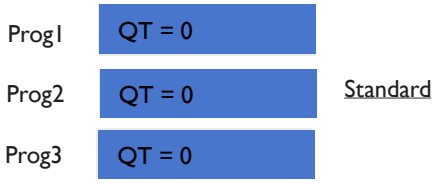
- **Folder containing the NC programs**: path in which the machine ISO code is saved.
- **bSolid programs folder**: path in which bSolid programs are saved.
- **Folder where the worklist searches for the programs during the import**: user can add one or more additional paths in which programs are searched during the import.
- **Work list output folder**: path in which the worklist are saved.
- **Extensions considered as ISO programs**: list of extensions to be considered as ISO programs.
- **Automatic work list saving**: if checked allow to automatically save the worklist when some modification are made.

Worklist

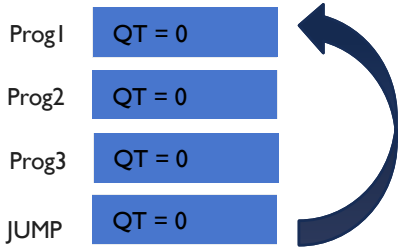
Settings



- **Adding a program with the work list in execution**: two different adding modes:
  - **Program added**: it add the program at the end of the worklist (it will not be executed unless it's expressly started by the user !).
  - **Add programs at start**: it add the program at the end of the worklist and it's automatically executed.
- **Converted programs folder**: path in which to save the programs that have been converted (Convert program button)
- **Replace programs after conversion**: if selected, it delete from the worklist the original program after the conversion
- **Work list evolution mode**: two different execution modes:



Standard



Consumption