

EUREKA

10.1

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EUREKA CHRONOS – USER MANUAL

Ultima revisione: 11.06.2021

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2. Project configuration
3. Optimize the feedrate
4. Analysis of the results
5. Data backup

1. INTERFACE

- 1.1. Chronos project
- 1.2. Window arrangement
- 1.3. General options

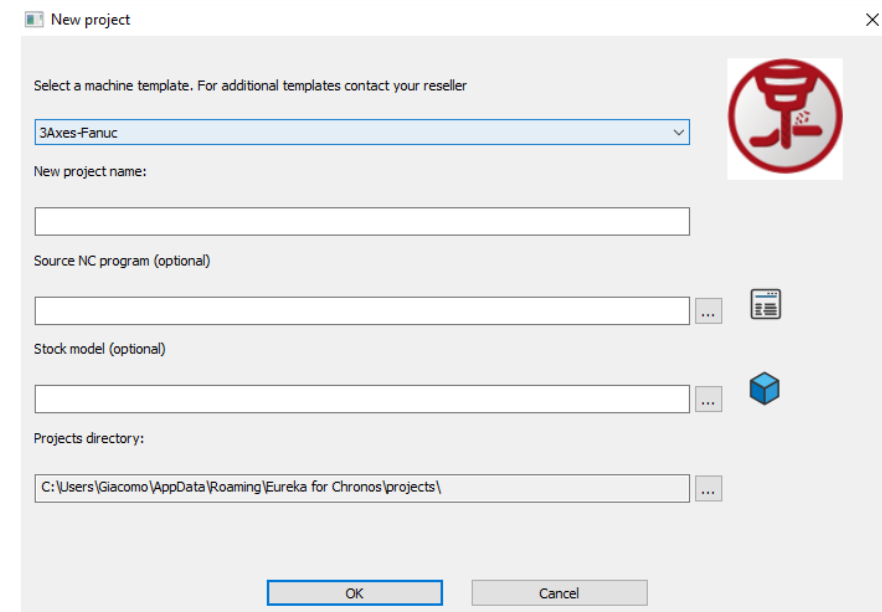
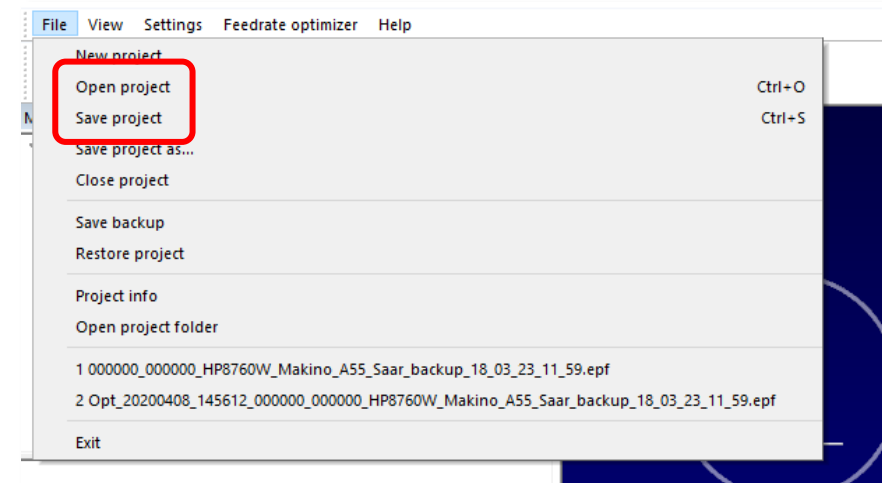
1.1. CHRONOS PROJECT

- "File"
 - "New project"
- OR
- "Open project" to load an existing project.

New project:

Using the interface:

1. Select a machine template from the list
(Example: "3 axis-Fanuc").
2. Specify a project name. *This name will be the name of the Chronos project.*
3. Load an NC Program.
4. Load a stock model.
5. Choose a project directory, *where Eureka will create the project structure for the Chronos project.*
6. "Ok"



1.1. CHRONOS PROJECT

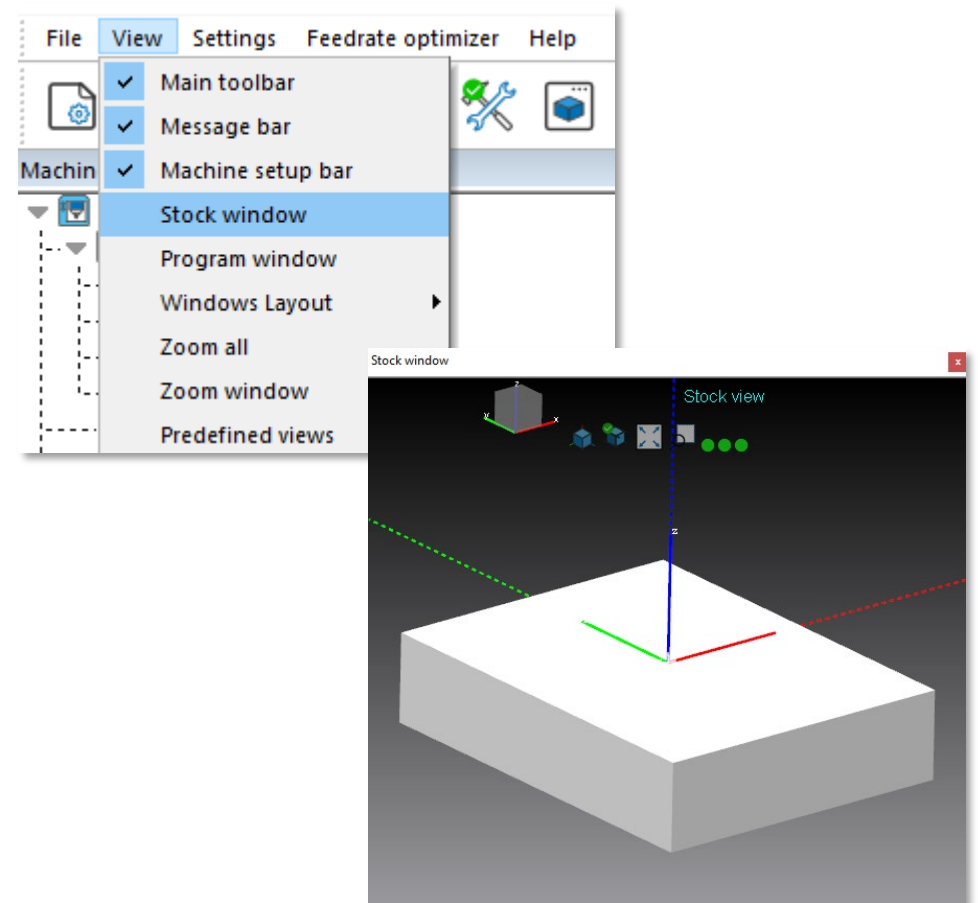
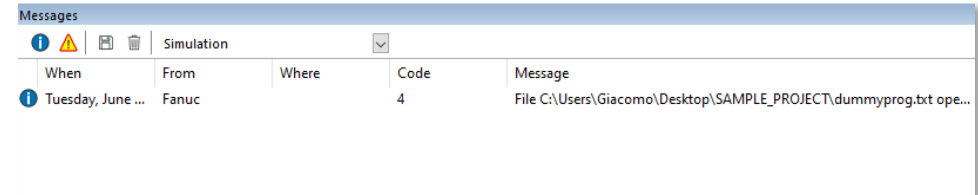
Few seconds and the Chronos project will appear automatically.

Remember to check the message window for errors or problems. If the messages are only blue (communications) everything is correct.

To check the “STOCK” geometry, remember to:

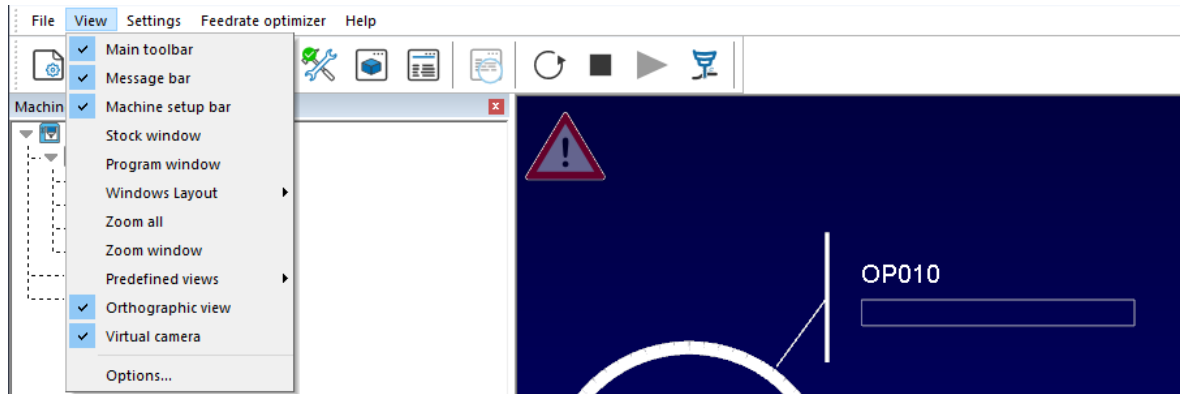
- “View”
- “Stock window”

NOTE: In Chronos, the finished parts and the fixtures are not considered/imported.



1.2. WINDOW ARRANGEMENT

- *«View» Click on the checkbox» to hide / show the necessary windows.*

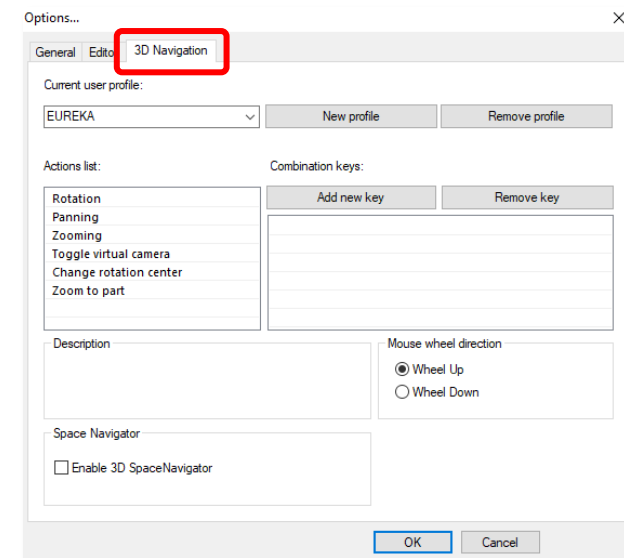
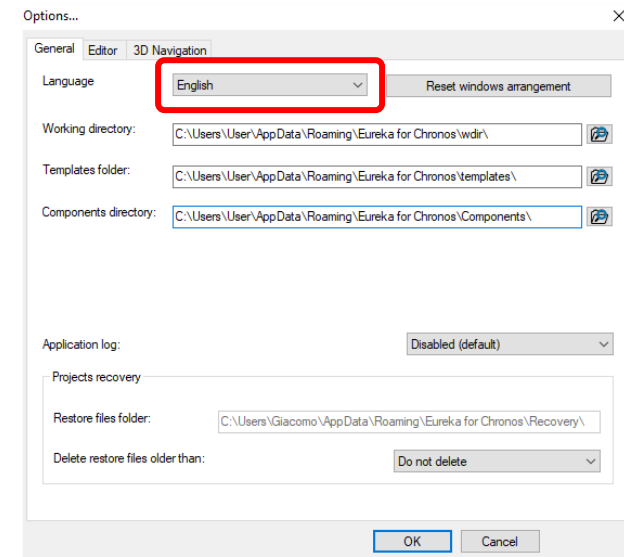


Check:

- *Toolbar*
- *Message bar*
- *Machine preparation bar*
- *Drag the title bar of the listed windows to view the **anchor points**.*
- *Move the mouse over the anchor point to constrain the window and thus compose your work environment.*
- *At any time, it will be possible to undock the windows and change their arrangement.*

1.3. GENERAL OPTIONS

- «View» Options»
- "General"
 - Select "Language"
 - Choose the language.
 - Restart the application to apply the changes.
- "3D navigation"
 - Create a new profile and modify the keys to customize the navigation mode.

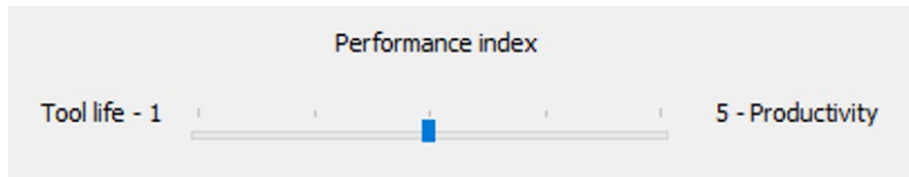


2. PROJECT CONFIGURATION

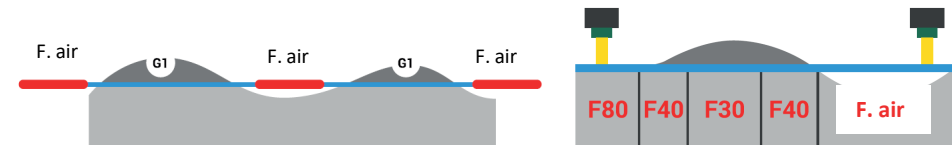
- 2.1. Configure optimizer
- 2.2. Program
- 2.3. Playlist configuration
- 2.4. Subprograms
- 2.5. Workorigins
- 2.6. Absolute origin – G53
- 2.7. Tools
- 2.8. Workpiece
- 2.9. 3D model import reference

2.1. CONFIGURE OPTIMIZER

- "Setting"
- "Configure optimizer"
- "Performance index": drag the "Tool life / Productivity" bar to change the performance of the optimizer.



- 1 – Tool life
- 2 –
- 3 – Balanced
- 4 –
- 5 – Productivity



Configure optimizer

Default parameters

A.I.

Performance index

Tool life - 1 | 5 - Productivity

Max override in air (%) 200 ☐ Max feed in air (MMPM): 40000

Max override in material (%) 120 ☐ Max feed in cut (MMPM): 20000

Min override in material (%) 80 ☐ Do not add intermediate movements

In case of material removal negligible or material removal variations too small

Max override in material (%) 110

Min override in material (%) 90

Results

☐ Save optimization report in Excel format

Options

☐ Optimize continuous 5-axis machining

☐ Optimize lines executed more times using the analysis of the first execution

OK Cancel

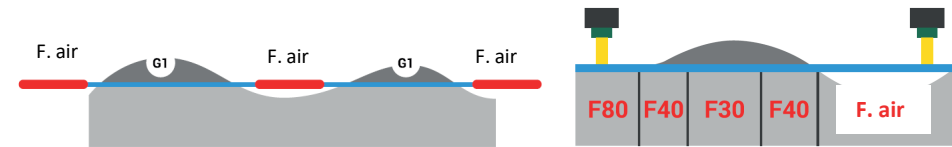
2.1. CONFIGURE OPTIMIZER

- "Setting"
- "Configure optimizer"
- "Performance index": drag the "Tool life / Productivity" bar to change the performance of the optimizer.

Max override in air (%): *maximum percentage of increment for the movements in air (Ex: 200% of the programmed federate).*

Max override in the material (%): *maximum percentage of increment for the movements in the material (Ex: 120% of the programmed feedrate).*

Min override in the material (%): *minimum percentage of increment for the movements in the material (Ex: 80% of the programmed feedrate).*



Configure optimizer

Default parameters

A.I. Performance index

Tool life - 1 | 5 - Productivity

Max override in air (%) 200

Max override in material (%) 120

Min override in material (%) 80

Max feed in air (MMPM): 40000

Max feed in cut (MMPM): 20000

Do not add intermediate movements

In case of material removal negligible or material removal variations too small

Max override in material (%) 110

Min override in material (%) 90

Results

Save optimization report in Excel format

Options

Optimize continuous 5-axis machining

Optimize lines executed more times using the analysis of the first execution

OK Cancel

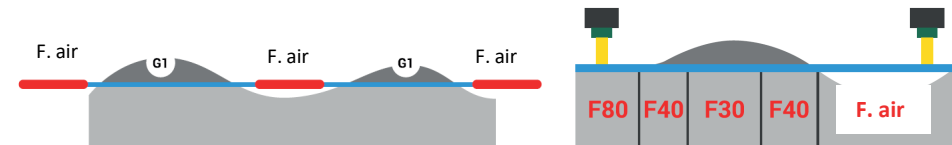
2.1. CONFIGURE OPTIMIZER

- "Setting"
- "Configure optimizer"
- "Performance index": drag the "Tool life / Productivity" bar to change the performance of the optimizer.

Maximum Airspeed (MMPM): *maximum speed for movements in air (Ex: 40000 mm/min). Remember to check the box to turn on the option.*

Maximum Cutting Speed (MMPM): *maximum limit for the working movements (Ex: 2000 mm/min).*

Do not add intermediate movements: *Chronos will not create intermediate movements between two lines of the NC code.*



Configure optimizer

Default parameters

A.I.

Performance index

Tool life - 1 | 5 - Productivity

Max override in air (%) 200

Max override in material (%) 120

Min override in material (%) 80

☐ Max feed in air (MMPM): 40000

☐ Max feed in cut (MMPM): 20000

☐ Do not add intermediate movements

In case of material removal negligible or material removal variations too small

Max override in material (%) 110

Min override in material (%) 90

Results

☐ Save optimization report in Excel format

Options

☐ Optimize continuous 5-axis machining

☐ Optimize lines executed more times using the analysis of the first execution

OK Cancel

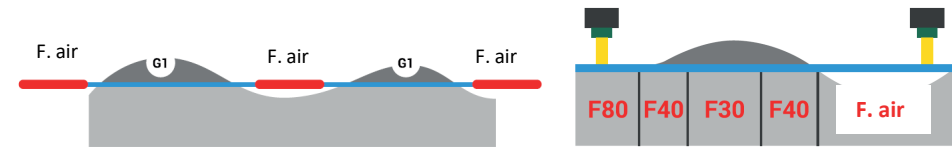
2.1. CONFIGURE OPTIMIZER

- "Setting"
- "Configure optimizer"
- "Performance index": drag the "Tool life / Productivity" bar to change the performance of the optimizer.

In case of material removal negligible or material removal variation too small.

Max override in the material (%): *maximum percentage of increment for the movements in the material (Ex: 110% of the programmed feedrate).*

Min override in the material (%): *minimum percentage of increment for the movements in the material (Ex: 90% of the programmed feedrate).*



Configure optimizer

Default parameters

A.I.

Performance index

Tool life - 1 | 5 - Productivity

Max override in air (%) 200

Max override in material (%) 120

Min override in material (%) 80

☐ Max feed in air (MMPM): 40000

☐ Max feed in cut (MMPM): 20000

☐ Do not add intermediate movements

In case of material removal negligible or material removal variations too small

Max override in material (%) 110

Min override in material (%) 90

Results

☐ Save optimization report in Excel format

Options

☐ Optimize continuous 5-axis machining

☐ Optimize lines executed more times using the analysis of the first execution

OK Cancel

2.1. CONFIGURE OPTIMIZER

In case of material removal negligible or material removal variation too small, a small icon (bell) with a red dot, will appear close to “Mode”, inside the “Feedrate optimizer” window.

Moving the mouse on the icon, Chronos will show the message.

In this case, Chronos will use the previous options to optimize the code.

Use:

- “Max override in the material” = 100
- “Min override in the material” = 100

To **NOT** optimize these movements.

Feedrate optimizer

Optimizable operations	Before/after	Mode	Settings for
# 1 Tool code 81	0:0:32.67 / 0:0:16.43 	Save 49.7% Mode Volume rate User	Mode
# 2 Tool code 21	0:02:10 / 0:01:11 	Save 45.5% Mode Volume rate User	Mode
# 3 Tool code 37	0:18:10 / 0:13:23 	Save 26.3% Mode Volume rate User	Max override Max override Min override

Settings for
Mode
Max override
Max override
Min override
Feed
20000

User
ie rate
User
ie rate

Mode
A.I.

Max override in air (%) 200

Max override in material (%) 120

Operation #3 Tool code 37
Material removal negligible or material removal variations too small.
Consider to optimize only in air.

20000
16000

In case of material removal negligible or material removal variations too small

Max override in material (%) 100

Min override in material (%) 100

2.1. CONFIGURE OPTIMIZER

- "Setting"
- "Configure optimizer"
- "Performance index": drag the "Tool life / Productivity" bar to change the performance of the optimizer.

Results.


- Check «**Save optimization report in excell format**»: generate an «.xlsx» (Excel) file when the new ISO program is generated.
- Check "**Optimize lines performed several times using the first run analysis**": apply the optimization algorithms only on the first line of a series of equal movements.

Configure optimizer

Default parameters

A.I.

Performance index

Tool life - 1  5 - Productivity

Max override in air (%) ☐ Max feed in air (MMPM):

Max override in material (%) ☐ Max feed in cut (MMPM):

Min override in material (%) ☐ Do not add intermediate movements

In case of material removal negligible or material removal variations too small

Max override in material (%)

Min override in material (%)

Results

☐ Save optimization report in Excel format

Options

☐ Optimize continuous 5-axis machining

☐ Optimize lines executed more times using the analysis of the first execution

OK Cancel

2.2. PROGRAM

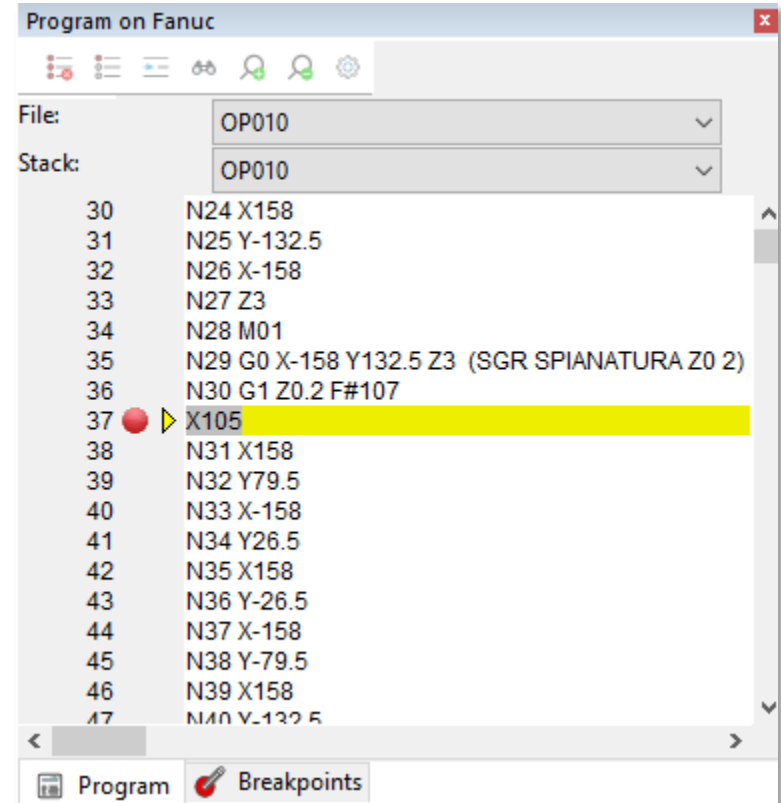
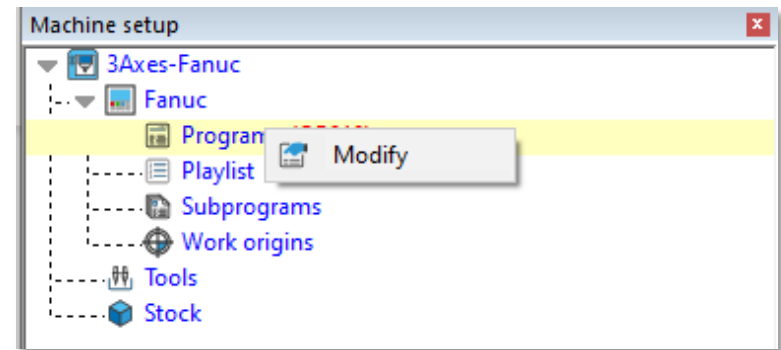
Using the command "New project", Chronos will add automatically the Program file. Is possible to change it, following this procedure:

Make sure you have clicked on the «Stop simulation» button.

- DX click on «**Program**».
- «Edit».
- Select the ISO file you want to use as the main program.
- When the upload is complete, the program window will be shown.

Is **NOT** possible to modify the loaded program.

It will be possible to position the Program window by dragging it from the title bar and using the anchor points that will be shown in the 3D view.



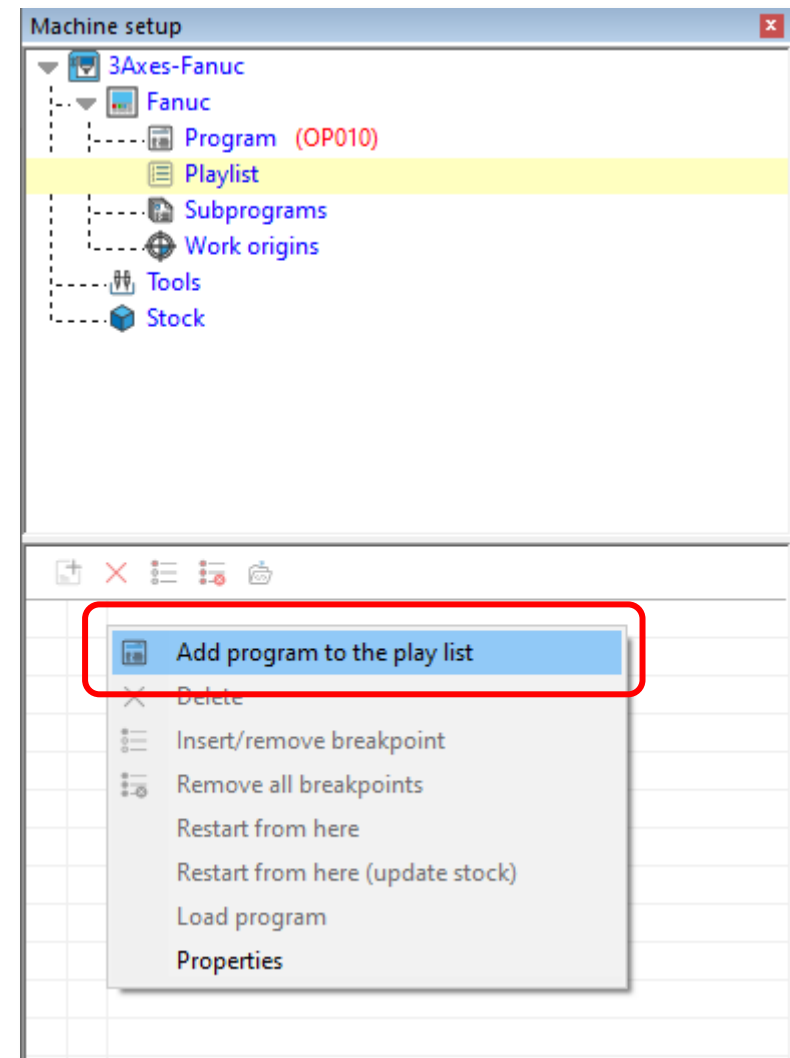
2.3. PLAYLIST

Make sure you have clicked on the «Stop simulation» button.

- Left click on «**Playlist**».
- Right click on the page below the machine preparation (yellow window)
- «**Add program to simulate**».

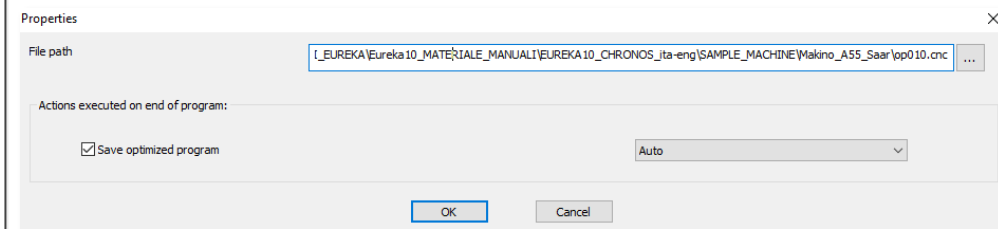
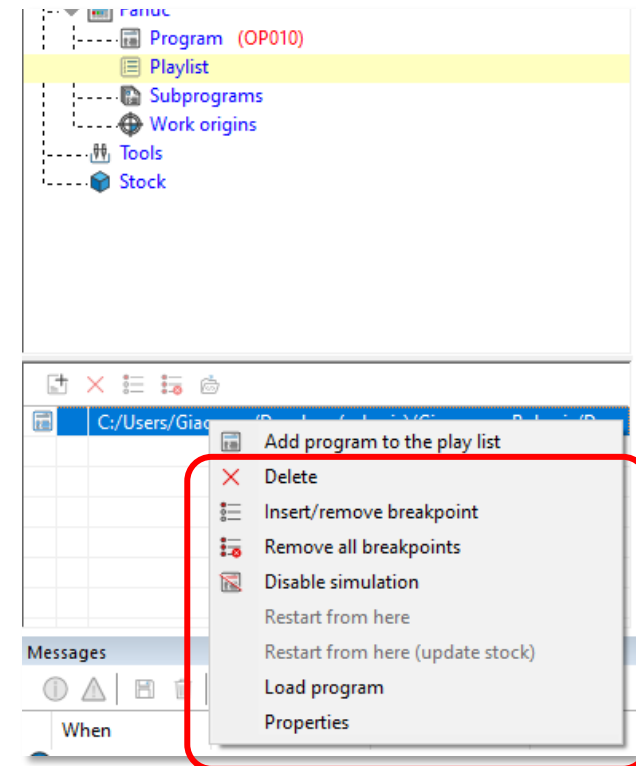
It will be possible to load more than one program at the same time.

At the end of the simulation of the first program, Chronos will perform automatic operations. After that, it will run the next program in the list.



2.3. PLAYLIST

- Right click on the loaded programs:
 - «Delete»:
 - «Insert/remove breakpoint»
 - «Remove all breakpoints»:
 - «Disable simulation»
- «Properties»
 - **“Auto”:** Chronos will simulate all the loaded programs until the end. At any time, the User can stop the simulation clicking on the “Pause” icon and run the optimizer (add a breakpoint at the end of a program to stop the simulation and analyze the results).
 - **“Open Chronos window”:** at the end of each loaded program, Chronos will open the optimizer and will show the results (good for the initial test).



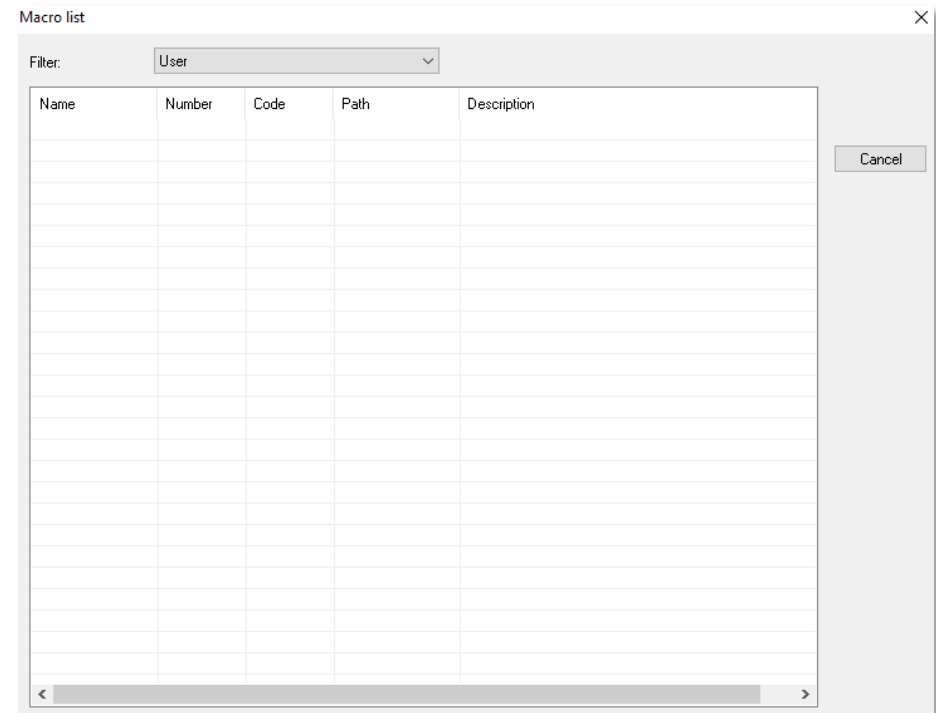
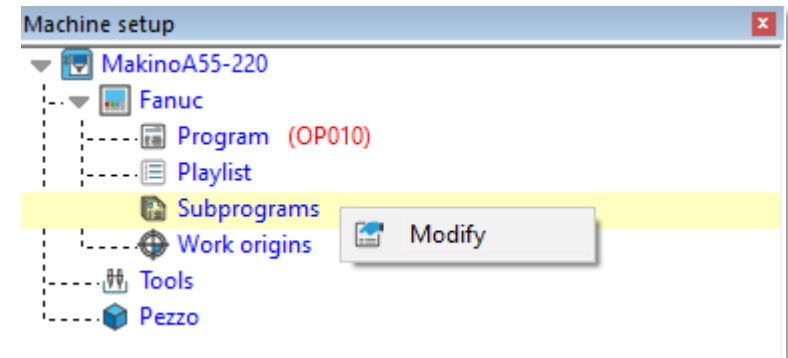
2.4. SUBPROGRAMS

Make sure you have clicked on the «Stop simulation» button.

- *DX click on "Subprograms"*
- *«Edit».*
- *"Add" command to load a specific macro or subroutine.*
- *The latter will be shown in the list of available macros / subroutines.*

In the program window, click on the «File» list to view the contents of the available macros.

*In the case of new macros, used for **any future project**, it will be necessary to contact your technical reference to modify the template file of the machine used.*



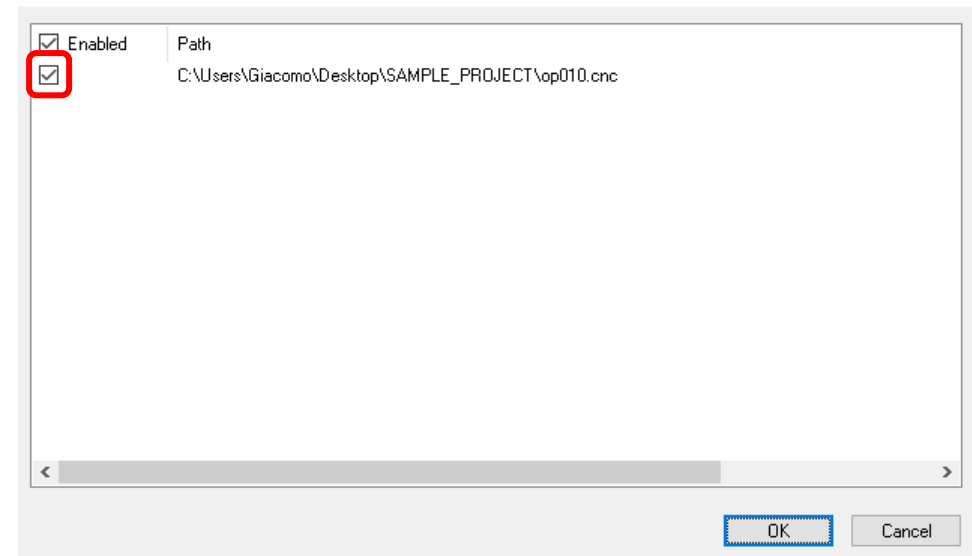
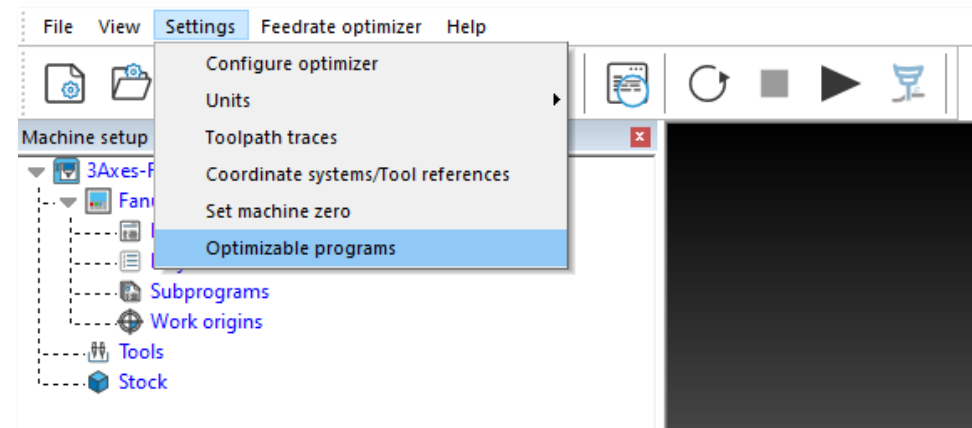
2.4. SUBPROGRAMS

- “Settings”
- “Optimizable programs”

Check the “Optimizable programs” window to turn on/off the programs and subprograms that the user want to optimize.

- Click on the checkbox to turn on/off the optimization.

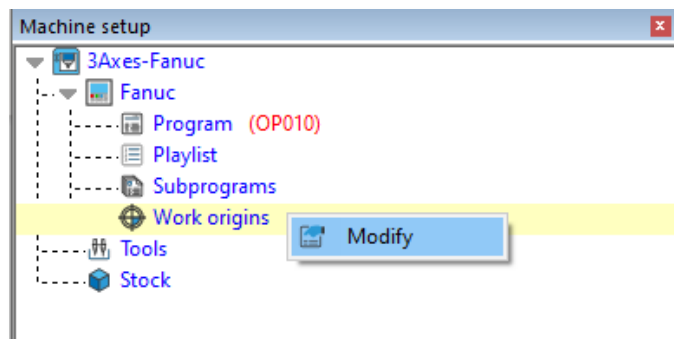
At the end of the optimization, inside the «opt_...» folder, Chronos will save the selected optimized subprograms.



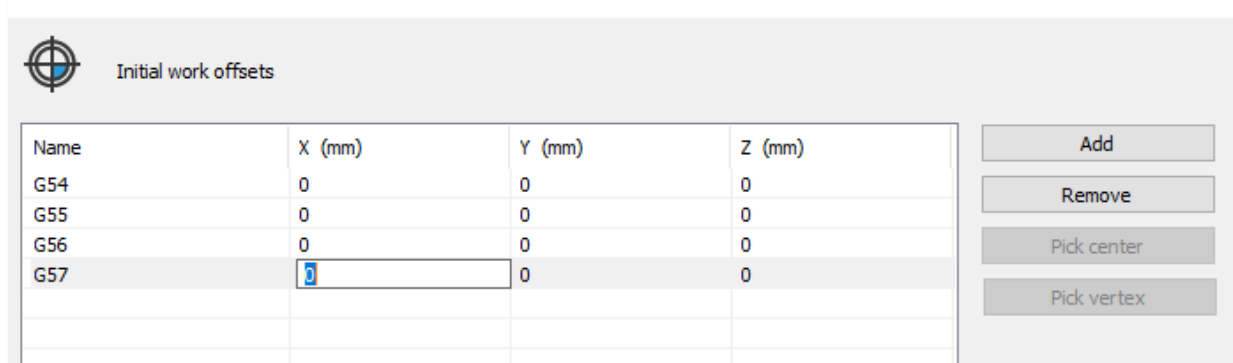
2.5. WORK ORIGINS

Make sure you have clicked on the «Restart» button.

- Right click on «**Work origins**»
- «Edit».
- Click on «Add», to create a new origin.
- Double click on the "Name" field to change the origin code (G54, O1, etc ...).
- Double click on the "X, Y or Z" field, to modify the values.
- Click on «Restart» to see the updated position of the origin.



Initial work offsets Fanuc



The dialog box 'Initial work offsets Fanuc' contains a table for defining work offsets. The table has columns for Name, X (mm), Y (mm), and Z (mm). The rows are G54, G55, G56, and G57. The G57 row is currently selected, and the X (mm) field is active with the value 0. To the right of the table are four buttons: Add, Remove, Pick center, and Pick vertex.

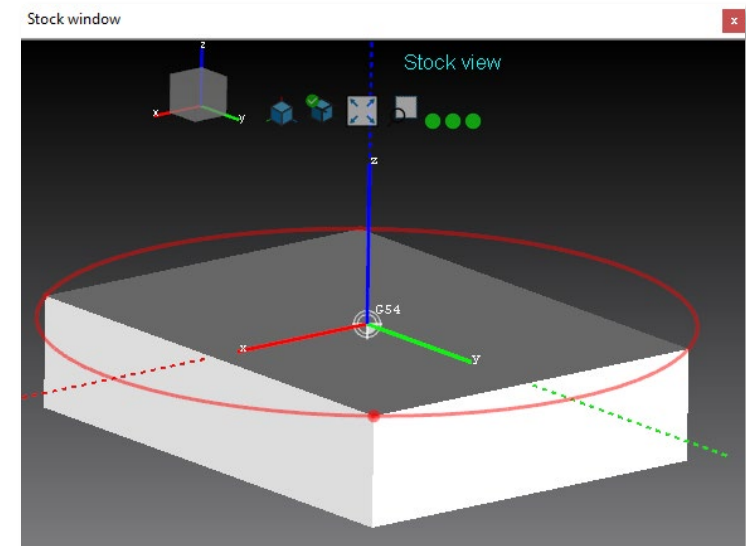
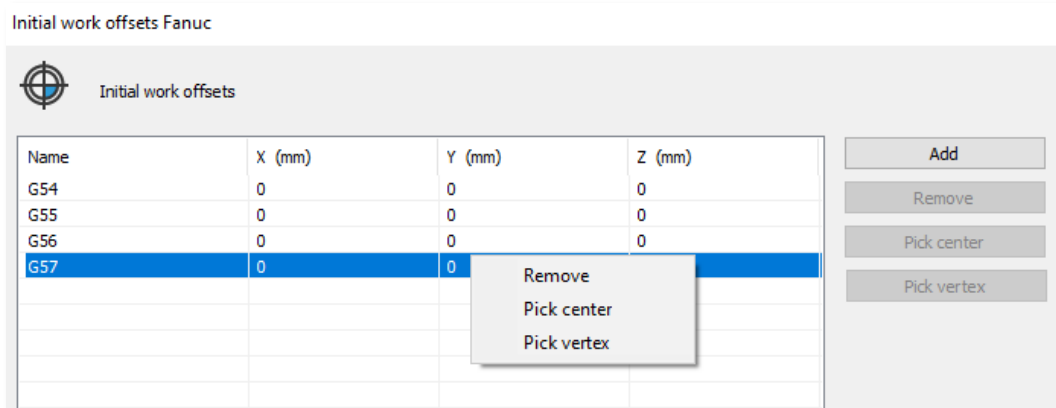
Name	X (mm)	Y (mm)	Z (mm)
G54	0	0	0
G55	0	0	0
G56	0	0	0
G57	0	0	0

2.5. WORK ORIGINS

- Right click on the “X, Y or Z” field to directly capture the origins on the STL geometries of the machine or part / equipment.
- «Center by 3 points»: select 3 vertices to acquire the center of a circle by 3 points.

or

- “Select vertex”: select 1 vertex. The coordinates of the origin will be equivalent to the coordinates of the selected vertex.



2.6. ABSOLUTE ORIGIN – G53

- «View > Stock window»

Keep this window opened to check the references.

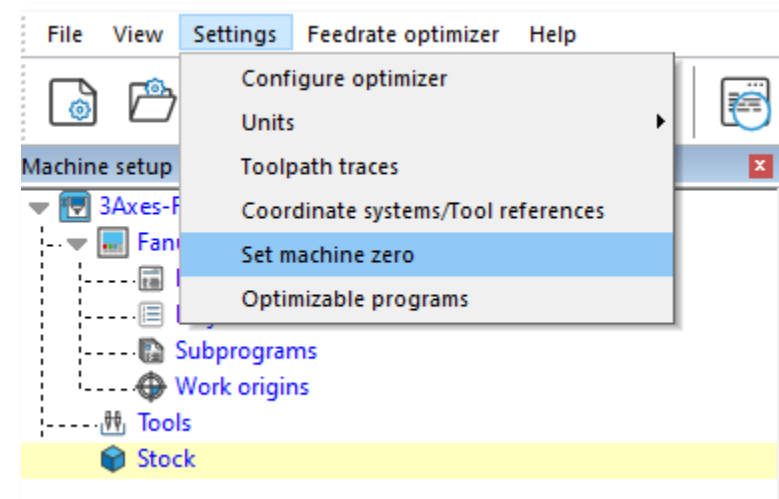
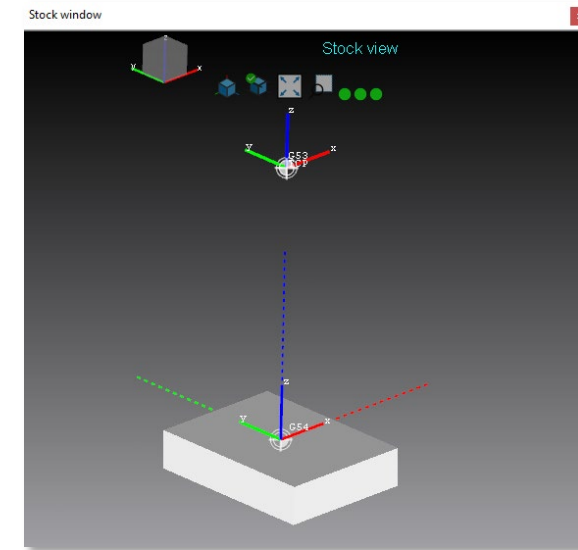
How to change the **G53**:

- «Settings»
- «Set the machine zero»

This term represents the reference for absolute movements (Ex. G53 G0 X100).

G54 : this reference is already changed using «Machine setup > Work origins»

This term represents the reference for movements in work (Ex: G54 G0 X100).

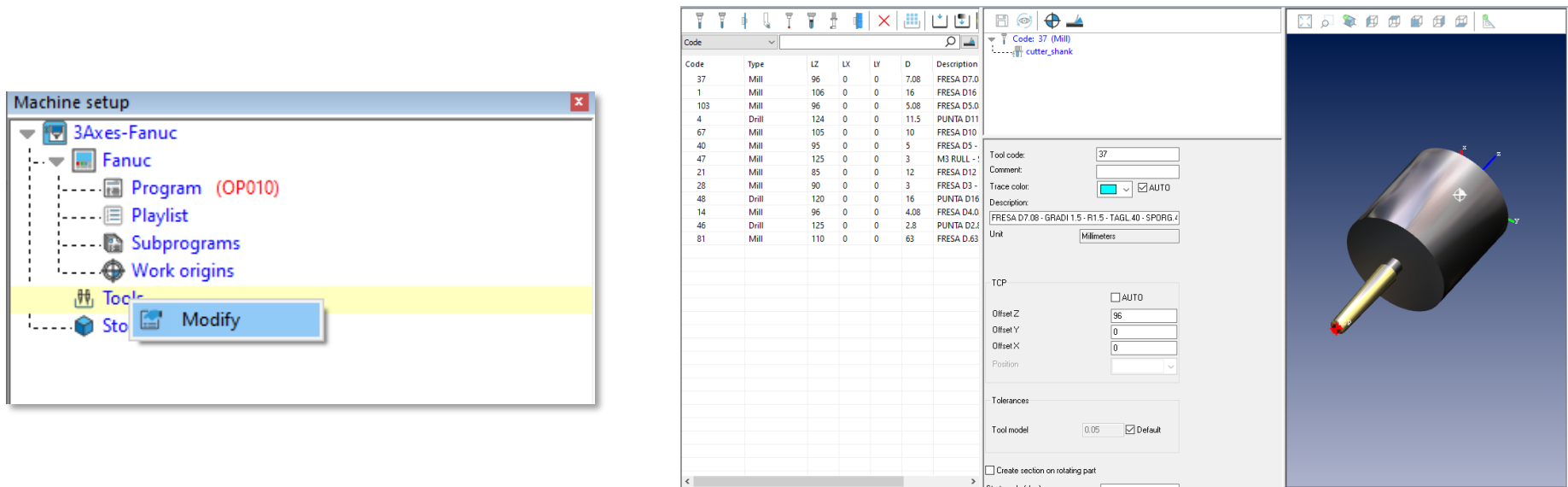


2.7. TOOL DATABASE

- Right click on "Tools"
- «Edit»

The geometry of the cutting and non-cutting parts can be recreated in Chronos, thanks to parametric shapes and / or 3D «.stl» models.

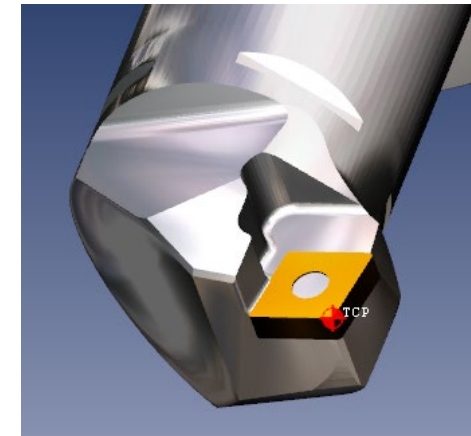
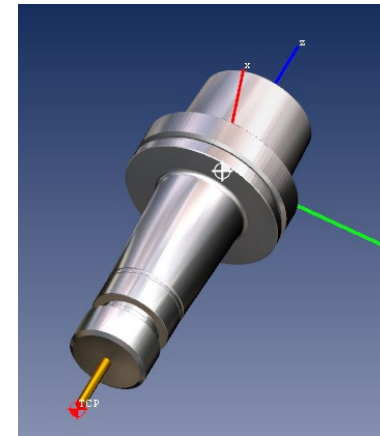
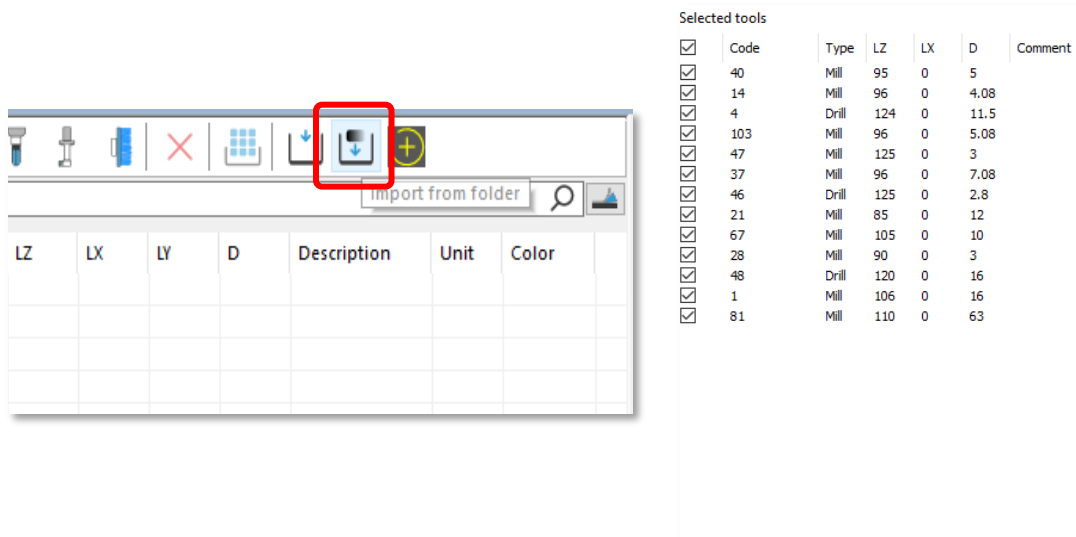
(In terms of performance, parametric shapes return the best results).



2.7. TOOL DATABASE

- Use the “Import from folder” icon to use and import an existing tool database from a folder.

Consult the document «Eureka10_DATABASE_TOOLS_eng» for more information about the creation of parametric tools, shaped from 2D profiles, 3D models, or revolution and extrusion.



2.8. STOCK (WORKPIECE)

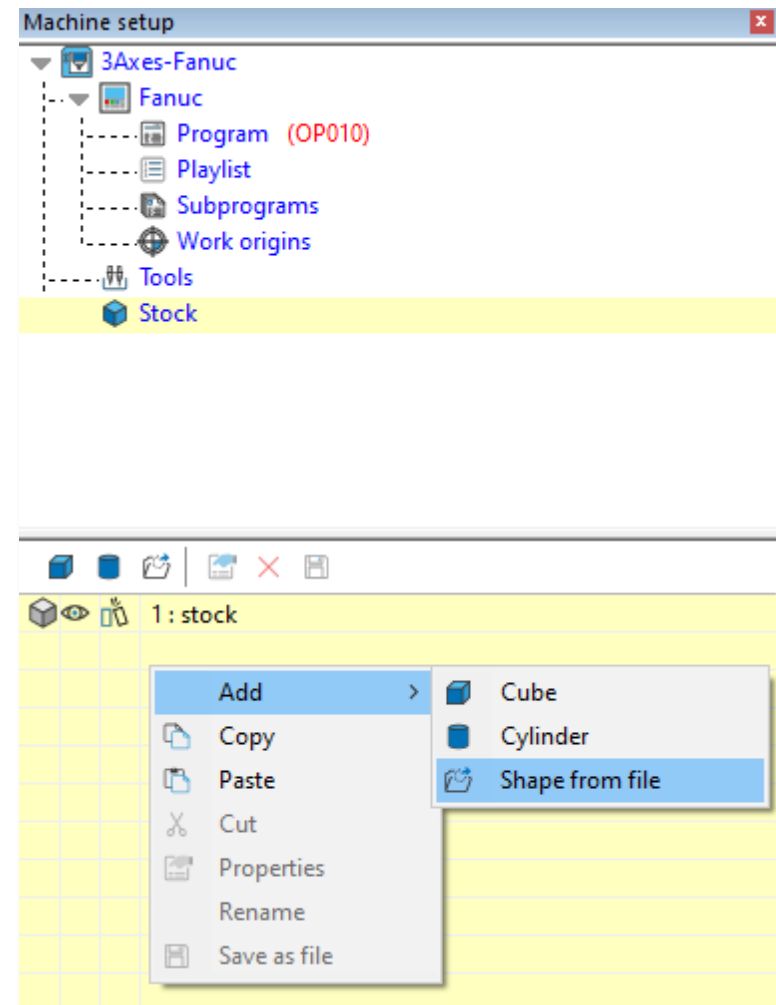
Using the command "New project", Chronos will add automatically the Stock model. Is possible to change it, following this procedure:

Make sure you have clicked on the «Stop simulation» button.

- Left click on «**Stock**».
- Right click in the window below the "Machine setup" (yellow window)
- «Add > Shape from file» to load a 3D model (preferably in «.stl» format) previously exported from CAD or CAM.

OR

- «Add» and select one of the available parametric shapes.
 - «**Properties**»: the properties window will be displayed, in order to change the position, scale, color and transparency of the 3D model.
 - «**Save**»: is possible to save a machined stock file. The format can be ".stl" / ".estk5" / ".wrl"



2.9. 3D MODEL IMPORT REFERENCE

- «View > Stock window»

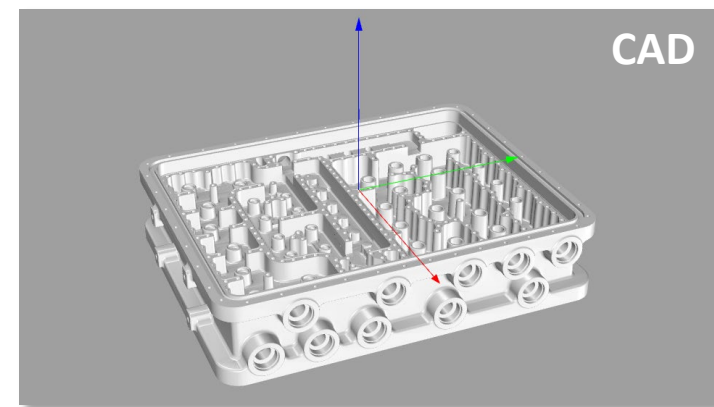
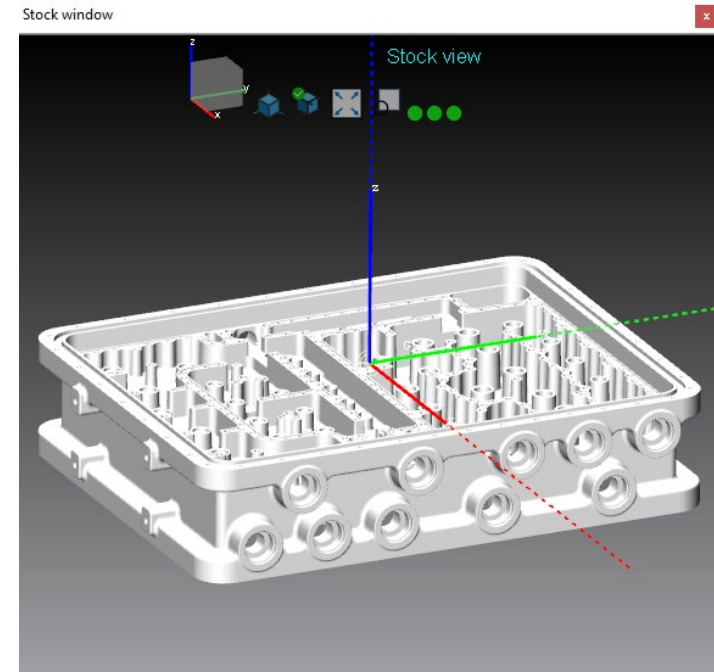
Keep this window opened to check the references.

The 3D model of the stock is imported using as global origin, the dashed tern.

For the «**Shape from file**», the 3D model will be imported with the same reference used in the CAD software.

For the «**Parametric shape**», is important to choose the global reference, inside the «Properties».

To reduce the number of steps to fix the workpiece position, is suggested to export the 3D models from CAD already in a good position.



3. OPTIMIZE THE FEEDRATE

3.1. Pre-analysis

3.2. ISO program analysis

3.3. Open the feedrate optimizer

3.4. Change the parameters of the optimizer

3.5. "A.I."

3.6. "User"

3.1. PRE-ANALYSIS

Make sure you have clicked on the «Stop simulation» button.

- Click on the "Pre-analysis" icon
- "Restart"

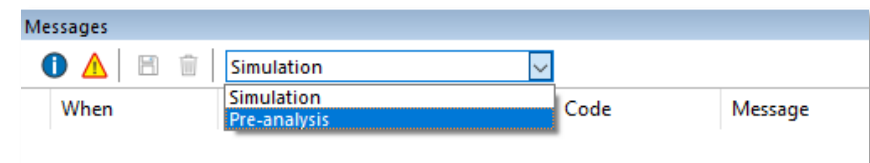
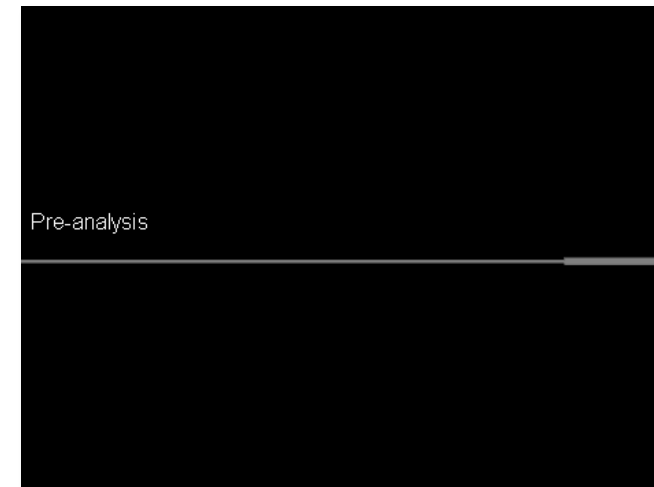
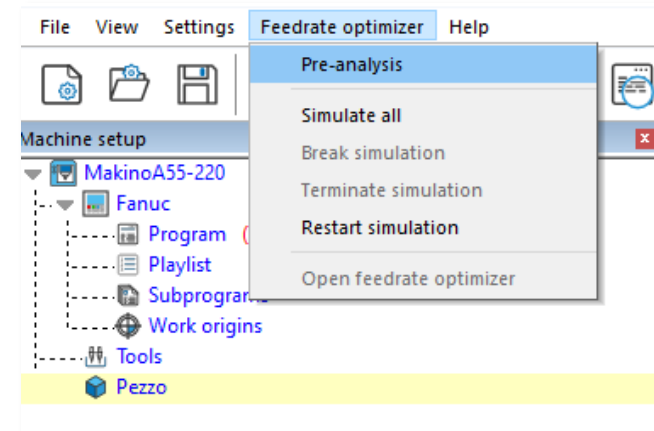
Chronos will begin a fast analysis of the imported NC program.

Once the pre-analysis is finished, by clicking on the "Simulate without display" icon, Chronos will show:

- Time spent in simulation.
- Estimated simulation time.
- Time remaining to complete the simulation.

Check the message window, locate the "Simulation" option and select "Pre-analysis".

Chronos will show the result of the pre-analysis.

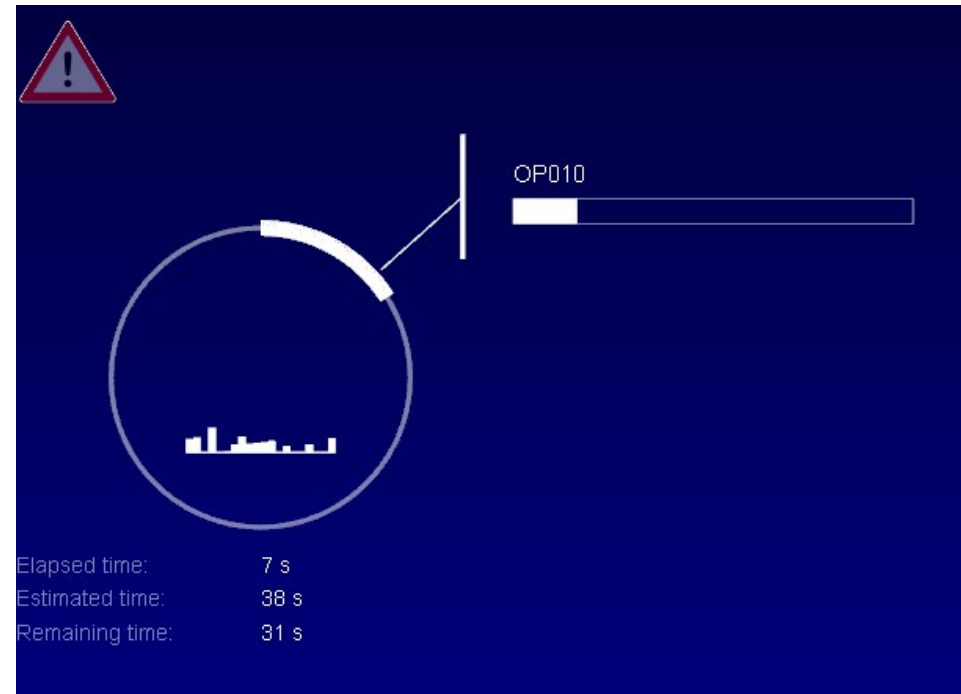
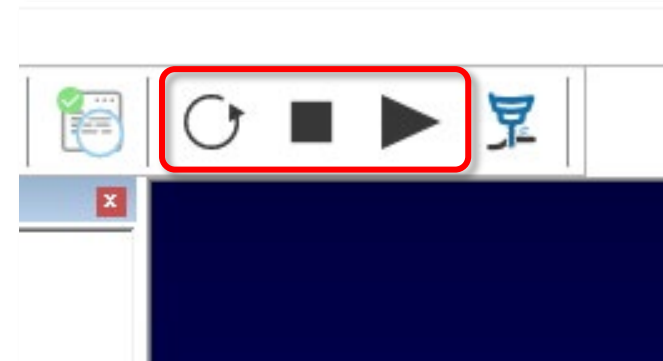


3.2. ISO PROGRAM ANALYSIS

«**Restart**»: restores the machined model and restores the simulation to its initial state.

«**Terminate simulation**»: stop the simulation and allows to import new 3D models, new programs or perform some operations.

«**Simulate and analyze**»: start analyzing the ISO program.



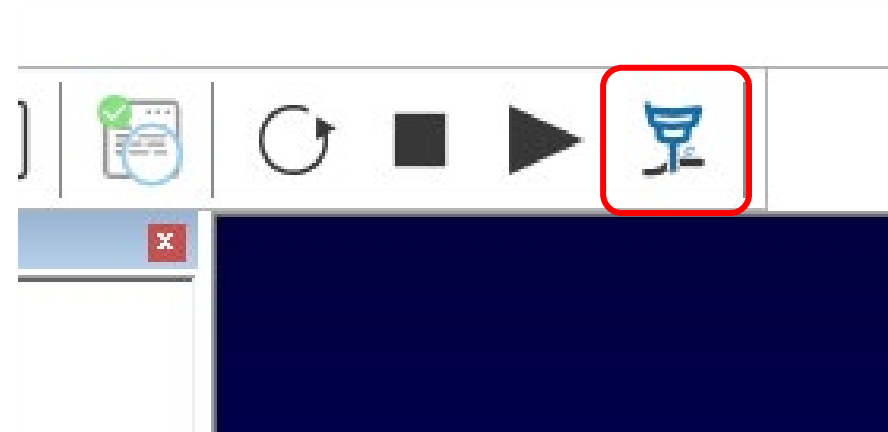
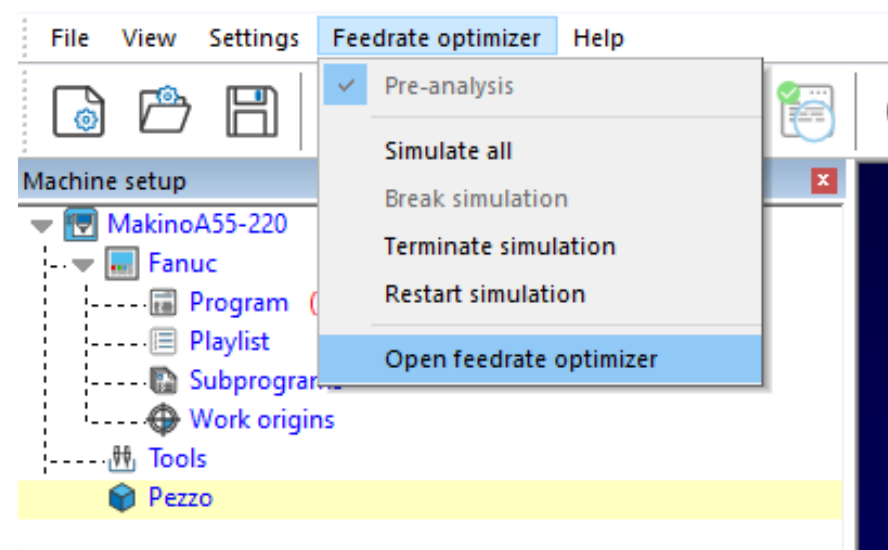
3.3. OPEN THE FEEDRATE OPTIMIZER

- "Feedrate optimizer" menu
- "Open feedrate optimizer"

OR

- Select the "Open Chronos" icon

Following the analysis of the NC program, by opening this window, the first optimization results will be shown.



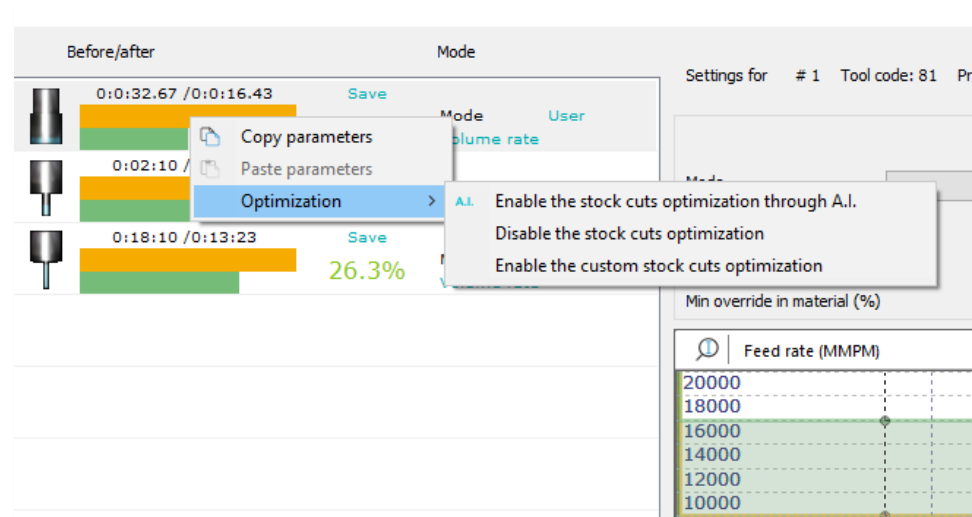
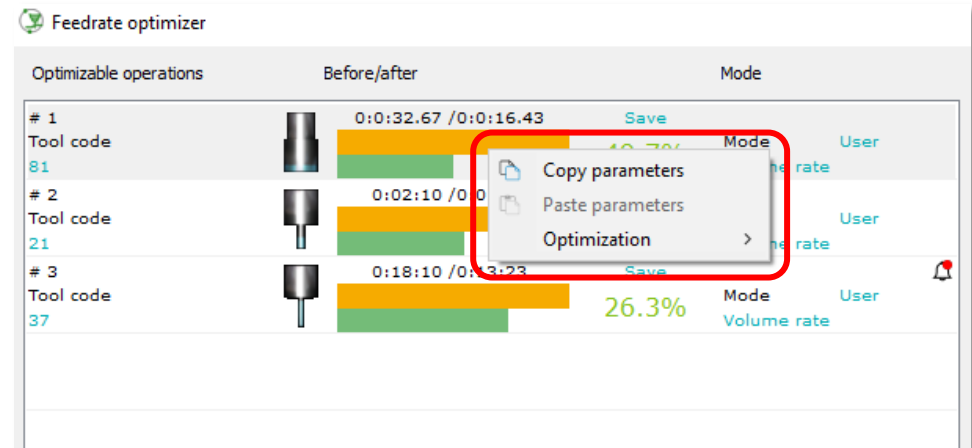
3.3. OPEN THE FEEDRATE OPTIMIZER

On the top left of the “Federate optimizer” window, right click on a tool in the list to:

- “Copy parameters”. After that, is possible to right click on another tool ad “Paste parameters”.

(The «Paste paramaters» command works with multiple selection too).

- «Optimization» the user can switch between the different «Mode» strategies (A.I., User, Not enabled).



3.4. CHANGE THE PARAMETERS OF THE OPTIMIZER

"Mode":

- "Not enabled": the optimization will not be applied for this specific tool.
- "User": the parameters entered manually by the Chronos user will be used to optimize the ISO program associated with this specific tool.
- **"Artificial Intelligence"**: Chronos will exploit artificial intelligence. The user will only have to choose whether to adopt a more conservative strategy (Tool) or whether to give priority to performance and time savings (Productivity).

Settings for # 1 Tool code: 81 Program name: OP010

Mode: A.I. (selected)

Max override in air (%): 100

Max override in material (%): 20

Min override in material (%): 50

Tool life - 1

Performance index

5 - Productivity

Max feed in air (MMPM): 40000

Max feed in cut (MMPM): 20000

Do not add intermediate movements

Feed rate (MMPM)

Apply

3.5. «A.I.»

- Drag the “Performance index” bar to change the result of the optimization.
 - “**Tool life**”: minimum performance to reduce the tool wear.
 - “**Productivity**”: maximum performance and the maximum increment of the federate to save time.

The other parameters are the same to the other “Mode”.

Settings for # 1 Tool code: 81 Program name: OP010 Apply

Mode A.I. Performance index Tool life - 1 5 - Productivity

Max override in air (%)	<input type="text" value="200"/>	<input checked="" type="checkbox"/> Max feed in air (MMPM):	<input type="text" value="40000"/>
Max override in material (%)	<input type="text" value="120"/>	<input checked="" type="checkbox"/> Max feed in cut (MMPM):	<input type="text" value="20000"/>
Min override in material (%)	<input type="text" value="50"/>	<input type="checkbox"/> Do not add intermediate movements	

3.6. «User»

- Specify the **volume rate (cm³/min)**.
 - Chronos will apply the other parameters to keep more constant as possible the volume.

The other parameters are the same for the other modalities.

Settings for # 1 Tool code: 81 Program name: OP010 Apply

Mode	User	Volume rate (cm ³ /min)	500
Max override in air (%)	200	<input checked="" type="checkbox"/> Max feed in air (MMPM):	40000
Max override in material (%)	120	<input checked="" type="checkbox"/> Max feed in cut (MMPM):	20000
Min override in material (%)	50	<input type="checkbox"/> Do not add intermediate movements	

4. ANALYSIS OF THE RESULTS

4.1. Percentage of saved time

4.2. Removed volume and feedrate graph

4.1. PERCENTAGE OF SAVED TIME

«**Before**»: original working time, without optimizations.

«**After**»: optimized working time.

"**Save**": Percentage of savings (time) regarding the analyzed tool.

In the list, on the left, click on each tool to analyze the different results.

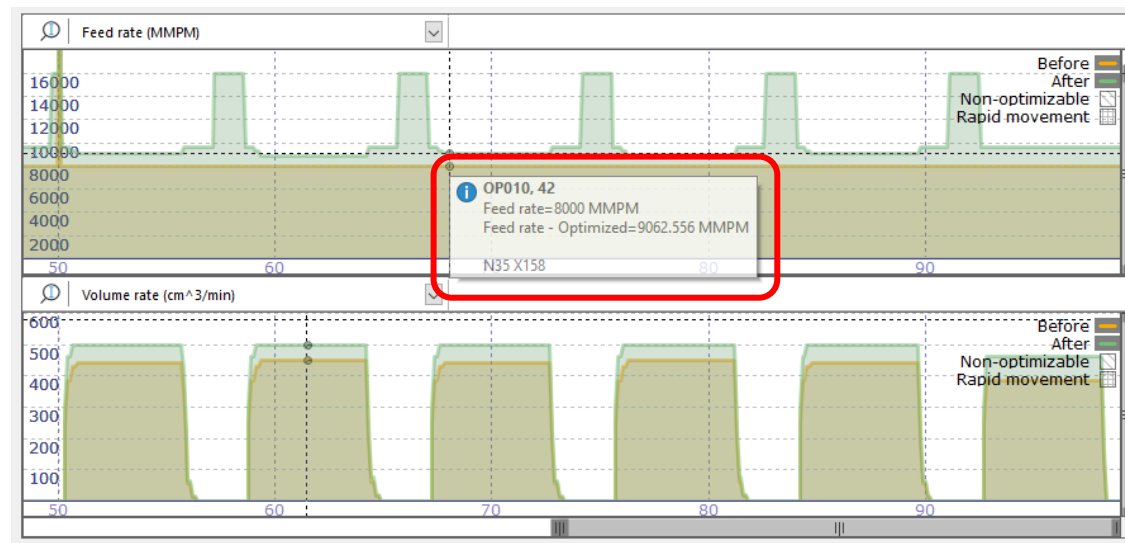
- Change the parameters or drag the A.I. bar.
- Click on «**Apply**».

The results will be updated again, showing the removed volume and progress graphs and the new savings value for the specific tool.

The screenshot displays the Eureka 10.1 Virtual Machining software interface. At the top, it shows the 'Before' time as 01:21:45 (in orange) and the 'After' time as 01:10:38 (in green). The 'Save' percentage is prominently displayed as 13.6% in green. Below this, there is a section for 'Output folder name' with a bell icon and a text box containing 'Opt_202106'. A red rectangle highlights the 'Apply' button. Below the button, there are input fields for '500', '40000', and '20000', and a label 'Intermediate movements'. At the bottom, there is a progress bar and a 'Before' label.

4.2. REMOVED VOLUME AND FEEDRATE GRAPH

- Hover the cursor over one of the two available graphs to get information about the original / optimized feed rate or the volume removed per original / optimized time unit.
- Drag the grey bars to the side and bottom of the graphs to change the scale of the graph and increase/decrease the amount of information shown.



5. DATA BACKUP

5.1. Save the optimized program

5.2. Save backup

5.3. «HELP»

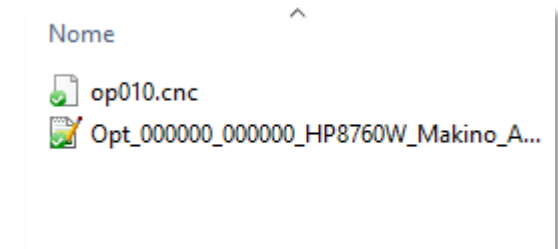
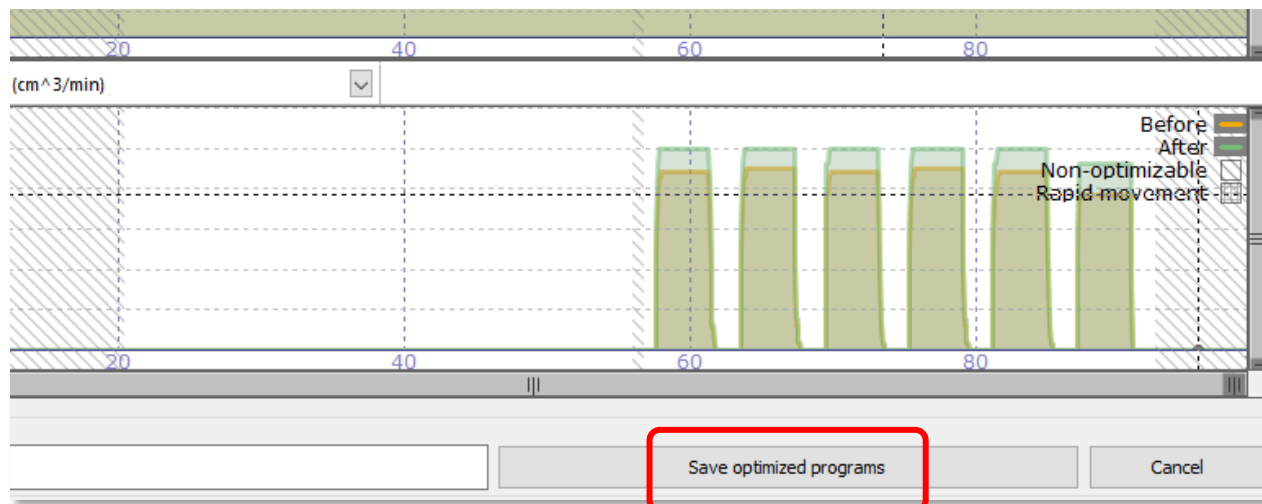
5.1. SAVE THE OPTIMIZED PROGRAM

To the left of the "Save optimized programs" command, it will be possible to read and customize the name of the optimized program.

Click on «Save optimized programs» to generate the **optimized code**.

When the user click on the "Restart" simulation icon, Chronos will change automatically the name of the saved program with a combination of letters and numbers (name-hour/minutes/seconds).

If the user want to overwrite the results, the name of the optimized code must be the same to the previous one.



5.1. SAVE THE OPTIMIZED PROGRAM

On right, a short example of an optimized program in Chronos.

Is possible to see the changes with the feedrate and the movements in air.

This picture is a good example to understand how Chronos works with the movements in work and the movements in air,

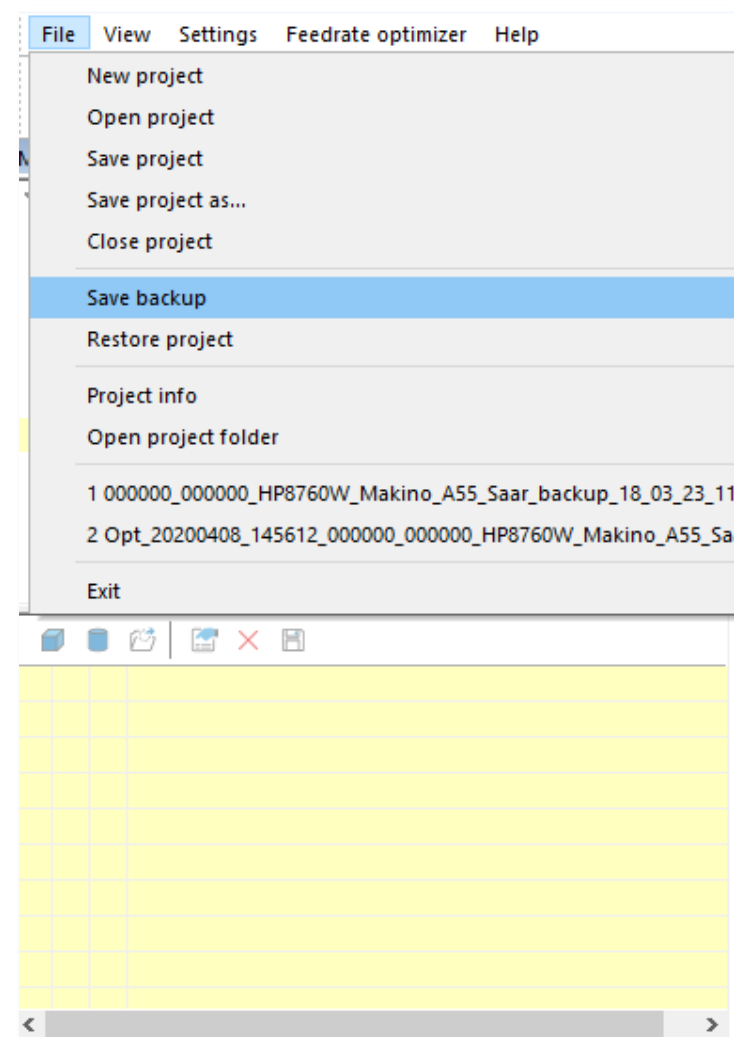
```
G1 X-158. F32000
G1 Y26.5
G1 X-148.125 F11520
G1 X-138.25 F10363
G1 X-128.375 F9344
G1 X88.875 F9063
G1 X148.125 F11520
G1 X158. F32000
G1 Y-26.5
G1 X148.125 F11520
G1 X138.25 F10363
G1 X128.375 F9272
G1 X-88.875 F8919
G1 X-148.125 F11520
G1 X-158. F32000 air
G1 Y-79.5
G1 X-148.125 F11520
G1 X-138.25 F10363
G1 X-128.375 F9344
G1 X88.875 F9063
G1 X148.125 F11520
G1 X158. F32000 air
G1 Y-132.5
G1 X148.125 F11520
G1 X-88.875 F10363
G1 X-148.125 F11520
G1 X-158. F32000 air
```

5.2. SAVE BACKUP

- "File"
- "Save backup"
- Indicate the location where the backup folder will be generated.

"Backup" means a folder containing all information and files used by Chronos.

The backup generated by Chronos can also be opened with Eureka.



5.3. «HELP»

- "Help"
- "Help"

The «help» document is a good solution to find informations about Chronos.

Tool database, functionalities and procedures.

The language of the options depends to the system language.

The language of the contents, depends to the Chronos language.

