MAL MANUFACTURING AUTOMATION

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NPRO Help File

Contents

1. Getting Started

Introduction

Npro is the most advanced physics based process simulation and NC program optimization NX plug-in available.

Unlike geometry and post-process based solutions, Npro allows process planners to visualize, simulate, and optimize NC tool paths directly in NX.

For this reason, Npro is the ultimate machining optimization tool for process planners and NC programmers.

1.1 What is NPRO?

Npro is the most advanced physics based process simulation and NC program optimization NX plug-in available.

Unlike geometry and post-process based solutions, Npro allows process planners to visualize, simulate, and optimize NC tool paths directly in NX.

For this reason, Npro is the ultimate machining optimization tool for process planners and NC programmers.

1.2 License Information

To Be Announced

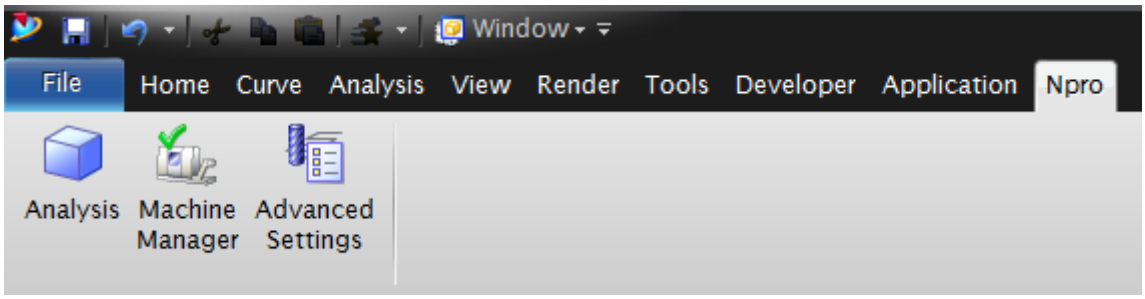
1.3 System Requirements

Required hardware and software:

- **PC:** PC with a Intel/AMD processor with a minimum of 2 cores at 2.8Ghz
- **Operating System:** Windows 7, 8 or later.
- **Software:** Siemens NX
- **Video Card:** Direct X 10.0 compatible VGA card.
- **Memory:** We recommend a minimum of 6GB of RAM, upwards to 16gb or even 32gb if the part size is large.
- **License:** Will be provided when the software is purchased.

2. User Interface Overview

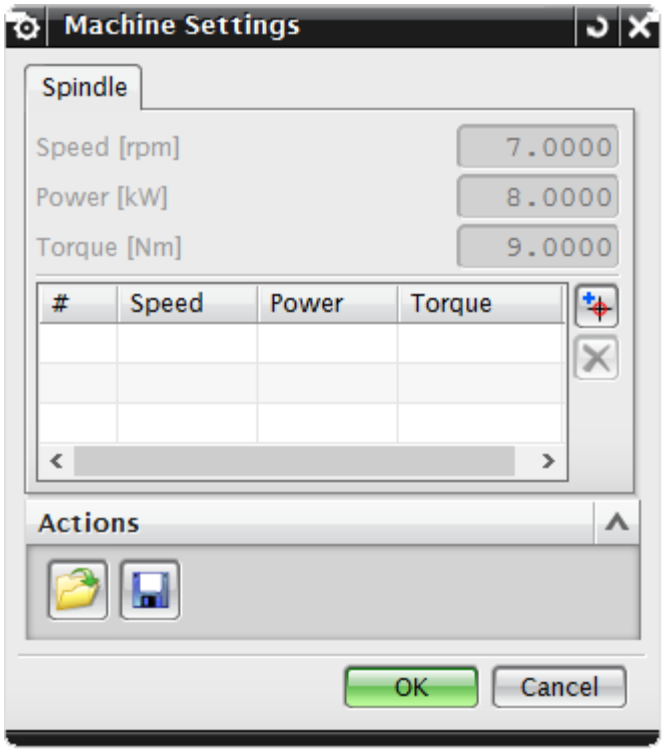
To access Npro, open a project and click on the Npro tab. Under the Npro tab, click on the **Analysis** button to access the main interface.

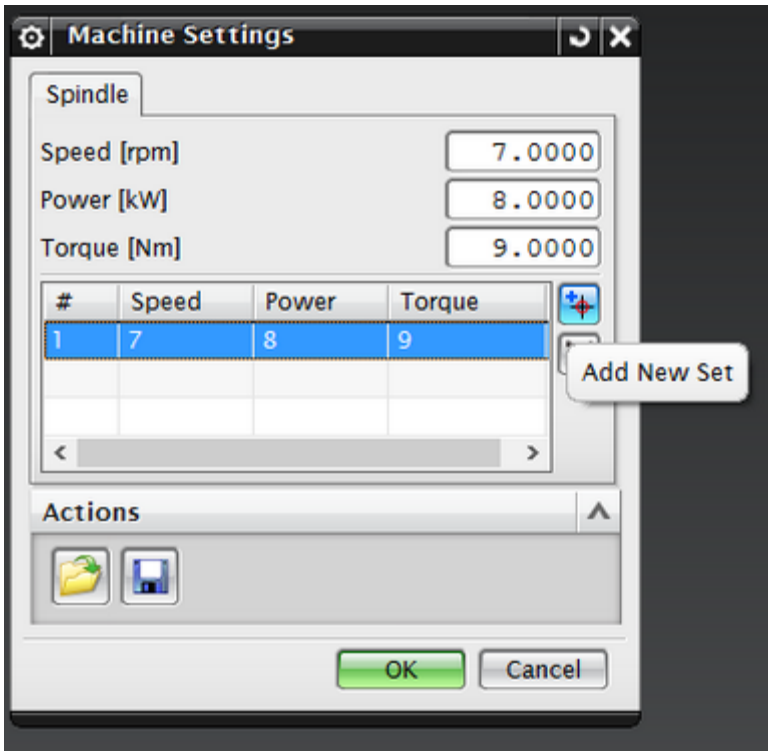


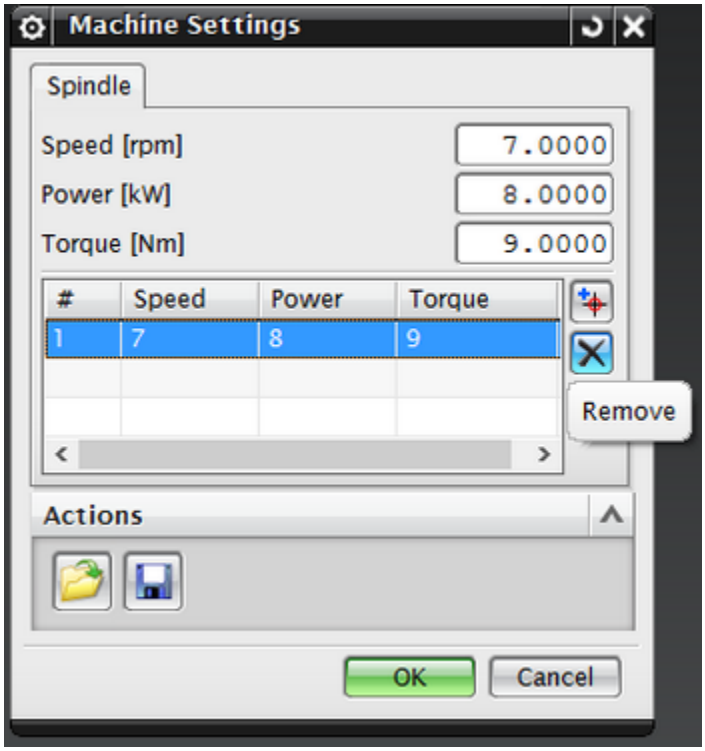
Npro's Analysis interface consists of three main sections:

1. **Dashboard**: The Main Window where you can set your simulation and optimization requirements
2. **Actions Menu**: Consists of Buttons which are used to control the Dashboard / Main Window
3. **Results**: Graphs indicating values which were Simulated/Optimized

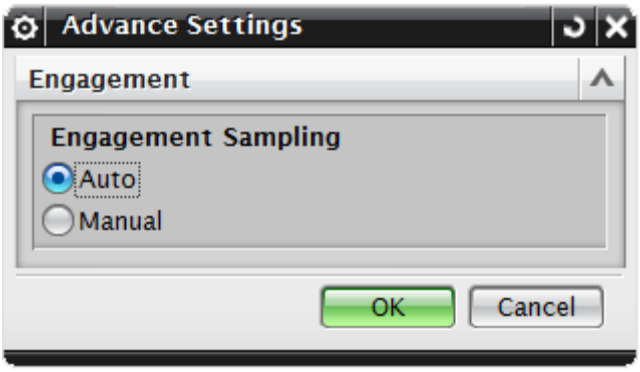
Npro's Machine Manager is used to enter physical constraints of the machine:

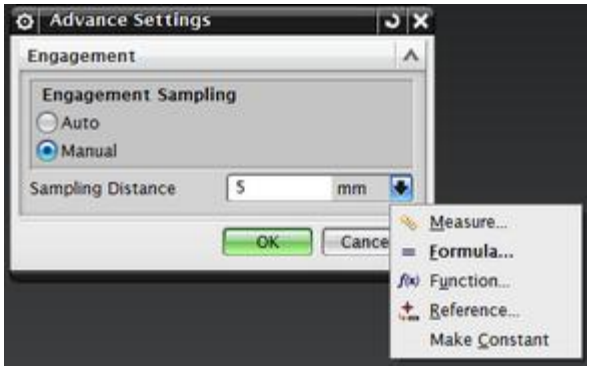






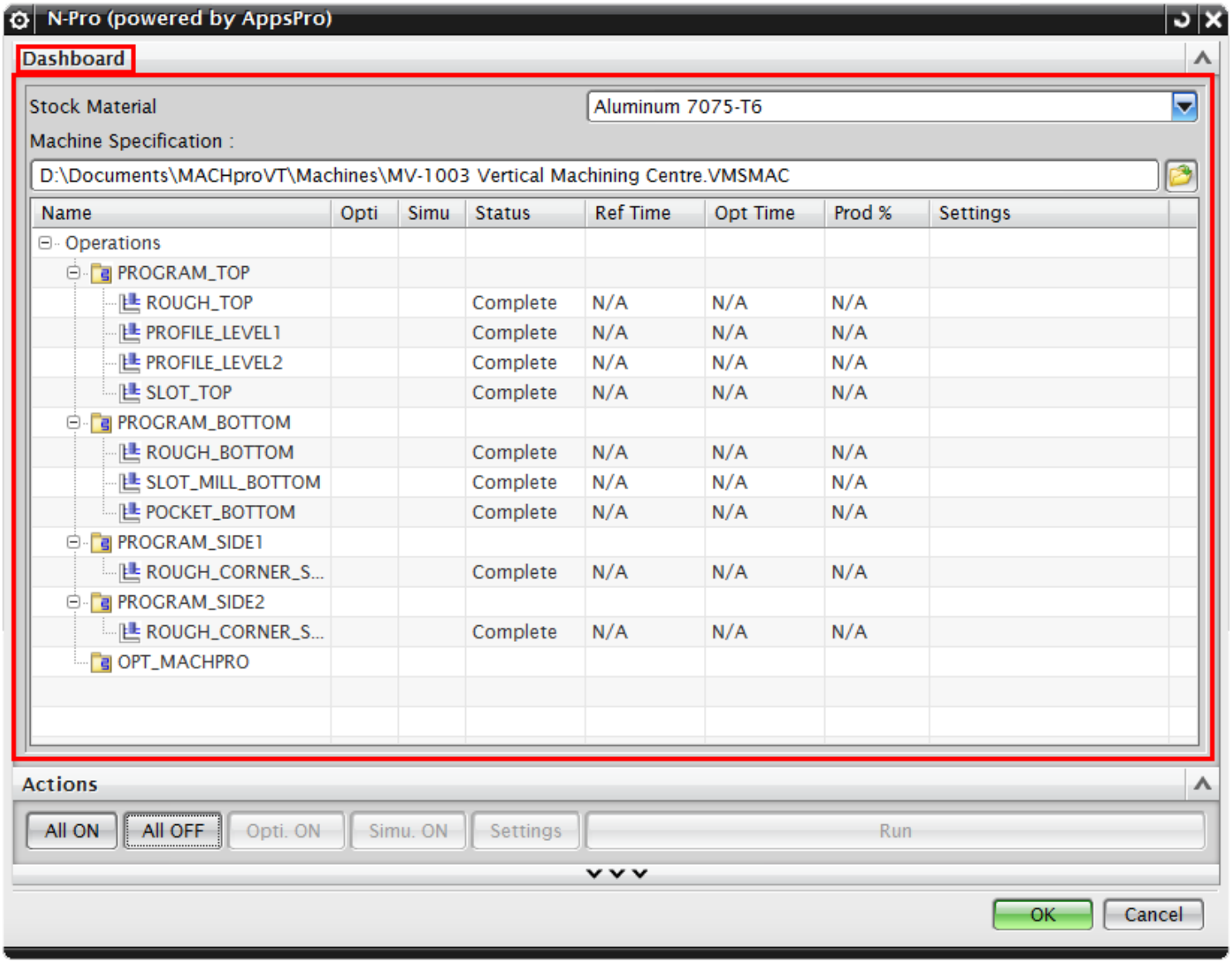
The Advanced Settings area is used for setting up the sampling distance of Npro's engine calculations:





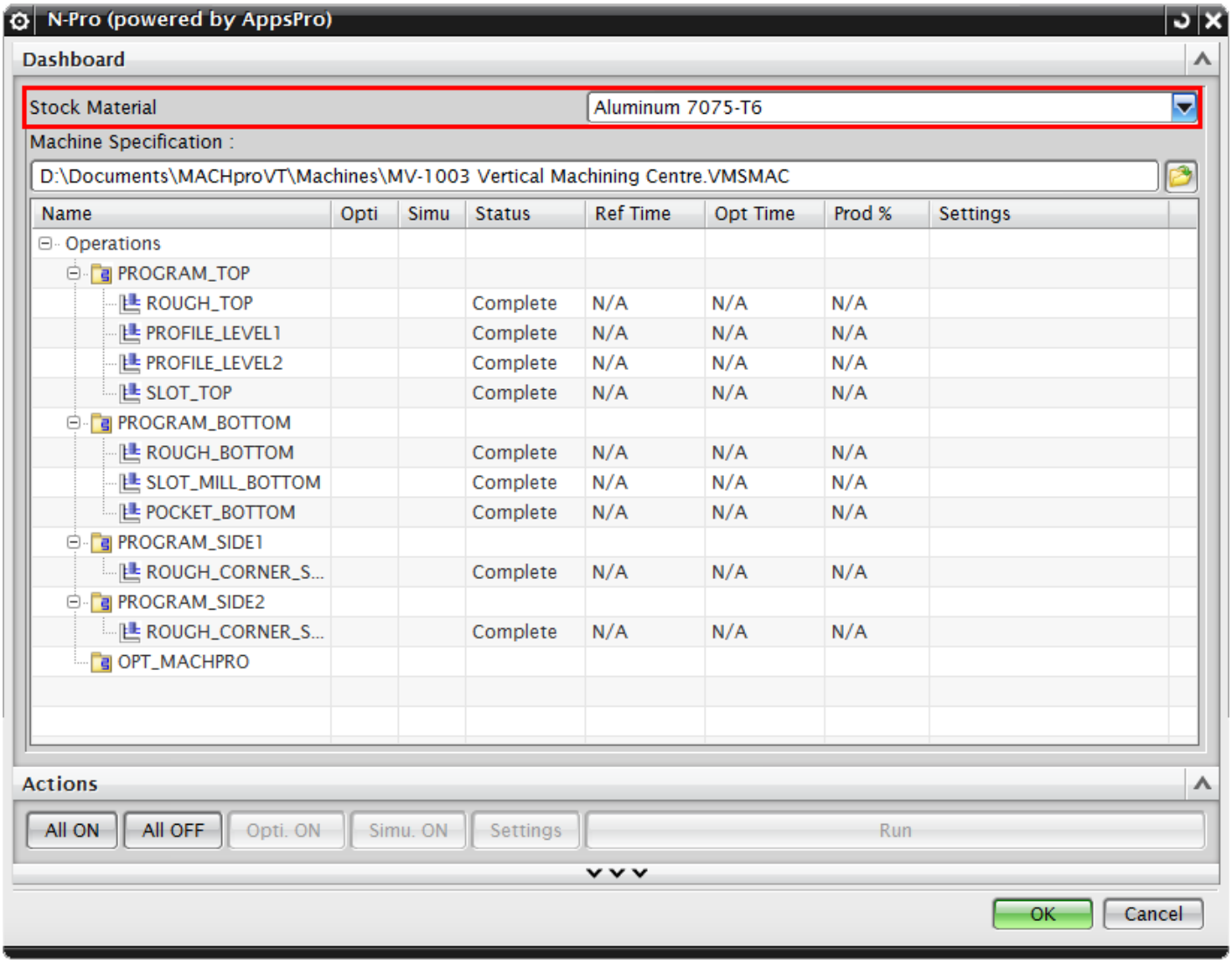
2.1 Dashboard: Main Window

The Dashboard is the main window where you can set your simulation and optimization requirements:



2.1.1 Stock Material Selection

Npro has **20+** commonly used materials available in it's database. If your material is not available, please contact us.



Materials Available:

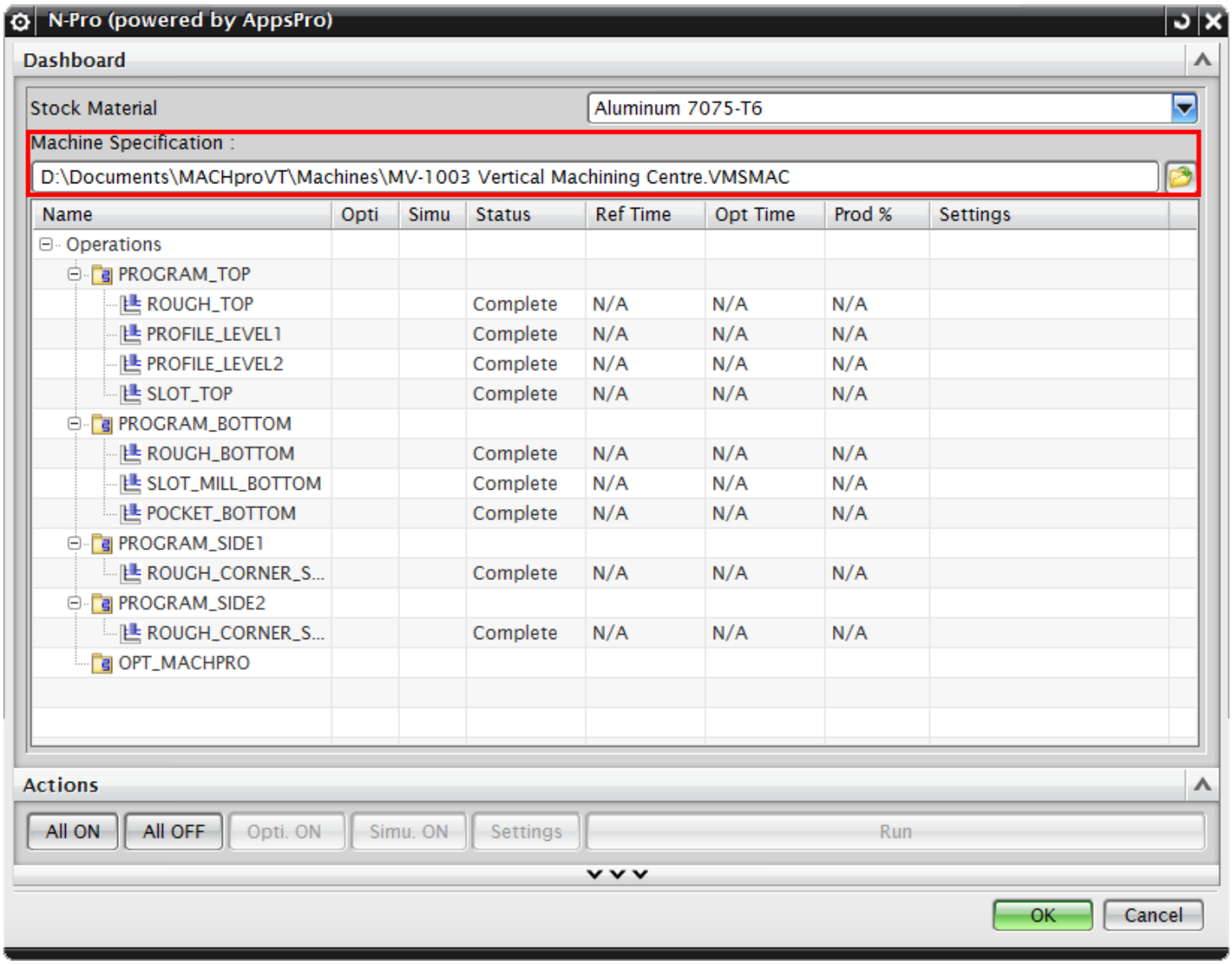
1. Aluminum 7075-T6
2. Aluminum 356.0-T6
3. AISI P20 Mold Steel
4. Aluminum 705i-T74
5. AISI 4340 StSel

6. Aluminum 7050-T7451 Low Speed V<200 m/min
7. Aluminum 7050-T7451
8. Titanium lloy Ti6Al4V (Orthogonal to Oblique)
9. AISI P20 Steel - Ballend mill calibrated with axial depth of 0.05in
10. NRC - MDF
11. CAST Iron C450
12. Gray Cast Iron
13. Titanium Alloy Ti6AL4V (Average)
14. AISI P20 Steel - Ballend mill a=0.065in
15. Inconel 718
16. Inconel 625
17. Niobium
18. Thermo-Span Superalloy
19. Alumiuum 6061-T6
20. Waspaloy
21. AISI 630 Steel
22. AISI 1050 Steel
23. Aluminum 319.0-T6
24. Alumec 89

2.1.2 Machine Spacification

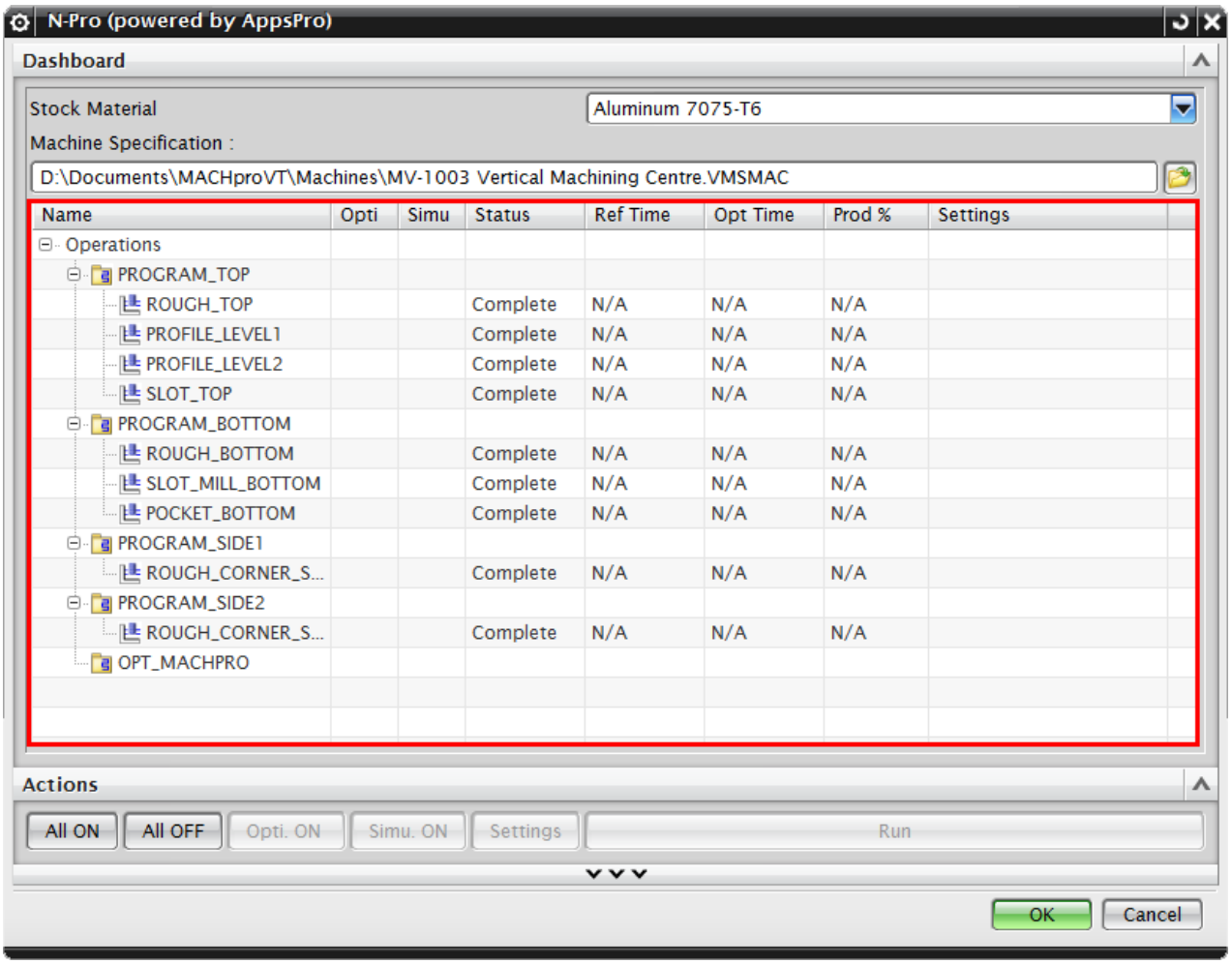
Npro uses the machine's specifications as part of its simulation/optimization criteria. To define a machine, please refer to section '2.0 User Interface'.

Once a machine's specifications have been entered you may select the machine from the **Dashboard**:



2.1.3 Main Window

Npro's main window displays the general process simulation & optimization information of the



project:

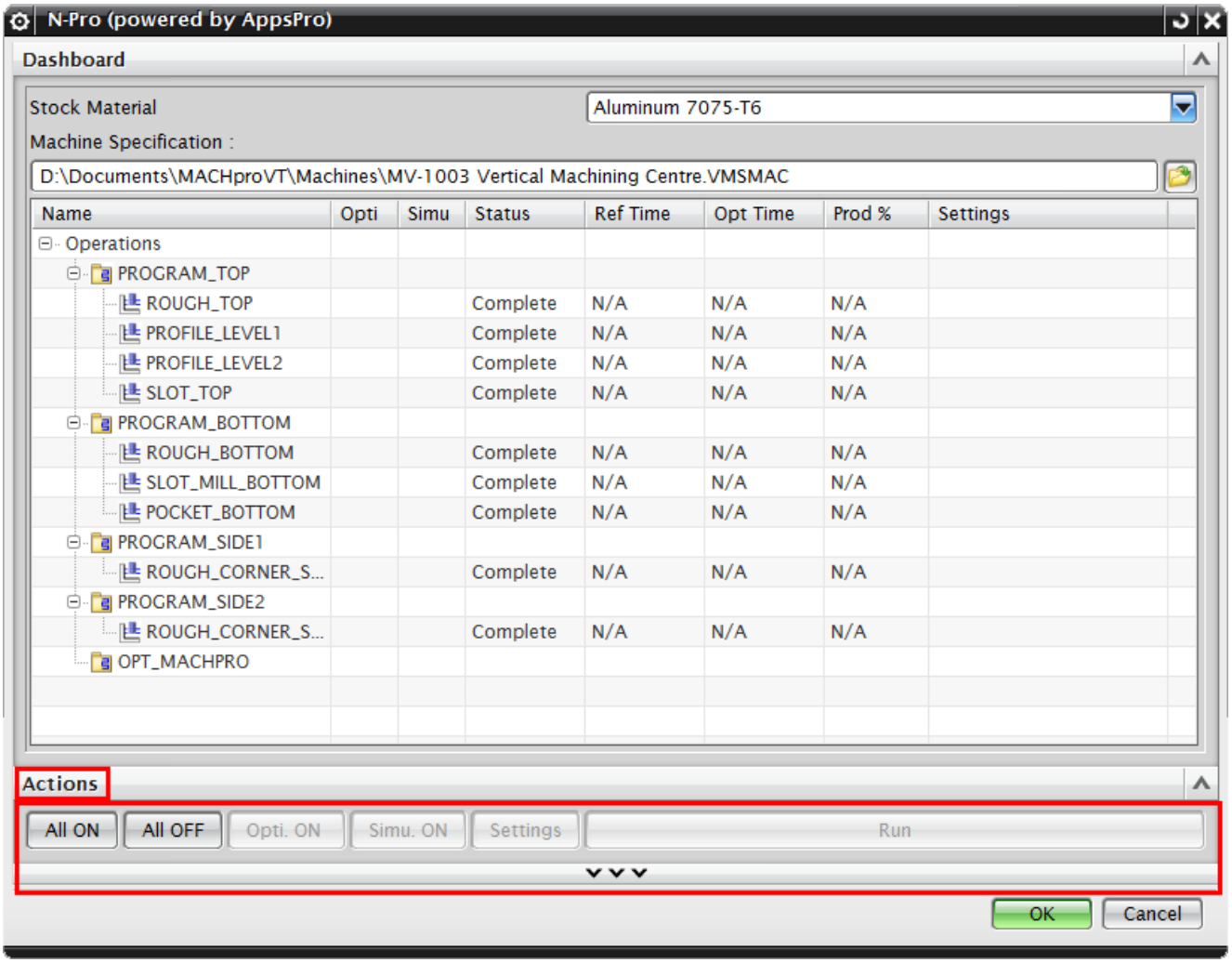
The columns used are described as follows:

- **Namem** The name of the program as set within NX.
  Opti: Displays a green check mark if optimization is enabled for the select program
- program/operation.
  Simu: Displays a green check mark if simulation is enabled for the select program
- program/operation.
- **Status:** Displays the status of the simulation/optimization results.
  Ref Time: Displays the current, non-optimized machining time for the select
- program/operation.
- **Opt Time:** Displays the new, optimized machining time for the select program/operation.
  Prod %: Displays the new increased/decreased production percentage. **Npro** will decrease
- productivity if incorrect feeds were originally entered.

- **Settings:** Displays a brief overview of the program settings.

2.2 Actions Menu

The Action Menu consists of the following buttons which are used to control the Dashboard / Main Window:



- **All ON:** Turns **on** Simulation and Optimization for all program operations.
- **All OFF:** Turns **off** Simulation and Optimization for all program operations.
- **Opti. ON/OFF:** Tunns **on**/**off** Optimization from the selected operation.
- **Simu. ON/OFF:** Turns **on**/**off** Simulation from the selected operation.
- **Settings:** Opens the settings window for the selected operation.
- **Run:** Runs simulation and/or optimization of all operations based on the user's selection.

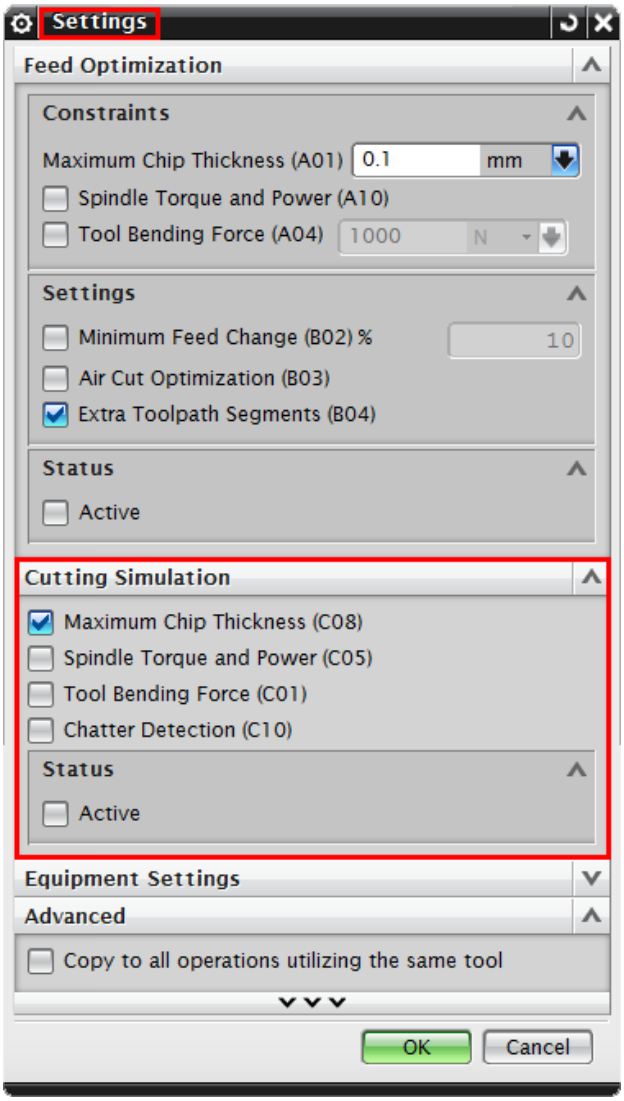
2.3 Results

Npro's Results consist of two main areas:

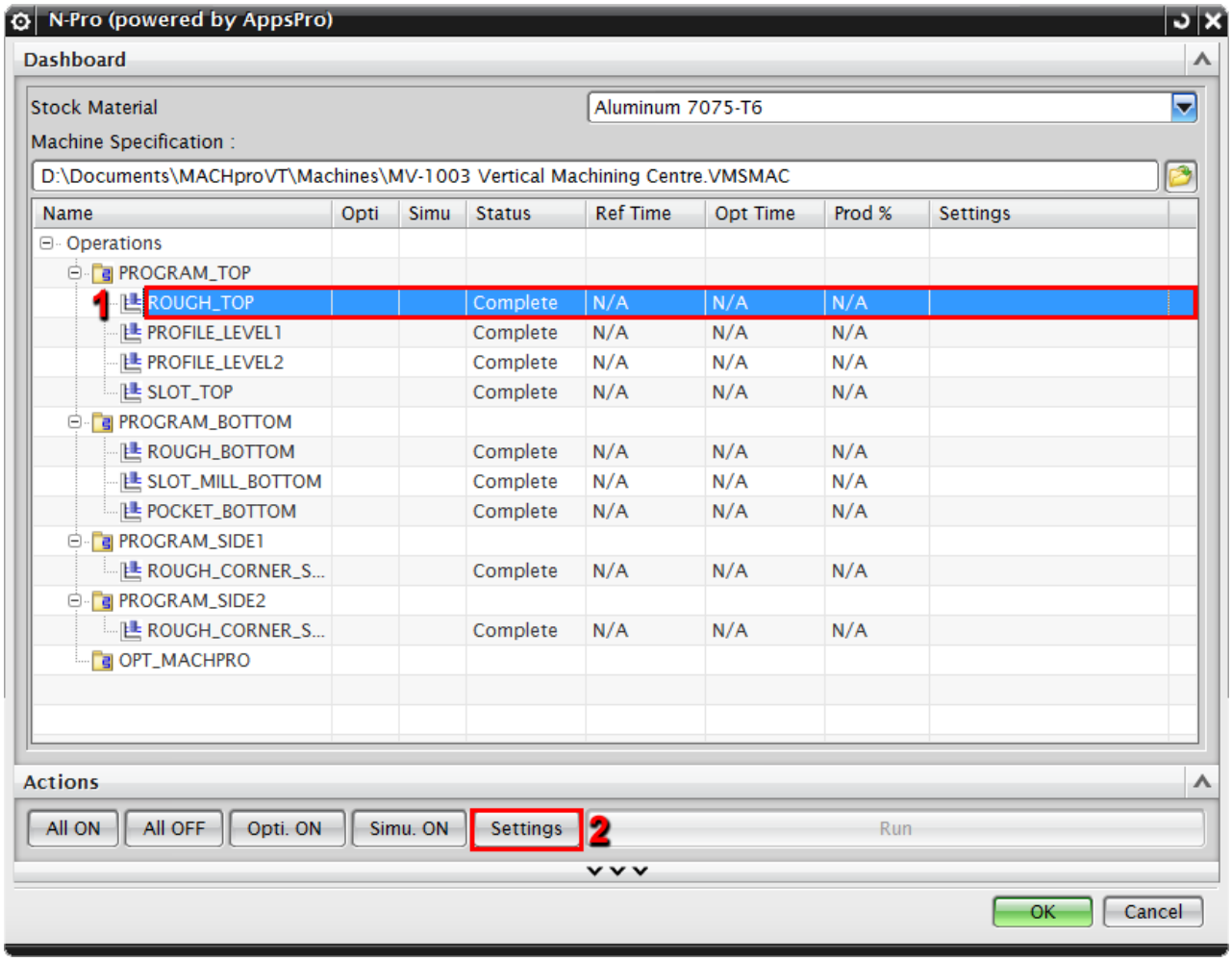
1. Graphs showing **simulation results** and/or **optimization results**
2. **New tool paths** generated instantly with **optimized feed rates**

3.0 Settings

The Settings pop-up dialogue is used to edit simulation/operation constraints for the selected operation.



To access the settings of an operation, first click on the operation, and then click on settings. Alternatively, you may double-click the desired operation:

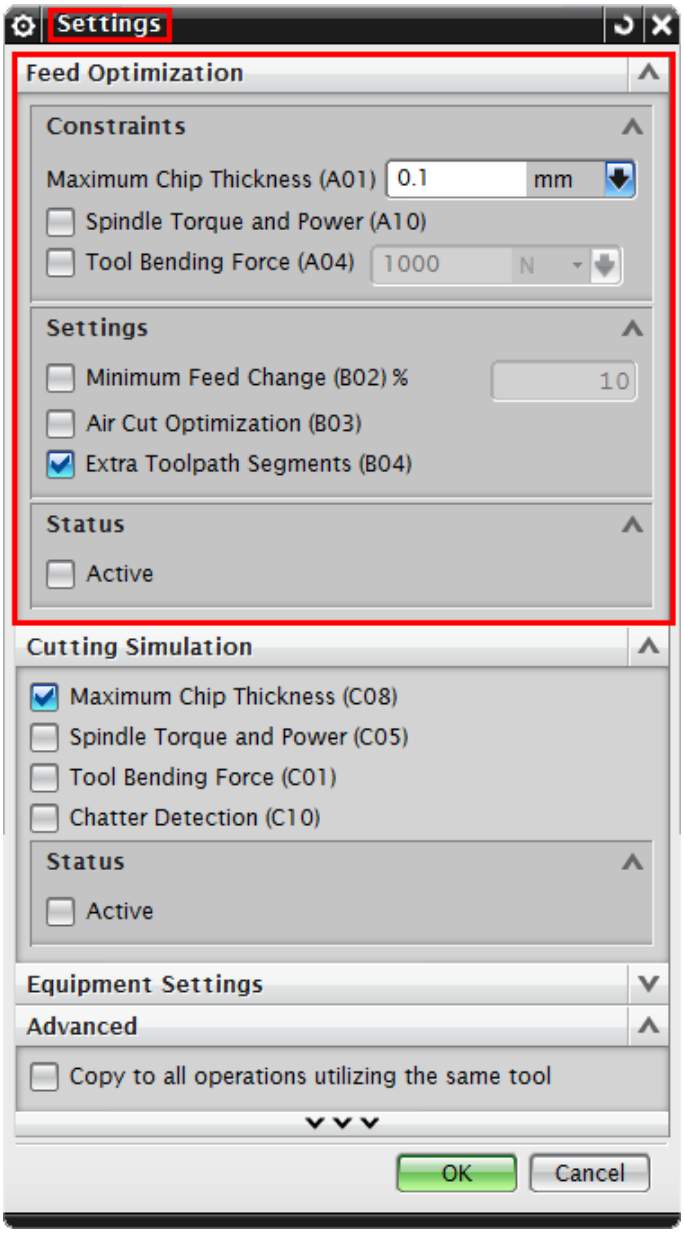


The Settings window is divided under four categories as follows:

- 3.1 Feed Optimization
- 3.2 Cutting Simulation
- 3.3 Equipment Settings
- 3.4 Advanced

3.1 Feed Optimization

The Feed Optimization dialogue is where the user sets physical constraints to the operation.



Maximum Chip Thickness (A01): Enter the upper limit for the chip thickness during machining

Spindle Torque & Power (A10): Uses the Torque/Power limits of the selected machine for simulation/optimization. If selected, the new tool path will not violate the machine's limits.

Tool Bending Force (A04): Enter the limit of the tool bending force, feeds will be adjusted with the tool bending limit in mind.

Minimum Feed Change % (B02): Enter a minimum limit on the feed change from the original tool path.

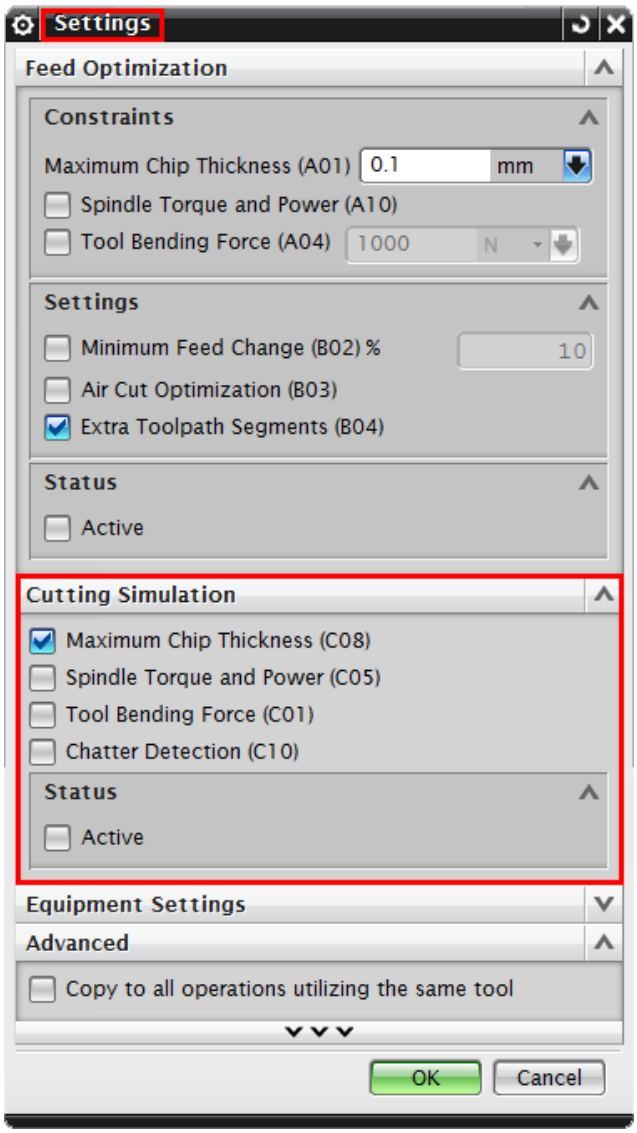
Air Cut Optimization (B03): Also optimizes air movements based on machine limits.

Extra Tool path Segments (B04): Splits/adds toolpath segments to acheive best optimization results.

Status: Activates/Deactivates Feed Optimization.

3.2Cutting Simulation

The Cutting Simulation dialogue is where the user enables/disables simulation of existing tool path operations.



Maximum Chip Thickness (C08): Simulates the maximum chip thickness during machining

Spindle Torque & Power (C05): Simulates the variation in spindle torque and power during machining

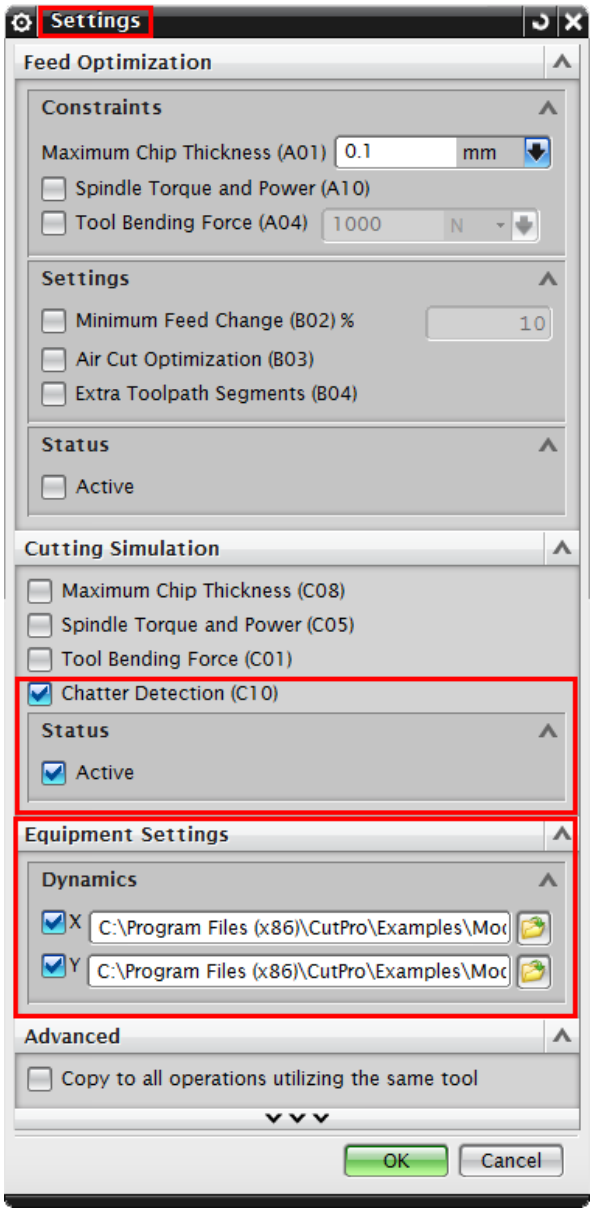
Tool Bending Force (C01): Simulates the variation in tool bending forces during machining

Chatter Detection (C10): Detects chatter locations during machining (Requires tool flexibility data, refer to Equipment Settings)

Status: Activates/Deactivates Cutting Simulation.

3.3 Equipment Settings

The Equipment Settings dialogue is **only enabled when Chatter Detection is Activated**

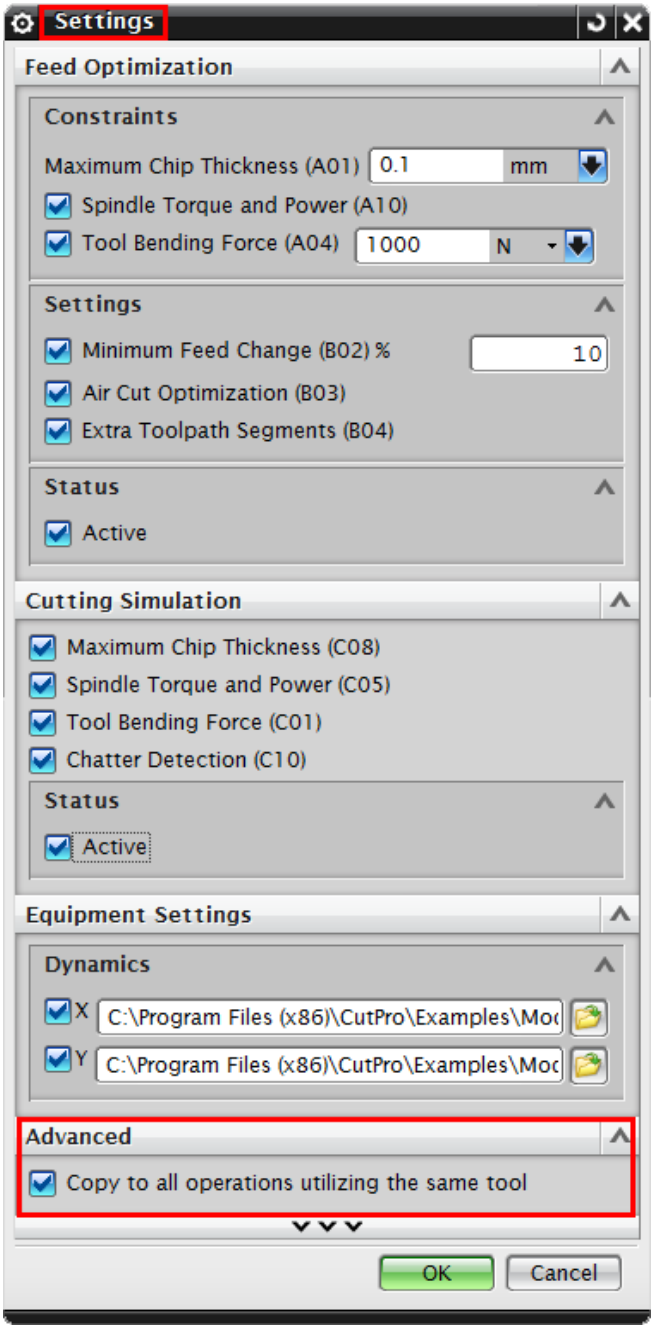


- **Chatter Detection (C10):** Detects chatter locations during machining (Requires tool flexibility data)
- **Dynamics X/Y:** The Dynamics dialogue is where the user imports impact test (also known as a tap test) FRF results in***.CMP** file format

For more details on impact testing, please refer to our website.

3.4 Advanced

The Advanced window is used when the user wishes to **copy all simulation/optimize settings to other programs with the same tool number.**

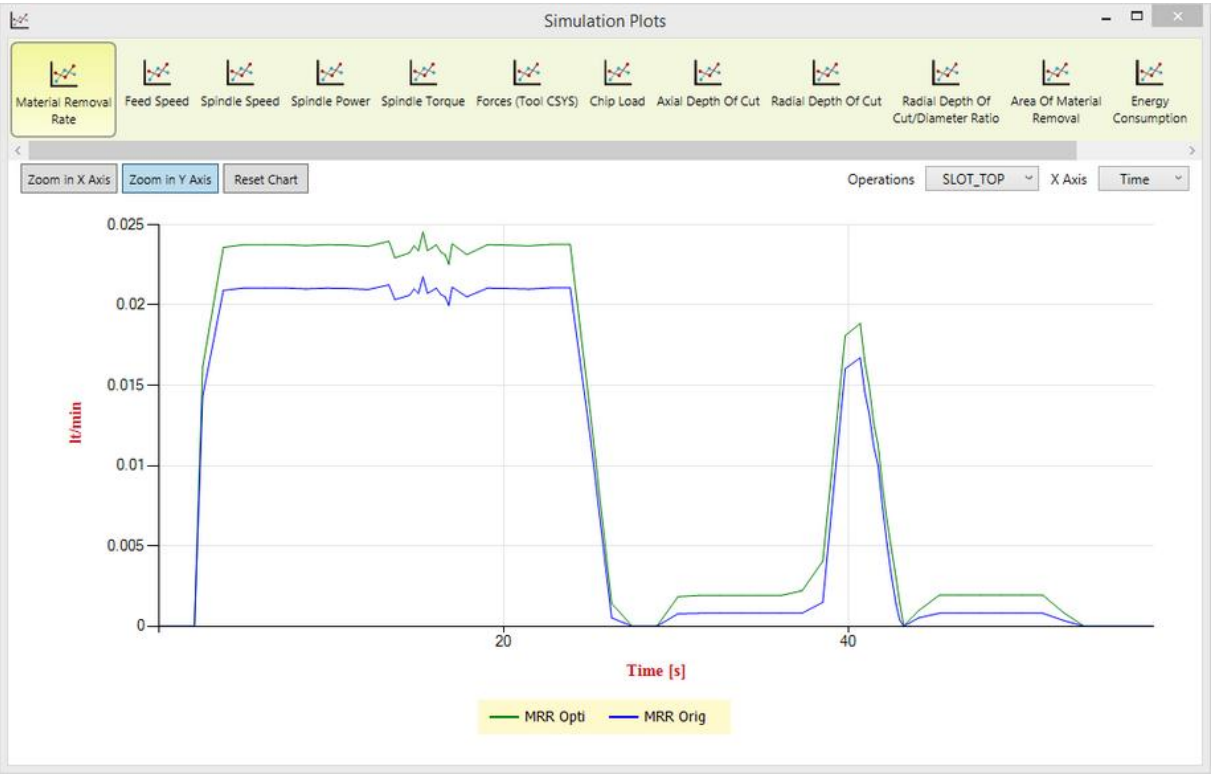


4.0 Results

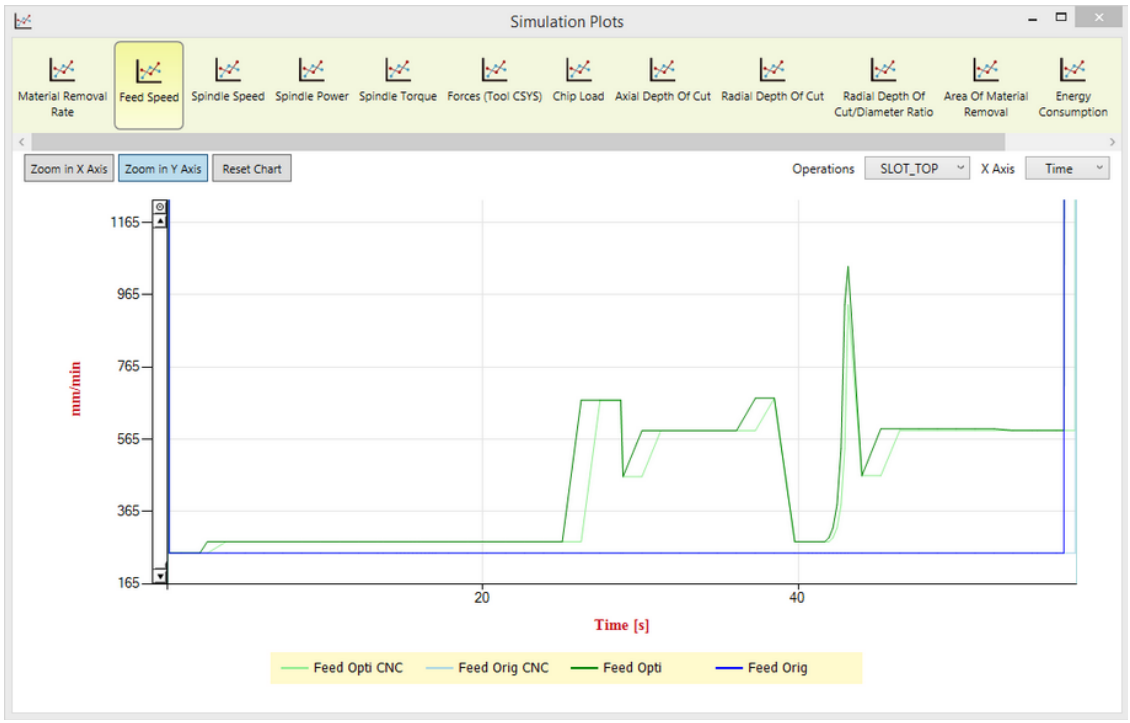
Npro's Results consist of two main areas:

1. Graphs showing **simulation results** and **optimization results**, such as these, as an example:

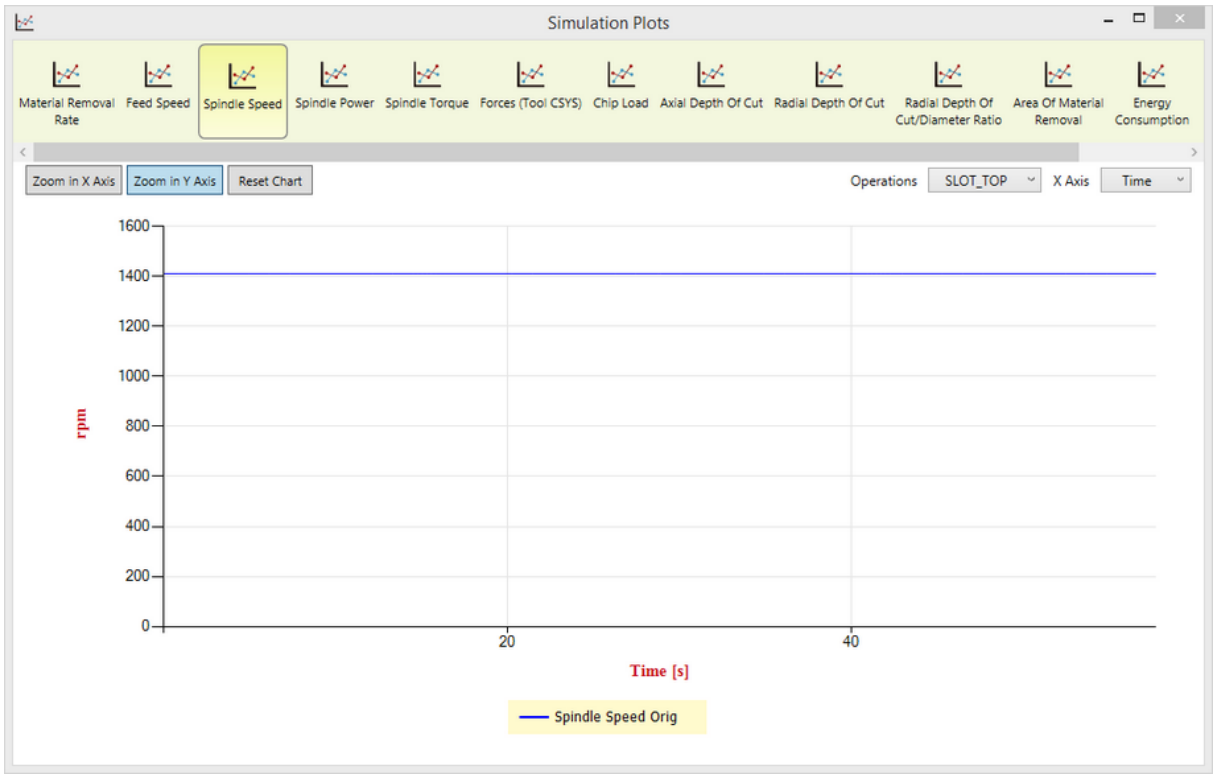
Material Removal Rate



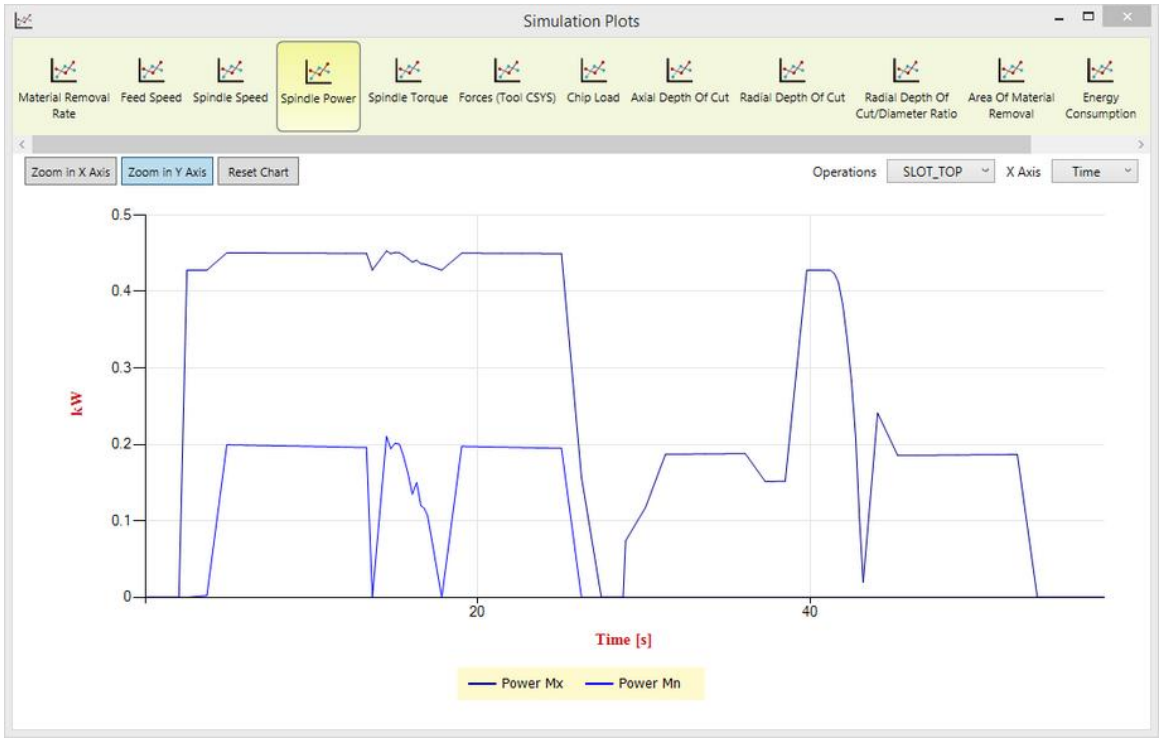
Feed Speed



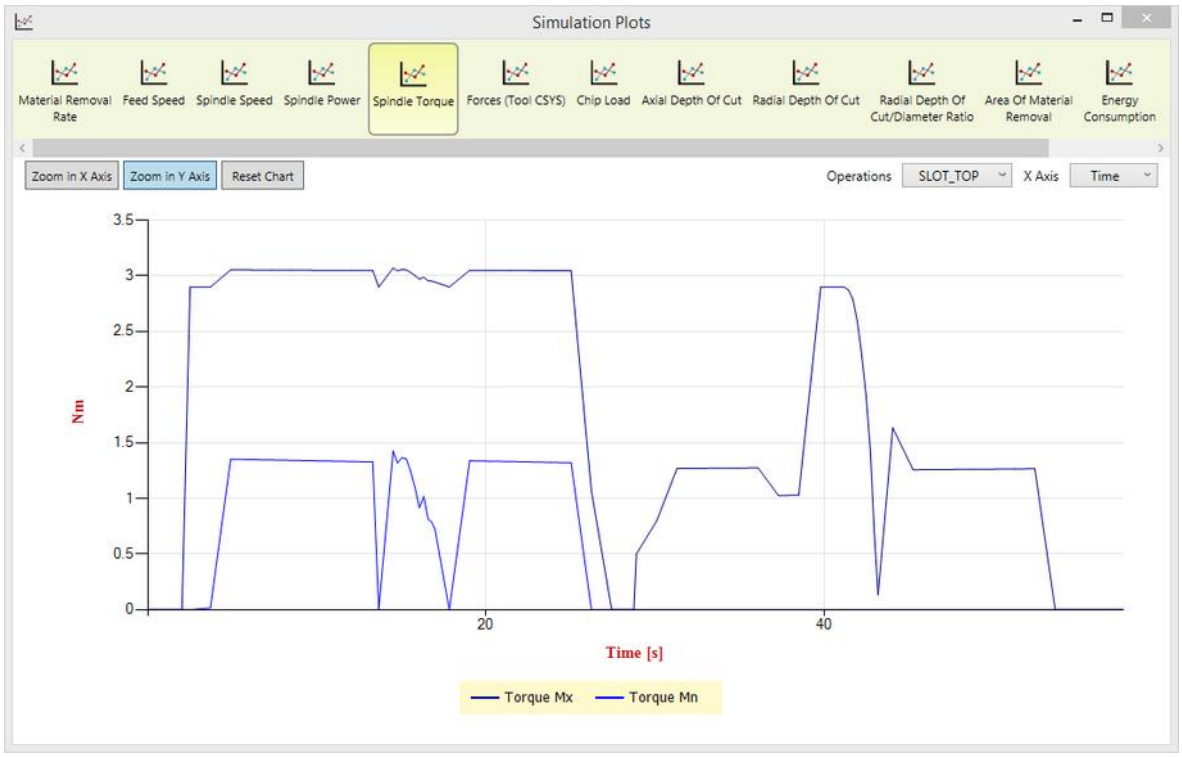
- Spindle Speed



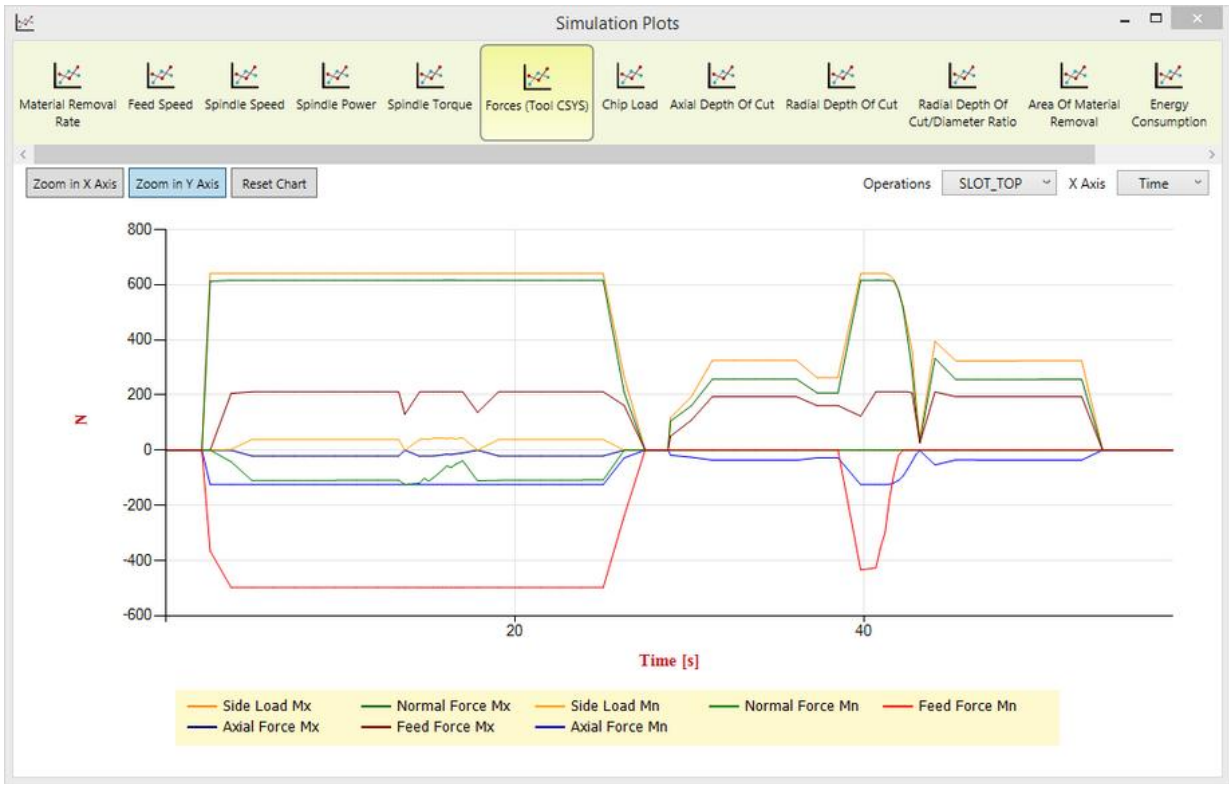
Spindle Power



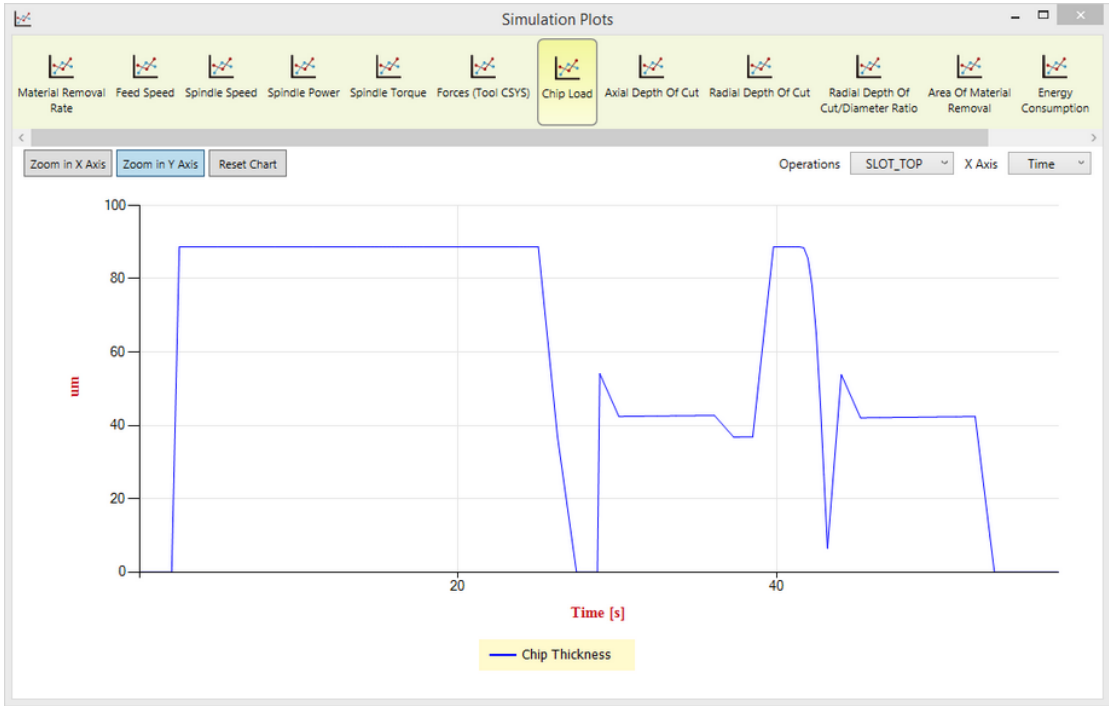
- Spindle Torque



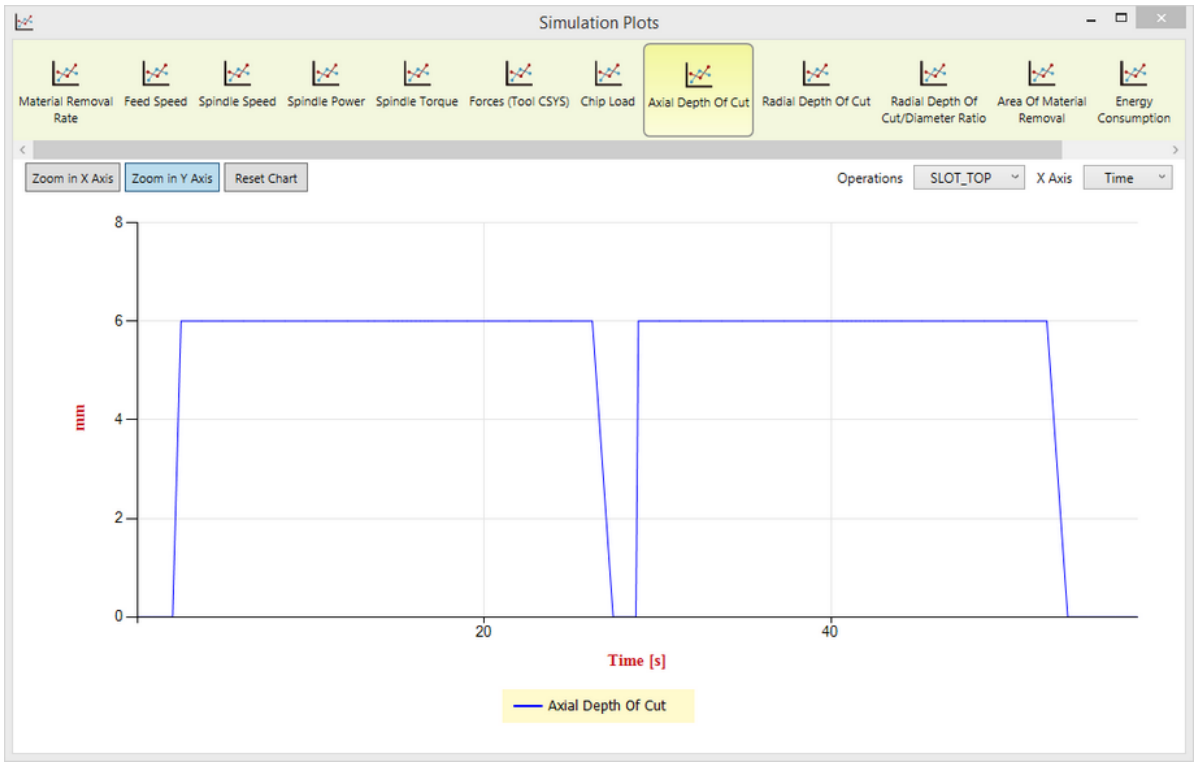
- Forces (Tool)



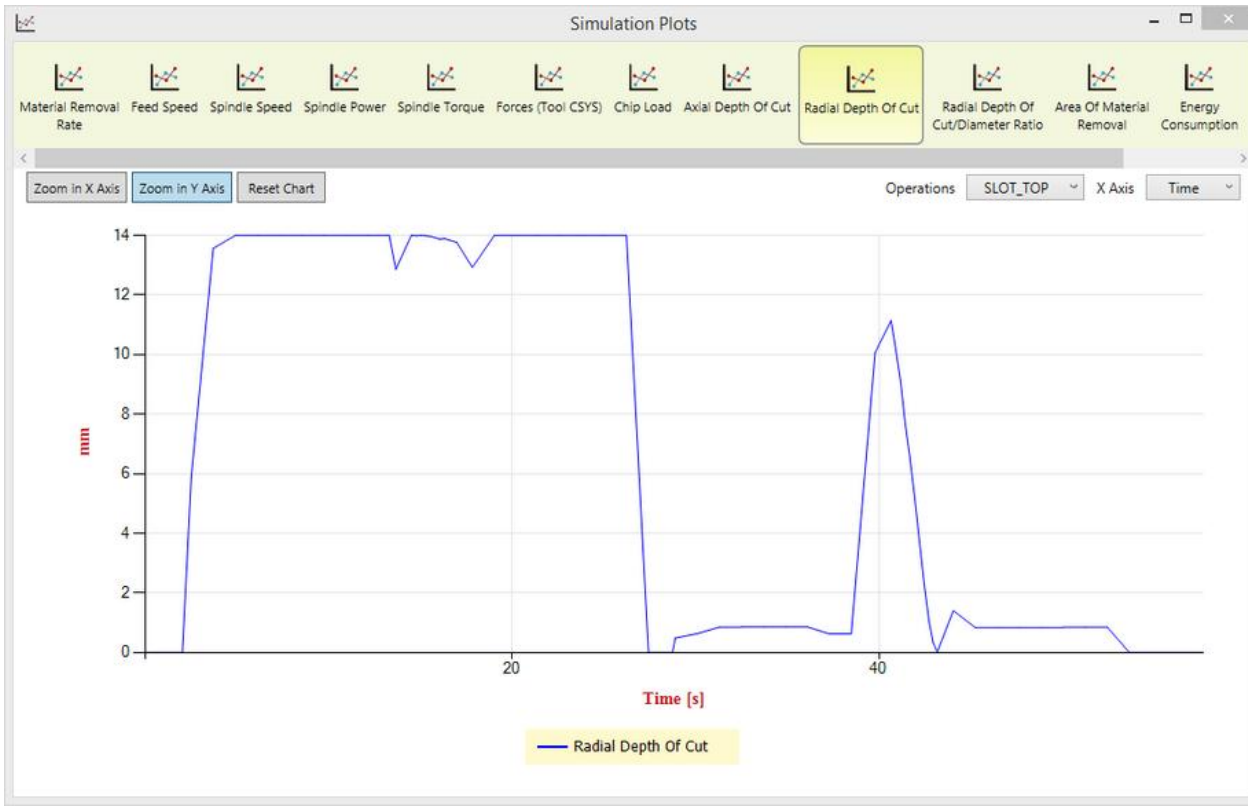
- Chip Load



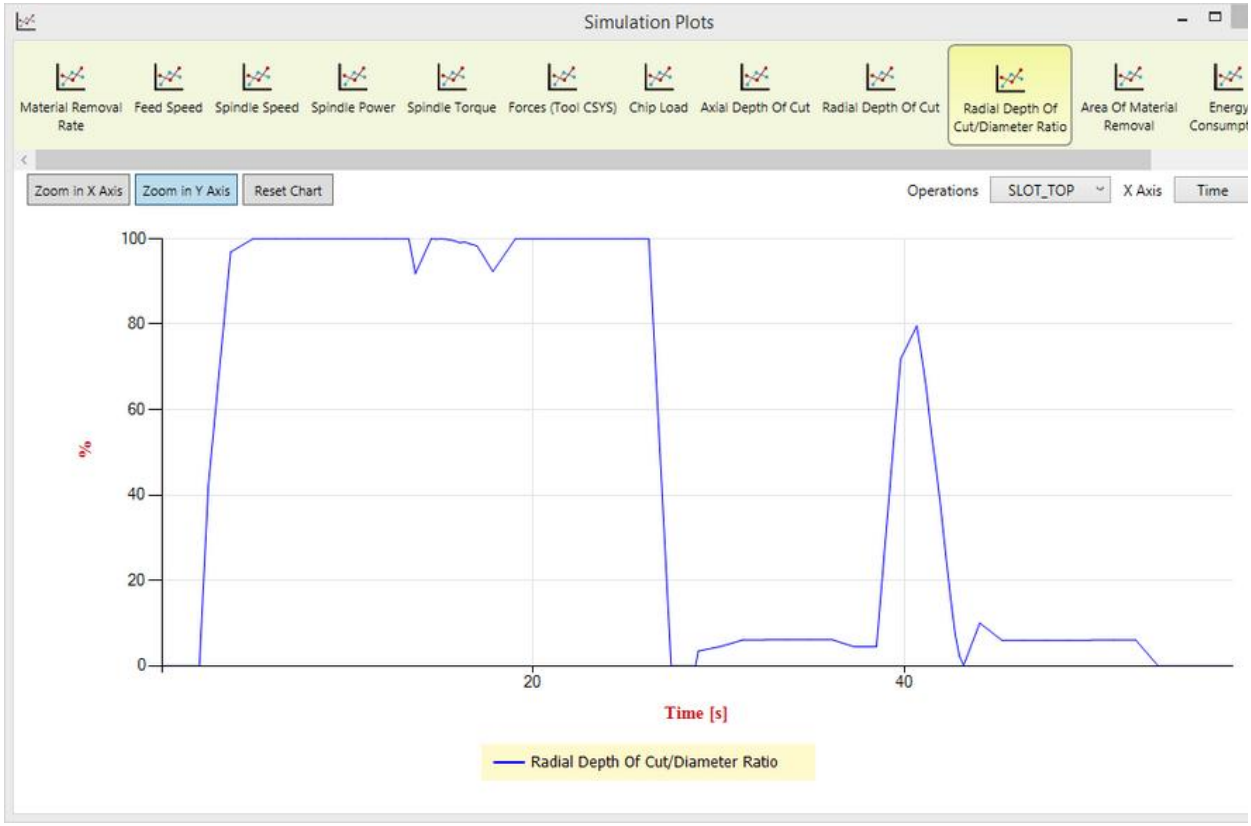
- Axial Depth of Cut



Radial Depth Of Cut

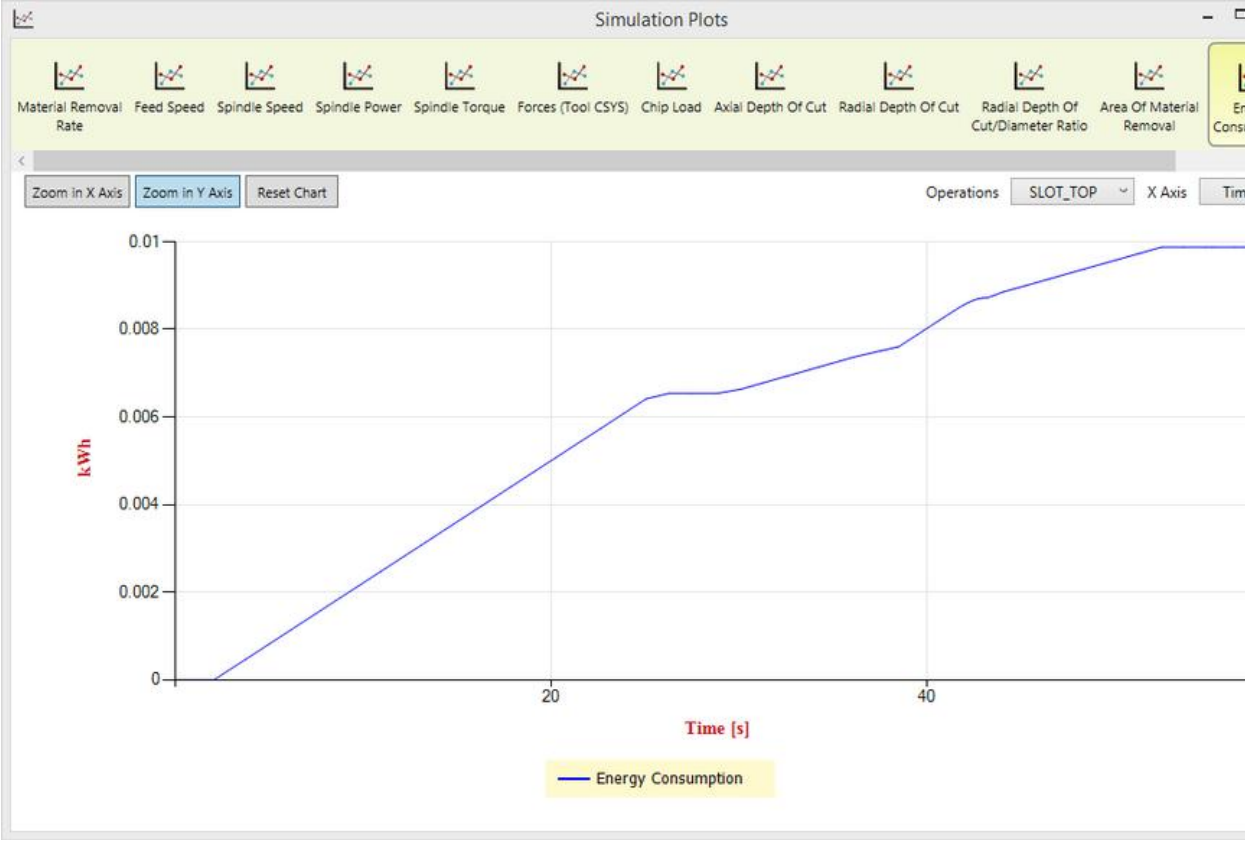


- Radial Depth of Cut/Daameter Ratio



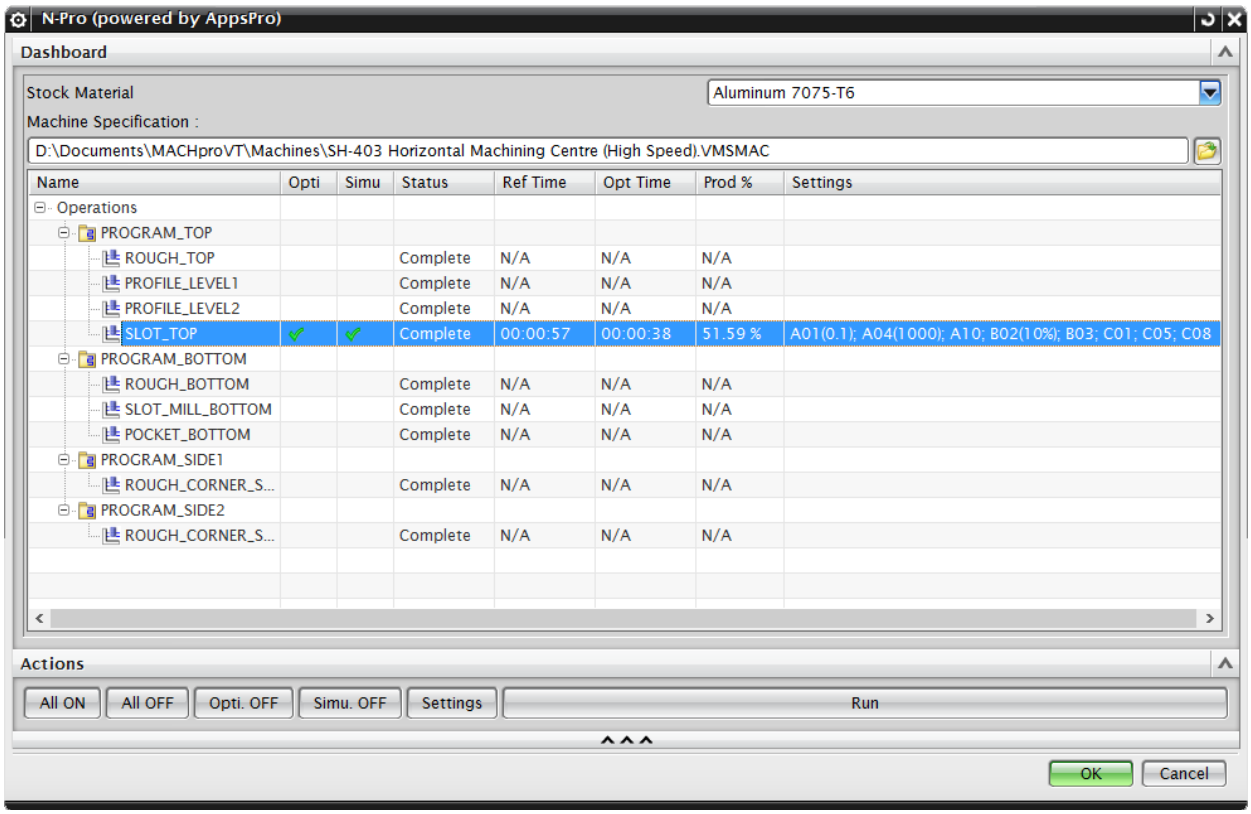
- Area of Material Removed

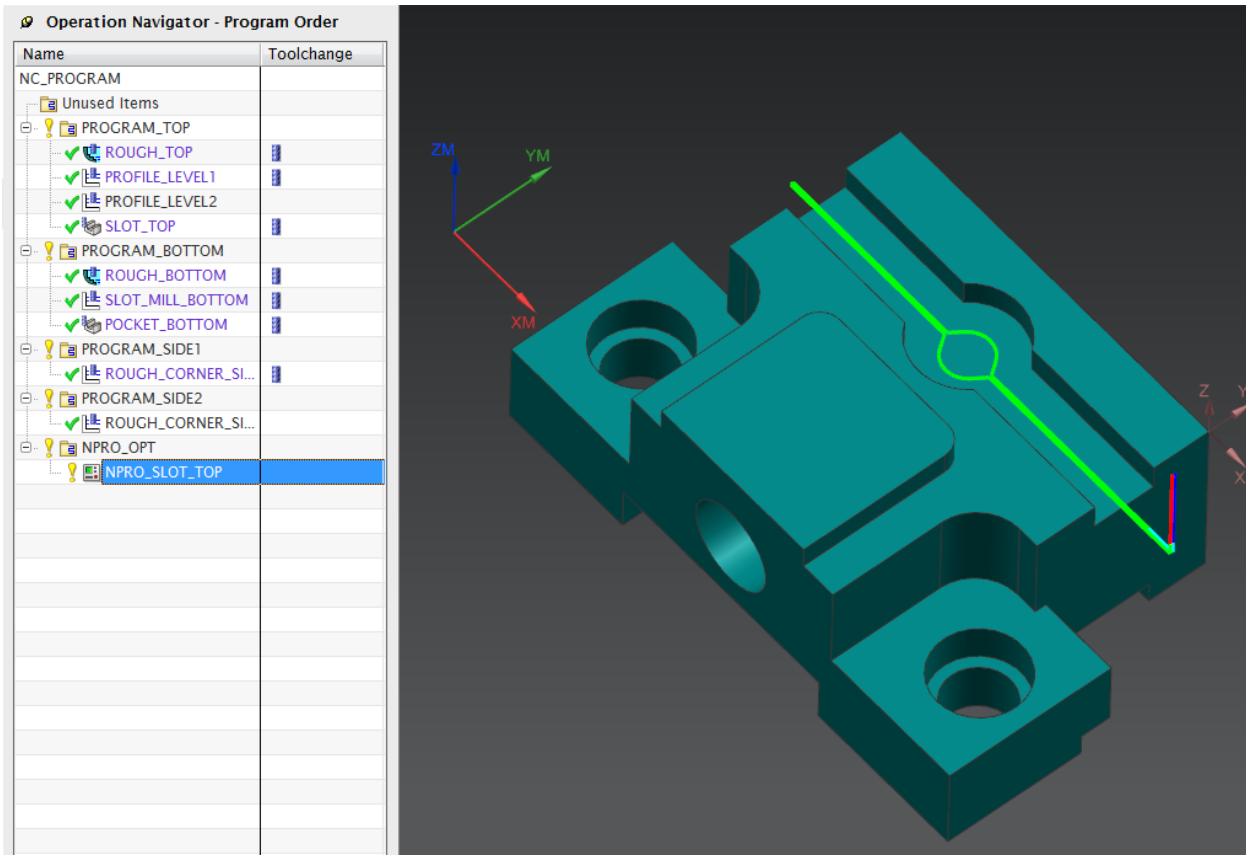
- Energy Consumption



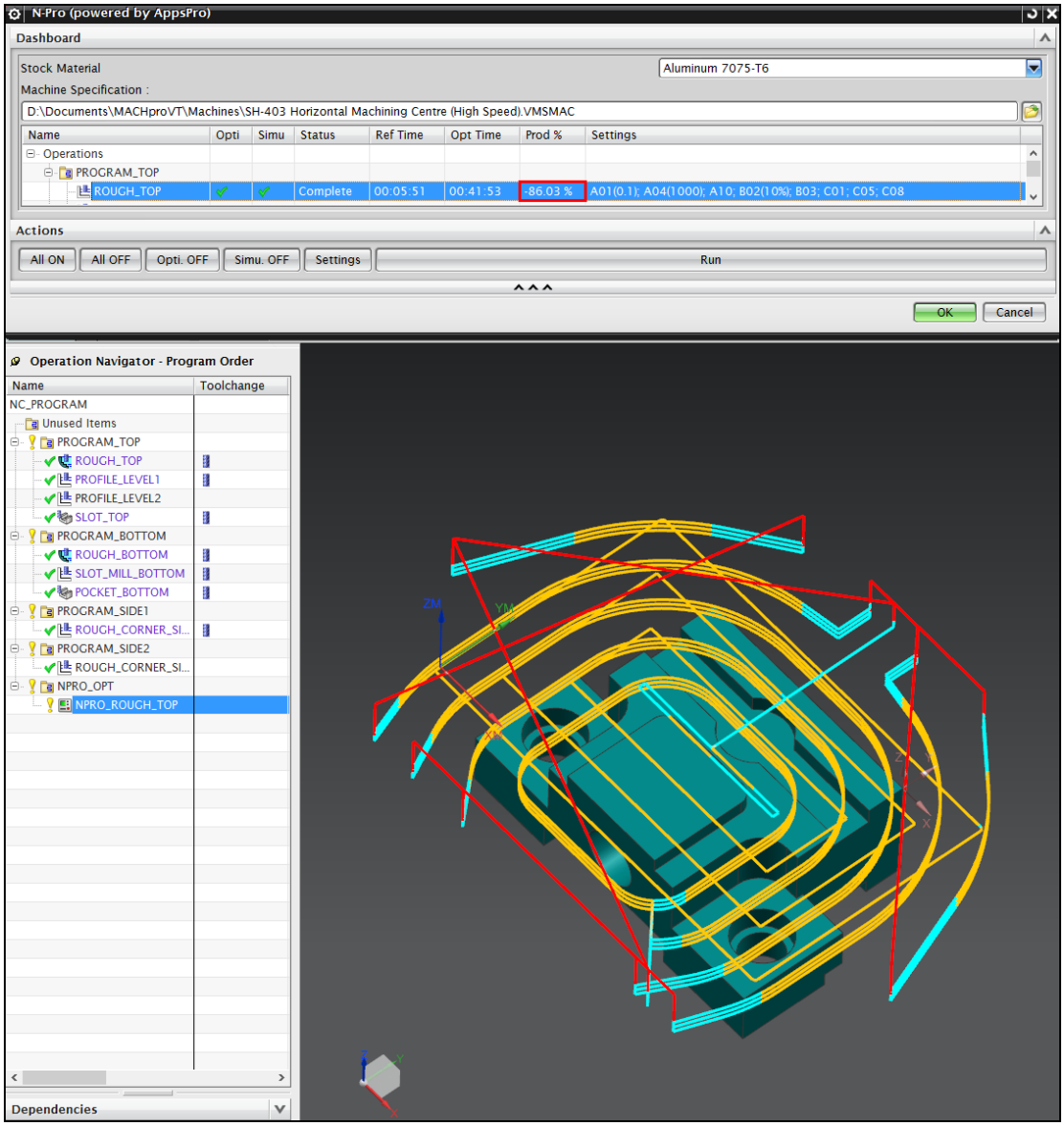
2. **New tool paths** generated instantly with **optimized feed rates:**

✚ Increased (room for improvement)





✚ Decreased (improper feed selection in original toolpath)



These new tool paths will be generated under **"NPRO_OPT"** in the Operation Navigator.

The generated tool paths are color coded as follows:

Red: Rapid movements

Blue: Feedrate Optimized = Feedrate Original

Yellow: Feedrate Optimized < Feedrate Original (Decreased)

Green: Feedrate Optimized > Feedrate Original (Increased)