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TubePro User Manual for Two-Chuck Machines

System: FSCUT 3000 series, FSCUT 5000 series

Document version: V1.1.0

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Foreword

Thank you for using BOCHU TubePro Laser Cutting System Software.

TubePro is a laser cutting software for tubes, featuring high precision and high efficiency. Its main functions include ***Visual Calibration***, ***Parameters Modification***, ***Custom PLC***, ***Simulation*** and accurate control for laser cutting.

For the actual processing, TubePro must work together with the motion control card. TubePro will run in Demo mode when used on a PC without motion control card.

Please note that this manual provides software instructions of the two-chuck machines. For other tools or details required advanced permissions, please refer to other manuals or contact our technical support. Due to the continuous update of system functions, the functions you are using may differ in some aspects from the statements in this manual.

If you have any questions or suggestions, feel free to contact us!

Convention Symbol Explanation

Notice: Supplementary or explanatory information for the use of this product.

Caution: If not operated as specified, it may result in minor physical injury or equipment damage.

Warning: If not operated as specified, it may lead to death or serious physical injury.

Danger: If not operated as specified, it will cause death or serious physical injury.

Disclaimer

The machine tool operation and laser cutting quality have something to do with the material being cut, the laser used, the gas used, the pressure and the parameters you set. Please set the parameters according to your cutting process requirements! Improper parameter setting and operation may lead to poor cutting effect, damage to laser head or other machine components and even personal injury. TubePro has tried its best to provide various protection measures. Laser equipment manufacturers and end users are supposed to abide by operating procedures to avoid injury accidents as possible as they can.

BOCHU shall not be liable for any direct or indirect losses arising from the following circumstances: damages caused by improper use of this manual or the product, failures to comply with safety operating procedures, or force majeure events such as natural disasters.

Additionally, operational equipment carries inherent risks. Users are obligated to implement robust fault-handling mechanisms and safety protections. BOCHU assumes no responsibility for any incidental or consequential losses resulting from such risks.

Revision History

Version No.	Date	Description
V1.1.0	2025/6/10	Updated based on TubePro 10.2501.2.0

Contents

Chapter 1 System Selection Guide

TubePro 2-Chuck is specially designed for efficient tube processing, supporting for functions including ***Dodge***, ***Interpolation Follow,*** and ***Holder follow***, and capable of processing tubes of multiple types. The available systems of 2-Chuck are shown below. You may refer to this table or contact the BOCHU for system selection.

Table 1-1 TubePro 2-Chuck System Selection

Functions	3000S	3000DE-L	3000DE-M	3000DE-G	5000B	5000BH
Real-time EtherCAT	-	√	√	√	√	√
Dodge	√	√	√	√	√	√
Interpolation Follow	-	√	√	√	√	√
BLT Intelligent Cutting Head	-	-	√	√	√	√
Holder Follow	-	-	-	√	√	√
Chuck Size (> 120 mm)	√	√	√	√	√	√
Hardware	Board	Master Station Card	Master Station Card	Master Station Card	Industrial Control Computer	Industrial Control Computer

⚠ Caution: 3000DE-M + Holder Follow= 3000DE-G

Chapter 2 Preliminary Debugging

Preliminary debugging is used for the first power-on debugging. After mechanical assembly is completed, the preliminary debugging can ensure that functions such as each motion axis and holder can be used normally.

2.1 Debugging Procedures

The main procedures are shown below:

Figure 2-1 Main procedures for debugging

2.2 Procedures

Users shall configure the parameters of height controller and the basic parameters of Axis X, Y, Z, A, and B in Machine Config Tool before opening TubePro.

For ***Travel range,*** a rough value can be set in the first. For the ***Pulses, Limit logic, Servo alarms, Return origin direction, Return origin signal***, users should fill in based on the actual situation.

Figure 2-2 Axis configuration

2.2.1 Return Origin

Open TubePro, and visit with Admin mode for following debugging.

Manual jog each axis at low speed. If a soft limit alarm occurs, temporarily disable ***Soft limit protection*** in the ***Jog Quick Settings***. If a ***Return Origin*** alarm occurs, use the ***Ignore Origin Alarm*** option in the drop-down menu of the ***Return Origin*** button.

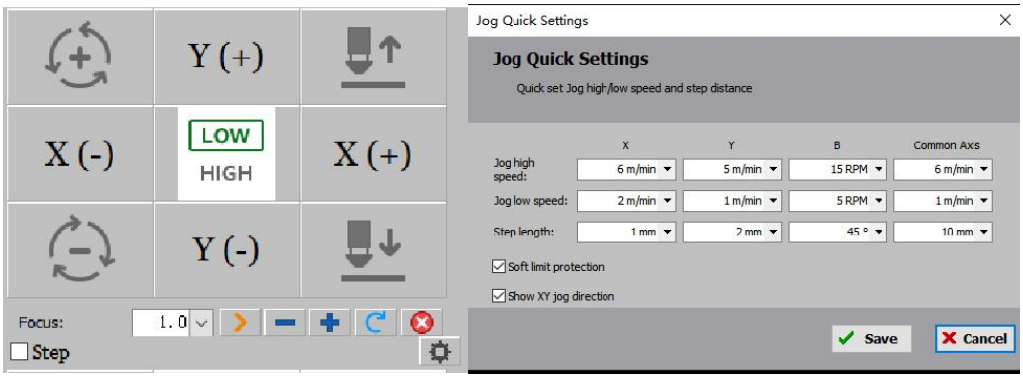


Figure 2-3 Jog settings

After confirming normal jog, open ***Motion control monitor*** under the ***Monitor*** of ***Tools*** menu. Trigger the origin and limit switches of each axis sequentially (do not jog the axis during this step). For photoelectric switches, use a baffle to block the light beam. Observe the corresponding signals on the monitoring interface.

After verifying that the origin and limit switches are functioning properly, you can proceed with the ***Return Origin*** operation.

During the first debugging session, perform single-axis Return Origin tests first. Click the dropdown button for ***Return Origin*** and execute single-axis Return Origin for the Z/X/Y/B axes sequentially.

After confirming successful Return Origin for all individual axes, configure specific Return Origin actions in the ***Return Origin*** according to the machine model. Subsequently, you can directly click ***All Return Origin*** button to perform simultaneous origin returning for all axes.

2.2.2 Holder Debugging

If holders are installed, estimate the Y-axis lowering position parameters for each holder before closing the software to configure them: After performing ***Return Origin***, jog the Y-axis to a position where each holder is safely distanced from the main chuck. Considering parameters like holder lifting/lowering duration and rapid travel speed, ensure no collision occurs during operation. Record the

current Y-axis value as a reference for the holder's lowering position parameter.

After recording all holders, close the software and open the Machine Config tool. Navigate to the ***Holder settings*** page to input the parameters. After configuring holders in the tool, click ***Manual Debug*** in the menu bar to open the ***Debug chuck, holder and single axis*** menu.

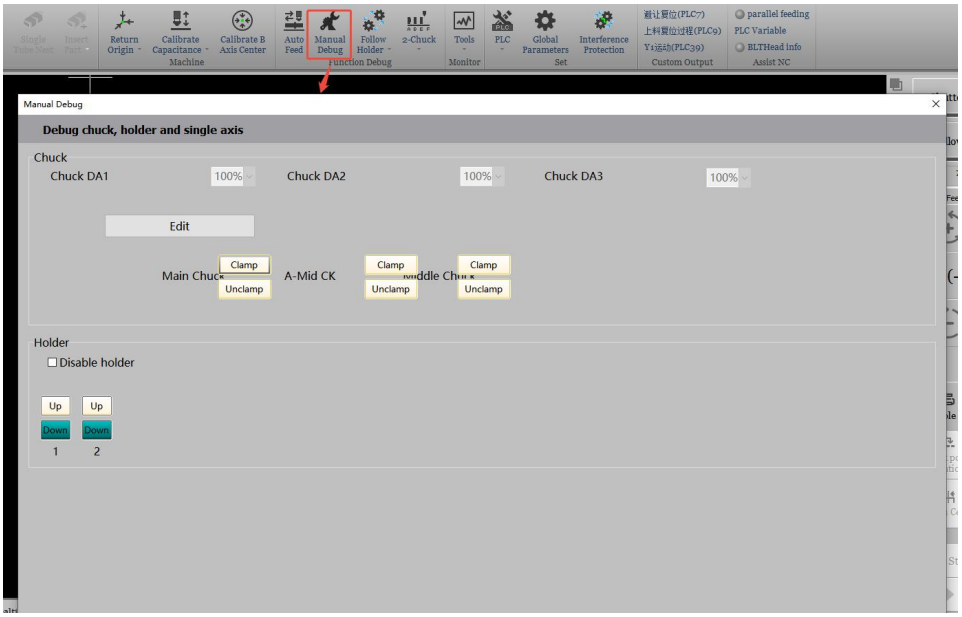


Figure 2-4 Manual debugging

If the holder gas main valve output is configured, ***Disable Holder Function*** will be enabled by default. Disable this manually to proceed. Holders with Y lowering position parameters greater than the current Y coordinate are considered safe and can be manually raised/lowered on the debugging page.

Use a stopwatch to measure lifting/lowering time, then refine the default in-place time and lowering position parameters based on actual performance.

2.2.3 Chuck Debugging

After configuration, the chuck can be controlled to clamp/unclamp in ***Manual Debug***. Measure the time required for the chuck to clamp and unclamp with a stopwatch, and configure this time as the default in-position time for chuck clamping and unclamping.

After successful debugging, load and clamp the tube by clicking the chuck's ***clamp/unclamp*** buttons. If a holder is configured, it can be used in coordination.

2.2.4 Capacitance Calibration

Jog the X/Y/B axes to position the rectangular tube below the cutting head, ensuring the upper surface of the tube is approximately horizontal. Then jog the Z axis to bring the cutting head nozzle close to the tube surface. Click ***Calibrate Capacitance***. A safety confirmation dialog will appear—click ***OK*** to start calibrating the height controller.

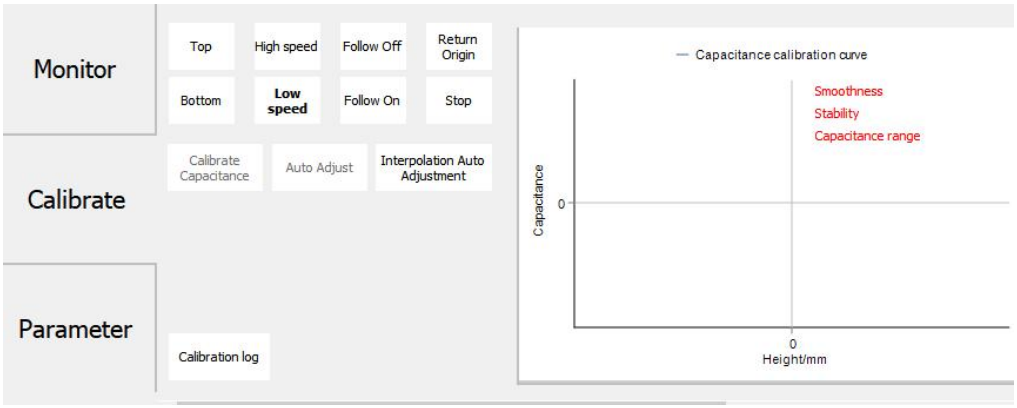


Figure 2-5 Capacitance Calibration

2.2.5 Calibrate B-axis

Step 1 Jog the X/Y/B axes to position a standard rectangular tube (without chamfers) below the cutting head nozzle, ensuring the tube's upper surface is approximately horizontal.

Figure 2-6 B-axis Center Calibration

Step 2 Open ***Calibrate B Axis Center*** window enter the dimensions of the rectangular tube, and click ***Start***. After the calibration is finished, click ***Save***.

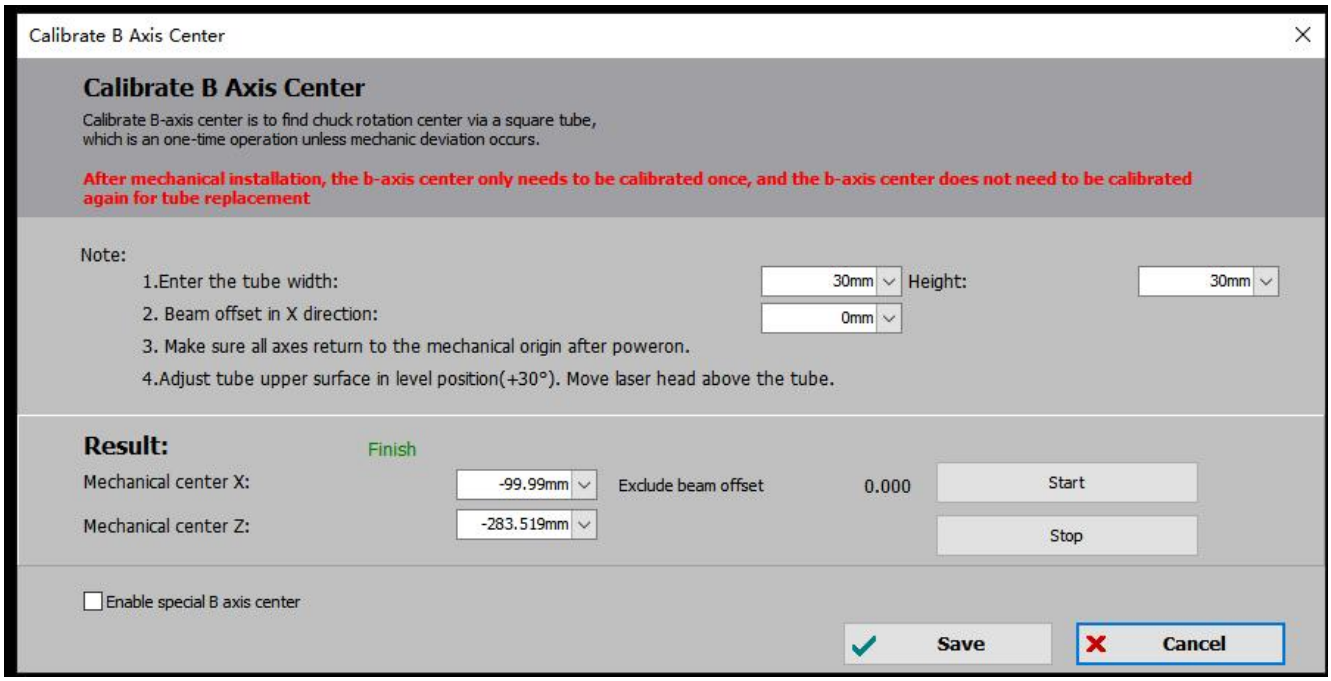


Figure 2-7 Calibrate B-axis center

Notice:

1. A standard rectangular tube without chamfers must be used. Chamfers will affect the accuracy of B-axis calibration.

2. Before calibrating the B-axis center, ensure accurate and reliable coordinates for the X/Z/B axes—perform a full return to origin for all axes beforehand. Calibrate the B-axis center only once during the first debugging; no need to redo it if the mechanical structure is not moved afterward.

Additionally, after configuring basic parameters such as laser, gas, and alarms, the machine will have basic processing capabilities.

Chapter 3 Quick Start

3.1 Quick Start

Quick start for machining with debugged machines. Before processing, it should be confirmed that the system has returned to the origin, and the capacitance calibration and pressure calibration are done. Otherwise, please execute the operations including returning to origin, calibrating the capacitance, and calibrating the B-axis via a standard rectangular tube without chamfers.

The processing procedures of TubePro is shown below:

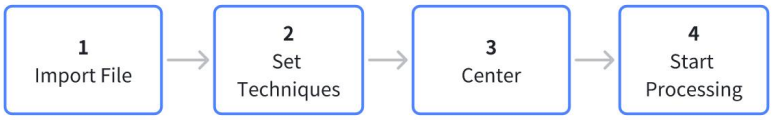


Figure 3-1 The processing procedures of TubePro

3.1.1 Import File

Click the ***Open*** menu and select the *.zx or *.zzx file to be processed. When opening a drawing, the right side of the page previews the processing graphics and dimensions.

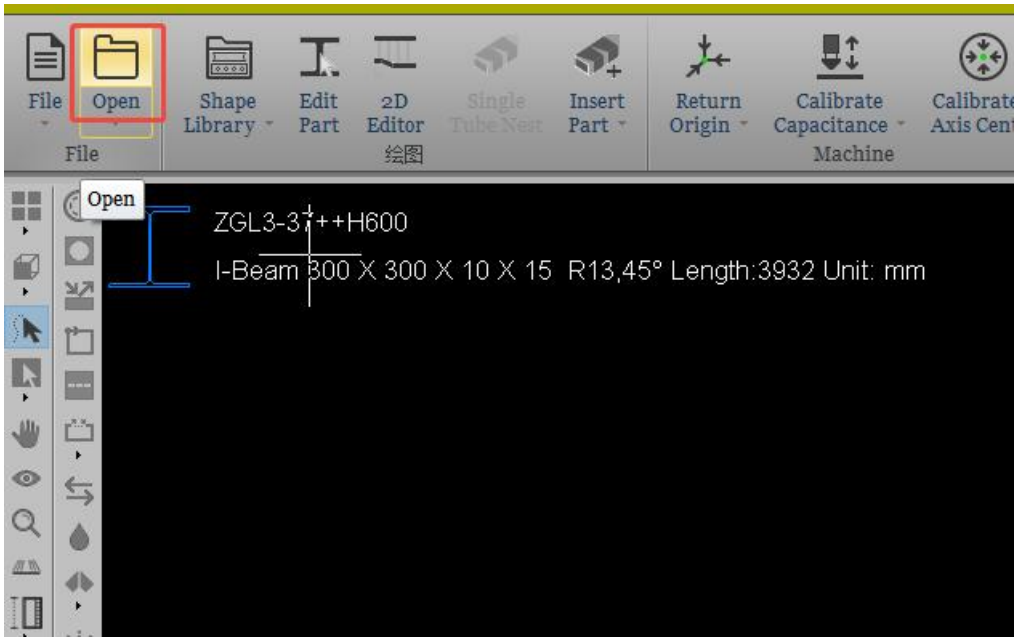


Figure 3-2 Opening a drawing

3.1.2 Set Techniques

After import, use the right-side toolbar to configure layer properties and layer processes for the graphics.

Click the ***Layer*** button to set technique parameters for layers, including cutting, piercing, tube corner, and bevel processes.

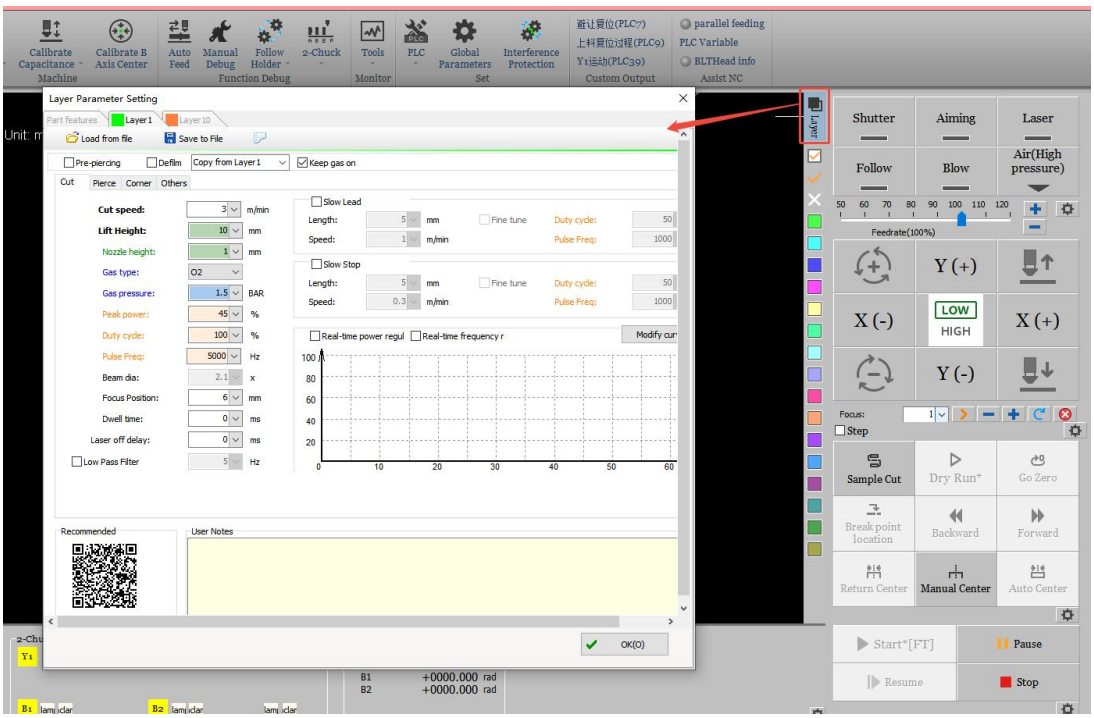


Figure 3-3 Set techniques

3.1.3 Start Processing

Before starting, center the tube, then click ***Start*** in the operation panel to begin processing the graphics. During processing, the part's progress will show in the status bar.

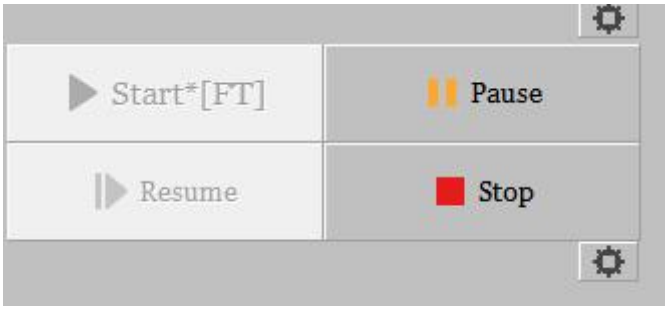


Figure 3-4 Start machining

3.1.4 Alarm Introduction

During operation, if an alarm or warning occurs, relevant information will appear in the top alarm status bar, with the alarm time and details shown in the bottom alarm description area.

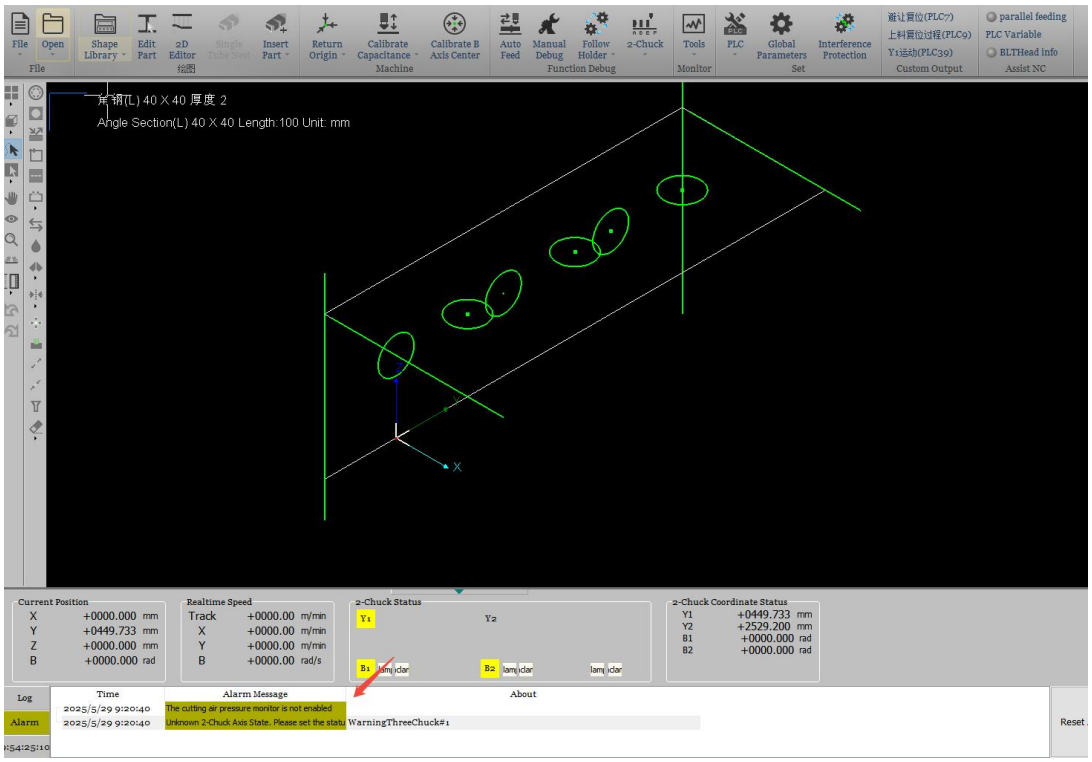


Figure 3-5 Alarm information

⚠ Caution:

1. For axis limit alarms, check axis status via ***Tools → Motion Control Monitor*** to troubleshoot.

2. For I/O port-related alarms, check input status via ***Tools → I/O Board Monitor*** to resolve issues.

3.2 Software Installation & Uninstallation

Close antivirus software and any running TubePro or Machine Config tool before installing. Double-click the installation package and follow prompts to install.

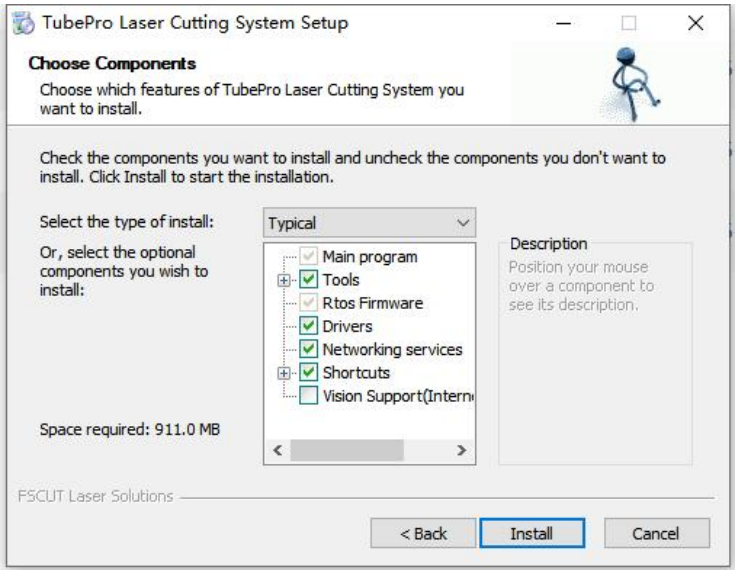


Figure 3-6 Install TubePro

⚠ Caution: Overwrite installation retains previous parameter configurations. To clear all data, please uninstall TubePro.

During uninstallation, choose whether to delete user data. If ***Uninstall user data*** is checked, mechanical settings, PLC configurations, and technique parameters will be erased.

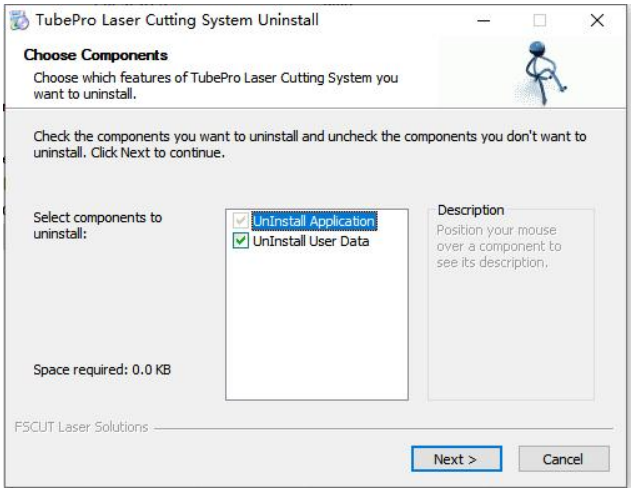


Figure 3-7 Uninstall TubePro

⚠ Caution: By default, deleting user data is checked. For software upgrades, it is recommended to perform an overwrite installation. Use uninstallation only if data loss or file corruption occurs.

Chapter 4 Software Functions

4.1 Quick Access Toolbar

Quick Access Toolbar includes ***Lead-in Line***, ***Start Point***, ***Micro-joint***, ***Reverse, Cooling Point, Weld Seam Compensation, Center, Nudge Graphic, Clear, Display Mode, Views***, etc.

Table 4-1 Quick Access Toolbar

Icon	Name	Description
	Select lines	Select the specified graphic. If you click the part area, you can select all paths of the part at once (the front face of the co-edge part is not selected).
	Drag	Allows you to drag the graphic to view. Alternatively, you can drag the graphic to view it by pressing and holding the ***Ctrl+ scroll***.
	3D view.	It allows you to rotate the view for 3D graphics. You can also enter 3D view mode by holding and dragging the mouse. Press and hold the ***Shift + scroll***, then drag the mouse to rotate the graphics around the central axis of the tube.
	Fit Window	Adjust the display of the graphic to fit the current window.
	Compensation	Set kerf compensation for the selected graphic or all graphics. When compensation is added, the original graphic changes to white, the compensated graphic changes to the original layer color. The actual cut will follow the compensated trajectory.
	In/Out	To choose cut inner or outer, which decides the leadline and compensation are inside or outside the graphic.
	Lead-in Line	Set the lead-in/out line for the selected graphic or all graphics. You can set the lead line type, length, and angle, and add a cooling point.
	Start point	Set the starting position of each trajectory in the graphic.
	Microjoint	Adds a small distance joint on the graphic. The laser will not cut on the place with micro-joint. You can insert multiple microjoints by continuously clicking on the graphic. Hold down the ***Shift*** and click ***Microjoint*** to delete it.
	Gap	Leave a segment uncut at the end of the cutting path (used in C-shaped co-edge cutting).
	Seal	Used to remove gaps and overcuts, restoring the gap/overcut-free state.
	Reverse	Reverse the cutting direction of the machining graphic paths.
	Cooling point.	The laser is off and the gas is blowing at the cooling point.After the cooling

Icon	Name	Description
		point delay, the processing continues. The cooling point delay is configured in the global parameters.
	Weld Seam Compensation	Set whether to use weld seam compensation for the graphic cross-section position.
	Center	Set the starting point of the graphic as the centering point. ● Click ***Center*** for a single selected graphic to set its starting point as the centering point. ● Click ***Center*** for multiple selected graphics to automatically set centering points. TubePro will add centering points to appropriate graphics based on the configured minimum centering point spacing. When processing reaches a centering point, the system will automatically center first and then continue processing.
	Single Face Center.	Set the one-side centering point for trajectories in the graphic. Square tubes and L/C steel profiles support adding one-side centering points, while cut-off lines and side holes do not.
	Tube Profile Measurement:	Allows direct addition of the tube profile measurement function to a trajectory. After successful addition, a **Tube Profile Measurement** label will appear on this bevel trajectory. Supports automatically setting profile measurement points for nesting drawings.
	Nudge	Move the selected graphics slightly along the X or Y-axis direction for easy debugging.
	Clear	You can select ***Clear Compensation/Leadline/MicroJoint/Cooling Point/Nudge/All.***
	Countersink Bevel	Allows modification of toolpaths for parts with Countersink Bevel.
	Join Nearest.	Combines multiple curves into a single curve based on the given merging precision.
	Break Curve.	Divides graphics or part areas along a specific curve.
	Intersect Hole	Regards the curve as a planar curve in the XY plane, used for bevel cutting of intersecting lines.
	Display	Choose whether to show open graphics/processing sequence/path start/path direction/Microjoint/travel path/section/surface rendering/normal vector/ highlighted leadline /cutting head model.
	View	Select the view mode. ● You can select Default/Top/Main/Bottom/Back/Right/Left/Southwest

Icon	Name	Description
		Isometric/Northeast Isometric/Southeast Isometric/East-West Isometric/Northwest Isometric view. View refresh can be switched on/off; ● You can set the view to reverse (rotate the drawing 180° along the Z-axis) in cases where the clamping method of non-symmetric pipe materials such as angle steel and profiled steel is inconsistent with the drawing on the YOZ. In this situation, there is no need to remove and re-clamp the tube. ● You can just reverse the view to ensure the actual tube orientation is consistent with that is in the drawing.
	Measure	After clicking ***Measure***, left-click the two points to be measured on the graph. The distance between the two points and the absolute distances in the X/Y/Z directions will be displayed in the log.
	Undo	Click ***Undo***, and you can withdraw the previous operation.
	Redo	Click ***Redo***, and you can restore the previous operation.

4.2 Machining Control

As shown in the figure, ***Machining Control*** is on the right side of the interface, including ***Burst, Jog, Debug*** and ***Process***, whose control parameters can be changed in settings respectively. The below shows the details about these four operation zones.

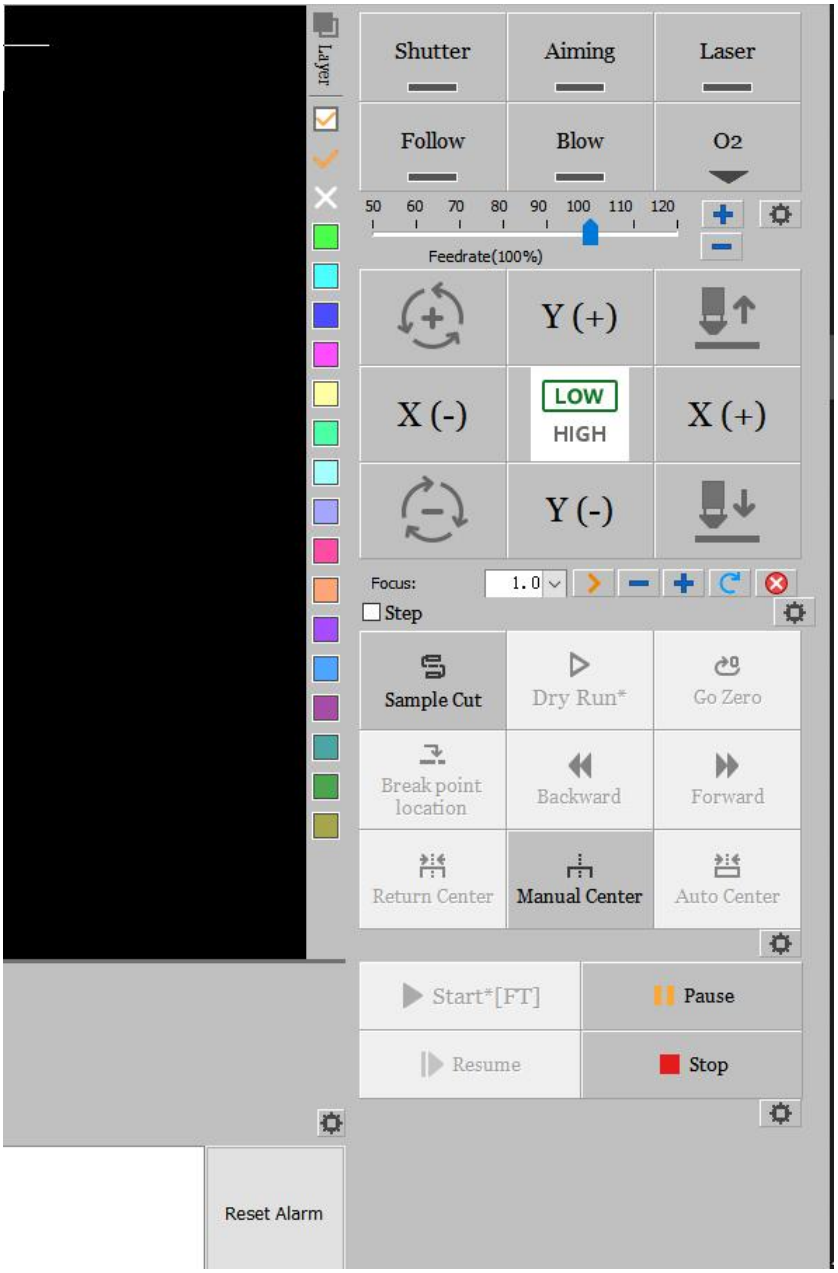


Figure 4-2 Machining control

4.2.1 Burst

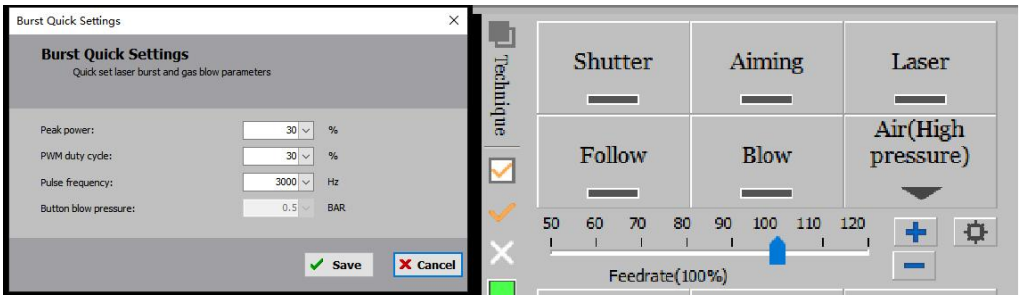


Figure 4-3 Burst control panel

The parameters of Burst Control is shown below:

Table 4-2 Burst Control

Parameter	Description
Shutter	Turn on the Shutter manually before processing.
Aiming	Used as the pilot light. the Aiming can inspect the optical path, verify the laser connection, and position the cutting head.
Laser	Spot-irradiate with the laser. With ***Shutter*** on, left-click for single burst, and right-click for continuous shooting.
Follow	Set the height controller for following levels.
Blow	Click ***Blow*** for air blowing when no tube is being processed. Automatic air blowing is activated during processing, with real-time display of the air blowing status.
Air	Select blowing gas type.
⚙	Quick setting parameters for Laser On and Gas On

Table 4-3 Laser On and Gas On Parameters

Parameter	Description
Peak power	Peak power of burst laser.
PWM duty circle	Set the PWM duty circle when bursting.
Pulse frequency	Set the carrier frequency of the PWM modulation signal, i.e., the number of light emissions per second. A larger value indicates more continuous light emission.
Button blow pressure	Set for the blowing gas pressure.

4.2.2 Jog Control

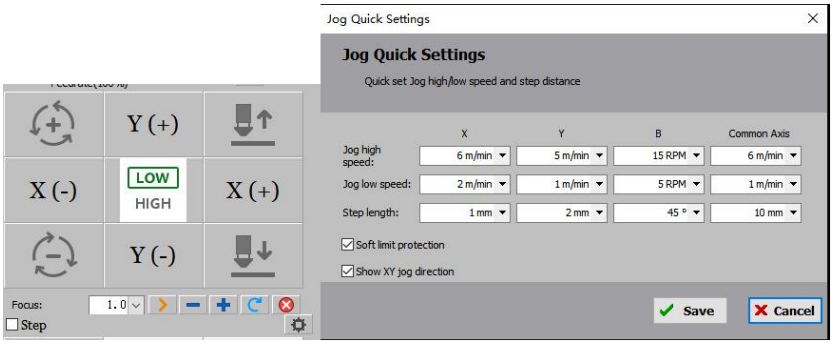


Figure 4-4 Jog control panel

The parameters of Jog Control is shown below:

Table 4-4 Jog Control Parameters

Parameter	Description
Jog panel	Jog or step the X/Y/Z/A/B axes. After configuring general-purpose axes, jogging or stepping for general-purpose axes can also be set.
LOW/HIGH	The option to set Low or High speed for Jog or Step.
Step	If enabled, the cutting head will move by PWM duty circle of designated distance, or it will move by Jog.
Focus	If an electric focusing cutting head is configured, focus jogging is available. The five buttons represent: ***Locate to Specified Point, Negative Jog, Positive Jog, Return Origin, Stop.***
⚙	The specific settings are as follows:

Table 4-5 Jog Quick Settings

Parameter	Description
Jog high speed	Set the high-speed jogging/stepping speed for X/Y/A/B axes and general-purpose axes.
Jog low speed	Set the low-speed jogging/stepping speed for X/Y/A/B axes and general-purpose axes.
Step length	Set the stepping length of X/Y/A/B axes.
Soft limit protection	Set whether the system enables soft limit protection. The soft limit travel is set in Machine Config tool.
Show X/Y jog direction	After checking the box, the jog icons for XY will change from arrows to ±XY directions to indicate the jogging direction.

4.2.3 Debugging Panel

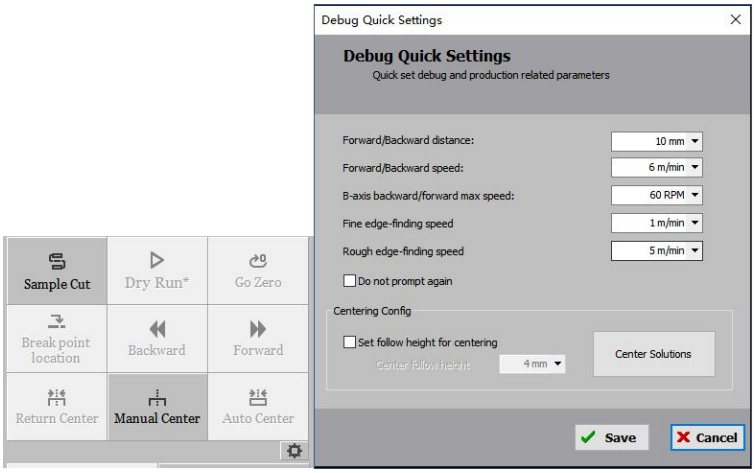


Figure 4-5 Debugging Panel

The parameters are shown below:

Table 4-6 Debugging Operation

Parameter	Description
Sample Cut	Used for non-full-tube processing scenarios. After completing the processing, the machine will stop at the end point, neither returning to the zero point nor executing the PLC (Programmable Logic Controller) command for file termination. This mode can be enabled when processing individual parts.
Dry Run	The machine tool moves according to the graphic, but there is no laser emission, no follow, and no gas blowing.
Return Center	The machine's X, B, Z, and A axes move to the program zero point.
Go zero	The machine moves to the graphic zero point, with all X, Y, Z, B, and A axes in motion.
Break point location	After an error triggers an alarm and stops processing, use ***Break point location*** to return to the exact position where processing halted, then resume operations.
Forward/Backward	After breakpoint positioning or pausing, click ***Forward*** or ***Backward*** to adjust the processing position.
Manual Center	For irregular-shaped tubes where automatic centering fails, manually set the deviation between the tube's drawing center and rotation center.
Automatic Center	Automatically measure tube deviations to ensure trajectory accuracy during processing. The software selects the appropriate centering method based on the imported drawing type.
⚙	Debugging Quick Settings.

Table 4-7 Debugging Quick Settings

Parameter	Description
Forward/Backward distance.	Set the distance for forward/backward adjustments. Use it during pause to position the location.
Forward/Backward speed	Set max moving speed for Forward/Backward.
B-axis backward/forward max speed	Limit the maximum speed of the B-axis during forward/backward operations.
Fine edge-finding speed	Set the speed for precise edge detection during B-axis centering.
Rough edge-finding speed	Set the speed for initial edge detection during B-axis centering.
Don't prompt again	Suppress the ***Resume Processing*** pop-up when restarting via the Remote Control.
Set follow height for centering	When checked, allows setting the cutting head height during centering operations.
Center Solutions	The software suggests suitable centering methods based on the current tube type.

4.2.4 Processing Control Panel

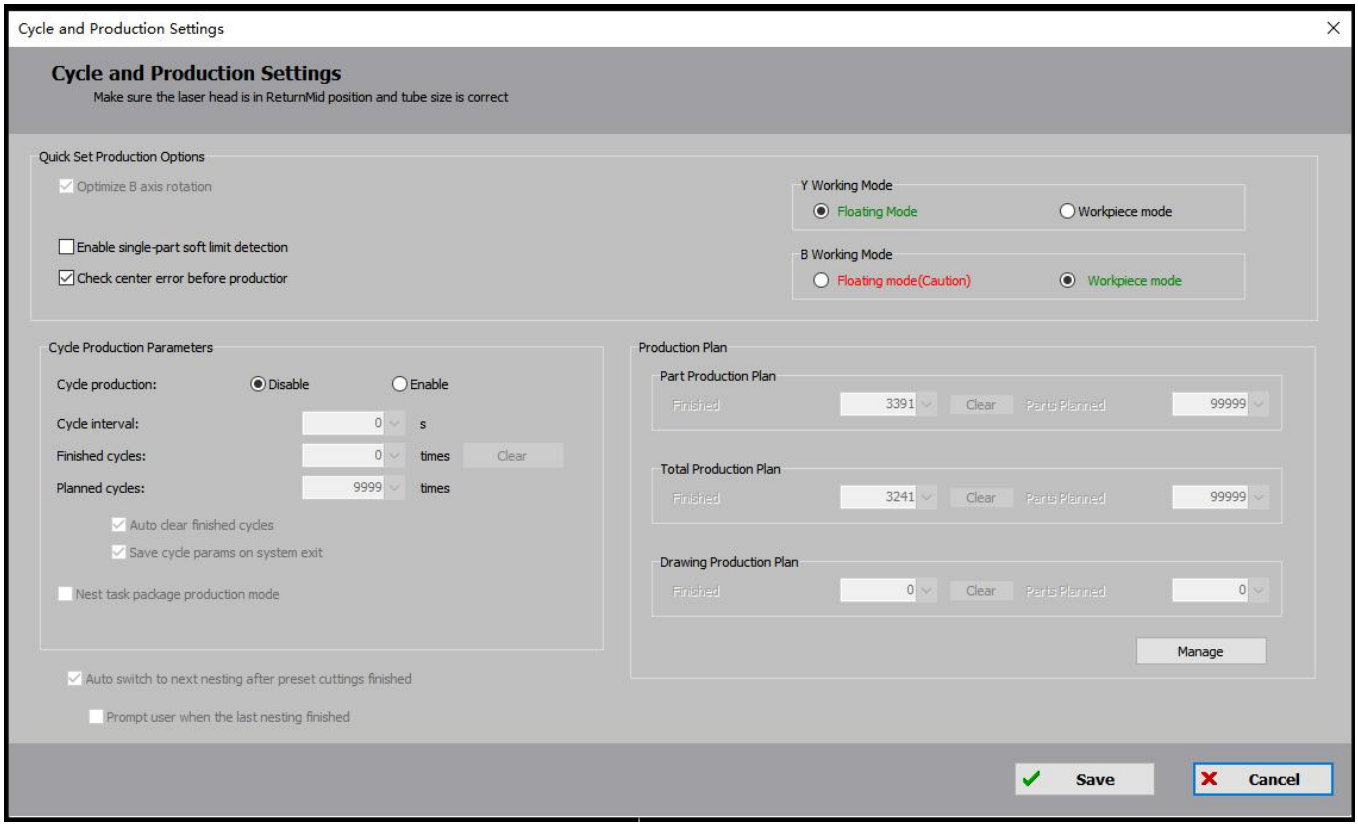


Figure 4-6 Processing control panel

The parameters are shown below:

Table 4-8 Processing Control Panel Parameters

Parameter	Description
Start	Start machining. * indicates modified graphic parameters; A = Auto Loading; F = Auto Feeding; L = Cycle Processing.
Pause	Halt processing. Changes to **Quick Resume**, which skips piercing when resumed.
Continue	Resume processing, including piercing if configured in graphic parameters.
Stop	Stop the current system command.
⚙	Cycle and Production detailed settings.

4.3 File Menu

4.3.1 About

Click ***File → About*** to view: ***Program version, Release date, Control card model, Follower type, Laser model, License expiration date***.

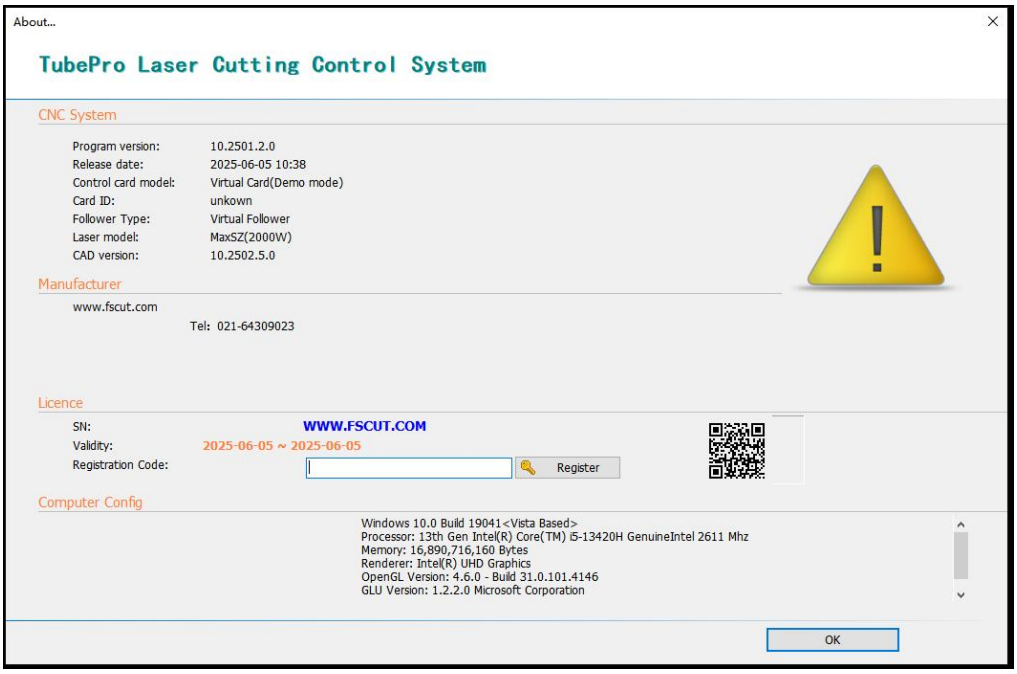


Figure 4-7 About

4.3.2 Parameter Backup & Restore

- Backup: Generate a .cfgpkg file via ***File → Parameter Backup***.
- Restore: Double-click the backup file, select parameters to restore, and click ***Recover***.

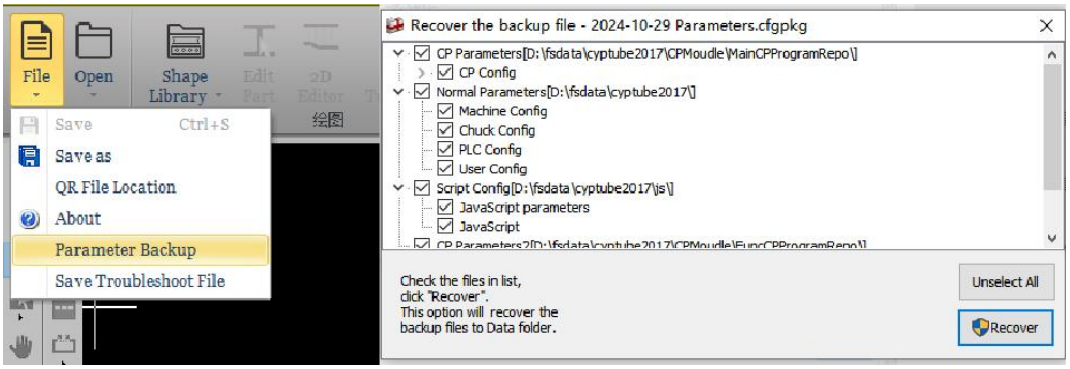


Figure 4-8 Parameter backup and restore

4.4 Return Origin and Machine Calibration

The drop-down menu for returning to origin are shown below:

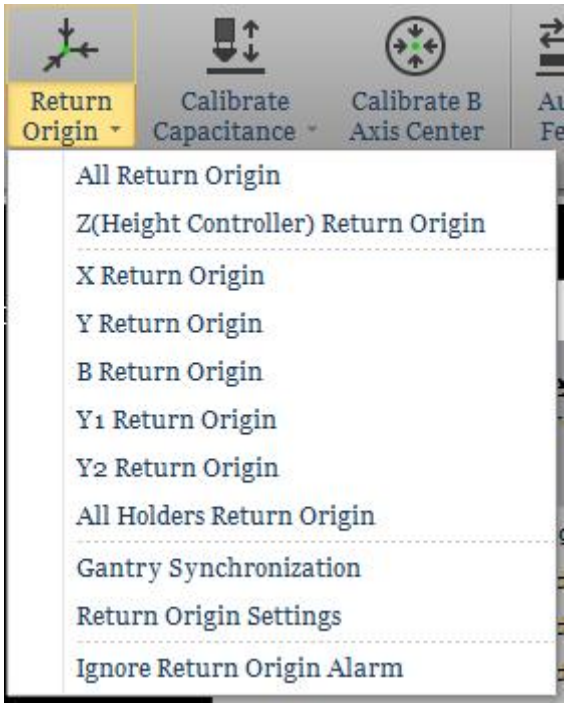


Figure 4-9 Return origin settings

You can configure different origin return methods for specific machine models.The drop-down menu allows selecting independent origin return for axes: Y1, Y2, B1, B2.

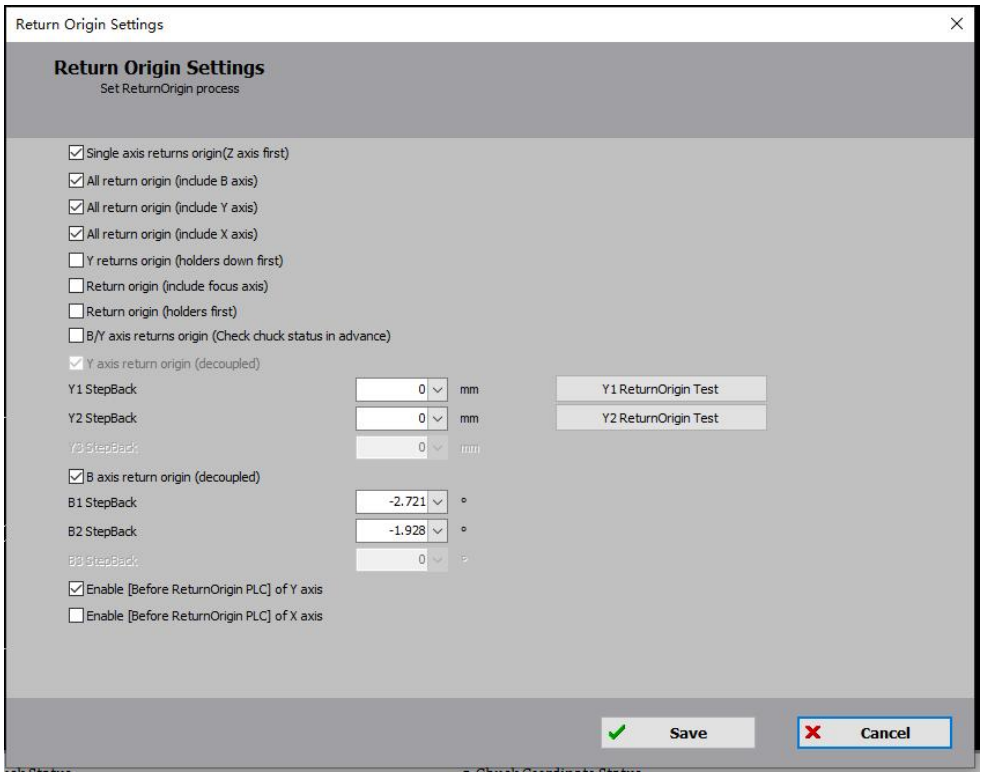


Figure 4-10 Return origin parameters

If ***Return origin alarm alert at startup*** is enabled in ***Advanced Configuration*** of Machine Config tool, the alarm will trigger on startup and must be cleared via origin return. In Admin mode of the software, you can click ***Ignore Origin Alarm*** to suppress this alarm, allowing continued debugging without returning origin. Please ensure personal safety and equipment safety during this operation.

Figure 4-11 Force origin alarm

The parameters are shown below:

Table 4-9 Return Origin Parameters

Parameter	Description
Single axis returns origin (Z-axis first)	To ensure the safety of the cutting head, check this option to make the Z-axis (height controller) return to origin first before single-axis return to origin for X/Y/A/B axes. F indicates the automatic feeding function is enabled; L indicates the cycle processing function is enabled.

Parameter	Description
All return origin (include B-axis)	Not checked by default. Do not check this for machines without B-axis origin switches; for dual-drive B-axis machines with separate origin switches, it is not recommended to check this to prevent tube twisting caused by forgetting to unload the tube during return to origin when ***B-axis independent return to origin after uncoupled*** is also checked.
All return origin (include Y-axis)	Not checked by default. Check this option if you want the Y-axis to return to origin together during all axes return to origin. It is recommended not to check this to avoid the tube falling off the middle chuck or sagging due to gravity after clamping, when performing ***All return origin***.
Y-axis return origin (holders down first)	Checked by default. For safety, holders should be in the lowered state during Y-axis return to origin to prevent collisions.
Return origin (include focus axis)	When checked, the focus axis will return to origin first during the first return to origin after software startup to ensure correct focus position.
Return origin (holders first)	To prevent coordinate errors, checking this ensures all holder axes return to origin first, avoiding chuck collisions with holders.
B/Y axis returns origin (Check chuck status in advance)	When checked, if both the main and middle chucks are clamped, independent B/Y return to origin is not allowed. This prevents the tube from being pulled out or twisted while clamped.
Y-axis return origin (Check chuck status in advance)	Check this option if Y1 and Y2 axes need independent return to origin. Y1 and Y2 axes must have separate origin switches or limiters set.
B-axis return origin (decoupled)	If checked, ensure the chuck is unloaded before return to origin. The B-axis will perform independent return to origin and retract by their respective set distances, with inconsistent angles between chucks during the process, which may cause tube twisting or serious damage if clamped. If unchecked, all B-axes move synchronously during return to origin.
Enable ***Before ReturnOrigin PLC*** of Y-axis	Checked by default. The Y-axis will execute ***PLC before Return Origin*** and ***PLC after Return Origin*** during return to origin.
Enable ***Before ReturnOrigin PLC*** of X-axis	Checked by default. The X-axis will execute ***PLC before Return Origin*** and ***PLC after Return Origin*** during return to origin.
All return origin (include A-axis)	Not checked by default. Check this option if you want the A-axis to return to origin together during full return to origin.

4.4.1 Capacitance Calibration

Before calibrating the height controller, jog the cutting height, and make sure the nozzle approximately 2 mm above the metal tube surface. Click ***Capacitance Calibration*** in the software and wait for successful calibration. A calibration result showing ***Smoothness: Excellent, Stability: Excellent*** indicates success.

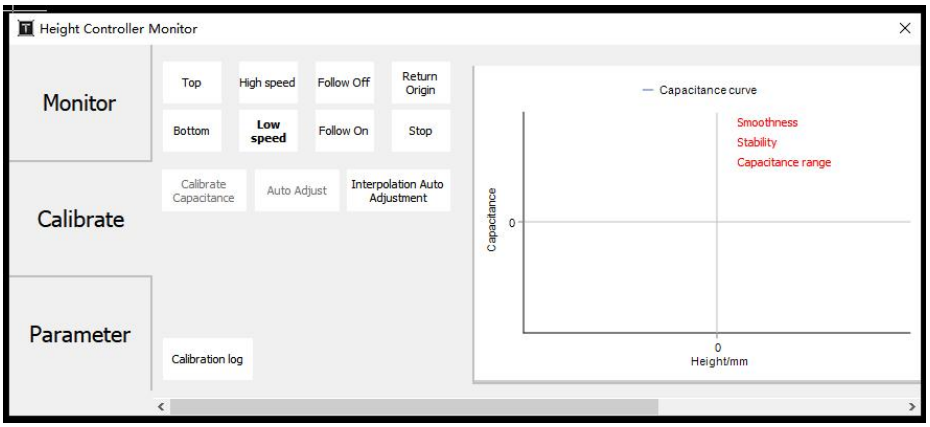


Figure 4-12 Sampling range of Capacitance Calibration

4.4.2 B-axis Center Calibration

Once the mechanical structure is fixed, the B-axis has a fixed rotation center. Calibrating the B-axis center determines the coordinates (X, Z) of this center on the XZ plane. Use a standard rectangular tube without chamfers for calibration. Ensure the X, Z, A, and B axes have completed return to origin. Position the cutting head nozzle above the standard tube, enter the tube's width and height, then click ***Start***. Save and exit after calibration is complete.

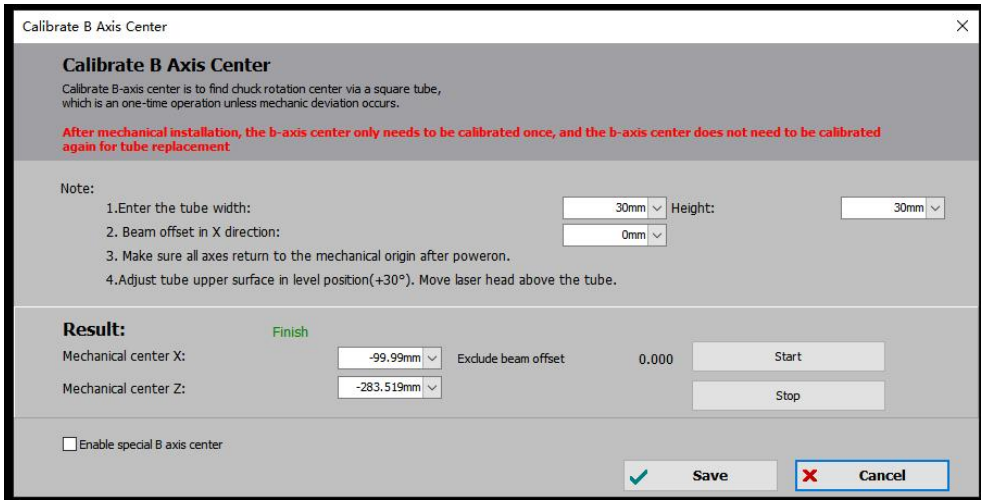


Figure 4-13 Calibrate B-axis Center

The parameters are shown below

Table 4-10 Calibrate B-axis Center Parameters

Parameter	Description
Rectangular Tube Dimensions	Set the width and height of the standard rectangular tube. It is recommended to use standard rectangular tubes without chamfers.
Exclude beam offset	Set the beam spot offset error of the current cutting head. Application Scenario: TubePro measures the B-axis center based on the nozzle center. If the piercing hole cut has deviations due to the laser beam spot not being at the nozzle center, divide the deviation by 2 and enter it as the beam offset.
Result	Displays the mechanical rotation center coordinate value.
Enable Special B-axis Center	If the machine tool has a special structure (e.g., 7-Axis Delivering model or middle chuck dodge model) where the mechanical rotation center changes during cutting, a special B-axis center can be pre-calibrated. The default B-axis center is still used for normal cutting. When the mechanical rotation center changes, the special B-axis center can be enabled via PLC to improve cutting accuracy. The Copy + Save button copies the B-axis center values.
Save/Cancel	Save: Records the measurement result as the B-axis center. Cancel: Discards the changes without saving.

4.5 Manual Debug

The ***Manual Debug*** page is shown below:

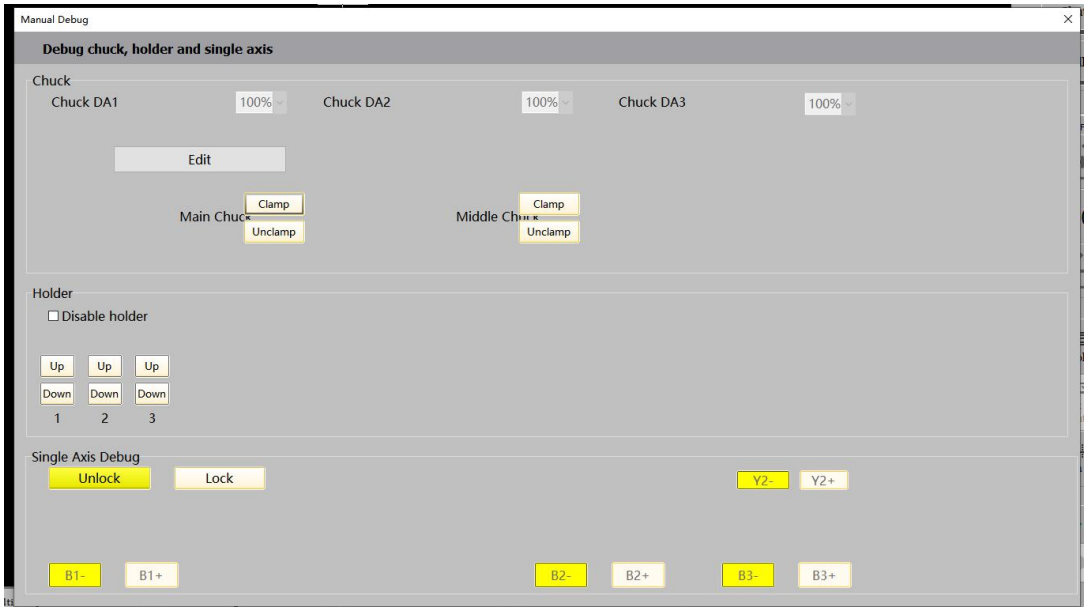


Figure 4-14 Manual Debug

4.5.1 Chuck Debugging

Before clicking chuck ***Clamp/Unclamp*** on the ***Manual Debug*** page, use a stopwatch to measure the time required for the chuck to clamp and unclamp. Then configure this time as the ***Default in-place time*** for chuck clamping and unclamping in Machine Config tool. After configuration, test whether the in-place time is set reasonably.

The manual debugging interface displays chucks configured in Machine Config tool; unconfigured chucks are hidden.

The chuck pressure ratio corresponds to the chuck pressure auxiliary DA in the Machine Config tool, which adjusts clamping pressure after configuration.

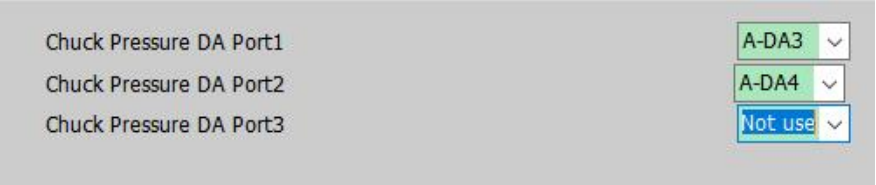


Figure 4-15 Chuck air pressure auxiliary DA Pport

Click ***Clamp/Unclamp*** to actuate the corresponding chuck. After the default in-place time, the button turns green to indicate the current chuck status.

4.5.2 Holder Debugging

Before debugging holders, configure the corresponding lowering position parameters for each holder in Machine Config tool. Only holders with Y lowering position parameters greater than the current actual Y coordinate are considered safe and can be manually raised/lowered on the manual debugging page.

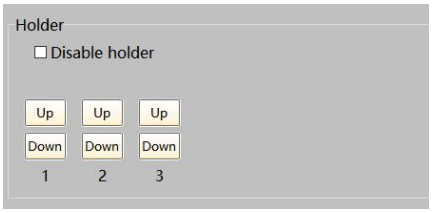


Figure 4-16 Holder debugging

If a holder gas main valve output port is configured in Machine Config tool, ***Disable holder*** is enabled by default. You should disable it manually to start holder debugging.

4.6 **Holder Follow**

If follow holders for loading are configured, a ***Holder Follow*** icon will appear in the function debugging area. Click ***Holder Follow*** to enter the debugging page, where you can perform jogging, origin returning, and holder calibration to enable coupled follow during processing.

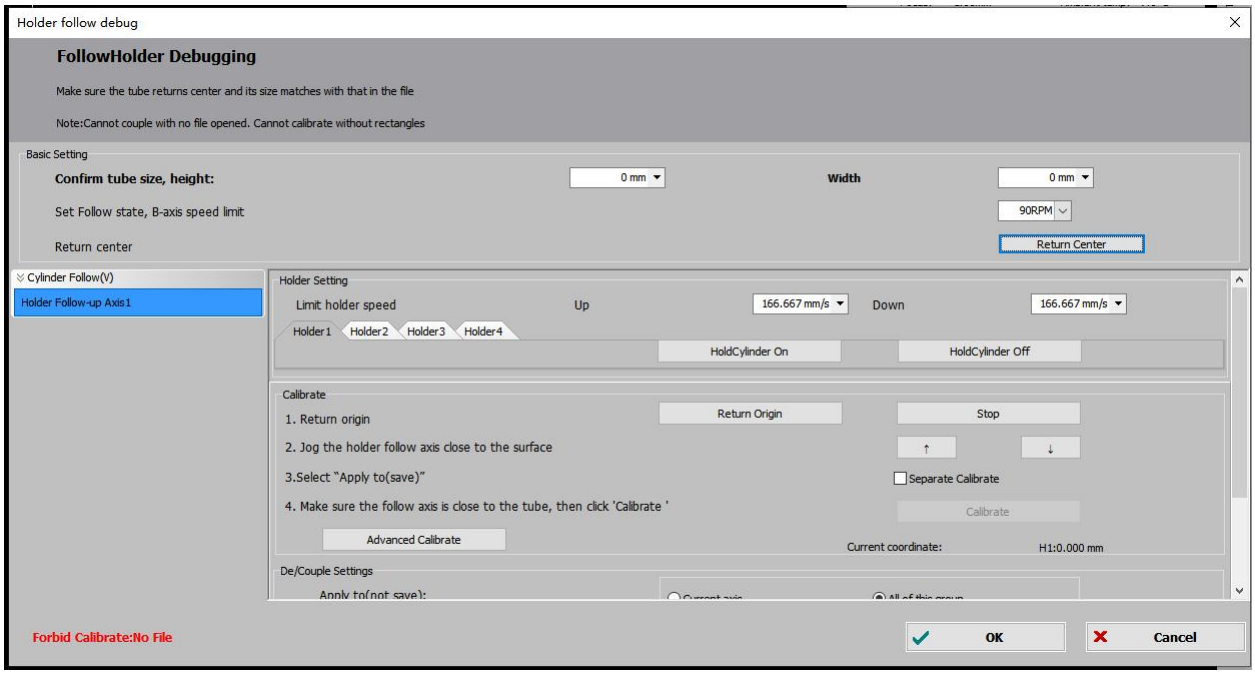


Figure 4-17 Holder Follow

⚠ Notice: The FSCUT3000DE-L does not support ***Holder Follow***.

4.7 Monitor

4.7.1 Height Controller Monitor

Click ***Tools→Monitor→Height Controller Monitor,*** and you can see the real-time capacitance, capacitance curve and capacitance temperature drift caused by heat, as shown in the following figure:

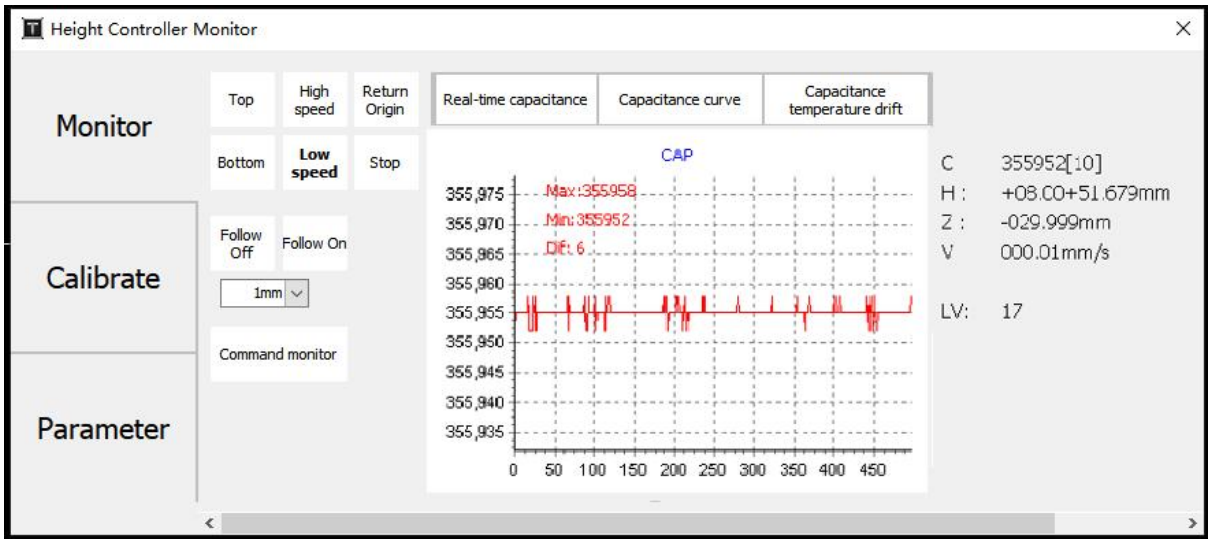


Figure 4-18 Height controller

On the ***Calibrate*** page, you can calibrate the capacitance, adjust the rigidity level, and check the history record of capacitance calibration.

Height Controller Monitor page is consisted of the parameters to adjust the height controller. After clicking on ***Unlock Parameter***, you can modify the parameters. After modification, you must click **Write In Parameter** to save and apply the modified parameters.

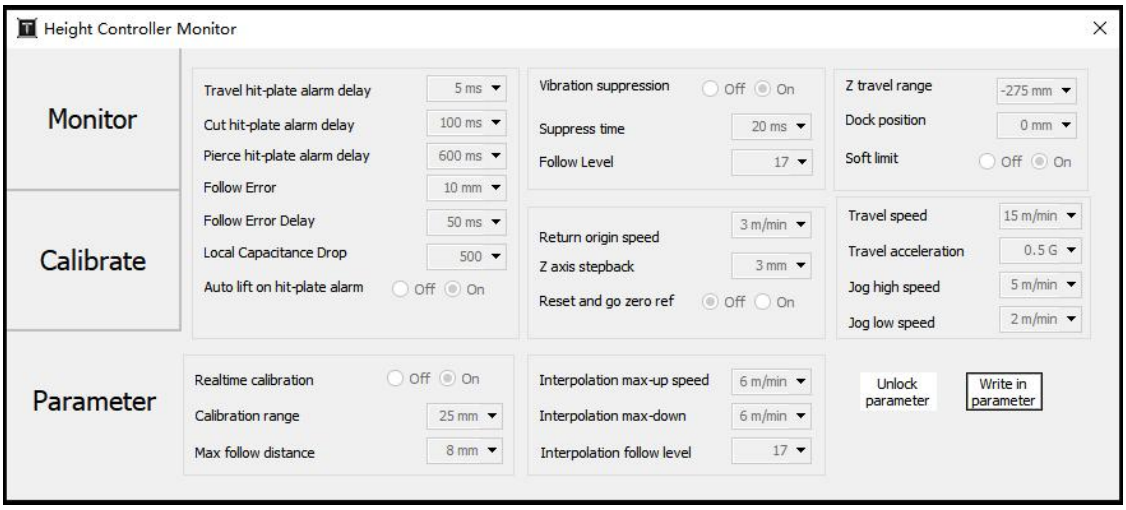


Figure 4-19 Detailed Parameter

Table 4-11 Height Controller Parameter Table

Parameter	Description
HitPlate alarm delay in Travel/Cut/Pierce	When the system is in Stop, Travel, Cut or Pierce status, if HitPlate duration reaches the delay time you set, then the cutting head will automatically lift up for protection and give alarm signals. When this value is set to 0, the hit-plate alarm will no longer be triggered in the Stop/Travel/Cut/Pierce state.
Follow error	Maximum follow error allowed by the height controller. After the cutting head follows in place, once the follow error exceeds this set value as the cutting head moves out of the tube boundary or the tube shakes violently, it will give a Follow deviation alarm.
Follow error delay	Set Follow Deviation Alarm filtering time. Set it larger to allow longer follow error time for better anti-interference capability.
Local capacitance drop	When local capacitance diminished exceeds this set value, TubePro will give this alarm.
Vibration suppression	It is capable to suppress the vibration caused by the cutting airflow on the tube with weak structural rigidity so as to reduce the cross-section wavy lines. Also the vibration from airflow and surface slags.
Suppression time	It can determine the intensity of Vibration suppression, and a larger value will get stronger suppression effect but slower controller response. The default value is 20 ms, and the recommended range is 5 ~ 50 ms.
Follow level	The Follow Level ranges from 1 to 30, and the default is 17. A higher level brings less average error and quicker follow motion, also stronger Follow capability on the tilted tube. However, if the gain is too strong, the system will generate self-excited oscillation. You can automatically acquire a proper level by auto adjust.
Return origin speed	The speed for returning origin.
Z-axis stepback	A retreat distance from the origin switch, set as the Z-axis coordinate origin.
Reset and go zero ref	Whether to go to ***Zero Ref***. after ***Return Origin***.
Z travel range	The stroke of Z-axis. (downward is negative).
Dock position	Dock coordinate for Z-axis.
Soft limit	Whether to enable Soft Limit Protection for the height controller.
Travel Speed	Travel speed of the height controller.
Travel Acceleration	Height controller travel acceleration.
Jog high speed	Set high speed parameter for Jog.
Jog low speed	Set low speed parameter for Jog.

4.7.2 Motion Control Monitor

Click ***Tools→Monitor→Motion control monitor*** on the top bar of TubePro, and you will see the window below:

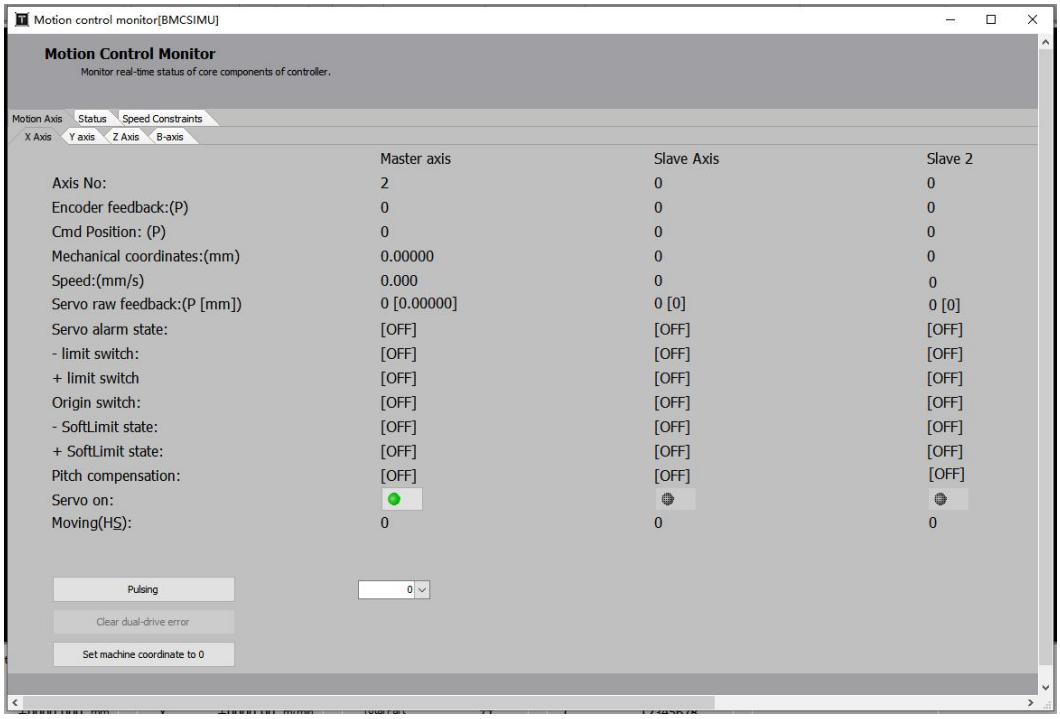


Figure 4-20 Motion axis monitor

On the **Motion Axis** monitoring page, you can view the enabled status, alarm status, hard limit status, soft limit status, origin returning switch status, pitch compensation status, command position, feedback position, mechanical coordinates, and motion speed of each servo axis. You can also send servo enable/disable commands, pulse debugging commands, clear coordinates, and clear dual-drive alarms. The specific parameters are as follows:

Table 4-12 Motion Axis Monitor Parameters

Parameter	Description
Axis No.	The configured physical axis number.
Encoder feedback	Servo encoder feedback value. (Unit: pulses.)
Command position	Command position, unit: pulses.
Mechanical coordinates	Mechanical coordinates, i.e., system command coordinate position, unit: mm or rad.
Motion speed	Real-time feedback speed of the current servo.
Servo raw feedback	Records the feedback position of the servo motor, unit: pulses.
Servo alarm state	Current alarm status of the servo.

Parameter	Description
-/+ limit switch	Current input status of negative/positive hard limit switches.
Origin switch	Current input status of the Return Origin switch.
-/+ SoftLimit switch	Current negative/positive Soft Limit input status.
Pitch compensation	Only supported for X and Y axes, and used for detection if pitch error compensation is enabled.
Servo on	Click to enable or disable servo power.
Pulsing	In the system stop state, specified pulses can be sent for testing.
Clear dual-drive error.	Clear the errors of dual-drive.
Set machine coordinates to 0	Set the current coordinate of Z-axis as zero.

On the page of ***Status*** monitoring, it is possible to view more low-level kernel status information, such as mechanical coordinates, program user coordinates, and G-code instruction information, etc.

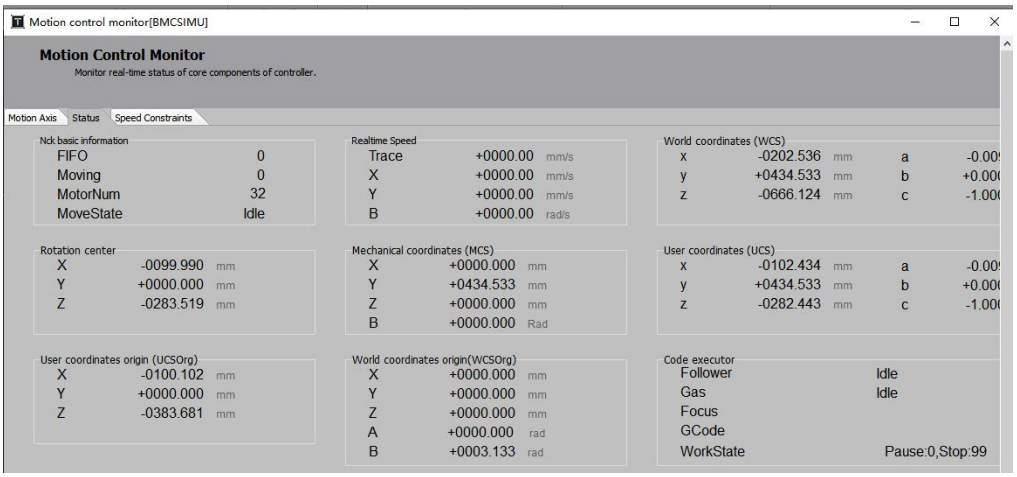


Figure 4-21 Status monitoring

On the ***Speed Constraints*** page, you can directly view the constraint configurations for the speed and acceleration of each logical axis.

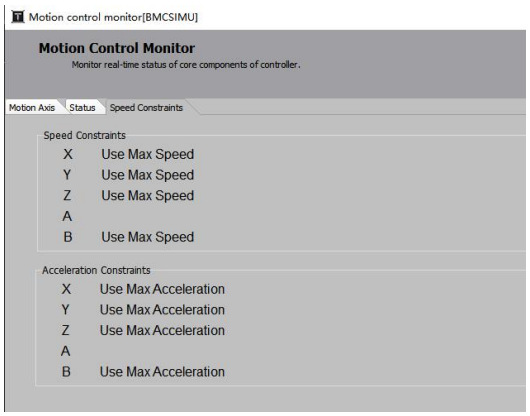


Figure 4-22 Speed Constraints

4.7.3 IO Board Monitor

Click ***Tools→Monitors→IO Board Monitor***, and you can see the window shown below:

In IO Board Monitor interface, you can select a specific board ID on the upper left, and test inputs and outputs, monitor inputs status, adjust PWM and DA signals and check DA sampling results etc.

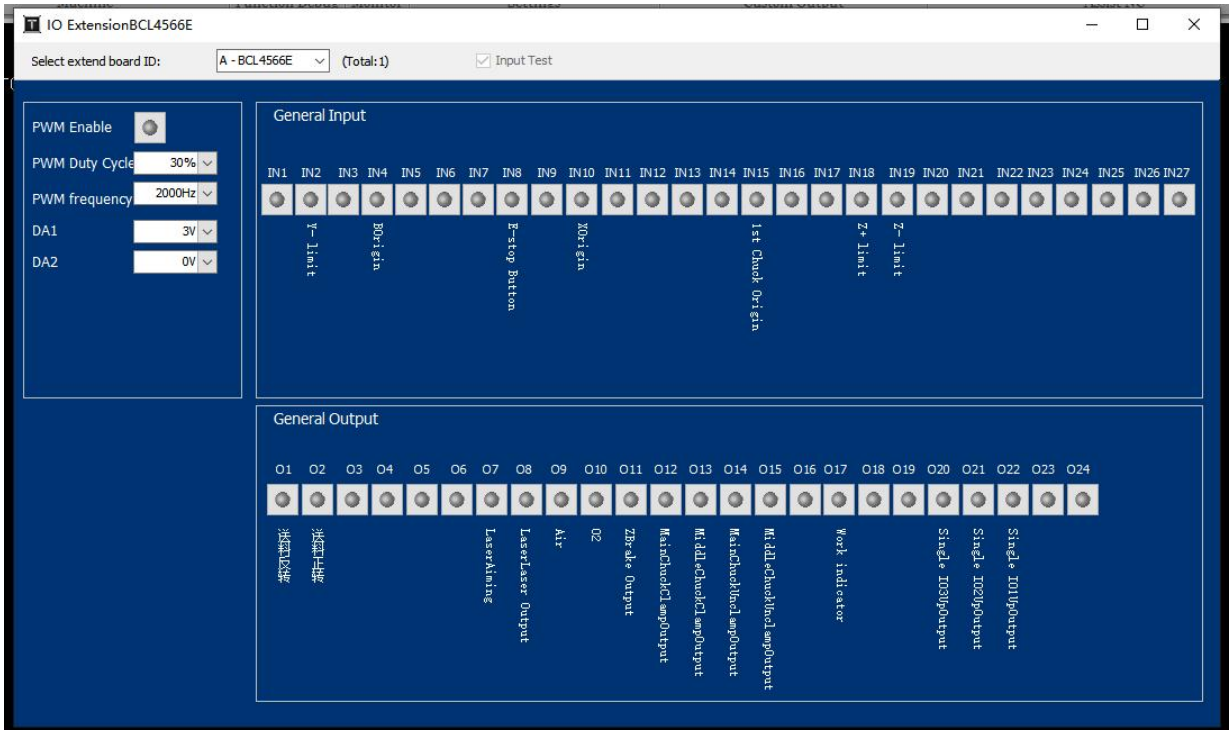


Figure 4-23 IO Board Monitor

4.7.4 Realtime Curve Monitor

Click ***Tools→Monitors→Realtime Curve Monitor***, and you can see the window shown below:

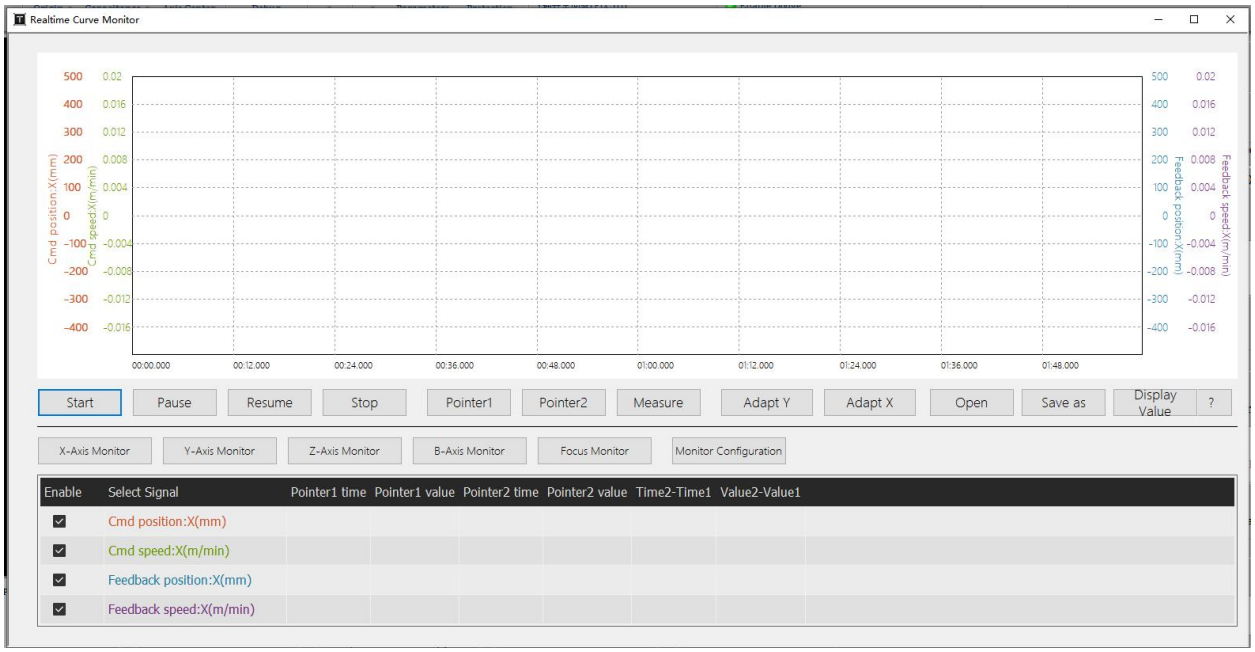


Figure 4-24 Realtime Curve Monitor

Realtime Curve Monitor can accurately sample the command position, command speed, feedback position, feedback speed, feedback torque, command position deviation, double-drive position deviation, buffer number and BCS height. You can select four signals for each monitoring, and all logic axes and functional axes are included. The monitoring result can be displayed in curve. By default, there will be four signal curves which can be selected as needed by clicking ***Signal Name*** at the bottom. You can also zoom a certain range of the curve by selecting.

Vertical axis zoom of the curve is achieved via the mouse wheel. Hold down the ***Ctrl*** and left-click to pan the monitoring curve vertically/horizontally. The monitoring range of the curve in the window can also be adjusted using ***Adapt Y*** or ***Adapt X***.

Left-click and drag to select a region of the monitoring curve for zooming in to view details. Two cursors (Pointer 1 and Pointer 2) can also be set on the curve to capture precise values at specific moments. All monitored curves can be saved as *.csv files for data storage. You can open previously saved *.csv files at any time to review the monitoring curves.

4.7.5 Remote Control Features

Click ***Tools→Monitors→Remote Control Features***, and you can see the window below. This interface can display the configured extended functions and the effect of swapping the order of X and Y.

Figure 4-25 Remote Control Features

4.8 Auxiliary

4.8.1 Quick CutOff

Click ***Tools→Auxiliary→Quick CutOff***, and you can see the window below.

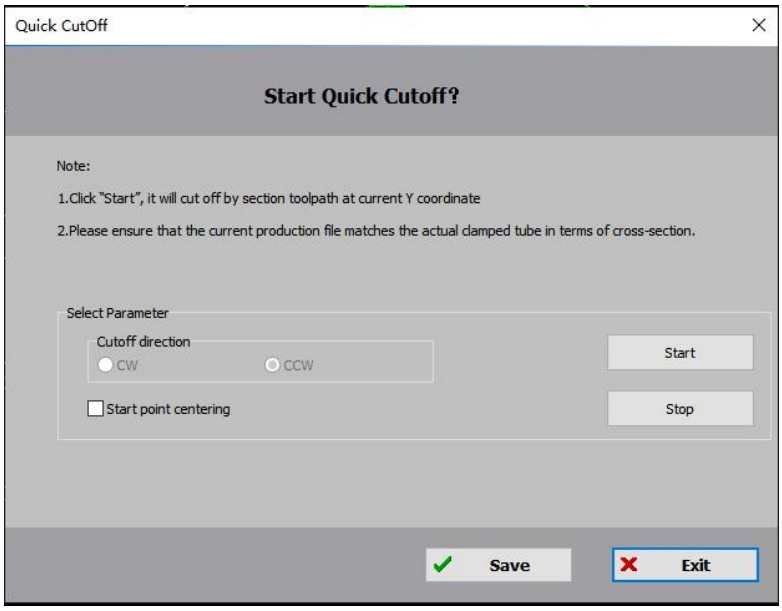


Figure 4-26 Quick CutOff

TubePro supports ***Quick CutOff*** for common tube types such as square tubes, rectangular tubes, round tubes, triangular tubes, obround tubes, and flat steel, as well as some irregular tubes. However, Quick CutOff cannot be used for channel steel, angle steel, or irregular tubes with unclosed or concave cross-sections.

Quick CutOff will sever the tube clockwise or counterclockwise at the current Y-axis position. If ***Start point centering*** is checked, a start point centering operation will be performed before cutting.

4.8.2 Quick Align Tube Head

Click ***Tools→Auxiliary→Quick Align Tube Head***, and you can see the window below. This function is capable of finding the tube head automatically, and the cutting head finally stops at a certain distance from the tube head.

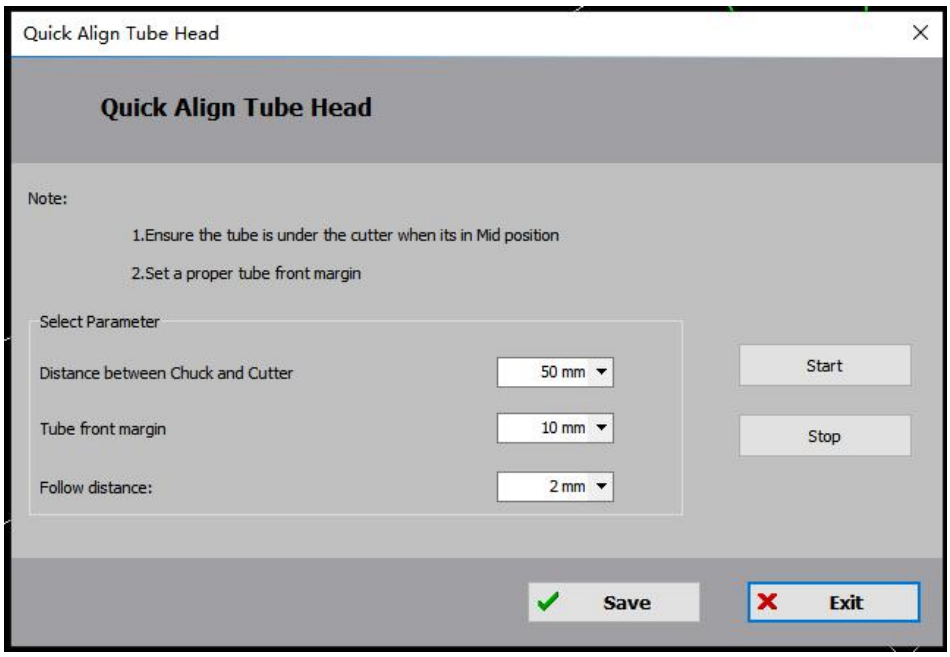


Figure 4-27 Quick Align Tube Head

The parameters are shown below:

Table 4-13 Quick Align Tube Head Parameters

Parameter Name	Description
Distance between Chuck and Cutter	To prevent the follow-up head collision caused by the tube not extending below the cutting head, the tube will be fed forward by a certain distance when performing ***Quick Align Tube Head***. The default parameter is 120 mm, which can be adjusted according to actual conditions.
Tube front margin	After the cutting head moves outward to detect the tube edge, the Y-axis advances by an offset distance in the positive direction to prevent vibration caused by processing at the tube's edge.
Follow distance	The cutting head height when executing ***Quick Align Tube Head.***

4.8.3 Quick AI Weld Seam Detection

Click ***Tools→Auxiliary→Quick AI Weld Seam Detection***, and you can set for operations after weld seam detected.

Figure 4-28 Entrance of the function

This configuration performs the same effect as that in Machine Config tool. The changes of this window will be synchronized to the configurations in Machine Config tool, and vice versa.

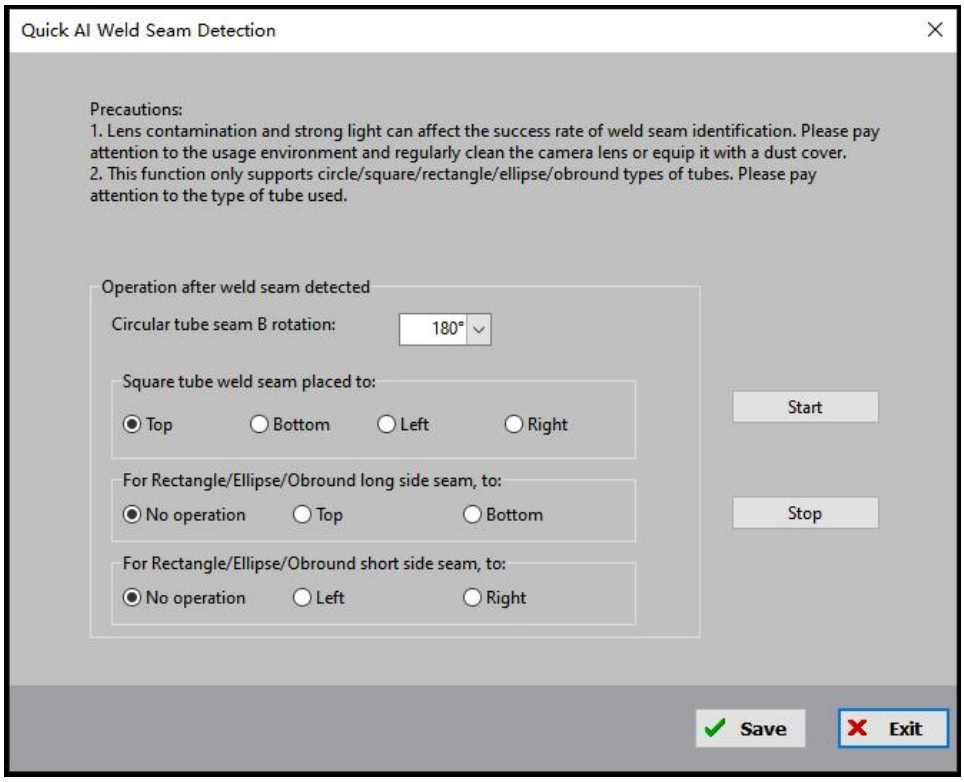


Figure 4-29 Quick AI Weld Seam Detection

4.8.4 Multi-File Production

Click ***Tools→Auxiliary→Multi-File Production***, and you can see the window below. You can open the files of a certain location from ***Single input port*** or open the files of combined locations from ***Multi-bit input.***

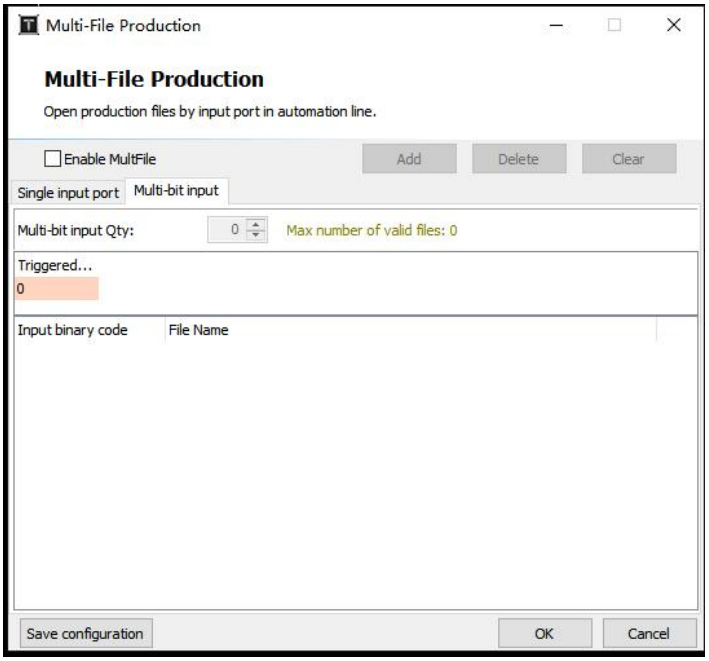


Figure 4-30 Multi-File Production

4.8.5 Time Estimation

Click ***Tools→Auxiliary→Time Estimation***, and you can see the window below:

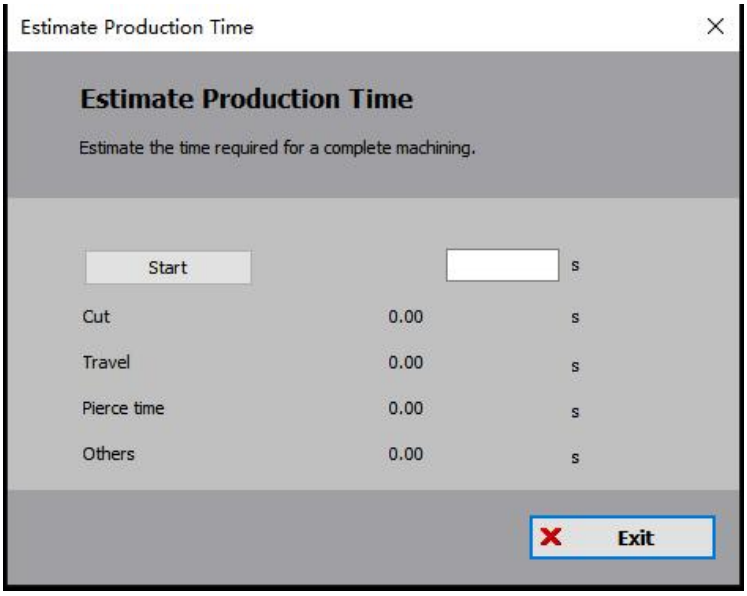


Figure 4-31 Estimate Production Time

Click ***Start***, and the system will automatically calculate the time for the entire processing, and display the time for cutting, traveling, piercing, and others.

4.8.6 Profile Correction

Click ***Tools→Auxiliary→Profile Correction***, and you can see the window below:

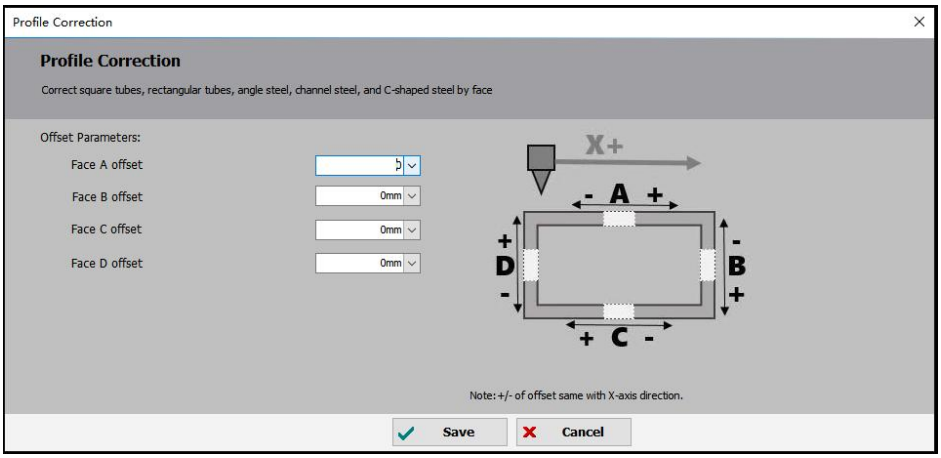


Figure 4-32 Profile Correction

Profile Correction can be used when the tube to be cut is non-standard, applicable for square tubes, rectangular tubes, angle steel, channel steel, and C-channel steel. These parameters directly modify the contour holes on the tube surface without affecting the cutoff line.

4.8.7 Gas DA Correction

Click ***Tools→Auxiliary→Gas DA Correction***, and you can see the window below:

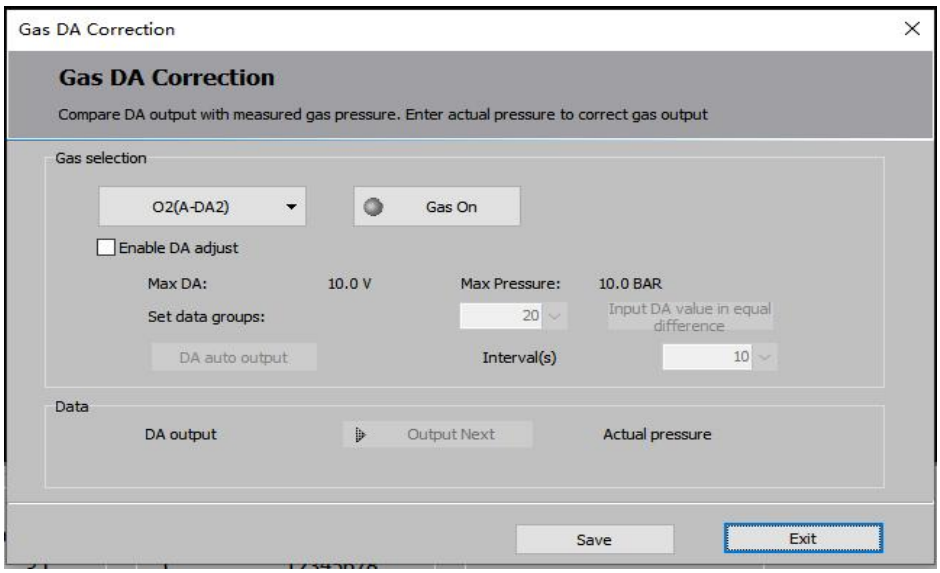


Figure 4-33 Gas DA Correction

The parameters are shown below:

Table 4-14 Gas DA Correction Parameters

Parameter	Description
Gas selection	Select the gas for correction.
Set data groups	Set the number of linear nodes for data—the more groups, the more accurate the fitting.
Input DA value in equal difference	Set the DA value automatic distribution according to the equal difference of the groups.
DA Output	Output the DA value one by one.

4.8.8 Cycle and Production Settings

Click T***ools→Auxiliary→Cycle and Production Settings***, and you can see the window below:

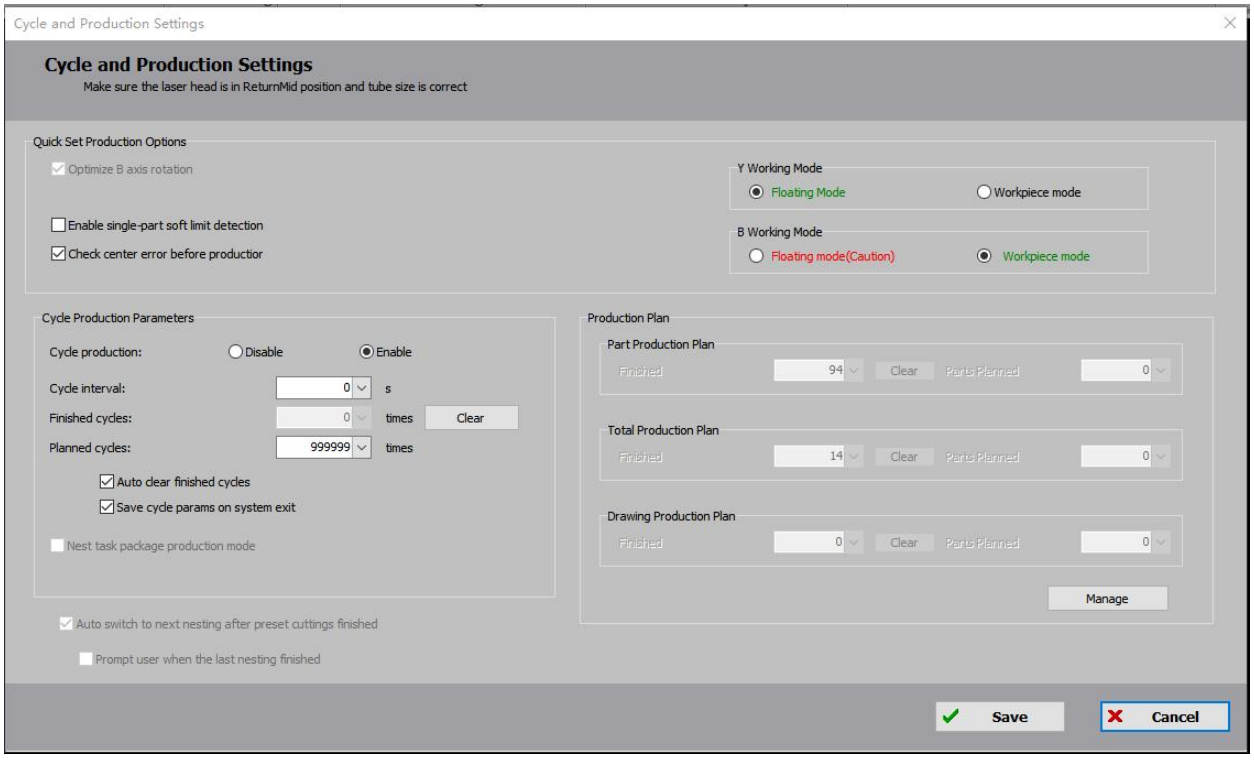


Figure 4-34 Cycle and Production Settings

You can set the production process in this window. The parameters of ***Cycle and Production Settings*** are shown below:

Table 4-15 Cycle and Production Settings Parameters

Parameter	Description
Optimize B-axis rotation	If the B-axis uses an absolute encoder, overflow issues may occur. When checked, the B-axis will move in the opposite direction during idle movement (when it does not affect processing) to mitigate this.
Enable single-part soft limit detection	When the option is unchecked, clicking ***Start*** triggers a full-file verification to check if the entire machining program will exceed the software limits (soft limits) during processing. If any part of the program exceeds these limits, the machine will not start. When the option is checked, the system performs a dynamic check only for the next part in the queue.
Check center error before production	When checked, the system will automatically detect excessive centering deviation before machining. If the centering deviation exceeds 5 mm, a warning message will be logged.
Y/B axes working mode	In ***Floating Mode***, processes start from the current position, treating it as the machining origin. In ***Workpiece Mode,*** the specified start point in the current file is adopted as the machining zero point, moving to that position before starting processing. It is recommended to use Floating Mode for the Y-axis and Workpiece Mode for the B-axis during processing.

In the ***Cycle Production Settings*** module, you can configure parameters for cyclic production. Cycle demonstration processing is used in exhibitions to repeatedly machine graphics without laser emission for demonstration purposes, or to complete full-tube cycle demonstrations with automatic loading/unloading PLC systems.

In this module, you can:

- Select to enable or disable **Cycle Production**.
- Set the **Cycle interval** and **Planned Cycles**.
- View the current number of completed cycles and clear the data to zero.
- When the following options are checked, they will automatically clear the completed cycle count. Save the configured cycle processing parameters when exiting the program.

In the **Production Plan** module, you can specify the processing calculation method:

- Calculated by the number of parts processed.
- Calculated by the number of times the file is processed.
- Calculated by the number of times the current drawing is processed.
- The corresponding meanings of the parameters in this module are as shown in the table below:

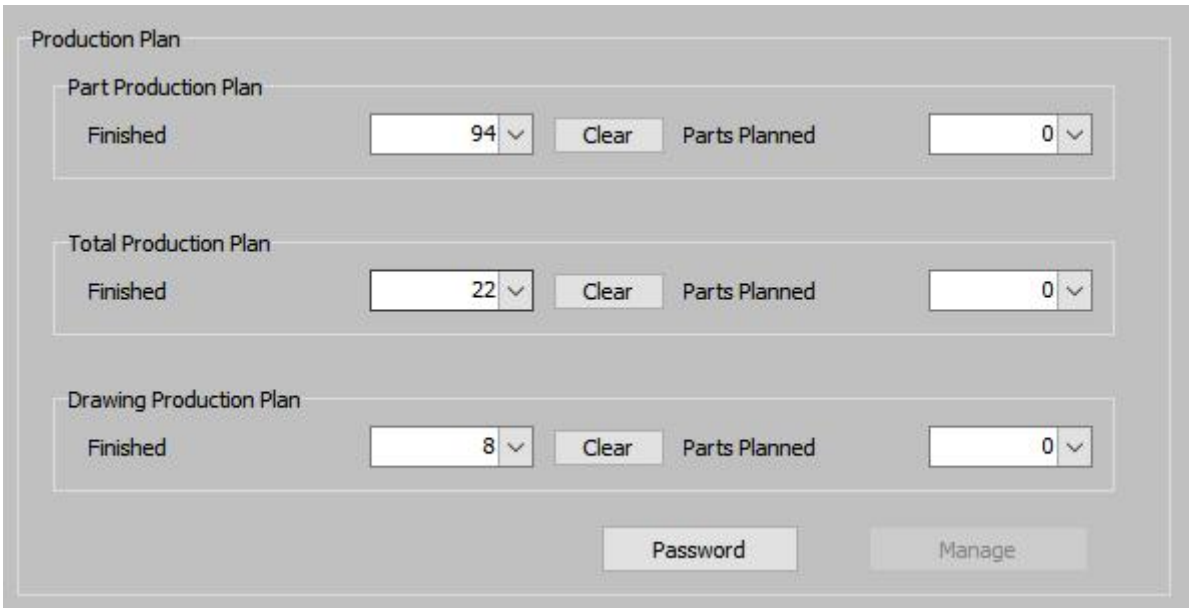


Figure 4-35 Production plan

The parameters are shown below:

Table 4-16 Production Plan Parameters

Parameters	Description
Part production plan	The system counts the number of processed parts and allows manual reset. It will automatically stop and print completion information upon reaching the specified quantity. A setting of zero disables this function. The counting function is enabled in proofing mode but disabled during simulation or dry run
Total production plan	The system calculates based on the number of file processing cycles. The count increments by one each time a file is completely processed. Manual reset is supported.
Drawing production plan	The system tracks processing cycles for the current drawing. The count increments automatically upon successful completion of each file processing task. A manual reset function is available for the counter.
Manage/Password	The function can be password-protected to prevent unauthorized modification of production statistics.

When importing special drawings (nesting job packages containing multiple processable nesting files in the production plan), a new module will appear on the existing interface as shown below:

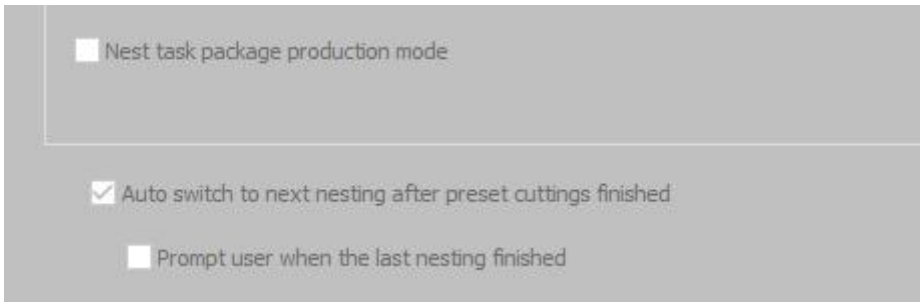


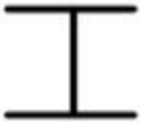
Figure 4-36 Cycle Production Settings

Once ***Nest task package production mode*** is checked, ***Auto switch to next nesting after preset cuttings finished*** will be automatically checked. You can choose whether to check ***Prompt user when the last nesting finished***.

4.9 Center/Position

Center is used to measure the deviation between the tube center and the rotation center (the center of B-axis), so that the processing accuracy can be ensured. Thus, the ***Center*** shall be executed before processing, and the software will record the deviation. There are various types of centering in TubePro, applicable for different tubes.

Table 4-17 Center Parameters

Centering Type	Tubes	General Tube Section
4-Point Center	Rectangular tubes, round tubes, oval tubes.	
5-Point Center	Rectangular tubes, oval tubes.	
Elliptical Tube Center	Elliptical Tube.	
L Section Center	Angle steel with an included angle of 60° ~ 150°.	
I-Beam Center	For I-Beams.	
Square tube find	Suitable for tubes with two	

Centering Type	Tubes	General Tube Section
edge and center	adjacent right-angle edges, such as rectangular pipes, square tubes, L/C-shaped steel (angle steel, channel steel, C-shaped steel), and special-shaped tubes (select a suitable centering method according to the actual tube section).	
Symmetric Arc Center	Suitable for tubes with symmetric arcs.	
Single Face Level	Pipes with straight edges in the cross-section can all be used, such as I-beams and D-shaped steel.	
Manual Center	Special-shaped tubes that cannot automatically center.	
Advanced Manual Center	For center script centering, the centering action can be independently programmed or used with external sensors such as probes and other equipment.	

After importing a file, the system will automatically identify the tube type and match a suitable automatic center-finding method. If multiple automatic center-finding methods are applicable to this tube type, you can select the automatic centering method in ***Debugging Quick Settings*** (i.e., the settings button below ***Auto Center***); if there is no matching automatic centering method for this tube type, please select manual centering or advanced manual centering as appropriate.

⚠ Notice: Before center-finding for all tubes, ensure that the tube clamping angle is basically consistent with the drawing. If the angle deviation is large, first perform ***Single-Face Level*** or ***Set Current Horizontal State*** to align the tube clamping angle with the drawing.

4.9.1 Tube Profile Measurement

Open via ***Tools→Center/Position→Tube Profile Measurement*** for manual operation.

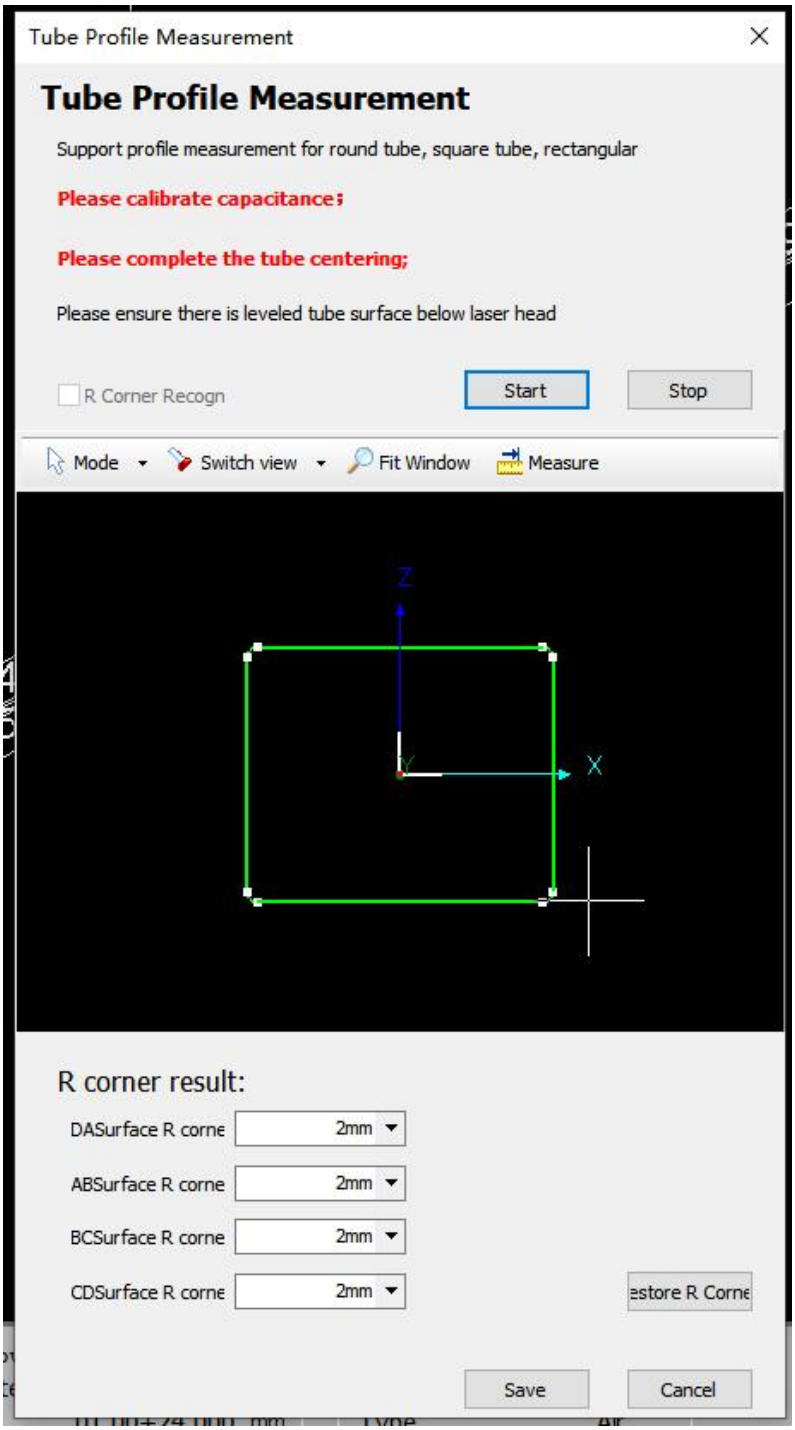


Figure 4-37 Manual Tube Profile Measurement

In addition to standard cross-section scanning, this function includes measurement and correction of tube R-corner radii. Parameter explanations are shown below

- Automatic R-Corner Recognition: For square/rectangular tubes or C-channels, the system

automatically detects R-corners during profile measurement (automatic detection disabled for R ≤ 5 mm).

- R corner result: For square tubes/rectangular tubes/C-section steel, the system automatically detects the size of the radius corner, supports manual modification, and applies it to the current tube, and updates the radius corner size after manual or automatic tube contour measurement is completed.
- Restore R corner: One-click restoration to the radius corner size in the original drawing.
- Scan result: After completing tube contour measurement, the scanning result will be displayed in the tube contour scanning window together with the original trajectory (original trajectory in green, actual trajectory in cyan).

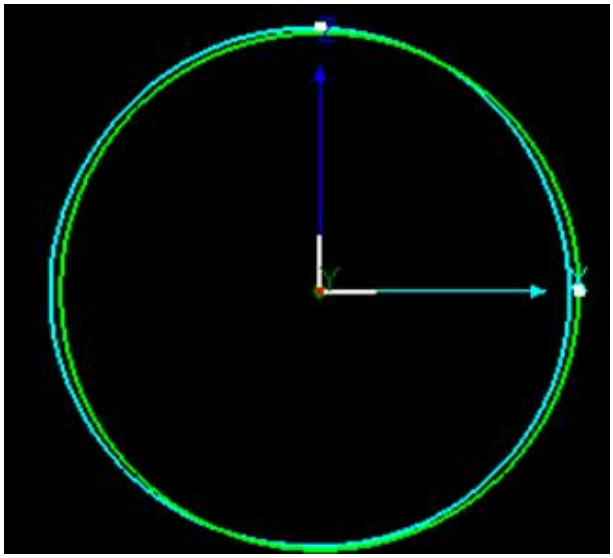


Figure 4-38 Tube profile measurement

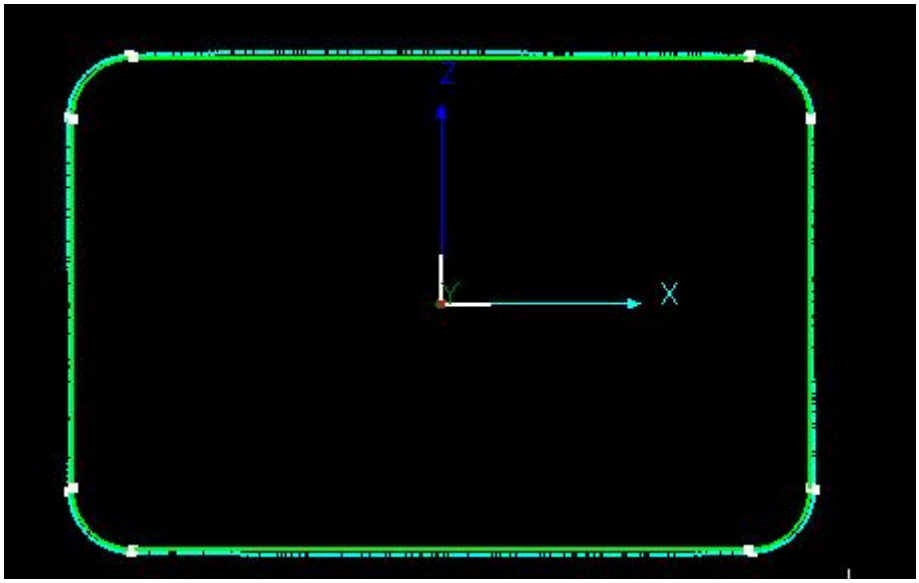


Figure 4-39 Rectangular tube profile

Unlike the activation method of centering (deviation compensation is applied to the cutting process as soon as centering is completed), the deviation compensation for tube contour measurement must be enabled in conjunction with processing parameters. Click ***Techniques→Others***, and check ***Tube Profile Offset (V/Y Bevel).***

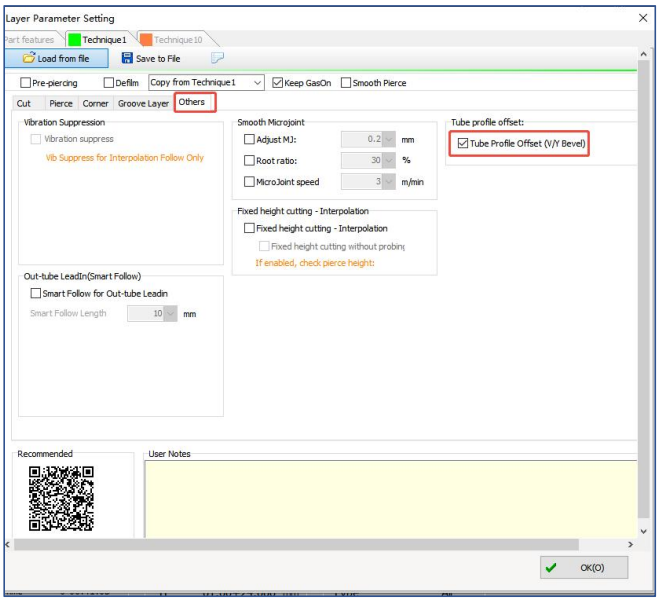


Figure 4-40 Tube Profile Measurement

4.9.2 Single Face Level

Click ***Tools→Center/Position→Single Face Level***, and you will see the window below.

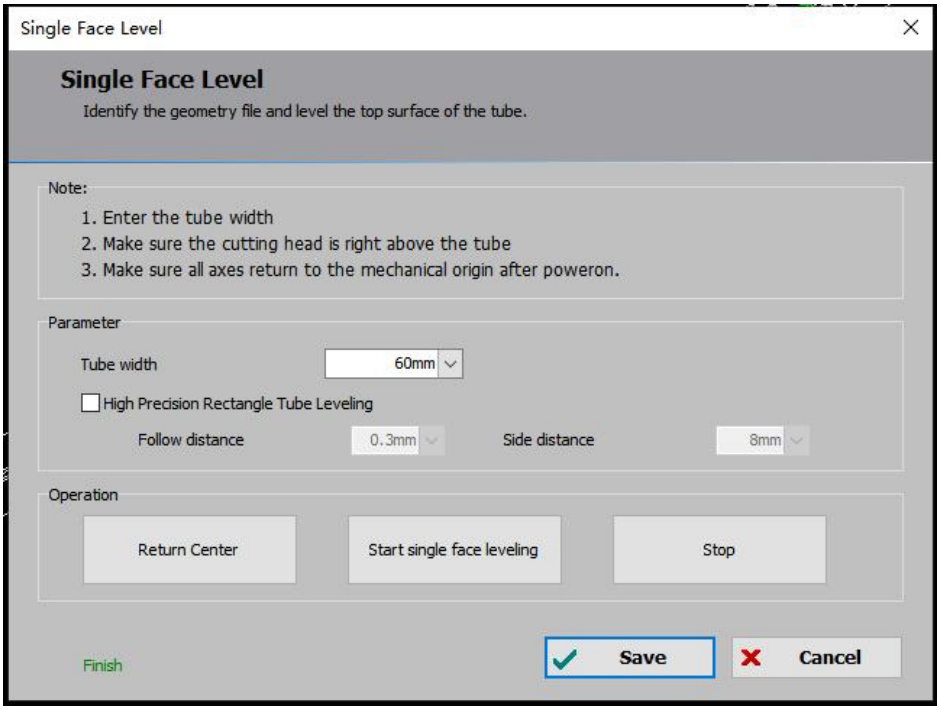


Figure 4-41 Single Face Level

Single Face Level can correct a flat surface of the tube to a horizontal state and align this surface with the default upward-facing side in the drawing. After clamping the tube, single-surface leveling can match the actual clamping position with the drawing.

If a drawing is imported, the software automatically retrieves the dimensional width; if no drawing is available, manually enter the width of the surface to be leveled. Then move the nozzle directly above the tube, click ***Single Face Level***, and click ***Save*** after the operation is complete to finish leveling.

Example: For a triangular tube as shown, the drawing defaults the longest side to face upward, but if the tube is initially clamped with the longest side positioned downward at an angle, it does not match the drawing and cannot be processed. In this case, jog the longest side to a roughly horizontal position, then perform single-surface leveling to fully align the clamping state with the drawing.

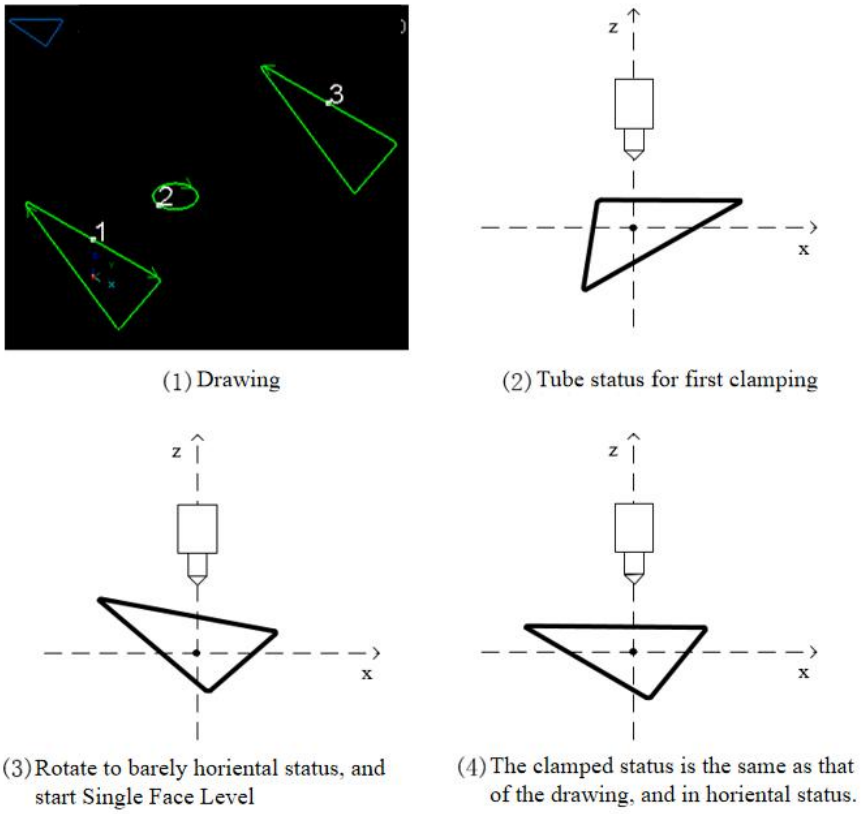


Figure 4-42 Triangular tube leveling

When using ***Single Face Level***, ensure all axes have returned to their mechanical origins after power-up, the tube dimensions are correctly entered, and the cutting head nozzle is directly above the tube (use ***Return Center*** to quickly adjust the nozzle position). After leveling, click ***Save***.

4.9.3 4-Point Center

Click ***Tools→Center/Position→Height Controller Center→4-Point Center***, and you will see the window below.

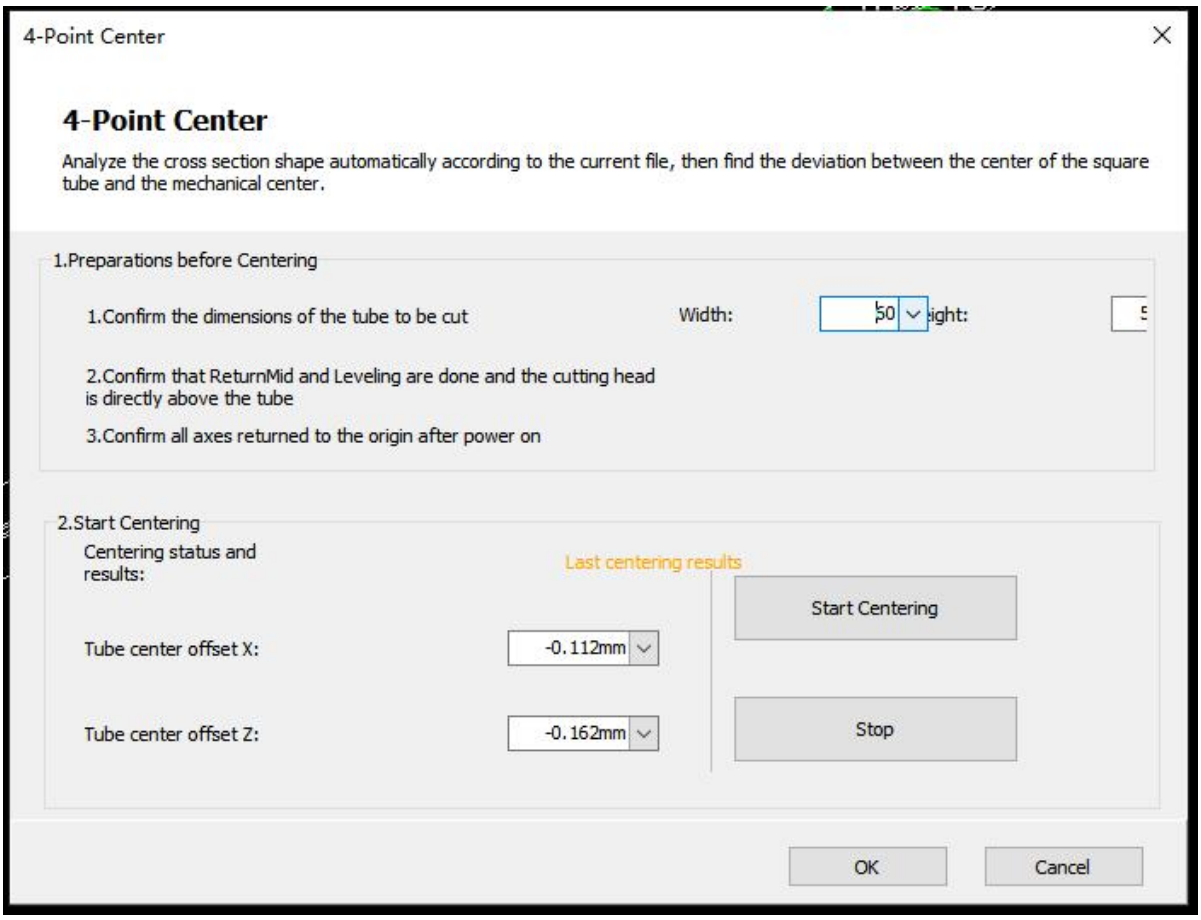


Figure 4-43 4-Point Center

4-Point Center is applicable to rectangular tubes, round tubes, and waist-shaped tubes. During centering, the system follows the four surfaces of the tube to find their coordinates, automatically calculates the deviation between the tube center and the mechanical center, and compensates for it during cutting.

Before starting, confirm the tube dimensions, ensure all axes have returned origin after power-up, and verify centering and leveling. Click ***Start;*** and the X and Z deviation values will display in the interface after completion.

4.9.4 5-Point Center

Applicable to rectangular tubes and waist-shaped tubes. Unlike Four-Point Center, this function

automatically levels the tube, so no separate single-surface leveling is required.

Click ***Tools→Center/Position→Height Controller Center→4-Point Center***, and you will see the window below.

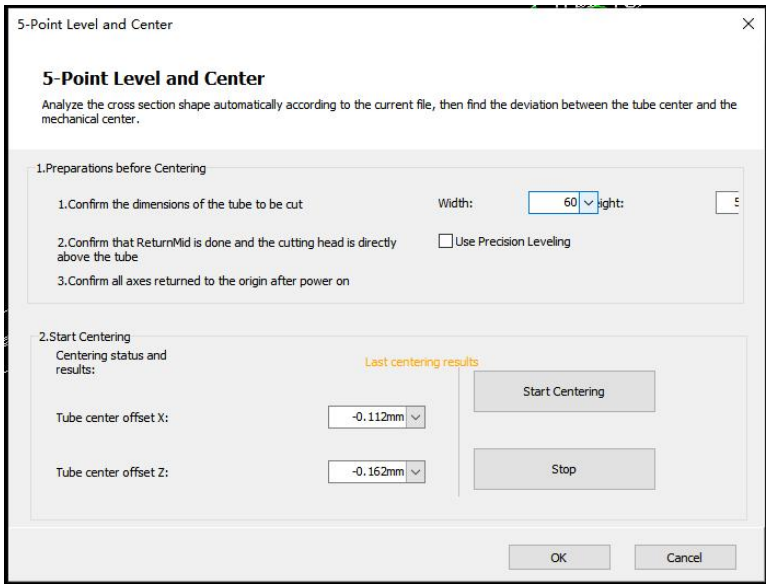


Figure 4-44 5-Point Level and Center

4.9.5 Multi-Face Center

Click ***Tools→Center/Position→Height Controller Center→Multi-Face Center***, and you will see the window below.

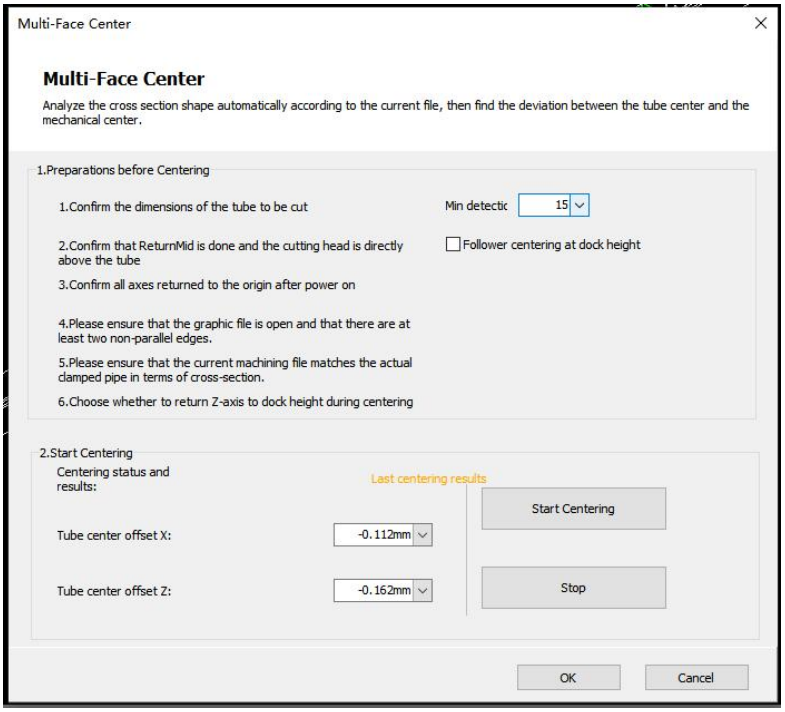


Figure 4-45 Multi-Face Center

Multi-Face Center is applicable to triangular tubes, polygonal-section tubes, and non-standard tubes with at least two non-parallel edges. The center of the non-standard tube is defined as the center of its outer bounding box.

Click ***Start***, and all edges in the cross-section with a length greater than or equal to the ***Minimum Detection Width*** will be followed. After the following is completed, the system will return to the first cross-section and automatically calculate the deviation between the tube center and the mechanical center, displaying the deviation value in ***Centering status and results***. If there is interference with the cutting head during cross-section following, check ***Follower centering at dock height***.

4.9.6 Ellipse Center

Click ***Tools→Center/Position→Height Controller Center→Ellipse Center***, and you will see the window below.

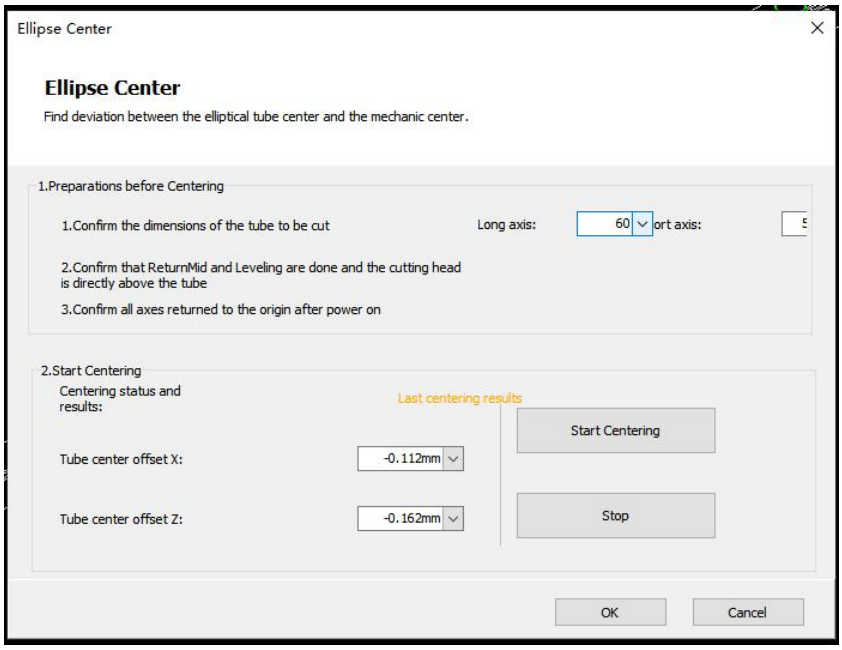


Figure 4-46 Ellipse Center

Ellipse Center can be used to find the deviation between the elliptical tube center and the mechanical center. Before use, jog the elliptical tube to a state where the major axis is roughly horizontal, then perform ***Single Face Level***. Ensure all axes have returned origin after power-up, tube dimensions are correctly entered, and the nozzle is directly above the tube.

4.9.7 L Section Center

Click ***Tools→Center/Position→Height Controller Center→L Section Center***, and you will see the window below.

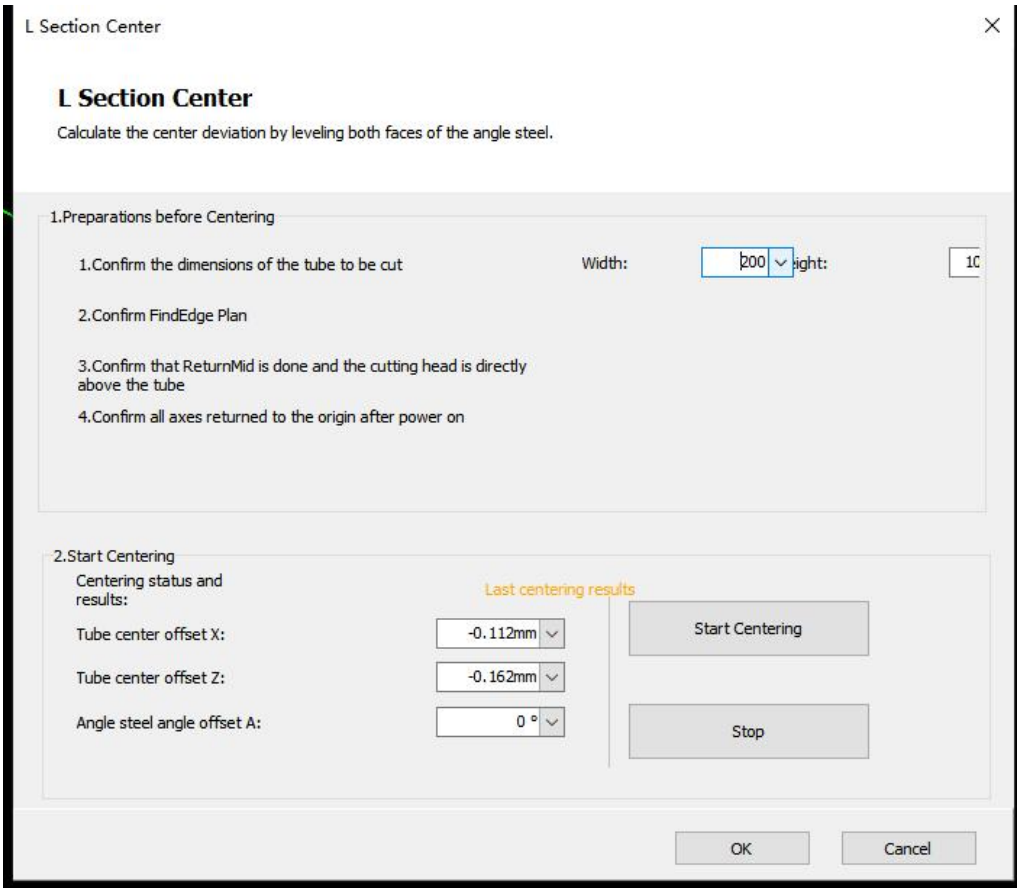


Figure 4-47 L Section Center

Applicable to angle irons with an included angle of 60° to 150°. Unlike other centering methods, the result includes ***L-Beam Angle Deviation A***, which provides the deviation (in radians, where 1° = 0.01745 rad) of the angle between the two surfaces from the standard 90°.

4.9.8 Find Edge and Center

Find Edge and Center is applicable to tubes with two adjacent right-angled edges, such as rectangular tubes, square tubes, L/C steel (angle steel, channel steel, C-shaped steel), and special-shaped tubes (select a suitable center-finding method according to the actual tube shape).

Click ***Tools→Center/Position→Height Controller Center→Find Edge and Center***, and you will see the window below.

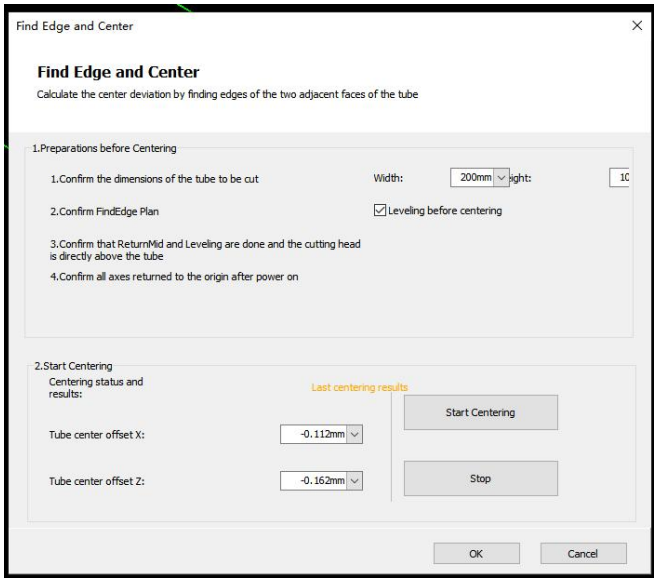


Figure 4-48 Find Edge and Center

4.9.9 Symmetric Arc Center

Click ***Tools→Center/Position→Height Controller Center→Symmetric Arc Center***, and you will see the window below.

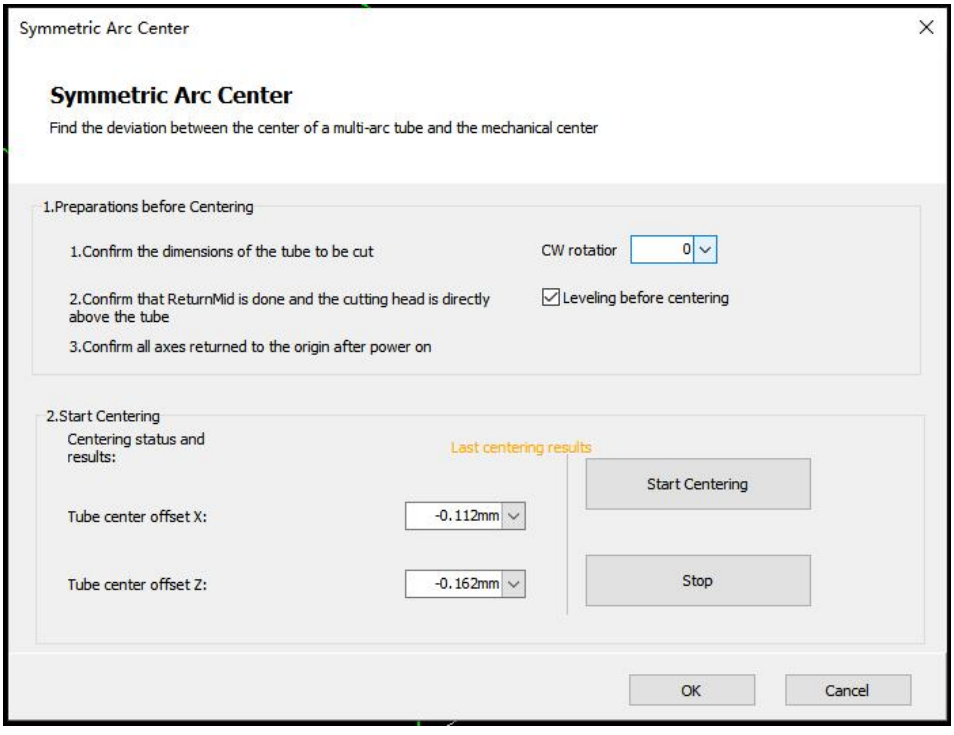


Figure 4-49 Symmetric Arc Center

Symmetrical Arc Center is suitable for special-shaped tubes with fully curved surfaces (no flat surfaces) and symmetrical about the YOZ plane. During center finding, the widest surface must face upward. You can manually jog to roughly level the wide surface, check ***Level*** before centering, and the system will automatically level once before center finding to ensure the wide surface is horizontal. If fixed fixtures are used during clamping, causing the wide surface to maintain a specific angle with the horizontal plane each time, you can input the ***Clockwise Rotation Angle*** to rotate the pipe to a roughly horizontal position of the wide surface before leveling (if checked).

4.9.10 I-Beam Center

Click ***Tools→Center/Position→Height Controller Center→I-Beam Center***, and you will see the window below. This center-finding method applies to I-beams. Before center finding, confirm that the system has returned to the center and been leveled.

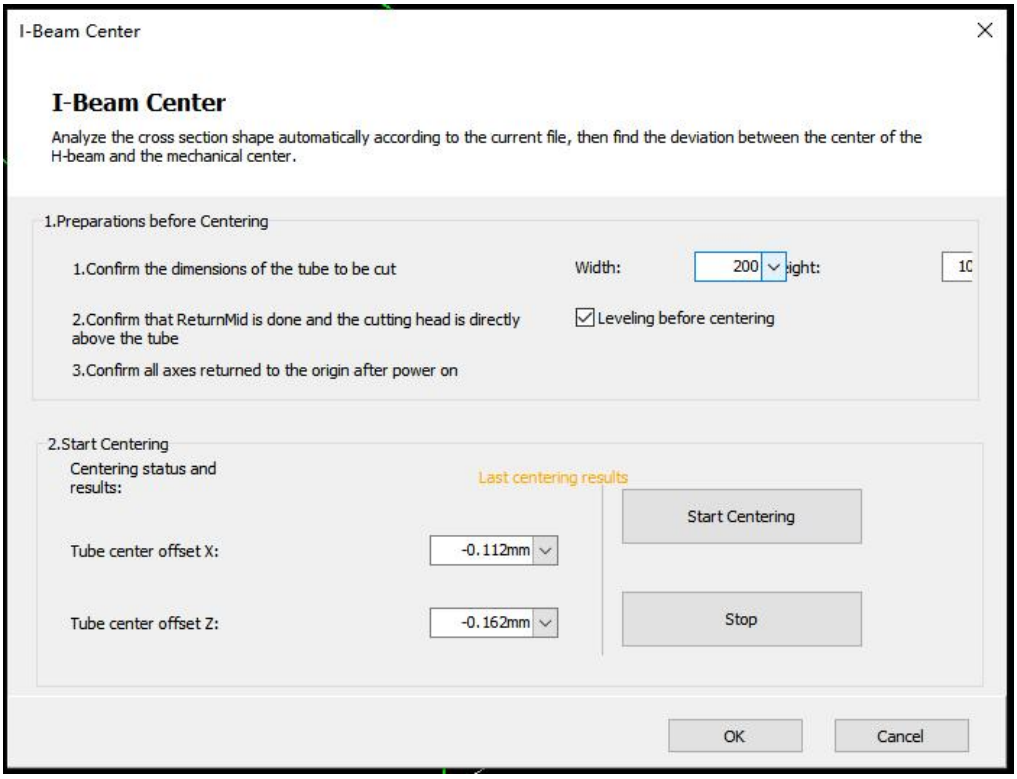


Figure 4-50 I-Beam Center

4.9.11 Advanced Manual Center

Click ***Tools→Center/Position→Height Controller Center→Advanced Manual Center***, and you will see the window below.

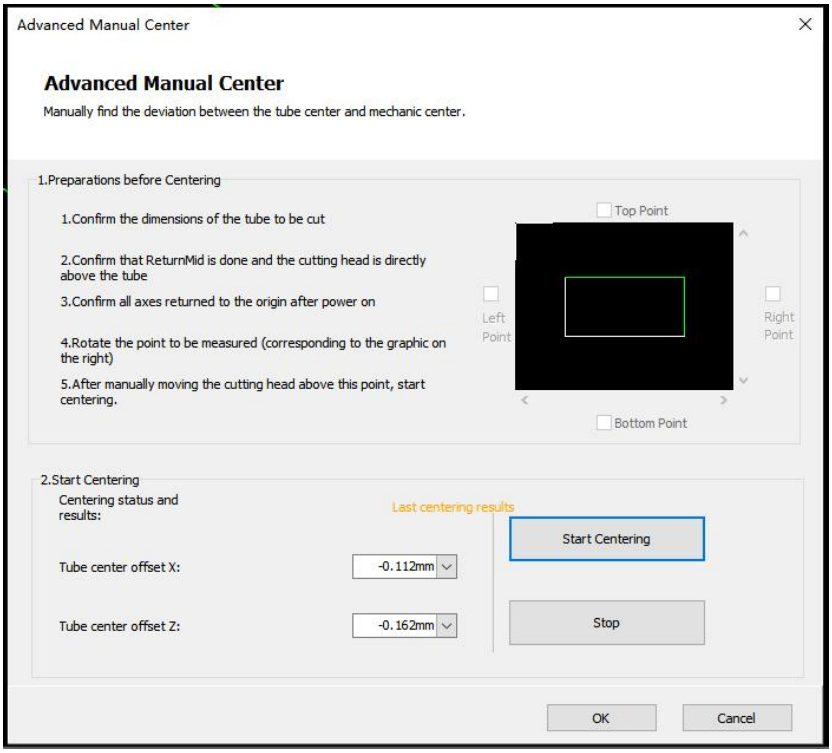


Figure 4-51 Advanced Manual Center

Advanced Manual Center is suitable for special-shaped tubes that cannot be automatically centered. Take the special-shaped tube shown in the diagram below as an example: the software will find the highest points on the upper, lower, left, and right surfaces, and select one of them as the reference point.

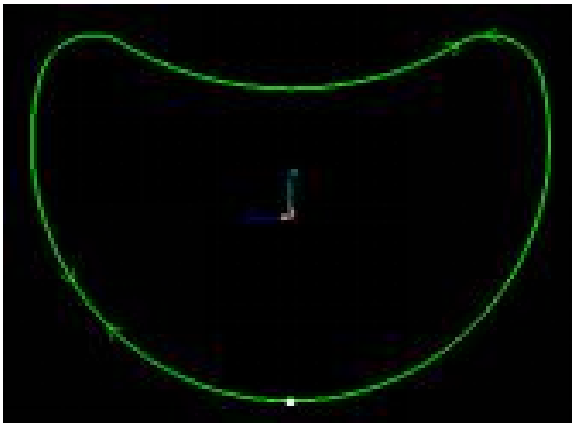


Figure 4-52 Special-shaped tube

For example, if the right point is selected as the reference point, rotate the tube until the right side is horizontally upward. Jog the cutting head to directly above the right point, click ***Start Center***, and after

center finding is complete, click ***Save*** to exit the interface.

4.9.12 Calibrate B-axis and Square Tube Centering

When the mechanical structure is fixed, the B-axis has a fixed rotation center. Calibrating the B-axis is to determine the coordinates (X, Z) of this rotation center on the XZ plane. To measure the B-axis center, a standard rectangular tube without chamfers is required. Before calibration:

- Ensure the system's X, Z, A, and B axes have returned to their origin positions.
- Move the cutting head directly above the rectangular tube.
- Enter the width and height of the rectangular tube, click **Start Centering** to calibrate.

After calibration, the coordinates of the B-axis center and the deviation from the tube center will be displayed in Centering status and results.

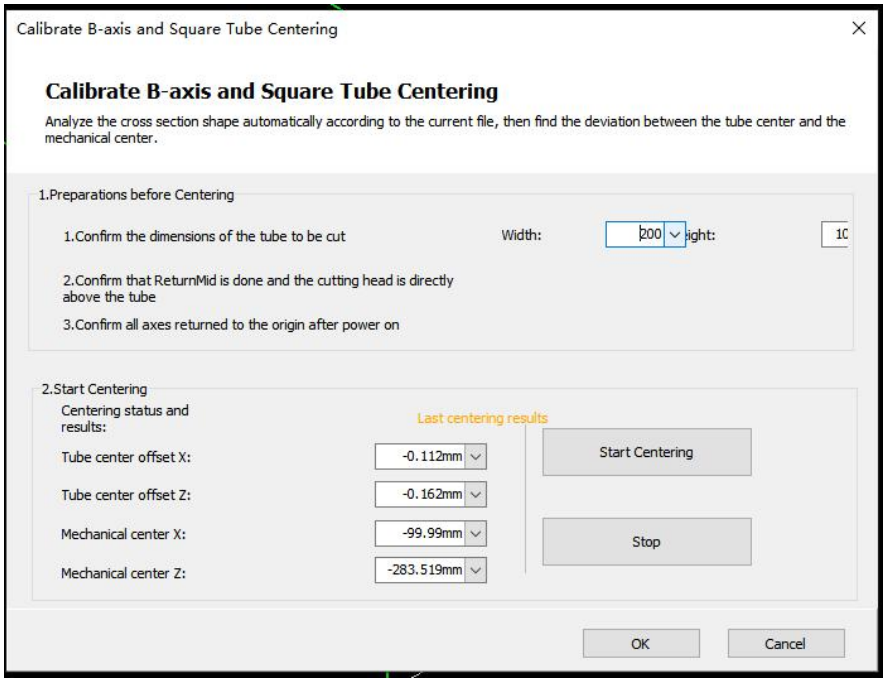


Figure 4-53 Calibrate B-axis and Square Tube Centering

4.9.13 Manual Center

Some special-shaped tubes cannot be automatically centered and require manual leveling, as well as inputting deviations in the X and Z directions.

Thus, it is essential to level one side of the tube to ensure it is clamped consistent with the drawing.

If single-side leveling is impossible, jog the tube to roughly match the drawing, then click ***Manual Center→Set Current Horizontal State***.

Move the cutting head to the midpoint of the tube in the X direction, record the current X mechanical coordinate, and calculate the center offset in the X direction by referencing the B-axis center calibration results. Center offset X = Tube Center Coordinate X - Machine Center Coordinate X.

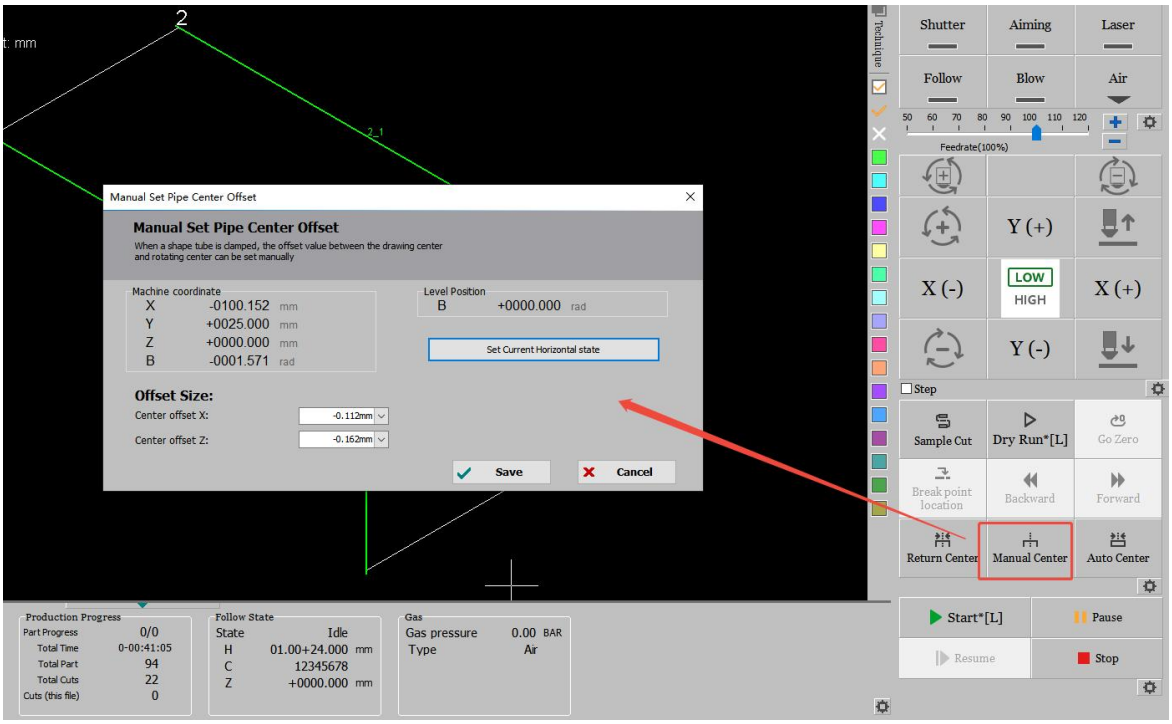


Figure 4-54 Manually set the tube center offset

4.9.14 Center During Processing

For longer tubes, issues like twisting, eccentricity, and deformation may occur due to gravity and other factors. As the tube center may shift after each processing segment, the accuracy is affected. To address this, center-finding points can be set on the processing graph. When machining reaches such a graph, an automatic center-finding operation will be performed first before continuing with the processing.

For a single selected graph: Click ***Find Center*** in the left toolbar to set the starting point of the graph as the center point. For multiple selected graphs: Click ***Find Center***, and after setting the minimum interval between center-finding points within the part, the system will automatically place center-finding points. Additionally, you can choose to perform center finding at the start of each part.

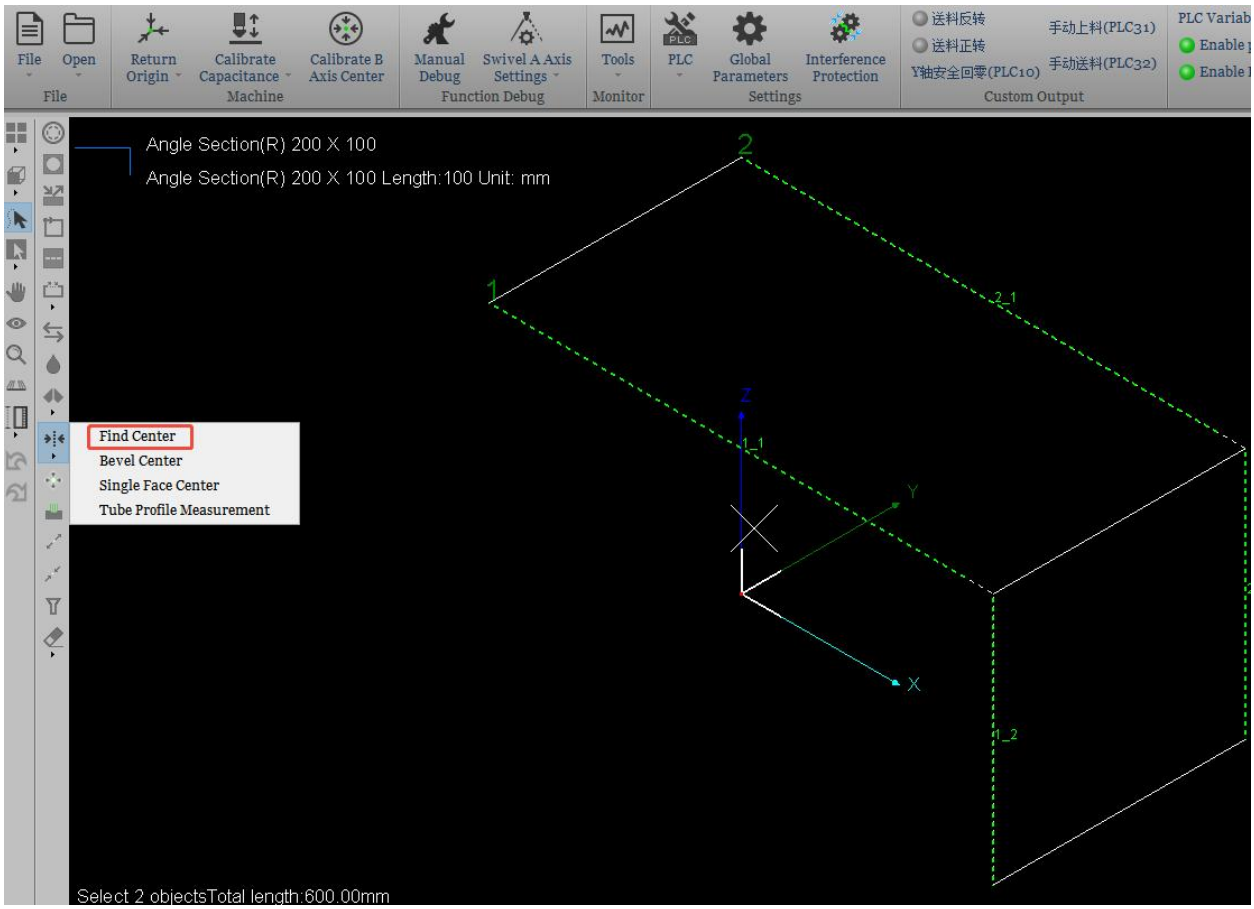


Figure 4-55 Setting center points

The automatic center-finding mode during processing can be selected on the **Settings** page.

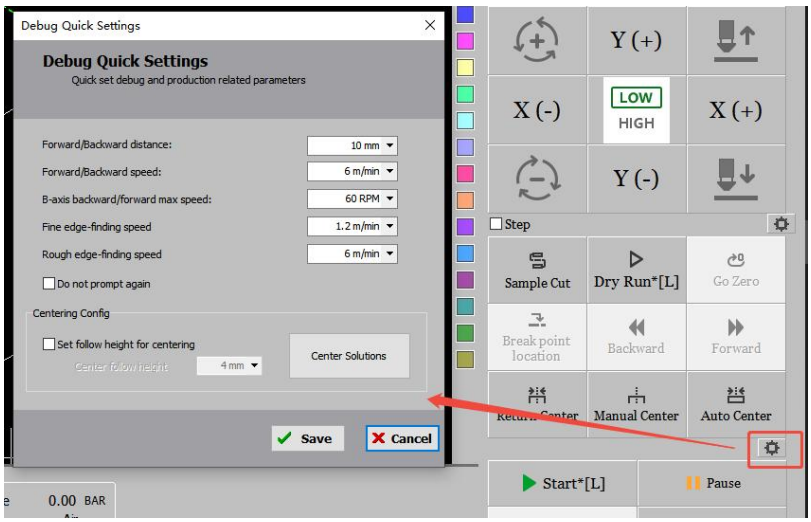
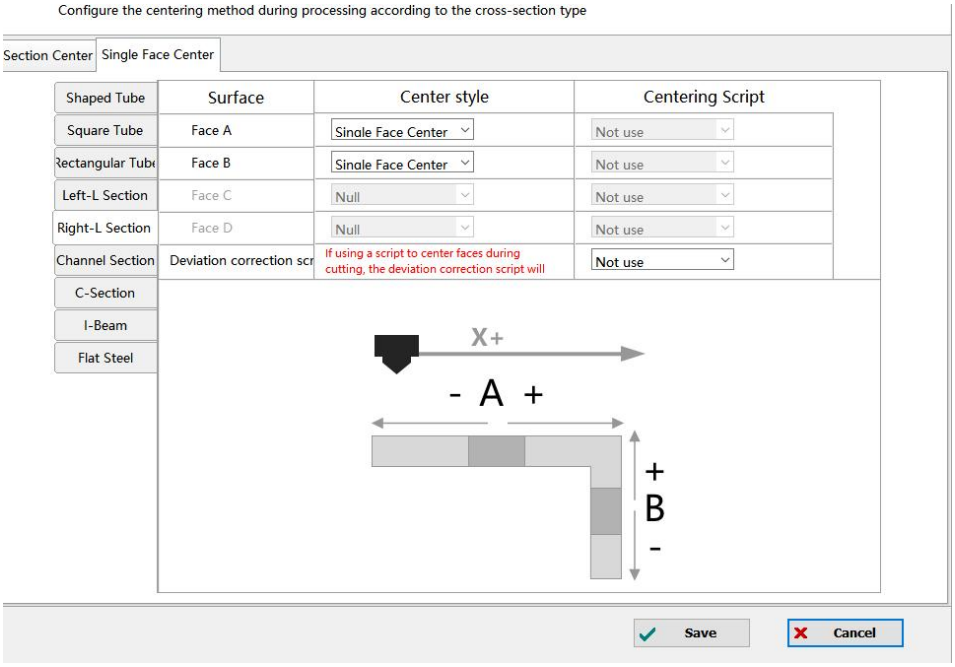


Figure 4-56 Center settings

4.9.15 Single Face Center



- Based on single-face center finding, expand center-finding modes in file parameters to select single-face center finding for surfaces A, B, C, or D.
- Default single-face center-finding modes (7 types): Single Face Center, Left Find Edge, Right Find Edge, Level + Single Face Center, Level + Left Find Edge, Level + Right Find Edge, and Script Center.

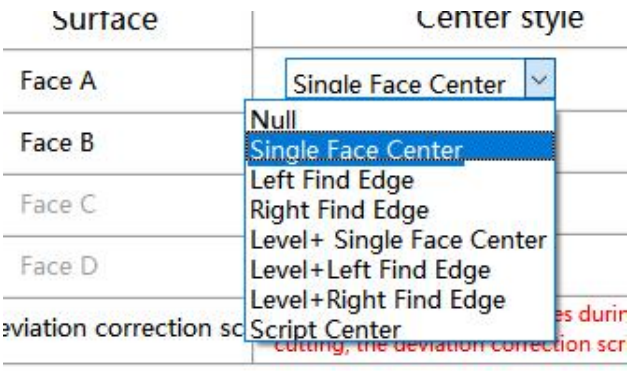


Figure 4-57 Centering modes

- Script Center supports custom center-finding actions or external sensors like probes.
- Special-shaped tubes default to surface A center finding.
- For tubes with stable errors in left/right edge finding, use deviation correction scripts for compensation.

4.10 Cutting Head

4.10.1 BLT Cutting Head Debugging

If you have configure BLT cutting head, also enabled ***Spot control*** in Machine Config tool, and checked BLT, then you can see the ***BLT Laser Head Diagnosis*** page on TubePro. Click ***Tools→Laser Head → BLT Head Debug***, and you can see the window below.

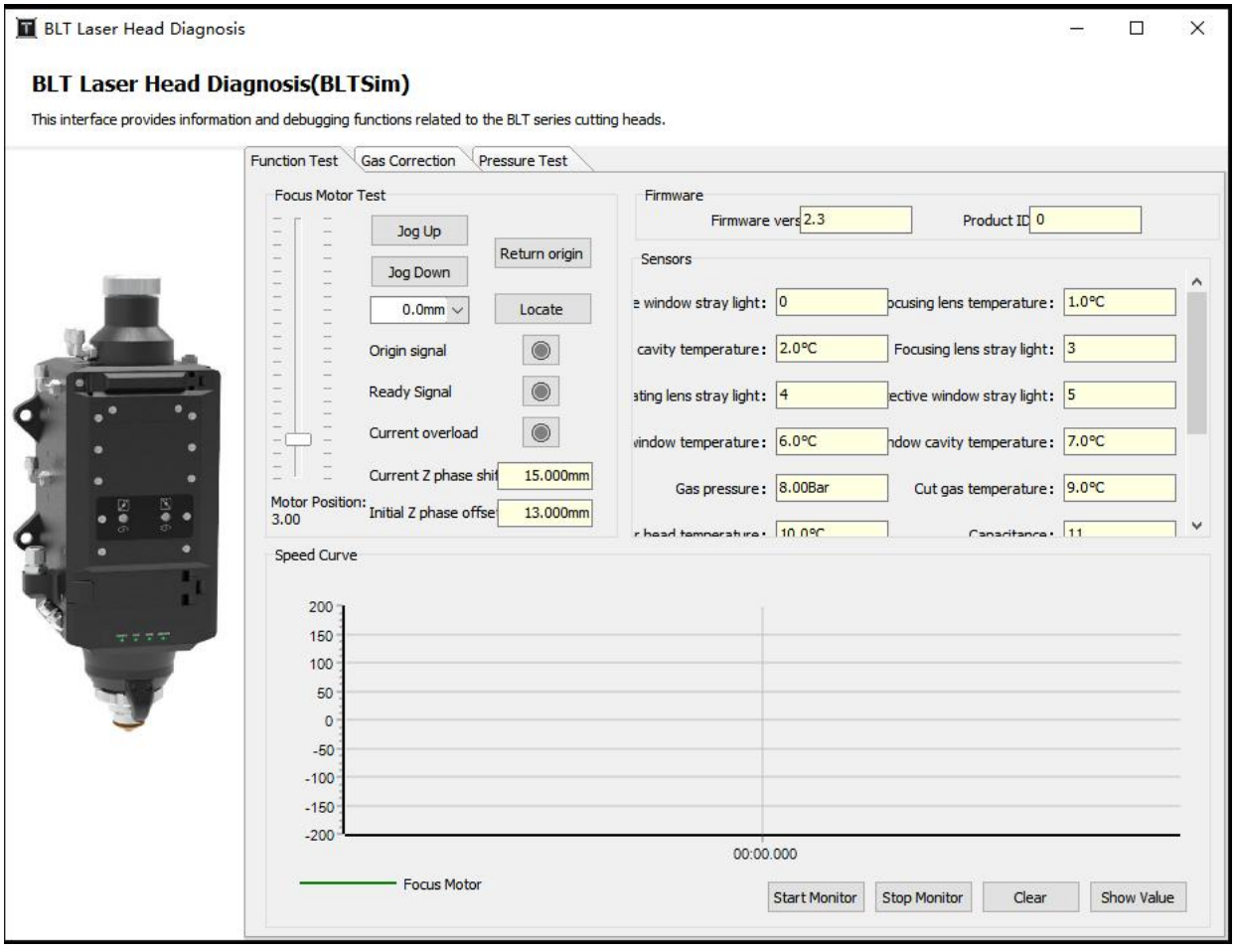


Figure 4-58 BLT Cutting head debugging

The meanings of parameters in function testing are as follows:

Table 4-18 Focus Motor Test

Parameter	Description
Origin Signal	During origin returning, when the cutting head baffle passes the induction position, the limit switch is triggered, and the origin signal light turns on.
Ready Signal	After power-on, when the motor has no servo alarm and phase searching is successful, the ready signal light turns on.
Current overload	When the motor is blocked or stuck, and the motor current exceeds the set value, this signal becomes active.
Current Z phase shift	Displays the Z-phase deviation of the current homing operation after origin is completed.
Initial Z phase offset	Displays the Z-phase deviation after completing the installation origin.
Location	Positions the coordinate of the focus motor.

Table 4-19 Sensors

Parameter	Description
Protective Window Temperature	Monitors the temperature rise of the protective window to determine its cleanliness, effectively avoiding cutting instability caused by window contamination. Alarms are issued when the sensor fails, temperature is high, or temperature rise is high.
Protective Chamber Temperature	
Cutting Gas Pressure	Displays the gas pressure and temperature inside the current cutting head, and issues a warning when the sensor fails or the monitoring function is not enabled. Cutting pressure monitoring thresholds can be configured in Machine Config tool.
Cutting Gas Temperature	
Capacitance	Displays the capacitance value between the current cutting head and the tube. An alarm will be triggered when the capacitance becomes 0 or the cutting head touches the tube.
Sensor Head Temperature	Displays the current sensor head temperature and turns off the laser in advance when the sensor head is disconnected. An alarm will be triggered when the capacitance sensor head temperature is too high or disconnected.
Focusing Lens Temperature	It can monitor the contamination of the focusing lens. When the sensor fails, the temperature is high, or the temperature rise is high, a warning will be issued. When the temperature is excessively high or the temperature rise is excessive, an
Core Chamber Temperature	

Parameter	Description
	alarm will be triggered.
Protective Window Cartridge Gas Pressure	Displays the current gas pressure in the protective window cartridge and issues an alarm when the cartridge leaks air.
Upper Protective Window Stray light	Contaminants on the mirror cause diffuse reflection of the laser, known as stray light. The contamination level of the upper protective window can be judged by the displayed value to prevent window explosion, and an alarm prompt of Lower Protective Window Contamination will be issued when exceeding the configured alarm threshold.
Lower Protective Window Stray Light	Contaminants on the window cause diffuse reflection of the laser beam, resulting in stray light. The contamination level of the lower protective window can be determined by the displayed stray light value. This helps prevent window explosion and triggers an alarm prompt for **Lower Protective Window Contamination** when exceeding the configured threshold.
Focusing Lens Stray Light	Contaminants on the lens cause diffuse reflection of the laser beam, resulting in stray light. The contamination level of the focusing lens can be determined by the displayed stray light value.

Gas Correction adjusts the relationship between the DA proportional valve voltage and gas pressure to ensure precise pressure output during processing. Click ***Quick Gas Correction***.

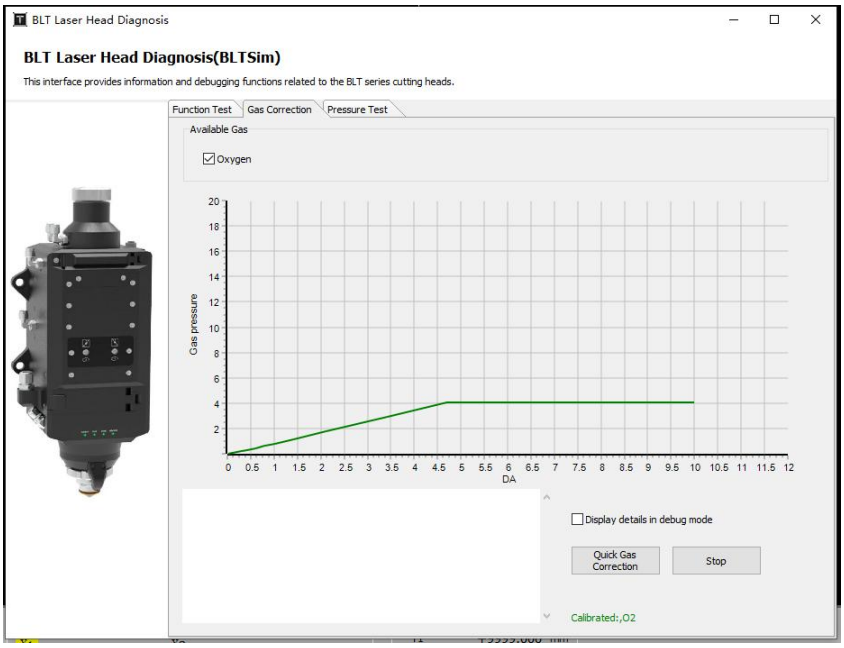


Figure 4-59 Gas Correction

On the page of ***Gas Correction***, you can monitor the target gas pressure and current gas pressure values for the selected gas type to determine the current gas status, such as whether there is a gas shortage.

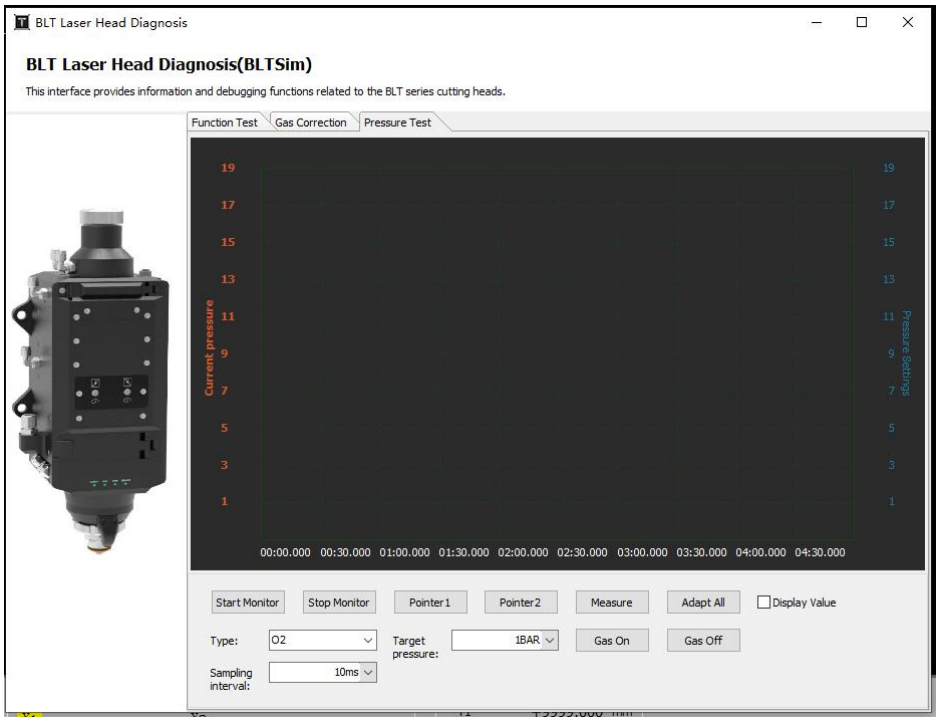


Figure 4-60 Gas Pressure Test

4.10.2 Auto Focus Test

Click ***Tools→Laser Head→Auto Focus Test***, and you will see the window below.

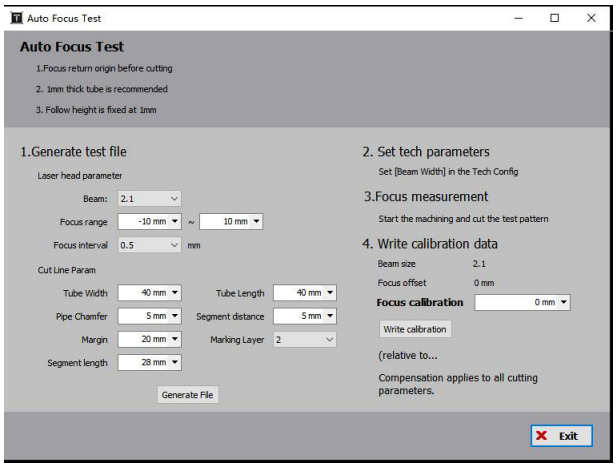


Figure 4-61 Auto Focus Test

The automatic focus test is used to find the actual focus value corresponding to the zero focus of the cutting head. The usage steps are as follows:

Step 1 Select the spot to be tested, modify the focus range and focus spacing, set the processing line parameters, and click ***Generate File*** to generate a test drawing based on the parameters.

Step 2 Click **Layer** above the layer color block on the right side of the software page, and set the ***Beam Diameter*** to the spot value to be tested.

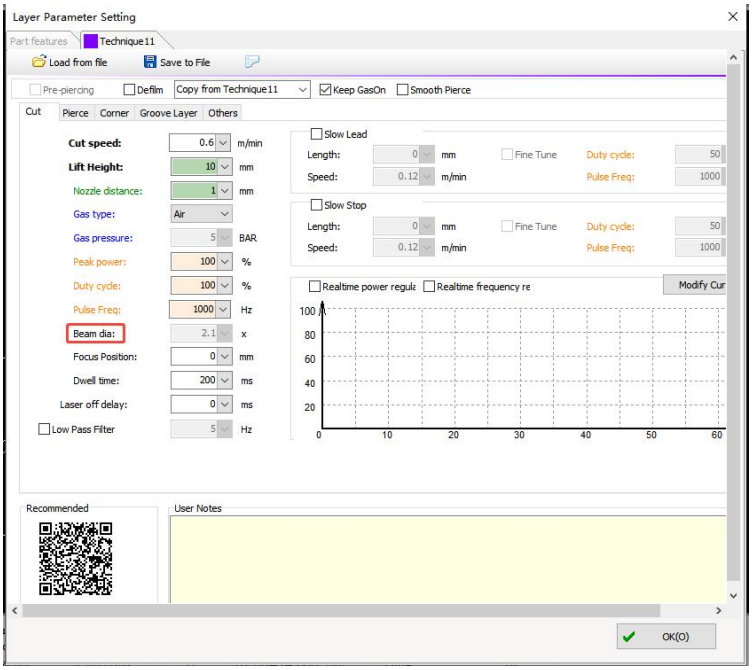


Figure 4-62 Beam diameter

Step 3 Execute the processing operation to cut the test pattern.

Step 4 Analyze the cutting effects at different focus points, find the one with the thinnest cutting kerf width, enter the corresponding focus value into **Focus calibration**, and click **Write Calibration** to perform focus compensation.

4.11 Debug Tools

4.11.1 Auto Gas Correction

Please refer to Gas Correction.

4.11.2 Common Axis Debug

You can select the specified axis for jogging, returning origin in this window.

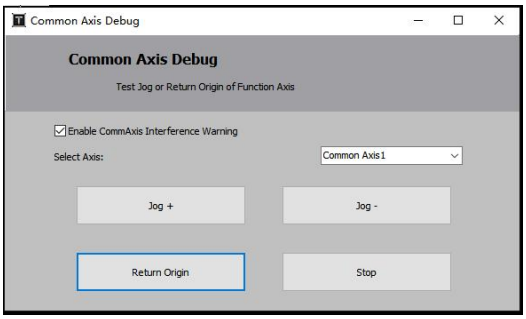


Figure 4-63 Common axis debugging

4.11.3 Tape Shot

Click ***Tools→Debug Tools→Tape Shot***, and you will see the window below.

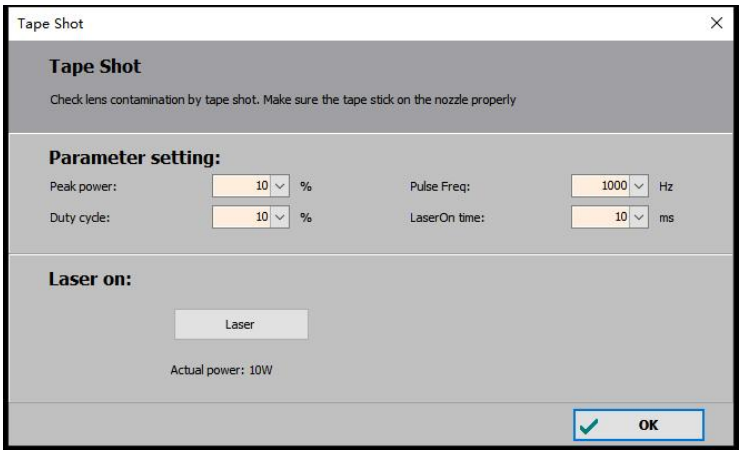


Figure 4-64 Tape Shot

Tape Shot is used to check for window contamination in the optical path. The usage method is as follows:

Step 1 Place tape at an appropriate position below the cutting head.

Step 2 Adjust the laser parameters.

Step 3 Click ***Burst.***

Step 4 After emitting ***Burst***, inspect the light spot on the tape to determine whether the lens is contaminated. If contamination is present, further detection is required to identify the source of contamination.

4.11.4 Z-Phase Signal Initialization

Click ***Tools→Debugging Tools→Z-Phase Signal Initialization*** to open the page as shown below.

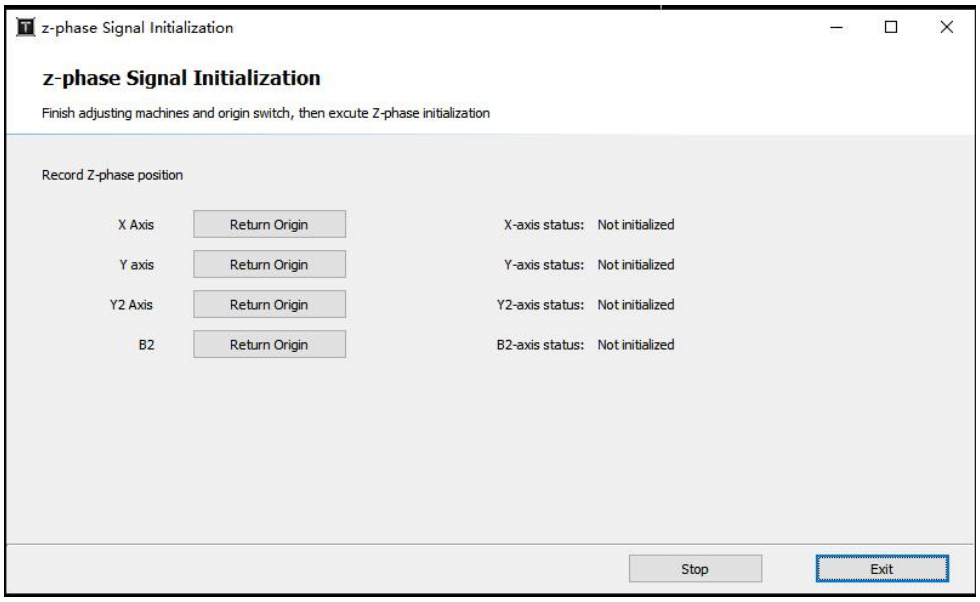


Figure 4-65 Z-Phase Initialization

Perform ***Z-phase signal initialization*** when the machine is first manufactured, after mechanical adjustments, or after resetting the origin switch.

⚠ Notice: To use this function, check ***Use Z-Phase Signal*** in ***Return Origin*** parameters of ***Axis Configuration*** in Machine Configuration tool .

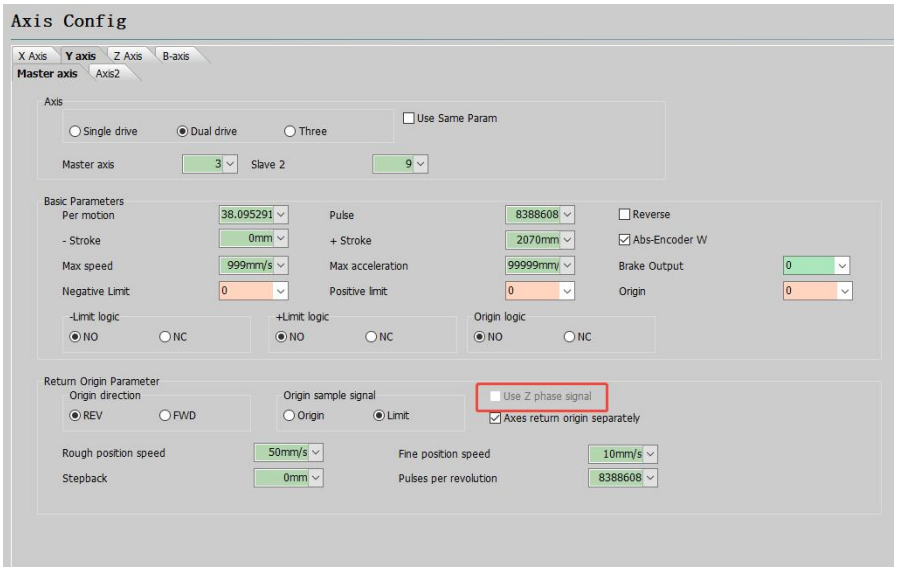


Figure 4-66 Using Z-Phase Signal

4.12 Installation Tool

4.12.1 Cycle Production Test

Click ***Tools→Installation Tools→Cycle Production Test*** to display the interface as shown below. This function is used to set parameters for cycle production test. You can fill in the planned cycles, finished cycles, and cycle interval, and clear the displayed number of cycles after starting the test, and select the PLC process and cycle count.

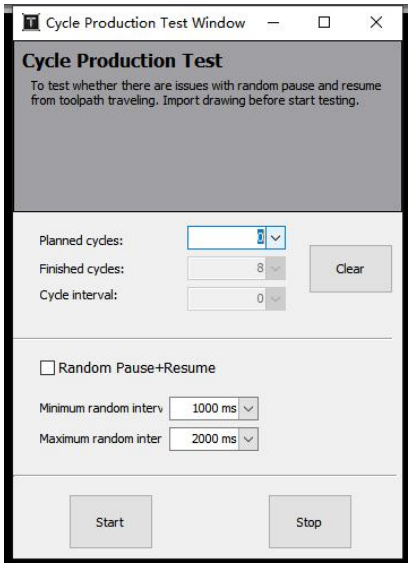


Figure 4-67 Cycle Production Test settings

4.12.2 Optics Adjustment Interface

Click ***Tools→Installation Tool→Optics Adjustment Interface***, you can see the window below.

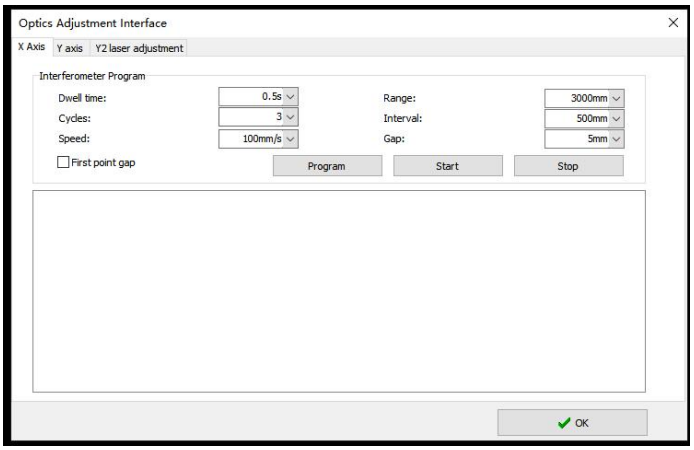


Figure 4-68 Interferometer program

This function adjusts the optical path of the coordinate axis. Click to generate the program in the blank area below the pop-up window. After confirming the program is correct and the following conditions are met, click ***Start*** to begin measurement:

- Condition 1: The measured axis has correctly returned to the origin, and measurement starts from the origin.
- Condition 2: The interferometer is ready, and its parameters match those set in the software.

Table 4-20 Interferometer Parameter Table

Parameter	Requirements
Dwell time	Set slightly longer than the interferometer's ***Minimum Stop Cycle*** to ensure correct point recognition.
Range	Automatically read; must match the value set in the interferometer. Enter negative values for origin in the forward direction, and positive values otherwise. The system will prompt for errors during saving.
Cycles	Must match the ***Measurement Count*** set in the interferometer. Since the software only reads results from one round trip, multiple measurement data will only import the first set of results.
Interval	Must match the value set in the interferometer; otherwise, data may not be measured.
Gap	When moving in the reverse direction, the system will first continue moving the set distance in the original direction, then return the same distance to eliminate mechanical backlash. This value should not exceed the interval value minus the tolerance; otherwise, the interferometer may misidentify it as a measurement point.

4.13 Advanced Tools

4.13.1 New Motor Tuning Tool

Click ***Tools → Advanced Tools → New Motor Tuning Tool***, and you will see the window below.

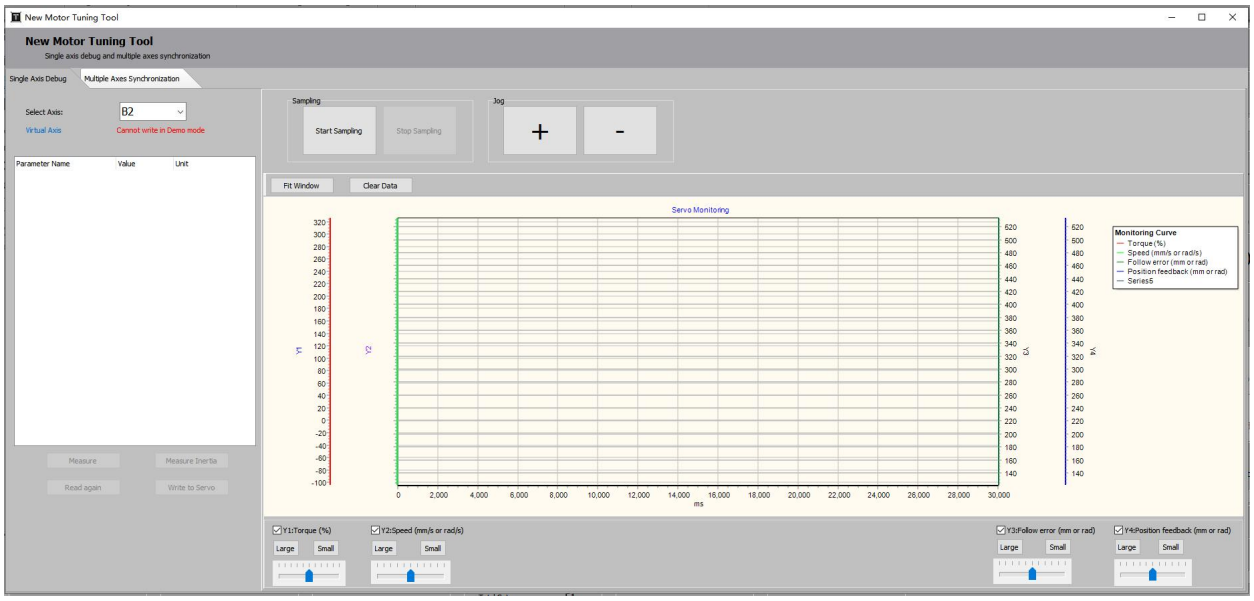


Figure 4-69 New Motor Tuning Tool

The parameters are shown below:

Table 4-21 New Motor Tuning Tool

Parameter Name	Requirements
Single Axis Debug	Mainly used to check if the inertia ratio of the single-axis servo is correct and if the static torque is normal.
Multiple Axes Synchronization	Used for circle test, rectangular test, wrap circle test, bevel cutoff test, and custom test. Tests the error between graphic commands and feedback positions.

In ***Testing Path***, fill in parameters, and click ***Generate Path*** to create a test pattern. Click ***Start Testing***; the blue trajectory displayed on the interface is the feedback actual trajectory, and corresponding error values will show in ***Test Results.***

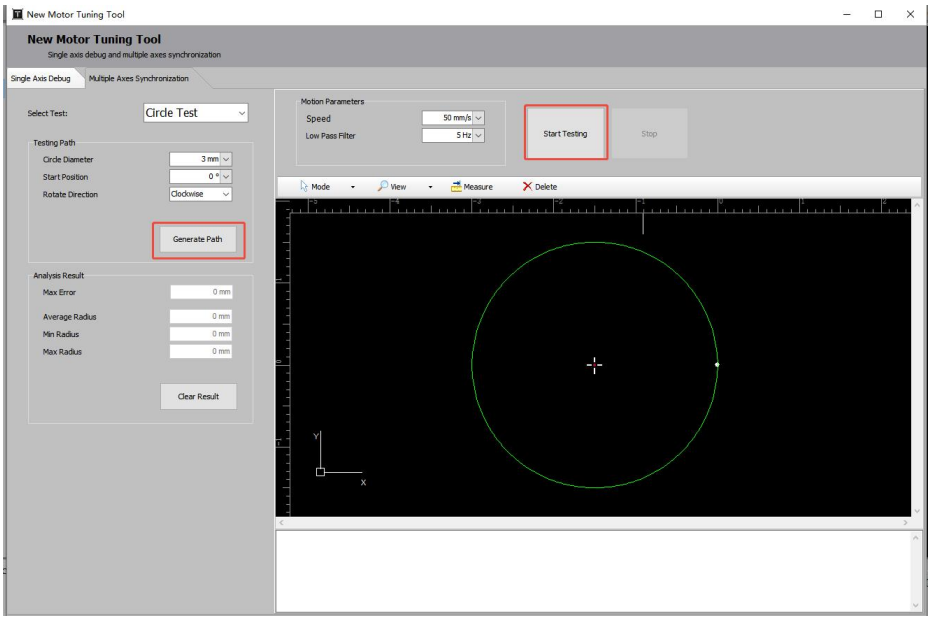


Figure 4-70 View errors

4.13.2 Find Edge Repetition Accuracy

Click ***Tool→Advanced Tools→Find Edge Repetition Accuracy*** to display the interface as shown below.

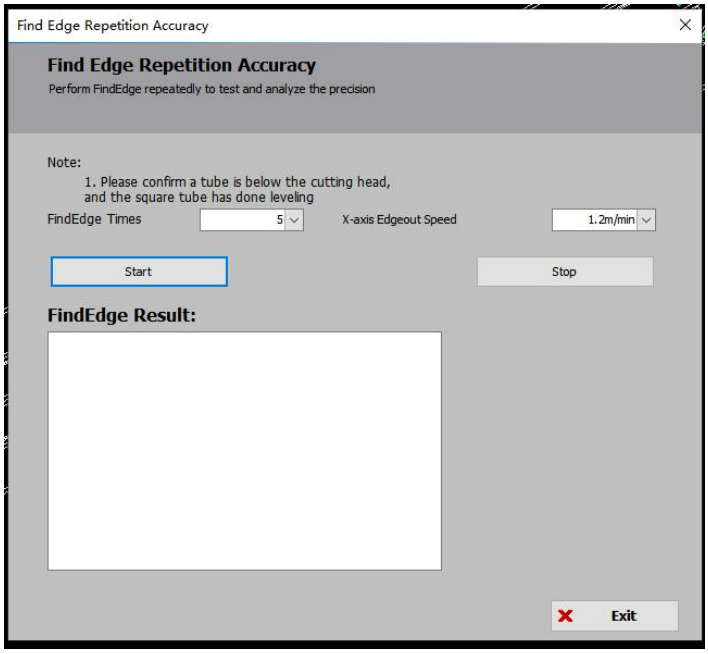


Figure 4-71 Find Edge Repetition Accuracy

This function tests the edge-finding performance of the height controller to check if it meets specifications. Normal 2D nozzle edge-finding maximum error: within 0.08 mm. Normal 3D nozzle edge-finding maximum error: within 0.12 mm.

4.13.3 Square Tube Profile Accuracy

Click ***Tool→Advanced Tools→Square Tube Section Accuracy*** to display the interface as shown below. Section analysis visualizes the appearance of rectangular tubes and tests deviations between the current tube and an ideal rectangular tube.

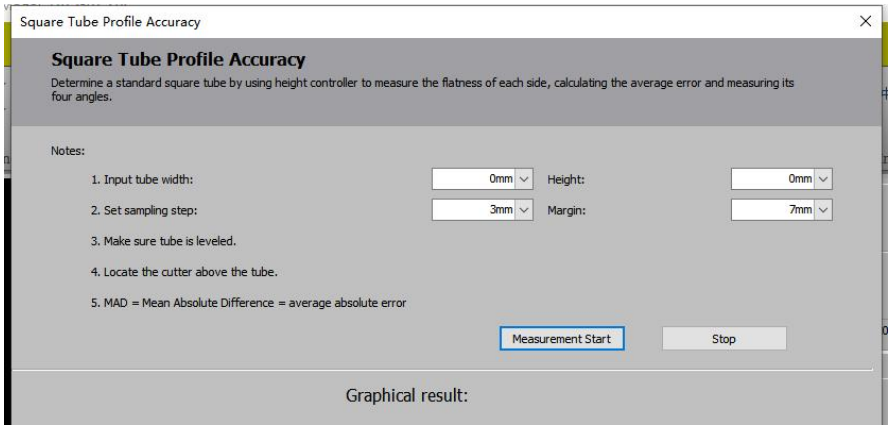


Figure 4-72 Square tube section accuracy

4.13.4 Coordinates Viewer

Click ***Tools→Advanced Tools→Coordinates Viewer*** to view the machine coordinates of the current position or manually switch the main axis controlled by the jog operation panel.

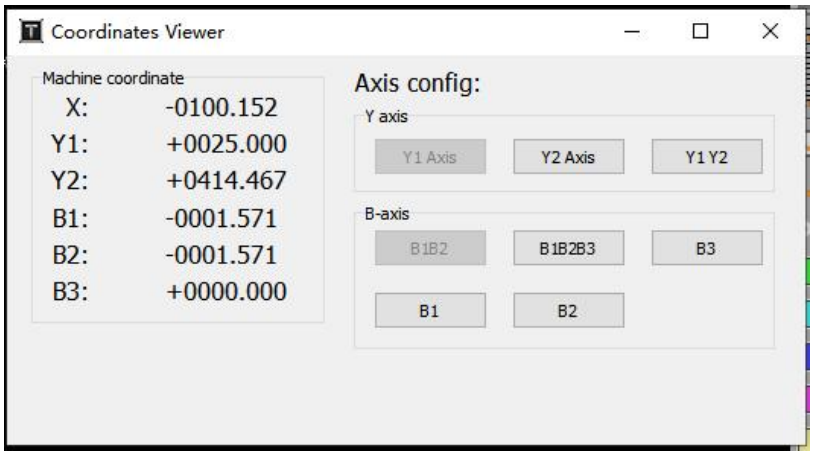


Figure 4-73 Coordinates Viewer

4.13.5 Create CAD Test File

Click ***Tools→Advanced Tools→Generate CAD Test File*** to open the page as shown below.

To facilitate trial cutting, TubePro provides a function to create test files, allowing quick creation of through-hole graphic on rectangular tubes for simple testing.

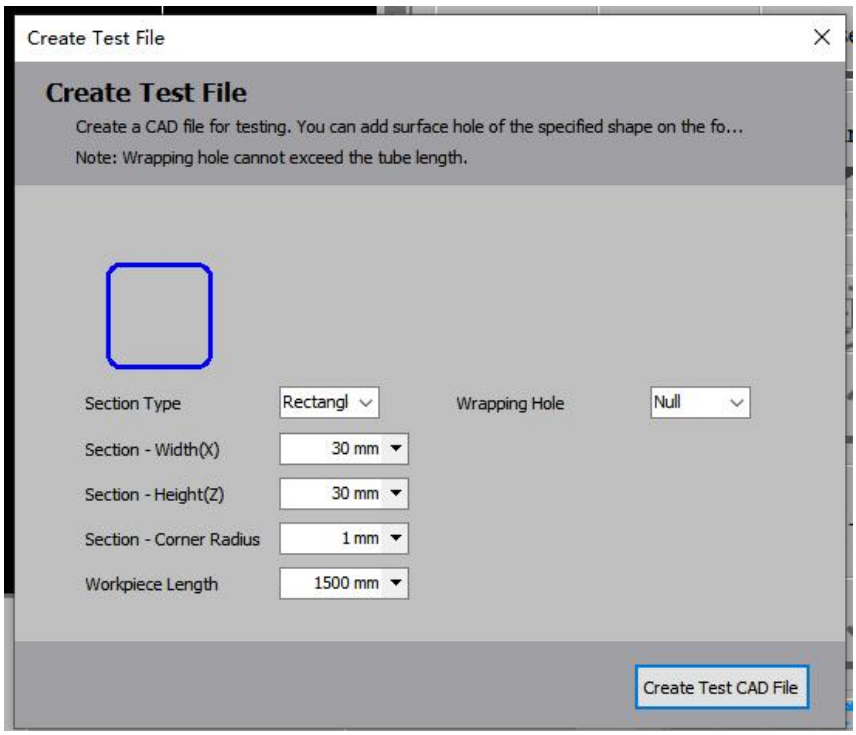


Figure 4-74 Create CAD test file

Select rectangular or circular holes and set the distance from the hole center to the near end face. Set tube surface *.DXF cladding, import the corresponding *.DXF file, and enter the cladding start position and left/right section distances.

4.13.6 Advanced Debug Tools

Click ***Tools→Advanced Tools→Advanced Debugging Tool*** and select ***Set Current as Mechanical Origin*** to set the current position of the cutting head as the origin (resetting X/Y/A/B coordinates to 0). Please use with caution.

4.14 Global Parameters

Global parameters include settings for production, motion parameters, algorithm parameters, and regular units.

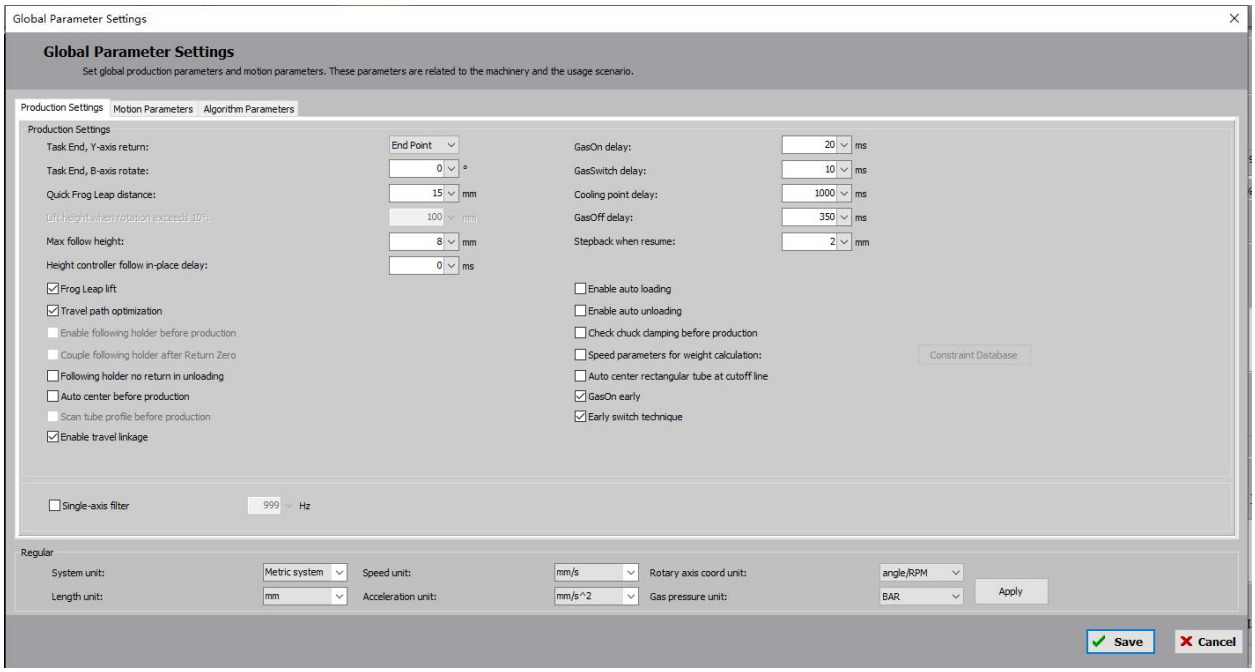


Figure 4-75 Global Parameter Settings

4.14.1 Production Settings

The parameters are shown below:

Table 4-22 Production Setting Parameters

Parameter	Description
Task End, Y-axis return	Options: Zero Point/End Point.
Task End, B-axis return	For special machine types, the B-axis rotates at the end of processing to facilitate loading.
Quick Frog Leap distance	When checked, traveling smaller than this value performs fast Frog leap (no lift/delay), while larger movements use leap with lift/delay; unchecked disables leap.
Lift height when rotation exceeds 10°	Z-axis lift height for surface switching without traveling optimization (disabled when air movement optimization is enabled).
Max follow height	Sets a maximum following height for capacitive sensing limitations of sharp nozzles.
Height controller	Time required for the height adjuster to complete following actions.

Parameter	Description
follow in-place delay	
GasOn delay	This is to make sure that the gas pressure at the cutting head stabilizes after the gas circuit opens.
GasSwitch Delay	When changing the gas, there should be a delay from completely purging the original gas to the new gas reaching a stable pressure at the cutting head. First gas blow after processing starts adds an extra gas change delay to the gas on delay as the initial gas on delay.
Cooling point Delay	The time for blowing gas to cool down at the cooling point.
GasOff Delay	After completion of the cutting process, it is advisable to introduce a delay before shutting off the gas. By implementing this delay, the number of gas opening actions for short-distance cuts can be minimized.
Stepback when resume	Retraction distance of the cutting head when resuming after a pause.
Frog leap lift	Uses leap lift during travel.
Travel path optimization	Optimizes Z-axis lift based on tube dimensions in the graph during travel.
Enable auto loading	Executes the ***Loading*** PLC before the ***File Start*** PLC when processing begins.
Enable auto unloading	Executes ***Unloading*** PLC after the ***End File*** PLC at processing completion.
Enable following holder before production	If equipped with a following holders to auto-engage the holder coupled following mode before processing.
Check chuck clamping before production	Checks chuck status before starting; prompts an alert if not clamped.
Couple following holder after Return Zero	Engages holder in coupled following mode after each homing.
Speed parameters for weight calculation	Sets different Y/B-axis travel speeds, accelerations, and cutting accelerations based on tube weight (up to 6 groups).
Auto center rectangular tube	Enables real-time deviation calculation for rectangular tubes (only available for bus systems), collecting Z-value data during cutting to update the configuration file.

Parameter	Description
at cutoff line	
Auto center before production	Forces centering for the first cut of parts (ineffective for non-standard tubes).
Early GasOn	(Checked by default) Enables pre-gas activation during travel to improve efficiency and reduce gas on delay per trajectory.
Early switch technique	(Checked by default) Parallelizes process setting time, focus, spot size, laser power, etc., during travel to improve efficiency.

4.14.2 Motion Parameters

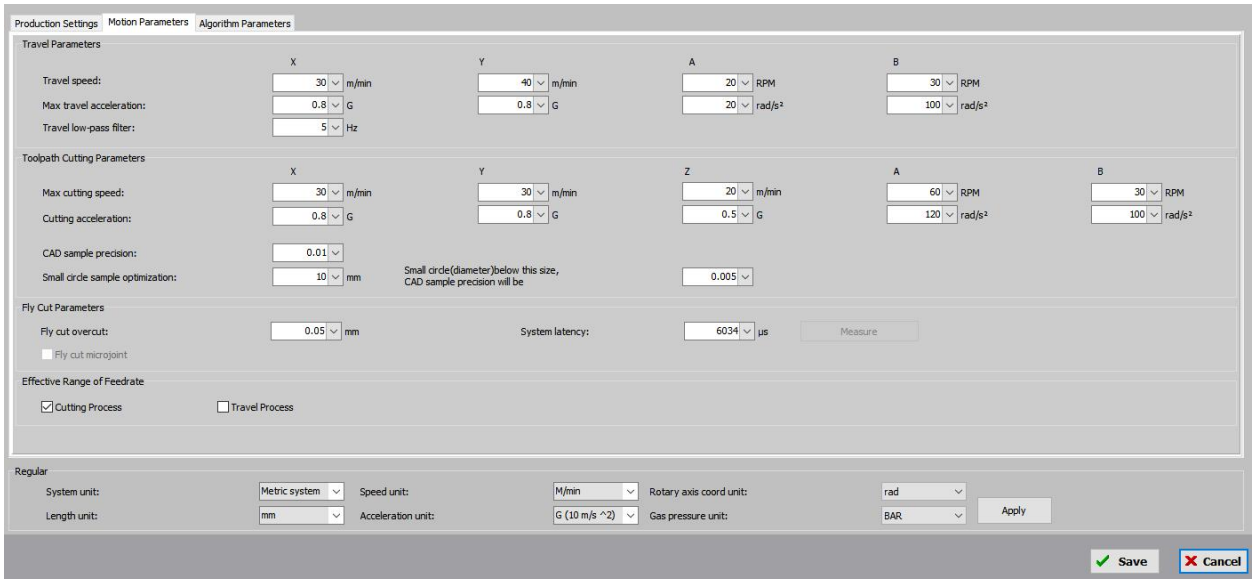


Figure 4-76 Motion parameters

The parameters are shown below:

Table 4-23 Motion Parameters

Parameters	Description
Travel Speed for X/Y/A/B axes	Set the max travel speed for X/Y/A/B axes.
Max travel acceleration	Set the max travel speed for X/Y/A/B axes.
Travel low pass filter	Sets the low-pass filter frequency for travel (default: 5 Hz). Adjust it to a smaller value to reduce cutting deviation.
Max Cutting Speed	Constrains single-axis processing speed for X/Y/A/B axes.
Cutting acceleration	Constrains single-axis processing acceleration for X/Y/A/B axes.
CAD sample precision	Improves precision and smoothness of processed curves by setting sampling accuracy.
Small circle sample optimization	Sets independent CAD precision for small circles; Ineffective for TubesT clad circles and punching circles; Applies to *.igs or .*sat parts Trajectories are valid for circular holes, not valid for ellipses, rectangular tubes, or non-closed shapes; Cutoff lines, replacement with lines, and replacement with points are not valid.
Fly Cut Parameters	Sets overshoot distance for fly cuts to ensure complete hole cutting.
System latency	Automatically calculates and compensates for system delay via EtherCAT bus to ensure multi-axis synchronization and hole position accuracy.
Range of Feedrate	Controls cutting speed by adjusting the effective range of feed rate overrides for process debugging.

4.14.3 Algorithm Parameters

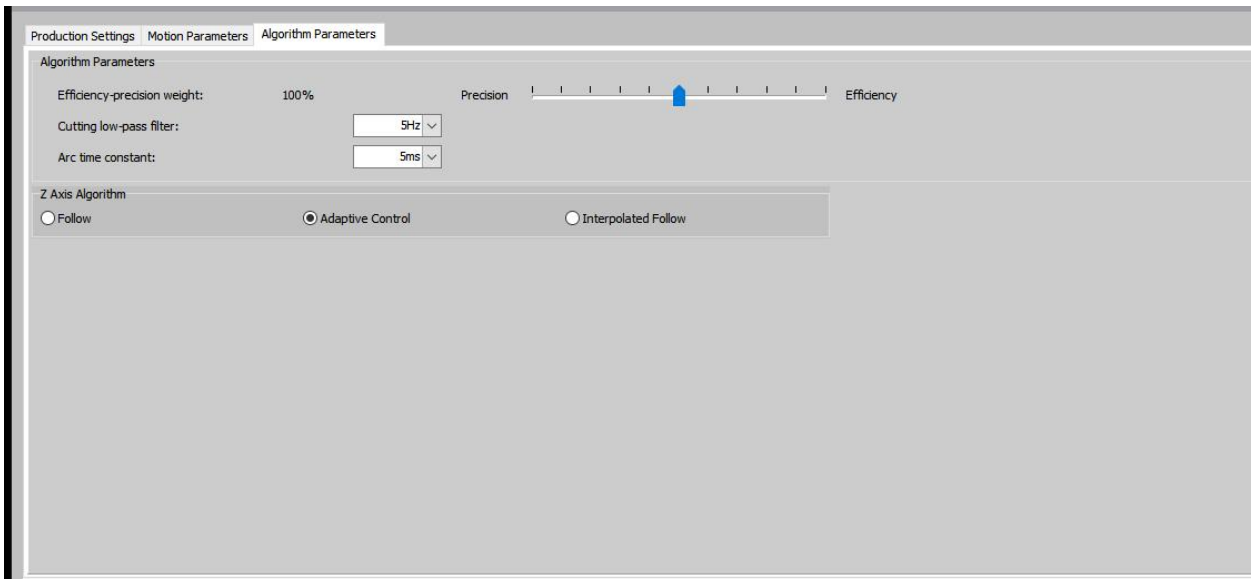


Figure 4-77 Algorithm Parameters

The details are shown below:

Table 4-24 Algorithm Parameters

Parameter	Name & Description
Algorithm Parameters	Efficiency-Precision Weight: Cutting low-pass filter frequency (default: 5 Hz). Higher machine performance allows higher acceleration and filter frequency. Small Circle Time Constant: Minimum time parameter for small circle processing (larger values improve precision).
Z-Axis Algorithm	Three Z-axis control algorithms for different scenarios.

4.14.4 Regular

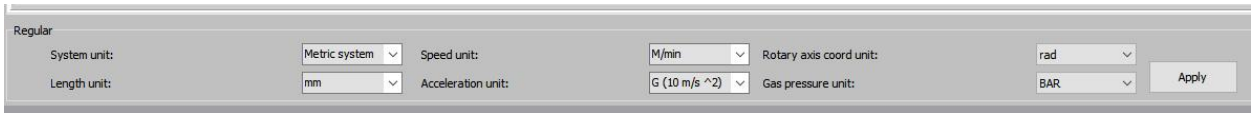


Figure 4-78 Speed unit

The parameters are shown below.

Table 4-25 Regular Parameters

Parameter	Name & Description
System unit	The system supports two unit types: Metric and Imperial.
Speed unit	➢ Millimeters per second (mm/s), Meters per second (m/s), Meters per minute (m/min); Millimeters per minute (mm/min); ➢ Inches per minute (in/min); Inches per second (in/s).
Rotary axis coordinate unit	Radians. Degrees/RPM (degrees per minute) Revolutions + Degrees
Length unit	Millimeters (mm); Inches (inch).
Acceleration unit	➢ Metric: ● Millimeters per second squared (mm/s^2) ● G (1 G = 10 meters per second squared, m/s^2) ● Meters per minute squared (m/min^2) ● Meters per second squared (m/s^2) ➢ Imperial: ● Inches per second squared (in/s^2) ● Feet per second squared (ft/s^2)
Gas pressure unit	Bar, Psi (pounds per square inch), MPa (megapascals)

4.15 Technique Parameter Setting

If there are multiple layers of a drawing, then each layer can be configured with specified techniques. You can configure them according to actual needs.

4.15.1 Cutting Techniques

You can set parameters including ***Cut speed***, ***Gas pressure, Power, Delay*** in ***Techniques***.

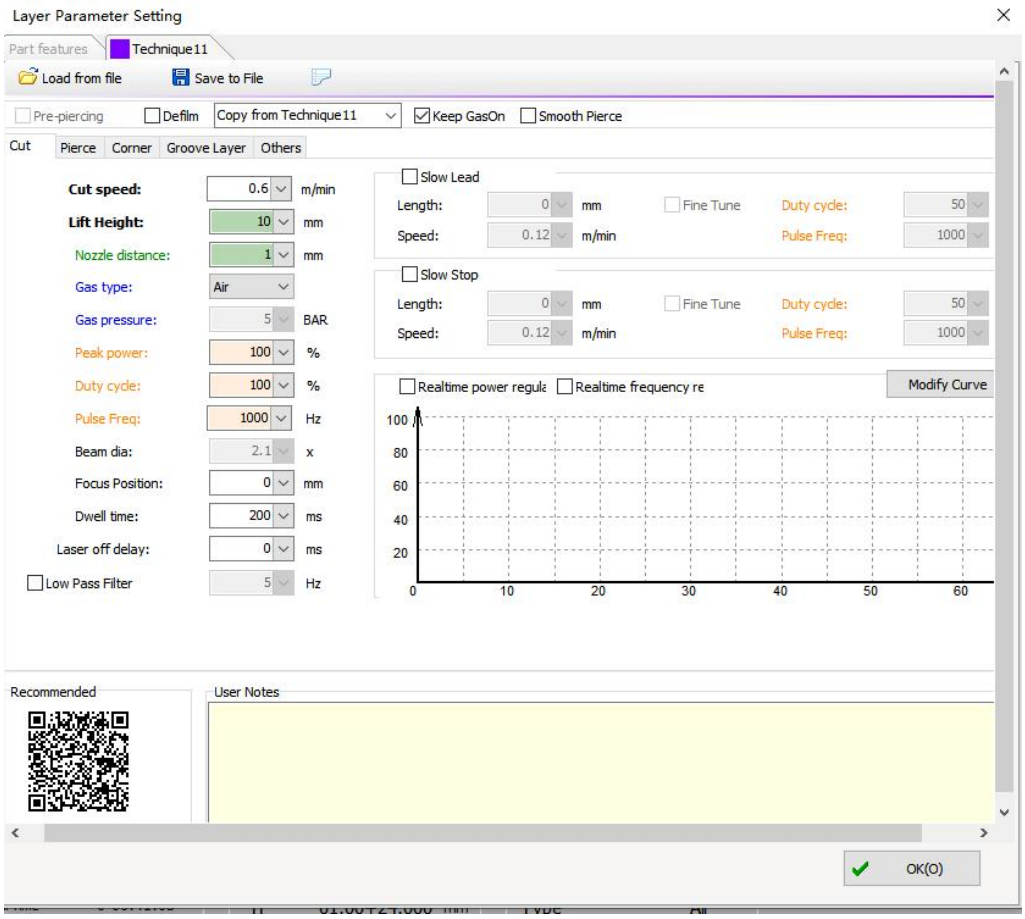


Figure 4-79 Cutting techniques

The parameters are shown below:

Table 4-26 Cut Technique Parameters

Parameter	Description
Lift height	The height by which the Z-axis is lifted when traveling from the end of one cutting path to the start of the next during normal machining operations.
Beam/Focus	If a cutting head with electric focus adjustment is used, parameters for the beam/focus can be configured.
Dwell time	The delay from the start of cutting to the movement along the trajectory is set to ensure that the laser can burn through the tube material.
Laser off delay	The time from the end of the trajectory to the laser shutdown.
Slow Lead	Used to set the distance, speed, laser frequency, and duty cycle for the starting part of each trajectory.
Slow Stop	Used to set the distance, speed, laser frequency, and duty cycle for the ending segment of each trajectory.
Low Pass Filter	If enabled, a separate low-pass filter for this layer can be set; if not enabled, this layer will use the low-pass filter for processing in the global parameters.
Realtime power regulation	Set the relationship between the laser power/frequency and the cutting speed for trajectory processing.
Modify curve	Specifically edit the curve that maps power/frequency to cutting speed.
Defilm	The laser power can be reduced beforehand to remove the oxide layer or protective coating on the tube surface. After checking this option, parameters for the surface cleaning process need to be configured.
Keep Gas on	When checked, the gas supply remains continuously on from the start to the end of processing.

4.15.2 Pierce Techniques

Click ***Layer***, and you will enter the window to set the technique parameters.

Figure 4-80 Layer Technique Parameters

Select the layer, and click ***Pierce***, and then you can configure the pierce method, and pierce parameter.

You can select piercing method, including ***No Pierce, 1-stage, 2-stage, and 3-stage***, and adjust the parameters. There are three types of piercing, including Segment Pierce, Flash Pierce, Incremental Pierce. If the piercing method is set to both 2-stage piercing and 1-stage piercing, 2-stage piercing will be performed first, followed by 1-stage piercing. The related parameters are shown below:

Table 4-27 Piercing Parameter Table

Parameter	Description
Segmented Pierce	Uses corresponding parameters (power, frequency, duty cycle, etc.) at different piercing heights to perform piercing within the set time.
Flash Pierce	Rapidly changes frequency and power for piercing, enabling fast penetration of thick tubes.
Incremental Pierce	After piercing at the current height for the dwell time, the cutting head moves to the next height at a certain speed (speed = height difference / piercing time) while continuously emitting laser light.
Incremental time	The time for the cutting head to move from the current height to the next height.
Nozzle height	The height of the nozzle during piercing.
Gas type	Sets the gas type used during piercing.

Parameter	Description
Gas pressure	Sets the gas pressure during piercing.
Peak power	Sets the laser peak power during piercing.
Duty cycle	Sets the laser duty cycle during piercing.
Pulse frequency	Sets the laser frequency during piercing.
Beam diameter	If a focusing axis is configured, sets the piercing spot diameter.
Spot position	If a focusing axis is configured, sets the piercing focus position.
Dewell time	The time the cutting head stays at the current height for piercing.
LaserOff Blow	The time for gas blowing after piercing stops.

4.15.3 Corner Technique

Enabling the corner processing technology can improve the cutting quality of pipe corners. On ***Corner*** technique page, you can configure the following parameters: Follow height offset, corner pressure, peak power, duty cycle, and pulse frequency. Additionally, you can constrain the speed and acceleration of the B-axis.

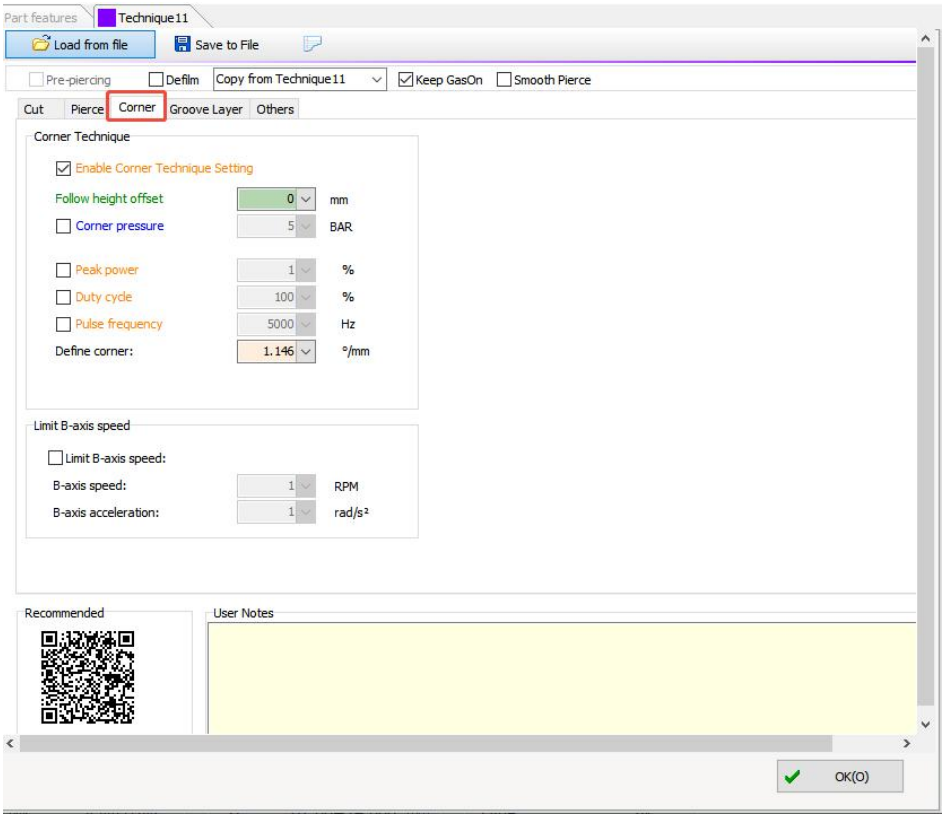


Figure 4-81 Corner Technique

The parameters of corner techniques are shown below.

Table 4-28 Corner Technique Parameters

Parameter	Description
Follow height offset	For the rectangular tube offset value, during a 90° rotation, the value first rises from zero, reaches its maximum at 45° (which equals the process setting value), and finally decreases back to zero. Triangular tubes follow a similar pattern but with a 120° rotation angle, where the maximum value is reached at the 60° mark during rotation. Other tube types do not undergo height offset.
Corner pressure	The gas pressure generated by the nozzle when cutting tube corners has a default value of 5 bar.
Peak power	If the machine' laser uses DA (Digital-to-Analog) control for peak power, the peak power during corner cutting can be configured separately.
Duty cycle	When cutting corners, the duty cycle can be appropriately reduced to avoid burning the workpiece.
Pulse frequency	The pulse frequency during corner cutting is 5000 Hz by default.
Define corner	When machining 1 mm in the X direction, if the B - axis needs to rotate a set angle, it is considered that the corner section has been entered. It is recommended to use the default value 1.146°/mm.
Limit B-axis speed	The speed of B-axis has influence on the cutting quality of different tube types. Using specified B-axis speed can improve the cutting quality without affect the entire cutting efficiency.

4.15.4 Part Features

Part Features are the parameters for different tubes or files.

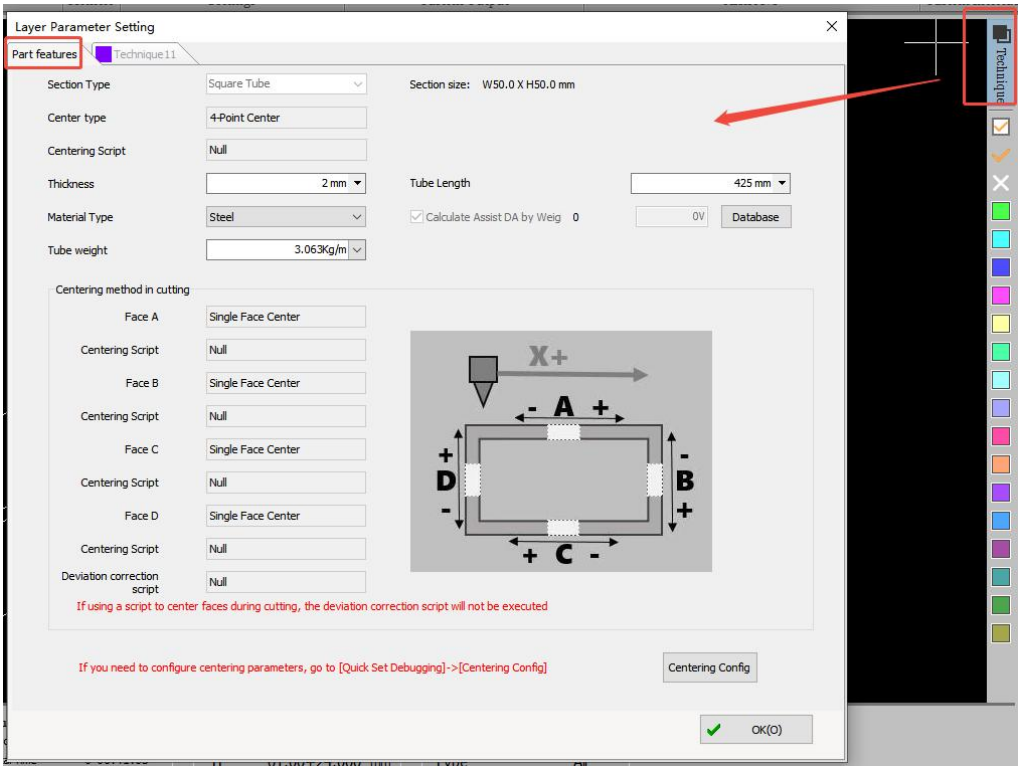


Figure 4-82 Part Feature

The parameters are shown below

Table 4-29 Part Feature Parameters

Parameter Name	Description
Section Type	The system will automatically recognize the section type and dimension based on the file
Center type	Based on different tube types, the system will select the proper centering type. When processing the graphic with centering point, the system will center first before cutting.

4.16 Custom Processes

Click ***PLC***, and you can edit PLCs in the pop-up window.

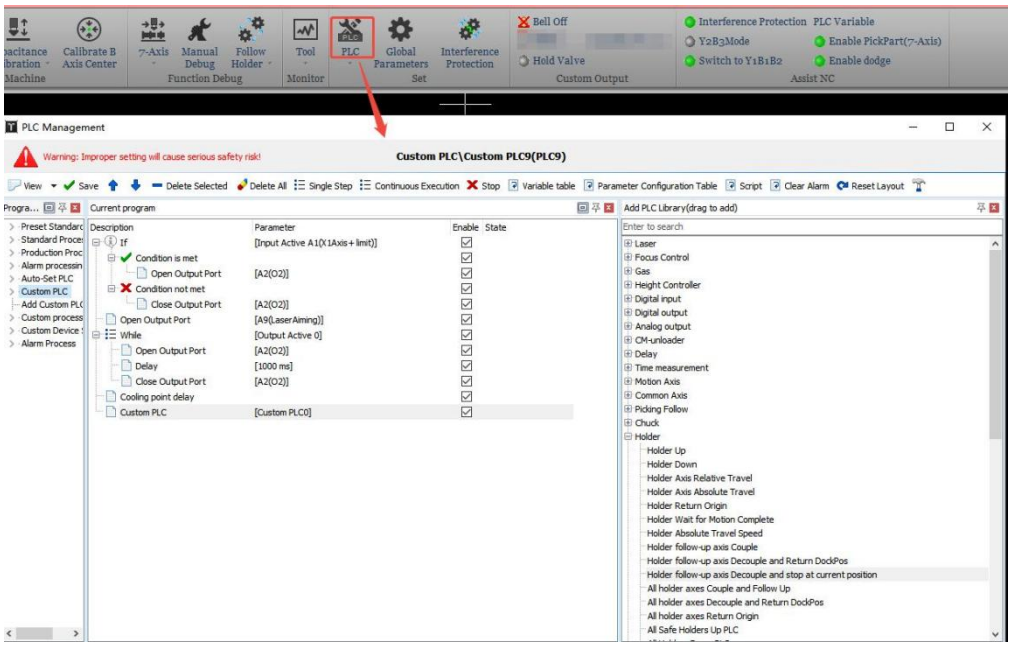


Figure 4-83 PLC configurations

4.16.1 Overview of Custom Processes

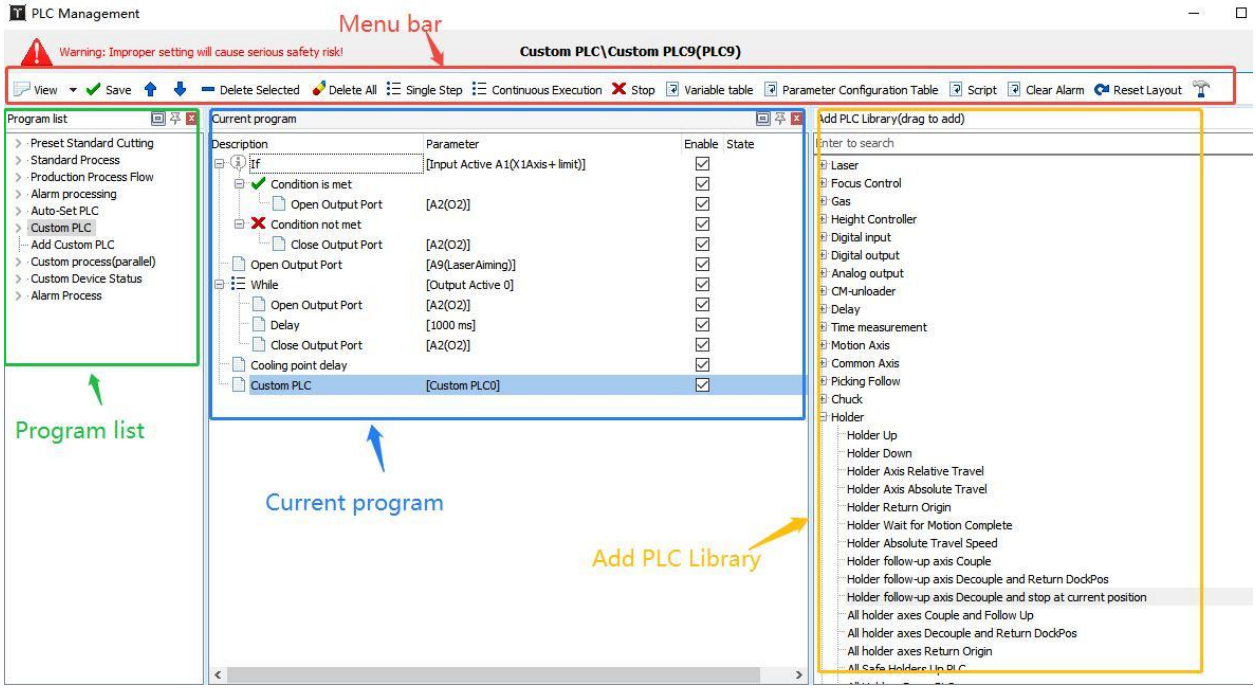


Figure 4-84 Overview of PLC Custom Processes

For more instructions on PLC, please refer to TubePro PLC Instruction.

4.16.2 Script Function

Enter the Machine Config tool, open the ***Advanced Configuration*** interface, check ***Enable script function***, and save the settings.

In TubePro, click ***CNC Script Editor*** from the ***PLC Process*** drop-down menu to start writing scripts.

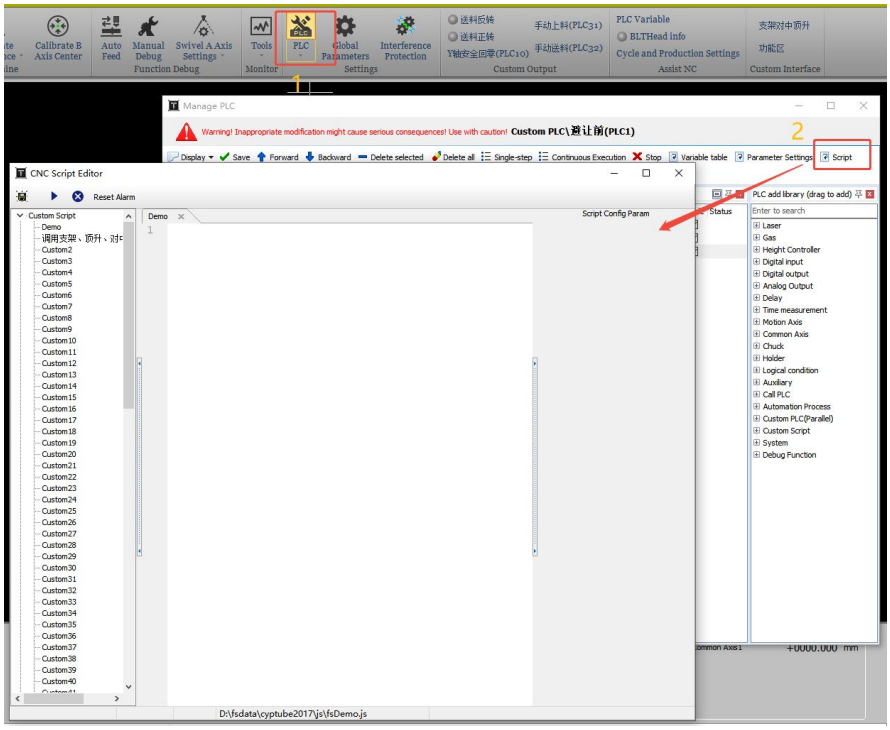


Figure 4-85 Script

During execution, scripts can trigger different action sequences based on external command (cmd) values. Configure the ***Wait for Script Execution Time***:

If the timeout is exceeded, the software will issue an alarm prompt.

If set to 0, the software will wait indefinitely for the script to complete.

If unset, the script will run in parallel (non-blocking mode). Scripts can only be stopped via external calls. Pressing the ***Stop*** button will not halt execution.

Chapter 5 2-Chuck Functions

5.1 **Dodge**

Dodge is divided into **Laser Head dodge** and **Chuck dodge**. Select the Dodge type according to your actual mechanical structure. The actions are as follows:

1. During cutting: The Y1 stroke of the main chuck gradually moves toward the dodge position. When the next cutting trajectory exceeds this position, the dodge action is triggered.
2. Dodge sequence: Execute pre-dodge PLC commands. Move the dodge axis (direction depends on the selected dodge type).
3. Execute post-dodge PLC commands. The position of the cutting head/chuck changes.
4. If ***Enable Y1 Axis Positive Stroke Dodge*** is configured, the positive stroke of the Y1 axis will also be updated accordingly.

5.1.1 Dodge Trigger Conditions

The Dodge action triggers if the next cutting trajectory would cause the Y1 axis to move beyond the specified position. For trajectories on the last part, Dodge can only trigger before the last part if ***Single Part Detection*** is enabled.

Required conditions:

- Condition 1: Part extension length > dodge relative distance - Distance from middle chuck to cutting head. If not met, dodge is blocked with an alert: ***Tube will be pulled out of the middle chuck***.
- Condition 2: Enable dodge for short parts. If the part extension length < dodge relative distance - Distance from middle chuck to cutting head, dodge triggers with automatic release of the middle chuck.

5.1.2 Cutting Head Dodge Parameter Configuration

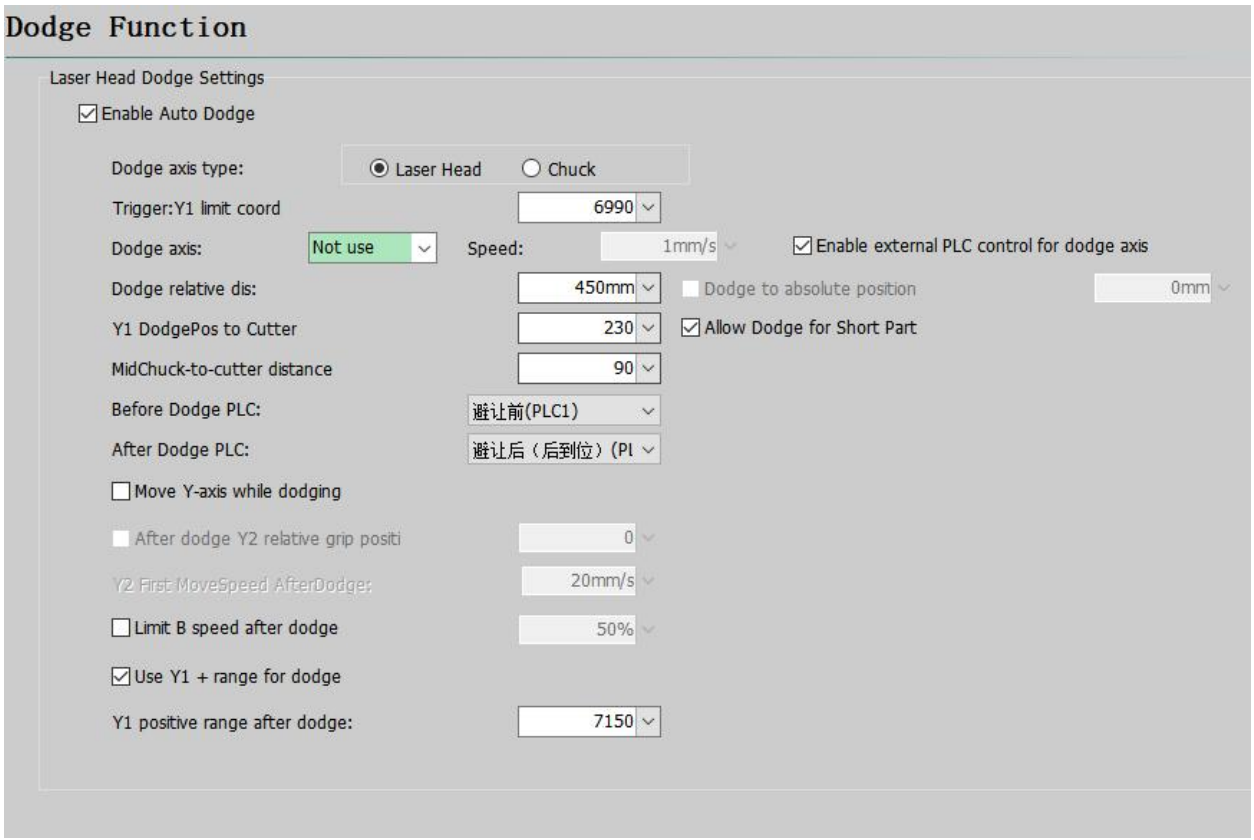


Figure 5-1 Cutting head dodges

- Trigger: Y1 limit coordinate: The Y1 coordinate that triggers dodge if exceeded by the next trajectory.
- Dodge axis: Choose a general-purpose axis and set its parameters.
- Speed: Movement speed during dodge.
- Dodge relative distance: Distance to move relative to the current position.

⚠ Notice: Positive/negative values matter. Default direction for cutting head dodge is negative Y-axis.

- Dodge Axis Absolute Position: Check to move to an absolute coordinate (recommended).
- Distance from Y1 dodge Position to Cutting Head: Distance when dodge triggers.
- Distance from Middle Chuck to Cutting Head: Measured from the outer edge of the chuck jaws.
- Allow dodge for Short Parts: Bypasses checks for tube pullout, allowing single-chuck cutting.
- Pre-dodge Actions: Custom PLC commands (e.g., Z-axis lift, X-axis reposition, lowering support

brackets).

- Post-dodge Actions: Custom PLC commands after dodge. Synchronize Y1 Axis with dodge Axis: Check to move Y1 and the dodge axis together.
- Y2 Cutting Preparation Speed after Avoidance: Speed for Y2 to move to the cutting position (7-axis systems only).
- Limit B-Axis Speed after Avoidance: Applies speed limits to the B-axis post-avoidance.
- Enable Y1 Positive Stroke after Avoidance: Adjusts the Y1 stroke range. Resets after processing.

5.1.3 Chuck Dodge Parameter Configuration

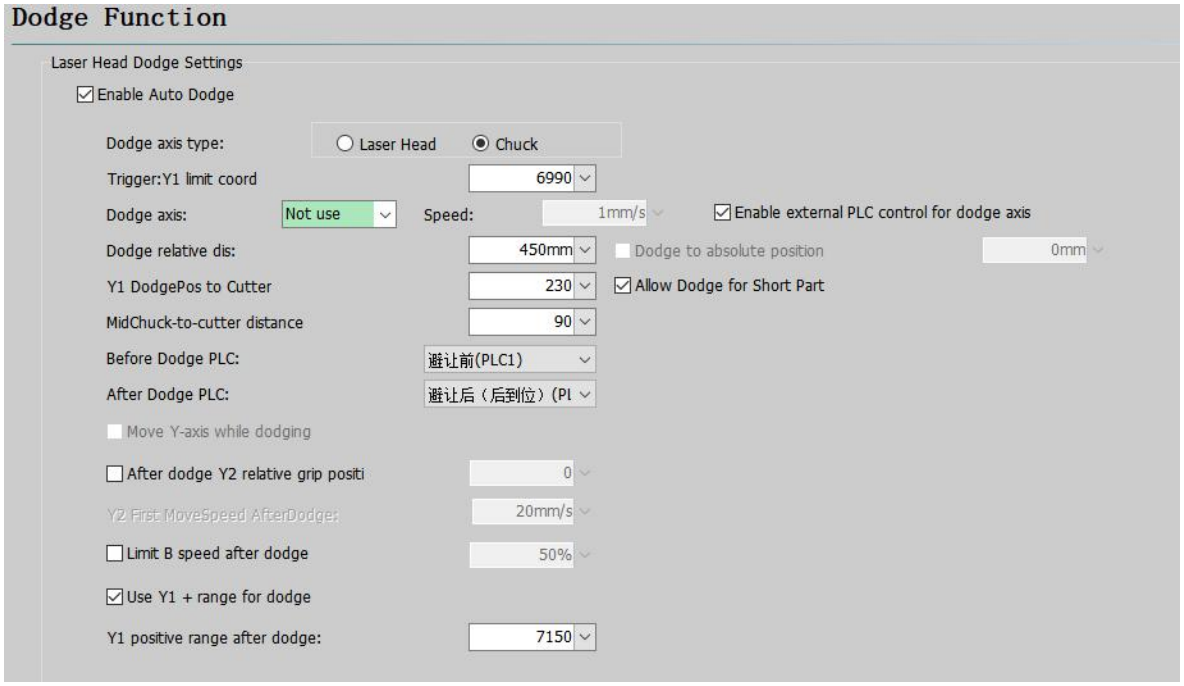


Figure 5-2 Chuck dodging configuration

- Trigger Condition & Y1 Limit Coordinate: Identical to cutting head dodge.
- Dodge Axis : Choose a general-purpose axis.
- Speed: Movement speed during dodge.
- Dodge relative distance: Distance to move relative to current position.

> ⚠ Notice: Default direction for chuck dodge is positive Y-axis.

- Dodge Axis Absolute Position: Check to move to an absolute coordinate (recommended).

- Distance from Y1 dodge Position to Cutting Head: Distance when dodge triggers.
- Distance from Middle Chuck to Cutting Head: Measured from the outer edge of the chuck jaws.
- Allow dodge for Short Parts: Bypasses checks for tube pullout.
- Pre-dodge Actions: Custom PLC commands (e.g., Z-axis lift, bracket adjustments).
- Post-dodge Actions: Custom PLC commands after dodge.
- Synchronize Y1 Axis with dodge Axis: Move Y1 and the dodge axis together.
- Y2 Clamping Position after dodge: Position for Y2 to clamp (7-axis systems only).
- Limit B-Axis Speed after dodge: Apply speed limits post-dodge.
- Enable Y1 Positive Stroke after dodge: Adjusts Y1 stroke range. Resets after processing.

5.2 Bevel Cutting

Enable ***Bevel Cutting*** in ***Advanced Tools*** of the Machine Config tool. Configure the A-axis in the ***Axis Configuration*** page. Refer to TubePro Bevel Precision Marking & Bevel Compensation for details.

5.3 Automatic Feeding

5.3.1 Enable 2-Chuck Automatic Feeding

Check ***Enable Db chuck AutoFeed*** in ***Chuck→Chuck Function*** (top menu of the Machine Config tool). If a tailstock length sensor is installed, check ***Monitor tailing length input*** in the ***Tailing length input port monitoring*** section.

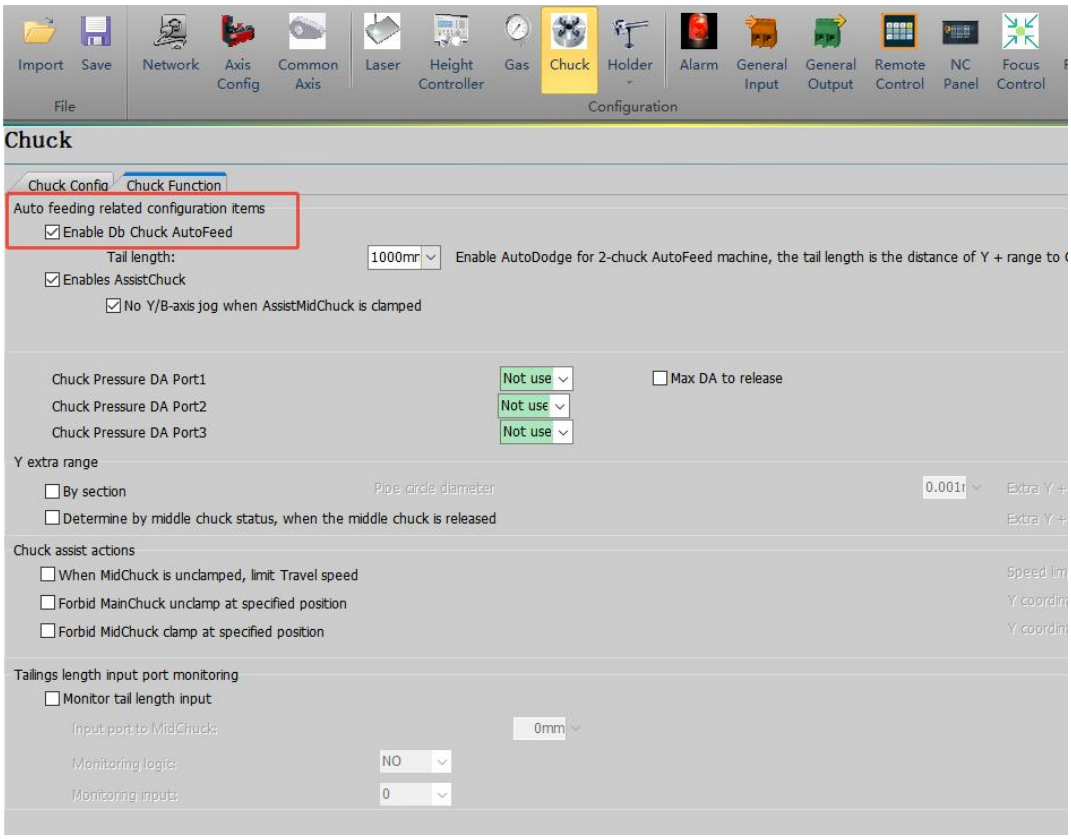


Figure 5-3 Chuck Configuration

5.3.2 Automatic Feeding Configuration

Click ***Auto Feed*** in the TubePro top menu and select ***Enable***. Enter the tube length and feeding range based on your material.

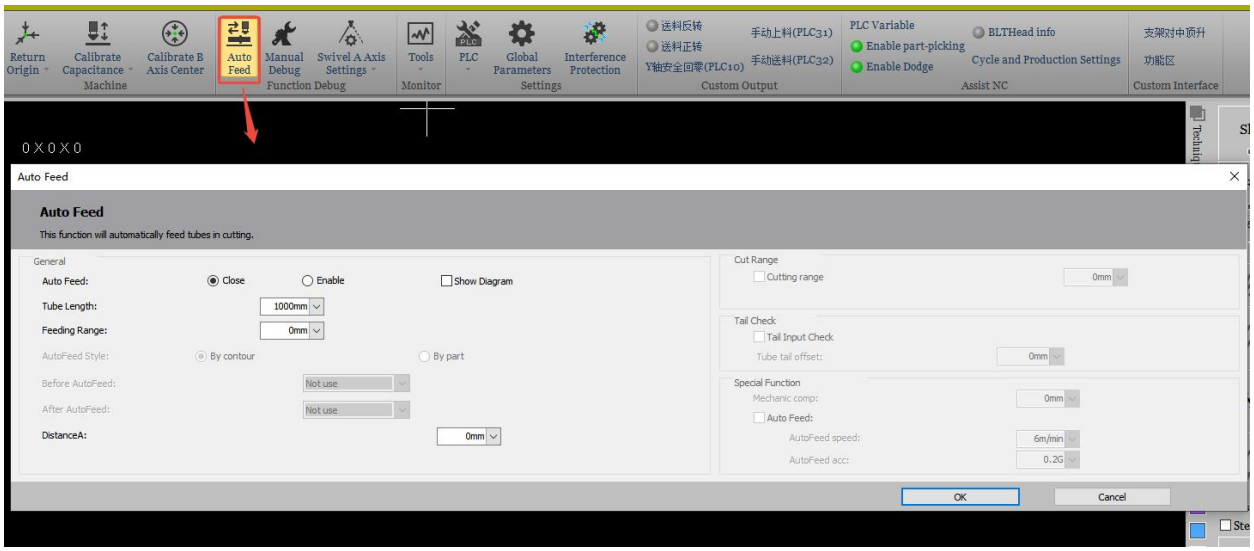


Figure 5-4 Auto-feed

- General settings
  - Tube Length: Length of the current tube.
  - Feed Range: Reciprocal stroke of the middle chuck (maximum: Y-axis total stroke).

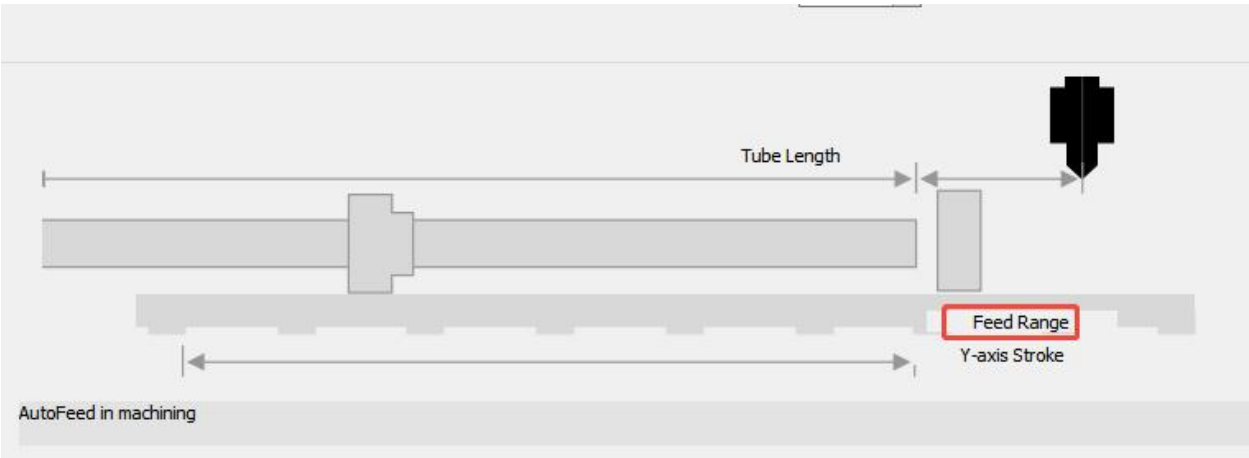


Figure 5-5 Feeding Stroke

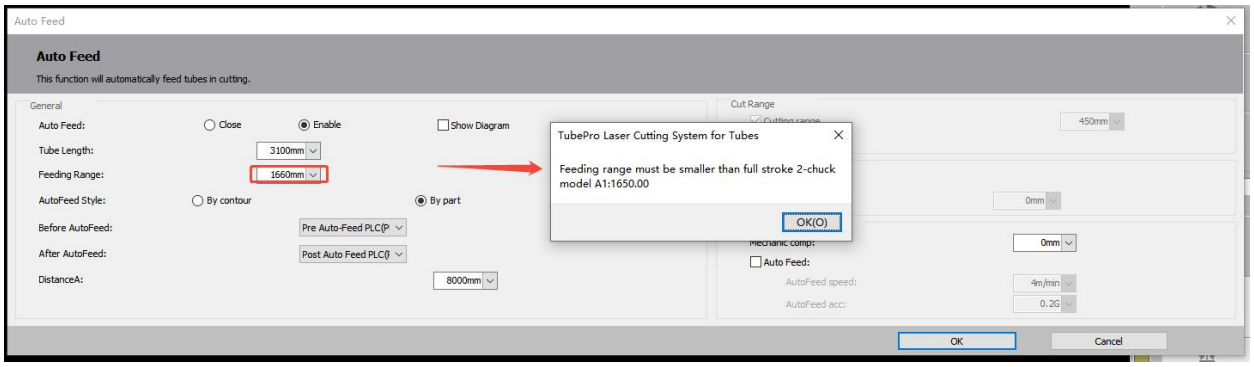


Figure 5-6 The feeding stroke cannot exceed A1

⚠ Notice: For full-stroke 2-chuck machines, the feeding range cannot exceed ***Main Chuck dodge Trigger Position A1*** in the dual-chuck parameters.

- Automatic Feeding Judgment:
  - Check Before Cutting Trajectory: Feed if the next trajectory exceeds the feeding stroke. Minimizes feeding during a trajectory but may increase total feeds (ideal for long parts).
  - Check Before Cutting Part: Feed if the next part exceeds the feeding stroke. Ensures no feeding during a single part (ideal for short parts).
  - Pre-Feeding PLC: Select PLC commands to execute before feeding.
  - Post-Feeding PLC: Select PLC commands to execute after feeding.

⚠ Notice: Pre/post-feeding PLC commands must coordinate with auxiliary chuck clamping/unclamping (do not manually configure output ports).

- Distance from **Tube Tip to Cutting Head after Loading** (Distance A): Measured after loading. The Y-axis moves forward by ***Distance A*** before starting processing.

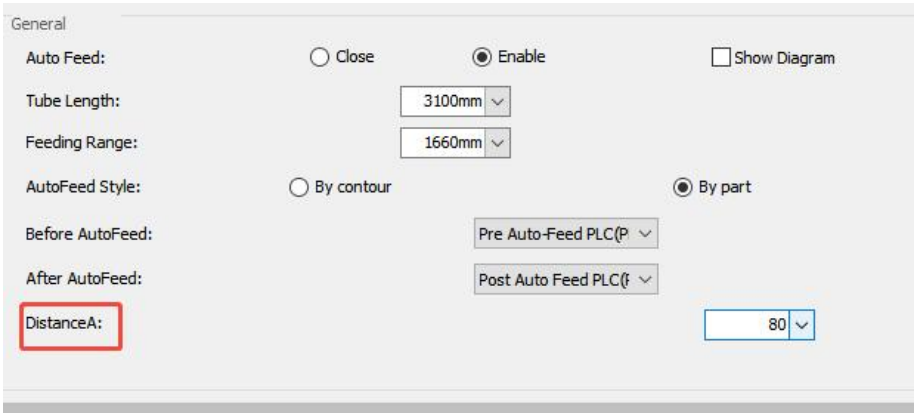


Figure 5-7 Distance A

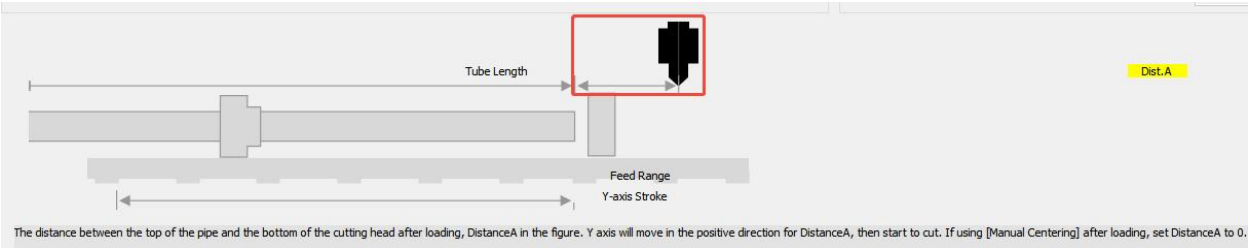


Figure 5-8 Distance A

⚠ Notice: Set Distance A to 0 if using ***Quick Align Tube Head*** after loading.

- Cutting Stroke
  - Enable Cutting Stroke: Restricts all trajectories to a specified range for improved precision on short features.

⚠ Notice: Cutting stroke must be shorter than the feeding stroke.

- Tail Detection
  - Enable Input Monitoring: Use sensors to detect remaining tube length and prevent empty cut.
  - Tailstock Error Compensation: Adjusts for sensor delay. The system calculates compensation dynamically based on feeding speed.
- Special Functions:
  - Automatic Feeding Mechanical Compensation: Corrects fixed errors from mechanical backlash.
  - Enable Custom Feeding Speed/Acceleration: Set Y-axis rapid traverse speed during feeding.

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Shanghai BOCHU Electronic Technology Co., Ltd.
No. 1000, South Lanxianghu Road, Minhang District, Shanghai City, China

Web: www.bochu.com
Tel: +86(21)64309023
Email: Support@bochu.com